

NAME OF APPLICANT: CHINA AFRICAN PRECIOUS METALS (PTY) LTD. – ORKNEY GOLD MINE

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DMR REFERENCE NO.: NW 30/5/1/2/2/76 MR

SHANGONI
Management Services (Pty) Ltd



QUANTITATIVE ASSESSMENT OF ALTERNATIVES FOR THE ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

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1. Background description

The seven (7) shafts that constitutes CAPM Orkney Gold Mine, initially formed part of the Anglo American Vaal Reef Operation and were named No.'s 1 to 7 shafts. The ownership of the shafts then changed to African Rainbow Minerals (Pty) Ltd. (ARMgold) and consisted of ARMgold 1 (No.1, No.2 and No.5 shaft) and ARMgold 2 (No.3, No.4, No.6 and No.7 Shaft). In October 2003, ARMgold merged with Harmony Gold and the mines name changed to the Harmony Orkney Operation No.1 to No.7 shafts.

Pamodzi Gold bought the operations from Harmony Gold in March of 2008, however Pamodzi was provisionally liquidated in March of 2009 and final liquidation granted in October 2009. In late 2009, Aurora Empowerment Systems took over management of the Orkney Operations. The operations remained dormant until 2011, when Pamodzi Gold entered into a sales agreement with CAPM in August 2011. The sales agreement with CAPM included the full acquisition of all assets of the Orkney Gold Mine.

CAPM Orkney Gold Mine therefore proposes to re-commence operations initially at the No.7 Shaft. The shaft will be dewatered and the shaft reconditioned with depth. Once mining commences within the No.7 Shaft, the dewatering of the No.6 Shaft will commence and the shaft reconditioned with depth, whereafter mining within the No.6 Shaft will commence. Approximately two (2) years after the commencement of mining activities within the No.7 Shaft and the No.6 Shaft, the CAPM Orkney Gold Mine will investigate the viability of re-commencing mining operations within the No.4 Shaft and the No.1 Shaft. Should it be found viable, the No.4 Shaft and the No.1 Shaft will be dewatered, the shafts reconditioned and mining operations will recommence.

2. Description of the activities to be undertaken

2.1 Mineral to be mined

The mine is situated on a portion of the Klerksdorp Gold Fields. It exploits gold bearing conglomerates of the Central Rand and Ventersdorp Groups that are some of the several major gold fields situated on the northern and western margins of the 320km by 160km area of preservation of Central Rand Sediments. Gold is produced as the primary product with uranium as a potential by-product.

2.2 Description of the main mining activities and processes

The CAPM Orkney Gold Mine is an existing mine situated on a portion of the Klerksdorp Gold Field. As described above, the operation was subsequently sold to CAPM in 2011 through a Section 11 Application. The operation has been in under care and maintenance since 2009. The mine consists of seven shaft areas (as described in Part 4.2.1 above). CAPM Orkney Gold Mine intends to commence



with operations at the No.7 and No.6 shafts. Approximately two (2) years after the commencement of operation at the No.7 and No. 6 shaft, CAPM will investigate the viability of commencing with operations at the No. 4 and No. 1 Shaft.

As it stands, operations at the No.3 Shaft will not commence as the shaft barrel was twisted. It is for this reason that CAPM is currently in the process of decommissioning and rehabilitating this shaft area. The head gear and associated infrastructure has been removed and the shaft has been capped. Similarly, operations at the No.5 Shaft will not commence as operations at the shaft have ceased and the majority of the infrastructure (excluding the shaft and headgear) have been decommissioned and removed. CAPM is therefore also in the process of decommissioning and rehabilitating this shaft area.

CAPM received permission from the DMR to gain access up to a level of 60 m below the surface, in order to re-equip both No.6 and No.7 Shafts with steel, which has been completed. Once full operations commence, dewatering of the No. 7 Shaft will take place at approximately 1.3 Megalitres per day (a Water Use Licence for this water use will be in place). Upon reaching the base level of the No.7 Shaft (approximately 1420 m below the surface), dewatering of the No. 6 Shaft will occur. The No. 4 Shaft will remain as an emergency exit shaft until operations commence at that shaft.

2.2.1 Mining method

The mining method to be employed at the CAPM Orkney Gold Mine is conventional scattered breast mining consisting of the standard deep level underground stoping layout, for extraction of narrow generally flat dipping gold reefs occurring deeper than 500m below surface.

2.2.2 Ore Processing

No ore processing activities will be undertaken at the CAPM Orkney Gold Mine. All ore mined at the CAPM Orkney Gold Mine will be transported to the surface where it will be temporarily stockpiled at the shaft area. The ore will then be transported via haulage trucks to the Nicolor South Plant, located at the Buffelsfontein Gold Mine for processing.

The main metallurgical processes undertaken at the Nicolor South Plant are follows:

- Ore reception.
- Milling.
- Thickening.
- Leaching.
- Adsorption.
- Elution.
- Smelting.



A description of each of these processes is provided below with *Figure 1* below presenting the process flow of the Nicolor South Plant.

4.2.3.2.1 Ore reception

Ore is transported to the plant via haulage truck. Prior to entering the plant, the mass is measured at the plant weighbridge. The ore is then placed on pads according to source. At the appropriate time the ore is then conveyed to a stockpile which sits on four vibro-feeders that feed two grinding mills.

4.2.3.2.2 Milling

The Grinding Mill is a large revolving cylinder in which size reduction of the ore (to 75 microns) takes place. The size reduction is by self grinding and impact (steel balls are added into the mill to assist). Water is added to the milling process in order to allow for efficient milling and ease of transport. The resultant slurry (approximately 15% solids) is then pumped to the thickening section.

4.2.3.2.3 Thickening

Excess water is removed through the utilisation of large settling tanks known as thickeners. The thickened slurry (approximately 50% solids) is then pumped to the leaching section.

4.2.3.2.4 Leaching

The thickened slurry flows into tanks which provide sufficient retention time to allow the gold in the solids to be dissolved by an oxygenated cyanide solution.

4.2.3.2.5 Adsorption

After the leaching process, the gold in solution is pumped to the CIP section where gold is adsorbed onto carbon in a set of tanks.

4.2.3.2.6 Elution

The gold loaded carbon is then pumped to the elution circuit where the gold is desorbed with superheated water. The desorbed gold in solution is in turn passed through an electro-winning circuit which extracts gold from the solution using an electrical current. The gold in solution is deposited on steel wire wool cathodes.

4.2.3.2.7 Smelting

The gold coated wire wool is removed from the electrowinning cell and then calcined. After calcination the resulting material is then smelted to produce a gold bar.



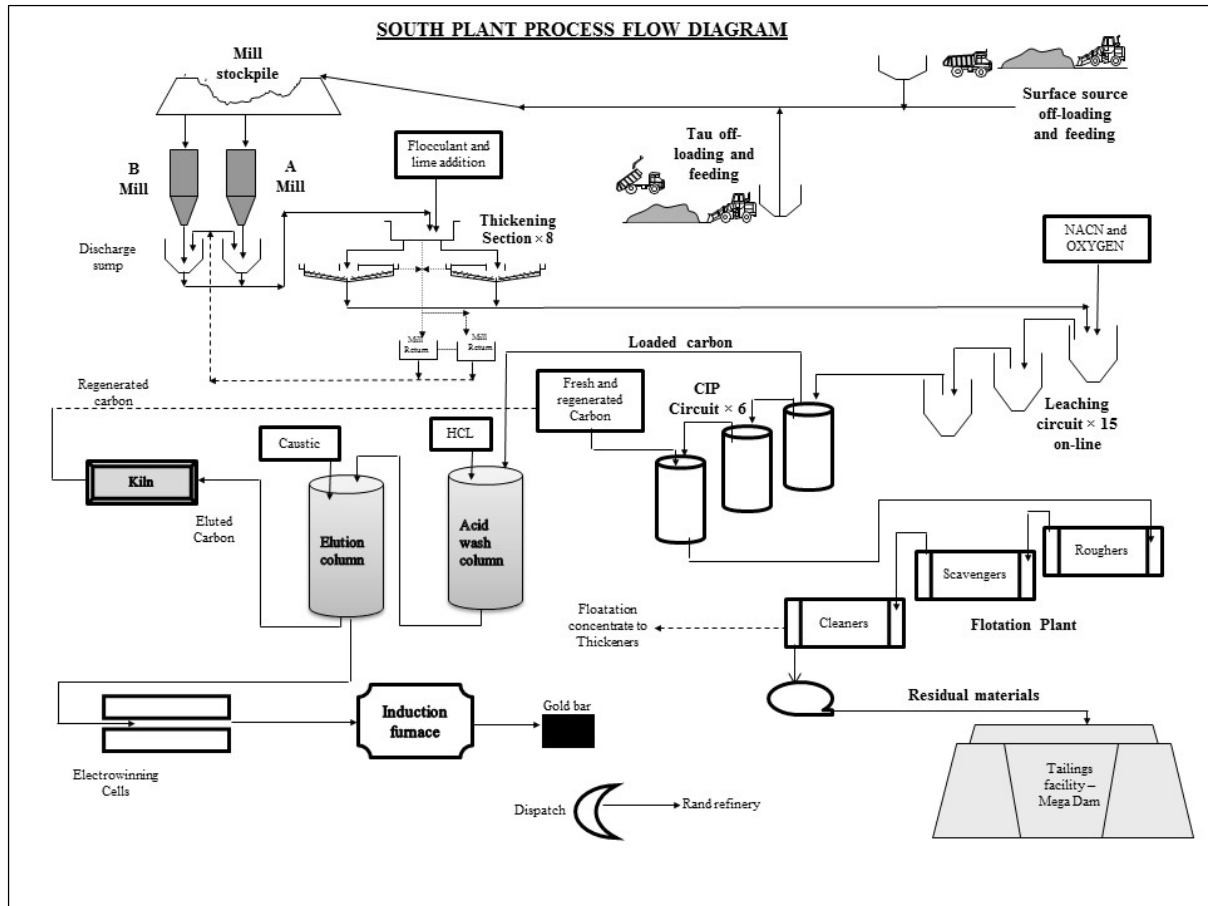


Figure 1: Nicolor South Plant process flow diagram

2.2.3 Mine and plant residue

As described above, all ore mined at the CAPM Orkney Gold Mine will be transported to the Nicolor South Plant, located at the Buffelsfontein Gold Mine, for processing. As a result, the mine does not have and will not have any mine or plant residue stockpiles. As described above in Part 4.2.2.2, all residue produced by the Nicolor South Plant is deposited on the Mega Dam Tailings Facility, which is located to the north-east of the plant. The Mega Dam Tailings Facility is however the property of AGA and an agreement is in place between the Nicolor South Plant and AGA for the deposition of the the plant residue. The tailings facility is therefore the responsibility of AGA.

2.2.4 Linear activities: mineral transport on site

The ore that is mined at the CAPM Orkney Gold Mine is transported to the surface whereafter it is either temporarily stockpiled (in a designated area) or transported via haulage trucks directly to the Nicolor South Plant, dependent on the plant processing capability. A maximum of 40 ktpm of ore will be transported, via road, per month.

2.2.5 Linear activities: Mineral transport off-site

As described above, the ore will be transported via haulage trucks to the Nicolor South Plant for processing. The current formal road network will be utilised to transport ore from the various shafts to the Nicolor South Plant. Ore from the No. 6 and No. 7 shafts (the first shafts to commence with operation) will transported via haulage trucks along the R502, which is an approximate distance of 18 km.

2.2.6 Water management

Groundwater

Once operations at the No.7 Shaft commence, all shaft water (fissure water accumulating within the shaft) will pumped to surface and pumped directly to the AngloGoldAshanti Vaal River Operations plant located adjacent to the No.7 Shaft area. CAPM Gold and AngloGoldAshanti Vaal River Operations are currently in negotiations regarding the acceptance of the shaft water. Refer also to the geohydrological investigation titled “China African Precious Metals: Orkney Gold Mine, Geohydrological Investigation as input to the EMPR” dated March 2015 and compiled by Shangoni AquScience (AquScience, 2015). The report is attached to the EIA and EMPr document as Annexure C1).

Storm water

The information contained in this section of the document is extracted from the report titled: “*China African Precious Metals (Pty) Ltd. Orkney Gold Mine, Storm Water Management Plan*” dated March 2015 and compiled by Shangoni Management Services (Shangoni, 2015). The conceptual Storm Water Management Plan report is attached to the EIA and EMPr document as Annexure C2.

As part of the conceptual SWMP, each management area at the CAPM Orkney Gold Mine operation and respective shaft areas is discussed by indicating the main drainage philosophy anticipated using contour data and the current / proposed runoff control strategies. The location as well as direction of clean and affected runoff is indicated in the SWMP. A detailed description of the storm water environment, and the measures to control clean runoff and retain affected runoff is also provided in the discussion tables using the maps as reference. Refer to Part 4 fo the SWMP (attached to the EIA and EMPr document as Annexure C2) for a detailed description of the stormwater management to be employed at the CAPM Orkney Gold Mine.

Process water

As no ore processing activities are undertaken at the CAPM Orkney Gold Mine, no process water is required or generated.



Potable water

Potable water at the CAPM Orkney Gold mine is obtained from three (3) sources, namely, Mid-vaal (non-profit organisation), the City of Matlosana Local Municipality and Anglogoldashanti Vaa River Operations (AGA). Table 1 below presents the sources of potable water at the various shaft areas.

Table 1: Sources of potable water at the CAPM Orkney Gold Mine

Shaft	Potable water source
No. 1 Shaft	None.
No. 2 Shaft	None.
No. 3 Shaft	None.
No. 4 Shaft	Potable water at the No. 4 Shaft Hostel is currently obtained from Mid-Vaal.
No. 5 Shaft	Potable water at the No. 5 Shaft hostel is currently obtained from AGA. A verbal agreement is currently in place between CAPM and AGA for the use of potable water and a written agreement/contract is in the process of being obtained. AGA provides CAPM with monthly invoices for the current potable water requirements.
No. 6 Shaft	Potable water at the No. 6 Shaft is currently obtained from the City of Matlosana Local Municipality.
No. 7 Shaft	All potable water requirements at the No. 7 shaft are obtained from AGA. A verbal agreement is currently in place between CAPM and AGA for the use of potable water and a written agreement/contract is in the process of being obtained. AGA provides CAPM with monthly invoices for the current potable water requirements.

2.2.7 Non-mineral Waste management

General waste at the shaft areas of the CAPM Orkney Gold Mine is disposed of / collected in appropriately marked bins. General waste accumulating in these bins as well as collected at the hostels and office areas are removed by a suitable contractor to a licenced landfill facility. Hazardous waste (such as oil, grease fluorescent light bulbs) are stored in marked bins at designated areas across the shaft areas and are serviced by a suitable contractor for disposal at a licenced disposal facility.

2.3 Estimated reserves

The information in this part of the document was sourced from the mineral resources technical document titled: “*An independent JORC 2012 Technical Report on the Mineral Resources for the Orkney Mine North-West Province, South Africa, on behalf of China African Precious Metals (Pty) Ltd.*” dated July 2014 and compiled by Minxcon (Minxcon, 2014).



The depleted Mineral Resources per shaft for the Orkney Operations for 2014 are listed in the following tables

Table 2: 2014 Mineral Resource Statement for the No.2 Shaft (extracted from Minxcon, 2014)

Orkney 2	Mt	Grade	Tonnes Au	Moz
		g/t		
Measured	2.29	15.22	34.89	1.12
Indicated	0.52	12.99	6.77	0.22
M&I	2.81	14.83	41.66	1.34
Inferred	0.41	13.91	5.64	0.18
Total	3.22	14.69	47.3	1.52

Table 3: 2014 Mineral Resource Statement for the No.4 Shaft (extracted from Minxcon, 2014)

Orkney 4	Mt	Grade	Tonnes Au	Moz
		g/t		
Measured	8.37	11.05	92.45	2.97
Indicated	5.06	10.75	54.41	1.75
M&I	13.43	10.94	146.86	4.72
Inferred	10.77	6.39	68.84	2.21
Total	24.2	8.91	215.7	6.93

Table 4: 2014 Mineral Resource Statement for the No.6 Shaft (extracted from Minxcon, 2014)

Orkney 6	Mt	Grade	Tonnes Au	Moz
		g/t		
Measured	11.89	6.78	80.56	2.59
Indicated	3.89	6.33	24.6	0.79
M&I	15.78	6.66	105.16	3.38
Inferred	10.17	4.83	49.08	1.58
Total	25.95	5.94	154.24	4.96

Table 5: 2014 Mineral Resource Statement for the No.7 Shaft (extracted from Minxcon, 2014)

Orkney 7	Mt	Grade	Tonnes Au	Moz
		g/t		
Measured	4.03	5.8	23.37	0.75
Indicated	2.61	5.47	14.29	0.46
M&I	6.64	5.67	37.66	1.21
Inferred	11.3	4.15	46.84	1.51
Total	17.94	4.71	84.5	2.72



Table 6: 2014 Measured and indicated mineral resources for the CAPM Orkney Gold Mine (extracted from Minxcon, 2014)

Mineral Resource Category	Shaft or Area	Tonnes	Au	Grade	Au
		Mt	000kg	g/t	Moz
Measured	Orkney 6	11.89	80.56	6.78	2.59
	Orkney 7	4.03	23.37	5.80	0.75
	Orkney 2	2.29	34.89	15.22	1.12
	Orkney 4	8.37	92.45	11.05	2.97
Total		26.58	231.26	8.70	7.44
Indicated	Orkney 6	3.89	24.60	6.33	0.79
	Orkney 7	2.61	14.29	5.47	0.46
	Orkney 2	0.52	6.77	12.99	0.22
	Orkney 4	5.06	54.41	10.75	1.75
Total		12.08	100.07	8.28	3.22
Grand-total		38.66	331.33	8.57	10.65

Table 7: 2014 Inferred mineral resources for the CAPM Orkney Gold Mine (extracted from Minxcon, 2014)

Mineral Resource Category	Shaft or Area	Tonnes	Au	Grade	Au
		Mt	000kg	g/t	Moz
Inferred	Orkney 6	10.17	49.08	4.83	1.58
	Orkney 7	11.30	46.84	4.15	1.51
	Orkney 2	0.41	5.64	13.91	0.18
	Orkney 4	10.77	68.84	6.39	2.21
Total		32.65	170.41	5.22	5.48

2.4 Production rate and Life of Mine

The estimated production rate will be 1.56Mtpa to the Nicolor South Plant (130ktpm). There will be a build-up for the first 4 years.

The total period for which authorisation is required (Life of Mine), is approximately 12 years, with a breakdown as provided in Table 8 below.

Table 8: Breakdown of the Life of Mine

Stages of operation	Timeframe (Years)
Planning	N/A
Construction	N/A
Commissioning	0.5 years
Operation	10 years



Stages of operation	Timeframe (Years)
Closure	1 year
Total Period	11.5 years



3. Alternatives associated with the proposed project

The following definition of “alternatives” is given in the EIA Regulations of 18 June 2010: “alternatives”, in relation to the proposed activity, *means different means of meeting the general purpose and requirements of the activity, which may include alternatives to-*

- a) *the property on which or location where it is proposed to undertake the activity;*
- b) *the type of activity to be undertaken;*
- c) *the design or layout of the activity;*
- d) *the technology to be used in the activity;*
- e) *the operational aspects of the activity; and*
- f) *the option of not implementing the activity”.*

A number of alternatives have been identified and will be evaluated for the proposed project. These alternatives are as follows:

- Process alternatives.
- Scheduling alternatives.
- No-go Option.
- Land use alternatives.

3.1 Details of all alternatives considered

As described in Part 1 above, the CAPM Orkney Gold Mine is an existing gold mine that CAPM purchased from Pamodzi. As part of the purchase agreement, CAPM purchased all assets and infrastructure associated with the Orkney Gold Mine. Therefore no alternative site locations could be considered due to the mine being an existing mine, that was operational in the past. However based on the Department of Environmental Affairs Integrated Environmental Management Series 11 “*Criteria for determining Alternatives in EIA*” dated 2004, alternatives in terms of activity, process, schedule and the “No-go options” were identified.

3.1.1 Proposed activity

The proposed activity is to reinstate the mining of gold bearing ore utilising the conventional scattered breast mining method consisting of the standard deep level underground stoping layout at the No.7 Shaft. The operations will initially commence at the No.7 Shaft through the dewatering of the shaft and the reconditioning of the shaft with depth. Once mining operations within the No.7 Shaft commence, the dewatering and shaft recondition of the No.6 Shaft will take place, whereafter mining within the No.6 Shaft will commence. All shaft water abstracted from the No.7 and the No.6 Shaft will be supplied to the AngloGoldAshanti Vaal River Operation (AGA) processing plant (an agreement between AGA and CAPM, for AGA to accept the water, is in the process negotiations). All ore mined within the No.7 and



No.6 Shaft will be hoisted to surface and transported by haulage truck (utilising the formal road network) to the Nicolor South Plant, where the gold bearing ore will be processed. Therefore CAPM does not and will not (for the time being) own and/or manage any mine and plant residue deposits.

Once operations at the No.7 and the No.6 Shafts are successfully underway, the CAPM Orkney Gold Mine will investigate the viability of re-commencing operations at the No.4 Shaft (approximately 2 years after and the No.1 Shaft (approximately two (2) years after commencement at the No.6 Shaft).

3.1.2 Process alternatives

Two alternatives have been identified in terms of process and include the following:

- Construction of a processing plant to process the mined ore.
- Utilisation of an existing processing plant to process the mined ore.

The preferred alternative for the CAMP Orkney Gold Mine is transport the mined ore to the Nicolor South Plant for processing. Although this alternative has high cost investment over the long term due to processing fees and transport costs, the plant is not owned or operated by CAPM and therefore no mine and plant residue deposits will be owned or managed by CAPM. The construction of a processing plant will be a very high initial cost investment but will however allow for a greater return on investment.

3.1.3 Scheduling alternatives

Two alternatives in terms of scheduling have been identified and these include:

- The commencement of operations initially at the No.7 Shaft, then the No.6 Shaft and approximately after two (2) years operations will commence at the No.4 Shaft and No.1 Shaft.
- The commencement of operations at all of the shafts at once.

The preferred alternative, in terms of scheduling, is to initially only commence operations at the No.7 Shaft and then the No.6 Shaft and then in approximately two (2) years, commence operations at the No.4 Shaft and the No.1 Shaft. This alternative is preferred due to the very high investment required to recondition the shafts and all associated infrastructure, of all seven shafts, in order to be safe for operations in terms of MPRDA, 2002 and the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA, 1996).

3.1.4 No-go option

If the gold reserves within the CAPM Orkney Gold Mine Mining Right area are not mined at this time, the *status quo* environmental conditions within the Mining Right area will continue until change in activity and/or development occurs within or close to this area.



Physical and biophysical environment – The proposed project is expected to create a number of environmental impacts of which not all may necessarily effectively mitigated and include impacts on surface water and most notably, groundwater. Acid mine drainage is likely to develop due to the interactions of the groundwater with the pyrite that constitutes 10% to 30% of the VCR. As the groundwater is allowed to recharge and flood the shafts, it may become contaminated and acidic and upon reaching the Environmental Critical Level (ECL) (Refer to Chapter I of Part 7.4.1 of the EIA and EMPr) the aquifers will become contaminated.

Social – The CAPM Orkney Gold Mine is situated within the vicinity of the town Orkney. The proposed re-commencement of the operations at the No.7 Shaft and the No.6 Shaft (initially) will result in the creation of job opportunities. As stipulated in the CAPM Orkney Gld Mine SLP (refer to the Annexure G of the EIA and EMPr) the CAPM Orkney Gold Mine will employ approximately 471 individuals, of which the majority (a minimum of 95%) will be sourced from the local community. This will therefore result in the experience of a positive impact in terms of social as well as economic aspects. However, should the “no-go option” be implemented, the baseline status quo will remain with no additional job creation. Several potential impacts in terms of social aspects are also likely to be generated as a result of the re-instatement of operations at the CAPM Orkney Gold Mine and include: increase traffic, impacts on sense of place, dust generation, influx of jobseekers to the area (including the increased crime, spread of HIV) and visual aspects. It is however important to note that the the CAPM Orkney Gold Mine is an existing mine that was purchased by CAPM in 2011 and mining within the area has taken place for over a century. Therefore the local community and regular visitors to the area would be desensitised to the mining activities that will be conducted.

Economic – In the event that the “no-go option” is implemented, several existing jobs will be lost and skills development may cease. The positive impacts associated with the creation of approximately 471 jobs and contributions of the mine to the local economy would therefore be lost. The remaining gold bearing ore body will also remain *in situ* and unutilised. It is however important to note that should the CAPM Orkney Gold Mine not proceed with the proposed re-instatement of operations, the mining of the gold reserves may not necessarily be avoided as the Mining Right could be sold to another company unless the DMR declares the reserves “off-limits” and sterilises these reserves.

3.1.5 Land use alternatives

The following land use alternatives have been identified and were investigated and are briefly compared in Table 9 below:

- Re-instatement of mining at the No.7 Shaft and No.6 Shaft.
- Rehabilitate and utilise the surface area for grazing of livestock / No-go option.
- Rehabilitate and utilise the surface area for crop production / No-go option.
- Rehabilitate the surface area to wilderness / No-go option.



Major impacts associated with each land use alternative have been summarised for comparative purposes. Each proposed land use alternative may impact on the natural environment at the proposed site.



Table 9: Land use alternative assessment

Environmental component	Mining – current land use	Grazing / No-go option	Crop production / No-go option	Wilderness / No-go option
Geology	The mining and removal of gold bearing ore will result in the permanent destruction of the localised geological strata.	No impact.	No impact.	No impact.
Topography	No further impacts	Overgrazing may result in soil erosion which in turn may alter the topography.	Topography of the area may be altered during the contouring and establishment of crop fields.	No impact.
Soil	Soil surrounding the shaft areas may be contaminated in the event that contaminated surface water runoff enter the receiving environment.	Overgrazing may result in the exposure of bare soils to the elements, which may lead to erosion.	Soils will may be chemically and physically modified.	Soil erosion may occur should rehabilitation of the shaft surface area not be conducted in an appropriate manner.
Land use	No further impacts.	Land use will change to agriculture.	Land use will change to agriculture.	Land use will change.
Land capability	No further impacts. However, soil surrounding the shaft areas may be contaminated in the event that contaminated surface water runoff enter the receiving environment.	Land capability may be lowered if overgrazing occurs.	Land capability may be impacted on if poor farming techniques are implemented.	Land capability may be impact upon should rehabilitation not be conducted in an appropriate manner.
Flora	The edge effects of mining may impact on the natural vegetation.	Natural vegetation may be impacted on if overgrazing occurs.	Natural vegetation may be impacted on should agricultural activities occur within the natural vegetation areas.	In the event that rehabilitation is not conducted in an appropriate manner, alien and invasive species may establish.
Fauna	The edge effects of mining may impact on the fauna.	No impact if overgrazing is prevented.	Natural vegetation may be impacted on should agricultural	The establishment of alien and invasive plant species may result



Environmental component	Mining – current land use	Grazing / No-go option	Crop production / No-go option	Wilderness / No-go option
			activities occur within the natural and indigenous vegetation areas. This in turn may lead to the destruction of habitats and thus impacting on the species diversity of the area.	in a decline in habitat diversity and integrity.
Surface water	Downstream surface water quality may be compromised should contaminated surface leave the shaft area and enter the receiving environment.	Overgrazing may lead to soil erosion and may have an impact on the downstream surface water quality.	Soil erosion may have an impact on the downstream surface water quality. Surface water runoff may also become contaminated should it come into contact with the chemicals and/or fertilisers.	In the event that rehabilitation has been insufficiently conducted, soil erosion may lead to an increase in suspended sediment that may affected the quality of the surface water resources in the vicinity. The areas that have been reshaped may lead to the ponding of surface water, thereby in
Groundwater	Groundwater may become contaminated should it come into contact with pyrite bearing rock. Should this water reach the Environmental Critical Zone, the aquifers will become contaminated.	No further impact.	No further impact.	No further impact.
Air quality	Dust may be generated as a result of the proposed mining activities.	Dust may be generated if overgrazing occurs and bare soil is exposed to the elements.	Dust will be generated after the harvest season as bare soil will be exposed to the elements.	No further impact.



Environmental component	Mining – current land use	Grazing / No-go option	Crop production / No-go option	Wilderness / No-go option
Noise	Noise levels will increase as a result of the proposed mining and mining related activities.	No further impact.	No further impact.	No further impact.
Visual	The visual environment will be altered and may impact on the sense of place of the area. However the community is likely desensitised to the mining activities as mining has been conducted for over a century in this area.	No further impact.	The planting of crops will alter the visual environment, but will not be intrusive.	No further impact.
Sensitive landscapes	Should contaminated surface water runoff leave the shaft areas and enter the surrounding environment, the natural vegetation may be impacted upon.	No further impact.	No further impact.	No further impact.
Sites of archaeological and cultural interest	It is not anticipated that the reinstatement of operations at the No.7 and No.6 Shaft will result in an impact on any sites of archaeological and cultural interest. It is however important to note that there are workshops located on the No.7 Shaft area which are protected under the National Heritage Act, 1999 (Act No. 25 of 1999).	No further impact. It is however important to note that there is infrastructure located on the No.7 Shaft area which are protected under the National Heritage Act, 1999 (Act No. 25 of 1999). The appropriate authorisation is therefore required to remove this infrastructure.	No further impact. It is however important to note that there is infrastructure located on the No.7 Shaft area which are protected under the National Heritage Act, 1999 (Act No. 25 of 1999). The appropriate authorisation is therefore required to remove this infrastructure.	No further impact. It is however important to note that there is infrastructure located on the No.7 Shaft area which are protected under the National Heritage Act, 1999 (Act No. 25 of 1999). The appropriate authorisation is therefore required to remove this infrastructure.



Environmental component	Mining – current land use	Grazing / No-go option	Crop production / No-go option	Wilderness / No-go option
	No. 25 of 1999). The appropriate authorisation is therefore required to remove this infrastructure.			
Socio-economic	Job security of the mine’s current employees will increase, along with other benefits arising from the Social and Labour Plan. The reinstatement of operations will also allow for the creation of 471 jobs.	Some jobs may be created.	Some jobs may be created.	No further impact.
Interested and affected parties	Surrounding landowners may be further impacted upon as a result of impacts listed above.	Surrounding landowners may be further impacted upon as a result of impacts listed above.	Surrounding landowners may be further impacted upon as a result of impacts listed above.	No further impact.



3.2 Positives and negatives that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and community affected.



Table 10: Advantage and disadvantages of the proposed activity and associated alternatives

Alternative		Advantages	Disadvantages
Process alternatives	Utilisation of an existing processing plant to process the mined ore (preferred option).	<p>The processing of the ore by an off-site plant owned and managed by another company is advantageous in a sense that the cost investment is low over the short term (in comparison to the cost involved in constructing and operating a processing plant).</p> <p>CAPM therefore does not need to own or manage any mine or plant residue deposits (including the associated environmental impacts).</p>	<p>It is a high cost investment over the long term due to the costs involved in terms of transport and as well as processing.</p> <p>Relatively low return on investment, when compared to operating your own processing plant.</p>
	Construction of a processing plant to process the mined ore.	<p>Relatively higher return on investment when compared to the costs involved in transport as well as paying another company to process the ore.</p>	<p>High initial cost investment in terms of construction.</p> <p>All plant residue deposits will need to manage (including all impacts on the biophysical and socio-economic environments).</p>
Scheduling alternatives	The commencement of operations initially at the No.7 Shaft, then the No.6 Shaft and approximately after two (2) years operations will commence at the No.4 Shaft and No.1 Shaft (preferred option).	<p>A relatively lower initial cost investment will be required when compared to commencing operations at all shafts at once.</p> <p>AGA will be able to accept the volume water abstracted from the No.7 Shaft and the No.</p>	<p>The period over which the potential impacts on the bio-physical and socio-economic environment are experienced, will occur over a longer period.</p>



Alternative		Advantages	Disadvantages
		<p>6 Shaft (agreement is still under negotiation between CAPM and AGA).</p> <p>Nicolor South Plant will be able to process the ore mined at the No.7 Shaft and the No.6 Shaft.</p> <p>The impacts may be cumulatively less than in commencing operations at all shafts at once.</p>	
	The commencement of operations at all of the shafts at once.	The period over which the impacts on the bio-physical and socio-economic environment are experienced, will be of a shorter period.	<p>A high initial cost investment in terms of dewatering all of the shafts and re-conditioning all of the shafts in order to ensure safety.</p> <p>High cost investment due to the labour force required to conduct mining activities at all shafts, at once.</p> <p>AGA may not be able to accept the large volume shaft water abstracted from all of shafts, at once (agreement is still under negotiation between APM and AGA).</p> <p>Nicolor South Plant may not be able to process the larger volumes of ore mined from all the shafts, at once.</p>



Alternative		Advantages	Disadvantages
			The potential impacts may be cumulatively greater should operations at all shafts commence at once.
No-go option		<p>The implementation of the no-go option would result in the current <i>status quo</i> of the area to remain the same. The implementation of the no-go option would also require CAPM Orkney Gold Mine to rehabilitate all surface area and cap all of the shafts.</p> <p>The shaft surface areas would therefore be rehabilitated for agricultural use or rehabilitated back to wilderness.</p>	<p>The implementation of the no-go option would result in the closure of the mine and the rehabilitation of all disturbed area. This would result in a very high loss for CAPM Orkney Gold Mine as the mine was purchased from Pamodzi Gold and operations and mining has yet commenced at the CAPM Orkney Gold Mine.</p>



3.3 Statement motivating the preferred site

Evaluating the alternatives, through evaluating the risks pertaining to the various options, and the concerns as raised by the affected parties and the mitigation measures or site alternatives, the preferred options are described in Table 11 below.

Table 11: Motivation for the preferred site

Preferred alternative	Motivation
<p>The commencement and reinstatement of operations at the No.7 Shaft, then the No.6 Shaft and (in approximately two (2) years) the No.4 Shaft and the No.1 Shaft.</p>	<p>1. The CAPM Orkney Gold Mine is an existing gold mine which CAPM purchased from Pamodzi Gold in 2011.</p>
	<p>2. As part of the purchase agreement between CAPM and Pamodzi Gold, all shafts, assets and associated infrastructure were to be purchased. Therefore, no alternatives in terms of site location could be identified.</p>
	<p>3. Operations will commence at the No.7 Shaft through the dewatering of the shaft and the reconditioning of the shaft with depth. Once mining operations commence at the No.7 Shaft, operations at the No.6 Shaft will commence through the dewatering of the shaft and reconditioning of the shaft with depth. Thereafter mining operations at the No.7 Shaft and the No.6 Shaft will occur in parallel.</p> <p>Approximately two (2) years after the commencement of operations at the No.6 Shaft, CAPM Orkney Gold Mine will investigate the viability of commencing with operations at the No. 4 Shaft and the No.1 Shaft.</p>
	<p>4. No operations will continue at the No.3 Shaft as the shaft barrel is twisted. Therefore, CAPM Orkney Gold Mine is in the process of rehabilitating the shaft area. The headgear and several other infrastructure has been removed and the shaft has been capped.</p> <p>Similarly, no operations will be undertaken at the No.5 Shaft. All infrastructure has been removed except for the Headgear and the shaft (which is currently covered but uncapped).</p>



4. Method of assessing the environmental aspects including the proposed method of assessing alternatives

4.1. Categories for Site Selection

Four categories have been selected for review of each selected option, which include Environmental / Legal, Technical / Engineering, Economical and Social. Criteria as used for the various categories are reflected in Table 12.

4.2 Criteria

Under the 4 selected categories, a number of criteria have been identified for assessment, as contained within Table 12.

Table 12: Site Selection Criteria

CRITERIA	CATEGORY			
	ENVIRONMENTAL / LEGAL	TECHNICAL / ENGINEERING	ECONOMICAL	SOCIAL
AIR QUALITY	X			
AQUATIC AND SURFACE WATER	X			
CULTURAL HERITAGE	X			
FAUNA	X			
FLORA	X			
GEOHYDROLOGY	X			
GEOLOGY	X			
NOISE	X			
SOIL	X			
TRAFFIC	X			
VIBRATION AND AIR BLAST	X			
VISUAL	X			
OTHER LEGAL REQUIREMENTS (E.G. WATER USE ACTIVITIES, EIA REQUIREMENTS ETC.)	X			
SENSE OF PLACE				X
SOCIAL LICENSE TO OPERATE				X
SOCIO-ECONOMIC				X
HAZARDS TO COMMUNITY, THEFT, HEALTH RISKS, ETC.				X

CRITERIA	CATEGORY			
	ENVIRONMENTAL / LEGAL	TECHNICAL / ENGINEERING	ECONOMICAL	SOCIAL
EASE OF INTEGRATION WITH PLANNED INFRASTRUCTURE		X		
SITE ACCESS		X		
CONSTRAINTS TO SITE LAYOUT		X		
CONSTRUCTION DURATION		X		
CONSTRUCTION RISKS		X		
OPERATIONAL RISKS		X		
CAPITAL COST (INCLUDING SITE ESTABLISHMENT/PREPARATIO N)			X	
OPERATING COST			X	
SITE REHABILITATION			X	

4.3 Assigning score

Under each of the four categories, by assessing the identified criteria, a score is assigned to each of the identified options (Between 1 and 3, with 3 being most favourable). The final score obtained for each of the option support decision on the most suitable for the proposed development.

4.4 Category Weighting

Table 13 below contains the weighting as assigned to each category. The higher the weighting, the more important the category.

Table 13: Category Weighting

CATEGORY	PROCESS	SCHEDULING	NO-GO
ENVIRONMENTAL/LEGAL	0.3	0.25	0.3
SOCIAL	0.15	0.15	0.25
TECHNICAL/ENGINEERING	0.25	0.3	0.15
ECONOMICAL	0.3	0.3	0.3

4.5 Criteria Weighting

Table 14 below contains the weighting as assigned to each criteria. The higher the weighting, the more significant the criteria.



Table 14: Criteria Weighting¹

MAJOR CRITERIA	ALTERNATIVE		
	PROCESS	SCHEDULING	NO-GO
AIR QUALITY	4	3	3
AQUATIC AND SURFACE WATER	4	3	3
CULTURAL HERITAGE	2	3	5
FAUNA	3	2	3
FLORA	3	2	3
GEOHYDROLOGY	5	5	5
GEOLOGY	1	3	2
NOISE	4	3	3
SOIL	5	3	4
TRAFFIC	1	4	2
VIBRATION AND AIR BLAST	2	3	2
VISUAL	5	4	3
OTHER LEGAL REQUIREMENTS (E.G. WATER USE ACTIVITIES, EIA REQUIREMENTS ETC.)	4	3	3
SENSE OF PLACE	5	2	4
SOCIAL LICENSE TO OPERATE	3	3	3
SOCIO-ECONOMIC	3	3	5
HAZARDS TO COMMUNITY, THEFT, HEALTH RISKS	5	3	3
EASE OF INTEGRATION WITH PLANNED INFRASTRUCTURE	3	3	5
SITE ACCESS	2	2	2
CONSTRAINTS TO SITE LAYOUT	4	3	3
CONSTRUCTION DURATION	4	2	2
CONSTRUCTION RISKS	3	3	2
OPERATIONAL RISKS	4	3	3
CAPITAL COST (INCLUDING SITE ESTABLISHMENT/ PREPARATION)	5	5	5
OPERATING COST	3	4	5
SITE REHABILITATION	5	4	5

¹ Assigning a criteria weighting should not be viewed as the overall importance or significance placed on such criteria, but how strongly such criteria may influence a specific alternative assessment in context to other criteria.



4.6 Calculating Score

Initial score

An initial score is assigned to each of the options, for each of the criteria identified. As this is a comparative analysis, a score of 1, 2 and 3 is assigned, where 1 is least favourable, and 3 being most favourable. In event where all options have similar favourability, a score of 3 is assigned to all sites. Where only two alternatives are assessed a score of either 1 (least favourable) or 2 (most favourable) is assigned.

Assigning weighting

The weighting value of the assessed criteria is multiplied with the initial score allocated to each option for every criteria assessed, which is added to obtain a final score to be reflected under the four categories. Final values to be reflected as percentage of maximum score.

Final score

The final score for each of the options is obtained by multiplying the % score for each category by the assigned weighting and adding the respective scores (as obtained for each category) to reach a final value for each option. The higher the % value, the more favourable the option.

The results of the scoring for each of the various alternatives as assessed are contained in Appendix A.



5. Results of the alternatives assessment matrices

5.1 Alternatives in terms of process (processing plant)

Two alternatives have been identified in terms of process and include the following:

- Construction of a processing plant to process the mined ore.
- Utilisation of an existing processing plant to process the mined ore.

As reflected in the results of the comparative analysis, the preferred alternative is that of the processing of the ore by the Nicolor South Plant. Refer to *Table 15* and *Table 16* below for the results of the comparative analysis and comments on the results, for the alternatives in terms of transport, respectively.

Table 15: Comparative assessment results - Process

	Utilisation of an existing processing plant (Nicolor South Plant)	Construction of a processing plant
Environmental	98.84%	89.53%
Social	100.00%	84.38%
Technical	90.00%	65.00%
Economic	88.46%	61.54%
Final score	93.69%	74.23%

Table 16: Comments for alternatives in terms of process

Option	Alternative	Comments
Option A	Utilisation of an existing processing plant (Nicolor South Plant)	<p>As seen in Table 15 above, the processing of the ore by the Nicolor South Plant is the best option in terms of all aspects (environmental, social, technical and economic). However, as indicated in Table 10 above, there are several disadvantages associated with this alternative and is namely in terms of economic aspects. The utilisation of another plant to process the ore doesn't require the initial capital to construct a processing plant. However, over the long term, it is more economically viable to construct a plant as there is a higher return on investment, resulting specifically from the transportation and processing costs.</p> <p>It is also important to note that the processing of the ore by the Nicolor South Plant doesn't prevent any further impacts on the environment by CAPM Orkney Gold Mine, but merely adds cumulatively to the existing impacts of the Nicolor South Plant.</p>



Option	Alternative	Comments
Option B	Construction of a processing plant	As seen from the results presented in Table 15 above, the construction of a processing plant scored the lowest with a final score of 74.23%. It is important to note that, as described above, over the long term, it is more economically viable to construct a plant as there is a higher return on investment, resulting specifically from the transportation and processing costs.

5.2 Alternatives in terms of scheduling

Two alternatives in terms of scheduling have been identified and these include:

- The commencement of operations initially at the No.7 Shaft, then the No.6 Shaft and approximately after two (2) years operations will commence at the No.4 Shaft and No.1 Shaft.
- The commencement of operations at all of the shafts at once.

As reflected in the results of the comparative analysis, the preferred alternative is that of the commencement of operation initially at the No.7 Shaft, then the No.6 Shaft and approximately two (2) years the commencement of operations at the No.4 Shaft and the No.1 Shaft. Refer to *Table 17* and *Table 18* below for the results of the comparative analysis and comments on the results, for the alternatives in terms of transport, respectively.

Table 17: Comparative assessment results - Scheduling

	Commencement initially at the No.7 Shaft then the No.6 Shaft	The commencement of operations at all of the shafts at once
Environmental	100.00%	84.15%
Social	100.00%	100.00%
Technical	100.00%	84.38%
Economic	100.00%	80.77%
Final score	100.00%	85.58%

Table 18: Comments for alternatives in terms of scheduling

Option	Alternative	Comments
Option A	Commencement initially at the No.7 Shaft then the No.6 Shaft.	<p>The results of the comparative assessment indicate that this option is the best option as it scored a rating of 100% as compared to 85.58% for option B.</p> <p>The reasons why the option may have scored higher can also be deduced from comparison of the advantages and disadvantages of the alternatives as presented in Table 10 above, and include: Lesser magnitude of the cumulative</p>



Option	Alternative	Comments
		impacts, lower initial capital costs required and an easier integration with the current infrastructure and plans of the mine.
Option B	The commencement of operations at all of the shafts at once.	<p>As described above, this option scored 85.58% in the comparative assessment and could be as a result of the following:</p> <ul style="list-style-type: none"> • Possible greater magnitude of cumulative impacts. • Higher initial capital costs required. <p>Refer also to Table 10 for a comparison of the advantages and disadvantages of the two alternative options.</p>

5.3 Proposed activity in comparison to the no-go options

As reflected in the results of the comparative analysis, the preferred alternative is that of the commencement of operation initially at the No.7 Shaft, then the No.6 Shaft and approximately two (2) years the commencement of operations at the No.4 Shaft and the No.1 Shaft. Refer to *Table 19* and *Table 20* below for the results of the comparative analysis and comments on the results, for the alternatives in terms of transport, respectively.

Table 19: Comparative assessment results of the proposed activity against the no-go options

	Proposed activity	No-go option - Grazing	No-go option - Crop production	No-go option - wilderness
Environmental	46.34%	76.42%	72.36%	95.93%
Social	68.89%	73.33%	73.33%	77.78%
Technical	86.27%	80.39%	80.39%	80.39%
Economic	100.00%	33.33%	33.33%	33.33%
Final score	74.07%	63.32%	62.10%	70.28%

Table 20: Comments for comparison of the proposed activity and the no-go option alternatives

Option	Alternative	Comments
Option A	Proposed activity	<p>In terms of the environmental and social aspects, the proposed activity scored the lowest in comparison to the no-go option with 46.34% and 68.89%, respectively. However, the proposed activity scored the highest in terms of technical and economic aspects with 86.27% and 100%, respectively thus resulting in the highest final score of 74.07%.</p> <p>This may be as a result of the CAPM Orkney Gold Mine being an existing mine which was purchased from Pamodzi Gold in 2011. All assets were purchased as part of the purchase agreement (including all infrastructure). Should the no-go option be implemented, the socio-economic benefits of the</p>

Option	Alternative	Comments
		projects (job creation, positive impacts on the local economy) will not be experienced and it will result in a large loss of revenue for CAPM as operations have not yet commenced. Refer also to Table 10 above.
Option B	No-go option – Grazing	The no-go option by rehabilitating to the land use of agriculture for grazing purposes obtained the third highest score, 63.32%. Although this option scored higher than option A (proposed activity) in both the environmental and social aspects, the no-go option of rehabilitating to the land use of wilderness obtained a greater score in all aspects as well as in final score
Option C	No-go option – Crop production	The no-go option by rehabilitating to the land use of agriculture for crop production obtained the lowest score, 62.10%. Although this option scored higher than option A (proposed activity) in both the environmental and social aspects, the no-go option of rehabilitating to the land use of wilderness obtained a greater score in all aspects as well as in final score.
Option D	No-go option – Wilderness	<p>The no-go option by rehabilitating to the land use of wilderness obtained the second highest final score, 70.28%. Although this option scored higher than option A (proposed activity) in both the environmental and social aspects, the proposed activity scored the highest in terms of technical and economic aspects with 86.27% and 100%, respectively thus resulting in the highest final score.</p> <p>This may be as a result of the fact that should the no-go option be implemented, the socio-economic benefits of the projects (job creation, positive impacts on the local economy) will not be experienced and it will result in a large loss of revenue for CAPM as operations have not yet commenced.</p>

