



# Chapter 21

**Unplanned Events  
(Natural Hazards and Accident Events)**

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### Purpose of EIS

The EIS has been prepared by, for and on behalf of Wafi Mining Limited and Newcrest PNG 2 Limited (together the “**WGJV Participants**”), being the participants in the Wafi-Golpu Joint Venture (“**WGJV**”) and the registered holders of exploration licences EL 440 and EL1105, for the sole purpose of an application (the “**Permit Application**”) by them for environmental approval under the Environment Act 2000 (the “**Act**”) for the proposed construction, operation and (ultimately) closure of an underground copper-gold mine and associated ore processing, concentrate transport and handling, power generation, water and tailings management, and related support facilities and services (the “**Project**”) in Morobe Province, Independent State of Papua New Guinea. The EIS was prepared with input from consultants engaged by the WGJV Participants and/or their related bodies corporate (“**Consultants**”).

The Permit Application is to be lodged with the Conservation and Environment Protection Authority (“**CEPA**”), Independent State of Papua New Guinea.

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### Development of Project subject to Approvals, Further Studies and Market and Operating Conditions

Any future development of the Project is subject to further studies, completion of statutory processes, receipt of all necessary or desirable Papua New Guinea Government and WGJV Participant approvals, and market and operating conditions.

Engineering design and other studies are continuing and aspects of the proposed Project design and timetable may change.

### NEWCREST MINING LIMITED DISCLAIMER

Newcrest Mining Limited (“**Newcrest**”) is the ultimate holding company of Newcrest PNG 2 Limited and any reference below to “Newcrest” or the “Company” includes both Newcrest Mining Limited and Newcrest PNG 2 Limited.

### Forward Looking Statements

The EIS includes forward looking statements. Forward looking statements can generally be identified by the use of words such as “may”, “will”, “expect”, “intend”, “plan”, “estimate”, “anticipate”, “continue”, “outlook” and “guidance”, or other similar words and may include, without limitation, statements regarding plans, strategies and objectives of management, anticipated production or construction commencement dates and expected costs or production outputs. The Company continues to distinguish between outlook and guidance. Guidance statements relate to the current financial year. Outlook statements relate to years subsequent to the current financial year.

Forward looking statements inherently involve known and unknown risks, uncertainties and other factors that may cause the Company’s actual results, performance and achievements to differ materially from statements in this EIS. Relevant factors may include, but are not limited to, changes in commodity prices, foreign exchange fluctuations and general economic conditions, increased costs and demand for production inputs, the speculative nature of exploration and project development, including the risks of obtaining necessary licences and permits and diminishing quantities or grades of reserves, political and social risks, changes to the regulatory framework within which the Company operates or may in the future operate, environmental conditions including extreme weather conditions, recruitment and retention of personnel, industrial relations issues and litigation.

Forward looking statements are based on the Company’s good faith assumptions as to the financial, market, regulatory and other relevant environments that will exist and affect the Company’s business and operations in the future.

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Newcrest results are reported under International Financial Reporting Standards (IFRS) including EBIT and EBITDA. The EIS also includes non-IFRS information including Underlying profit (profit after tax before significant items attributable to owners of the parent company), All-In Sustaining Cost (determined in accordance with the World Gold Council Guidance Note on Non-GAAP Metrics released June 2013), AISC Margin (realised gold price less AISC per ounce sold (where expressed as USD), or realised gold price less AISC per ounce sold divided by realised gold price (where expressed as a %), Interest Coverage Ratio (EBITDA/Interest payable for the relevant period), Free cash flow (cash flow from operating activities less cash flow related to investing activities), EBITDA margin (EBITDA expressed as a percentage of revenue) and EBIT margin (EBIT expressed as a percentage of revenue). These measures are used internally by Management to assess the performance of the business and make decisions on the allocation of resources and are included in the EIS to provide greater understanding of the underlying performance of Newcrest's operations. The non-IFRS information has not been subject to audit or review by Newcrest's external auditor and should be used in addition to IFRS information.

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As an Australian Company with securities listed on the Australian Securities Exchange (ASX), Newcrest is subject to Australian disclosure requirements and standards, including the requirements of the Corporations Act 2001 and the ASX. Investors should note that it is a requirement of the ASX listing rules that the reporting of Ore Reserves and Mineral Resources in Australia comply with the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC Code) and that Newcrest's Ore Reserve and Mineral Resource estimates comply with the JORC Code.

### Competent Person's Statement

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

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Harmony Gold Mining Company Limited ("Harmony") is the ultimate holding company of Wafi Mining Limited and any reference below to "Harmony" or the "Company" includes both Harmony Gold Mining Company Limited and Wafi Mining Limited.

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These materials contain forward-looking statements within the meaning of the safe harbor provided by Section 21E of the Securities Exchange Act of 1934, as amended, and Section 27A of the Securities Act of 1933, as amended, with respect to our financial condition, results of operations, business strategies, operating efficiencies, competitive positions, growth opportunities for existing services, plans and objectives of

management, markets for stock and other matters. These include all statements other than statements of historical fact, including, without limitation, any statements preceded by, followed by, or that include the words "targets", "believes", "expects", "aims", "intends", "will", "may", "anticipates", "would", "should", "could", "estimates", "forecast", "predict", "continue" or similar expressions or the negative thereof.

These forward-looking statements, including, among others, those relating to our future business prospects, revenues and income, wherever they may occur in this EIS and the exhibits to this EIS, are essentially estimates reflecting the best judgment of our senior management and involve a number of risks and uncertainties that could cause actual results to differ materially from those suggested by the forward-looking statements. As a consequence, these forward-looking statements should be considered in light of various important factors, including those set forth in these materials. Important factors that could cause actual results to differ materially from estimates or projections contained in the forward-looking statements include, without limitation: overall economic and business conditions in South Africa, Papua New Guinea, Australia and elsewhere, estimates of future earnings, and the sensitivity of earnings to the gold and other metals prices, estimates of future gold and other metals production and sales, estimates of future cash costs, estimates of future cash flows, and the sensitivity of cash flows to the gold and other metals prices, statements regarding future debt repayments, estimates of future capital expenditures, the success of our business strategy, development activities and other initiatives, estimates of reserves statements regarding future exploration results and the replacement of reserves, the ability to achieve anticipated efficiencies and other cost savings in connection with past and future acquisitions, fluctuations in the market price of gold, the occurrence of hazards associated with underground and surface gold mining, the occurrence of labour disruptions, power cost increases as well as power stoppages, fluctuations and usage constraints, supply chain shortages and increases in the prices of production imports, availability, terms and deployment of capital, changes in government regulation, particularly mining rights and environmental regulation, fluctuations in exchange rates, the adequacy of the Group's insurance coverage and socio-economic or political instability in South Africa and Papua New Guinea and other countries in which we operate.

For a more detailed discussion of such risks and other factors (such as availability of credit or other sources of financing), see the Company's latest Integrated Annual Report and Form 20-F which is on file with the Securities and Exchange Commission, as well as the Company's other Securities and Exchange Commission filings. The Company undertakes no obligation to update publicly or release any revisions to these forward-looking statements to reflect events or circumstances after the date of this EIS or to reflect the occurrence of unanticipated events, except as required by law.

### Competent Person's Statement

The Wafi-Golpu Joint Venture is an unincorporated joint venture between a wholly-owned subsidiary of Harmony Gold Mining Company Limited and a wholly-owned subsidiary of Newcrest Mining Limited.

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

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## 21. UNPLANNED EVENTS (NATURAL HAZARDS AND ACCIDENTAL EVENTS)

In addition to the predicted environmental, socioeconomic and cultural heritage impacts associated with the Wafi-Golpu Project (the Project) that are considered as part of normal operating conditions (discussed in chapters 14 to 20), significant potential impacts can also result from “unplanned” events.

These events are often described as ‘low probability, high consequence’ events in reference to the position they occupy on a typical risk matrix.

They can be broadly categorised as:

- Natural events – Significant seismic, weather or other natural events that occur infrequently but have the potential to cause significant damage.
- Accidental events – Events originating from human activity that are considered unlikely due to the engineering design, operational controls and monitoring programs that are in place, but have the potential to cause significant damage if they do occur.

The environmental and regulatory consequences potentially resulting from these events can be large in scale and long term, and may include:

- Major, and potentially ongoing, uncontrolled releases of contaminants to the natural environment, with consequent environmental impacts
- Widespread contamination of soil, groundwater, surface waters and the marine environment
- Degradation of large areas of terrestrial habitat
- Significant unplanned changes to landform
- Short-term impacts to air quality
- Long-term non-compliance with regulatory requirements

In recognition of the scale and longevity of the potential impacts that may result from these unplanned events, the primary strategy for reducing the risk is to implement Project design controls that reduce the potential for such events to cause environmental harm. Design controls relevant to environmental protection from the unplanned events described in this chapter, are presented herein.

In the event that a significant, unplanned event did occur, WGJV would implement its risk-based Crisis, Emergency and Incident Management Plan. This plan provides for the following:

- Measures to reduce risks to as low as reasonably practicable
- Training and induction requirements for Project personnel and contractors
- Regular inspection and maintenance of emergency and spill response equipment
- Regular inspection of hazardous materials storage and handling facilities
- Regular inspection and maintenance of fire suppression and firefighting equipment
- Regular drills to ensure timely and effective response to an emergency or spill
- Protocol for notifying potentially affected communities of emergency or spill
- Protocol for coordinating response with relevant PNG authorities and governments
- Protocol for coordinating medical evacuations

The potential socioeconomic and cultural heritage consequences of unplanned events may include:

- Compromised health and/or safety, including potentially fatal injury to persons
- Damage to property
- Diminished livelihoods (e.g., through loss or damage or restricted access to land and/or water resources)
- Financial hardship and/or increased vulnerability for persons and their dependants in the event of a fatality, major life-changing injury and/or temporary or permanent Project closure
- Reduced access and damage or destruction to both tangible and intangible cultural heritage sites

## 21.1. Regulatory and Corporate Framework

### 21.1.1. Regulatory Framework

Legislation of the Independent State of Papua New Guinea (PNG) does not contain specific requirements for extreme natural hazard identification or risk assessment for a mining project. However:

- Section 7 of the *Environment Act 2000* provides that a person shall not carry out an activity that causes, or is likely to cause, environmental harm, unless all reasonable and practicable measures are taken to prevent or minimise the environmental harm.
- Section 43(1) of the *Mining Act 1992* requires that proposals submitted for mining leases (and special mining leases) provide adequately for environmental protection.
- The Environmental Code of Practice for the Mining Industry (OEC, 2000) requires the development of contingency plans to manage the risks of unexpected incidents, such as natural phenomena or equipment failures.

### 21.1.2. Corporate Framework

The WGJV Sustainable Business Management System policies and standards described in Chapter 3, Legal, Policy and Administrative Framework, and Chapter 23, Integrated Management System, contain a specific risk management policy for identifying and controlling risks associated with exploration and mining by WGJV in PNG. This is underpinned by the WGJV Risk Management Plan. Furthermore, various other WGJV Sustainable Business Management System policies and standards require that risk management systems be implemented for WGJV's operations.

From an environmental perspective, WGJV's Environment Policy targets environmental performance in WGJV's exploration and mining activities and outlines how this will be achieved by (among other things) identifying, mitigating and acting upon environmental risks to achieve target environmental outcomes, improving performance, and aiming to prevent pollution. This, in turn, complements the WGJV Social Responsibility Policy which aims to protect the communities in which the WGJV operate through safety, health, social and cultural heritage management.

The WGJV Crisis, Emergency and Incident Management Plan defines the processes for responding to incidents in terms of three levels of incident, each requiring different internal notifications and response.

The levels of incident are defined as follows:

- Level 1 – These are non-continuous with minor consequence, for example a small fire or explosion, equipment malfunction or security incident. Level 1 incidents are managed by the On-Scene Commander (a senior responding person); this person is normally the Emergency Response Superintendent or delegate.
- Level 2 – These are continuous but limited consequence, for example a serious fire or explosion, material release or severe weather activity. Level 2 incidents require the mobilisation of an Emergency Management Team.
- Level 3 – These are continuous with major long-term, potentially serious consequences and possible shutdown, for example major fire or explosion, material release, severe weather, natural disaster or blockade event. Level 3 incidents require the early notification and mobilisation of a Crisis Management Team including involvement of WGJV executives.

Levels 2 and 3 incident responses would likely be initiated in response to major natural hazard and accidental events.

The management approach to emergency incidents ensures that appropriate communication with communities and other relevant stakeholders occurs as close as possible to the occurrence of an event.

In accordance with Section 8 of the *Environment Act 2000*, the Conservation and Environment Protection Authority (CEPA) must also be informed as soon as practicable of any instance where serious environmental harm has occurred.

## 21.2. Specific Potential Unplanned Event Scenarios

It is not possible to foresee or prevent the negative impacts of all unlikely, naturally occurring or unplanned events which may have a high consequence. However, drawing on an understanding of the Project location and the proposed Project activities, the WGJV has completed various risk assessments to identify events/scenarios and prepare for the potential event scenarios below, including the proposed controls to avoid or minimise the potential impacts.

Despite the low probability of occurrence of these events, WGJV has given these events due consideration and, where practicable, has designed the Project to reduce the likelihood of the potential impacts being realised. These scenarios and management measures will be regularly reviewed throughout the life of the Project as part of the WGJV's hazard/risk management approach.

### 21.2.1. Natural Events

The potential natural events considered most likely to affect the Project are:

- Seismic events
- Tsunami, storm surge and flood events
- Bushfire
- Drought

#### 21.2.1.1. Potential Impacts

The most likely potential impacts of the natural events identified in Section 21.2.1 include:

- Potential injuries or fatalities for Project personnel and/or third-parties
- Damage to Project facilities, including concentrate filtration plant, declines, block caves, Watut Process Plant, waste rock dumps, explosives magazines, Project roads, bridges, power generation facilities, Outfall System, water supply and borrow pits
- Uncontrolled release of hazardous and non-hazardous materials to the environment posing potential risk to human and ecological health
- Terrestrial and aquatic habitat destruction and watercourse sedimentation potentially leading to significant environmental damage and diminished livelihoods and/or threat to community health and safety (e.g., loss of food and water supplies)
- Temporary or premature or permanent Project closure
- Damage to or destruction of cultural heritage areas or artefacts of cultural heritage significance

#### 21.2.1.2. Design Controls

Design and construction of Project facilities will be informed by PNG and local data and will be in accordance with applicable standards (e.g., seismic events, flood immunity, wind velocities).

#### 21.2.2. Pipeline Rupture

The Infrastructure Corridor, within which the concentrate, terrestrial tailings and fuel pipelines will run, will extend approximately 100 kilometres (km) from the Watut Process Plant to the Port Facilities Area and Outfall Area. The pipelines will be buried for most of the route, with watercourse crossings to be either via open trenching or direct pipe trenchless method.

The tailings and concentrate pipelines will be built in accordance with internationally recognised best practice standards (ASME B36.10 Welded and Seamless Wrought Steel Pipe). These two pipelines are steel with a high density polyethylene (HDPE) liner whereas tailings pipelines are typically HDPE only. Continuous pipeline interference monitoring, leak detection monitoring and automatic shutdown systems on pumps will act to limit the volume released in the unlikely event of any potential rupture. The concentrate and terrestrial tailings pipelines can also be shut down at both ends of the pipe (Mine Area and Port Facilities Area / Outfall Area). As a result of these design, construction and management measures a leak is unlikely and the detection and response to a potential leak would be rapid. The actual volume of slurry released from a potential leak would depend on multiple factors including the point at which it occurred along the length of the pipeline, depth of burial, local topography, vacuum effects and the size of the breach.

The fuel pipeline will be constructed in accordance with AS2885.1-2012 Pipelines – Gas and liquid petroleum Part 1: Design and construction, which requires valves every 15km and either side of each major water crossing with a non-return valve on the downstream side of the crossing. Sections of the fuel pipeline could also be isolated in the event of a potential leak.

#### 21.2.2.1. Potential Impacts

The copper concentrate contains elevated levels of copper and an assessment of the material indicates that, when exposed to oxygen (as would occur in the case of an



unplanned release), the sulphide-rich concentrate may generate acidic leachate that could cause the death of vegetation, reduce water quality, and affect sensitive aquatic biota such as fish and frogs within the area impacted by a spill.

While the tailings slurry is expected to initially be non-acid generating with neutral pH, it will contain sulphides (with the potential to oxidise and lead to acid and metalliferous drainage (AMD) if exposed to atmospheric conditions) and elevated metals concentrations that could result in environmental impacts in the event of a leak in the pipeline.

Release of fuel into a watercourse as a result of fuel pipeline rupture has the potential to result in toxicological effects of petroleum hydrocarbons to aquatic biota, as well as leading to an increased risk of fire. Watercourse contamination would also have the potential to impact subsistence land and water resources used by communities.

The main potential impacts from the release of concentrate, tailings or fuel that may cause harm are:

- Generation of sulphuric acid (with corresponding low pH), anoxia and soluble metal formation (and toxicity), following sulphide oxidation if the concentrate is not recovered quickly enough and/or if portions of the concentrate are not able to be recovered
- Damage to terrestrial and aquatic habitats due to smothering by slurry
- Loss or decline of terrestrial and aquatic habitats due to leaching and runoff from residual spilled material
- Soil, groundwater and surface waters contamination from metals/metalloids and hydrocarbons in the concentrate potentially causing significant environmental harm and risk to human health
- Changes in aquatic flora and fauna biodiversity and abundance through death or avoidance of impacted habitats
- Increased risk of fire caused by the release of fuel
- Contamination of subsistence land and water resources
- Diminished livelihoods and/or threat to community health and safety

The degree of impact of any potential pipeline rupture will depend on a number of factors, particularly the location at which a rupture occurs, the quantity of material released into the environment, the dispersal pathway of material (i.e., whether the rupture occurs within watercourse or adjacent to terrestrial lands and areas of cropping or habitation) and the duration of exposure.

#### 21.2.2.2. Design, Inspection and Monitoring

The following controls have or will be accommodated in the design of the concentrate, terrestrial tailings and fuel pipelines:

- Use seismic data and geohazard assessment, including test pit and drilling data, to inform route selection and subject it to third party independent design review.
- Bury steel pipes at depths consistent with international standards to prevent accidental damage or interference.
- Ensure pipelines have external coating, cathodic protection and HDPE liners to minimise wear and corrosion.
- Use a 'pipe-in-pipe' pipeline design (effectively a double-walled pipe) and bury below the predicted water scour depth at major river crossings.

- Manage pipeline operations using pipeline interference monitoring and leak detection systems. These would identify possible attempts to interfere with the pipelines (whether accidental or deliberate), measure the flow and pressure of concentrate, tailings and fuel and shut down the pipeline pumps on detection of a pre-determined pressure or flow loss (i.e., a leak) to limit the potential volume of material lost.
- Implement containment facilities at the Port Facilities Area capable of storing the full concentrate pipeline contents in the event of an emergency.
- Design and construct the tailings mix/de-aeration tank within a dry moat, to capture and store overflow.

Furthermore, pipelines will be inspected and maintained regularly and in accordance with applicable standards. Spill response procedures are included in Attachment 3, Environmental Management Plan.

### 21.2.3. Underground Access Way Collapse

Seismic activity, ground support failure due to stress, or unanticipated response to a blast or caving program have the potential to result in a collapse of the underground access ways at the mine (such as declines, development drives or vertical openings).

#### 21.2.3.1. Potential Impacts

The main potential impacts from collapse of underground access ways that may cause harm are:

- Project personnel injuries or fatalities
- Damage or loss of Project facilities
- Temporary or premature Project closure

#### 21.2.3.2. Design, Inspection and Monitoring

The following controls have or will be accommodated in Project design:

- Use seismic data and modelling and further geotechnical testing to inform mine design, mine scheduling (of caving), ground support design, and drilling and blasting programs.
- Design key underground infrastructure (where people are) to be located in areas of competent rock.
- Apply quality assurance and quality control processes to:
  - Geotechnical and mining investigations forming the basis of the mine design and scheduling.
  - Construction, excavation and installation of ground support.
- Implement dewatering programs and water interception/gathering informed by hydrogeological modelling.

The following inspection and monitoring measures are proposed:

- Routinely monitor suspected geotechnical weak areas and high risk areas for early warning of an imminent failure.
- Categorise seismic events to ensure that large events in proximity to underground excavations are detected and trigger appropriate actions and detailed reviews.

#### 21.2.4. Waste Rock Dump Failure

An earthquake or extreme rainfall event with magnitudes above design allowances have the potential to result in failure in the integrity of waste rock dump cells containing potentially acid forming (PAF) material.

##### 21.2.4.1. Potential Impacts

The main potential impacts from a waste rock dump failure are:

- Project personnel injuries or fatalities
- Damage to terrestrial and aquatic habitats and biota due to smothering by mobilised sediment
- Soil, groundwater and surface waters contamination causing significant environmental harm (including to aquatic ecology) and risk to human health from AMD generation
- Contamination or destruction of land and water resources
- Diminished livelihoods and/or threat to health and safety

##### 21.2.4.2. Design Controls

The following controls have or will be accommodated in Project design:

- Use seismic, rainfall and hydrological data and further geotechnical testing to inform appropriate design and construction of the waste rock dumps.
- Apply quality assurance and quality control processes to geotechnical and mining investigations forming the basis of waste rock dump design and construction.
- Design the waste rock dumps and associated drainage systems and channels for a 1:100 flood event.
- Design and implement closure of the waste rock dumps appropriately, including revegetating exposed slopes as soon as practicable.

#### 21.2.5. Inundation of Port Facilities Area and Outfall Area

Inundation of the Port Facilities Area and/or the Outfall Area by the sea or flood waters is a risk for the Project, which would be an event likely to result in broad scale impacts on both the populace and businesses of Lae. The potential impacts to the Project are described below.

##### 21.2.5.1. Potential Impacts

The potential impacts from a tsunami, storm surge or flood are:

- Injuries to, or fatalities of, Project personnel and third parties
- Damage to or loss of Project facilities
- Soil, groundwater, surface waters and marine environment contamination from a metals/metalloids release causing significant environmental harm (including to marine ecology) and risk to human health
- Temporary Project closure

#### 21.2.5.2. Design, Inspection and Monitoring

The following controls have or will be accommodated in the design of the Port Facilities Area and Outfall Area:

- Design the Outfall Area to be above the flood/inundation levels, with additional consideration for potential exposure to tsunamis.
- Design the Outfall System to withstand 200-year design wave event.
- Design the Port Facilities Area to be above storm surge levels, with additional consideration for potential exposure to tsunamis.
- Design and construct the tailings mix/de-aeration tank within a dry moat, to capture and store overflow.
- Provide for emergency containment of the entire concentrate pipeline contents at the Port Facilities Area.
- Provide for emergency shutdown of the Outfall System to prevent overflow from the mix/de-aeration tank.

The Project will monitor alerts from the Pacific Tsunami Warning Centre.

#### 21.2.6. Explosion

The potential for an uncontrolled detonation of explosive materials, either in transit to site or at site (including underground workings), may lead to injuries and/or fatalities, impacts on villages and environmental impacts as described below.

##### 21.2.6.1. Potential Impacts

The main potential impacts from an explosion are:

- Injuries to, or fatalities of, Project personnel and third-parties
- Damage to infrastructure within the blast zone resulting in the loss of containment of chemicals and process materials causing adverse impacts on terrestrial and aquatic environments
- Emissions released into the air from the explosion and potential combustion
- Contaminated runoff from water used during firefighting impacting downstream environments
- Uncontrolled fire in adjacent vegetation
- Temporary Project closure

##### 21.2.6.2. Design and Management Measures

Explosives will be transported, stored and used in accordance with Australian Standard (AS) 2187.1-1998: Explosives - Storage, Transport and Use. The following management measures are proposed:

- Engage an experienced explosives contractor to:
  - Deliver raw materials and explosives to the site.
  - Be responsible for the operation and management of site storage, emulsion facilities and explosives magazines.
  - Deliver explosives to charging sites.
  - Load long holes.
  - Operate a mobile pumping unit.



- Use emulsions and other low-risk explosives that are not categorised as an explosive until sensitised with chemical gassing.
- Restrict access to the explosives magazine and establish a 500m safety exclusion zone around the facility.
- Clear vegetation to create a 30m firebreak around the explosives magazine.

#### 21.2.7. Fire

An uncontrolled fire within the Project Area may occur as a result of a natural event or an anthropogenic event either related or unrelated to the Project, including industrial plant and materials (e.g., electrical fault, uncontrolled explosion), a controlled burn/fire (e.g., local villagers managing their land resources, or as part of a WGJV-sanctioned burn), weather conditions or other factors.

##### 21.2.7.1. Potential Impacts

The main potential impacts from a fire are:

- Injuries to, or fatalities of, Project personnel and third-parties
- Damage to infrastructure within the fire-affected zone resulting in the loss of containment of chemicals and process materials
- Emissions release into the air from the fire, and contaminated runoff from firewater
- Loss or decline of terrestrial and aquatic habitats
- Soil, groundwater and surface waters contamination causing significant environmental harm and risk to human health
- Contamination or destruction of land and water resources
- Diminished livelihoods and/or threat to community health and safety
- Temporary Project closure

##### 21.2.7.2. Design, Management and Inspection

The following controls have or will be accommodated in Project design:

- Design fire systems to meet current applicable PNG standards. In the absence of the appropriate PNG standards, Australian Standards (e.g., AS1851-2012: Routine Service of Fire Protection Systems and Equipment).
- Design bulk fuel and hazardous materials storage facilities in accordance with AS1940-2017: The Storage and Handling of Flammable and Combustible Liquids.
- Install appropriate fire detection and suppression systems at all Project facilities.

The following management measures are also proposed:

- Clear vegetation around key Project infrastructure to create a firebreak.
- Store hazardous materials including bulk fuel separately and away from manned areas including control room and accommodation facilities.
- Maintain surface and underground firefighting equipment with rescue capability.

A recognised testing and certification authority will be engaged to inspect, approve, certify and commission all systems and individual equipment, wherever practicable.

### 21.2.8. Major Loss of Containment

There is the potential for the loss of containment of bulk quantities of fuel, chemicals, process materials or hazardous waste from a tank or transport vehicle following equipment failure or damage from collision, explosion, impact or earthquake. The spatial and temporal extent of any associated impacts will depend on the location of the incident, the volume of material released and the vectors present to transport contamination to other areas.

#### 21.2.8.1. Potential Impacts

The main potential impacts from a major loss of containment are:

- Injuries to, or fatalities of, Project personnel and third-party
- Hazardous materials release to the terrestrial, aquatic or marine environments causing contamination of land and/or waters and the destruction of ecosystems
- Diminished livelihoods and/or a threat to community health and safety through affected land and water resources (e.g., contamination of land and water resources)
- Temporary or premature Project closure

#### 21.2.8.2. Design Controls

The following controls have or will be accommodated in Project design:

- Design bulk fuel and hazardous materials storage facilities in accordance with AS1940-2017: The Storage and Handling of Flammable and Combustible Liquids.
- Construct enclosed bunds in key process, treatment and handling areas to contain spillages and prevent the possible mixing of acidic and alkaline materials, and to allow for the collection of effluent in sumps and its return in a controlled manner.
- Design wastewater containment facilities at the Port Facilities Area to hold the equivalent of 24 hours of filtrate to cater for maintenance and unplanned outages on the wastewater treatment plant.
- Design and construct the tailings mix/de-aeration tank within a dry moat, to capture and store overflow.
- Procure fit-for-purpose vehicles, plant and machinery and regularly inspect and maintain in accordance with manufacturer recommendations.

### 21.3. References

OEC. 2000. Environmental code of practice for the mining industry. Office of Environment and Conservation. Boroko, Papua New Guinea.