Broken Hill Operations Pty Ltd (BHOP)

Rasp Mine Extension

Risk Analysis – Surface / Environmental Aspects

Report Title: BHOP Rasp Mine Extension Risk Analysis – Surface / Environmental Aspects
Client: Visko Sulicich – Chief Operating Officer
Submitted By: Peter Reardon – Director SP Solutions
Job: J4508
Document: D6674
Revision: v2
Date: 25/10/14
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<tbody>
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<td>Broken Hill Operations (BHOP) – Rasp Mine Extension Risk Analysis Report</td>
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</table>

General Description

A summary of the review of controls and risks related to mine extension related hazards at the Rasp Mine. The primary focus is on the potential effects to the surface from the underground mining activities. Underground hazards and interactions with other underground workings or mines are assessed and controlled through the existing Mine Safety Management Plan.

Key Supporting Documentation

- AS/NZS ISO 31000 Risk Management
- Pacific Environment – 9328 CBH Rasp Vent Shaft #6 AQA L0 R1
- Prism Mining – Blast Vibration Review at Zinc Lodes, Rasp Mine
- Ground Control Engineering – G0057_AA_RE01_V03_RASP_ZINC_LODES DRAFT FINAL WITH APPENDICES, 16th October 2014
- EMM – Approval Variation Noise Assessment – Zinc Lodes
- Barnson - Extension to Rasp Mine at Broken Hill – Zinc Lode Affects to Road Reserve Infrastructure, 20 October 2014

Versions

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<th>No</th>
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<tbody>
<tr>
<td>1</td>
<td>Visko Sulicich</td>
<td>Chief Operating Officer (COO)</td>
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<tr>
<td>2</td>
<td>Gwen Wilson</td>
<td>Group Manager Health, Safety, Environment and Community</td>
</tr>
<tr>
<td>3</td>
<td>Safe Production Solutions</td>
<td>Records</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 EXECUTIVE SUMMARY</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>2 INTRODUCTION</strong></td>
<td>11</td>
</tr>
<tr>
<td>2.1 Objectives and Deliverables</td>
<td>11</td>
</tr>
<tr>
<td>2.2 Client</td>
<td>11</td>
</tr>
<tr>
<td>2.3 Scope</td>
<td>11</td>
</tr>
<tr>
<td>2.4 Team Mandate</td>
<td>11</td>
</tr>
<tr>
<td>2.5 External Facilitation</td>
<td>13</td>
</tr>
<tr>
<td>2.6 The Team</td>
<td>13</td>
</tr>
<tr>
<td><strong>3 ESTABLISH THE CONTEXT</strong></td>
<td>14</td>
</tr>
<tr>
<td>3.1 Strategic and Organisational Context</td>
<td>14</td>
</tr>
<tr>
<td>3.2 Risk Management Context</td>
<td>17</td>
</tr>
<tr>
<td>3.3 Legal Context</td>
<td>17</td>
</tr>
<tr>
<td>3.4 Key Assumptions</td>
<td>17</td>
</tr>
<tr>
<td>3.5 Referred Issues</td>
<td>17</td>
</tr>
<tr>
<td><strong>4 IDENTIFY RISKS</strong></td>
<td>18</td>
</tr>
<tr>
<td>4.1 Overview</td>
<td>18</td>
</tr>
<tr>
<td>4.2 Brainstorming</td>
<td>18</td>
</tr>
<tr>
<td>4.3 Threat Analysis</td>
<td>18</td>
</tr>
<tr>
<td><strong>5 ANALYSE RISKS</strong></td>
<td>19</td>
</tr>
<tr>
<td>5.1 Threat Analysis</td>
<td>19</td>
</tr>
<tr>
<td>5.2 Level of Risk – Risk Ranking</td>
<td>19</td>
</tr>
<tr>
<td>5.3 Risk Acceptability and Risk Criteria</td>
<td>20</td>
</tr>
<tr>
<td>5.4 Risk Priority</td>
<td>20</td>
</tr>
<tr>
<td><strong>6 TREAT RISKS</strong></td>
<td>21</td>
</tr>
<tr>
<td><strong>7 MONITOR AND REVIEW</strong></td>
<td>21</td>
</tr>
<tr>
<td>7.1 Nominated Coordinator</td>
<td>21</td>
</tr>
<tr>
<td>7.2 Implementation Review Plan</td>
<td>21</td>
</tr>
<tr>
<td>7.3 Communication and Consultation</td>
<td>21</td>
</tr>
<tr>
<td>7.4 Concluding Remarks</td>
<td>21</td>
</tr>
<tr>
<td><strong>8 REFERENCES</strong></td>
<td>22</td>
</tr>
<tr>
<td>8.1 Definitions and Abbreviations</td>
<td>23</td>
</tr>
<tr>
<td><strong>9 APPENDICES</strong></td>
<td>24</td>
</tr>
<tr>
<td>9.1 Affinity Diagrams – Brainstorming</td>
<td>25</td>
</tr>
<tr>
<td>9.2 Team Session – Threat Analysis (Causes, Controls, Recommendations)</td>
<td>27</td>
</tr>
<tr>
<td>9.3 Risk Treatment Plan / Risk Register</td>
<td>34</td>
</tr>
<tr>
<td>9.4 Photo Study</td>
<td>42</td>
</tr>
<tr>
<td>9.5 Risk Treatment</td>
<td>45</td>
</tr>
<tr>
<td>9.6 ABOUT YOUR REPORT</td>
<td>48</td>
</tr>
</tbody>
</table>
List of Tables

Table 1 : Consolidated Recommendations for Consideration ........................................................................6
Table 2 : Team Members ..............................................................................................................................13
Table 3 : Risk Treatment Plan ..................................................................................................................34

List of Figures

Figure 1 : Scope and Overview ..................................................................................................................12
Figure 2 : Location Map ..............................................................................................................................14
Figure 3 : Summary of Mineralised Zones ...............................................................................................14
Figure 4 : Area of Interest ...........................................................................................................................15
Figure 5 : Underground Workings relative to Surface Infrastructure ....................................................15
Figure 6 : Schematic Plan View – Bench Stopping Area ......................................................................16
Figure 7 : Schematic Section View ..........................................................................................................16
Figure 8 : Likelihood and Definition .........................................................................................................19
Figure 9 : Risk Likelihood and Consequence Matrix ...............................................................................19
Figure 10 : Risk Ranking Matrix ...............................................................................................................20
Figure 11 : Affinity Diagrams – Brainstorming 1 .....................................................................................25
Figure 12 : Affinity Diagrams – Brainstorming 2 .....................................................................................26
Figure 13 : Key Threats .............................................................................................................................27
Figure 14 : Threat – Ground Failure / Subsidence Affecting Surface ....................................................28
Figure 15 : Ground Failure / Subsidence Affecting Surface – Preventative Controls ............................29
Figure 16 : Threat – Blasting Affecting Surface .........................................................................................30
Figure 17 : Blasting Affecting Surface - Preventative Controls .................................................................31
Figure 18 : Threat – Noise .........................................................................................................................32
Figure 19 : Threat – Amenity – Light, Air Quality .....................................................................................32
Figure 20 : Threat – Impacts on Local Council Heritage .........................................................................33
Figure 21 : Representative Photos of the Area .........................................................................................42
Figure 22 : Wheel of Safe Production .......................................................................................................45
Figure 23 : Hierarchy of Control ...............................................................................................................46
Figure 24 : Risk Criteria "ALARP" ..........................................................................................................47
1 EXECUTIVE SUMMARY

Broken Hill Operations Pty Ltd (BHOP) is a subsidiary of CBH Resources. BHOP owns and operates the Rasp Mine in Broken Hill, Australia. BHOP engaged SP Solutions to facilitate a risk analysis on Rasp Mine Extension as part of the Mine Safety Management Plan and the Application process for the extension. The approach taken was to identify typical causes and the related controls for those hazards that posed a threat to surface infrastructure, activities, environmental and the community.

The scope for the study was:

“To conduct a risk analysis of the mine extension to identify threats/hazards during the life cycle of the project that may impact on the surface (primarily environmental and community risks); clarify the risk potential and identify preventative controls, reactive controls and recommendations for consideration.”

The Threat Analysis (Mind Maps) are included in Appendix 9.2, and the resulting Risk Treatment Plan is in Appendix 9.3.

Key Findings

A total of 5 key specific threats (with multiple sub-causes) were identified and have been included in the Analysis. Preventative and reactive or mitigation controls were allocated and an additional 24 recommendations were identified by the team for review by BHOP (refer to the Consolidated Action Plan on the next page).

Vibration transmission to the surface will be the primary concern but more data will be collected as access development gets closer to the area to verify effectiveness of controlling blasts. Blast size can therefore be controlled and increased incrementally to meet defined criteria. The critical control is that significantly smaller excavations will be created with significantly smaller blasts as compared with current mining activities.

Critical Controls for a range of threats identified at this stage of the process include:

<table>
<thead>
<tr>
<th>Rasp Mine Extension – Critical Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Modelling to ensure</td>
</tr>
<tr>
<td>constraints are known for drill/blast</td>
</tr>
<tr>
<td>designs and vibration analysis</td>
</tr>
<tr>
<td>60m Crown Pillar between surface</td>
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<tr>
<td>infrastructure and the upper mining</td>
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<tr>
<td>horizon</td>
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<tr>
<td>Geotechnical assessment to ensure safe</td>
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<tr>
<td>and stable excavations underground</td>
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<tr>
<td>Conservative stope design dimensions</td>
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<tr>
<td>Immediate filling after extraction</td>
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<tr>
<td>Mine planning and scheduling (operatio</td>
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<tr>
<td>nal control)</td>
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<tr>
<td>Ground control design</td>
</tr>
<tr>
<td>Geotechnical monitoring – verify</td>
</tr>
<tr>
<td>performance of the excavations</td>
</tr>
<tr>
<td>Ground Control Management Plan</td>
</tr>
<tr>
<td>Blasting assessment, vibration</td>
</tr>
<tr>
<td>and overpressure analysis</td>
</tr>
<tr>
<td>Drill and blast designs – limited in</td>
</tr>
<tr>
<td>size hence potential vibration</td>
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<tr>
<td>effects</td>
</tr>
<tr>
<td>Drilling implementation – to ensure</td>
</tr>
<tr>
<td>accurate drilling of blast holes</td>
</tr>
<tr>
<td>Preparation, charging and blast control</td>
</tr>
<tr>
<td>– various procedures to control the</td>
</tr>
<tr>
<td>blasting</td>
</tr>
<tr>
<td>Mine sequencing/scheduling – to</td>
</tr>
<tr>
<td>ensure excavations are created and</td>
</tr>
<tr>
<td>filled on time</td>
</tr>
<tr>
<td>Survey control – of drill/blast holes</td>
</tr>
<tr>
<td>and mining excavations to ensure</td>
</tr>
<tr>
<td>separation distances are maintained</td>
</tr>
<tr>
<td>Blasting Management Plan</td>
</tr>
<tr>
<td>Heritage management</td>
</tr>
<tr>
<td>TARP – Trigger and Action Response</td>
</tr>
<tr>
<td>Plan (in case there are potential</td>
</tr>
<tr>
<td>indicators of overpressure, vibration</td>
</tr>
<tr>
<td>or other effects on the surface</td>
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**Way Forward**

The following table summarises the additional controls / actions from the team session. These will be reviewed by the site management team and included into the system with accountabilities (By Whom) and timing (By When) where suitable.

<table>
<thead>
<tr>
<th>#</th>
<th>Threat/Hazard</th>
<th>Aspect</th>
<th>Information on Aspect</th>
<th>Additional Controls / Actions</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Key Assumptions</td>
<td>The current Mine Safety Management Plan (or similar) is effective for ongoing management of risks associated with mining activities underground (including the mining methods and all associated tasks such as drilling, blasting, equipment operation etc.) including interactions with Perilya activities.</td>
<td>Specific operational risk assessments are conducted on any new activity or interaction.</td>
<td>Conduct interaction risk assessment for mining in close proximity to Perilya as part of the safety management system.</td>
</tr>
<tr>
<td>2</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Data collection</td>
<td>Data collection and detailed characterisation of ground conditions in the hanging wall and crown of the ore lens using existing drill core from 22 holes. Collect data through a staged approach to opening the area (1) development (2) cut and fill (3) bench stope.</td>
<td>Conduct ongoing testing of representative samples of the rock mass to characterise the engineering properties - particularly after initial development. Also includes validation of drill hole orientation.</td>
</tr>
<tr>
<td>3</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Structural Model</td>
<td>Initial review indicates there are no significant structures, shear zones and dolerite.</td>
<td>Develop structural model and refine as obtain more data.</td>
</tr>
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**Table 1 : Consolidated Recommendations for Consideration**
<table>
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<tr>
<th>#</th>
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<th>Information on Aspect</th>
<th>Additional Controls / Actions</th>
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<tbody>
<tr>
<td>4</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Structural Model</td>
<td>Initial review indicates there are no significant structures, shear zones and dolerite.</td>
<td>Collect and interpret structural defect data and geotechnical data is necessary as mining progresses in the zinc lodes. This will allow validation of design parameters and timely input to the mine design process.</td>
</tr>
<tr>
<td>5</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>60m Crown Pillar between surface infrastructure and the upper mining horizon</td>
<td>Initial analysis has been focused on ensuring that the stopes are stable so that the crown pillar is not compromised – there must be no appreciable subsidence on the surface in order to protect surface assets</td>
<td>Formalise the analysis regarding the 60m pillar stability – COMPLETE. This has been completed and is provided in G0057_AA_RE01_V03_RASP_ZINC_LODES_DRAFT_FINAL_WITH_APPENDICES, 16th October 2014</td>
</tr>
<tr>
<td>6</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Geotechnical assessment</td>
<td>The significant shear zones identified from the geotechnical core logging are not located in the hanging wall or crown of the bench stopes and are not expected to have an impact on the stability of the stopes or development access drives. Escalation Factor: distribution of the available geotechnical data throughout the zinc lode ore body is insufficient to discount the potential risk that development or stoping could intersect structures with sufficient continuity to influence the stope stability during production.</td>
<td>Increase the size and quality of the geotechnical database for the Zinc Lodes by collecting geotechnical information from future resource drilling programs</td>
</tr>
<tr>
<td>7</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Immediate filling after extraction</td>
<td>Escalation Factor: not enough fill. Escalation Factor: fill infrastructure not in place to place fill. Combination of waste and hydraulic fill using existing fill and filling infrastructure extended as required (including tight filling the final 5m top access drive immediately beneath the road at decommissioning)</td>
<td>Ensure surface to underground backfill holes are included in the Mine Operations Plan (MOP) and Application</td>
</tr>
<tr>
<td>8</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Geotechnical monitoring</td>
<td>Ongoing monitoring and back analysis of the performance of stope spans is carried out. Stope performance data is recorded and applied to stope and mine design.</td>
<td>Develop a comprehensive program to monitor stope stability and potential surface subsidence (implemented before and during the extraction of the zinc lodes)</td>
</tr>
<tr>
<td>#</td>
<td>Threat/Hazard</td>
<td>Aspect</td>
<td>Information on Aspect</td>
<td>Additional Controls / Actions</td>
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</tr>
<tr>
<td>9</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Ground Control Management Plan (GCMP)</td>
<td>There is an existing Ground Control Management Plan for the organisation so this needs to be updated to include the safeguards identified in this review and associated studies (eg) geotechnical assessment and modelling</td>
<td>Update the ground control management plan (GCMP) for the Zinc Lodes ore body. COMPLETE - This has been completed and is provided in the Appendices of G0057_AA_RE01_V03_RASP_ZINC_LODES_DRAFT_FINAL_WITH_APPENDICES, 16th October 2014</td>
</tr>
<tr>
<td>10</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Trigger and Action Response Plan (TARP)</td>
<td>Trigger and Action Response Plan – is included in the GCMP but will need updating</td>
<td>Update the TARP to include the Zinc lode</td>
</tr>
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<td>11</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Vibration monitors are used to provide data from blasting and other potential sources (e.g.) activities on or near the points of interest such as the road, nearby buildings and Perilya activities etc.</td>
<td>Finalise the location of the vibration monitors (taking into account the nearest points of interest and associated limits that may be different for those points of interest, and the relative distances).</td>
</tr>
<tr>
<td>12</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Vibration monitors are used to provide data from blasting and other potential sources (e.g.) activities on or near the points of interest such as the road, nearby buildings and Perilya activities etc. Liaison with the road asset owner will be required to confirm blast levels that would not pose a threat to this structure. This level, based on engineering studies, will then be negotiated with the owner.</td>
<td>Formalise the limit for the road to protect the asset</td>
</tr>
<tr>
<td>13</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Vibration monitors are used to provide data from blasting and other potential sources (e.g.) activities on or near the points of interest such as the road, nearby buildings and Perilya activities etc. It is important to get baseline prior to blasting to ensure extraneous activities (eg) traffic, are taken into account</td>
<td>Validate the road vibration monitor to account for traffic effects (as a baseline)</td>
</tr>
<tr>
<td>#</td>
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<td>Aspect</td>
<td>Information on Aspect</td>
<td>Additional Controls / Actions</td>
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<tr>
<td>14</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Vibration monitors are used to provide data from blasting and other potential sources (e.g.) activities on or near the points of interest such as the road, nearby buildings and Perilya activities etc. There is an ongoing process of vibration analysis that can be updated as part of this vibration analysis</td>
<td>Finalise the 12 month rolling vibration data analysis</td>
</tr>
<tr>
<td>15</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Escalation factor: Do not set up the monitors properly and external interference</td>
<td>Establish the standard, procedure and training for the location, establishing, installing and taking results for monitor stations and roving monitoring units (including location and protection to prevent interference)</td>
</tr>
<tr>
<td>16</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Suitably competent personnel collect and review the data (internal and external)</td>
<td>Formalise the review/audit process for the vibration analysis and blast management plan</td>
</tr>
<tr>
<td>17</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Suitably competent personnel collect and review the data (internal and external)</td>
<td>Conduct additional training for key personnel (including assessment of vibration results, waveform etc.)</td>
</tr>
<tr>
<td>18</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Drilling implementation</td>
<td>Drilling equipment and drill consumables matched to achieving targeted limits – drilling accuracy can have significant impact on blast control (hence vibration)</td>
<td>Review the drilling equipment and drill consumables combination to optimise the control of drill hole accuracy</td>
</tr>
<tr>
<td>19</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Mine sequencing / scheduling</td>
<td>Firing takes into account points of interest with regards to vibration effects and potential impacts (Note: broken ground created between shots and the point of interest may have dampening effects)</td>
<td>Consider shrouding effects from filled stopes, voids and workings that assist to shield vibration transmission (Note: consider orientation of shear zones and how this can affect vibration transmission since can be variable)</td>
</tr>
<tr>
<td>20</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Survey control</td>
<td>Approved and accurate survey plans - Escalation Factor: Mismatch between grids used by Perilya and BHOP</td>
<td>Confirm the joining of the survey grids between BHOP and Perilya leases</td>
</tr>
<tr>
<td>#</td>
<td>Threat/Hazard</td>
<td>Aspect</td>
<td>Information on Aspect</td>
<td>Additional Controls / Actions</td>
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<tr>
<td>21</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blast Management Plan</td>
<td>Formalise the approach taken to control blasting</td>
<td>Finalise the Blast Management Plan</td>
</tr>
<tr>
<td>22</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Blast Management Plan</td>
<td>Personnel feeling vibration on the surface during blasting. The limit could be set for the road at 100mm/s to manage impact on the road corridor assets however vibrations could still be felt on the surface.</td>
<td>Establish agreed PPV at which point pedestrian and vehicle traffic may be warned and/or temporarily stopped during blasts that exceed those limits - develop procedure to be applied at the time as required.</td>
</tr>
<tr>
<td>23</td>
<td>Amenity - Light, Air Quality / Odour, amenity and public interaction</td>
<td>Shaft 5 is fenced</td>
<td>There is already fencing around Shaft 5 but this will need to be improved/repai red as required</td>
<td>Review and upgrade the hole cover, fencing and signage for shaft 5</td>
</tr>
<tr>
<td>24</td>
<td>Impacts on local council Heritage</td>
<td>Heritage management</td>
<td>The main heritage items are locally vested (Council) and on the BHOP leases – no known Nationally listed items</td>
<td>Review nearby heritage items</td>
</tr>
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2 INTRODUCTION

2.1 Objectives and Deliverables

The objectives of the team based risk analysis were as follows:

1. Identify, analyse, and assess the general risks associated with mine extension;
2. Identify current controls; and
3. Recommend additional controls where deficiencies or concerns are identified.

2.2 Client

The client for the risk assessment is Visko Sulicich – COO, Broken Hill Operations. The coordinator is Gwen Wilson – Group Manager of Safety, Health, Environment and Community, BHOP.

2.3 Scope

The scope was to:

“To conduct a risk analysis of the mine extension to identify threats/hazards during the life cycle of the project that may impact the surface (primarily environmental and community risks); clarify the risk potential and identify preventative controls, reactive controls and recommendations for consideration.”

The scope included:

1. Life cycle of the project – 3 years;
2. Linkages to current mine where applicable – concurrent activities that may impact on the project; and

The scope did not include:

1. Current operation; and
2. Satellite targets – block 8 (already in current approval).

The diagram on the following page was used to clarify the scope with the team.

2.4 Team Mandate

Provide input into the process and challenge the adequacy of the controls (eg) procedures, training, equipment etc. The key focus is on hazards (underlying threats/causes) and the controls. Recommendations to be provided for the client to consider as part of the overall risk management program.
Figure 1: Scope and Overview

To conduct a risk analysis of the mine extension to identify threats/hazards during the life cycle of the project; clarify the risk potential and identify preventative controls, reactive controls and recommendations for consideration.

Concurrent activities that may impact on the project:
- Zinc lode
- 3 years life cycle of the project
- Linkages to current mine where applicable

Current operation:
- Already in current approval
- Satellite targets - block B

The CBH Rasp Mine Extension - Surface Interaction Review

Mandate:
- Risk review is a key part of the application process
- Application is required to be submitted under the South Road
- The Rasp mine is intending to extend

Contact:
- COO
- Client

Scope includes:
- Scoping Statement
- Life cycle of the project
- Concurrent activities that may impact on the project

Scope does not include:
- Scope

Brainstorm of issues and areas to consider:
- Key Mine Phases
- Key Threats and Controls
- CBH Rasp Mine Extension - Surface Interaction Review

Key Assumptions:
- Conservation Management Plan will be completed
- The Ground Control Management Plan will be updated to suit the changes implemented for the mine extension / zinc lode
- The Blast Management Plan will be developed to suit the changes implemented for the mine extension / zinc lode
- The current Mine Safety Management Plan (or similar) is effective for ongoing management of risks associated with mining activities underground (including the mining method and all associated tasks such as drilling, blasting, equipment operation etc.) including interactions with Perilya activities.

AC - Conduct interaction risk assessment for mining in close proximity to Perilya as part of the safety management system.

Ground Failure / Subsidence affecting surface
- Blasting affecting surface (Vibrations and Overpressures)
- Noise
- Aesthetics - Light, Air Quality / Odour, amenity and public interaction
- Impacts on local council Heritage

= Linked Tree (More Information)
2.5 **External Facilitation**

The team was facilitated through the process by **SP Solutions** – a company specialising in project risk management processes.

2.6 **The Team**

The team met on 9th October 2014 on-site at Broken Hill Operations (BHOP). A team based approach was utilised in order to have an appropriate mix of skills and experience to identify the potential loss scenarios/issues and the controls to be applied. Details of the team members and their relevant qualifications and experience are included in the following table.

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation / Role</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob Williamson</td>
<td>BHOP / GM Rasp Mine</td>
<td>16 years. Bachelor of Engineering. First Class Mine Manager Certificate</td>
</tr>
<tr>
<td>Costa Papadopoulos</td>
<td>BHOP / HSE Manager Rasp Mine</td>
<td>25 years</td>
</tr>
<tr>
<td>Callum Ker</td>
<td>I.A.R. / Senior Mining Engineer</td>
<td>10 years. Bachelor of Engineering. Bachelor of Science (Geo)</td>
</tr>
<tr>
<td>Mike Humphreys</td>
<td>Prism Mining Pty Ltd</td>
<td>25 years. BSc. PHD of Mining Engineering</td>
</tr>
<tr>
<td>Gwen Wilson</td>
<td>BHOP / SHEC Group Manager</td>
<td>30 years. BCom. Occupational Grad Dip Hazard Management</td>
</tr>
<tr>
<td>Visko Sulicich</td>
<td>BHOP / COO</td>
<td>35 years. BE Mining. Mine Manager Certificate</td>
</tr>
<tr>
<td>Brett Anderson</td>
<td>BHOP / Mining Manager</td>
<td>25 years. BE Mining. Mine Manager Certificate</td>
</tr>
<tr>
<td>Leanne Waddell</td>
<td>BHOP / Technical Services Superintendent</td>
<td>17 years. Grad Dip of Mining</td>
</tr>
<tr>
<td>Patrick Evers</td>
<td>BHOP / Mining Superintendent</td>
<td>38 years</td>
</tr>
<tr>
<td>Cameron Tucker</td>
<td>GCE / Geotechnical Engineer</td>
<td>14 years</td>
</tr>
<tr>
<td>Richard Noonan</td>
<td>Barnson / Civil Engineer</td>
<td>22 years. BE, MIE Aust CP Eng</td>
</tr>
<tr>
<td>Peter Reardon</td>
<td>SP Solutions / Director Facilitator</td>
<td>BE Min Eng (Hon). Grad Dip Business Management. Registered First Class Mine Manager (Underground Metal). Over 25 years of experience in mining and construction incl. Mine Manager then 15 years as Principal of SPS conducting risk work throughout the minerals industry in Australia and overseas</td>
</tr>
</tbody>
</table>
3 Establish the Context

3.1 Strategic and Organisational Context

CBH Resources Limited is a significant producer of silver, lead and zinc in Australia. CBH owns Broken Hill Operations Pty. Ltd. (BHOP) which operates the Rasp Mine in Broken Hill. The Rasp mine was officially opened on 25 July 2012 and commercial rates of production are now being achieved. Annual production is planned to average 34,000 tonnes of zinc metal in concentrate, 28,000 tonnes of lead metal in concentrate, and 1.1 million ounces of silver in the lead concentrate. Rasp Mine employs 160 people and will have a mine life in excess of 15 years.


Figure 2: Location Map

The Rasp mine is following mineralisation towards the south and a new application is required to cover the program of work. The Zinc Lodes are typically higher in grade and it is intended that the ore will be blended with other ore sources so as to ensure the mine remains economically viable.

The following figures provide an overview to provide context for the risk analysis.

Figure 3: Summary of Mineralised Zones
Figure 4: Area of Interest

Figure 5: Underground Workings relative to Surface Infrastructure

- Bench Stoping
- Cut and fill
It should be noted that the plan view does not reflect the true width of mining underneath the area in question. The intent is to control the top of the nearest excavation to approximately 5m in width — this is the width of the initial access development drive only. That is, the closest excavation is restricted to 5m wide and 60m below the surface. Mining in this closest proximity would not last for a long period of time and this will be determined in the final production / mining schedules. The cut and fill stopes are deeper (hence further from surface infrastructure) than the bench stopes. The bench stopes may include an intermediate drill horizon to further control blast size and excavation stability but this can be assessed based on performance at the time.
3.2 Risk Management Context
The mine extension risk review is part of the BHOP Mine Safety Management System. The focus of this review is on the hazards and controls. The review process was:

1. based on the framework detailed in ISO 31000:2009 Principles and Generic Guidelines on Risk Management; and
2. aligned to meet BHOP and CBH requirements for risk management.

The Rasp mine is intending to extend under the South Road. The Application will be submitted soon and the risk review is a key part of the application process.

3.3 Legal Context
The primary focus of this review is on environmental and community risks. The document that supports the modification application is the Environment Assessment and this risk report will form part of this document. The relevant legislation is the Protection of the Environment Operations Act 1997 and regulations.

Outputs of this review may also be used for any health and safety risk assessments that BHOP may conduct on the mine extension (eg) interaction with Perilya activities, ground instability and inrush risk reviews. These are typically required under the following legislation in NSW:

- Mine Health and Safety Act 2004
- Mine Health and Safety Regulation 2007
- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2011

The NSW Work Health and Safety (WHS) Act requires all persons conducting a business or undertaking (including the mine holder and the mine operator) to ensure, so far as is reasonably practicable, that workers and other persons are not put at risk from work carried out as part of the business or undertaking. This involves eliminating or minimising risks to health and safety so far as is reasonably practicable.

3.4 Key Assumptions
The identification of key assumptions is a critical part of the risk assessment process – they form the basis for many engineering / project decisions and it is important that these are validated and reviewed as part of the risk management process.

Assumptions made were:

1. The Conservation Management Plan will be completed (post closure use or tourism etc.);
2. The Ground Control Management Plan will be updated to suit the changes implemented for the mine extension / zinc lodes;
3. The Blast Management Plan will be developed to suit the changes implemented for the mine extension / zinc lodes; and
4. The current Mine Safety Management Plan (MSMP or similar) is effective for ongoing management of risks associated with mining activities underground (including the mining methods and all associated tasks such as drilling, blasting, equipment operation etc.) including interactions with Perilya activities. An operational and interaction risk assessment will be conducted as part of the MSMP.

3.5 Referred Issues
There were no referred issues.
4 IDENTIFY RISKS

4.1 Overview

The key steps of the overall process included the following:

1. Data collection and analysis;
2. Conduct team based risk review;
3. Complete the Risk Treatment Plan (hazards, Preventative and Mitigating Controls, recommendations for improvement); and
4. Write report for review and distribution.

The team based risk analysis (this report) is only part of a comprehensive, ongoing process.

4.2 Brainstorming

This process involved encouraging all of the team members to note down their issues related to mine extensions at BHOP Rasp. The issues identified included:

- Causes / threats;
- Escalators (causes which impact on controls);
- Controls – either existing or potential improvements;
- Incidents / Outcomes (end result of incidents), and
- General background information.

The brainstorming list was then reviewed so as to ensure that all aspects and issues had been included. If not, the item was included into the Risk Treatment Plan. This ensured a range of techniques were utilised to build the risk model. The diagrams from the brainstorming at the start of the team session are included in Appendix 9.1. These lists may also be used for site engineers and technical personnel to take into consideration when developing applicable procedures and management plans to manage the specific causes/hazards.

4.3 Threat Analysis

A threat analysis was then conducted by the team. A series of diagrams were developed as a primary input into developing the Risk Treatment Plan.

These were focused on:

1. Causes / Hazards;
2. Preventative Controls;
3. Reactive or Mitigation Controls; and
4. Recommendations (Actions) to improve the effectiveness of current controls or fill significant gaps.

The team session diagrams for the Threat Analysis is included in Appendix 9.2.
5 ANALYSE RISKS

5.1 Threat Analysis

The Threat Analysis (Appendix 9.2) included information which allowed the development of the Risk Treatment Plan (Appendix 9.3).

5.2 Level of Risk – Risk Ranking

All issues identified by the team were risk ranked on the basis of current controls (residual risk). To calculate the likelihood of the consequence above occurring, refer to the following table:

Figure 8: Likelihood and Definition

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost Certain</td>
<td>Is expected to occur almost every time the task is completed. Occurs once per week.</td>
</tr>
<tr>
<td>Likely</td>
<td>Is likely to occur on a regular basis. Occurs once a month.</td>
</tr>
<tr>
<td>Possible</td>
<td>Would expect this to occur every now and then. Occurs once a year.</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Would not expect this to occur too often. Occurs every five years.</td>
</tr>
<tr>
<td>Rare</td>
<td>Not likely to occur unless under exceptional circumstances.</td>
</tr>
</tbody>
</table>

Combination of Likelihood and Consequence determines level of Risk, see the following table:

Figure 9: Risk Likelihood and Consequence Matrix

This Risk Ranking Matrix shall be used for all Risk Assessments and Incident Severity rating. To calculate the consequence, refer to the following table:
### 5.3 Risk Acceptability and Risk Criteria

The risk criteria utilised is to reduce the level of risk to As Low As Reasonably Practicable (ALARP).

### 5.4 Risk Priority

All mine extension risk elements were qualitatively risk ranked using the client Risk Assessment Matrix. This is included in the Risk Treatment Plan (Appendix 9.3).

---

**Figure 10: Risk Ranking Matrix**

<table>
<thead>
<tr>
<th>Safety</th>
<th>Environment</th>
<th>Community/Reputation</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatality</td>
<td>Fatality of a person.</td>
<td>Community complaint</td>
<td>Downtime of critical equipment &gt; 1 week.</td>
</tr>
<tr>
<td>Serious injury, loss of limb.</td>
<td>Severely health effects or death or severe impact to protected flora and fauna or their habitat.</td>
<td>Destruction of cultural items of significance.</td>
<td></td>
</tr>
<tr>
<td>Prosecution or litigation.</td>
<td>Prosecution or litigation.</td>
<td>Complaint causes cessation of operations &gt; 1 week.</td>
<td></td>
</tr>
<tr>
<td>Lost time injury.</td>
<td>Recorded health effect to people.</td>
<td>Community complaint</td>
<td>Downtime of critical equipment &gt; 1 shift &lt; 1 week.</td>
</tr>
<tr>
<td>Disabling injury &gt; 4 days.</td>
<td>Impact on protected fauna, flora.</td>
<td>Impacts State level.</td>
<td>Potential loss/property damage &gt; $50,000 &lt; $200,000.</td>
</tr>
<tr>
<td>Serious breach of safety regulations (breach of Golden Rules).</td>
<td>Emission/discharge exceeding legal guideline and requires government reporting.</td>
<td>Permanent damage to cultural items of significance.</td>
<td></td>
</tr>
<tr>
<td>Requires government reporting.</td>
<td>Loss of containment of substance (on site) &gt;200L.</td>
<td>Community relations affects ability to obtain environmental licence/approval.</td>
<td></td>
</tr>
<tr>
<td>Medical treatment eg stitches, etc.</td>
<td>Any loss of containment off site to private or State property, road, waterway, etc.</td>
<td>Production loss &gt; 4 hours &lt; 12 hours.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of containment of substance (on site) 50 – 200L.</td>
<td>Damage to items of significance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requires government reporting.</td>
<td>Community relations affects ability to obtain environmental licence/approval.</td>
<td></td>
</tr>
<tr>
<td>First aid treatment.</td>
<td>Loss of containment of substance (on site) 20 – 50L.</td>
<td>Local complaint resolved and has future impact.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-compliance with internal environmental target.</td>
<td>Minor infringement of cultural heritage.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concern by local community re environmental matter.</td>
<td>Production loss &gt; 1 hour &lt; 4 hours.</td>
<td></td>
</tr>
<tr>
<td>Reported injury, no first aid required.</td>
<td>Loss of containment of substance (on site) &lt;20L.</td>
<td>Theft on site no police involvement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local complaint resolved.</td>
<td>Local complaint resolved.</td>
<td></td>
</tr>
</tbody>
</table>
6 TREAT RISKS

The Threat Analysis (Appendix 9.2) included a summary of the controls for the threats.

Refer to risk treatment plan / risk register in Appendix 9.3.

Additional risk treatment information is provided in the Appendices (Appendix 9.5).

7 MONITOR AND REVIEW

7.1 Nominated Coordinator

The nominated coordinator is Gwen Wilson – Group Manager of Safety, Health, Environment and Community BHOP. The coordinator should encourage all parties who attended the team session to review this report and the identified hazards / issues – commenting as needed. The nominated coordinator should also:

1. Review the report to confirm the accuracy of the material recorded from the team session;
2. Provide feedback to the parties who attended the risk review on any decisions which may be different from team expectations / recommendations; and
3. Monitor the completion of the sustaining actions to confirm there is close out of each action.

7.2 Implementation Review Plan

It is critical that the risk controls and actions are appropriately managed. The expectation of the team was that:

1. Appropriate personnel and resources are allocated for implementation of recommended actions within the specified date for completion;
2. Assumptions are validated; and
3. Action items would be appropriately refined, resourced and implemented.

The client can make modifications to the recommended actions – but these should be done in light of the Risk Management framework. Where a change is required, the basis for the change and a desk top review to assess if the risk of the underlying hazard remains tolerable is required.

7.3 Communication and Consultation

Communication and consultation form an integral part of the risk management process. It is the client’s responsibility to confirm that this report is shared with all participants involved in the process and other stakeholders as appropriate throughout the life of the project.

Consultation and involvement were achieved with line personnel during the process, and the final outputs of this study should be shared more broadly with other personnel as required.

7.4 Concluding Remarks

A significant goal of the process was to identify the required controls to prevent a mine extension related incident from occurring and then to reduce the consequences if one occurs. The model will be used to guide the continual improvement of related management plans and procedures etc. on site.

SP Solutions would like to thank all personnel who contributed to the team session.
8 REFERENCES

- **Australian/New Zealand Standard** – AS/NZS/ISO 31000:2009 Risk Management
- **Pacific Environment** – Proposed upcast ventilation Shaft #6 – Air Quality aspects
- **Prism Mining** – Blast Vibration Review at Zinc Lodes, Rasp Mine
- **BHOP** – Blasting Parameters Calculation Sheet
- **Ground Control Engineering** – Draft Geotechnical Assessment – Zinc Lodes
- **EMM** – Approval Variation Noise Assessment – Zinc Lodes
- **NSW RMS** – Documentation Preparation for Application of Extension to Rasp Mine by BHOP
## 8.1 Definitions and Abbreviations

<table>
<thead>
<tr>
<th>TERM</th>
<th>EXPLANATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARP</td>
<td>“As Low As Reasonably Practicable”. The level of risk between tolerable and intolerable levels that can be achieved without expenditure of a disproportionate cost in relation to the benefit gained.</td>
</tr>
<tr>
<td>BHOP</td>
<td>Broken Hill Operations Pty Ltd.</td>
</tr>
<tr>
<td>DTI</td>
<td>Department of Trade and Investment (formerly Department of Industry and Investment)</td>
</tr>
<tr>
<td>Escalation Factor</td>
<td>The term “escalator” is applied in risk engineering to any factor (human error, equipment issue or aspect of the controlled work environment) which causes a preventative or mitigating control to fail or be significantly weakened. It is effectively the “failure mode of a control”</td>
</tr>
<tr>
<td>FFP</td>
<td>Fit For Purpose</td>
</tr>
<tr>
<td>GCMP</td>
<td>Ground Control Management Plan</td>
</tr>
<tr>
<td>Hazard</td>
<td>A thing or a situation with potential to cause loss including injury or illness to a person.</td>
</tr>
<tr>
<td>Inherent / Initial Risk</td>
<td>The risk associated with an unwanted event before any consideration of the existing controls is taken into account.</td>
</tr>
<tr>
<td>Inspection</td>
<td>A regular check of workplace equipment, working environment and practices, to identify hazards and deficiencies.</td>
</tr>
<tr>
<td>Job Safety Analysis (JSA / JHA)</td>
<td>Systematic breakdown of a job into steps in order to identify hazards associated with each step and the selection of appropriate controls to manage the identified hazards.</td>
</tr>
<tr>
<td>Level of risk</td>
<td>Term applied to a ranking using the company’s risk ranking matrix</td>
</tr>
<tr>
<td>Likelihood</td>
<td>Used as a qualitative description of probability and frequency</td>
</tr>
<tr>
<td>LTA</td>
<td>Less Than Adequate</td>
</tr>
<tr>
<td>MSMP</td>
<td>Mine Safety Management Plan</td>
</tr>
<tr>
<td>Personnel</td>
<td>Includes all people working in and around the site (e.g.) all contractors, sub-contractors, visitors, consultants, project managers etc.</td>
</tr>
<tr>
<td>PPV</td>
<td>Peak Particle Velocity – measurement for vibration in mm/s</td>
</tr>
<tr>
<td>Practicable</td>
<td>The extent to which actions are technically feasible, in view of cost, current knowledge and best practices in existence and under operating circumstances of the time.</td>
</tr>
<tr>
<td>Residual Risk</td>
<td>The risk associated with an unwanted event after consideration of the existing control measures is taken into account.</td>
</tr>
<tr>
<td>Review</td>
<td>An examination of the effectiveness, suitability and efficiency of a system and its components.</td>
</tr>
<tr>
<td>Risk</td>
<td>The combination of the potential consequences arising from a specified hazard together with the likelihood of the hazard actually resulting in an unwanted event.</td>
</tr>
<tr>
<td>Risk Management</td>
<td>The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, assessing, treating and monitoring risk.</td>
</tr>
<tr>
<td>RMS</td>
<td>Roads and Maritime Services</td>
</tr>
<tr>
<td>TARP</td>
<td>Trigger and Action Response Plan</td>
</tr>
</tbody>
</table>
9.1 Affinity Diagrams – Brainstorming

AC = Additional Control (Recommendation)

**Figure 11: Affinity Diagrams – Brainstorming**

- Plans to stabilize headframe no 4
- Devatering
- Resource shape
- Potential to extend to the north
- Southern section is indicated
- More drilling planned for post access
- No surface drilling
- More for the northern half of the resource but will be needed for whole ore block

**Old workings**
- Impact from fires - old hot spots
- Voids
- Ventilation impacts
- Air quality
- Flows
- Air quantity

**Dewatering**
- Inrush
- Accuracy of plans

**Blasting impacts on current working areas**
- Independent firings
- Main ramp access
- Drive connections

**Ground conditions**
- Ground methods
- Historical blasting data

**Survey data**
- Grid is different

**Within Scope**

Reviewed and managed within current mining systems and plan of work

The southern area will go close to the Periya boundary

Fill provision
Figure 12: Affinity Diagrams – Brainstorming 2

- **Geotechnical aspects and impacts**
  - Core logging and characterization from drill existing core
  - Defined geotechnical properties
  - Identified domains
  - Reasonable number of holes and data set is reasonable
  - Good spread of UCS and strength tests across the sections
  - No structural model

- **Ventilation options**
  - Fans being installed underground at the bottom of Number 5 (closer to the area) and 6 shafts (shaft 6 is further away)
  - Need assessment of the shaft
  - Shaft 7 potentially for an intake
  - Other workings drawn from shaft 7

- **Blast vibration**
  - Licence conditions
    - Nothing over 10 mm/s (PVA)
    - 95% under 5 mm/s PVA
  - Location is important
    - Number and where
    - Amenity aspects to consider
    - EIA approve locations
    - Need to get a balance with the number of monitors
  - Monitoring
    - Limit for overpressure
    - Location and quality of the monitor stations
    - Limits change depending on the different time of day
  - Variability in blast data
    - Dolerite dykes
    - Significant structure
    - Intervening ground conditions
  - Historically the blast vibration is difficult to predict and how the public reacts to it
  - Closer than before and we had problems before (6 waveforms)
  - Developing through first, then cut and fill, then the open stopes (scaling up)
  - PeriLyk seismic systems may provide data to assist us with modelling
  - Historical blasting data from PeriLyk

- **Within Scope**
  - Access development will be up from the north side so will drain back to the main Rasp lease
  - No construction - no additional traffic movements
  - No surface work
  - Potential for a secondary egress? Shaft

- **Local road and traffic movements**
  - 60m pillar based on CBH decision
  - Stopes stability analysis focused on preventing failure events that could affect the crown

- **Surface infrastructure**
  - Heritage Order
  - Heritage areas
  - No 7 headframe
  - Housing to the west
  - Road
  - Nearest residential house
  - Italian Club
  - Air St Residences

- **Survey data - grid is different**
  - Accuracy of plans
  - Independent firings
  - Main ramp access
  - Drive connections
  - Interaction of blasting activities
  - Vibration and overpressure control
9.2  Team Session – Threat Analysis (Causes, Controls, Recommendations)

There were 5 primary threats to surface infrastructure and the environment/community from underground activities identified by the team for further analysis. There are no surface construction activities or increase in traffic that could impact the area.

Figure 13 : Key Threats

Each group was analysed for sub-causes, preventative and reactive controls. The team discussed the suitability and effectiveness of the controls and identified additional controls – denoted by AC – Additional Control = Recommendation.
Figure 14: Threat – Ground Failure / Subsidence Affecting Surface

**Sub-causes**

- Large faults and structures
- Large voids
- Chimney caving
- Inappropriate design
- Not mined to design
- Disconnection from infrastructure
- Limited structural data and no structural model – this is critical for calculating final stable spans for stoping and for assessing the risk of stopes failure that may impact surface infrastructure.
- Large scale stopes over break
- Structurally controlled failures from hanging wall and crown resulting in changes in stope spans than predicted by empirical modelling
- Failure of pillars due to presence of unfavourable defects in the pillar

**Variability in geotechnical parameters used in the stope analysis.** There are inherent risks in extrapolating drill hole point data to generated rock mass conditions across domain. Whilst the host rock mass and the mineralised lenses could be described as close to homogeneous, there are localised variations in rock mass conditions. Assumptions are also made with regards to the presence of the critical defect set within the rock masses forming the stope walls.

**Reactive Controls**

- Suspension of blasting and/or reduced mine scheduling and alternate mining method based on monitoring results and geotechnical assessment
- Rib pillars may be required if weak ground conditions or a large scale geological structure is encountered
- Install additional ground support if required (localised)
- TARP
- Alternate route for traffic

**Preventative Controls**

- Large voids
- Chimney caving
- Inappropriate design
- Not mined to design
- Disconnection from infrastructure
- Limited structural data and no structural model – this is critical for calculating final stable spans for stoping and for assessing the risk of stopes failure that may impact surface infrastructure.
- Large scale stopes over break
- Structurally controlled failures from hanging wall and crown resulting in changes in stope spans than predicted by empirical modelling
- Failure of pillars due to presence of unfavourable defects in the pillar

**Ground Failure / Subsidence affecting surface**

- Inaccurate orientation of drill holes leading to incorrect interpretations
Figure 15: Ground Failure / Subsidence Affecting Surface – Preventative Controls

- **Data collection**: Collect data through a staged approach to opening the area (e.g., development of the 54 holes). This will allow validation of design parameters and timely input to the mine design process.

- **Structural Model**: Develop a structural model and refine it as data is obtained.

- **AC**: Develop structural model and refine it as data is obtained.

- **Mine planning and scheduling (operational control)**: Ensure that stope production rates do not exceed stable dimensions. Mining sequence to limit number of one bench stope at one time within the mining block.

- **Ground control design**: A complete strategy to extract each stope is in place that incorporates appropriate infrastructure to fill each stope after the completion of extraction. Ground control is installed according to the design.

- **Conservative slope design dimensions**: Combination of static and hydraulic fill using existing fill and filling infrastructure extended as required (including right filling the No. 5 ten top access vine immediately beneath the road at decommissioning).

- **AC**: Increase the size and quality of the geotechnical database for the 54 holes by collecting geotechnical information from future resource drilling programs.

- **Excavation Factor**: The significant shear zones identified from the geotechnical core logging are not located in the hanging wall or crown of the bench stops and are not expected to have an impact on the stability of the stopes or development access drives.

- **Section 1**: Stable at 35m however decision to apply more conservative approach (i.e., smaller 15m strike length with 5m pillars bench method OR intermediate all drive for SW cable bolting).

- **Section 2**: Stable 15m strike length. OR intermediate all drive for SW cable bolting.

- **Other sections**: Adjacent to the rear of the mine extension, stope and fill mining method.
Figure 16: Threat – Blasting Affecting Surface

Blasting affecting surface (Vibrations and Overpressure)

Subcauses:
- Inappropriate drill and blast plans
- Inappropriate drilling equipment (drilling accuracy)
- Higher confined blasting such as slots
- Faults and structures influencing vibration transmission
- Geographical continuity between the blast and point of interest or monitoring point
- Peak over-pressure
- Waveform - not considering as part of the analysis

Preventative Controls:

Reactive Controls:
- Complaints process
- Modification of blast designs to respond to changing conditions and vibration results
Figure 17: Blasting Affecting Surface - Preventative Controls

- **Figure 17**: Blasting Affecting Surface - Preventative Controls
  
  - **AC**: Finalise the Bin Management Plan
  - **Blasting Management Plan**: Controlled by the mine management
  - **Survey control**: Free of any man-made vibration
  
  - **Community Consultative Process**
  - **Trained and competent surveyors**: Assessment of pre-registered mine survey
  - **Surveyors**: Approved and accurate survey plans
  - **Site location**: Controlled by the mine management

- **Blasting Preventative Controls**
  
  - **Figure 17**: Blasting Affecting Surface - Preventative Controls
  
  - **AC**: Finalise the Bin Management Plan
  - **Blasting Management Plan**: Controlled by the mine management
  - **Survey control**: Free of any man-made vibration

- **Blasting assessment, vibration and overpressure analysis**
  
  - **Excavation factor**: The site survey was undertaken to identify vibration
  - **Excavation factor**: The site survey was undertaken to identify vibration

- **Mine sequencing/scheduling**
  
  - **Mine sequencing/scheduling**
  - **Mine sequencing/scheduling**
  - **Mine sequencing/scheduling**
  - **Mine sequencing/scheduling**

- **Preparation, charging and blast control**
  
  - **Preparation, charging and blast control**
  - **Preparation, charging and blast control**
  - **Preparation, charging and blast control**
  - **Preparation, charging and blast control**

- **Drill and blast designs**
  
  - **Drill and blast designs**
  - **Drill and blast designs**
  - **Drill and blast designs**
  - **Drill and blast designs**

- **Drilling implementation**
  
  - **Drilling implementation**
  - **Drilling implementation**
  - **Drilling implementation**
  - **Drilling implementation**

- **AC**: Finalise the Bin Management Plan
  - **Blasting Management Plan**: Controlled by the mine management
  - **Survey control**: Free of any man-made vibration

- **Vibration monitors**
  
  - **Vibration monitors**: Used to provide data from blasting and other sources
  - **Vibration monitors**: Used to provide data from blasting and other sources

- **Surface and Environmental Aspects**
  
  - **Surface and Environmental Aspects**
  - **Surface and Environmental Aspects**
  - **Surface and Environmental Aspects**
  - **Surface and Environmental Aspects**
Figure 18: Threat – Noise

Installing fans approx. 100m depth
Installing fans approx. 150m depth
Noise from shaft 5
Noise from shaft 6

Sub-causes
Noise

Preventative Controls
- Fans installed on bottom of shafts to provide separation to the surface
- Noise survey modelling
- Noise monitoring program

Reactive Controls
- Complaints process

Figure 19: Threat – Amenity – Light, Air Quality

No impact or changes from shafts 5 and 7
Shaft 6 exhaust
Public interaction

Sub-causes
Amenity – Light, Air Quality / Odour, amenity and public interaction

Preventative Controls
- No surface works
- Shaft 5 is downcasing
- Shaft 5 is fenced
- Shaft 6 location is in a mining area and separated from points of interest
- Shaft 6 exhaust monitoring
- AC - Review and upgrade the hole cover, fencing and signage for shaft 5

Reactive Controls
- Complaints process

Exhaust monitoring has indicated that the exhaust quality is not an issue
Figure 20: Threat – Impacts on Local Council Heritage

Impacts on local council Heritage

Preventative Controls
- Secure and stabilise head frame 4
- Regular monitoring and inspections of head frame 4
- Heritage management
  - As for ground stability and blasting controls

Reactive Controls
- Reinforce and repairs as required

Head frame 4 is primary heritage
- Old buildings and mining equipment

Sub-causes
### 9.3 Risk Treatment Plan / Risk Register

The Risk Treatment Plan is a “living document” and as such, should be added to the client Risk Register. The accountabilities (By Whom) and timing for completion (By When) will be allocated by the client for tracking. The 5 key threats (hazards) have been risk ranked – ground failure/subsidence, vibration/overpressure, noise, amenity and impacts on council heritage.

#### Table 3 : Risk Treatment Plan

<table>
<thead>
<tr>
<th>Ref</th>
<th>Threat</th>
<th>Sub-Causes</th>
<th>Preventative Controls</th>
<th>Information for Controls</th>
<th>Reactive (Mitigation) Controls</th>
<th>C</th>
<th>P</th>
<th>R</th>
<th>Additional Controls / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>Large faults and structures; Large voids; Chimney caving; Inappropriate design; Not minded to design; Distance from infrastructure; Limited structural data and no structural model - this is critical for calculating final stable spans for stoping and for assessing the risk of stope failure that may impact surface infrastructure; Large scale stope over break; Structurally controlled failures from hanging wall and crown resulting in changes in stope spans than predicted by empirical modelling; Failure of pillars due to presence of unfavourable defects in the pillar; Variability in geotechnical parameters used in the stope analysis. There are inherent risks in extrapolating drill hole point data to generalised rock mass conditions across domains. Whilst the host rock mass and the mineralised lenses could be described as close to homogeneous, there are localised variations in rock mass conditions. Assumptions are also made with regards to the presence of the critical defect set within the rock masses forming the stope walls; Rock mass conditions encountered during mining not the same that used for modelling; Insufficient fill; LTA fill quality and placement; LTA monitoring; Disturbance and interaction with historical workings - main lode is the closest; Variable geology; Inaccurate orientation of drill holes leading to incorrect interpretation</td>
<td>Data collection</td>
<td>Data collection and detailed characterisation of ground conditions in the hanging wall and crown of the ore lens using existing drill core from 22 holes; Collect data through a staged approach to opening the area (1) development (2) cut and fill (3) bench stope.</td>
<td>Suspension of blasting and/or revised mine scheduling and alternate mining method based monitoring results and geotechnical assessment</td>
<td>Catastrophic</td>
<td>Rare</td>
<td>Medium</td>
<td>15</td>
</tr>
</tbody>
</table>

NOTE: Ranked on the basis of Community. There is elevated “perception risk” even though the technical risk is managed appropriately. Mining activities could be suspended through perceived risk.
<table>
<thead>
<tr>
<th>Ref</th>
<th>Threat</th>
<th>Sub-Causes</th>
<th>Preventative Controls</th>
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<th>R</th>
<th>Additional Controls / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Structural Model</td>
<td>Initial review indicates there are no significant structures, shear zones and dolerite</td>
<td>Rib pillars may be required if weak ground conditions or a large scale geological structure is encountered</td>
<td></td>
<td></td>
<td></td>
<td>1 Develop structural model and refine as obtain more data; 2 Collect and interpret structural defect data and geotechnical data is necessary as mining progresses in the zinc lodes. This will allow validation of design parameters and timely input to the mine design process</td>
</tr>
<tr>
<td>4</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>60m Crown Pillar between surface infrastructure and the upper mining horizon</td>
<td>In combination with small and stable stopes, this is a significant barrier pillar</td>
<td>Install additional ground support if required (localised)</td>
<td></td>
<td></td>
<td></td>
<td>Formalise the analysis regarding the 60m pillar stability COMPLETE This has been completed and is provided in G0057_AA_REUSE_RASP_ZINC_LODES_DRAFT_FINAL_WITH_APPENDICES, 16th October 2014</td>
</tr>
<tr>
<td>5</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Geotechnical assessment</td>
<td>The significant shear zones identified from the geotechnical core logging are not located in the hanging wall or crown of the bench stopes and are not expected to have an impact on the stability of the stopes or development access drives; Escalation Factor : distribution of the available geotechnical data throughout the zinc lode ore body is insufficient to discount the potential risk that development or stoping could intersect structures with sufficient continuity to influence the stope stability during production.</td>
<td>TARP</td>
<td></td>
<td></td>
<td></td>
<td>1 Increase the size and quality of the geotechnical database for the Zinc Lodes by collecting geotechnical information from future resource drilling programs; 2 (Reactive) Update the TARP to include the Zinc Lode</td>
</tr>
<tr>
<td>6</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Conservative stope design dimensions</td>
<td>Section 1 - stable at 15m however decision to apply more conservative approach (i.e.) smaller 10m strike lengths with 5m pillars² bench method OR intermediate sill drive for HW cable bolting; Section 2 - stable 15m strike length OR intermediate sill drive for HW cable bolting; Flatter sections use cut and fill mining method.</td>
<td>As for current and recommended controls</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Immediate filling after extraction</td>
<td>Escalation Factor : not enough fill; Escalation Factor : fill infrastructure not in place to place fill; Combination of waste and hydraulic fill using existing fill and filling infrastructure extended as required (including tight filling the final 5m top access drive immediately beneath the road at decommissioning).</td>
<td>Ensure surface to underground backfill holes are included in the MOP and Application</td>
<td></td>
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</tbody>
</table>

¹ The geotechnical analysis indicates that 15m span without pillars is stable (G0057_AA_REUSE_V03_RASP_ZINC_LODES_DRAFT_FINAL_WITH_APPENDICES, 16th October 2014) so use of pillars (if required) would be very conservative.
<table>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Mine planning and scheduling (operational control)</td>
<td>Ensuring that stope production spans do not exceed stable dimensions; Mining sequence to limit number to one bench stope at one time within the mining block; A complete strategy to extract each stope is in place that incorporates appropriate infrastructure to fill each stope after the completion of extraction; Ground control is installed according to the design; Use of geotechnical back analysis in the mine design process.</td>
<td></td>
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<td></td>
<td></td>
<td>As for current and recommended controls</td>
</tr>
<tr>
<td>9</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Ground control design</td>
<td>Hanging wall cable bolt support installed in the top and bottom ore drives; Intermediate / mid span drive for additional HW support; Ground support designs are appropriate to control stope over break; Ground control strategies are in place to protect the crown between surface infrastructure and the planned upper mining horizon; Use of rib pillars for the bench method in Section 1 (if required).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As for current and recommended controls</td>
</tr>
<tr>
<td>10</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Geotechnical monitoring</td>
<td>Ongoing monitoring and back analysis of the performance of stope spans is carried; Stope performance data is recorded and applied to stope and mine design.</td>
<td></td>
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<td></td>
<td>1 Develop a comprehensive program to monitor stope stability and potential surface subsidence (implemented before and during the extraction of the zinc lodes); 2 Conduct a pre and post mining survey and assessment of the road; 3 Conduct a pre and post mining survey and assessment of the area within the potential area of influence (including any services and infrastructure inside and outside the mining lease ) (Note: incorporate the lateral extent of the distances to residential vibration monitoring points)</td>
</tr>
<tr>
<td>Ref</td>
<td>Threat</td>
<td>Sub-Causes</td>
<td>Preventative Controls</td>
<td>Information for Controls</td>
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<tr>
<td>11</td>
<td>Ground Failure / Subsidence affecting surface</td>
<td>As above</td>
<td>Ground Control Management Plan</td>
<td>A consolidation of the “system” to ensure stable excavations and prevention of subsidence</td>
<td>GCMP TARP</td>
<td></td>
<td></td>
<td></td>
<td>Update the ground control management plan (GCMP) for the Zinc Lodes ore body. COMPLETE</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>This has been completed and is provided in G0057_AA_RE01_V03_RASP_ZINC_LODES_DRAFT_FINAL_WITH_APPENDICES, 16th October 2014</td>
</tr>
<tr>
<td>12</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>Inappropriate drill and blast plans that include hole placement, burdens and spacing incorrect, interaction between rings; timing between holes and rings, type of explosives and sequencing. LTA drill and blast implementation that involves voids and shears affecting drill and blast; LTA drill hole prepping and survey prior to charging; drill / hole accuracy; LTA driller competencies; LTA charging crew competencies. Inappropriate drilling equipment. Higher confined basting such as slots. Faults and structures influencing vibration transmission. Distance from infrastructure. Geological continuity between the blast and point of interest or monitoring point. Adjacent to dolerite zones and dykes. Peak vibration. Peak over-pressure. Wave form – not considering as part of the analysis.</td>
<td>Blasting assessment, vibration and overpressure analysis</td>
<td>Vibration monitors are used to provide data from blasting and other potential sources (e.g.) activities on or near the points of interest such as the road, nearby buildings and Perilya activities etc. Standardised blast designs to allow effective monitoring and analysis of individual firings. Escalation factor: Do not set up the monitors properly and external interference. All monitor stations are checked they are dialled in and operational prior to blasts. Maintenance and calibration process for all monitors. Suitably competent personnel collect and review the data (internal and external). Ability to use roving monitoring units. Over-pressure data is collected from the same vibration stations. No open pathways that could lead to over-pressure events. (Note: the number 5 shaft has vent fans installed to act as a barrier to any over-pressure events)</td>
<td>Complaints process</td>
<td></td>
<td></td>
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<td></td>
<td>NOTE : Ranked on the basis of Community. There is elevated “perception risk” even though the technical risk is managed appropriately. Mining activities could be suspended through perceived risk that vibration is a major issue because people can feel and hear the blasts but the blasts are within agreed thresholds</td>
</tr>
</tbody>
</table>
### Ref 13: Blasting affecting surface (Vibrations and Overpressure)

**As above**

**Preventative Controls:**
- Drill and blast designs

**Information for Controls:**
- Slots - Increased number of reamers as easer holes; Smaller firings and bring the slot up sequentially.
- Rings – Smaller firings and fired sequentially. All - Maintain blasting designs as standard as possible (whilst allowing flexibility to match ore outlines). No current firings. Limited up-holes (which are more difficult to survey post drilling and prior to blasting, and managing charges); Design to optimise the instantaneous charge to control vibration (Note: the size of mining excavations (hence the size of firings) is constrained so as to prevent potential ground failure - refer to managing the threat of ground failure)); Designs consider the key criteria (charge mass, timing sequence, hole location); More perimeter holes particularly in narrow areas; Drill plans approved by mining engineers and management; Limit the blast duration where possible; Drill and blast designs are optimised from the results from each firing and potential effects from structures; No currently known major dykes that could act as transmission zones; As mining entry progresses into the area and discovers significant structures (including dykes and dolerite structure), the drill and blast design assesses the direction and potential impacts of the dyke on points of interest on the surface, and the design changed to suit; Drill and blast designs take into account structures and geological models; Progressive development into the area closer to the points of interest (from development to cut and fill then bench stoping) and data collected throughout these phases to apply in subsequent blasting.

**Reactive (Mitigation) Controls:**
- Modification of blast designs to respond to changing conditions and vibration results

**Additional Controls / Actions:**
- As for current and recommended controls

---

### Ref 14: Blasting affecting surface (Vibrations and Overpressure)

**As above**

**Preventative Controls:**
- Drilling implementation

**Information for Controls:**
- Accurate drilling - competent and trained personnel; Intermediate access mining method where require also provides improved drilling accuracy (since shorter holes); Drilling equipment and drill consumables matched to achieving targeted limits.

**Reactive (Mitigation) Controls:**
- Review the drilling equipment and drill consumables combination to optimise the control of drill hole accuracy
### BHOP - Rasp Mine Extension
#### Risk Analysis Report – Surface and Environmental Aspects

<table>
<thead>
<tr>
<th>Ref</th>
<th>Threat</th>
<th>Sub-Causes</th>
<th>Preventative Controls</th>
<th>Information for Controls</th>
<th>Reactive (Mitigation) Controls</th>
<th>C</th>
<th>P</th>
<th>R</th>
<th>Additional Controls / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>As above</td>
<td>Preparation, charging and blast control</td>
<td>All down holes are prepped and inspected to verify location, voids and other issues prior to charging; Approved charge plans; Trained and competent blast crew; Competent drill and blast engineers; low density explosives where applicable and suited to conditions; Intermediate access mining method where require also reduces the size of firings (since shorter holes and less explosives).</td>
<td></td>
<td>C</td>
<td>P</td>
<td>R</td>
<td>As for current and recommended controls</td>
</tr>
<tr>
<td>16</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>As above</td>
<td>Mine sequencing / scheduling</td>
<td>Firing takes into account points of interest with regards to vibration effects and potential impacts (Note: broken ground created between shots and the point of interest may have dampening effects). Coordination of activities and any interactions between Perilya and BHOP operations.</td>
<td></td>
<td>C</td>
<td>P</td>
<td>R</td>
<td>Consider shrouding effects from filled stopes, voids and workings that assist to shield vibration transmission (Note : consider orientation of shear zones and how this can affect vibration transmission since can be variable )</td>
</tr>
<tr>
<td>17</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>As above</td>
<td>Survey control</td>
<td>Trained and competent surveyors; Assessment / verification of the survey by Registered Mine Surveyor; Approved and accurate survey plans. Escalation factor: mis-match between grids used by Perilya and BHOP</td>
<td></td>
<td>C</td>
<td>P</td>
<td>R</td>
<td>Confirm the joining of the survey grids between BHOP and Perilya leases</td>
</tr>
<tr>
<td>18</td>
<td>Blasting affecting surface (Vibrations and Overpressure)</td>
<td>As above</td>
<td>Community Consultative Process</td>
<td>Communication and consultation with key stakeholders and the public</td>
<td></td>
<td>C</td>
<td>P</td>
<td>R</td>
<td>As for current and recommended controls</td>
</tr>
</tbody>
</table>
| 19  | Blasting affecting surface (Vibrations and Overpressure)               | As above, plus: Personnel feeling vibration on the surface during blasting. The limit could be set for the road at 100mm/s to manage impact on the road corridor assets however vibrations could still be felt on the surface. | Blasting Management Plan                                                                  | A consolidated document summarising the “system” to ensure blasts are controlled including management of access and interaction with the public and other stakeholders | Community Complaint process | C  | P | R | Finalise the Blast Management Plan
Establish agreed PPV at which point pedestrian and vehicle traffic may be warned and/or temporarily stopped during blasts that exceed those limits - develop procedure to be applied at the time as required. |
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Noise</td>
<td>Noise from shaft 5 – Installing fans approx. 100m depth. Noise from underground activities (eg) trucking and loading – the noise could propagate up shaft 5 Noise from shaft 6 – Installing fans approx. 150m depth.</td>
<td>Fans installed on bottom of shafts to provide separation to the surface Fans installed underground and not on the surface – fans have suppression units if required (based on noise monitoring) The installation of a brick ventilation wall and installation of fans provides a barrier between general underground operations noise from being transferred up the shaft</td>
<td>Complaints process</td>
<td>Moderate</td>
<td>Unlikely</td>
<td>Low 5</td>
<td>As for current – none additional for noise</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Noise</td>
<td>Noise from shaft 5 – Installing fans approx. 100m depth. Noise from underground activities (eg) trucking and loading – the noise could propagate up shaft 5 Noise from shaft 6 – Installing fans approx. 150m depth.</td>
<td>Noise survey modelling</td>
<td>Modelling of all noise sources</td>
<td>Refine model based on monitoring results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Noise</td>
<td>Noise from shaft 5 – Installing fans approx. 100m depth. Noise from underground activities (eg) trucking and loading – the noise could propagate up shaft 5 Noise from shaft 6 – Installing fans approx. 150m depth.</td>
<td>Noise monitoring program</td>
<td>Monitoring to verify noise levels and to provide feedback to fine tune / modify activities and equipment as required</td>
<td>Attenuation of equipment as required</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Amenity - Light, Air Quality / Odour, amenity and public interaction</td>
<td>No impact or changes from shafts 5 and 7; Shaft 6 exhaust; Public interaction.</td>
<td>No surface works</td>
<td>No additional construction or other activities on the surface</td>
<td>Complaints process</td>
<td>Minor</td>
<td>Rare</td>
<td>Low 1</td>
<td>As for current – none additional for amenity</td>
</tr>
<tr>
<td>24</td>
<td>Amenity - Light, Air Quality / Odour, amenity and public interaction</td>
<td>No impact or changes from shafts 5 and 7; Shaft 6 exhaust; Public interaction.</td>
<td>Shaft 5 is down casting</td>
<td>Takes any odour into the mine and away through existing airways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Amenity - Light, Air Quality / Odour, amenity and public interaction</td>
<td>No impact or changes from shafts 5 and 7; Shaft 6 exhaust; Public interaction.</td>
<td>Shaft 5 is fenced</td>
<td>To prevent access by the public – existing hazard</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ref</td>
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<td>Sub-Causes</td>
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<td>Information for Controls</td>
<td>Reactive (Mitigation) Controls</td>
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<td>R</td>
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</tr>
<tr>
<td>26</td>
<td>Amenity - Light, Air Quality / Odour, amenity and public interaction</td>
<td>No impact or changes from shafts 5 and 7; Shaft 6 exhaust; Public interaction.</td>
<td>Shaft 6 location is in a mining area and separated from points of interest</td>
<td>Separation and within older mining landscape</td>
<td></td>
<td></td>
<td></td>
<td>As for current – none additional for amenity</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Amenity - Light, Air Quality / Odour, amenity and public interaction</td>
<td>No impact or changes from shafts 5 and 7; Shaft 6 exhaust; Public interaction.</td>
<td>Shaft 6 exhaust monitoring</td>
<td>Exhaust monitoring has indicated that the exhaust quality is not an issue</td>
<td>Possible use of water suppressant in shaft if required</td>
<td></td>
<td></td>
<td></td>
<td>As for current – none additional for amenity</td>
</tr>
<tr>
<td>28</td>
<td>Impacts on local council Heritage</td>
<td>Head Frame 4 is primary heritage; Old buildings and mining equipment.</td>
<td>Secure and stabilise Head Frame 4</td>
<td>The old headframe is being stabilised prior to mining activities</td>
<td>Reinforce and repairs as required</td>
<td></td>
<td></td>
<td></td>
<td>As for current – none additional for heritage</td>
</tr>
<tr>
<td>29</td>
<td>Impacts on local council Heritage</td>
<td>Head Frame 4 is primary heritage; Old buildings and mining equipment.</td>
<td>Regular monitoring and inspections of Head Frame 4</td>
<td>Ongoing program of work – existing control (regardless of mine extension)</td>
<td></td>
<td></td>
<td></td>
<td>As for current – none additional for heritage</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Impacts on local council Heritage</td>
<td>Head Frame 4 is primary heritage; Old buildings and mining equipment.</td>
<td>Heritage management</td>
<td>Ongoing program of work – existing control (regardless of mine extension)</td>
<td></td>
<td></td>
<td></td>
<td>Review nearby heritage items</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Impacts on local council Heritage</td>
<td>Head Frame 4 is primary heritage; Old buildings and mining equipment.</td>
<td>As for ground stability and blasting controls</td>
<td>Ground movement and vibration could influence a structure of this nature but this will be controlled (refer above)</td>
<td></td>
<td></td>
<td></td>
<td>As for current – none additional for heritage</td>
<td></td>
</tr>
</tbody>
</table>
9.4 Photo Study

Figure 21: Representative Photos of the Area

Road – looking towards mining buildings. The road surface has been resealed several times and has been used for a long time. Appears in reasonable condition. Mining area fenced. Some public pedestrians / joggers walk beside the road.

Wooden head frame on the left is Head frame 4. This is being reinforced for safety regardless of the mine extension to ensure reasonable steps are taken to preserve for as long as possible (community interest aspect).

Older disused shaft 5 – fenced and will be turned into a downcast (fresh air intake) for the mine extension

Area opposite – two buildings one of which is vacant and another with a resident
<table>
<thead>
<tr>
<th>Cracking and deterioration of old concrete fencing and cracking in the asphalt in front of the buildings is evident</th>
<th>Front fence of second old building with a resident. Similar deteriorating condition of fencing and access</th>
</tr>
</thead>
<tbody>
<tr>
<td>View of road – there does appear to be a water / pipeline buried on the far side along the road corridor that needs to be taken into account</td>
<td>View of road</td>
</tr>
<tr>
<td>View of buildings</td>
<td>Building with tenant – old building and in poor condition</td>
</tr>
</tbody>
</table>
View from tenant residence – looking across the road

Walkway beside road – no under drainage / culverts evident
9.5 Risk Treatment

A Systems Model to Treat Risks

A systems approach to the treatment of risks involves consideration of three aspects:
1. Areas of intervention;
2. Wheel of Safe Production (Nertney Wheel); and
3. Sequence of Barriers.

Areas of intervention

Controls need to be considered through their area of intervention. Controls can act to:

- Prevent (P): Aim to reduce the probability of a loss event to as close as possible to zero. This is typically done by designing out the risk, using a different process or providing multiple hard barriers between energy sources and people. Controls can have a preventative nature that acts to avoid the unwanted event from occurring.

- Monitor (M): Aim to put monitoring regimes in place that detect the increased probability of a loss event. Typical examples are fire detection alarm systems, and daily site inspections for strata conditions.

- First Response (R): Aim to install operating systems that react quickly to minimise the consequence of a loss event. Typical examples are pumping systems, and Emergency Response procedures/teams.

- Restore (S): Aim to have access to procedures and resources that restores the system to the condition it was in before a loss event, with the intent of minimising the time the system is impaired and/or to prevent further deterioration of the system.

Wheel of Safe Production (Nertney Wheel)

To achieve safe production (centre of the wheel), certain key groups shown in the following figure need to be considered:

Figure 22: Wheel of Safe Production
The following is a general description of the groups within the wheel:

**Competent People**
- Supervision and managers
- Technical as well as operators and managers
- Training programs (the manuals are the documentation included in Safe Work Practices – people then have to be trained and assessed as competent on an ongoing basis);
- Skills and experience required, selection and placement

**Fit For Purpose Equipment**
- Special gear and hardware required
- Equipment suited to task (e.g. loaders, drills – include specification)
- PPE (personal protective equipment)
- Warning devices such as sirens, alarms, lights, signs, fencing
- Monitoring systems, interlocks with PLCs etc.

**Controlled Work Environment**
- Physical environment such as the weather, hot/cold, dust, noise
- Management such as rosters, time of work, communication, shift changes, systems generally
- Policies
- Planned inspections
- Audits and reviews

**Safe Work Practices**
- All documentation
- Procedures, standards and training manuals
- Maintenance programs/schedules
- Plans, schematics, wiring diagrams
- Risk assessments, JSAs
- Design processes and standards

**Sequence of Barriers (Hierarchy of Controls)**

Additional controls were developed throughout the hazard identification section of the risk assessment with a focus on the hierarchy of controls as depicted in the figure below.

![Figure 23: Hierarchy of Control](image-url)
Risk Acceptability and Risk Criteria

Legislation and good practice is targeted to reduce risk to “As Low as Reasonably Practicable” (ALARP), this is often interchanged with “As Low as Reasonably Achievable” (ALARA).

The purpose of risk criteria is to allow the organisation to clearly define unacceptable levels of risk, or conversely that level of risk which is acceptable or tolerable. In essence the risk criterion enables the organisation to prioritise actions proposed to control the risk during the risk assessment – leading to the development of the Risk Treatment Plan.

The ALARP principle, as represented in the diagram below, was developed to assist in the definition of the acceptability of risk and to demonstrate that an organisation has done all that is considered to be practical in reducing the level of exposure to a risk. More often this is done qualitatively rather than as a quantitative probability as shown on the right hand side of the diagram in the following figure. A risk may be considered to be tolerable in the ALARP zone if the cost of removing the risk is disproportionate to the benefits gained.

*Figure 24: Risk Criteria "ALARP"*
9.6 ABOUT YOUR REPORT

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- valid and factual inputs supplied by all third parties;
- key assumptions outside the influence of *SP Solutions*; and
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