Appendix 11

Whale Tail 2022 Annual Open Pit Geomechanical Inspection

Knight Piésold CONSULTING

Management System Certified by: bsi ISO 9001 ISO 14001 ISO 45001 CERTIFIED

March 17, 2023

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Dear Christian,

RE: Meadowbank Complex - Amaruq Site - 2022 Annual Open Pit Geomechanical Inspection

1.0 INTRODUCTION

Agnico Eagle Mines Limited (AEM) operates the Meadowbank Complex in Nunavut, Canada. The complex consists of the Meadowbank and Amaruq Sites. The Amaruq Site consists of several open pits at the Whale Tail and IVR deposits, and an underground mine at the Whale Tail deposit. Knight Piésold Ltd. (KP) has been providing geomechanical support for the Amaruq Site since 2015, including developing the open pit slope geometry recommendations and completing the annual third-party inspections of the open pits required under the water license for the mine.

The 2022 annual inspection of the open pits at the Amaruq Site is summarized in Appendix A of this letter.

2.0 OPEN PIT INSPECTIONS

The inspection was completed by Mr. Ben Peacock, P.Eng., of KP from August 14 to 19, 2022. The open pits and surface excavations in rock that were included in the inspection and their current status is summarized in Table 1.

Table 1 Open Pits Inspected and their Status

Open Pit	Current Status
Whale Tail Open Pit	Active mining
IVR V1 Open Pit	Active mining
IVR V1 Open Pit	Active mining
IVR West 1 Open Pit	Inactive, backfilling with waste rock in progress
IVR West 2 Open Pit	Active mining, expected completion in August, 2022
Attenuation Pond 5 (AP5)	Inactive, partially flooded

Several AEM staff participated in the inspection, with different staff taking part on different days. Those involved included:

- Christian Tremblay (Rock Mechanics Coordinator)
- Amadou Traore (Rock Mechanics Engineer)
- Vincent Duranleau (Rock Mechanics Technician)

Adam Jackson of Tetra Tech Canada Inc. was seconded to the mine at the time and also participated in the inspection.

The results of the inspection are detailed in Appendix A. Key comments are included below:

- No Priority 1 recommendations were made
- 14 Priority 2 recommendations were made
- 17 Priority 3 recommendations were made
- 9 Priority 4 recommendations (opportunities for improvement) were made

3.0 CLOSING

We trust this inspection summary meets your present needs. Please do not hesitate to contact us should you require anything further.

Yours truly,
Knight Piésold Ltd.

REGISTERED PROFESSIONAL ENGINEER
B.D. PEACOCK
LICENSEE
2023-03-17
NT/NU

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2023-03-17
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

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Principal Engineer

Approval that this document adheres to the Knight Piésold Quality System:

Attachments:
Appendix A Meadowbank Complex - Amaruq Site - 2022 Annual Open Pit Geomechanical Inspection

/bdp

APPENDIX A

Meadowbank Complex - Amaruq Site - 2022 Annual Open Pit Geomechanical Inspection

(Pages A-1 to A-90)

Meadowbank Complex - Amaruq Site

2022 Annual Open Pit Geomechanical Inspection

August 14 to 29, 2022

Outline

Introduction

Whale Tail Open Pit

IVR V1 & V2 Open Pits

IVR West Open Pits

AP5

Monitoring and Inspections

Ground Control Program

Recommendations

Introduction

Introduction

General

- Agnico Eagle Mines (AEM) operates the Meadowbank Complex in Nunavut. The complex consists of the Meadowbank and Amaruq Sites.
- The Amaruq Site consists of the Whale Tail and IVR deposits. The Whale Tail Open Pit entered commercial production in 2019 and the IVR V1 Open Pit entered production in 2020. Preparations for underground mining at the Whale Tail deposit are also underway.
- Knight Piésold (KP) has been providing geomechanical support for the Amaruq Site since 2016, including a 2018 feasibility design for the Whale Tail Open Pit, a 2019 feasibility design for the IVR V1 and V2 Open Pits, and several design studies for the underground mine. A detailed review of the Whale Tail Open Pit slope performance was completed in 2021 and 2022.
- KP has completed the annual inspections for the open pits at the Amaruq Site since 2019. The 2022 annual inspection was completed by Ben Peacock, P.Eng., during a site visit from August 14 to 19, 2022. The inspection is summarized in this presentation, along with a summary of other related discussion topics.

Introduction

Inspection

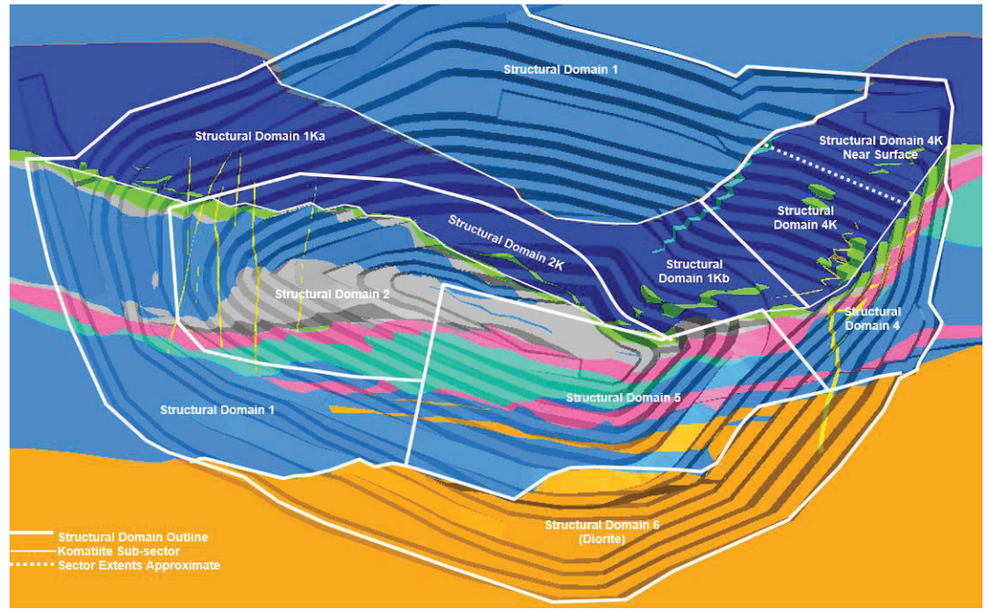
- The following open pits and surface excavations at the Amaruq Site were reviewed on August 14 and 15, 2022 (shown at right):
  - Whale Tail (WHL) Open Pit
  - IVR V1 Open Pit
  - IVR V2 Open Pit
  - IVR West 1 Open Pit
  - IVR West 2 Open Pit
  - AP5
- The participants included Christian Tremblay (AEM), Amadou Traore (AEM) and Adam Jackson (Tetra Tech).

Whale Tail Open Pit

Whale Tail Open Pit

Overview

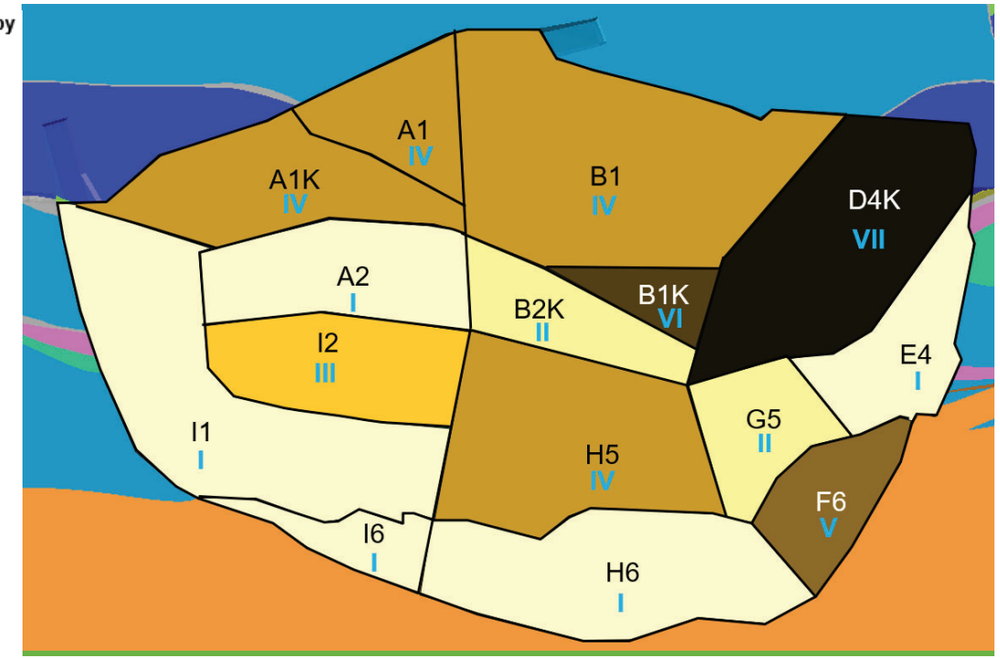
- The WHL-13A open pit is the current design pit for the Whale Tail deposit. The current structural domains (which control the achievable slope geometry in many cases) are shown at upper right along with the lithologies expected in the final open pit walls.
- The current design sectors and slope geometry recommendations are shown at lower right. These are based on the WHL-PH3-V11F open pit design.
- A detailed study of Design Sector D4K is in progress and could result in chances to these recommendations.



	Base Bench Geometry		Bench Geometry Controlled by Bench-Scale Failures	
I	BASE CASE BFA: 75° Bench Width: 10 m Bench Height: 21 m IRA: 53°	III	BFA: 65° Bench Width: 10 m Bench Height: 21 m IRA: 47°	
II	KOMATIITE BFA: 75° Bench Width: 10.5 m Bench Height: 21 m IRA: 52°	IV	BFA: 65° Bench Width: 10.5 m Bench Height: 21 m IRA: 46°	
		V	BFA: 75° Bench Width: 16 m Bench Height: 21 m IRA: 44°	
		VI	BFA: 55° Bench Width: 10.5 m Bench Height: 21 m IRA: 40°	
		VII	BFA: 55° Bench Width: 11 m Bench Height: 14 m IRA: 34°	

LITHOLOGY LEGEND:

- GREYWACKE
- CHERT
- KOMATIITE - NORTH LIMB
- KOMATIITE - SOUTH LIMB
- IRON FORMATION
- MAFIC VOLCANICS
- DIORITE
- RAMP FAULT



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Whale Tail Open Pit

Inspection

- The Whale Tail open pit was inspected on August 14 and 15, 2022. Observations made during the inspection are summarized on the following slides.
- The approximate open pit geometry at the time of the visit is shown at right. The approximate final crest position (Phase 3) is marked by the dashed yellow line, and the walls inspected are labelled relative to mine north.

Whale Tail Open Pit

Observations - Northwest Wall

BFA: 65°
Bench Width: 10 m
Bench Height: 21 m
IRA: 47°

- Final wall in Design Sector A1/A1K.
- No mining has occurred in this area and there have been no slope failures since the last annual inspection.
- The benches are generally performing well.
- The Oxidized Greywacke is thought to be associated with a talik zone below what was the western end of Whale Tail Lake. It is of lower rock mass quality than the Greywacke and prone to ravelling. The exposures along the ramp are limited in height and rockfall has not been a concern to date. If ravelling increases, a rockfall berm could be constructed along the inside of the ramp through this unit.

Whale Tail Open Pit

Observations - North Wall

BFA: 65°
Bench Width: 10 m
Bench Height: 21 m
IRA: 47°

- Final wall in Design Sector B1.
- Limited mining has occurred in this area and there have been no slope failures since the last annual inspection.
- The benches are performing better than expected, with the bench face often standing steeper than the foliation.
- The 2021/2022 design review found that many of the pre-shear drillholes have been drilled at an angle shallower than the planned 60°, reducing the effective bench width. Comments on drill and blast quality control are provided later in this presentation.

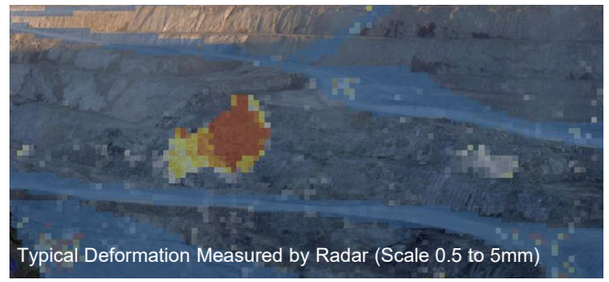
Whale Tail Open Pit

Observations - Phase 1 North Wall

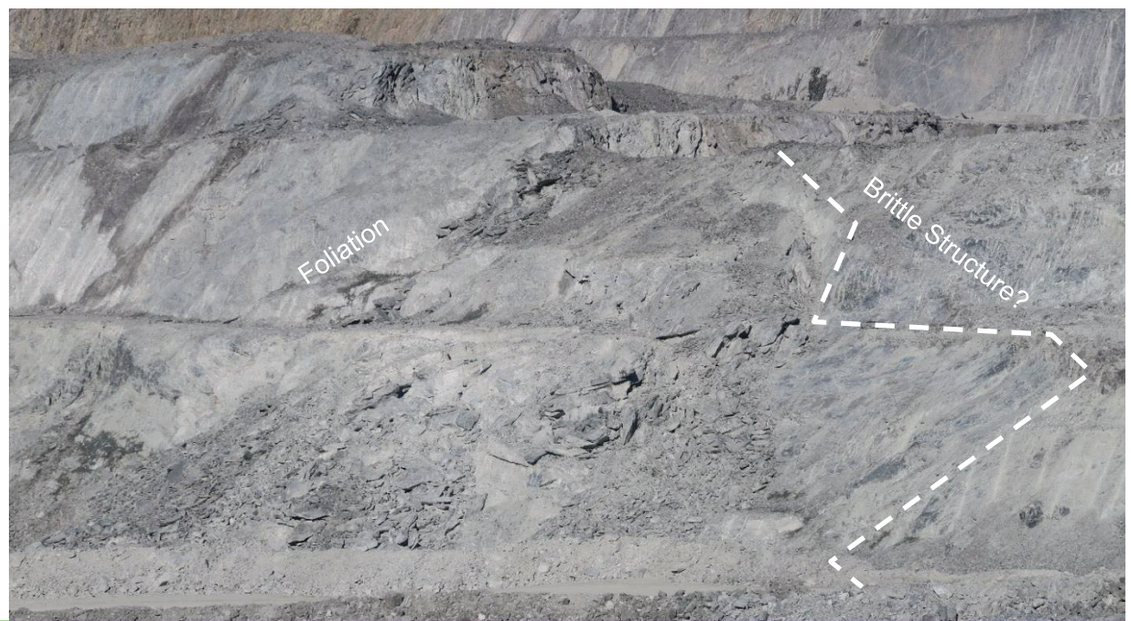
- Interim wall in Phase 1. Phase 1 has been the focus of production over the past year.
- The wall was established in the Komatiite, parallel to the foliation. As expected, a series of bench-scale failures have occurred in areas where the foliation locally dips at a shallower angle than the bench face.
- The implementation of a 55° pre-shear has improved slope performance and half barrels are visible in many areas. Bench-scale failures have and will continue to occur. AEM continues to complete extensive scaling in this sector in order to remove potential hazards and reduce the likelihood of a failure. This is endorsed.
- The bench failures almost always occur during freshet or the summer months.
- As a result, the development of the ramp along the this wall was prioritized during the 2021-2022 winter in order to minimize the rockfall risk to personnel. A berm was installed along the inside of the ramp prior to freshet.
- Two areas of instability have developed along this wall in 2022 (outlined in the image at right) and are described on the following slides.

Whale Tail Open Pit

Observations - Phase 1 North Wall (2)


Typical Deformation Measured by Radar (Scale 0.5 to 5mm)

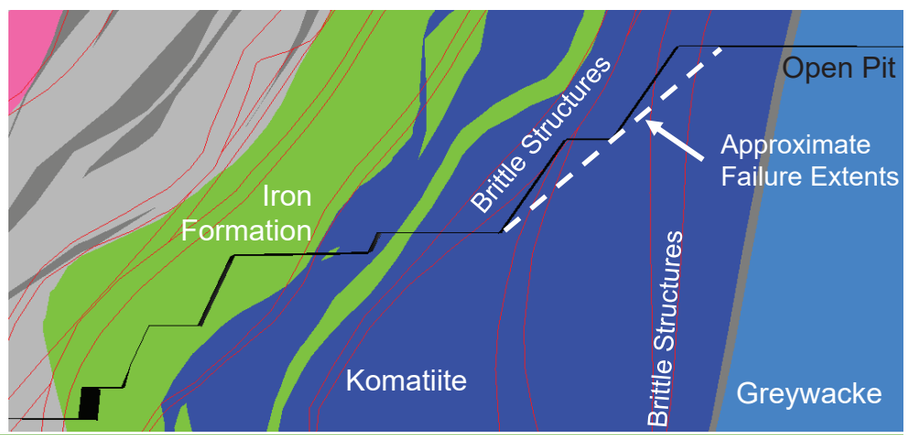
- A multi-bench failure has occurred progressively within the Komatiite over multiple events between May 14 and July 16, 2022.
- The area was identified as a potential instability during development and a berm constructed below the wall prior to freshet.
- The failure appears to be bounded by persistent structures. This could represent an undulation in the foliation, as similar geometries have resulted in bench scale failures in the past. The eastern contact appears to be more linear and may be a Brittle Structure.
- The failure mass continues to exhibit steady, gradual deformation in the radar data, in the order of 5 to 6 mm/day.



Whale Tail Open Pit

Observations - Phase 1 North Wall (3)

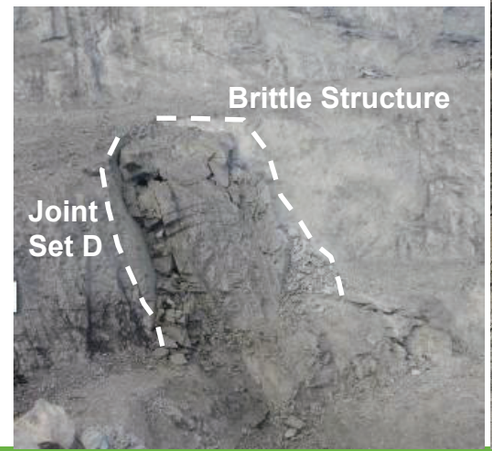
- A review of the lithology model suggests that the failure is unlikely to propagate significantly further back behind the crest due to the presence of the Greywacke.
- The potential for the failure to continue to propagate with depth was discussed as the structure defining the eastern boundary of the failure daylights below the ramp. The failure is larger than others along the Phase 1 North Wall and should be reviewed in greater detail to better understand the failure mechanism, likely contributing factors, and the potential for the failure to continue below the ramp. It may be possible to use the radar data to better understand the possible structural controls on the failure. A Maptek scan is recommended to document the failure geometry in detail.
- The Phase 1 pit will be used as a sump for managing water into 2024. Personnel will be travelling on the ramp below this failure during that time.
- Options for reducing the risk to personnel if the failure continues to progress were discussed. These include:
  - Buttressing the failure. This would limit the ramp to single lane traffic but that is expected to be manageable.
  - Allowing the water level to rise a point on the ramp above the failure. This would allow the pumps to be located above the failure, removing the requirement for personnel to travel below the failure. However, the infiltration of water into the toe of the failure mass would like adversely influence the performance of the failure. The potential risks associated with storing this much water above the underground workings would also need to be reviewed.
- The failure should continue to be monitored with the radar and the berm maintained.
- Once mining of Phase 1 is complete, the risks associated with on-going access below the failure should be reviewed and mitigation measures implemented as appropriate.

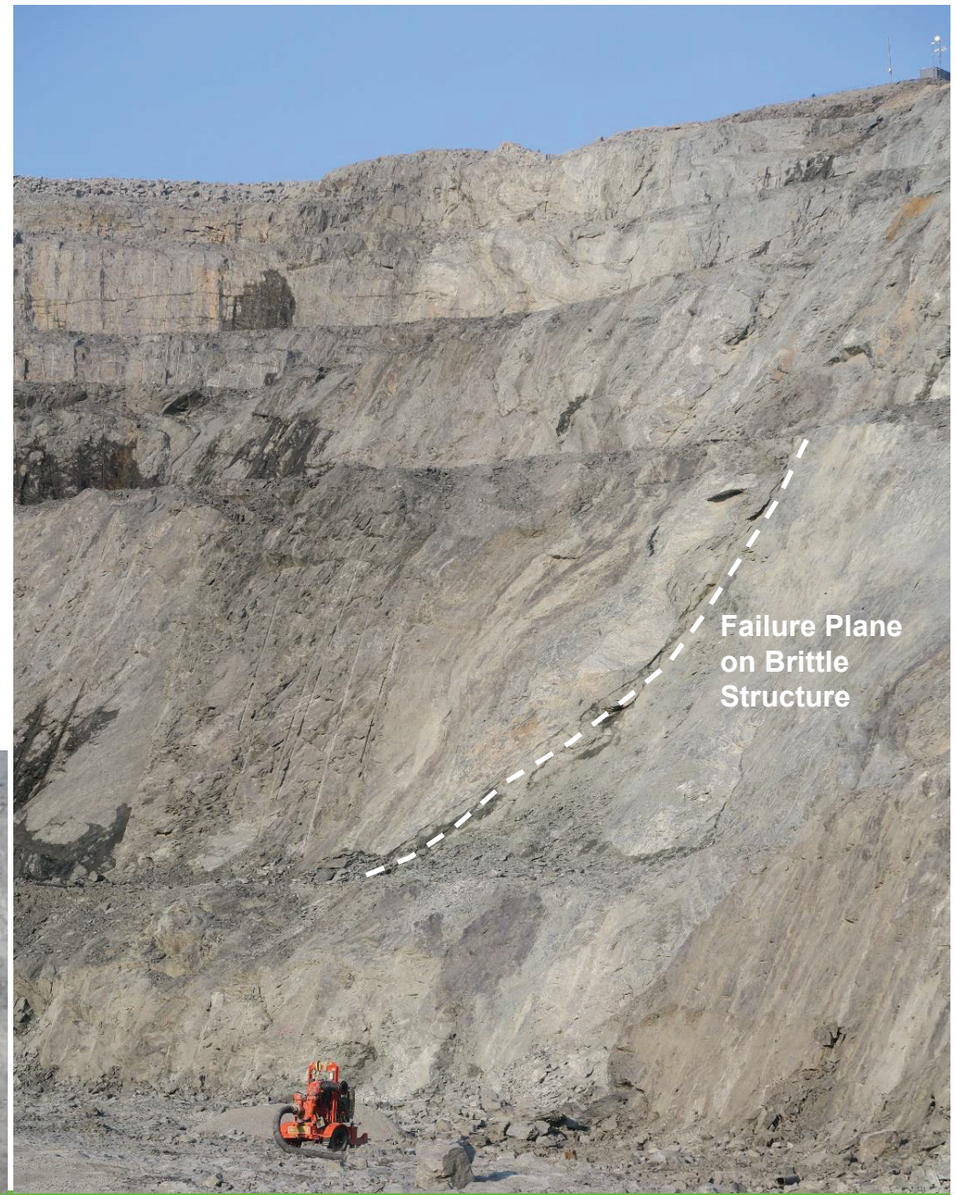


Whale Tail Open Pit

Observations - Phase 1 North Wall (4)

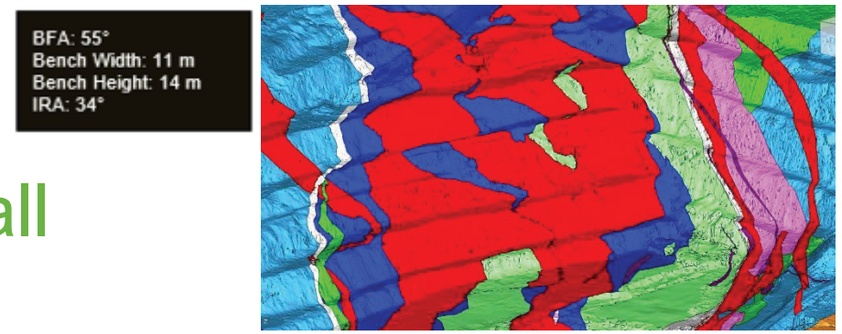
- During the site visit, a possible instability at the western end of the wall was identified based on trends in the radar monitoring data.
- A wedge is present on the wall, formed by a brittle structure and a cross-cutting structure (likely Joint Set D). The rock mass below the brittle structure is Komatiite but it is not clear if the wedge itself is Komatiite.
- The area was barricaded and access prevented. Due to the timing of the event, the pump shown in the photo was left within the barricaded area.
- After the site visit, a portion of the wedge failed in place on August 16 (see inset below). A small step-in with a berm has been left below the failure to allow mining to continue in the area.
  The area should continue to be monitored.
- The failure will be mined out when Phase 1 is pushed back to the final pit configuration.



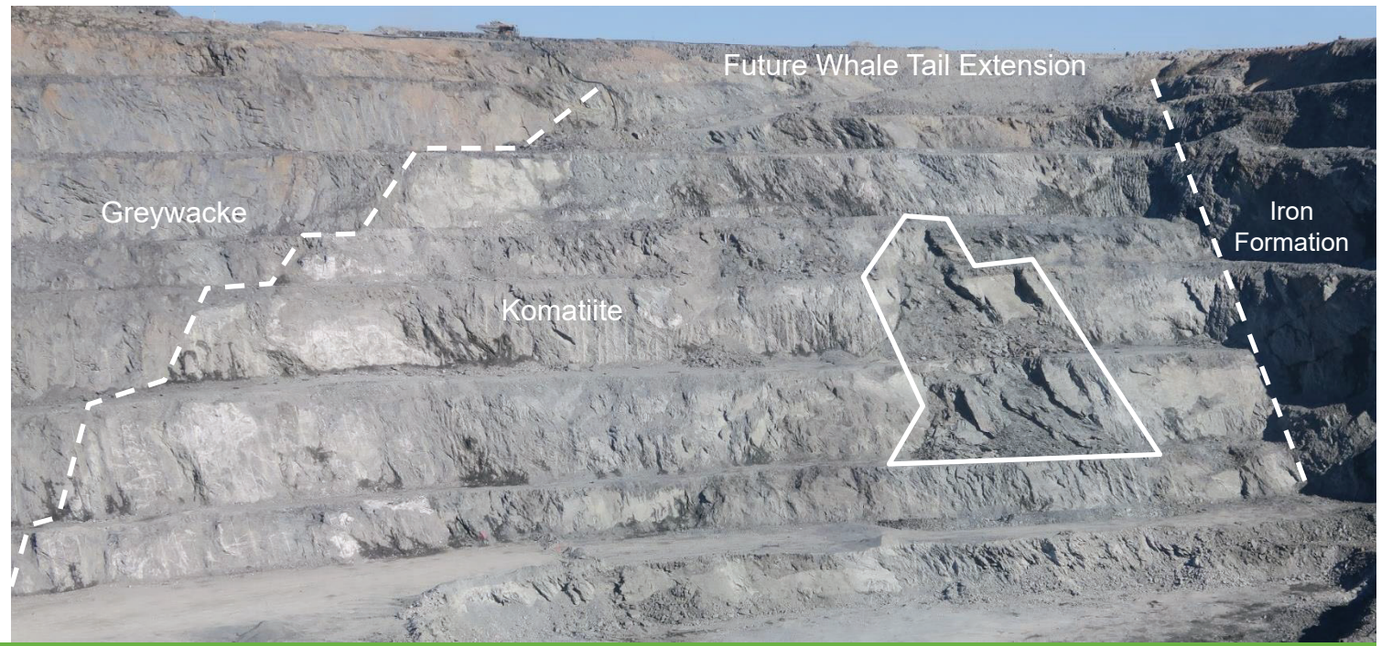


Whale Tail Open Pit

Observations - Northeast Wall

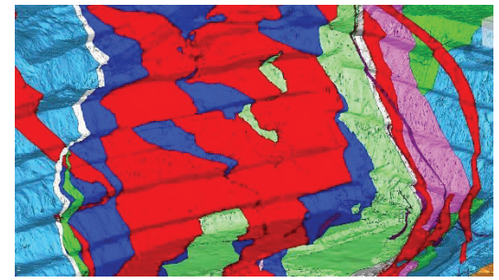


- Final wall in Design Sector D4K.
- This sector is within the Komatiite and has been characterized by a series of bench scale failures. The failures are currently understood to be a hybrid of failure on the foliation and failure of the weak rock mass, influenced by water (i.e., a combination of seepage within the talik and surface runoff) and the Brittle Structures.
- A revised slope design was developed in December 2021 and a pushback of the upper two benches completed to re-establish the slope. The pushback will eventually form part of the planned Whale Tail Extension to the northeast.
- The wall continues to be a focus for the Rock Mechanics team. Assessments of the overall slope stability using a numerical model and of the planned lower wall using kinematics are in progress.
- The performance of the benches has improved with the revised slope design. Several bench-scale failures have occurred and will continue to occur.
- A series of bench-scale failures have occurred at the eastern end of the sector (outlined at right). The failures have almost, but not yet, linked up. This area is discussed on the following slide.

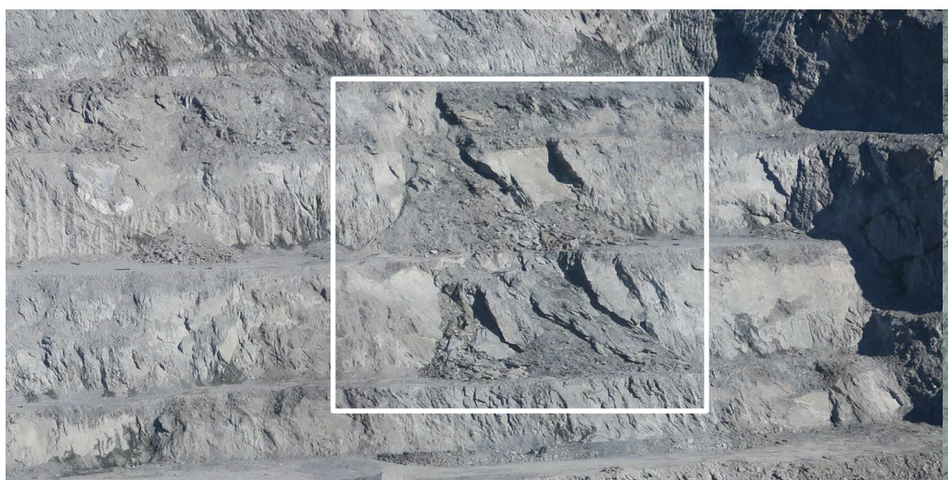


Whale Tail Open Pit

Observations - Northeast Wall (2)



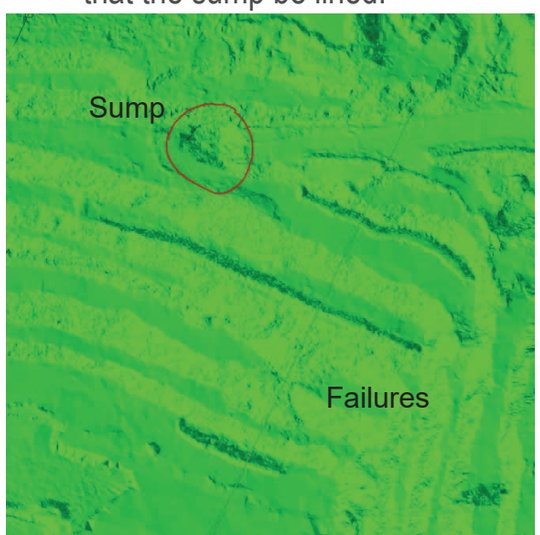
- Seven rockfalls and bench scale failures have been reported in this sector in 2022, ranging in tonnage between approx. 150 and 1500 tonnes. All but one are associated with a series of progressive failures associated with the area outlined in the left photo.
- The failures occurred during freshet, between May 28 and July 17, with most occurring in June. Failures were expected and a rockfall berm was constructed below this area prior to freshet.
- The middle photo shows the outlined area at the time of many of the initial failures in June. These failures were relatively small and several appear to be associated with surface water or erosion of the face (see next slide). The rock mass quality was noted to reduce as the rock mass thawed and these failures progressed over time. The failures on the two benches have almost linked up.
- The western limit of the failures appears to be defined by the foliation. The eastern limit of the failures appears to have a structural control (see right photo). This may be one of the brittle structures (see image at upper right, with brittle structures in red).

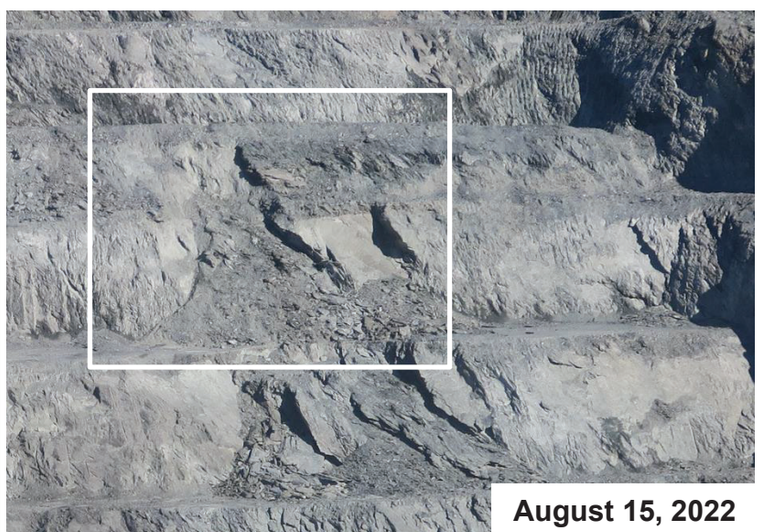


Whale Tail Open Pit

Observations - Northeast Wall (3)

- The site team believes that the infiltration of surface water and the erosion of brittle structures in the bench face likely contributed to the initial failure in May.
- The pushback is located within the drainage for what was the northeastern lobe of Whale Tail lake and water reports to the area. An unlined sump has been established at the base of the pushback at the top of the slope (left photo). The sump is on the Komatiite-Greywacke contact, which is likely promoting infiltration.
- Photos prior to the failures show surface water running across the bench face and eroding the weak rock mass (right photo). The water appears to be concentrated along the potential structure bounding the western edge of the failures.
- It seems reasonable that water is contributing to the failures. It is recommended that surface water be diverted away from the area to the extent possible and that the sump be lined.





August 15, 2022

Area Outlined in Middle Photo on June 13, 2022

Whale Tail Open Pit

NE Wall - Mitigation Measures

- Different strategies for reducing the exposure of personnel to rockfalls and bench-scale failures during mining in this sector were discussed:
  - Adjusting the sequence so that mining in this sector is completed during the winter when the wall is frozen (or at least is not completed during freshet). A high-level review suggests that this could likely be accommodated until mid-2025 without undue disruption. It is recommended that this approach be evaluated by the mine planners as it is likely the most effective.
  - Implementing single benching. A height of up to 10 or 11 m is achievable with the existing equipment, but does require scaling from a muck pad. The requirement for an 8 m minimum catch bench width results in a shallow IRA; as a result, this approach may not be viable.
- The ramp will pass through this sector, approximately 4.5 benches below the current toe of the slope. The current open pit design incorporates an increase in the width of the ramp in this area (from 28 to 36 m) as well as a step-out above a portion of the ramp in order to accommodate rockfall berms. This is endorsed.
- As noted, an assessment of the slope design for the lower Northeast wall is in progress. Several aspects of the slope design were discussed during the visit, notably:
  - The current design for the lower wall incorporates triple-benching rather than double-benching, which increases the exposure of personnel to rockfall. Recommend continuing with double-benching in the lower wall, at least where the wall is sub-parallel to the foliation.
  - The brittle structural model suggests the potential for a bench or multi-bench planar failure on one of the modelled structures directly below the planned ramp. This is being considered as part of the assessment. Modifications to the slope design or the use of ground support (e.g., dowels or cable bolts) may be required to reduce the potential for a failure impacting access along the ramp.

Whale Tail Open Pit

Observations - East Wall

BASE CASE
BFA: 75°
Bench Width: 10 m
Bench Height: 21 m
IRA: 53°

- Final wall in Design Sector E4.
- Limited mining has occurred along this wall since the 2021 review. Specific areas of note are listed below and outlined on the photo.

1. Material from a former in-pit dump remains on the face of the upper bench. A rockfall berm was constructed to retain ravelling material. No significant changes have been observed.
2. The Greywacke near the Diorite has experienced crest loss and previous rockfall events. A temporary step-out has been left below the area to reduce the exposure to personnel. The intention is to scale the area, clean the catch benches and recover the step-out as part of the Phase 3 pushback. This is endorsed. Several potentially unstable blocks were previously identified and should continue be monitored as part of the visual inspections. The drone should be used to supplement these inspections.
3. A joint set cross-cutting the foliation and dipping to the north is prominent in the Iron Formation near the Komatiite contact. It has locally resulted in increased crest loss.

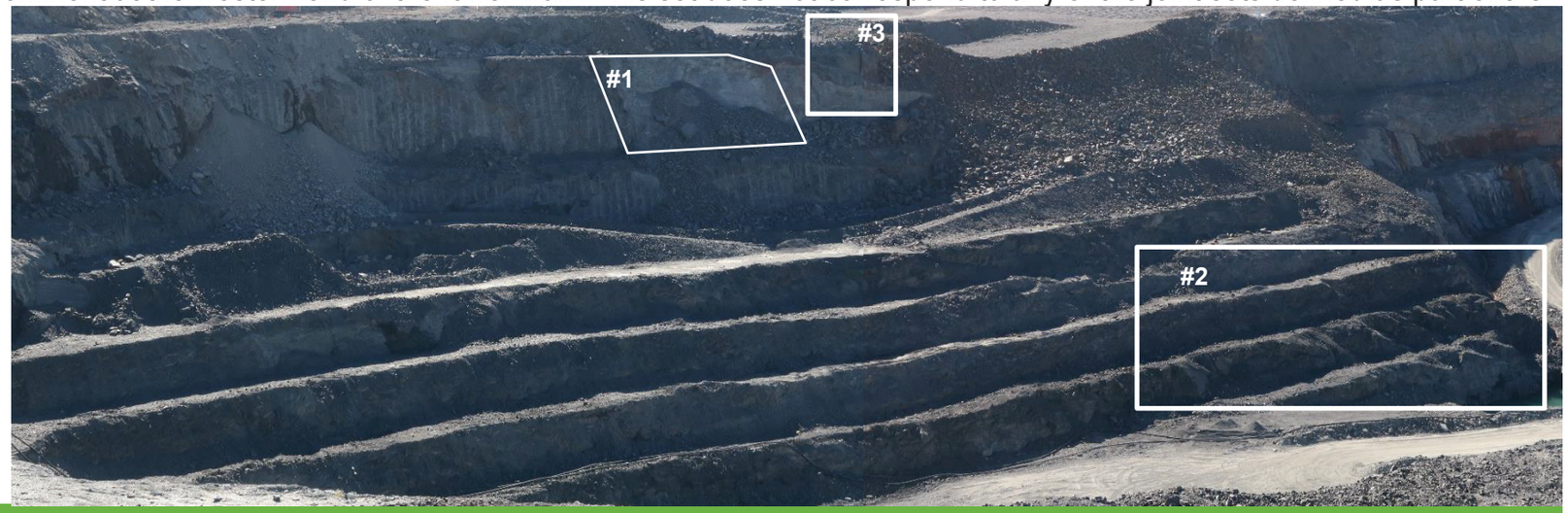
Whale Tail Open Pit

Observations - Phase 2 Southeast Wall

KOMATIITE
BFA: 75°
Bench Width: 10.5 m
Bench Height: 21 m
IRA: 52°

- Interim wall approximately within Design Sector G5. Also referred to as Phase 2 South (G5).
- The lower portion of the wall has been developed with single benches. This was initiated due to the rockfall hazard at the transition with the East Wall.
- The wall is in the process of being mined out as part of the Phase 3 pushback. Spillover from the pushback is accumulating on the uppermost catch benches. The single benches have been effective and material has not yet reached the lower benches or the pit floor. This should continue to be monitored.
- Specific areas of note are listed below and outlined on the photo.

1. A bench-scale failure occurred along a sub-vertical contact between the Komatiite and the Greywacke in 2021. The failure will be mined out by the pushback. It is likely that localized bench-scale failures will occur on adversely oriented contacts as mining progresses.
2. A joint set dipping to the northwest is prominent at the western end of the lower wall . This set does not correspond to any of the joint sets defined as part of the structural domains for the open pit, but may correspond to Joint Set F identified in the underground mine. These structures are locally forming wedges and should be mapped. If joints with this orientation occur more regularly, the bench design in this area should be reviewed.
3. A potentially unstable block is present at the edge of the pushback. See comments on next slide.



Whale Tail Open Pit

Observations - Phase 2 Southeast Wall (2)

- A potentially unstable block is present along one of the curvilinear structures present in the south wall of the open pit.
- The western edge of the block has been unconfined by the pushback and it appears that fractures within the block have started to dilate.
- The area was previously used to anchor one of the dewatering lines (using the 3 vertical posts at the crest) but was recently decommissioned for operational reasons.
- Access above the block should be restricted until it is mined out. Consider leaving some muck against the block to buttress it during drilling and blasting. The area should be monitored when crews are working in the area.

Whale Tail Open Pit

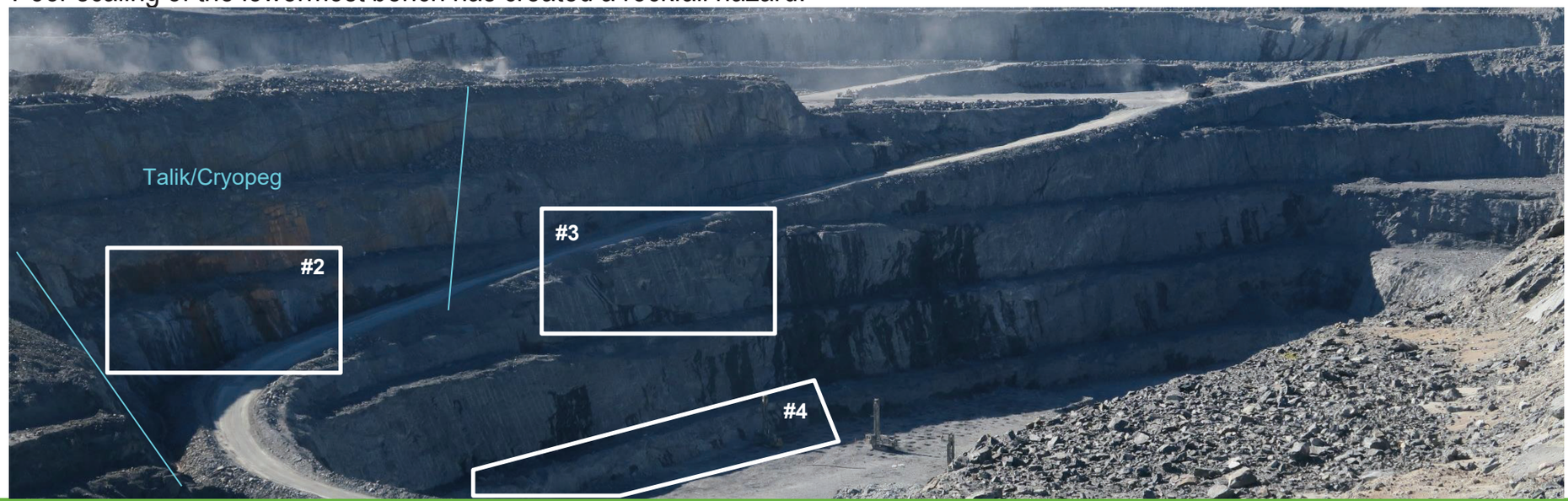
Observations - Phase 2 Southeast Wall (3)

- A Brittle Structure was observed at the western end of the wall, adjacent the Phase 2 ramp.
- This structure (#3) is modelled along the northern contact of the South Limb Komatiite. The observed position, orientation, and thickness of the structure agree well with the 3D structural model.
- No particular stability concerns were noted.
- In general, the 3D structural model has not been validated against the exposures in the open pit. Recommend doing so to build confidence in the model as it is being used to inform key design decisions.

Whale Tail Open Pit

Observations - Phase 2 South Wall

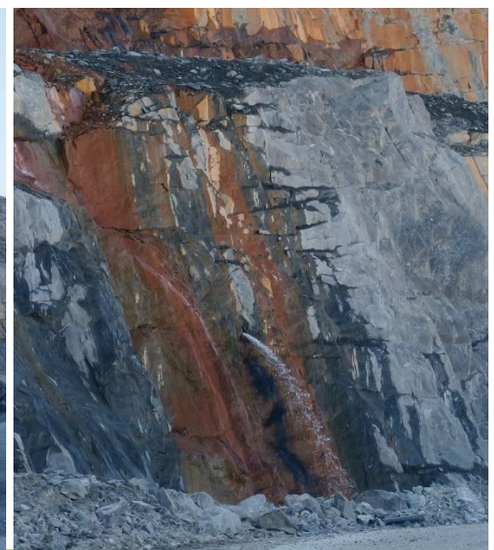
- Interim wall approximately within Design Sector H5. Also referred to as Phase 2 South (H5).
- The wall is generally performing well. Specific areas of note are listed below and discussed on the following slides.
  1. Spillover from the Phase 3 pushback has created a rockfall hazard along the Phase 1 ramp (not numbered below as it occurs throughout).
  2. Seepage within the talik associated with Whale Tail Lake.
  3. A possible unstable block was previously identified below the ramp.
  4. Poor scaling of the lowermost bench has created a rockfall hazard.



Whale Tail Open Pit

Observations - Phase 2 South Wall (2)

1. Spillover from the Phase 3 pushback has accumulated on the catch benches above the Phase 1 ramp and has previously blocked the ramp. The mine has limited the ramp to light vehicles and has partially constructed a rockfall berm along the inside of the ramp. The berm needs to be extended along the full length of the ramp and built up to ensure a consistent 2 m height (left photo). Some rockfall has accumulated behind the berm and it will need to be regularly inspected and maintained.
2. Prominent seeps are present in the lower South Wall, concentrated along sub-horizontal structures (centre photo). The seepage resulted in an ice wall but no significant ice falls occurred and the mine was able to manage this successfully. A water-management pushback has been planned to help mitigate this risk, which is endorsed. A test horizontal drain hole was completed (right photo) and has both consistently made water (including over the winter) and influenced the seeps on the wall. This suggests that horizontal drains may be viable in intercepting and managing seepage.



Whale Tail Open Pit

Observations - Phase 2 South Wall (3)

3. A potentially unstable daylighting wedge was identified below the Phase 1 ramp during the 2021 inspection. A preliminary assessment completed at the time by the mine suggested that the wedge was displacing in response to blasting and had a FoS < 1 if the structures are cohesionless and persistent. This is likely conservative for a wedge of this size but still indicates that the wedge may not be stable. The area will be mined out by the Phase 3 pushback.

- It is understood that the wedge is no longer responding to blasting; however, there have been no large blasts below the south wall recently. One is planned in the near-future and the response of the wedge should be carefully monitored.
- As the wedge undercuts the ramp, it was recommended that instrumentation be installed to monitor any displacement. This has not been done. The fracture defining the eastern end of the wedge appears to have dilated (photo at lower right). Given the size and position of the block, the installation of instrumentation (e.g., wireline extensometer) to supplement the radar coverage continues to be recommended.

Whale Tail Open Pit

Observations - Phase 2 South Wall (4)

4. Loose and overhangs are present along the crest of the lowermost bench on the south wall (photo at lower right). This flitch was approved by Rock Mechanics (student) and drilling of the pattern for the next flitch was in progress. The flitch should not have been approved with these hazards present. None of the personnel working in the area reported the hazard.

- While the crest needs to be scaled, the blastholes make scaling challenging. One possibility would be to carefully monitor the area during loading and then scale the flitch after the blast. The area should be noted on the hazard map.
- The circumstances should be reviewed with both Rock Mechanics and operations personnel, as several opportunities to identify and correct the hazard were missed. Did the person signing off on the bench have sufficient experience to complete the Bench Approval?

Evidence of the north dipping structures that form the basis for Structural Domain 5 was observed at the eastern end of the lower wall, north of the Komatiite contact. Mapping is recommended to better define the extents of this structural domain.

Whale Tail Open Pit

Observations - Phase 3 South Wall

BASE CASE
BFA: 75°
Bench Width: 10 m
Bench Height: 21 m
IRA: 53°

- Final wall within the Phase 3 Pushback (Design Sectors H6 and I6). The wall is predominantly Diorite.
- The area is a focus of current mining activity.
- Curvilinear structures are prominent in the wall and have locally contributed to crest loss (see left photo).
- Seepage from the lower bench face and floor was observed in the active mining area (see right photo). It is understood that this is a relatively recent development and is thought to be linked to a change in the blast pattern design, which now leaves a rock ridge between the pushback and the Phase 2 crest; the ridge may be retaining water that was previously draining into Phase 2.

Whale Tail Open Pit

Observations - Phase 3 South Wall (2)

- The rock mass characteristics of the Diorite exposed in the upper benches is variable. Some areas are characterized by few discontinuities forming large blocks (photo at right). In other areas, more discontinuities and and numerous small blocks are present (example on previous slide). The areas of lowest rock mass quality (photo at left) appear to be concentrated below the footprint of Whale Tail lake.
- In general, this variation in rock mass quality has not strongly influenced bench performance but has resulted in increased scaling or local rockfall hazards. Rockfall berms have been constructed below some of the blocky areas thought to represent the greatest hazard. This is endorsed.

Whale Tail Open Pit

Observations - Phase 3 South Wall (3)

- The mine has recently switched to double-benching using 10.5 m flitches in the Diorite instead of triple-benching using 7 m flitches.
- This reduces the overall exposure of personnel working near the face but makes scaling more difficult as the excavator must work from a muck pad to reach the crest. As part of this transition, carefully monitoring the scaling and placing additional emphasis on the Bench Approval process is recommended to ensure that hazards are managed.

Whale Tail Open Pit

Observations - Phase 3 South Wall (4)

- A prominent fault, believed to be the Ramp Fault, has been exposed in the southeast wall of the Phase 3 Pushback.
- The fault is associated with a zone of reduced rock mass quality 1 to 2 m thick and 10 to 20 cm of gouge.
- A considerable amount of loose was present on the wall. It is understood that the wall had not yet been approved and that additional scaling will be recommended. This is endorsed.

Whale Tail Open Pit

Observations - Phase 3 Southeast Wall

BFA: 75°
Bench Width: 16 m
Bench Height: 21 m
IRA: 44°

- Final wall in Design Sector F6.
- The slope geometry recommendations for this sector were adjusted in late 2021 as the strike of the sector had changed, increasing the potential for planar failure on Joint Set C.
- The achievable bench geometry is sensitive to both the persistence of Joint Set C and blasting and scaling practices. With careful blasting and scaling, a BFA of 75° and IRA of 44° could be achievable if the persistence is limited to 10 m or less, though with backbreak in the order of 8 m. However, if these practices are not used or are not effective, a BFA of 50° and IRA of 39° will be required.
- Geotechnical inspections and Bench Approvals were identified as a critical control for managing potential crest loss, rockfall and bench-scale failures.
- These are the first benches established in this sector and it is important to validate the bench design and implementation.

Whale Tail Open Pit

Observations - Phase 3 Southeast Wall (2)

- The first two benches were established as single 7m high benches without pre-shear. The reason for this is not clear.
- The bench faces have broken back to Joint Set C. The resulting catch bench width appears to be less than the 8 m minimum in at least some areas.
- It is understood that the benches were heavily scaled. Some of this material has been left on the catch benches compromising their capacity to retain rockfall. To the extent possible, this material should be cleaned up and removed.
- Several discontinuities defining the bench faces appear to be persistent over both benches (i.e., a persistence > 10 m).
- It is not clear whether the Bench Approval process was followed for these two benches. If it was, it did not achieve the desired outcome.
- The design bench geometry will not be achievable if the approach used for these two benches is continued. Mining practices have improved for the third bench, which is discussed on the next slide.

Whale Tail Open Pit

Observations - Phase 3 Southeast Wall (3)

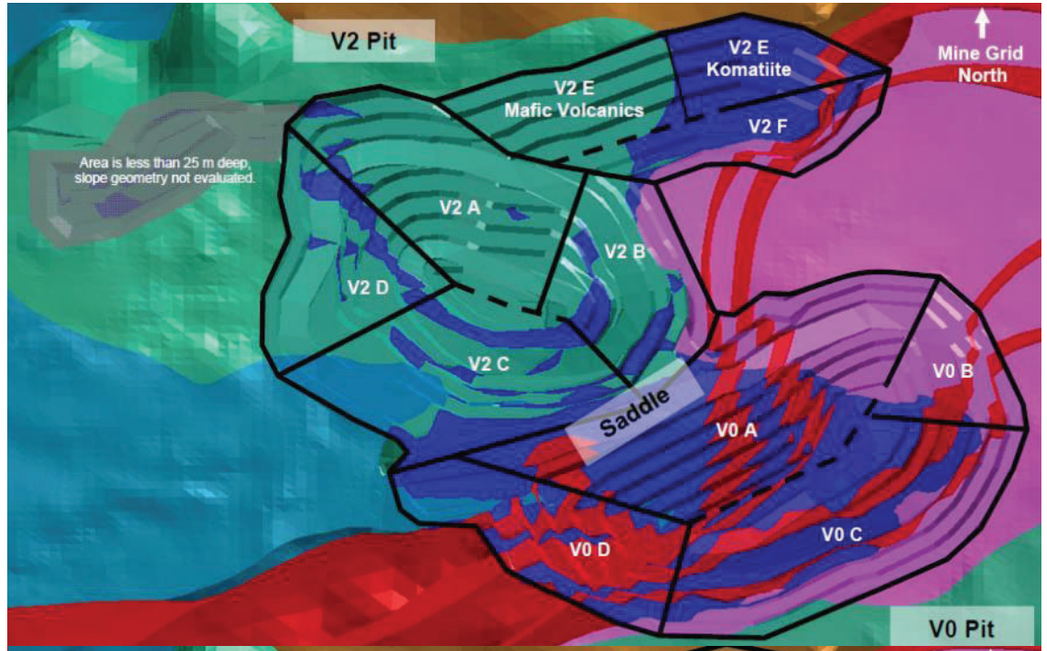
- The first flitch of the third bench had been established and drilling of the second flitch was in progress at the time of the visit. The bench is planned to be triple-benched. Pre-shear was used.
- The central portion of the bench has performed reasonably well (photo at right). Some crest loss, but half barrels visible over most of the face.
- The eastern portion of the bench has failed back to Joint Set C over almost the full height of the bench (photo at left). It is understood that this portion of the bench was scaled heavily, however some loose slabs were observed on the face that should be removed.
- It is understood that the Rock Mechanics student was tasked to do the Bench Approvals for this sector. Given the importance and challenging nature of this sector, it is recommended that the Bench Approvals for this area only be done by experienced personnel.
- It is not clear if the design BFA of 75° will be achievable for this sector. The remaining flitches of this bench need to be monitored and their performance documented. Once the bench is complete, a review should be completed to assess if the bench design is achievable or if it needs to revert to the shallower geometry (i.e., BFA of 50°).

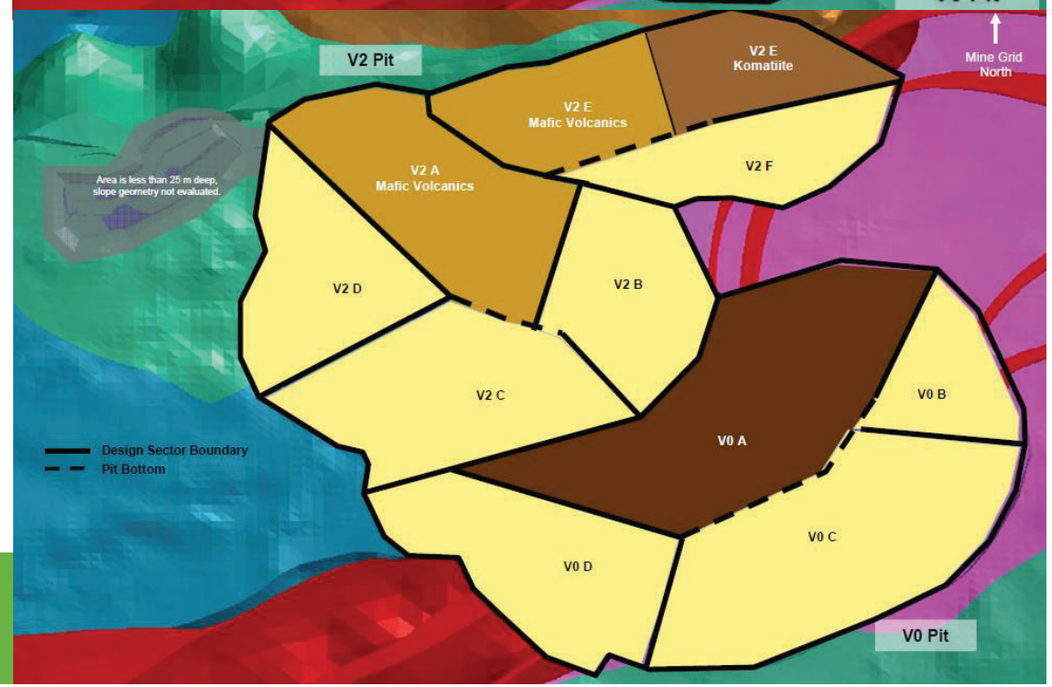
IVR V1 & V2 OPEN PITS

IVR V1 & V2 Open Pits

Overview

- The design recommendations for the IVR West 1, IVR West 2 and IVR V2 Extension open pits are shown at right for reference.
- The design sectors are shown at upper right along with the lithologies expected in the final open pit walls. The slope geometry recommendations are shown at lower right.
- Note that the V1 open pit was previously referred to as the V0 open pit and most design documents issued by KP refer to it as such.
- The design recommendations were developed based on the IVR-001-004C design. Updated designs, IVR-001-006C, have been developed for both open pits.





LEGEND:

- GREYWACKE (S3)
- CHERT (S10, S10E, S10mSi & S10sSi)
- KOMATIITE-0a - NORTH LIMB (V4-0a & V4Bio)
- KOMATIITE-0b - SOUTH LIMB (V4-0b & V4Bio)
- MAFIC VOLCANICS (V3 & I3A)
- BRITTLE STRUCTURES

Base Bench Geometry

BFA: 75°
Bench Width: 10.5 m
Bench Height: 21 m
IRA: 52°

Bench Geometry Controlled by Bench-Scale Failures

V2 A & V2 E
BFA: 75°
Bench Width: 10 m
Bench Height: 14 m
IRA: 46°

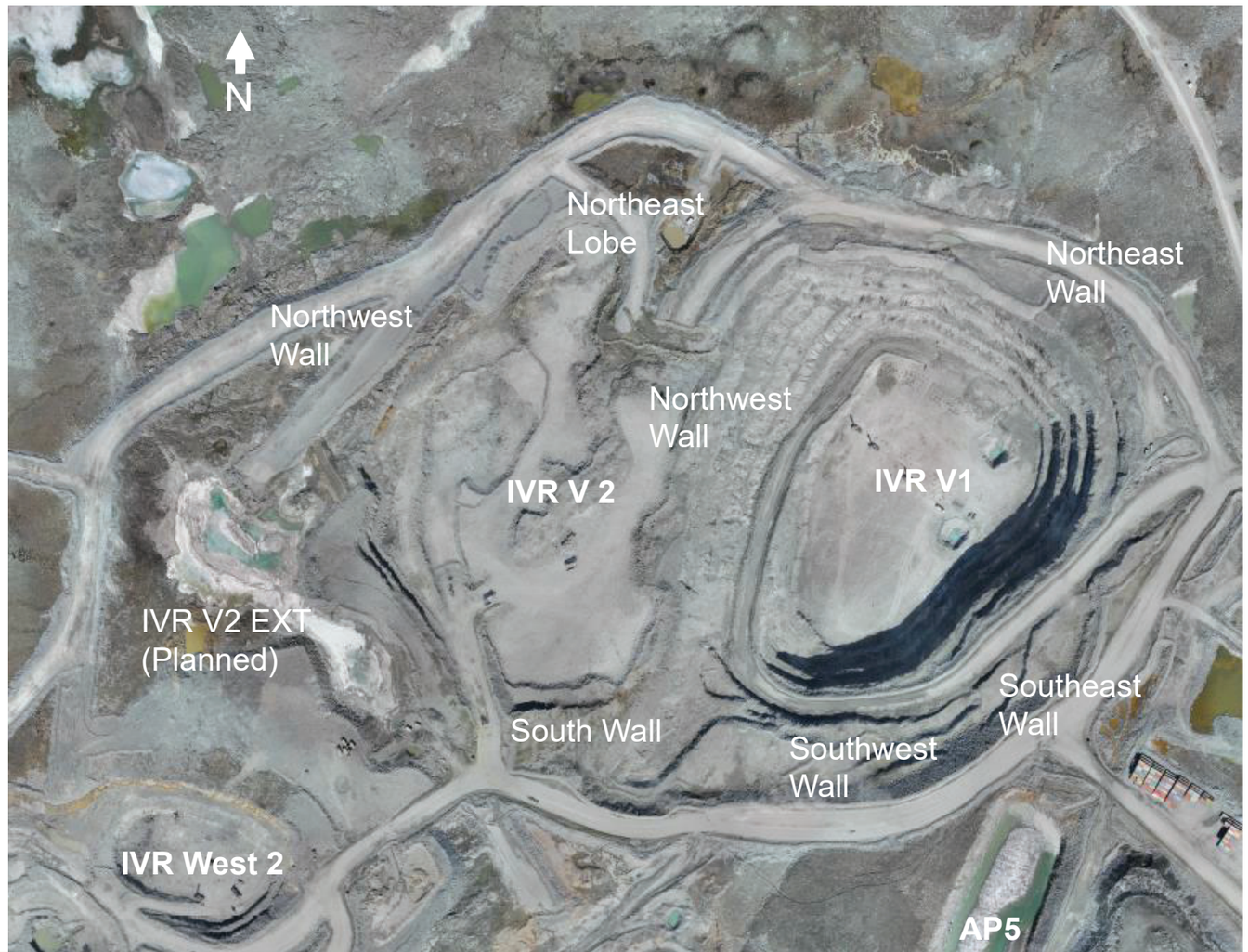
V2 E
BFA: 50°
Bench Width: 8 m
Bench Height: 14 m
IRA: 35°

V0 A
BFA: 45°
Bench Width: 8 m
Bench Height: 14 m
IRA: 32°

IVR V1 & V2 Open Pits

General

- The IVR V1 and IVR V2 open pits were inspected on August 14 and 15, 2022. Observations made during the inspection are summarized on the following slides.
- The approximate current pit geometry is shown at right. The walls inspected are labelled relative to mine north.
- Note that the IVR V2 Extension is planned as an expansion of the IVR V2 open pit towards the west, approaching the IVR West 2 open pit.



IVR V1 Open Pit

Observations - Northwest Wall

- Final wall in Design Sector V0A. This sector encompasses the footwall of the deposit.
- The slope geometry was expected to be controlled by the potential for bench and inter-ramp scale planar failures on the foliation (Joint Set A).
- Specific comments are provided on the following slides.

IVR V1 Open Pit

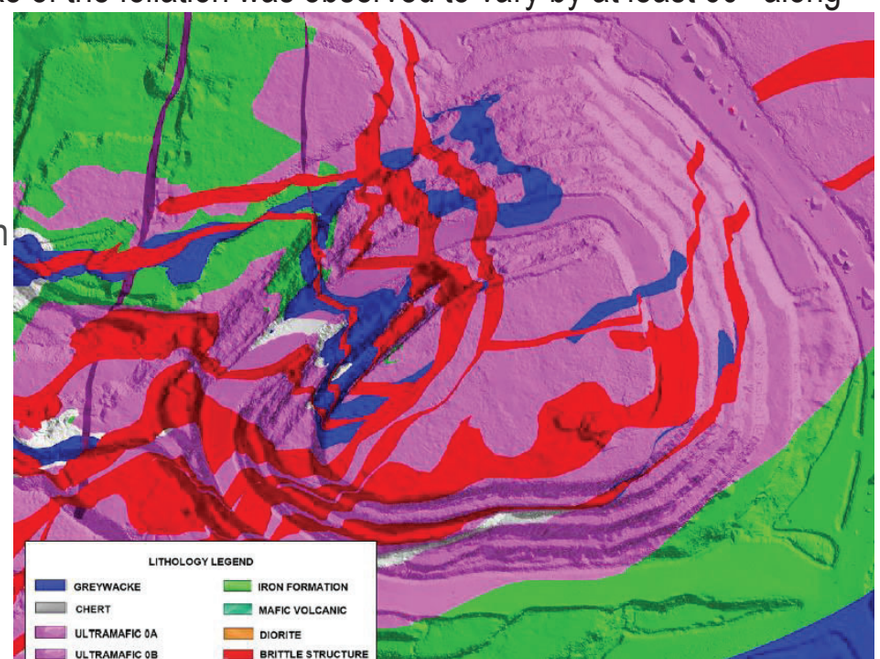
Observations - Northwest Wall

- The benches at the southern end of the upper wall failed back to the foliation during development. In some cases, there is effectively no catch bench width remaining.
- Mining of the IVR V2 open pit has resulted in spillover onto the northwest wall. The mine has adjusted the blasting practices to reduce this, but spillover is expected to continue.
- A rockfall berm has been established along the inside of the ramp and has capacity. The rockfall berm will need to be monitored and cleaned out as required as mining of IVR V2 continues.
- Mining of IVR V2 will ultimately remove the upper two to three benches of this wall, which will reduce the rockfall hazard in the long term.

IVR V1 Open Pit

Observations - Northwest Wall

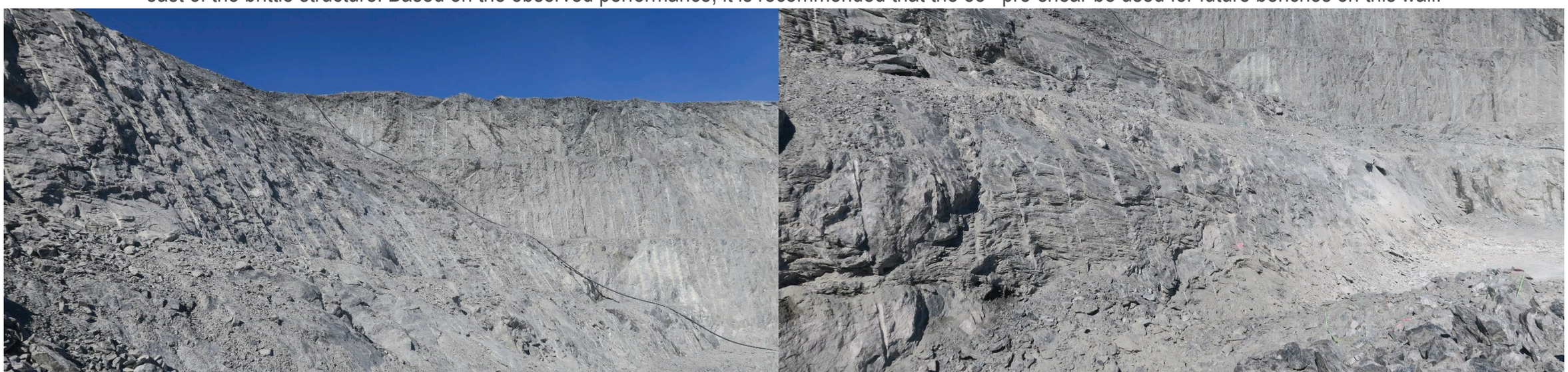
- The performance of the Northwest Wall varies significantly along the wall. Observations suggests that this is linked to:
  - **Lithology:** Bench faces steeper than the dip of the foliation have been achieved in an interval of Greywacke at the western end of the wall. The Greywacke is more competent than the Komatiite and has increased discontinuity shear strength.
  - **Foliation Orientation:** The foliation was expected to be parallel to the wall. Where this has occurred (e.g., the upper benches at the eastern end of the wall), the foliation has typically defined the bench face. However, the strike of the foliation was observed to vary by at least 60° along the wall and this has contributed to variable bench performance.
  - **Bench Design and Implementation:** The original design was for a 45° BFA established using staggered blast holes. This proved impractical to implement, at least partially due to poor control of the blast hole depth resulting in over-drilling. The mine has trialled pre-shear blasting of 55° and 65° BFAs, which is discussed in greater detail on the next slide. In both cases the catch bench width was increased to maintain the design IRA.
- Recommend documenting the lithology, rock mass structure, and bench performance at regular intervals along the Northeast Wall in order to better understand the controls on the wall performance. While relatively few benches remain in the IVR V2 pit, the results are relevant to the footwall of the IVR V1 pit.



IVR V1 Open Pit

Observations - Northwest Wall (2)

- The mine has trialled the use of a 55° and 65° pre-shear to define the bench face rather than using staggered blastholes. The 55° pre-shear trial was done at the east end of the wall, above the ramp (shown at lower left). It performed well. As a result, the mine tried 65°.
- The 65° pre-shear trial was done for the full length of the current bench. It performed well to the west of the brittle structure in the middle of the wall, with the bench face standing steeper than the dip of the foliation. This may be because the slope appears to be in the Mafic Volcanics in this area. East of the brittle structure (shown at lower right), the bench performance was marginal, with two bench-scale failures and increased crest loss. Subsequent to the site visit it is understood that additional bench-scale failure occurred in this area.
- The mine intends to use the 65° pre-shear for the remaining two to three benches. The bench performance suggests that this is aggressive, particularly to the east of the brittle structure. Based on the observed performance, it is recommended that the 55° pre-shear be used for future benches on this wall.

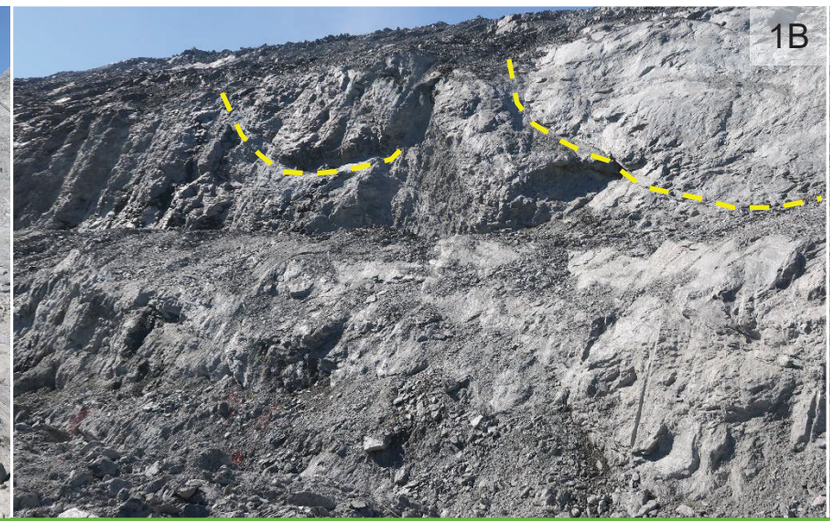


IVR V1 Open Pit

Observations - Northwest Wall (3)

- In May, a 100 tonne wedge failure occurred directly below the ramp on the foliation and a cross-cutting structure (outlined in white). This was part of the 65° BFA trial.
- Several hazards were observed on the eastern end where the 65° BFA was used:

1. The foliation has formed two slabs on the bench face of the second lowest bench (Photos 1A and 1B below), separated by what appears to be a brittle structure. These slabs are potential instabilities and should be a focus of future monitoring. It is understood that several rockfalls occurred in this area after the annual inspection.
2. There is a local overhang on the lowest bench (Photo 2 below). Recommend scaling it down.



IVR V1 Open Pit

Observations - Northeast Wall

- Final wall in Design Sector V0B.
- The wall is performing well. Half-barrels are visible. The foliation is oriented perpendicular to the wall.
- Cross-cutting structures resulted in numerous small wedges in the upper benches and significant scaling was required when the benches were established. There was a concern that the benches would ravel over time. However, to date, very little material has accumulated on the catch benches.
- No evidence of movement has been observed on several potential wedges identified during the 2021 inspection.

IVR V1 Open Pit

Observations - Southeast Wall

- Final wall in Design Sector V0C.
- The wall is performing well. Half barrels are visible and very little material is present on the catch benches.
- Several persistent cross-cutting features were identified during the 2021 inspection (examples circled below). These structures were not prominent in the structural data underlying the design of the open pit and there was a concern that they could impact the achievable slope geometry. It now appears that these structures were localized as they have not influenced the bench performance at depth.

IVR V1 Open Pit

Observations - Southwest Wall

- Final wall in Design Sector V0D.
- The wall is generally performing well. While the benches are primarily within the Komatiite and Brittle Structures, the wall is oriented perpendicular to the foliation.
- Numerous seeps are present in the wall. As the pit is thought to be entirely within permafrost, the seeps are assumed to be in the active layer.
- In the southwest corner of the pit, the seepage is sufficient to have caused a prominent Brittle Structure to erode (circled at left with close-up at right). The area should be monitored for ravelling over time.

IVR V2 Open Pit

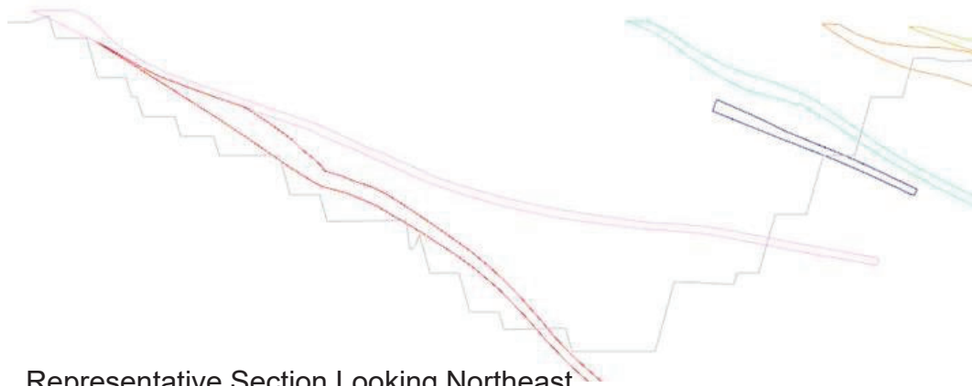
Observations - General

- The IVR V2 open pit is in the early stages of mining; approximately two benches have been established.
- These initial benches represent an important opportunity to validate the rock mass characterisation and slope geometry recommendations that underpin the open pit design. Recommend documenting the bench performance and key rock mass characteristics and comparing them to expectations.
- As noted earlier, managing spillover from the IVR V2 pit to the IVR V1 pit is an on-going challenge. The mine has adapted the blasting sequence to leave a small ridge adjacent the IVR V1 pit and then blasts the ridge into the V2 pit. This has been effective at reducing spillover.
- Comments on specific locations within the pit are provided on the following slides.

IVR V2 Open Pit

Observations - North Wall

- The north wall is located along the footwall of the deposit.
- Based on the results of the stability analyses, a decision was made to push back the wall so that it was located within the Mafic Volcanics rather than the Komatiite. This is expected to reduce the potential for bench- and multi-bench scale planar failures on the foliation. It also reduces the potential for inter-ramp scale planar failures on the brittle structures (see representative section below). If it is not possible to establish the wall in the Mafic Volcanics, it is likely that a much shallower slope will be required.
- It is important to verify that the slope is in fact being established in the Mafic Volcanics and below/behind the Brittle Structure expected along the contact between the Mafic Volcanics and the Komatiite.
- The performance of the initial two benches in this wall has been reasonable to date.



Representative Section Looking Northeast

IVR V2 Open Pit

Observations - North Wall “Turtlehead”

- The overburden in this area was thicker than expected, resulting in a large thermal cap. There are gaps in the thermal cap (outlined below in white) and exposed overburden is present along the crest of the upper bench. The overburden is likely to ravel over time. Section 1.135 of the Nunavut Mine Health and Safety Act requires unconsolidated material to be excavated back a minimum of 2 m from the crest. The thermal cap should be remediated in this area.
- Scaling of the end wall was in progress at the time of the inspection. Frequent hard toes were noted by the operator. The foliation is perpendicular to the wall in that area and significant scaling was required due to the presence of numerous small wedges/blocks. A potentially unstable block was observed on the wall (outlined below in black). It was not brought down with the scaling and should be monitored over time.
- A portion of the safety berm was missing at the end of the crest road where the photos below were taken. The berm should be re-established.

IVR V2 Open Pit

Observations - North Wall Noses

- A nose has been left in the final north wall adjacent the “Turtlehead” (shown in the photos below). The nose is intersected by a lens of Graphitic Chert aligned parallel to the north wall (circled in lower left photo).
- The creation of small, abrupt noses like this one should be avoided, particularly through contacts. The reduced confinement acting on the rock mass increases the potential for ravelling and instabilities over time.
- The nose may deteriorate further over time and should be specifically included in the visual inspection of the open pit.

IVR V2 Open Pit

Observations - Nose between IVR V1 and IVR V2

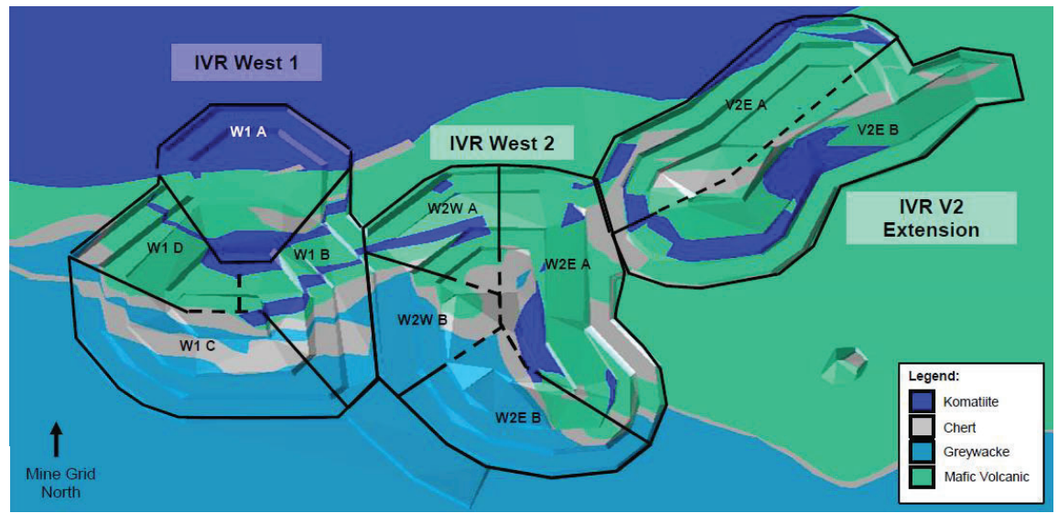
- A nose will be left on the uppermost bench at the point where the two open pits meet.
- The nose is in poor condition and had not been fully scaled at the time of the inspection. It should be scaled to reduce the rockfall hazard.
- The nose may deteriorate further over time and should be specifically included in the visual inspection of the open pit.

IVR WEST OPEN PITS

IVR West Open Pits

Overview

- The design recommendations for the IVR West 1, IVR West 2 and IVR V2 Extension open pits are shown at right for reference.
- The design sectors are shown at upper right along with the lithologies expected in the final open pit walls. The slope geometry recommendations are shown at lower right.
- The design of the open pits has changed since the recommendations were developed. The design shown here is the 20210202_ivr-w design.
- All three open pits have a depth of less than 50 m.



Base Bench Geometry

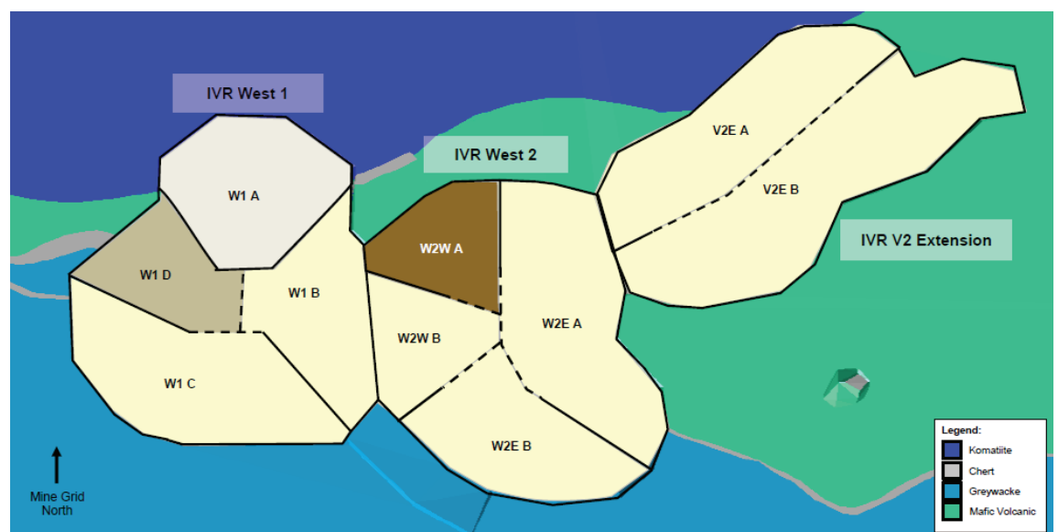
Base Case
BFA: 75°
Bench Width: 10 m
Bench Height: 21 m
IRA: 53°

Bench Geometry Controlled by Bench-Scale Failures

W1 A
BFA: 65°
Bench Width: 10.5 m
Bench Height: 21 m
IRA: 46°

W1 D
BFA: 65°
Bench Width: 10 m
Bench Height: 21 m
IRA: 47°

W2W A
BFA: 55°
Bench Width: 11 m
Bench Height: 21 m
IRA: 39°



IVR West Open Pits

General

- The IVR West 1 and IVR West 2 open pits were inspected on August 14 and 15, 2022. Observations made during the inspection are summarized on the following slides.
- The approximate current pit geometry is shown at right.
- Mining of IVR West 1 was recently completed and the open pit is being partially backfilled with waste rock. The drone imagery shown at right was taken prior to the start of backfilling.
- Mining of IVR West 2 will be completed in August 2022 at which point the open pit will be used for water management before being backfilled in 2033.
- Mining of IVR V2 Extension has not yet started.

IVR West Open Pits

Observations - IVR West 1

- Mining of the IVR West 1 pit is complete.
- A total of three single benches and one double bench were mined.
- The open pit is being backfilled with waste rock placed by end-dumping from the crest.
- A berm has been constructed on the ramp to prevent access to the open pit.

- The controls in place appear to be adequate to manage the expected hazards.

Looking Southeast

IVR West Open Pits

Observations - IVR West 2

- Mining of the IVR West 2 pit was nearing completion at the time of the inspection, with mining of the final bench in progress.
- The upper two benches are single benches. The lower bench is planned to be a triple bench, with a good-bye cut.
- As the pit will be used for on-going water management, safe access will need to be maintained once mining is complete.

- The rock mass structure within the open pit is complex, with the orientation of prominent structures changing over relatively short distances.
- The benches have generally performed well. Several rockfall hazards were observed and are shown on the following slide.

Looking East

IVR West Open Pits

Observations - IVR West 2

- Several rockfall hazards were observed along the northeast wall, above the ramp (circled at right).
- A thermal cap has not been constructed for the overburden between IVR West 1 and IVR West 2, and the overburden has started to slough. It is currently manageable, but if it progresses it could become a rockfall hazard.
- Recommend scaling the wall and constructing a rockfall berm along the inside of the ramp.

- The IVR V2 Extension is planned to merge with the east wall of this pit. The rockfall risk associated with spillover from blasting and the potential creation of noses at the breakthrough will need to be reviewed and managed.

Looking Northeast

AP5

AP5

Observations

- Attenuation Pond 5 is a former quarry located to the east of the WHL open pit that is now used for water management. The pond was inspected on August 15, 2022.
- The pond is partially flooded, with one to two benches exposed above the pond water level. As a result, a detailed inspection could not be completed.
- No stability concerns were identified in the exposed slopes.
- Pumps were present at the time of the inspection. Access to the ramp and pit was unrestricted, but pylons were installed during the inspection.

Monitoring and Inspections

Monitoring and Inspections

General

- The slope monitoring program at the mine currently consists of the following primary components:
  - Observations and Ground Control Log Book entries from mine personnel
  - Visual Inspections
    - Routine and special geotechnical inspections
    - Official wall inspections
    - Bench approvals
  - Slope Stability Radar (SSR) monitoring
- Note that in-situ instrumentation is not currently used, though vibrating wire piezometers and thermistors were installed in the past and additional instruments are planned in the future.
- Maptek LiDAR scans are used to document the achieved slope geometry but are not used for monitoring.

Monitoring and Inspections

Visual Inspections

- The frequency of each visual inspection, the person responsible and the communication of the results of the inspection are defined in the GCMP (at right).
- In addition to the inspections noted at right, the mine also employs a bench approval procedure.
- The routine and special visual inspections are documented with photos and summarized in emails. They focus on specific identified or reported hazards.
- The official wall inspections are completed by a multi-disciplinary group and consider all of the open pit walls rather than specific hazards. The inspections are documented with photos and in a formal report.
- Identified hazards are discussed, a risk rating assigned, and mitigation measures agreed upon.
- The GCMP also includes a commitment to use a drone to examine the catch benches and known geotechnical hazards but this has not been done in the last two years except on an ad-hoc basis. Several areas in the pits would benefit from drone inspections.

Table 5-5: Summary of Inspection Program

Structure	Responsible	Type	Frequency	Reporting	Distribution List
Whale Tail pit and IVR pit	Geotechnical Engineer or Technician	Routine visual inspection	1 x 2 days	Email highlighting the main observation and conclusions	Meadowbank Mine Operation Supervisors
		Official wall inspection	Biweekly	Wall inspection map and report	Surveyors, Grade control, Mine Ops, E&I, Environment, Mine inspector, Geology team
		Special visualization inspection	After each of these events: •New potential geotechnical hazard was identified by personnel working in the open pit and/or reported in the ground control book. • Rockfall (in area of event) •Earthquake	Ground control book and email highlighting the main observation and conclusions	Meadowbank Mine Operation Supervisors, Geotechnical coordinator
	Geotechnical Engineer and third-party reviewer	Annual pit slope performance	Once per year	Annual pit slope performance review	Geotechnical Team, Mine inspector, Regulators
	Geotechnical Engineer and Mine inspector expert	Mine inspector geotechnical inspection	Once per year	Whale Tail Project Mine Inspector review	Mine manager

Monitoring and Inspections

Visual Inspections - Comments

- The following comments from the previous annual review remain applicable:
  - The wall inspection reports rightfully focus on the identified hazards. Recommend also compiling a series of overview photos (e.g., of each major wall) with comments to generate a record of wall performance over time. This can be invaluable for back-analysis.
  - While there are frequent visual inspections, there should be a formal mechanism (e.g., TARP) in place to increase the frequency of inspections in the event that an instability is observed or, for example, particular deformation limits are exceeded.
  - Recommend incorporating a periodic inspection of the open pit crest for evidence of instability (e.g., above D4K). As a starting point, this could be completed monthly.
  - The drone inspection commitment in the GCMP should be reviewed and aligned with current needs and capabilities. For example a biannual (e.g., at start and end of summer) review of catch bench condition / performance.

Monitoring and Inspections

Hazard and Action Item Tracking

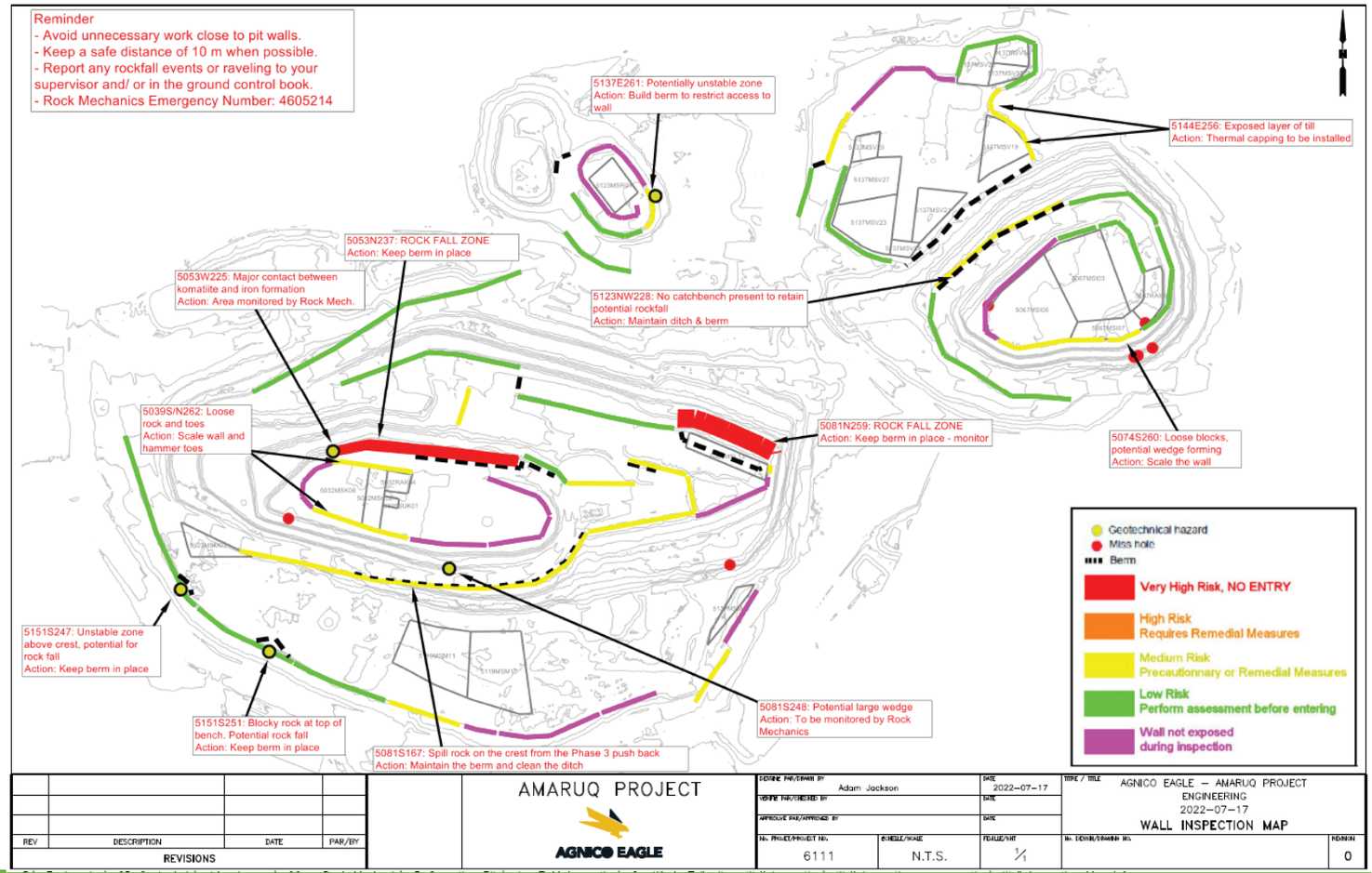
- Hazards, the associated risk rating, and any required corrective actions are tracked in a database. An example from the database is shown below.
- A total of 61 hazards had been identified in 2022 by the end of July. The most common hazards (34) are associated with rockfall hazards or loose. The remainder are roughly evenly split between possible wedges/bench-scale failures, hard toes, and exposed till at the crest of the slope.
- A due date to complete the corrective actions is specified. However, overdue items are not flagged. Recommend setting up a mechanism within the database to flag overdue corrective actions so that they aren't overlooked. For example, there are 55 hazards from 2020 and 2021 that are listed as either not completed or without a status. In many cases the recommendation appears to have been superseded or the hazard mitigated through other means; these items should be closed out.
- The date the corrective action is completed and the person who verified completion is tracked, with some exceptions. This is a good practice.
- Two of the hazards noted as requiring ongoing monitoring (e.g., slabs on the crest of the 5137 bench in Whale Tail Phase 3) have been removed from the hazard map (see next slide). It is not clear why some hazards requiring on-going monitoring are shown while these have been removed. Recommend showing all of the hazards on the map.

Date	ID	Pit/Quarry	Bench	Geotechnical Hazard	Corrective Measure	Due date	Completed (Yes/No)	Date completed	Approved by	Status
12-02-2022	5095W202	IVR	5095	Toes along the wall	hammer toes	Before staking out the 5081PS	Yes	?		
02-02-2022	5095NE203	IVR	5095	Loose material along the wall	Light scaling	Before marking of adjacent pattern	Yes	?		
02-02-2022	5151SW204	IVR	5151	Loose rocks and blocks	Scale the wall	Before marking of adjacent pattern	Yes	?		
28-02-2022	5137SE205	WT Phase 3	5137	Loose rock and block	Scale the wall & crest	Before making the adjacent pattern	Yes	?	DS	4
28-02-2022	5074SE206	WT Phase 2	5074	Block on the corner	Sacle and Hammer if needed	Before making the adjacent pattern	Yes	44620	MMM/AT	4

Monitoring and Inspections

Hazard / Risk Assessment

- Identified hazards and the required mitigation work are tracked on a Hazard Map available to the workforce. The map is an effective tool.
- There continues to be limited guidance on how to select the risk ratings. Recommend providing detailed guidance, including examples, on how to determine these ratings. The goal is to ensure that each member of the Rock Mechanics team can perform the assessment in a consistent and reliable manner.
- The map is updated every two weeks. However, with multiple pits in progress it is often rapidly out of date. Recommend issuing an update weekly (or more frequently) if there are notable changes. One possibility would be to issue a brief supplement that focuses solely on what has changed.



Monitoring and Inspections

Hazard / Risk Assessment

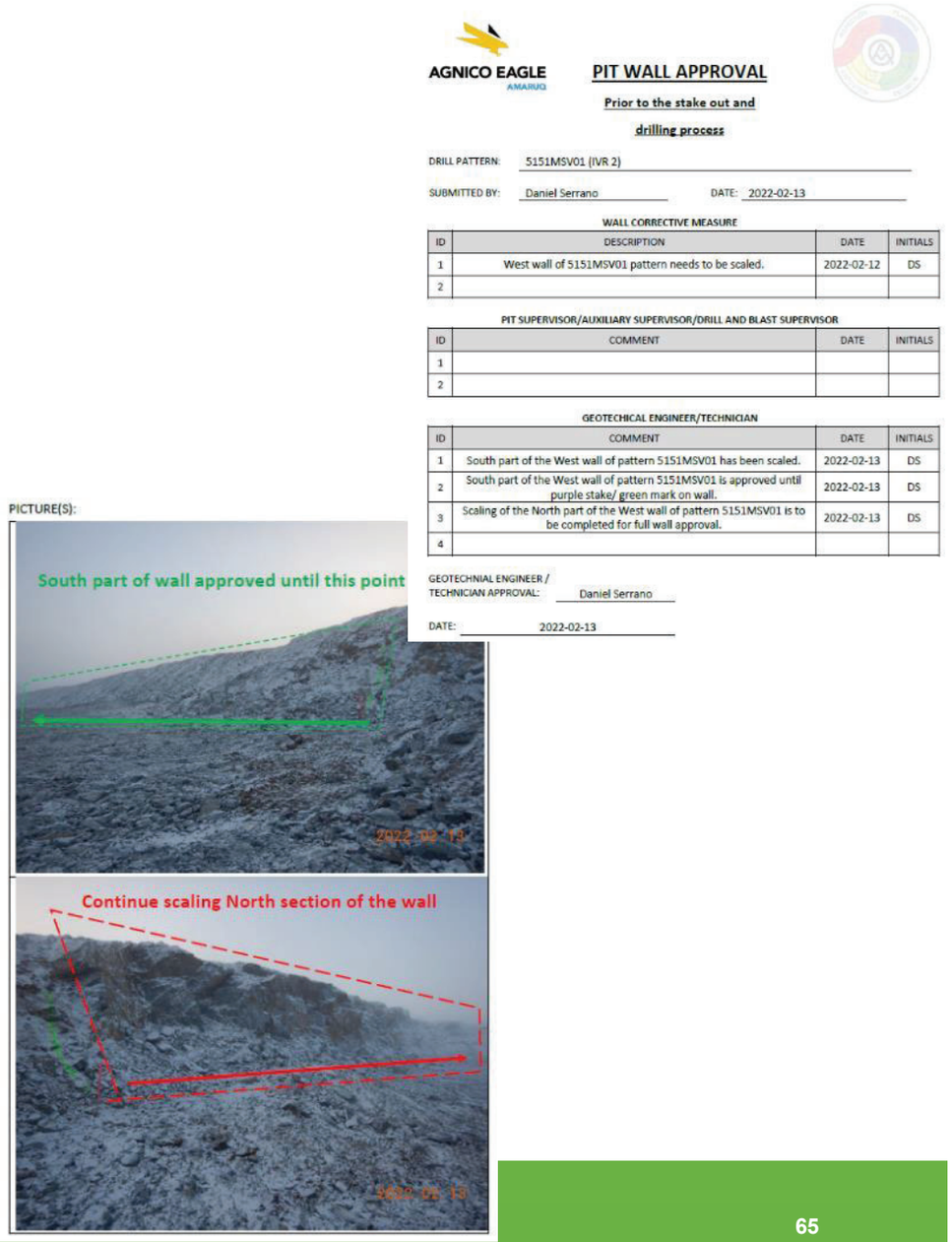
- The hazard maps form the basis for the risk-based Work Close to Pit Wall procedure, which is a key process for managing geotechnical risk (excerpt shown at right). It applies to personnel in vehicles as well as those on foot.
- Annual training is provided on the procedure.
- The procedure was discussed with one of the production geologists working in the pit and one of the rock mechanics engineers. Both were unaware that the hazard map rankings were linked to how work was to be completed near the highwall. The geologist indicated that they would use a spotter if they had to approach within 10 m of the wall but as they work alone it is not clear how reliably this is done.
- Large areas of the open pits are defined as Yellow Zones, where access can be granted by the pit supervisor with the use of a spotter. However, free access is maintained to many of these areas (e.g. Phase 2 ramp).
- The hazard maps are used both to present rock mechanics hazards and to communicate corrective actions. While this is efficient, it has created confusion at times (e.g., the Green Zones were mistakenly believed to mean that the bench had been approved).
- The following are recommended:
  - Review the Work Close to Pit Wall procedure to ensure that is effective, practical and used. Are spotters being consistently used in Yellow Zones?
  - Provide refresher training on the Work Close to Pit Wall procedure.
  - Refine the legend on the hazard map to clearly note the restrictions associated with the risk ratings (e.g., Yellow - Spotter Required).
  - Consider the use of physical markers (e.g. pylons) in the pit to remind personnel of hazards that are not bermed off (e.g., Yellow Zones).
  - Consider communicating the corrective actions separately to operations so that it is clear that the map is focussed on existing hazards.

- Red Zone: An area defined as very high risk.
- Orange Zone: An area defined as high risk. It is a section of the Pit Walls requiring remedial work and must remain closed to all duties, except to the machinery that carries the remedial work, until the work is completed.
- Yellow Zone: An area defined on the pit wall inspection map as medium risk. It is a section of the Pit Wall also requiring remedial work, but access can be granted by the pit supervisor with the use of the spotter.
- Green Zone: An area defined on the pit wall inspection map as low risk. It is a section of the Pit Walls where no remedial work is required to make the area safe for worker access. However, a regular workplace inspection must still occur prior to commencing work.
- Purple Zone: An area defined on the pit wall inspection map as an area where the wall was not exposed at the time of previous inspection.

Monitoring and Inspections

Bench Approval Process

- The rock mechanics group has implemented an approval process for the benches on the final walls (both ultimate pit and interim stages).
- The condition of the bench and whether or not the face has been adequately scaled is assessed. The process is intended to be completed after each 7 m flitch is established and before work resumes in the area. A standard two-page report is issued each time.
- This process is a key control for managing potential rockfalls and bench-scale instabilities and is formalized within the Pit Wall Approval procedure.
- Based on observations and discussions during the visit, the bench approval report would benefit from a checklist to improve consistency between staff and avoid hazards being missed. Approvals in key sectors (e.g. WHL F6) should be limited to experienced staff.



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PIT WALL APPROVAL

Prior to the stake out and drilling process

DRILL PATTERN: 5151MSV01 (IVR 2)

SUBMITTED BY: Daniel Serrano DATE: 2022-02-13

WALL CORRECTIVE MEASURE

ID	DESCRIPTION	DATE	INITIALS
1	West wall of 5151MSV01 pattern needs to be scaled.	2022-02-12	DS
2			

PIT SUPERVISOR/AUXILIARY SUPERVISOR/DRILL AND BLAST SUPERVISOR

ID	COMMENT	DATE	INITIALS
1			
2			

GEOTECHICAL ENGINEER/TECHNICIAN

ID	COMMENT	DATE	INITIALS
1	South part of the West wall of pattern 5151MSV01 has been scaled.	2022-02-13	DS
2	South part of the West wall of pattern 5151MSV01 is approved until purple stake/ green mark on wall.	2022-02-13	DS
3	Scaling of the North part of the West wall of pattern 5151MSV01 is to be completed for full wall approval.	2022-02-13	DS
4			

GEOTECHNIAL ENGINEER / TECHNICIAN APPROVAL: Daniel Serrano

DATE: 2022-02-13

PICTURE(S):

Monitoring and Inspections

Wall Approval Process

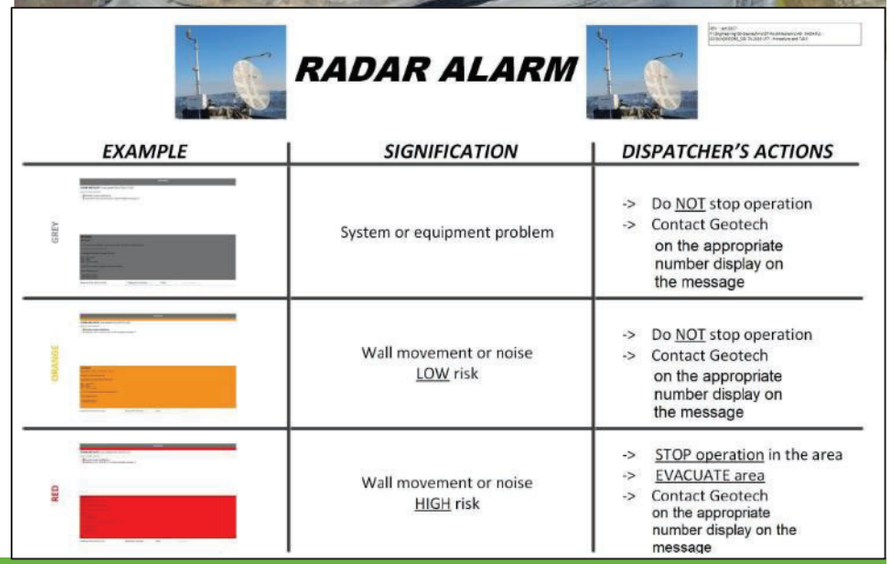
- Rock Mechanics must complete a Bench Approval before drilling can begin on a pattern adjacent to a given bench. Rock Mechanics tracks whether or not a bench is approved in a spreadsheet that is shared with Engineering and Operations. The responsibility is on Operations to check the spreadsheet and verify that a bench is approved before starting to drill the pattern.
- It is understood that this does not always happen and that patterns are sometimes drilled or pre-shear blasts completed before a bench is approved. It was not possible to review the frequency of these events but they are understood to be irregular.
- The communication and verification of whether or not a wall has been approved needs to be reviewed as the current process does not appear to be effective. The process should be reviewed with Engineering and Operations to ensure that bench approvals are completed before work is undertaken in the immediate vicinity. One possibility would be to transition the responsibility to the Drill and Blast Engineers, such that a pattern is not issued to Operations until the relevant benches/flitches have been approved.

Monitoring and Inspections

SSR - General

- The mine has two GroundProbe SSR-XT real aperture radars. One radar covers the north wall while the other radar covers the south wall (see image at right).
- There is a procedure setting out responsibilities and how the SSR data are communicated. The radar data are reviewed at least twice a day and whenever alarms are triggered. The process followed when an alarm is triggered is defined in a TARP, shown at lower right.
- The TARP describes Orange (contact rock mechanics) and Red (evacuate) alarms, but in practice only Orange alarms are used in order to provide the rock mechanics group greater flexibility in determining a response.
- Someone from Rock Mechanics is designated as being on-call and has a pager in the event that they cannot be immediately reached or it is night shift.

- The actions to be taken by Dispatch in the event of a Grey or Orange alarm specifically state that operations are not to be stopped. This is often at odds with the guidance provided by Rock Mechanics and creates room for confusion. Recommend modifying the response, so that the first action is to contact Rock Mechanics (or the Pit Supervisor).



Monitoring and Inspections

SSR Monitoring - Alarms

- The current Orange alarm thresholds are as follows:
  - Velocity exceeding 1.3 mm/hr with a calculation period of 180 minutes
  - 3 contiguous pixels over 2 consecutive scans
- Red alarms are not used. The Orange alarms are adjusted on an informal basis in response to observed conditions. For example, a lower deformation threshold may be used for an area of concern at a low angle of incidence. Additional parameters (e.g., coherence, inverse velocity) are used to interpret the observed movement on a case-by-case basis but are not incorporated into the alarms.
- The strategy of using Orange alarms and adjusting the alarm parameters on a case-by-case basis relies on an experienced operator who is familiar with the historical slope performance and is comfortable interpreting the data. The mine has recently developed a procedure for using the radar, including the process of setting alarms. This is a useful reference and particularly important given the number of new staff joining the Rock Mechanics team. However, neither the procedure nor the GCMP explain why the alarms have been set at their current values or provide guidance on how they can be adjusted based on different circumstances. While it is recognized that it is not practical to cover all eventualities, recommend providing additional guidance on how to define alarm criteria.
- As the open pit gets deeper and the potential for multi-bench failures increases, Red alarms will need to be developed for some areas in order to manage the associated risk. Recommend developing a Red trigger condition as a backstop for unexpected or unprecedented conditions.
- The SSR was involved in the forecasting of 10 of the 17 reported slope failures that had occurred in 2022 as of the time of the site visit. The failures that were not forecast occurred in areas that were masked or during periods when the radar was offline (see comments on next slide).
- The alarm parameters were last reviewed in 2021. Recommend completing a similar review in 2022 and establishing a commitment to do so annually.

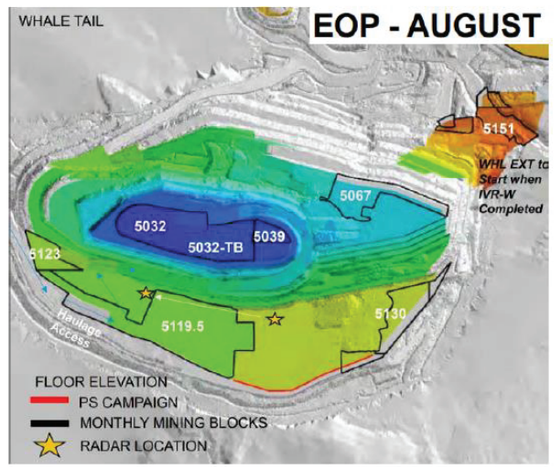
Monitoring and Inspections

SSR Monitoring - Coverage

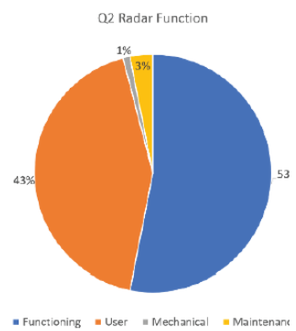
- The mining of multiple phases of the mine, particularly the Phase 3 pushback, strongly influences where the radar can be located and the activities that can be covered by the radar.
- The mine reviews the expected radar coverage relative to the planned mining as part of the quarterly reports (example at right). This is endorsed.
- Radar availability has been a significant limitation in 2022.
  - Radar SSR253 was damaged by flyrock and was only operating 18% of the time in Q1. The radar was repaired in April and availability improved in Q2 to 53% (a large proportion of the remaining downtime was due to intensive mining in Phase 3, represented by the orange “User” category in the chart).
  - Radar SSR560 was operating 100% of the time in Q1, reducing to 60% of Q2 due to an internal computer failure.
- It is understood that GroundProbe’s technical support has improved and this has helped with radar availability.
- As the radar is the sole quantitative monitoring system for the open pit slopes, this amount of downtime has a significant impact on the mine’s ability to manage geotechnical risk. This reinforces the need for additional monitoring systems.
- The SSR is a critical control for achieving an acceptable level of residual risk in sectors of the pit with an increased likelihood of slope failures (e.g., D4K, Phase 1 North Wall). Develop a formal process to stop or modify mining activities in these areas when radar coverage is not available. This can be linked to the Grey alarms.

MONITORING OF NORTH WALL

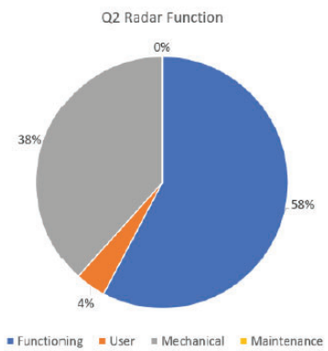
Exact location for the radar to be determined. It will be critical to monitor the NE wall once activities resume in Phase 2, however it may interfere with mining of 5130 bench in Phase 3. Blasts are typically directed to the west. Moving the radar out for each blast may be required.



SSR253



SSR560



Monitoring and Inspections

Instrumentation

- There are currently no geotechnical instruments being actively monitored in or around the open pit. The radar is the sole quantitative method for measuring surface displacement at the mine and the measured displacements are only along a vector between the radar and the pit wall.
- An additional surface monitoring system is recommended, such as prisms or GPS beacons, to complement the SSR, provide a long-term deformation baseline, and to allow the true displacement vector to be measured. It is acknowledged that the mine has had challenges with prisms in the past but it may be possible to benefit from the knowledge gained at other operations.
- The mine is currently planning and budgeting an instrumentation program for the Northeast Wall in 2023. The mine is planning to install a combination of Shape Accelerometer Arrays (SAA) and TDR cables to provide sub-surface data that can be used to better define deeper-seated instabilities. VWPs and thermistors are also planned within the four upper benches of the wall to better understand the potential impact of surface water infiltration on the bench performance. Two GPS beacons are also planned to complement the radar monitoring of the surface displacement. The proposed instrumentation is considered reasonable.
- The instrumentation should be expanded as mining progresses (e.g., Design Sector A1K).
- Vibrating Wire Piezometers and a thermistor were installed in the South Wall in 2022 to allow the effectiveness of the planned water management system to be quantified.

Monitoring and Inspections

Blasting

- The Third-Party review identified limitations in drilling and blasting practices as having a significant effect on wall performance and whether or not the design bench geometry was achieved. Two key limitations were the lack of quality control for the drilling and the use of a limited number of blast patterns for a wide range of conditions.
- The mine commissioned DynoNobel to review the blasting practices. Dyno recommended the use of stemming, air decking and larger diameter holes, and provided several trial patterns. A blasting trial is ongoing, which is endorsed.
  - The first trial blast for pre-shear with stemming was completed in the Diorite (Phase 3 Pushback) and a second trial was planned at the time of the visit.
  - The mine has concerns about the practicality of air decking in an arctic environment and with relatively high turnover of the blasting personnel. Patrick Andrieux of A2GC is reviewing the recommendations and adapting them for the mine.
  - Additional trial patterns were recommended for the Greywacke and Komatiite. The use of a different pattern for the Komatiite is likely to have a material impact on wall performance and a trial should be completed.

- Over the summer, an intern completed quality control on the depth of the blastholes. A Boretrak was also trialled to measure pre-shear drillhole deviation, and the mine is considering buying one. However, the quality control program won't be continued over the winter. Given the issues identified during the Third-Party review, it is recommended that the quality control program be continued over the winter.

Ground Control Program

Ground Control Program

General

Comments on the following aspects of the ground control program for the open pit are provided on the following slides:

- Mine Design Input and Review
- Quarterly Summary Reports
- Data Collection and Design Verification
- Resources and Training
- Ground Control Management Plan (GCMP)

Ground Control Program

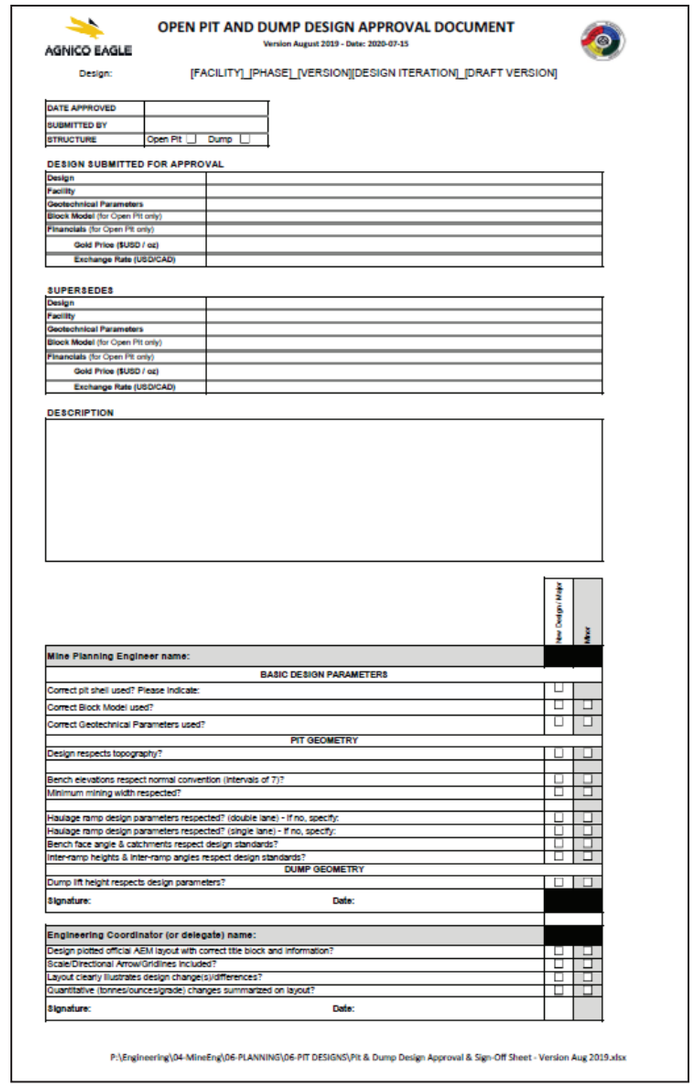
Mine Design Input and Review

- Regular review of, and feedback on, interim designs by the rock mechanics team is important as it allows early recognition and possible mitigation of potential slope instabilities or geomechanical hazards. Ground control factors requiring consideration include:
  - The structural domain(s) involved, including the presence of adverse structure and whether the conditions deviate from expectations.
  - The rock mass quality domains involved, including the presence of weak units (Komatiite and overburden) and whether the conditions deviate from expectations.
  - Whether the proposed design is consistent with the slope geometry recommendations (bench scale and inter-ramp scale).
  - Whether the slope geometry recommendations are applicable (e.g., is the orientation of the dominant structure relative to the orientation of the wall consistent with the analyses underlying the slope geometry recommendations). Is a specific analysis required (by the mine or a consultant)?
  - Possible interactions with faults and brittle structures (e.g. will a fault intersect or lie directly behind the slope).
  - Possible interactions with existing or predicted slope instabilities.
  - Possible interactions with talik or surface water (e.g. the formation of an ice wall or potential for significant inflows)
  - The creation of adverse slope geometry (e.g. a nose).
  - Potential impacts on nearby infrastructure (e.g. ramp, roads at pit crest, attenuation pond, etc.).
  - Is instrumentation or a specific monitoring plan required?

Ground Control Program

Mine Design Input and Review

- The rock mechanics team provides input to mine design and planning process as follows:
  - **Bench Master -** The Bench Master is reviewed by the rock mechanics team as part of the sign-off process.
  - **Weekly Mine Planning Meeting -** Attended by a member of the rock mechanics team. The mine plan for the next two weeks is discussed and any geomechanical considerations identified. Key decisions are documented in meeting minutes.
  - **Three Month Rolling Mine Plan (3MR) -** The rock mechanics team provides input to the 3MR as part of the mine planning meetings. High-level comments are documented in an overall summary presentation.
  - **Budget Mine Plan -** The rock mechanics team reviews the mine plan and key geomechanical considerations are summarized on a slide. Recommend documenting the review in greater detail, even if the document remains internal to the team.
- While the mine does not have an explicit Management of Change procedure, the "Open Pit and Dump Design Approval Document" is used to track sign-off, including from the rock mechanics team, on major changes to the open pit design. This is a good practice.
- The rock mechanics team has a good working relationship with the planners and geologists.



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OPEN PIT AND DUMP DESIGN APPROVAL DOCUMENT

Version August 2019 - Date: 2020-07-15

Design: [FACILITY]_[PHASE]_[VERSION][DESIGN ITERATION]_[DRAFT VERSION]

DATE APPROVED	
SUBMITTED BY	
STRUCTURE	Open Pit ☐ Dump ☐

DESIGN SUBMITTED FOR APPROVAL

Design	
Facility	
Geotechnical Parameters	
Block Model (for Open Pit only)	
Financials (for Open Pit only)	
Gold Price ($USD / oz)	
Exchange Rate (USD/CAD)	

SUPERSEDES

Design	
Facility	
Geotechnical Parameters	
Block Model (for Open Pit only)	
Financials (for Open Pit only)	
Gold Price ($USD / oz)	
Exchange Rate (USD/CAD)	

DESCRIPTION

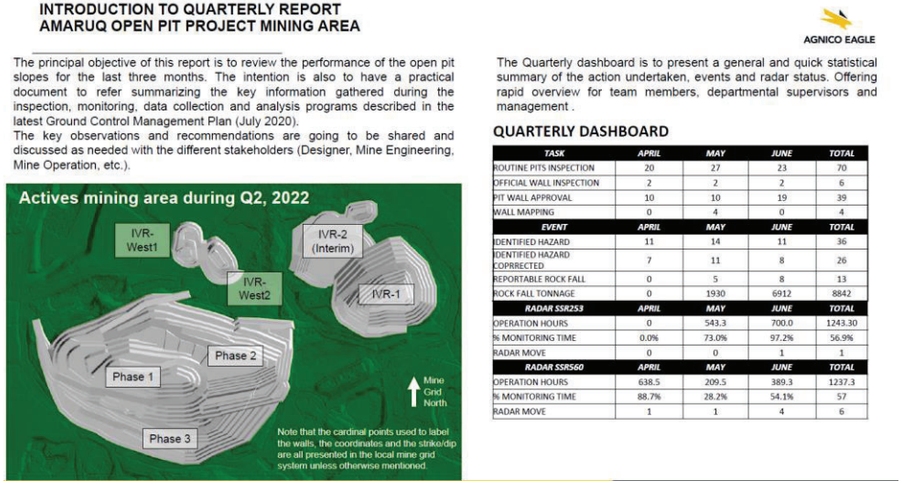
	New Design Major	Minor
Mine Planning Engineer name:		
BASIC DESIGN PARAMETERS		
Correct pit shell used? Please indicate:	☐	
Correct Block Model used?	☐	☐
Correct Geotechnical Parameters used?	☐	☐
PIT GEOMETRY		
Design respects topography?	☐	☐
Bench elevations respect normal convention (intervals of 7)?	☐	☐
Minimum mining width respected?	☐	☐
Haulage ramp design parameters respected? (double lane) - If no, specify:	☐	☐
Haulage ramp design parameters respected? (single lane) - If no, specify:	☐	☐
Bench face angle & catchments respect design standards?	☐	☐
Inter-ramp heights & inter-ramp angles respect design standards?	☐	☐
DUMP GEOMETRY		
Dump lift height respects design parameters?	☐	☐
Signature: **Date:**		
Engineering Coordinator (or delegate) name:		
Design plotted official AEM layout with correct title block and information?	☐	☐
Scale/Directional Arrow/Gridlines included?	☐	☐
Layout clearly illustrates design change(s)/differences?	☐	☐
Quantitative (tonnes/ounces/grade) changes summarized on layout?	☐	☐
Signature: **Date:**		

P:\Engineering\04-MineEng\06-PLANNING\06-PIT DESIGNS\Pit & Dump Design Approval & Sign-Off Sheet - Version Aug 2019.xlsx

Ground Control Program

Summary Reports

- The mine has committed to producing a report every four months that summarizes the slope performance and the inspection, monitoring, instrumentation, and rock mass characterization data collected over the reporting period. In practice, these are being issued quarterly.
- At the time of the inspection, two reports had been completed in 2022. The reports include:
  - A dashboard of Ground Control activities and identified hazards
  - A summary of open pit slope performance, including any slope failures
  - A summary of radar performance and coverage
  - An update on any projects
  - Planning for next quarter
- The following comments are provided on the reports:
  - The reports are a clear and effective summary and are endorsed.
  - The reports include a dashboard summary of the activities complete, but there is no reference to the commitments in the GCMP. Recommend including a column in the dashboard indicating the target frequency for the tracked items.
  - Consider including a slide commenting on the effectiveness of the mine's controls (e.g., radar alarms, prior identification of rockfalls, etc.)



INTRODUCTION TO QUARTERLY REPORT
AMARUQ OPEN PIT PROJECT MINING AREA

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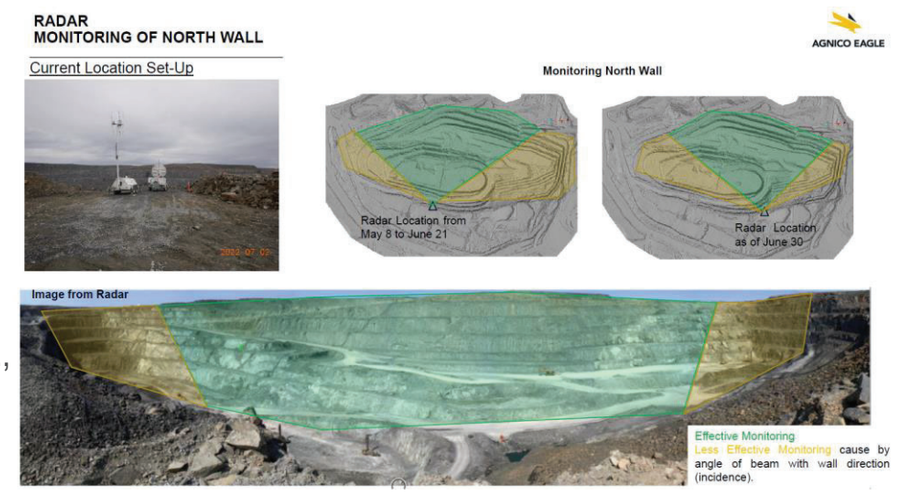
The principal objective of this report is to review the performance of the open pit slopes for the last three months. The intention is also to have a practical document to refer summarizing the key information gathered during the inspection, monitoring, data collection and analysis programs described in the latest Ground Control Management Plan (July 2020).
The key observations and recommendations are going to be shared and discussed as needed with the different stakeholders (Designer, Mine Engineering, Mine Operation, etc.).

Actives mining area during Q2, 2022

The Quarterly dashboard is to present a general and quick statistical summary of the action undertaken, events and radar status. Offering rapid overview for team members, departmental supervisors and management .

QUARTERLY DASHBOARD

TASK	APRIL	MAY	JUNE	TOTAL
ROUTINE PITS INSPECTION	20	27	23	70
OFFICIAL WALL INSPECTION	2	2	2	6
PIT WALL APPROVAL	10	10	19	39
WALL MAPPING	0	4	0	4
EVENT	**APRIL**	**MAY**	**JUNE**	**TOTAL**
IDENTIFIED HAZARD	11	14	11	36
IDENTIFIED HAZARD COPRRECTED	7	11	8	26
REPORTABLE ROCK FALL	0	5	8	13
ROCK FALL TONNAGE	0	1930	6912	8842
RADAR SSR253	**APRIL**	**MAY**	**JUNE**	**TOTAL**
OPERATION HOURS	0	543.3	700.0	1243.30
% MONITORING TIME	0.0%	73.0%	97.2%	56.9%
RADAR MOVE	0	0	1	1
RADAR SSR560	**APRIL**	**MAY**	**JUNE**	**TOTAL**
OPERATION HOURS	638.5	209.5	389.3	1237.3
% MONITORING TIME	88.7%	28.2%	54.1%	57
RADAR MOVE	1	1	4	6



RADAR
MONITORING OF NORTH WALL

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Current Location Set-Up

Monitoring North Wall

Image from Radar

Ground Control Program

Data Collection and Design Verification

The mine collects information to support design verification and reconciliation. These efforts can be broadly grouped into two categories.

- Rock Mass Characterization
  - Structural and rock mass quality mapping are to be completed for at least one location each 150 m along the length of the benches in the final walls.
  - Maptek LiDAR scans are completed for all benches on the final walls.
- Slope Performance
  - Bench backbreak is measured for the final walls using Maptek scans on a periodic basis and reviewed as part of the quarterly reports.
  - Rockfalls are tracked in a database as they occur.

Comments on the these activities are provided below.

- The geomechanical mapping is not reliably completed (e.g., 18 locations were mapped in Q1 but none were mapped in Q2). Additional mapping should be completed, particularly during the summer months when the bench faces are clear of snow.
- The mapping to date has been focussed on critical areas in Design Sector D4 of the Whale Tail pit and Design Sector V0A of the IVR V1 pit, which is endorsed. It should also include Design Sector F6 at the Whale Tail pit and Design Sectors V2A and V2E of the IVR V2 pit.
- The mine is now consistently recording all parameters for rockfall events.

Ground Control Program

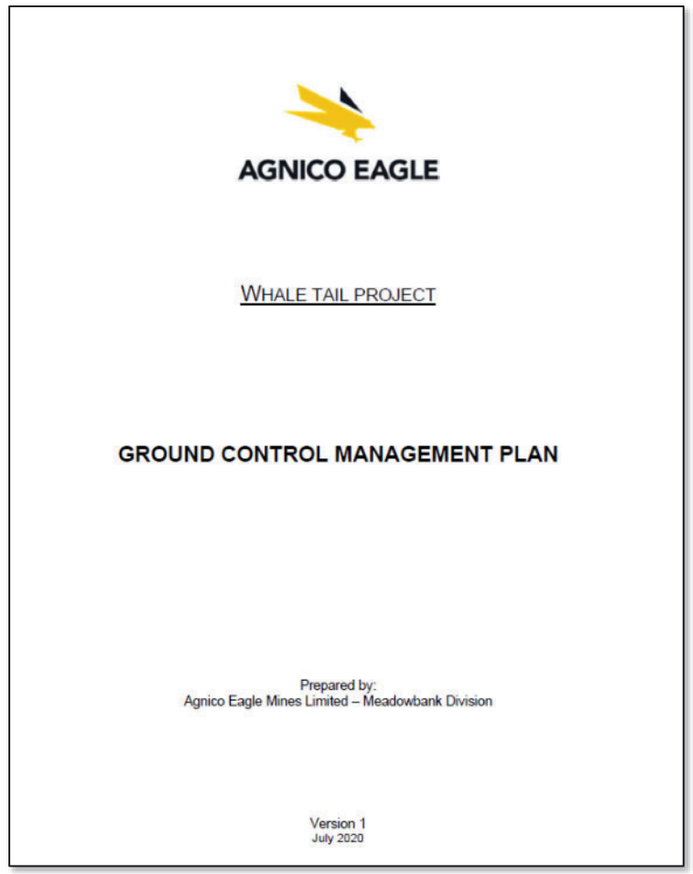
Resources and Training

- The rock mechanics team consists of:
  - Christian Tremblay, Rock Mechanics Coordinator
  - Amadou Traore, Rock Mechanics Engineer
  - Daniel Serrano, Rock Mechanics Engineer
  - Vincent Duranleau, Rock Mechanics Technician
  - Intern
  - During the summer of 2022, the team was supplemented by Adam Jackson from Tetra Tech.
- A new technician, formerly a surveyor in the open pit, is in the process of joining the team. A posting is open for a second rock mechanics coordinator.
- As a result, there are typically two rock mechanics staff on site at any given time. These staff are responsible for both of the open pits as well as the underground mine. The team are currently meeting most of their commitments for the open pits.
- The team has experienced significant turnover, with only two staff remaining from the team at the time of the 2021 review.
- The recent and planned hires put an emphasis on training while staff become familiar with the site and/or new responsibilities (e.g., someone with underground experience needs to learn about open pit rock mechanics). Recommend developing a skills matrix to help identify training needs.
- The team has a full suite of Rocscience software (DIPS, RocPlane, Swedge, RocFall, Slide, RS2) and also has access to Leapfrog, Maptek, and Pix4D. In particular, the team makes effective use of Leapfrog and Maptek to track and visualize observations and geomechanical data. This is endorsed.

Ground Control Program

GCMP

- The GCMP is a clear concise document. The GCMP has not been updated since July 2020 and needs to be updated as a priority. The GCMP should then be reviewed and updated annually. This is a regulatory requirement under the Nunavut Mine Health and Safety Regulations.
- For reference, the following observations and recommendations from the 2021 review are included:
  - Consider adding a one-page overview of the deposit geology and mine plan, including key information such as the ultimate pit dimensions, approximate mine life, major lithologies, etc.
  - (5.2.1.3) - Review and revise the commitments for drone monitoring so that they are focussed and achievable.
  - (5.3.2) Clarify that the collected data should be compared to the design basis for the open pit in addition to looking for trends.
  - (5.4.1) Note that crack meters and extensometers have not been installed and clarify that vibrating wire piezometers and thermistors are not currently being monitored. A plan with the location of the instrumentation should be included or referenced.
  - (5.5) Reference a register that tracks who has received what geomechanical training.
  - (8) Provide greater clarity and detail on the input the team provides to the mine planning and approval process. For example, the input to the Bench Master and 3MR.
  - Describe and include a commitment to the bench approval process.


AGNICO EAGLE

WHALE TAIL PROJECT

GROUND CONTROL MANAGEMENT PLAN

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Version 1
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Recommendations

Recommendations

Priorities

The recommendations stemming from the inspection have been grouped into four categories at AEM's request:

- **Priority 1 (P1):** A high priority or structural safety issue considered immediately dangerous to life, health or the environment. Also includes issues with a significant risk of regulatory enforcement.
- **Priority 2 (P2):** An issue that, if not corrected, could plausibly result in a structural safety issue leading to injury, environmental impact or significant regulatory enforcement. Also includes repeated deficiencies that demonstrate a systematic breakdown of procedures.
- **Priority 3 (P3):** Single occurrences of deficiencies or non-conformances that in isolation are unlikely to result in structural safety issues. Also includes recommendations for pro-active measures and design validation.
- **Priority 4 (P4):** Opportunity for improvement, for example to meet industry best practices.

The recommendations contained in this presentation are briefly summarized by category on the following slides.

Recommendations

P1 and P2

Priority 1 (P1):

- None identified

Priority 2 (P2):

1. Several areas were identified during the visit that should be scaled or rockfall hazards mitigated.
    a) Whale Tail Phase 2 South Wall
    b) Whale Tail Phase 3 South Wall at the Ramp Fault
    c) Loose slabs and debris from scaling on the Whale Tail Phase 3 Southeast Wall
    d) Loose slabs and overhangs on the lower northwest wall of the IVR V1 open pit
    e) Nose between IVR V1 and IVR V2
    f) Loose on the North and East walls of the IVR West 2 open pit
2. Remediate the thermal cap in the IVR V2 “Turtlehead”.
3. Construct, remediate or maintain rockfall or safety berms in the following locations:
    a) Along the inside of the Whale Tail Phase 2 ramp. The ramp needs to be extended along the upper ramp and built up to a consistent 2 m height.
    b) Along the inside of the ramp on the Northwest Wall of the IVR V1 open pit
    c) At the end of the crest road on the east side of the IVR V2 “Turtlehead”
    d) Along the inside of the ramp of the IVR West 2 open pit prior to the pit being used for water management

Recommendations

P2

Priority 2 (P2):

4. Prevent access above the potentially unstable block in the Whale Tail Phase 2 Southeast Wall. Consider leaving some muck against the block to buttress it during drilling and blasting. The area should be monitored when crews are working in the area.
5. Review the Work Close to Pit Wall procedure, how it is communicated and whether it is being consistently used, including:
    a) Provide refresher training on the procedure to ensure it is understood and implemented consistently.
    b) Review the use of spotters in Yellow Zones, as it is unclear if they are being reliably used.
    c) Review the annual training material and assess its appropriateness.
6. Review the use of the Hazard Maps:
    a) Refine the legend on the Hazard Map to clearly note the restrictions associated with the risk ratings (e.g., Yellow – Spotter Required).
    b) Provide more detailed guidance, including examples, on how to determine the risk ratings.
    c) Consider the use of physical markers (e.g., pylons) in the open pit to remind personnel of hazards that are not bermed off (e.g., Yellow Zones).
    d) Consider a separate method for communicating the corrective actions to Operations so that it is clear that the Hazard Map is focussed on existing hazards rather than whether or not work has been completed. This could be captured within the Bench Approval process.
    e) Two of the hazards noted as requiring ongoing monitoring in the Hazard Tracking Database have been removed from the hazard map. All current hazards requiring mitigation should be shown on the Hazard Map.
7. Implement a mechanism within the Hazard Tracking Database to flag overdue corrective actions. If an action has been superseded or the hazard mitigated through other means the action should be closed out.

Recommendations

P2

Priority 2 (P2):

8. Review the Pit Wall Approval process:
   a) Review the communication of bench approvals with Engineering and Operations to ensure that the process is reliably followed.
   b) Incorporate a checklist to improve consistency between staff and avoid hazards being missed.
   c) Limit approvals in key sectors (e.g. WHL F6) to experienced staff.
9. Formally identify sectors of the open pit where SSR is a critical control for achieving an acceptable level of residual risk. Develop a process to stop or modify mining activities in these areas when SSR coverage is not available. This could be captured within the SSR TARP.
10. Inspect the crest of the open pit for evidence of instability (e.g., above D4K) periodically. As a starting point, this could be completed in the spring and fall.
11. Conduct periodic drone inspections of the open pit slopes. Review the inspection frequency in the GCMP and align it with current needs/capabilities.
12. Implement an additional surface monitoring system, such as prisms or GPS beacons, to complement the SSR, provide a long-term deformation baseline, and to allow the true displacement vector to be measured.
13. Update the GCMP and subsequently review and update it annually. The GCMP has not been updated since July 2020 and annual updates are a regulatory requirement under the Nunavut Mine Health and Safety Regulations.
14. Complete the on-going review and re-design of the Northeast Wall of the Whale Tail open pit. Possible measures under consideration include managing surface water, seasonal mining and double-benching in the lower wall.

Recommendations

P3

Priority 3 (P3):

1. Several areas were identified during the visit that should be a focus of on-going monitoring and inspections:
    a) The failure in the Phase 1 North Wall of the Whale Tail open pit
    b) The failed slab in the northwest corner of the Phase 1 North Wall of the Whale Tail open pit
    c) The potentially unstable blocks in the Whale Tail East Wall
    d) The accumulation of rockfall on the catch benches of the Whale Tail Phase 2 Southeast wall
    e) The potentially unstable wedge below the Whale Tail Phase 2 ramp, particularly during blasting below the wedge
    f) The Brittle Structure with seepage in the southwest corner of the IVR V1 open pit
    g) The nose on the north wall of the IVR V2 open pit
    h) The potentially unstable block in the IVR V2 open pit North wall “Turtlehead”
    i) The nose between the IVR V1 and IVR V2 open pits
2. Review the risks associated with future access below the failure in the Phase 1 North Wall of the Whale Tail open pit for water management purposes. Implement mitigation measures as appropriate.
3. Review the rockfall risk associated with spillover from blasting and the potential creation of noses at the breakthrough between the IVR West 2 and IVR V2 Extension pits.

Recommendations

P3

Priority 3 (P3):

4. Install instrumentation (e.g., wireline extensometer) in the potentially unstable wedge below the Whale Tail Phase 1 ramp to supplement radar monitoring.
5. Review failure in the Phase 1 North Wall of the Whale Tail open pit in greater detail to better understand the failure mechanism, likely contributing factors, and the potential for the failure to continue below the ramp. A Maptek scan is recommended to better define the failure geometry.
6. Monitor the implementation and performance of the double-benching trial in the Diorite at the Whale Tail pit. In particular, there will need to be an emphasis on scaling and the Bench Approval process to ensure that hazards are managed.
7. Monitor the implementation and performance of the benches in the Whale Tail Phase 3 Southeast Wall (Design Sector F6). Once the next bench is complete, a review should be completed to assess if the current bench design is achievable or if it needs to be adjusted (i.e., to a BFA of 50°).
8. Revert to a 55° pre-shear angle for the IVR V1 Northwest Wall (Design Sector V0A).
9. Review the effectiveness of the SSR alarm parameters in 2022 and establish a commitment to review the parameters annually.
10. Define a red trigger for the SSR TARP to provide a backstop for unprecedented or unexpected conditions.
11. Adjust the SSR TARP so that the response to Grey and Orange SSR alarms does not explicitly state that mining operations are not to be stopped.
12. Complete the recommended blasting trials. In particular, the development of a blasting pattern for the Komatiite is likely to be beneficial to bench performance.

Recommendations

P3

Priority 3 (P3):

13. Implement a year-round blasting quality control program, at a minimum measuring blasthole depth.
14. Undertake structural mapping to:
    a) Define the northwest dipping joint set in the lower Phase 2 Southeast Wall of the Whale Tail open pit
    b) Better define the extents of Structural Domain 5 in the Whale Tail open pit
    c) Validate the Brittle Structure model.
15. Document the lithology, rock mass structure, and bench performance at regular intervals along the Northeast Wall of the IVR V2 pit in order to better understand the controls on the wall performance. While few benches remain in the pit, the results are relevant to the footwall of the IVR V1 pit.
16. Document the bench performance and key rock mass characteristics in the IVR V2 open pit and compare them to the design. In particular, it is important to verify that the north wall is being established in the Mafic Volcanics and below the Brittle Structure expected along the contact between the Mafic Volcanics and the Komatiite as the slope geometry recommendations for the V2A and V2E design sectors are based on this premise.
17. Complete geomechanical mapping on a regular basis, consistent with the commitments in the GCMP. Mapping is particularly important in Q2 and Q3 when the bench faces are clear of snow. The mapping should focus on critical areas of the open pit, including Design Sectors D4K and F6 of the Whale Tail pit and V0A, V2A and V2E of the IVR pits.

Recommendations

P4

Priority 4 (P4):

1. Take a series of overview photos (e.g., of each major wall) as part of the visual inspections to generate a record of wall performance over time.
2. Implement a formal mechanism (e.g., TARP) to increase the frequency of inspections in the event that an instability is observed or, for example, particular deformation limits are exceeded.
3. Explain in the GCMP or radar monitoring procedure why the SSR alarms have been set at their current values and provide guidance on how they can be adjusted based on different circumstances.
4. Evaluate methods for communicating updates to the hazard map outside of the regular two-week period if there are notable changes to the identified hazards. As an alternative to issuing an updated map, a brief addendum describing the change could be issued.
5. Document the review of the Budget Mine Plan in greater detail, even if the document remains internal to the team, in order to better capture risks and opportunities.
6. Add the following to the Quarterly Summary Reports to improve the communication of the completed rock mechanics activities and their effectiveness:
    a) The reports include a dashboard summary of the activities complete, but there is no reference to the commitments in the GCMP. Recommend including a column in the dashboard indicating the target frequency for the tracked items.
    b) Consider including a slide commenting on the effectiveness of the mine's controls (e.g. radar alarms, prior identification of rockfalls, etc.).
7. Develop a skills matrix to help identify training needs.

Recommendations

P4

Priority 4 (P4) (cont'd):

8. The following opportunities to improve the Hazard Maps
9. The following comments are provided for the GCMP:
    a) Consider adding a one-page overview of the deposit geology and mine plan, including key information such as the ultimate pit dimensions, approximate mine life, major lithologies, etc.
    b) (5.2.1.3) - Review and revise the commitments for drone monitoring so that they are focussed and achievable.
    c) (5.3.2) Clarify that the collected data should be compared to the design basis for the open pit in addition to looking for trends.
    d) (5.4.1) Note that crack meters and extensometers have not been installed and clarify that vibrating wire piezometers and thermistors are not currently being monitored. A plan with the location of the instrumentation should be included or referenced.
    e) (5.5) Reference a register that tracks who has received what geomechanical training.
    f) (8) Provide greater clarity and detail on the input the team provides to the mine planning and approval process. For example, the input to the Bench Master and 3MR.
    g) Describe and include a commitment to the bench approval process.


THANK
YOU