Exhibit 96.2

Goldfields.com

Technical Report Summary of

Mineral reserves and Mineral resources 31 December 2022

For

Gold Fields Limited – Tarkwa Gold Mine – Ghana

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1 Executive Summary

This technical report summary (TRS) was prepared for Gold Fields Limited (Gold Fields or the Company or the Registrant), a production stage issuer. The purpose of this TRS for Tarkwa Gold Mine (Tarkwa) is to highlight significant information in the report focusing on property ownership, exploration strategy and results, Mineral resources and Mineral reserves and key capital and operating cost estimates. Tarkwa is a production stage property located in Ghana, West Africa and this technical report summary has been compiled in accordance with the disclosure requirements for mining registrants as specified in Subpart 1300 of Regulation S-K under the Securities Act of 1933 (SK 1300).

The effective date of this technical report summary is 31 December 2022.

Unless otherwise specified, all units of currency are in United States Dollars ($). All measurements except for troy ounces (oz) are metric.

During 2022, cost inflation was offset by higher realised gold prices throughout the year. Mineral resources and Mineral reserves price decks have increased from 2021 but have been applied primarily to financial evaluations for Gold Fields Ghana (including Tarkwa). The increased price deck for 2022 has not yet been applied to the full mine planning and optimisation processes at Tarkwa.

1.1 Property description and ownership

Tarkwa is located approximately 300 kilometres (km) by road west of Accra, the capital of Ghana, West Africa. (Figure 1.1.1).

Figure 1.1.1: Location of Tarkwa in Ghana

Source: Tarkwa CPR, 2022

Gold Fields Ghana Ltd (GFGL) was incorporated in Ghana in 1993 as the legal entity holding the Tarkwa concession exploration and mining rights over a total area of 20,825 ha. GFGL is the operator of the mine, and the Company is the majority shareholder with 90 % of the issued shares in GFGL with the Ghanaian Government holding a 10 % free carried interest as required under the Mining Law of Ghana.

The major components of the Tarkwa mining and processing operation are:

- Four large open pits (Pepe-Mantraim, Teberebie, Akontansi and Kottraverchy).
- A large ore stockpile and 'spent ore' on the South Heap Leach Pad.
- A 14 Mt per annum carbon-in-leach (CIL) process plant.
- Tailings storage facilities (TSF).
- A power plant.
- A hybrid renewable power plant.
- Centralised administrative office, engineering and equipment workshops and residential villages.

1.2 Geology and mineralisation

The Tarkwa orebodies are located within the Tarkwaian System, which forms a significant portion of the stratigraphy of the Ashanti Belt which is a broadly synclinal structure of Proterozoic age in south-western Ghana.

The geology of the Tarkwa orebodies is dominated by the Banket series, subdivided into footwall and barren hanging wall quartzites, separated by a sequence of mineralised conglomerates and pebbly quartzites.

The stratigraphy of the individual quartzite units is well established, with auriferous reefs interbedded with barren immature quartzites. Structurally, the Tarkwaian belt has been subject to moderate folding and at least five episodes of deformation. Generally, the reefs dip between 15 and 35 degrees except at the Pepe North and Kottraverchy open pits, where the limbs of the anticline steepen to 70 degrees.

1.3 Exploration, development and operations

Tarkwa is a well-established mining operation and exploration activities are focused on discovery and Mineral resource development necessary to support the exploration pipeline and life of mine extension opportunities. Four large open pits currently exploit the stacked, narrow auriferous conglomerates using conventional drill and blast with truck and shovel methods. Tarkwa utilises contractor mining and haulage to the processing facility. Momentum on waste stripping is closely monitored to ensure that the ore bodies are opened-up timeously to expose the ore as required by the mine plan and schedule.

A total of 2,538 exploration holes have been drilled on the Tarkwa concession, of which 2,096 were drilled by GFGL (591 RC and 1,505 DD with an additional 94 deflections completed on the DD holes). A further 228 DD holes were drilled on the Tarkwa concession prior to 1993 and an additional 214 DD holes on the northern Teberebie concession area prior to 2000.

An annual budget of $3.0 million was approved for 2022 to drill a total of 4 km and conduct ground geophysical survey work over two target areas. A significant portion of the budget was spent testing for a northern extension to the Kobada orebody in the Kobada North target area. In addition, a Mineral resource definition drilling programme was successfully completed in the Ulap South target area.

A budget of $3.0 million (Table 5) has been approved for 2023. The team plans to use this to complete 11.4 km of drilling over three target areas. Early-stage prospective exploration targets will be tested for structurally controlled hydrothermal orebodies. The recent production performance of Tarkwa is summarised in Table 12.2.1.

1.4 Mineral resource estimates

The Tarkwa Mineral resources exclusive of Mineral reserves as of 31 December 2022 are summarised in Table 1.4.1. The Mineral resources are quoted as 90 % attributable to Gold Fields and are net of production depletion up to 31 December 2022. The point of reference for the Mineral resources is in-situ and a minimum mining width with dilution is applied. Open pit Mineral resources are confined by $1600 per ounce diluted resource pit shells and the tonnes and grades are reported as undiluted and in situ.

Table 1.4.1: Tarkwa - summary of attributable gold Mineral resources as at 31 December 2022 (fiscal year end) based on a gold price of $1,600/oz

	Resources (exclusive of Mineral reserves)			Cutoff grades	Metallurgical recovery
	Amount/	Grade	Amount		
	(kt)	Au/ (g/t Au)	Au/ (koz Au)	(g/t Au)	(%)
Open pit Mineral resources					
OP measured Mineral resources	9,535	1.5	453	0.34 - 0.43	89.5 - 97
OP indicated Mineral resources	51,763	1.3	2,240	0.34 - 0.43	89.5 - 97
OP measured + indicated Mineral resources	61,298	1.4	2,692	0.34 - 0.43	89.5 - 97
OP inferred Mineral resources	5,425	1.5	255	0.34 - 0.43	89.5 - 97
Stockpile Mineral resources					
SP measured Mineral resources	80	0.3	1	0.34	90
SP indicated Mineral resources					
SP measured + indicated Mineral resources	80	0.3	1	0.34	90
SP inferred Mineral resources					
Total Tarkwa Mineral Resources					
Total Measured mineral resources 2022	9,615	1.5	453		
Total indicated Mineral resources 2022	51,763	1.3	2,240		
Total measured + indicated Mineral resources 2022	61,378	1.4	2,693		
Total inferred Mineral resources 2022	5,425	1.5	255		
Total M+I Mineral resources 2021	68,932	1.4	3,054		
Total Inferred Mineral resources 2021	6,904	1.5	322		
Total M+I Year on year difference (%)	-11 %	-1 %	-12 %		
Total Inferred Year on year difference (%)	-21 %	1 %	-21 %		

Notes:

a) Mineral resources are exclusive of Mineral reserves. Rounding of figures may result in minor computational discrepancies.

b) Mineral resources categories are assigned with consideration given to geological complexity, grade variance, drillhole intersection spacing and proximity of mining development. See Section 11.1.12 for more information.

c) Quoted as diluted in-situ metric tonnes and grades. Metallurgical recovery factors have not been applied to the Mineral resource estimates. The approximate range metallurgical recovery factor is 89.5 % to 97 % for open pit feed. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product recovered from ore treated at the process plant to its total specific mineral content before treatment. Tarkwa mining operations vary according to the mix of the source material (e.g., oxide, transitional, fresh and ore type blend).

d) The gold metal price used for the 2022 Mineral resources are based on a gold price of $1,600 per ounce. Open pit Mineral resource constraining shells for Ghanaian operations are similarly based on revenue factor 1 pits unless otherwise stated. The gold price used for Mineral resources is approximately 14 % higher than the selected Mineral reserve price. The gold price used for Mineral resources is detailed for clarity in Chapter 16, Marketing.

e) The cutoff grade may vary per open pit mine, depending on the respective costs, depletion schedule, ore type, expected mining dilution and expected mining recovery. The average or range of cutoff grade values applied to the Mineral resources are: Tarkwa 0.34 g/t to 0.43 g/t Au mill feed (open pit). The cutoff grade for the spent ore heap leach is estimated at 0.32 g/t to 0.42 g/t.

f) The Mineral resources are based on initial assessments at the resource price of $1,600/oz and consider estimates of all Tarkwa costs, the impact of modifying factors such as mining dilution and mining recovery, processing recovery and royalties. Mineral resources are altered through the application of Environmental, Social and Governance (ESG) criteria to demonstrate reasonable prospects for economic extraction.

g) The Mineral resources are estimated at a point in time and can be affected by changes in the gold price, US Dollar currency exchange rates, permitting, legislation, costs and operating parameters.

h) Tarkwa is 90 % attributable to Gold Fields.

Source: Tarkwa CPR, 2022

1.5 Mineral reserve estimates

The Tarkwa Mineral reserves as at 31 December 2022 are summarised in Table 1.5.1. The Mineral reserves are 90 % attributable to Gold Fields and are net of production depletion up to 31 December 2022. The point of reference for the Mineral reserves is ore delivered to the processing facility.

Table 1.5.1: Tarkwa – summary of attributable gold Mineral reserves as at 31 December 2022 based on a gold price of $1,400/oz

	Amount/	Grades/	Amount/	Cutoff grades/	Metallurgical recovery/
	(kt)	(g/t Au)	(koz Au)	(g/t Au)	(%)
Open Pit Mineral Reserves					
OP proved Mineral reserves	33,601	1.3	1,357	0.4 – 0.5	89.5 – 97.2
OP probable Mineral reserves	66,374	1.2	2,549	0.4 – 0.5	89.5 – 97.2
OP total Mineral reserves	99,975	1.2	3,906	0.4 – 0.5	89.5 – 97.2
Stockpile Mineral Reserves					
SP proved Mineral reserves	9,726	0.8	255	0.42	97.2
SP probable Mineral reserves	53,964	0.4	694	0.32	90
SP total Mineral reserves	63,690	0.5	949	0.32 – 0.42	90 – 97.2
Total Mineral reserves					
Total proved Mineral reserves	43,327	1.2	1,612		
Total probable Mineral reserves	120,339	0.8	3,243		
Total Tarkwa Mineral reserves 2022	163,666	0.92	4,856		
Total Tarkwa Mineral reserves 2021	174,246	0.93	5,224		
Year on year difference (%)	-6 %	-1 %	-7 %		

Notes:

a) Rounding of figures may result in minor computational discrepancies.

b) Refer to Table 12.5.1 for year-on-year Mineral Reserve comparison.

c) Quoted as mill delivered metric tonnes and run-of-mine grades, inclusive of all mining dilutions and gold losses except mill recovery. Metallurgical recovery factors have not been applied to the reserve figures. The approximate range metallurgical recovery factor is 89.5 % to 97.2 % for open pit feed. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product recovered from ore treated at the process plant to its total specific mineral content before treatment. The recoveries for Tarkwa vary according to the mix of the source material (e.g., oxide, transitional fresh and ore type blend) and method of treatment.

d) The gold price used for the 2022 LOM Mineral reserves is $1,400 per ounce. Open pit Mineral reserves at Tarkwa are based on optimised pits using appropriate mine design and extraction schedules. The gold price used for Mineral reserves is detailed in particularity in Chapter 16 Marketing.

e) Dilution relates to planned and unplanned waste and/or low-grade material being mined and delivered to the process plant. Ranges are given for those operations that have multiple orebody styles and mining methodologies. The mine dilution factors are 30 cm hanging wall and 20 cm footwall skins.

f) The mining recovery factor relates to the proportion or percentage of ore mined from the defined orebody at the gold price used for the declaration of Mineral reserves. This percentage will vary from mining area to mining area and reflects planned and scheduled reserves against actual tonnes, grade and metal mined, with all modifying factors and mining constraints applied. The mining recovery factors are 100 % (open pit).

g) The cutoff grade may vary per open pit, depending on the respective costs, depletion schedule, ore type, expected mining dilution and expected mining recovery. The range of cutoff grade values applied in the planning process is: Tarkwa 0.32 g/t to 0.5 g/t Au mill feed.

h) A gold ounces-based Mine Call Factor (metal called for over metal accounted for) determined primarily on historic performance but also on realistic planned improvements where appropriate is applied to the Mineral reserves. A Mine Call Factor of 97 % has been applied at Tarkwa.

i) The Mineral reserves are estimated at a point in time and can be affected by changes in the gold price, US Dollar currency exchange rates, permitting, legislation, costs and operating parameters.

j) Tarkwa is 90 % attributable to Gold Fields and is entitled to mine all declared material located within the property's mineral leases and all necessary statutory mining authorisations and permits are in place or have reasonable expectation of being granted.

Source: Tarkwa CPR, 2022

The Tarkwa Mineral reserves are the economically mineable part of the measured and indicated Mineral resources based on based on technical and economic studies completed to a minimum of a pre-feasibility level of study using a reserve gold price of $1,400/oz to justify their extraction as at 31 December 2022. The Tarkwa life of mine reserve has a pre-feasibility study estimated accuracy of ±25 % with a contingency lower than or equal to 15 %.

1.6 Capital and operating cost estimates

Major budgeted capital cost items forecast to 2035 for the 31 December 2022 Mineral reserve LOM plan are summarised in Table 1.6.1.

Table 1.6.1: Sustaining and project capital expenditure estimate

		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Capital	$ million	237.1	204.6	198.4	208.6	277.6	236.5	156.1	177.7	59.1	8.8	8.9	12.8	0.0

Notes:

a) The detailed capital cost schedule is presented in Table 18.2.1.

b) This capital summary estimate is for the Mineral reserve life of mine schedule.

c) Closure costs are included in operating costs.

Source: Tarkwa CPR, 2022

Table 1.6.2: Operating costs estimate

		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Operating costs	$ million	439.0	458.0	427.3	408.6	331.2	389.2	402.1	398.1	282.2	241.4	142.9	161.1	139.4

Notes:

a) The detailed operating cost schedule is presented in Table 18.3.1.

b) This operating cost summary estimate is for the Mineral reserve LOM schedule.

c) Closure costs are presented from 2035 onwards.

Source: Tarkwa CPR, 2022

The estimated closure cost as at the end of December 2022 is $113.0 million. A cash deposit of $68.7 million has been made available to finance the closure cost with the remaining $44.3 million provided for in the LOM model.

1.7 Permitting

The key operating environmental permits for the operation are issued by the Ghanaian Environmental Protection Agency (EPA) and the Minerals Commission depending on type. The Water Use permits listed below are in place and are valid up to December 2025.

- Water Abstraction – Groundwater.
- Water Discharge.
- Pit Dewatering.
- Environmental Licence.

The permits for the construction and operation of the Tailings Storage Facility (TSF) 2 stage 8 were approved in 2022 and are valid until construction is completed.

The Environmental certificate expired in January 2022. The mine has submitted an updated Environmental Management Plan (EMP) to the EPA for consideration and approval. The processing and permit fees have been paid and Tarkwa is awaiting issuance of the certificate.

Permit required in 2023 is for the construction of TSF 5 stage 3 embankment wall raise. Environmental management at Tarkwa is conducted within the framework of an ISO 14001 certified environmental management system (EMS). The foundation of the EMS is Tarkwa's Environmental Policy, which is aligned with the Gold Fields Limited Environmental Policy.

1.8 Conclusions and recommendations

The Tarkwa Mineral reserves currently support a 13-year life of mine plan to 2035 that values the operation at a net present value of $182.3 million at a DCF discount rate of 15.9 % and a reserve gold price of $1,400/oz. Potential life extensions to the open pits will require additional exploration that is funded annually and the completion of relevant studies which have a current focus on reducing mining costs through the use of appropriate technology and innovation. The maiden TRS for Tarkwa had an effective date of 31 December 2021. This Technical Report Summary is the first update of the Tarkwa TRS and has an effective date of 31 December 2022. The triggering event for this update is the impairment of the Tarkwa book value by $325 million (grossed up for tax) because of increased inflationary pressure, higher applied discount rate, and lower applied Mineral resource price for the book value. Table 19.2.1 outlines the impairment calculation.

Gold Fields' commitment to materiality, transparency and competency in its Mineral resources and Mineral reserves disclosure to regulators and in the public domain is of paramount importance to the Qualified person. The QP is satisfied that this report meets these objectives and has no further recommendations regarding this disclosure. The Registrants Executive Committee and Board of Directors continue to endorse the company's internal and external review and audit assurance protocols. This Technical Report Summary should be read in totality to gain a full understanding of Tarkwa's Mineral resource and Mineral reserve estimation and reporting process, including data integrity, estimation methodologies, modifying factors, mining and processing capacity and capability, confidence in the estimates, economic analysis, risk and uncertainty and overall projected property value.

However, to ensure consolidated coverage of the company's primary internal controls in generating Mineral resource and reserve estimates a key point summary is provided in Chapter 21 for reference.

2 Introduction

2.1 Registrant for whom the Technical Report Summary was prepared

The Tarkwa Technical Report Summary was prepared for Gold Fields Limited (Gold Fields or the Company or the Registrant), a production stage issuer.

2.2 Terms of reference and purpose of the Technical Report Summary

The purpose of this TRS is to support the disclosure of Mineral resources and Mineral reserves for Tarkwa, a production stage property located in Ghana (Figure 1.1.1), and the report has been prepared in accordance with disclosure requirements for mining registrants as specified in SK 1300.

The maiden TRS for Tarkwa had an effective date of 31 December 2021. This Technical Report Summary is the first update of the Tarkwa TRS and has an effective date of 31 December 2022. The triggering event for an updated TRS is that Tarkwa has booked a $325 million impairment (grossed up for tax) due to increased inflationary pressure, higher applied discount rate, and lower applied Mineral resource price. Table 19.2.1 outlines the impairment calculation.

In addition to this disclosure being in line with the S-K 1300 rule, the Mineral resources and Mineral reserves stated in this Technical Report Summary have also been reported in accordance with the South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves (SAMREC Code 2016). SAMREC is aligned to the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Reporting Template November 2019.

2.3 Sources of information

This Technical Report Summary is principally based on information disclosed in the "Competent Person's Report on the Material Assets of Tarkwa Gold Mine" prepared by Tarkwa Qualified persons on behalf of the Company and has been reviewed by Regional and Corporate subject matter experts and Qualified persons. The Competent Person's Report (CPR) was supplemented by technical reports and studies prepared by the Company and third-party specialists engaged by the Company as cited throughout this Technical Report Summary and listed in Chapter 24.

Reliance was also placed on certain economic, marketing and legal information beyond the expertise of the Qualified persons used in the determination of modifying factors. This information provided by the Company is cited in this Technical Report Summary and is listed in Chapter 25.

Unless otherwise specified, all units of currency are in United States Dollars ($). All measurements are metric except for troy ounces (oz).

2.4 Qualified persons and details of inspection

The Qualified persons responsible for the preparation of this Technical Report Summary are listed in Table 2.4.1. All the Qualified persons are eligible members in good standing of a recognised professional organisation (RPO) within the mining industry and have at least five years of relevant experience in the type of mineralisation and type of deposit under consideration and in the specific type of activity that the Qualified person is undertaking on behalf of the Company at the time this Technical Report Summary was prepared.

The recognised professional organisation affiliation in good standing has been reviewed by Gold Fields. The Qualified persons have been appointed by Gold Fields.

Table 2.4.1: List of Qualified persons

Incumbent	Employer	Position	Affiliation in good standing	Relevant experience (years)	Details of inspection	Responsibility for which chapters
Dr Julian Verbeek	Gold Fields	VP Geology and Mineral resources and Group QP	FAusIMM – 207994	35	Has attended site	This document has been prepared under the supervision of and reviewed by Julian Verbeek. Chapters 1-26
Jason Sander	Gold Fields	VP Mining	FAusIMM – 111818	27	Has attended site	Overview and review of document. Chapters 1-5, 10 & 12-26
Dr Winfred Assibey-Bonsu	Gold Fields	Group Geostatistician and Evaluator	FSAIMM – 700632	36	Has attended site	Resources Estimation. Chapters 1 – 9 & 11 & 20-26 Geology (excluding sections 1.6 and 7.4)
Andrew Engelbrecht	Gold Fields	Group Geologist	MAusIMM – 224997	22	Has attended site	Geology and Resources. Chapters 1 – 9 & 11 & 20-26
Peter Andrews	Gold Fields	VP: Geotechnical	MAusIMM CP – 302255	26	Has attended site	Geotechnical review. Sections 7.4, 15.2 & 17.3.2
Daniel Hillier	Gold Fields	VP: Metallurgy	FAusIMM CP – 227106	32	Has attended site	Chapters 10 & 14
Johan Boshoff	Gold Fields	Group Head of Tailings	FAusIMM – 1007564	27	Has attended site	Tailings Review. Sections 15.1 & 17.3.1
Andre Badenhorst	Gold Fields	Group Technical and Reporting Governance Manager	AusIMM – 309882	42	Has attended site	Chapters 1-26
Joseph Nyan	Gold Fields	Regional Strategic Planning Manager	FAusIMM CP(Min) – 305323	23	Site employee	Economic analysis Chapters 1-5, 10 & 12-26
Steven Robins	Gold Fields	Regional Geology Manager and Acting Vice President Technical Services	AusIMM – 222533	26	Regional employee based at site on rotation	Jointly responsible for the overall correctness, standard and compliance of the Mineral resource and Mineral reserve estimate. Chapters 1 – 26
Godfred Baba Avane	Gold Fields	Geology Manager	AusIMM – 309400	27	Site employee	Chapters 1-26
Matthew Aboagye	Gold Fields	Unit Manager Resource Evaluation	MAusIMM – 322689	18	Site employee	Mineral resources. Chapters 6 – 9 & 11
Kwame Appau	Gold Fields	Study Manager	MAusIMM CP (No 316308)	15	Site employee	Chapters 1-5, 10 & 12-26

Notes: The Qualified persons attended site during 2022 for Mineral reserve and Mineral resource reviews, and the Mineral reserves and Mineral resources were reviewed according to the Chapter 21 description.

2.5 Report version update

The maiden Technical Report Summary for Tarkwa was filed with an effective date of 31 December 2021. This is the first update provided by Gold Fields for the Tarkwa property with an effective date of 31 December 2022. The triggering event for this update is the impairment of the Tarkwa book value by $325 million, including gross up for tax, because of increased inflationary pressure, higher applied discount rate and lower applied Mineral resource price. Table 19.2.1 outlines the impairment calculation.

3 Property description

3.1 Property location

The Tarkwa Gold Mine is located in south-western Ghana, about 300 km by road west of the capital city Accra (Figure 1.1.1), at latitude 5°19'37" N and longitude 2°01'17" W. The Property consists of the Tarkwa open pit mining and processing operation on the Tarkwa concession and the adjacent northern portion of the Teberebie concession acquired in August 2000 (Figure 1.1.1 shows location of Tarkwa and the material assets). The mine is served by a main road, which connects it to the port of Takoradi some 60 km to the southeast. Most supplies are transported by truck to the property.

3.2 Ownership

Gold Fields Ghana Ltd (GFGL) was incorporated in Ghana in 1993 as the legal entity holding the Tarkwa concession mining rights. GFGL is the operator of the mine, and the Company is the majority shareholder with 90 % of the issued shares in GFGL with the Ghanaian Government holding a 10 % free carried interest as required under the Mining Law of Ghana.

3.3 Property area

The Tarkwa property comprises exploration and mineral rights over a total area of 20,825 ha.

3.4 Property mineral titles, claims, mineral rights, leases and options

GFGL holds five mining leases in respect of its operations at Tarkwa and two mining leases for its operations at Teberebie. The rights to the two Teberebie mining leases are held through a deed of assignment with a subsidiary of AngloGold Ashanti that is operating the adjacent Iduapriem Mine. The map of Tarkwa mineral leases is shown in Figure 3.4.1 and the mineral leases are listed in Table 3.4.1. The mineral leases cover all the declared Mineral reserves. GFGL has legal entitlement to the minerals being reported upon with no known impediments.

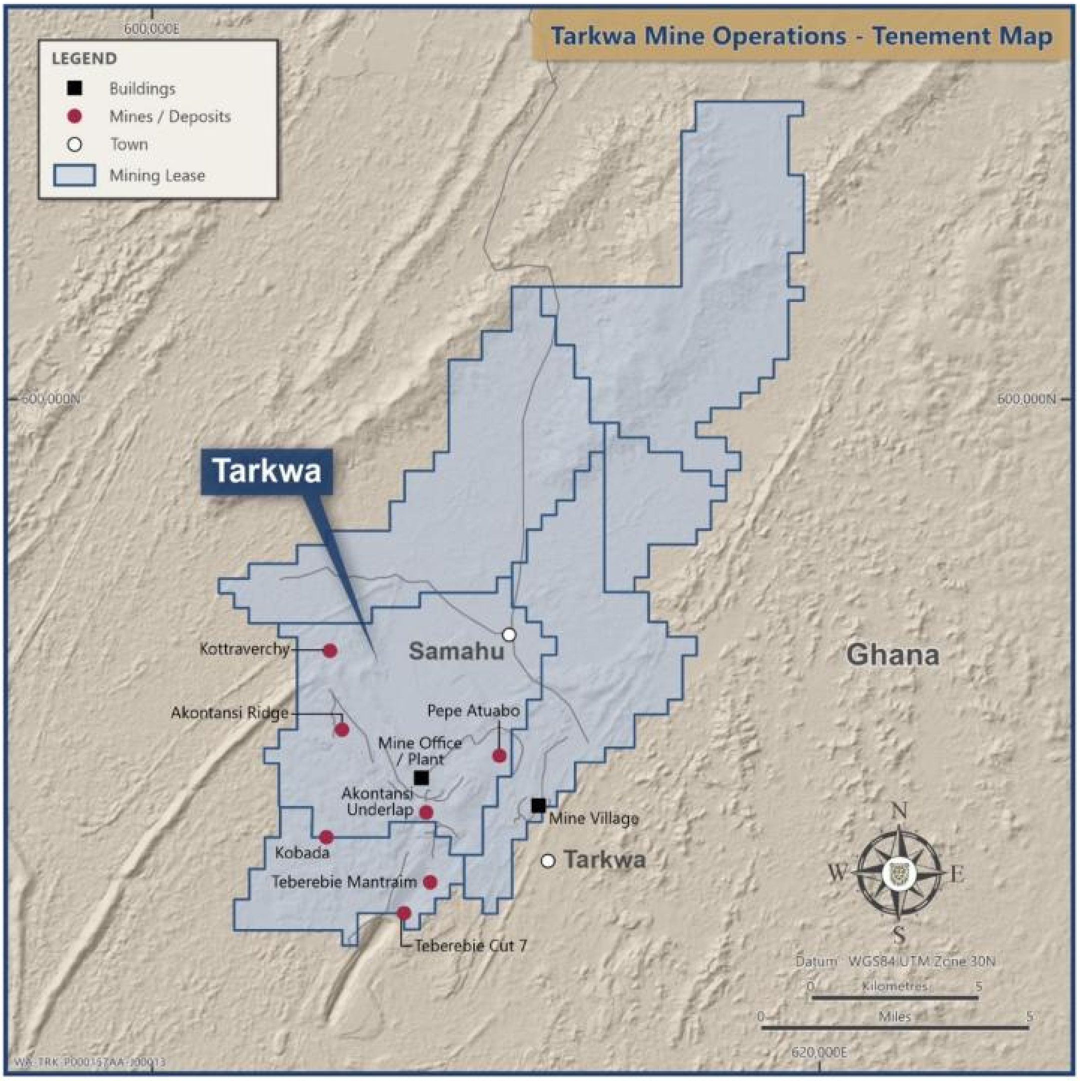
Table 3.4.1: List of Tarkwa mineral leases

Location	Mining Lease ID	Mining Leases (ha)	Expiry date	Unblocked area (km^2)	Blocked area (km^2)	Cadastral / block system (no. of blocks)
Tarkwa	WR 637/97 (ML1)	2,227	17 April, 2027	22.27	10.92	52
Tarkwa	WR 640/97 (ML4)	3,420	17 April, 2027	34.20	32.97	157
Tarkwa	WR 639/97 (ML3)	4,951	17 April, 2027	49.51	47.04	224
Tarkwa	WR 638/97 (ML2)	4,299	17 April, 2027	42.99	46.62	222
Tarkwa	WR 641/97 (ML5)	4,338	17 April, 2027	43.38	43.89	209
Teberebie	WR 1518/96	1,590 (Includes 1,520/96)	1 February, 2036	15.90	17.22	82

Notes: The Qualified Persons opinion is that licenses and tenements are in good standing to enable execution of the life of mine plan and can be renewed or extended as required.

Source: Tarkwa CPR, 2022

Figure 3.4.1: Tarkwa mineral lease map



Source: Tarkwa CPR, 2022

The Government of Ghana through the Minerals Commission has implemented a new lease boundary system called the cadastral (block) system in which all leases were converted into block sizes of a minimum 5" x 5" size. Under this new system, the 208.25 km² belonging to GFGL translates to 946 blocks (198.66 km²).

There used to be an area of overlap between the Tarkwa and Damang licenses in WR 637/97 where Damang had rights to a depth of 30 m with Tarkwa holding the rights below that depth. Both Damang and Tarkwa have applied to relinquish this overlap area to the government, which has been accepted in principle and will be applied in 2023.

In 2013, an agreement was entered into between GFGL and AngloGold Ashanti Iduapriem Ltd (AAIL) with the consent of the Minerals Commission to mine the 100 m boundary pillars left between the two mines as a statutory requirement. The two pillars occur along major ridges which are being mined by both companies. There is a pillar between the Ajopa Lease Area (AAIL) and Kottraverchy Lease Area (GFGL) called the "Ajopa Pillar" and a second between the Awunaben Lease Area (AAIL) and Teberebie Lease Area (GFGL) called the "Teberebie Pillar". For operational reasons, and in accordance with the terms of this agreement, the parties agreed that AAIL will solely and wholly mine the Ajopa pillar and GFGL will solely and wholly mine the Teberebie Pillar.

3.5 Mineral rights description

Under the Constitution of Ghana, the ownership of all minerals in their natural state in Ghana is in the Republic of Ghana, and all minerals are vested in the President on behalf of and in trust for the people. Under Ghanaian law, neither a landowner nor any other person may search for minerals or mine on any land without having been granted a mineral right by the Minister responsible for mines. In addition, under Ghanaian law, the Tarkwa property mining leases are subject to the ratification by the Parliament of the Republic of Ghana. The Minerals Commission, the statutory corporation overseeing the mining operations on behalf of the Government of Ghana, has confirmed that the Tarkwa mining leases have been ratified by Parliament.

The Minerals and Mining Law 1986 (PNDCL 153) (as amended) under which the mineral rights to GFGL were granted has been repealed and replaced by the Minerals and Mining Act, 2006 (Act 703) which came into effect on 31 March 2006. However, Act 703 provides that leases, permits and licenses granted or issued under the repealed laws will continue under those laws unless the Minister responsible for minerals provides otherwise by regulation. Therefore, unless and until such regulations are passed in respect of GFGL's mineral rights, PNDCL 153 will continue to apply to GFGL's current operations in Ghana. Act 703 further provides that even if a mineral right is made subject to its provisions shall not have the effect of increasing the holder's costs or financial burden for a period of five years from Act 703 coming into effect.

Under the provisions of PNDCL 153, the size of an area in respect of which a mining lease may be granted cannot exceed 50 km² for any single grant or 150 km² in the aggregate for any company. GFGL's mining leases cover approximately 198.66 km² which was acquired before the restrictions were put in place and GFGL is therefore not affected by this later directive.

Three forms of mineral rights are recognised under Ghanaian law. The first is a reconnaissance licence that entitles the holder to search for minerals by geochemical, geophysical and geological means but does not permit drilling or excavation. The second is a prospecting licence that allows the holder to search for minerals and permits, among other things, such excavation as may be necessary for prospecting and the third a mining lease which entitles the holder to extract minerals.

A licence is required for the export, sale or other disposal of minerals and the permission of the Chief Inspector of Mines is required to remove minerals obtained by the holder of a mineral right. Under Ghanaian law, the Government has a pre-emptive right to purchase gold produced and all products derived from the refining or treatment of minerals at fair market value. However, under the Property's Development Agreement the Company is entitled to export and sell its entire production of gold and by-products.

In Ghana, mining companies are required to pay a royalty rate of 5 % to the Government based on gold production in accordance with Section 25 of the Minerals and Mining Act, 2006 (Act 703). From 1 January 2017 a Development Agreement was signed between GFGL and the Government of Ghana and included a statutory royalty to be paid dependent on the gold price and is calculated annually on the sliding scale shown in Table 3.5.1. A royalty rate of 4 % applied based on the average gold price for the period.

Table 3.5.1: Royalty rate schedule

Royalty rate	Average annual gold price	
	Low value	High value
3.0 %	$0.00	$1,299.99
3.5 %	$1,300.00	$1,450.00
4.0 %	$1,451.00	$2,300.00
5.0 %	$2,301.00	Unlimited

Source: Tarkwa CPR, 2022

Mineral rights and/or mining rights are subject to the necessary approvals and permits discussed in Chapter 17.

3.6 Encumbrances

There are no fines, penalties, sanctions or other encumbrances for non-compliance or breaches of the terms and conditions of GFGL's mineral rights.

Chapter 17 discloses the remediation and reclamation guarantees that are pertinent to Tarkwa.

3.7 Other significant factors and risks

In terms of mining, there are no other significant factors or risks that affect access, title, or the right or ability to perform work on the Property and therefore execute the LOM plan. The Qualified person has relied on information provided by the Registrant in preparing their findings and conclusions regarding other significant factors and risks and they are not aware of any other current or pending licensing or legal matters that may have an influence on the rights to explore or mine for minerals at Tarkwa. A review of recent Company public disclosure documents including the annual report (Form 20-F for the 12 months Ended 31 December 2022) do not contain any statements by the directors on any legal proceedings or other material conditions that may impact on the Company's ability to continue mining or exploration activities at Tarkwa.

3.8 Royalties or similar interest

Apart from the Development Agreement linked statutory royalty to be calculated annually, as described in Section 3.5, there are no other third-party royalty or similar interests held by Gold Fields at Tarkwa.

4 Accessibility, climate, local resources, infrastructure and physiography

4.1 Topography, elevation and vegetation

The topography across Tarkwa's property is characterised by a series of ridges and valleys within a generally low-lying plain. Elevations range from 60 m to 300 m above sea level. No major rivers traverse the mining area.

The vegetation cover is a mixture of tropical rainforest and semi-deciduous forest. Most of the original rainforest has been cut for timber or cleared for farming. Dense secondary growth has reclaimed abandoned fields and this covers most of the steep ridges. Deforestation due to subsistence farming has altered the vegetation cover in the mine environs to secondary forest, scrub and cleared land. The principal crops grown include cocoa, plantain, pineapple, cassava, maize, yam, oil palm and coffee. There is no primary forest on the Property.

4.2 Access

The mine is located 4 km west of the town of Tarkwa with a population of 62,737 (Tarkwa township and its catchment area) with access roads and good infrastructure and is connected by asphalt road to the port of Takoradi, 60 km to the southeast on the Atlantic coast. The nearest major airport is at Takoradi.

4.3 Climate

Tarkwa has a tropical climate characterised by distinct rainy seasons with an average annual rainfall of 1,930 mm. The two normal periods of heavy rainfall are from April to July and from October to November, with a dry season from December to March.

Although minor disruptions to operations are experienced during the wet season, there have been no long-term constraints nor anticipated long-term constraints on production at any particular time during the year. Allowances are made in the mining schedule for periods of heavy rainfall and fog and appropriate water management logistics and procedures are in place in the open pits to mitigate the impact of heavy rainfall.

Average monthly temperatures range between a maximum of 28 °C and 34 °C and a minimum of 22 °C and 24 °C.

Tarkwa mine regularly conducts climate change risk and vulnerability assessments, and develops adaptation and mitigation plans to address and identified risks. Currently, there are no extreme climate conditions that are experienced that materially affect operations.

4.4 Infrastructure

Tarkwa is an extensive open pit gold mining operation with associated infrastructure and facilities that operate year-round. Major infrastructure owned and operated by GFGL includes two rock crushers, a 14 Mt per annum CIL process plant, two completed heap leach facilities, several large waste dumps, tailings storage facilities (TSF), haul roads, administration centres and residential villages (Figure 4.4.1Figure 3.4.1).

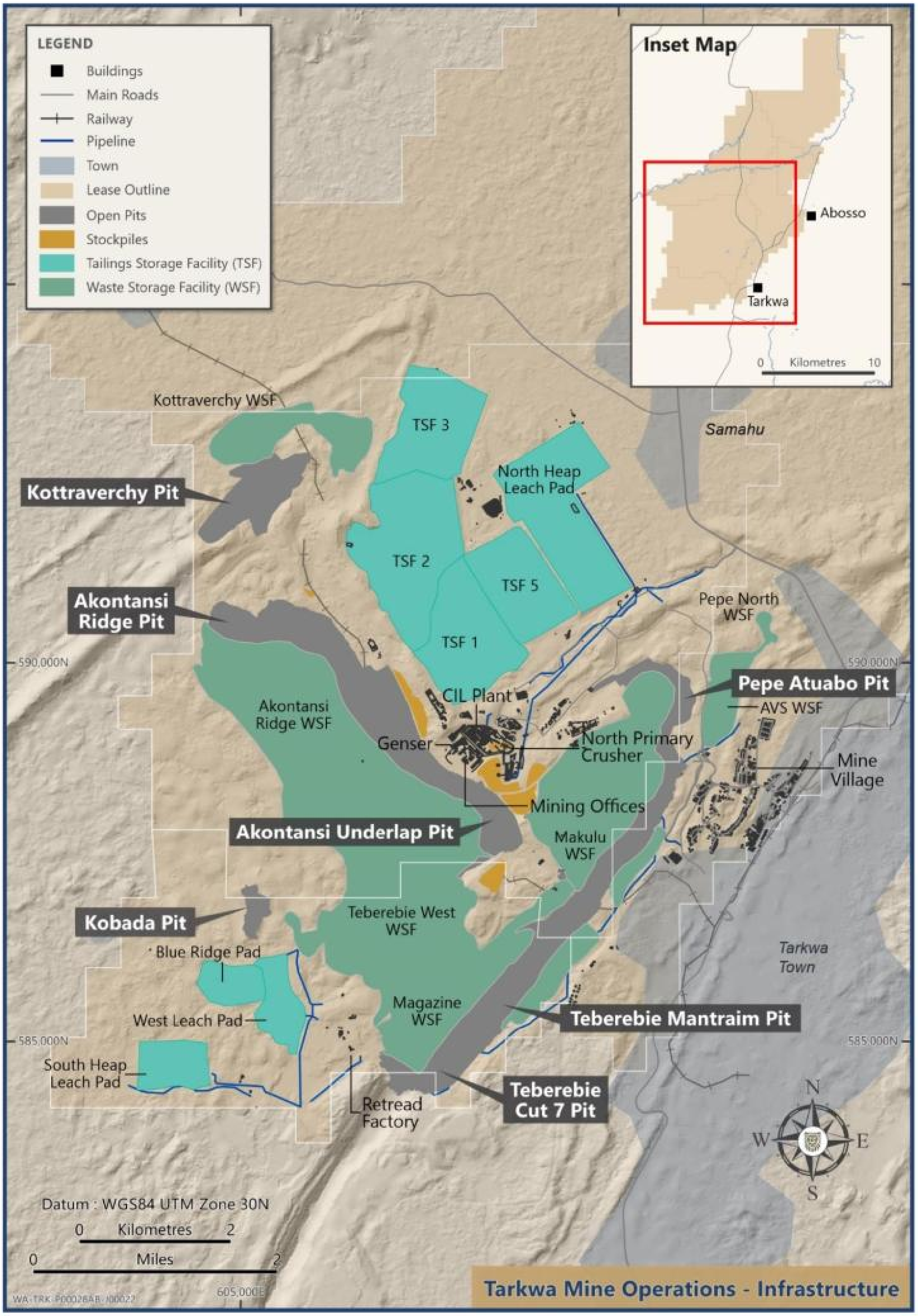
The process plant and main administration offices are located north of the Akontansi open pit. The process plant consists of a SAG mill, ball mill and conventional CIL gold recovery circuit.

Tarkwa has four purpose-built engineered TSFs (TSF 1, 2, 3 and 5). TSF 1, 2 and 5 are active, while TSF 3 is inactive and undergoing decommissioning. The facilities are in the mine concession's northern extremities and about 1.5 km northwest of the process plant.

Tarkwa has existing heavy mining equipment (HME) fleet maintenance workshops currently being used by the mining contractor and fuel storage facilities, as well as supporting offices and stores.

Water for processing is taken from the supernatant ponds of the tailing's storage facilities and surface raw water from the Pepe Water storage dam. Potable water is from underground boreholes.

Figure 4.4.1: Tarkwa operating sites, infrastructure and mineral lease



Source: Tarkwa CPR, 2022

Power is supplied to Tarkwa by Ghana's electricity generation company (VRA), the bulk transporter (GridCo) and Ghana's distribution company (ECG). The mine has four Independent Power Producer (IPP) gas turbines with a total generation capacity of about 40 MW installed circa 2016. This ensures that the mine takes 94 % of electricity for mine consumption from the IPP (Genser Energy). Tarkwa's monthly power consumption is about 25 GWh. The average demand is 38 MW.

Employees are accommodated in four company owned residential areas as well as privately owned houses in the adjoining town of Tarkwa. Recreational facilities include two clubs, restaurant, swimming pool, golf course, tennis court, gymnasium and squash court.

Most supplies are transported by truck to the property.

The nearest community, adjacent to the property, is the Brahabobom community, with a population of 3,025.

Takoradi is the nearest city to Tarkwa, located along the Atlantic coast and about 60 km southeast of Tarkwa. Takoradi has a population of approximately 450,000 and includes the nearest major airport to the property.

Further details regarding the infrastructure are provided in Chapter 15.

Excluding the mining contractor, all personnel working on the mine are mine employees and contractors are called in as and when the need arises. Personnel operating at senior and middle management levels are recruited and appointed in line with Company policy and consideration is given to applicants from host communities, where training programs are provided when required. Tarkwa operates safe, functional work rosters to ensure continuous mining operations.

4.5 Book Value

The economic analysis disclosed in Chapter 19 is in relation to the attributable Mineral reserves only and excludes Mineral resources and lower grade material. The assumptions, parameters and cashflows are only intended to support the Mineral reserve declaration for the operation. Certain assumptions and estimates might differ from the long-term outlook or actual results of the operation, including the commodity prices used, which are materially different from current spot prices. Changes in these assumptions may result in significant changes to mine plans, cost models and the NPV of the operation. The Mineral reserves will therefore by nature, not necessarily represent the total future economic benefit that can be derived from the Property.

Net Book value of property, plant and equipment consists mainly of land holdings, mine infrastructure, mine equipment, mine development, mineral and surface rights and processing plant related assets of the Property. Tarkwa had a book value of $1,109.3 million on a 100 % basis as at 31 December 2021.

After adjusting for an impairment of $325 million (grossed up for tax) in 2022, Tarkwa now has a book value of $778.9 million. The impairment was as a result of increased inflationary pressure, higher applied discount rate and lower applied Mineral resource price. Table 19.2.1 outlines the impairment calculation. The Qualified person is of the opinion that the book value estimated as described is expected to be different to the NPV for the attributable Mineral reserve only.

5 History

Sinking of the Abontiakoon vertical shaft near Tarkwa town was completed in 1935 and a central mill with a capacity of 30,000 t/month was constructed in the following four years. Several small mining companies operated the Abontiakoon concession, but in 1960 all workings were abandoned and allowed to flood. In 1961, production restarted under the State Gold Mining Corporation and in 1963 the Tarkwa mines were renamed Tarkwa Goldfields Limited. The Apinto shaft was sunk in the mid-seventies.

GFGL signed a management contract with the Ghanaian government to operate the mine in 1993 and in 1996 completed a feasibility study on an open pit/heap leach operation. In 1998, the initial Tarkwa Phase 1 development was completed for an open pit operation, mining 14.5 Mt per annum (including 4.7 Mt per annum of heap leach feed ore). In 1999, the Tarkwa Phase 2 expansion was completed to increase the mining rate to 20.7 Mt per annum and heap leach feed ore production up to 7.2 Mt per annum. All underground operations and the associated processing plant ceased production.

In 2000, GFG acquired the northern area of Teberebie and mining production was increased to 36 Mt per annum.

Tarkwa implemented owner mining in July 2004 and commissioned a CIL plant with a nameplate capacity of 4.2 Mt per annum in October 2004. The expanded CIL plant was commissioned in January 2009 and a design throughput of 12.3 Mt per annum was achieved in September 2009. Conversion to owner maintenance was completed in 2010.

In 2011, GFGL acquired IAMGold's 18.9 % interest in Tarkwa and currently holds 90 %, with the remaining 10 % held by the Ghanaian government. At the end of 2013, all heap leach operations ceased.

The CIL plant capacity was increased to 13.5 Mt per annum late in 2014 and is currently doing 14 Mt per annum after the introduction of the gravity circuits in 2018.

Tarkwa reverted to a contractor mining model in 2018 after a comprehensive trade-off analysis indicated cashflow and All-in-Costs (AIC) benefits.

In recent years, exploration efforts at Tarkwa have gained traction as the potential to expand the historical pit shell limits was fully realised through targeted resource extensional exploration drilling campaigns. Recent exploration drilling has been conducted over four target areas in initial and resource definition programs to replenish and boost the Mineral resources and Mineral reserves portfolio. Drilling programs were executed at Akontansi-Ridge, Teberebie East and Ulap South to define Resources on the down-directions of the various palaeoplacer deposits. A drilling program was also concluded in Underlap (Ulap) East to test for possible eastern extensions of the Ulap North extension orebody.

The recent production performance of Tarkwa is summarised in Table 12.2.1.

Exploration continued to focus on the palaeoplacer potential in the four targeted areas namely, Ulap South/West Hill, Ulap East and Ulap West. A drilling program was also successfully executed at the Akontansi-Ridge North target area to convert the defined Mineral resources in the down-dip extension of the Akontansi orebody into Mineral reserves. Initial framework drilling programs were also executed in Kottraverchy East and Ulap-Pepe Dozer Build Yard area.

Brownfield focused exploration commenced in August 2014 and led to the execution of an extensive program of soil sampling, field mapping and trenching across selected areas of the mine lease backed by interpretation of existing geophysical data. The outcome of this work resulted in the discovery of the Kobada hydrothermal orebody, resulting in a small maiden hydrothermal open pit. In June 2018 Tarkwa focussed predominantly on exploring for near-mine palaeoplacer potential as extensions of or proximal to existing open pits. This led to major successes in terms of discovery, resource definition and subsequent conversion to Mineral reserves. The Ulap North Extension orebody was discovered and defined by this exploration. This significantly augmented the Mineral resource and Mineral reserve portfolio of the mine, both replacing depletion and leveraging growth in terms of ounces and life extension. Whilst the exploration team continue to explore on-lease for palaeoplacer potential, efforts are underway to explore both north and south of Tarkwa in search of shear hosted hydrothermal mineralisation.

Further details on GFGL's exploration activities are provided in Chapter 7.

6 Geological setting, mineralisation and deposit

6.1 Geological setting

6.1.1 Regional Geology South Western Ghana

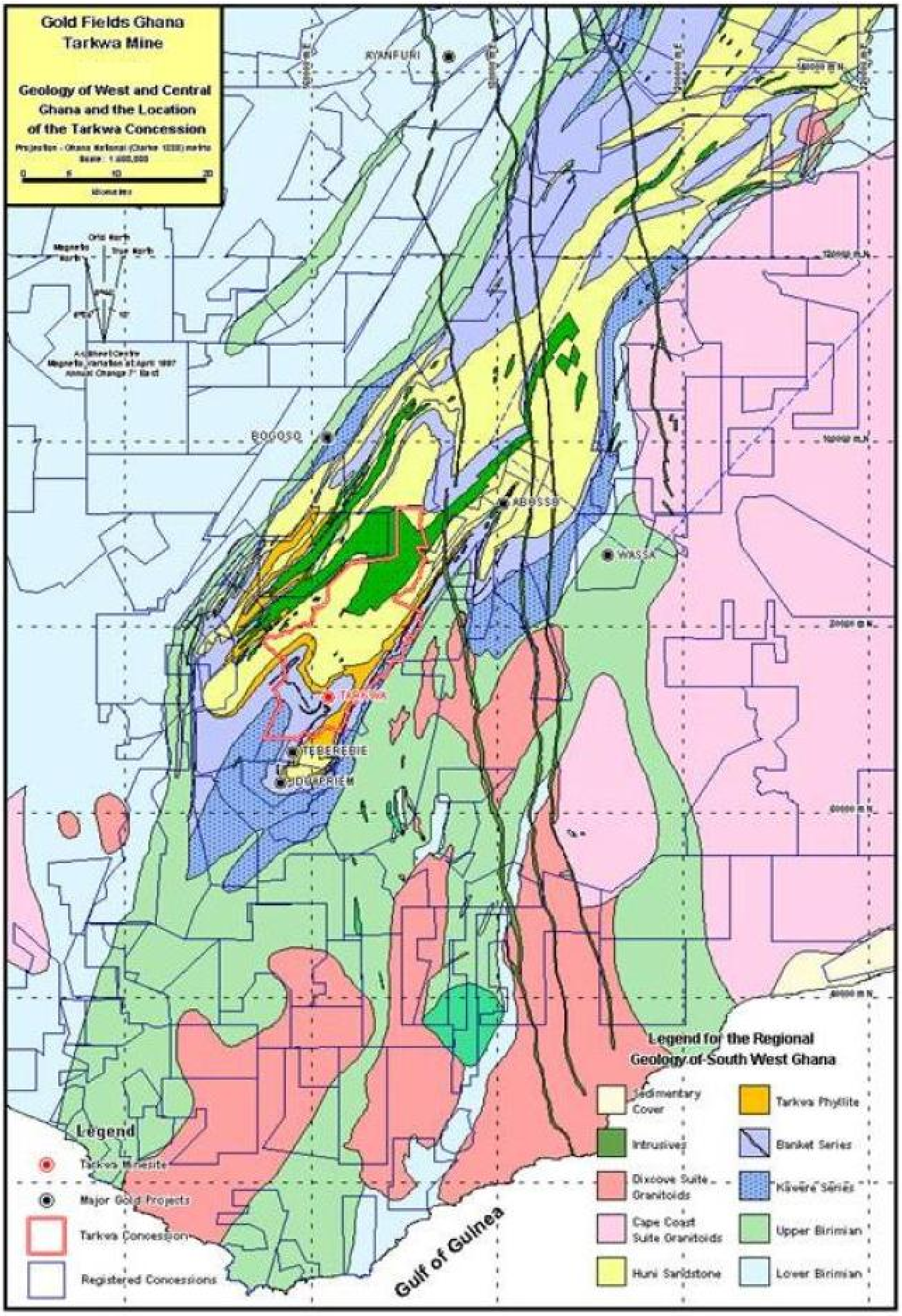
The majority of Ghana is underlain by metamorphosed Palaeoproterozoic (~2300-1900 Ma) rocks of the volcano-sedimentary Birimian Supergroup and the overlying clastic sedimentary Tarkwaian Group. The Tarkwa orebodies are located within the Tarkwaian System, which forms a significant portion of the stratigraphy of the Ashanti Belt in southwest Ghana. The Ashanti Belt is a north-easterly striking, broadly synclinal structure made up of Lower Proterozoic sediments and volcanics underlain by metavolcanics and metasediments of the Birimian Supergroup. The Tarkwaian stratigraphy comprises a thick sequence of folded, faulted, metamorphosed sandstones, conglomerates and shales, indicative of deposition into a rift setting. The contact between the Birimian and the Tarkwaian is commonly marked by zones of intense shearing and is host to several significant shear-hosted gold deposits including Prestea, Bogoso and Obuasi.

The Tarkwaian Group unconformably overlies the Birimian Supergroup and is characterised by low grade (lower greenschist) metamorphism and a predominance of coarse grained, immature sedimentary units. It is subdivided into four major units, which from oldest to youngest are:

- Kawere Series (250-700 m) – poorly sorted, polymictic conglomerates and quartzites with no significant mineralisation.
- Banket Series – comprises well sorted conglomerates, made up of Birimian quartz pebbles and volcanic clasts, with interbedded cross-bedded sandstones. Contains significant gold mineralisation including the Tarkwa orebodies. In the Pepe area, the Banket Series is approximately 32 m thick and at Kottraverchy up to 270 m thick.
- Tarkwa Phyllite Series (120-140 m) – fine grained chloritic siltstones, mudstones and schists with no significant mineralisation. The series grades upwards into the Huni Sandstone.
- Huni Series (1,370 m) – fine grained massive quartzites interbedded in places by phyllites and intruded by later stage dolerites and with no significant mineralisation.

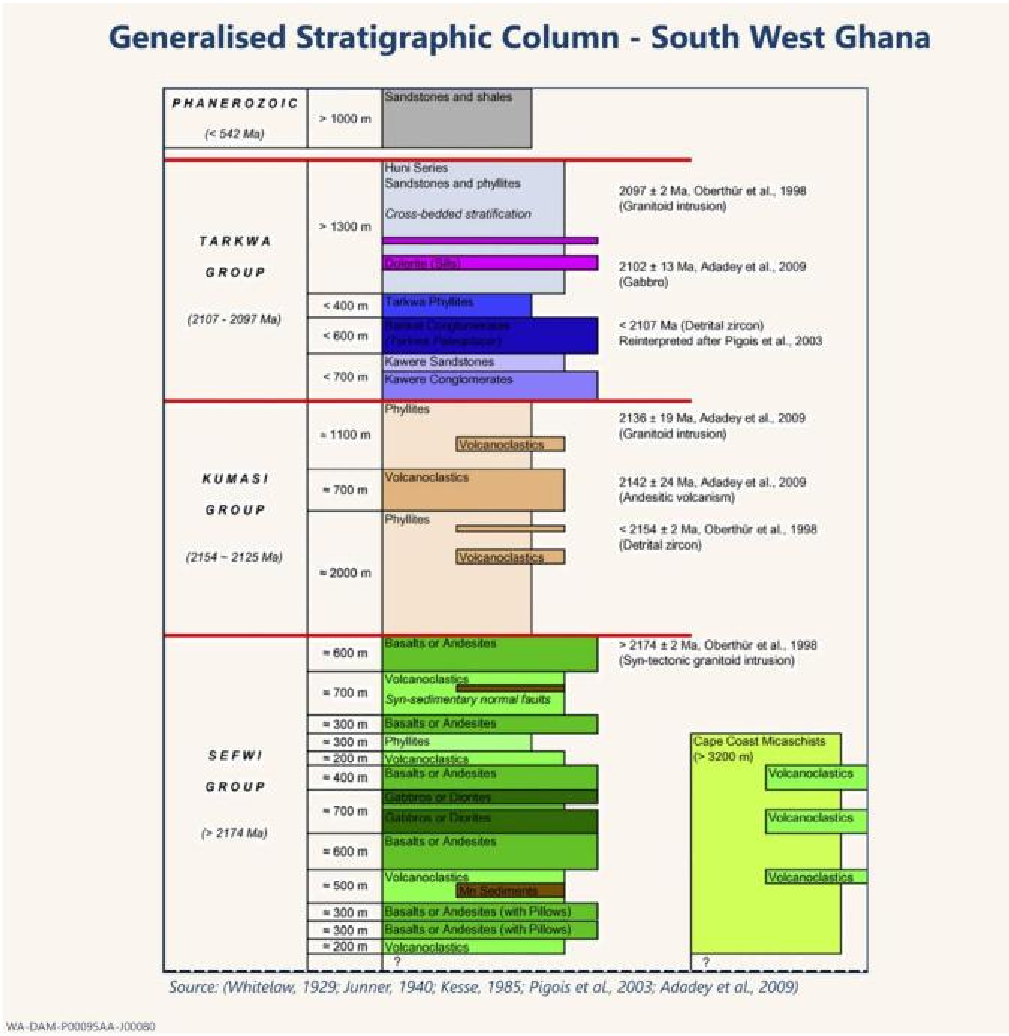
The regional geology is shown in Figure 6.1.1 with a regional stratigraphic column in Figure 6.1.2.

Figure 6.1.1: Regional geology of the Ashanti Belt, south-western Ghana



Source: Tarkwa CPR, 2022

Figure 6.1.2: Regional generalised stratigraphic column, south-western Ghana



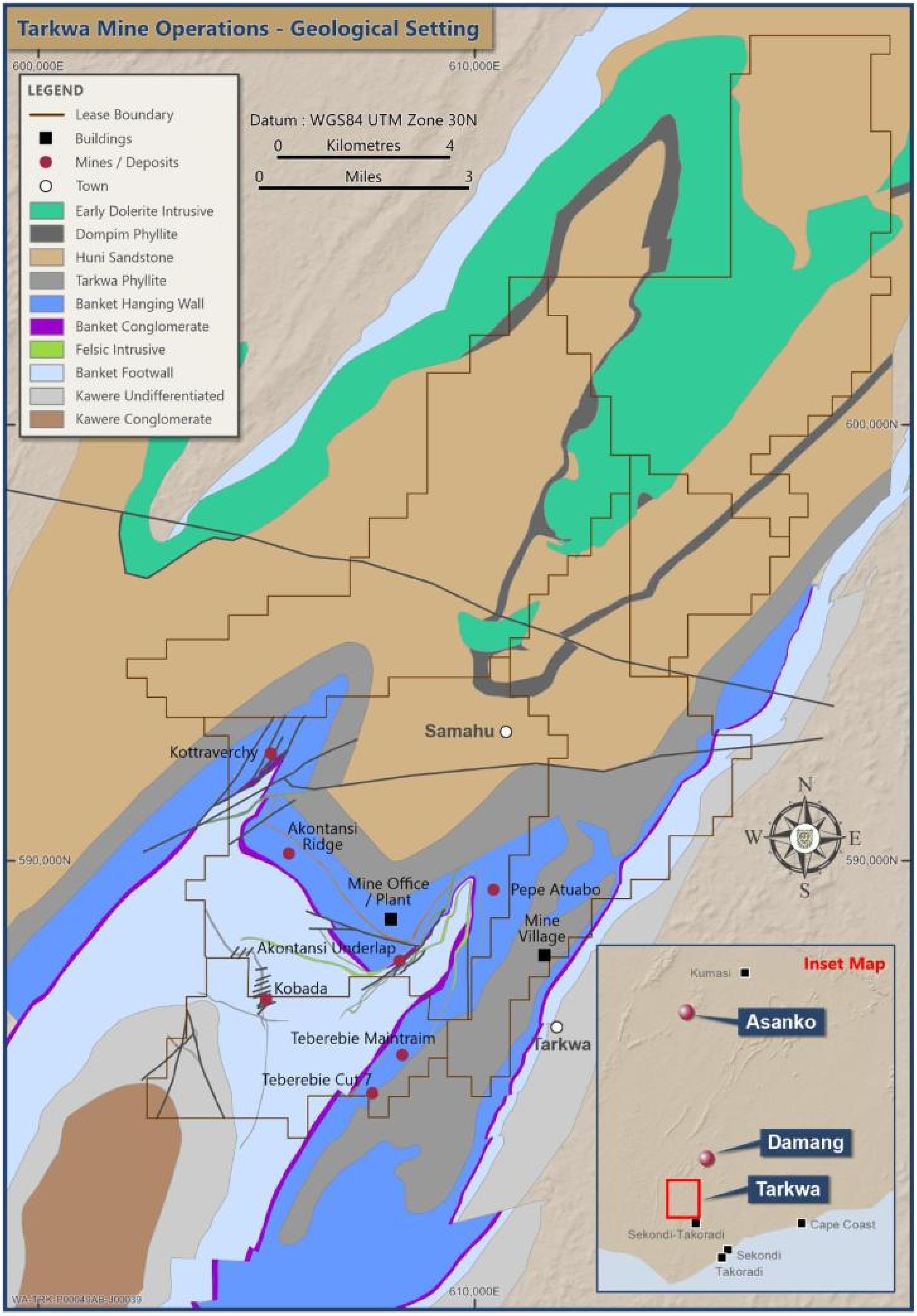
Source: Tarkwa CPR, 2022

6.1.2 Tarkwa Geology Southwestern Ghana

The local geology at Tarkwa is dominated by the Banket Series, which can be further sub-divided into a footwall and hanging wall barren quartzite, separated by a sequence of mineralised conglomerates and pebbly quartzites (Figure 6.1.3).

The stratigraphy of the individual quartzite units is well established with auriferous reefs interbedded by barren immature quartzites. The units thicken to the west and are laterally extensive throughout the deposit. However the package thins towards the source area in the east, where reworking of the lower conglomeratic horizons occurred during periodic episodes of basin uplift. Palaeocurrent flow parameters indicate a sedimentological-fluvial flow from the east to southeast proximal to the source area.

Figure 6.1.3: Local geology of Tarkwa gold mine area



Source: Tarkwa CPR, 2022

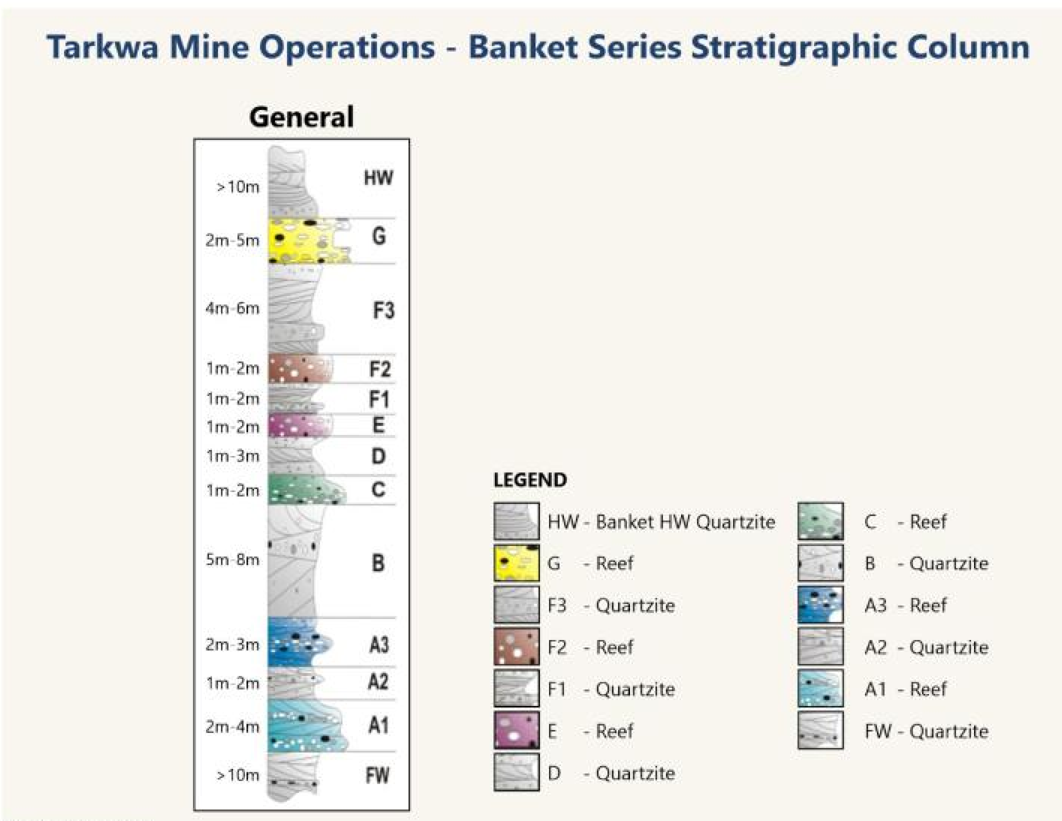
Structurally, the Tarkwaian belt has been subject to moderate folding, and at least five episodes of deformation (D2-D6). Originally, deposition of the Tarkwaian Group sediments occurred into a long, narrow basin with the western fault-bounded contact forming an extensional half-graben environment with associated low to steep angle normal faulting. Subsequent compression and folding led to the development of thrust faults and reversing of previous normal faults. The final stages involved further thrusting in a south-westerly direction.

The ore bodies at Tarkwa are cut by numerous predominantly reverse faults, which generally run perpendicular to the strike. Initially, zoning and structural interpretation using borehole sections extracted from the drillhole database is carried out prior to modelling of the individual reef horizons at Tarkwa (using Surpac and Leapfrog software). 3D wireframe planes of the structural discontinuities (faults) are constructed during the structural interpretation and all new drillholes are assigned to structural zones. Several igneous intrusions cross cut the reef ore bodies and these can result in areas being sterilised. The major intrusions are also modelled as 3D wireframes that are used to cut the initial reef wireframes to ensure ore is removed from the sterilised areas.

6.1.3 Tarkwa Sedimentology

The major gold bearing horizons are locally termed Afc, A1 A3, B2, C, E, F2, F4 and G. These vary in thickness from 1.5 m to 10 m thick and dip at 15-250 (Figure 6.1.4). Gold is mainly concentrated in the matrix of the conglomerate and pebbly conglomerate units.

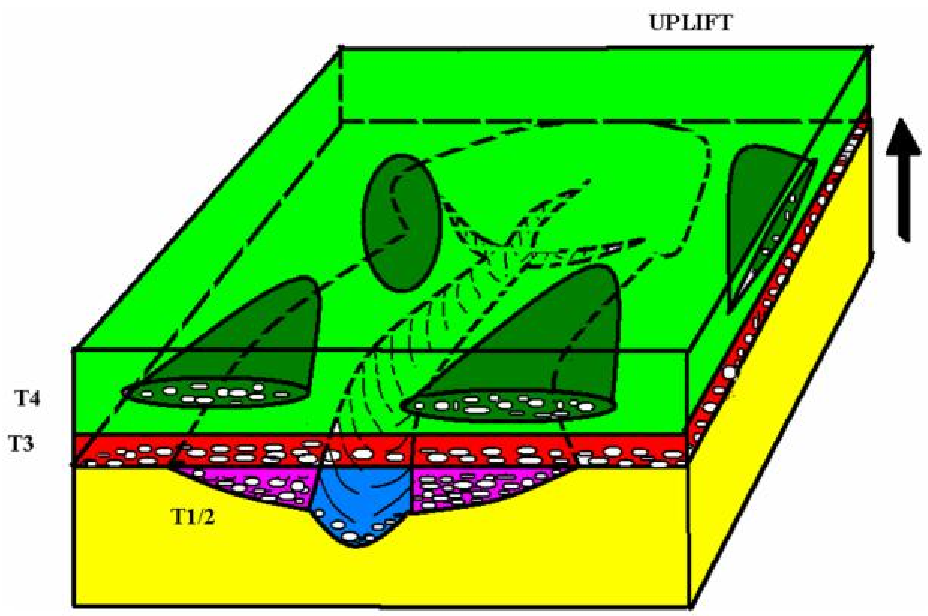
Figure 6.1.4: Figure Tarkwa Stratigraphic Column



Source: Tarkwa CPR, 2022

Sedimentological studies of the detailed stratigraphy within individual A reefs and A-Footwall reefs units led to the recognition of both lateral and vertical facies variations. The modelling of these units also resulted in the identification of a cycle of events from initial channel formation and rapid down cutting of the central channel (basin down warp time units T1 and T2) through a period of uplift and reworking (T3, Figure 6.1.5). Finally, a period of meandering channel bars and flow reduction led to the development of low-grade conglomerates with silty interbeds (T4). The T3 sequence is recognised as the principal episode of gold deposition and concentration within these reefs. The C, E and G reefs style of sedimentation differs from that of the channelised A reefs to more localised sheet flood dominated alluvial fan deposits.

Figure 6.1.5: Schematic diagram showing lateral and vertical facies variations within the A and A Footwall reefs



Source: Tarkwa CPR, 2022

6.1.4 Tarkwa lithology – Kobada

The major lithological units present in the relatively small hydrothermal-style Kobada pit area comprise immature pebbly sandstones, poorly sorted conglomerate, fine-grained sandstones, a highly altered feldspathic sandstone unit and a micro-diorite which hosts gold mineralisation. The polymictic conglomerate horizon situated stratigraphically above the mineralised micro-diorite is a reliable stratigraphic marker unit.

6.1.5 Tarkwa weathering

The weathering profile affects the porosity of the ore and varies from surface due to fluctuations in groundwater levels, generally from 1 m to 40 m below surface. Faulting, fracturing and primary lithological permeabilities modify the depth to porosity relationship. Individual core samples taken at 50 cm intervals are composited per reef zone and a manual method of contouring the different porosity values (P Codes) is used per reef. These contours are then used as constraints for estimating the P Code values into the Mineral resource block models per reef to inform the metallurgical response and recovery criteria for the modifying factors. See Section 11.1.3 for more information.

6.2 Mineralisation

The Tarkwa orebody comprises a series of planar meta-sedimentary palaeoplacer deposits (2,132-2,095 Ma old), broadly similar to those mined in the Witwaterstrand Basin of South Africa (2,900-2,700 Ma old) with haematite being the dominant heavy mineral at Tarkwa as opposed to pyrite in the Witwatersrand deposits.

The mineral association of the reefs is consistent throughout all the open pits. The predominant gangue minerals are quartzite (83-90 wt%), muscovite (6-12 wt%) and kaolinite (1-3 wt%). The presence of kaolinite is an indication of the degree of superficial weathering of the orebody. Iron oxide, predominantly haematite, is the most common non-silicate gangue mineral found in most parts of the deposit, varying between 2-3 wt%, along with minor magnetite. There are also trace amounts of todorokite (a hydrous manganese oxide, <1 wt%) and copper. Sulphur exists in very minor quantities. It is especially associated with quartz veining at Pepe North and the Pepe West Limb area, most of which has already been mined out. The concentrations are too low to have any detrimental effect on gold cyanidation or the environment. The reefs are interbedded with barren quartzite zones. The major gold bearing horizons are (Figure 6.1.4):

- Afc – up to 3.0 m thick, only occurs in the west and sub crops against the A1 in the east. Well sorted with rounded clasts of quartzite and visible gold. The Afc sub-outcrops against the A1 package at Akontansi East and is therefore not developed in the Pepe-Teberebie area.
- A1 – between 2-7 m thick, moderately to poorly sorted conglomerate and thin quartzites with occasional visible gold.
- A3 – up to 7 m thick, moderately sorted thin discontinuous conglomerate lenses within a package of cross stratified quartzites, visible gold is rare. In the Pepe-Teberebie area, the A2 quartzite unit is too thin to be mined separately, and the A1, A2 and A3 units are mined as a combined A reef package.
- CDE – up to 8 m thick and can be subdivided into the lower C reef and upper E reef, both of which are conglomeratic and are separated by the D reef quartzite.
- F2 – a variably developed polymictic gravel up to 2 m thick, essentially a marker horizon, except in the east where it carries low grades; and G – varies from a 2-6 m thick poorly sorted conglomerate with clasts of quartzite and phyllite.

Geological modelling is based on the exploration DD and RC data from grade control drilling. Pit mapping data, most commonly in the form of survey pick-ups of geological structures and reef boundary contacts, is incorporated into the structural interpretation.

7 Exploration

7.1 Exploration at Tarkwa

Tarkwa is a well-established mining operation and exploration activities are focused on discovery and resource development to support the exploration pipeline and life of mine extension opportunities.

In 2022 $3.0 million was spent to complete 2.1 km of RC and 1.9 km of DD drilling principally over two target areas, Ulap South and Kobada North in resource definition and initial drilling programmes respectively. The team also conducted ground geophysical survey work over prospective early-stage targets in a search for structurally controlled hydrothermal orebodies.A significant portion of the budget was utilised to test for a northern extension to the Kobada orebody in the Kobada North target area, following up on an earlier trench excavation program totalling 1,600 linear metres (15 trenches) over a 0.9 km^2 area. These trenches were orientated and mapped to record lithology, veining, alteration assemblages and structures.

A resource definition drilling programme was also successfully completed over Ulap South. An exploration budget of $3.0 million has been approved for 2023 to further explore early-stage targets identified as having the potential to host structurally controlled hydrothermal orebodies.

7.2 Drilling

7.2.1 Type and extent

Drilling at Tarkwa is completed by diamond core (DD) and reverse circulation percussion (RC) methods. The DD drilling is primarily undertaken with HQ and NQ diameter core using a standard tube. PQ diameter core has also been used for metallurgical sampling purposes. The RC drillholes are primarily drilled with 5" – 5.5" diameter drill bits. Due to the relatively flat dip of the strata, the majority of DD and RC holes are drilled vertically but are occasionally inclined in more steeply dipping areas. Inclined DD holes are also drilled for geotechnical purposes.

DD is initially carried out on a wide-spaced grid of 200 m along strike and 100 m down dip (400 m x 200 m in some areas). This grid is infilled to a spacing of 100 m x 100 m or 50 m x 100 m. RC may be used for the infill drilling.

A locality map for the 2022 exploration activity is provided in Figure 7.2.1.

The Qualified person's opinion of the 2022 exploration programs and results is:

a) All procedures and parameters applied to the surveys and investigations are appropriate for the style of mineralisation being prospected.

b) The exploration programs have confirmed continuity of geology and controls on gold mineralisation in key areas.

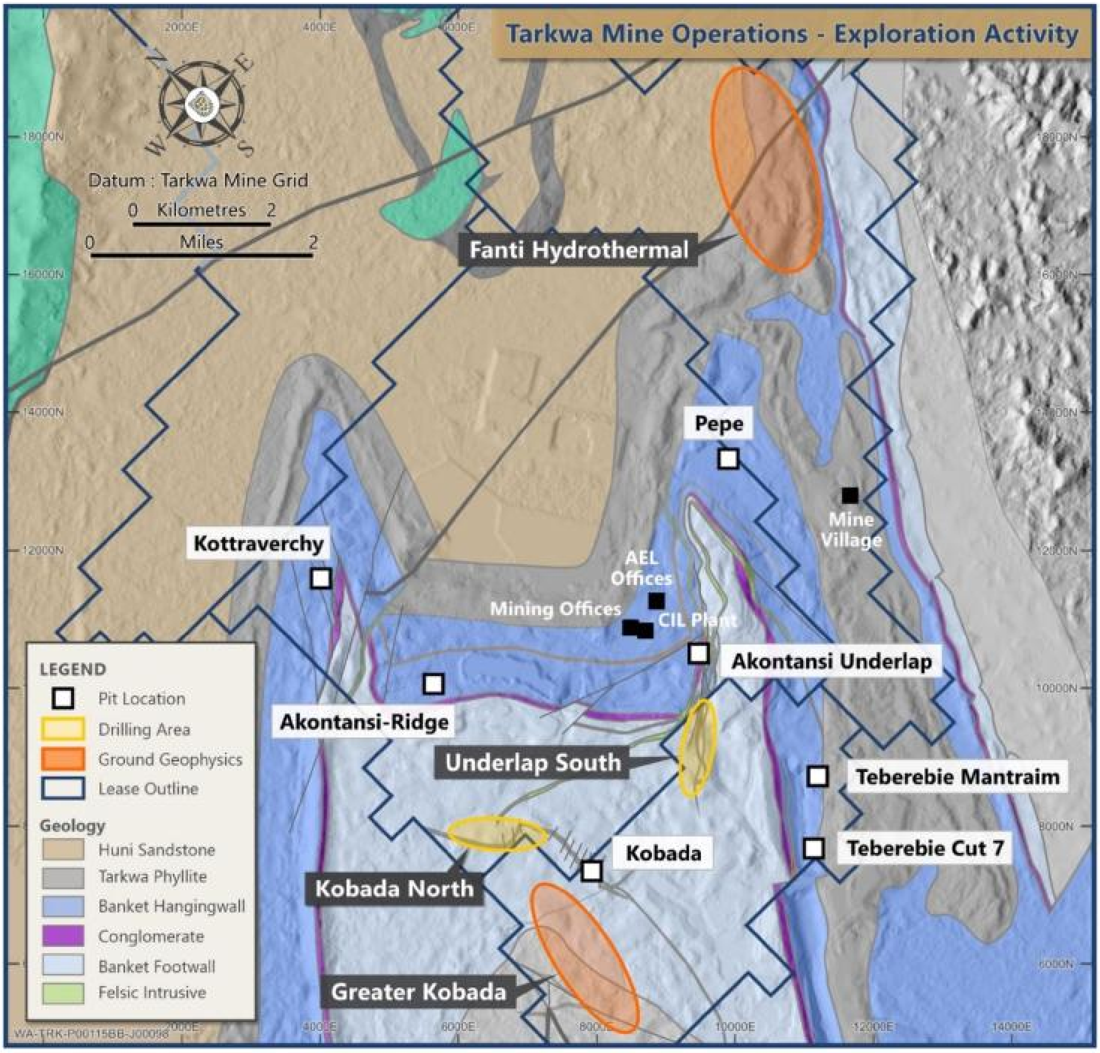
c) There were no material variations encountered during the exploration programs.

d) Based on the 2022 exploration and results, a 2023 exploration budget has been approved to retain traction on the programs and to progress leading projects.

e) A register of individual drill results would be too voluminous, potentially misleading and not relevant to the current reporting of Mineral resources and Mineral reserves. All relevant drillholes are incorporated in geological models and have been used to underpin mineralisation estimates and models.

An additional 128 off-concession exploration boreholes have been included in the Tarkwa database for the purpose of defining geological continuity at the lease boundaries.

Figure 7.2.1: Locality Map of 2022 Exploration Activities



Source: Tarkwa CPR, 2022

7.2.2 Procedures

All DD drill core and RC chips are logged by GFGL Geologists and is directly imported into a Datashed® database.

The DD holes are logged according to standard lithological codes on the Company's standard sedimentological drillhole log sheets for palaeoplacer deposits. Specific emphasis is placed on recognising sedimentary contacts, fining and coarsening cycles, as well as structural discontinuities. In case of DD data, preliminary zoning of stratigraphic horizons is made during the data capture phase in the field. The final stratigraphic zoning is completed after loading of all assay data into the primary database. Preliminary zoning, lithology, assay and structural data is plotted along a downhole stratigraphic profile. This profile is used to finalise the zoning at the core storage facility using the retained half core as a reference. During logging, core bedding angles of lithologic units are measured with a correction factor applied for apparent thicknesses to obtain the true thicknesses of each reef horizon.

RC drillhole chips are logged in 1 m intervals according to the same lithological codes. Matrix grain sizes, colour, sample condition, penetration rates and sample weights are captured in conjunction with the lithological codes. The logged and zoned DD holes are used as templates during zoning of RC chip data. Structural features, zone thicknesses, lithological and grade profiles from all drillholes and in-pit mapping data are considered when finalising the RC drillhole stratigraphic zones.

The logging at Tarkwa is both quantitative and qualitative. Photographs have been taken of all DD split core since 2011 (Figure 7.2.2).

Figure 7.2.2: Example of diamond drill core photo

Source: Tarkwa CPR, 2022

Two survey methods are currently used at Tarkwa for topographical and drillhole collar surveys:

- Traversing by total station with an accuracy of one second of arc. The technique employed is the three-tripod system with an acceptable closure within 10 mm.
- Real Time Kinematic (RTK) Global Positioning System (GPS) surveying where there is no vegetation cover to an accuracy within 4 cm.

Drillholes are completed at various azimuths and dips depending on the geometry of the target orebody. Downhole surveys are carried out on all DD holes and a Reflex downhole set (Reflex Ez-trac) and Reflex orientation setup (Reflex Ez-mark) are used to conduct downhole survey and drillhole orientation, respectively. If any of the surveys are suspect, a re-survey is requested. No downhole surveys are carried out on the vertical RC holes which are drilled to a maximum depth of 130 m. Average deviations in DD downhole surveys are 1 ° (1.7 m) at 100 m depth. All survey data is captured into a Datashed® database.

RC holes are sampled at 1 m intervals, while DD holes are sampled based on geology criteria. The minimum interval is 0.2 m to a maximum 1 m. The drill core is logged and halved with one half sent to the laboratory for assaying and the other half retained for quality control (QC) and validation purposes.

DD sample recovery is accurately measured. The average sample recovery for RC is 85 %, while the average sample recovery for DD is 90 %. In general, there were no issues related to poor sample recovery rendering samples unrepresentative. Where voids are encountered (e.g., old underground or artisanal workings), the gap is logged in the DD or RC drillhole logs.

During RC drilling, each sample collected is weighed and the weight and sample condition recorded on the drillhole log. The recoveries are monitored for each sample and the drilling is stopped if expected recoveries fall below 80 % on three consecutive samples. No bias is observed in these lower recovery samples or wet samples in the data set. This is supported by the reconciliation of production to the grade control model, which is well within acceptable industry limits.

Cores and half cores are stored on site at the Tarkwa core yard, a dedicated facility for storage of exploration drill cores. RC sample rejects are also stored at the core yard until all assays have been returned and have been subjected to QA-QC analysis. Once data validation has been completed, RC rejects are routinely disposed of. RC chips are selected on an ad-hoc basis depending on their relevance and these are then kept on site in chip trays for future reference.

The Qualified person's opinion of the exploration and resource extension drilling is:

a) All drilling and exploration field activities are supervised to ensure health and safety and maintain appropriate technical standards.

b) The drillhole surveys are adequate by type and length for the intended purpose.

c) Utilising orientated core significantly enhances recorded information to assist with 3D modelling.

d) The drillhole database and subsequent modelling aligns to core recovery losses and should not cause material errors.

e) Post QA/QC screening and validation exploration results are incorporated into the estimation of Mineral resources; the categorisation of Mineral resource described in Chapter 11.

f) Validated exploration results are used in the Mineral resource estimation.

g) Individual exploration drillhole information is not viewed as significant or material to the Mineral resource and Mineral reserve reporting at Tarkwa and consequently exploration data is not presented in its entirety.

h) All exploration activities, including drilling, database management, validation and QA/QC, prior to incorporating relevant data into the resource modelling and estimation process, is viewed as sufficient, appropriate, technically assured and suitable to support Mineral resources.

7.2.3 Results

In Ulap South a total of 1,379 m were drilled on six holes completing a resource definition programme over 1 km strike extension. The drill holes successfully intersected the down-dip portion of the anticipated Banket conglomerates as anticipated. These Banket reef zones which comprise relatively well-sorted conglomerates interbedded with quartzites (located below the Banket hanging wall horizon) and are intruded by fault laminated mafic and felsic igneous bodies.

A drill programme consisting of 2,610 m was executed in Kobada North to test for the continuation of the Kobada orebody both along strike and down-dip. A similar litho-structural environment was encountered comprising a sequence of fine and coarse-grained sandstones, polymitic conglomerate and micro-diorite intrusion. Late-stage northeast-southwest faults and a northeast plunging anticline were observed. Comparatively low gold grades were returned as a result a decrease in intensity of quartz veining, alteration and sulphide (pyrite) mineralisation. In particular a distinct drop in density of shear and extensional quartz-tourmaline veins critical for gold mineralisation was observed.

7.3 Hydrogeology

Pumping tests are conducted as the main method of obtaining valuable hydrogeological information necessary to characterise the groundwater system on the mine. Pumping of wells stresses the aquifer and creates a cone of depression in the rock units. The hydraulic properties of the hydrogeological units within Tarkwa influence the nature of the draw down cone. Therefore, the aquifer parameters are obtained by monitoring the manner in which an area of drawdown expands.

Alternatively, the falling head slug test is also done to help determine hydraulic conductivity in the immediate vicinity of the holes. The test assumes homogeneity of formation within the vicinity of the hole.

The hydrogeological characteristics of the general Tarkwa area reflect data collated from the initial site in December 1994 by Golder for Teberebie Goldfields and ongoing hydrological data collection to the present day.

A regional groundwater survey was followed by Mine scale airlift, pumping and packer testing to establish initial hydrogeological parameters and including an initial hydrogeological database. Based on these a generalised hydrogeological model was established for the Tarkwa area.

The study requirements included: Targeted pumping and airlift testing; piezometer installation; enhancement of hydrogeological database and 3D model; initial assessment of depressurisation and dewatering requirements.

7.3.1 Data from stream flows and location

These locations were determined after the site had been entirely mapped and stream patterns and directions were identified. Approximate measurements of stream flow direction were carried out at three different locations with the stream flow pattern in the valleys and throughout the mine site estimated from the range of measured stream flow rates of 1 L/s to 90 L/s. It should be noted that these ranges of flows do not reflect the maximum downstream flow out of the concession area and the wet season flows.

Observations of the stream flow assessment at Tarkwa can be summarised as:

- Direction of flow within the concession area is generally towards the south.
- Majority of flow passes to the west of the Teberebie Ridge.
- Flows through the Mantraim eastern valley pass to the Awunaben area.
- Relevant streams were diverted with channels and perimeter drains before mining of the pits and they have very minimal or no impact on the mining operations.
- Flows recorded in the streams are considered to represent baseflow conditions.

7.3.2 Data from exploration boreholes

Various exploration boreholes were selected and converted into piezometers for measuring the level of the groundwater level (free water surface). These boreholes are open systems and therefore standpipe piezometers were installed in them. These are measured on monthly basis to determine whether there are any changes or not in the free groundwater surface.

Piezometers have been installed at various locations around the pits and measurements have been consistent with previous information. Rainwater has not had significant impact on the groundwater level. New piezometers are always drilled and installed whenever existing ones are mined out due to push backs.

7.3.3 Rainfall data

Rainfall monitoring data have been made available using rain gauge measurement from several points. Rainfall patterns have generally not changed from historic patterns. Various monitoring points have also been set up across site. Comparison of rainfall figures over a 10-year period indicates higher values in 2014 with Akontansi Ridge recording the highest rainfall, while Pepe recorded the lowest value within the same year. This information indicates localised variations of rainfall pattern across site. Significant local variations are recorded within the rainfall patterns, with rain at a particular pit while no rain is recorded at a different pit at Tarkwa. Current rainfall events have been consistent with historic information.

7.3.4 Hydrogeology assessment summary

The hydrogeology of the area has been assessed from the available data and is summarised as follows:

- A major water table lies at valley level. It does not appear that the valley is perched and there is a basic continuity between the groundwater in the valleys and the rock mass.
- Minor seepage is evident from within the ridge system, at least in the Teberebie Ridge area where groundwater exits in the pit face at around the site elevation.
- There was evidence of artesian pressures within the fault system between Mantraim and Awunaben experienced during drilling of a water well.
- The permeability of the fault zone between Awunaben and Mantraim has been assessed from the water well test to be 5.4*10-6 m/s. Packer tests in drillholes within the fault zone returned variable results, with one indicating a permeability of 3*10-6 m/s.

- Slight seepages (0.5 L/s to 1.0 L/s) were evident from exploration drillholes located towards the base of the Teberebie Ridge, approximately 10 m to 15 m above the valley floor level on the eastern side.
- The calculated permeabilities from the packer tests in the Mantraim series of exploration drillholes ranged from 1.8*10-8 m/s to 1.4*10-6 m/s, with an overall mean of 2.6*10-7 m/s.

Test results indicated a general tightness of the of the rock mass, although some areas also showed the openness of the rock mass structure, from a free flowing to tight rock mass.

It is anticipated that such range of rock mass conditions could occur throughout the excavation with limited seepage in the tight rock mass and seepage points or small flows within the open textured rock mass. From the packer testing the rock mass can be described as relatively low permeability. Higher flows are usually expected within the fault bounded areas.

The Qualified persons opinion of the hydrology is:

a) Tarkwa has reliance on appropriate hydrological studies conducted at all relevant sites

b) Hydrology is not viewed as presenting a material risk to Tarkwa or the Mineral resource and Mineral reserve estimates.

7.4 Geotechnical

Dedicated geotechnical data is collected for geotechnical pit design purposes. This may vary from logging of diamond core, to mapping of exposed surfaces once excavation starts. These geotechnical holes are planned along the periphery of the pit to intercept major and discrete structures that could have a detrimental effect on slope stability. Representative samples are collected and sent to the laboratory for testing. Ongoing data collection on selected exploration holes is carried out on selected exploration holes to increase data density.

Sampling for the various tests is guided by the mine's sampling protocols as captured in the slope management plan. The main tests that are required for the determination of rock mass properties are the uniaxial and triaxial compressive tests.

7.4.1 Uniaxial compressive test (UCS)

The Uniaxial compressive strength (UCS) test is used to determine the uniaxial compressive strength (unconfined compressive strength), the Young's modulus and Poisson's ratio. The following processes ensure reliable results are obtained from the UCS test:

1. Selected samples are free of defects.
2. The samples must be circular cylinders with the height twice the core diameter.
3. The ends of the samples must be flat within 0.02 mm.
4. The samples must not be stored for more than 30 days and they must be tested at their natural moisture content.

During the testing, uniaxial load is applied to the specimen at a constant stress rate of 0.5 Mpa/sec to 1.0 Mpa/sec by using a universal testing machine. Axial load and radial or circumferential strains are recorded throughout the test. All samples are photographed, and all visible defects logged before testing. After testing, the sample are photographed again, and all failure planes logged.

7.4.2 Triaxial compressive test (TCS)

Frictional angle (Ø) and cohesion (c) which are the shear strength parameters for intact rocks are determined by triaxial testing. Rock samples are loaded axially and radially by a confining pressure which is kept constant. Steps undertaken to obtain reliable results are:

1. The maximum confining pressure must be half of the unconfined compressive strength of the sample.
2. The test is repeated for at least five different confining pressures.

3. At least two tests are required to be conducted for each confining pressure.

The rock mass parameters adopted for the numeric analyses are largely based on laboratory test results. The key assumptions for the rock mass properties are stated below:

1. The uniaxial compressive strength values are the 25th percentile values.
2. The adopted mi values are the 25th percentile values.
3. Rock mass properties were estimated using the Hoek Brown failure criteria.
4. To determine cohesion and frictional angles for two intervals of confining stress, a bilinear Mohr-Coulomb envelop was fitted on a nonlinear Hoek-Brown curve.

A representative number of all (uncut) resource diamond drilling, preferably HQ core size, is geotechnically logged and sampled for laboratory testing. In addition, targeted, dedicated triple-tube geotechnical holes are required for any study. These are planned by the responsible geotechnical department.

Tarkwa guidelines for open pit studies are a minimum of one drillhole per 100 m of pit crest, or one drillhole pierce point per 4 ha of pit slope surface. Entire recovered orientated core is logged to determine representative rock mass.

Table 7.4.1: Required representative samples for laboratory testing

Type of test	Samples	Underground	Open pit
Direct Shear (For weathered rock, saprolite, fault gouge, etc.)	5 per domain	☒	☑
Uniaxial Compressive Strength (UCS) (With Youngs Modulus and Poisson's ratio determination)	5 per lithology	☑	☑
Triaxial Compressive Tests (5 suites at four confining pressures)	20 per lithology	☑	☑
Brazilian Tensile Strength	5 per lithology	☑	☒
Acoustic Emission (AE)	3 per site	☑	☒

Notes:

a) Tarkwa has completed this testing for the life of mine Reserve and has ongoing testing of new discoveries.

b) Domains and lithologies are based on core logging.

c) Additional sample testing is requested if required.

Source: Tarkwa CPR, 2022

All materials testing is performed in accordance with International Society for Rock Mechanics, ISRM, (1978) standards. A summary of material testing parameters for Tarkwa can be seen in Table 7.4.2 below.

Table 7.4.2: Tarkwa material testing parameters

Material	UCS (MPA)	Density (γ) Kg/m^3	Rock Mass Friction Φ(degrees)	Rock Mass Cohesion C (Kpa)	Young Modulus E (Gpa)	Poisson Ratio η	Permeability K (m/s)
Overburden and soft rock	20-50	2200	28-32	25-65	1-3	0.28-0.32	$2*10^{-5}$
Intermediate rock	75-120	2400	32-36	130-170	8-12	0.22-0.28	$2*10^{-6}$
Hard rock	150-180	2700	38-42	350-450	15-25	0.18-0.22	$2*10^{-7}$
Intrusive (soft)	1	1800	18-22	20-40	0.8-1.2	0.35-0.45	$1*10^{-7}$
Intrusive (Hard)	100	2500	34-38	80-120	3.7	0.32-0.38	$5*10^{-8}$

Source: Tarkwa CPR, 2022

The Qualified person's opinion of the geotechnical work is:

a) Tarkwa has completed all appropriate testing for the current life of mine reserve and continues to test all new significant discoveries.

b) Geotechnical domains and lithologies are based on core logging and modelled by the Geology department.

c) Sample testing is adequate for the purposes of this report.

d) The quality of the sampling and laboratory testing is adequate to support the Mineral resource and Mineral reserve estimates.

7.5 Density

Rock density is a critical input to the resource block model and for determining the tonnage of an orebody. It therefore impacts the total Mineral resource deposit. Consequently, independent porosity and density determinations are calculated from DD core samples for most resource areas (Table 7.5.1, Table 7.5.2 and Table 7.5.3). This is done at the SGS laboratory in Tarkwa using a hydrostatic immersion (wax-immersion) method. The weathering has affected rocks near the surface by oxidation with consequent clay alteration, which in turn affects the porosity, density and metallurgical characteristics of the deposit.

From the outset, Tarkwa Mine has sought to model the weathering alteration characteristics of the deposit. Initially, a qualitative visual estimate was used to gauge porosity, which was subsequently updated to a wetting test where the quantity and rate of water absorption was measured. The procedure currently in use is a direct measurement of the porosity percentage, or void space, through an immersion technique. The method used is based on an International Standard Method ISO 5017. The statistical analyses of initial test results done on Tarkwa drill cores shows a 94 % linear correlation between Bulk Density and Apparent Porosity. Gold dissolution tests on cores and crushed ore samples show a more scattered trend, however, a clear relationship exists between apparent porosities and gold dissolution characteristics. Six thousand porosity and bulk density determinations have been made on 5 cm core samples taken every 50 cm in the various reef units and in some of the intervening quartzite beds, from 1,070 drillholes at Pepe, Mantraim, Akontansi and Kottraverchy.

The weathering profile, and porosity, of the ore varies from surface. This relates to the fluctuations in groundwater levels, which generally vary from 1 m to 40 m. Faulting, fracturing and primary lithological permeability modify the depth to porosity relationship. Individual samples taken at 50 cm intervals are composited per reef zone and the Mine uses a manual method of contouring the different porosity values (P Codes) per reef. These contours are then used as constraints for estimating the P Code values into the block models per reef. The specific gravity and dissolution factors are assigned directly from the P code values for each reef. These are also tested with new drilling data during infill campaigns. The tables used to assign these densities and dissolutions for the various pits are shown below.

Table 7.5.1: Tarkwa Density – Akontansi

Akontansi Porosity Table										
PCODE	REEF-Specific Gravity									Dissolution (%)
	G	E	C	CDE	A3	A1	Afc	Afc3	Afc1	
0	2.69	2.66	2.66	2.66	2.66	2.67	2.68	2.68	2.68	43.75
1	2.66	2.65	2.65	2.65	2.65	2.65	2.66	2.66	2.66	53.5
2	2.66	2.63	2.63	2.63	2.61	2.61	2.61	2.61	2.61	68.13
3	2.63	2.57	2.57	2.57	2.61	2.61	2.61	2.61	2.61	76.44
4	2.57	2.54	2.54	2.54	2.61	2.61	2.61	2.61	2.61	80.85
5	2.54	2.5	2.5	2.5	2.45	2.45	2.43	2.43	2.43	86.73

Source: Tarkwa CPR, 2022

Table 7.5.2: Tarkwa Density – Pepe, Teberebie

Pepe Porosity Table						
PCODE	REEF-Specific Gravity					Dissolution (%)
	A	C	E	F2	G	
0	2.69	2.69	2.69	2.67	2.69	53.50
1	2.60	2.66	2.66	2.65	2.66	60.33
2	2.54	2.60	2.58	2.58	2.60	72.03
3	2.60	2.60	2.58	2.58	2.60	78.88
4	2.57	2.60	2.58	2.58	2.60	82.80
5	2.48	2.46	2.44	2.38	2.47	86.73

Teberebie Porosity Table									
PCODE	REEF-Specific Gravity								Dissolution (%)
	A	CDE	C	E	F24	F2	F4	G	
0	2.69	2.69	2.69	2.69	2.67	2.67	2.67	2.69	43.75
1	2.60	2.66	2.66	2.66	2.65	2.65	2.65	2.66	53.50
2	2.64	2.60	2.60	2.58	2.58	2.58	2.58	2.60	68.13
3	2.60	2.60	2.60	2.58	2.58	2.58	2.58	2.60	76.44
4	2.57	2.60	2.60	2.58	2.58	2.58	2.58	2.60	80.85
5	2.48	2.46	2.46	2.44	2.38	2.38	2.38	2.47	86.73

Source: Tarkwa CPR, 2022

Table 7.5.3: Tarkwa Density – Kottraverchy

Kottraverchy Porosity Table										
PCODE	REEF-Specific Gravity									Dissolution (%)
	A	CDE	C	E	F24	F2	F4	G		
0	2.69	2.66	2.66	2.66	2.66	2.67	2.68	2.68	2.68	43.75
1	2.66	2.65	2.65	2.65	2.65	2.65	2.66	2.66	2.66	53.5
2	2.66	2.63	2.63	2.63	2.61	2.61	2.61	2.61	2.61	68.13
3	2.63	2.57	2.57	2.57	2.61	2.61	2.61	2.61	2.61	76.44
4	2.57	2.54	2.54	2.54	2.61	2.61	2.61	2.61	2.61	80.85
5	2.54	2.5	2.5	2.5	2.45	2.45	2.43	2.43	2.43	86.73

Source: Tarkwa CPR, 2022

The weathering profile, and hence the porosity of the ore, varies from surface due to fluctuations in groundwater levels which generally vary from 1 m to 40 m. Faulting, fracturing and primary lithological permeabilities modify the depth to porosity relationship. Individual core samples taken at 50 cm intervals are composited per reef zone and a manual method of contouring the different porosity values (P Codes) is used per reef for the metallurgical response factors.

The Qualified person's opinion of the density work is:

a) The bulk density testing is adequate for the intended purpose and the tonnage estimation based on the bulk densities appear to have little bias.

b) Bulk densities are consistent with lithology and ore types estimated over a ±25-year mining history.

8 Sample preparation, analyses and security

8.1 Sample preparation and collection

8.1.1 For DD core

- A geologist is responsible for measuring, marking, logging and determination of sample positions. The geologist provides the sampler with the required sample depths ensuring that discrete lithologies are sampled separately where possible and sufficient sample is available for assay with a minimum 15 cm length for NQ diameter half core samples.
- A maximum of 25 cm to 30 cm half core samples are taken in ore zones. In the waste zones 30 cm – 50 cm half core samples are taken for 1 m above and below each ore zone. Prior to sampling, the core is cut in half along split lines using a diamond blade core saw. The split line connects all the low node points of the average apparent dip. The core is cut so that the blade passes through both split lines to produce two half cylinders of equal dimension.
- A sampler then tickets and bags the upper half of the split core for assay and completes the drillhole sampling record provided by the geologist, including information regarding the sample number, date submitted and batch number. QA/QC assurance samples are added to each batch submission to ensure that sufficient sampling process verification techniques are applied.
- The remaining half cores (reference cores) are returned to the core boxes for storage. The borehole sampling record is captured on the logging computer and then synchronised with the main database by the database administrator on completion of the ticketing and bagging, prior to despatch to the assay laboratory.
- All sampled half drill core is stored together with non-mineralised whole core in ultraviolet resistant plastic or aluminium core trays at the core storage facility on the mining lease area. All DD sample pulps are retrieved from the assay laboratory and stored at the core storage facility.

8.1.2 For RC chips

- Sampling during drilling and grade control is carried out on vertical 1 m composites with sampling starting in the hanging wall of the uppermost reef horizon and continuing below the footwall of the lowermost package.
- Sample delivered from the cyclone by the drill contractor is weighed before the material is tipped into the splitter. These weights are recorded on the logging tablet along with the state of the sample (dry or wet). The recoveries are monitored for each sample and the drilling is stopped if expected recoveries fall below 80 % on three consecutive samples.
- A single tier splitter is used to split the sample on a 50:50 basis. Both portions of the initial split are reloaded through the splitter to ensure sample homogenisation. The sample is then reduced in volume using the splitter, with the alternating reject portion being discarded at each pass until a representative sample split of 2-3 kg is obtained.
- The reject portion is bagged and stored in the field until the assay batch results have been received and accepted before being discarded. The other split is bagged and sent to the assay laboratory for analysis. In general, wet samples are only encountered when initially intersecting the water table (two to three metres).
- In the case of wet samples, the sample is allowed to settle and the sample bag is pierced at the top to prevent the samples from being washed out. After draining the water, the sample is tipped onto a clean plastic bag and thoroughly mixed. It is then flattened and sampled on a regular grid pattern.
- The RC assay pulps are stored at the assay laboratory's storage facility for a minimum period of three months. A small percentage of the RC pulps are retrieved for the purposes of blind resubmission.
- Before samples are sent to the laboratory, the samplers are required to label the plastic sample bags with a permanent, black/blue marker pen with unique identification numbers.
- A labelled ticket with the identification number is also stapled to the inside of each split sample bag.

The samples are then sent to the laboratory in a batch.

Sample Submission protocol:

- Generally, the Laboratory collects samples from the mine and transports these to their laboratory.
- A despatch sheet is prepared by the QA/QC person, which include the number of samples, the method of analysis required and the types of samples.
- A waybill is also prepared which is signed by either the QA/QC Manager or Chief Resource Geologist with a SOX stamp.
- The number of samples is confirmed by the Laboratory representative by signing on the sample sheet attached to the despatch sheet.
- Laboratory representatives are pre-registered in the Gold Fields Identification System.
- Samples are then handed over to the laboratory representative, who sends the samples, the despatch sheet and waybill to Protection Services for verification and signing.

8.2 Sample analysis

The primary laboratory used for both DD and RC drillhole sample analysis is SGS Tarkwa.

SGS is an independent ISO17025 accredited laboratory (certified by the South African National Accreditation System (SANAS). The conformance certificate is ISO 9001:2015. Process production samples are analysed at the mine site laboratory, with SGS used as an umpire laboratory.

Samples received at SGS Tarkwa are first sorted and any anomaly is reported together with the supplied documentation. The samples are subsequently dried to a maximum of 105 °C, crushed, split to the required weight and milled to 75 µm.

For samples analysed by fire assay (FA):

- 50 g sample aliquot is taken using mat rolling.
- Flux is added with appropriate proportion placed in crucibles.
- The crucibles are loaded into a furnace and melted at a temperature of 1,050 °C.
- The molten sample is then poured and allowed to cool to form a glass at the top and lead with the heavy minerals at the base.
- The glass is knocked off and the lead button placed in cupels for cupellation.
- After cupellation, the prill is digested initially with nitric acid followed by hydrochloric acid.
- The solution is made to an appropriate volume and analysed by Atomic Absorption Spectrometry (AAS).

8.2.1 For samples analysed by bottle roll leach:

- A 500 g sample is mixed with an equal proportion of water (500 mL).
- One tablet of cyanide is then placed in the solution and bottle rolled for four hours.
- The solution is allowed to settle and an appropriate volume (20 mL) of aliquot is taken. 4 mL of Di Iso Butyl Ketone (DIBK) is added to the solution and shaken vigorously for at least 30 seconds and analysed for gold by AAS.
- The grade of the original solid is calculated from the solid/solution ratio and the AAS reading.

The Qualified Person has reviewed the certificates and is of the opinion that the analytical laboratories are certificated and have effective process and protocol in place to ensure quality control and assurance and minimise any material errors.

8.3 Quality control and quality assurance (QA/QC)

To monitor QA/QC, Tarkwa has a comprehensive "Best Practice" QC system, comprising written procedures and monitoring by the Geology group, coupled with internal and external audits. The QA/QC procedures, audits, round-robin benchmarking, as well as the submission of blanks and standards are specified, and full documentation is kept on site at Tarkwa.

QC samples are submitted within laboratory batches allowing for monitoring of the drilling, sampling and laboratory sample preparation techniques as well as for analytical accuracy and precision. The different types of QC samples are summarised in Table 8.3.1.

Table 8.3.1: Quality control sample types

Sample description	QC stage	Comments
Field duplicate	Sample source and sampling in the field	Monitors the sampling process in the field
Laboratory duplicate	Sample Preparation at Milling Stage	Monitors the sampling of aliquot
Coarse crush duplicate	Sample Preparation after crushing, but before pulverised	Monitors the splitting of the splitting after crushing
Standard/blank	Fields	Monitors the accuracy of results and contamination
Pulp re-assay	Analytical	Checks the accuracy of results
Pulp umpire	Analytical (at the end of a program)	Checks the acceptability of the results compared to other labs

Source: Tarkwa CPR, 2022

The following protocols and checks are undertaken at Tarkwa:

- Six standards (including Certified Reference Material (CRM from Rock Lab) and field blanks) are inserted in every 50-sample batch.
- A duplicate sample is produced for 5 % of all samples taken (1 in 20), which involves the production of two samples from the same sample interval during initial sample collection at the drill site. This provides information on sample repeatability and sampling error.
- The laboratory produces a repeat sample for 2.5 % of all samples (1 in 40) from the initial coarse reject, to check for laboratory preparation errors.
- The laboratory produces a repeat sample for 5 % of all samples (1 in 20) from the initial pulp reject, to check for laboratory preparation errors.
- All samples with assay >=3.0 g/t Au are re-assayed to check that the gold is fully digested during the Rapid Cyanide Leach process, which is the same as the Bottle roll leach procedure, and the values are accurate. DD samples with assay >5 g/t Au are re-assayed for accuracy.
- Each batch of 50 assays includes one standard and one blank. Also, on average, two duplicates and two repeats are inserted.
- 5 % (1 in 20) sample pulps are blind and are re-assayed by SGS to check analytical precision.
- Pulp rejects of the samples sent to SGS are returned and 20 % of these are submitted to the umpire laboratory Intertek. The Laboratory Certified reference material is inserted by the laboratory for them to check the accuracy of their system.
- The QA/QC procedures, audits, round-robin benchmarking, as well as the submission of blanks and standards are specified, and full documentation is kept on site at Tarkwa.
- QA/QC reports are reviewed on weekly basis by the Chief Database Geologist and Geology Manager. Any issues highlighted by the reports are immediately brought to the attention of the Assay Laboratory Manager and Chief Chemist.

- It is expected that Field Duplicates return a bias equal or below 5 % and HARD of 20 % at the 90th percentile and when, these results are not met, it is brought to the attention of the field geologists and samplers so that they can intervene to improve the sampling process.
- It is expected that Lab Crusher Duplicates return a bias equal or below 5 % and HARD of 20 % at the 90th percentile and when, these results are not met, the lab's attention is brought to it for discussion and improvement.
- It is expected that Lab Pulp Repeats return a bias equal or below 5 % and HARD of 10 % at the 90th percentile and when, these results are not met, the lab's attention is brought to it for discussion and improvement.
- Standard results are plotted in a control chart with Upper and Lower Limits being ±3SD and every standard that falls out is re-assayed with 5 primary samples before and after the failed standard. Only a maximum of 5 % bias is allowed.
- Field pulp and coarse bank results are plotted in a control chart with Upper Limit being five times the lower detection limit, which is 0.01 ppm.

On a monthly basis, a laboratory audit is conducted by the Database Administrator and the Chief Database Geologist. Any issues are also discussed during these visits.

Tarkwa's borehole sampling protocol and QA/QC procedures are reviewed internally by the Gold Fields corporate technical services team during internal audits. They have also been reviewed by Agoratek International (D. Francois-Bongarcon) in 2000 and 2004, as well as during annual Mineral resource audits undertaken by Snowden and Optiro. The most recent external audit was conducted by Golder and Associates in December 2021. None of these audits highlighted any material issues of concern.

The Qualified person considers the sample preparation, sample analysis and quality control procedures and quality assurance actions to be adequate, conventional in methodology and representative of industry leading practice. All the procedures are appropriate to ensure the validity and integrity of the analytical results. The sample preparation and security procedures have been reviewed. The sample preparation is found to be adequate with effective supervision and in line with industry leading standards. No material bias is indicated that could potentially impact the sampling preparation and analysis. Sample security enforcement is reliable with low consequence if in the unlikely event of security protocols failure.

9 Data verification

The execution of both on mine and regional exploration programmes is completed in line with industry best practice and in accordance with standards and procedures developed by Tarkwa and Gold Fields over a number of years. The process comprises a combination of procedures, audits and sign-off documents for all key elements that input into the generation of a Mineral resource model to ensure full compliance. The key components of the geological data acquisition framework include:

- Validity – Controls to ensure the validity of key activities.
- Accuracy – Controls to establish the accuracy of data inputs and outputs.
- Completeness – Controls to ensure the completeness of the process followed.
- Timing – Preventative and detective controls to identify potential risk and deviation of quality.
- Segregation of duties/sign-off – key members of the senior team are responsible for different aspects of the process.

The Qualified person is of the opinion that the data verification process and protocols are adequate to minimise any material errors, are in line with industry leading standards and underpin the technical assurance and validity of the sampling results.

9.1 Data management

Data obtained from the drillholes is stored in electronic format using DataShed® software. LogChief® is used to capture RC and DD logging data in the field, which is then synchronised with DataShed®.

Before data can be accessed, a data access form is completed for approval by the Geology Manager. DataShed® uses ConfigManager that is used to manage access and protocols on the type of data being accessed.

Data validation checks during both data capture and synchronisation are completed using the master database libraries. LogChief®, which is used by geologists for data collection has validation tools that prevents erroneous data from being captured. Geologists export data to the database geologist for import. DataShed® also has validation tools to prevent erroneous data from being imported.

The database captures the following primary data elements:

- The collar positions of all RC and DD drillholes.
- Meta-data of drillholes are collected and imported.
- Downhole survey data.
- Geological (lithological, sedimentological and structural) logging data.
- Assay data.
- Apparent porosity measurements in DD drillholes.

It is a pre-requisite that all data are validated by the database administrator and the program geologists before data is imported into the database. Confirmation is also required that all data are validated prior to being imported into the final database tables. Only accepted results are used in for Mineral resource estimation. Any primary results failing the QA/QC standards are rejected, re-assayed and re-imported for approval by the program geologist.

Limited data are used from non-Tarkwa sources. Where such data is used it is acknowledged and identified in the appropriate reports. Standard practice is to convert this data to comply with Tarkwa standards and that the data validation and checks are completed prior to importing it into the database.

The Qualified person's opinion of the data management is:

- The data management process and protocols are adequate to minimise any material errors.
- Regular validation of the database and data management process is aligned with standard industry practices and is monitored through the SOX risk assessment control matrix criteria.

9.2 Plant Sampling

Daily composite samples of process plant feed and tailings streams are taken to assist with on-site gold accounting and reconciliation. These samples are collected using a combination of automatic sampling stations as well as manual cuts using appropriately designed samplers. Solid sample composites are analysed using fire assay with an AAS finish. Carbon sample composites are analysed using high temperature ashing, acid digest and an AAS finish. Solution sample composites are analysed using DIBK extraction and an AAS finish. All laboratory assaying procedures are aligned with industry standard practices.

In accordance with Gold Fields Plant Metal Accounting Standard, a gold in circuit survey is undertaken monthly to reconcile (by mass balance) the back-calculated gold grade of the mill feed with the mill feed grade estimates obtained using plant samples and assays. The monthly variance between the assayed grade and the back-calculated grade is monitored, and an investigation is required where this variance exceeds the minimum allowable thresholds as outlined in the Gold Fields Plant Metal Accounting Standard.

9.3 Drilling

All current and historical data is validated using SQL Queries and 3D software packages. Holes are checked to confirm they have the appropriate tagged nomenclature including Hole IDs (which are unique), DH Surveys, Depth and Prospect Area etc. Coordinates of drillholes are checked to verify the location captured is correct. Drillhole Start and End dates are also imported and validated.

The Qualified person is of the opinion that the drilling protocols described in this report are adequate to minimise material errors and provide the necessary technical assurance.

9.4 Sampling

The drillhole sample details are imported and validated with requisite checks that include:

- The sample ID, which is unique.
- Sample category.
- Sample Recovery.
- Sampler.
- Date sampled.
- QAQC samples inserted.

Core cutting sheets are generated, and once populated during the logging and sampling process, these are re-imported. Some data, such as core logging and underground development face sampling, is entered or edited manually into the database table forms or data entry objects. A unique sample dispatch is generated and emailed to the laboratory. Assays returned from the laboratory are linked to this dispatch and are emailed as a SIF file. These files include detailed information about the batch number, analytical methods, units used, detection limits and which elements were assayed. The file also includes all QC data in the sequence of analysis.

The Qualified person is of the opinion that the sampling protocols are adequate to minimise material errors and the analytical procedures reflect industry standard practice or better and are appropriate for resource estimation.

9.5 Survey

Downhole Survey details imported and validated include:

- The appropriate hole ID.
- The depth of the survey taken.
- The dip and dip direction.
- The instrument and method used.
- The instrument operator.

Additional drillhole validation is completed using Datamine® or Leapfrog® software. This validation checks for unique collar locations, overlapping intervals, excessive downhole deviation and matching total drill depth within all tables. Errors are reviewed and either corrected or flagged and excluded from use during estimation. All issues identified are corrected in the database.

The Qualified person is of the opinion that the survey protocols are adequate to minimise material errors.

9.6 Sample analysis

All assays are received from the Laboratory via email from the Laboratory. Each assay batch has dispatch numbers provided by the Database Geologist and the Job number provided by the Lab. As soon as assays are received, they are manually checked and then imported. DataShed® captures assay sample numbers and compare these with existing sample numbers that have already been imported. If the sample numbers are not in the database, an error report is generated. Section 8.3 provides a summary of the QA/QC sample protocols applied.

9.7 Geological modelling

The geological modelling is based on the exploration DD and grade control RC data. Pit mapping data, most commonly in the form of survey pick-ups of geological structures and reef boundary contacts, is incorporated into the structural interpretation. The orebodies at Tarkwa are cut by numerous predominantly reverse faults, which generally run perpendicular to the strike and are predominantly reverse faults. Initially, zoning and structural interpretation is carried out using borehole sections extracted from the drillhole database is carried out prior to modelling of the individual reef horizons at Tarkwa (using Surpac and Leapfrog software). 3D wireframe planes of the structural discontinuities (faults) are constructed during the structural interpretation and all new drillholes are zoned. Several igneous intrusions crosscut the mineralised reef units, which can cause areas to be sterilised. Major igneous intrusions are also modelled as 3D wireframes and these are used to cut the initial reef wireframes to ensure ore is removed from the sterilised areas.

One of two processes is then used for modelling each individual reef horizon within the orebody. In the first process, each reef is modelled as a series of 3D footwall and hanging wall surface section strings. This is done using the results from the available drilling. These are then projected past the modelled structural wireframe surfaces and are then linked to create closed wireframes. Alternatively, each reef is modelled as a 3D wireframe based on interpolation of the reef thickness. The first stage is to create a footwall triangulation surface, using the intersection point in each borehole and projecting the surface past modelled discontinuities. The vertical thickness ("VT") of the reef is then calculated for each borehole and this variable is interpolated into a 25 x 25 m grid using an inverse distance squared (ID^2) sample weighting. The interpolated VT value is added to the elevation attribute of the footwall triangulation surface to create a series of 25 m by 25 m spaced points. These are then triangulated to create a physical hanging wall surface. The surface is then checked to determine whether the borehole intersection points have been honoured. Hanging wall and footwall surface boundary strings are then used to close the footwall and hanging wall surfaces and create a 3D wireframe model.

The 3D wireframes produced by either method are then cut on the structural discontinuities (fault reef intersections) and igneous intrusions to prevent duplication or potential over-estimation of reef volumes.

The first method described takes longer to complete but produces more reliable results in structurally complex areas. Both methods can produce practical, technically sound wireframes that honour the geological geometry and currently both methods are considered appropriate. Recently, Leapfrog software has been introduced to speed up the wireframing process in the less structurally complex areas. The geological model produced is audited internally by peer review and externally by the Corporate Technical Services team.

The Qualified person's opinion of the geological modelling is:

- The geological modelling protocols are adequate to minimise material errors.
- The controls have been reviewed and considered adequate and reasonable and material bias or errors are not expected.
- The systems to reduce human and procedural errors, checks and balances are adequate and minimise the potential for any material errors.
- The protocols are adequate as reviewed and the Mineral resource models are based on sound, verified data and the resource models generated and provided to the planning engineers are deemed industry leading practice and appropriate for mine planning and scheduling.

10 Mineral processing and metallurgical testing

10.1 Testing and procedures

10.1.1 Background

The predominant gold ores contributing to the Tarkwa life of mine Mineral reserve comprise material in order of decreasing contribution Akontansi pit, Teberebie pit and the South Heap Leach (SHL) tailings material. Relatively minor contributions to the plant feed over the life of mine come from low-grade surface stockpiles, Kottraverchy pit, Kobada pit and Pepe/Mantraim pit.

Oxide ores within the main Tarkwa pits that were historically treated using heap leaching have since been depleted, and all remaining ore is fresh. The heap leaching facility is closed, and only the milling/CIL circuit remains operational.

From a metallurgical response perspective, the Tarkwa Mineral reserves are considered as being grouped into three different types (Main Tarkwa pits, Kobada and the SHL tailings), with each described in the following sections.

Akontansi, Teberebie, Kottraverchy and Pepe/Mantraim pits (Main Tarkwa pits) and low-grade surface stockpiles

Geologically, the Tarkwa orebodies typically consist of a series of planar meta-sedimentary palaeoplacer deposits broadly similar to those mined in the Witwatersrand Basin of South Africa but with magnetite being the dominant heavy mineral at Tarkwa as opposed to pyrite within the Witwatersrand deposits.

Mineralisation and gold deportment of the reefs are consistent throughout the all the main Tarkwa open pits (Akontansi, Teberebie, Kottraverchy and Pepe/Mantraim).

The predominant gangue minerals are quartzite (83-90 wt%), muscovite (6-12 wt%) and kaolinite (1-3 wt%). Sulphur exists in very minor quantities and is associated with quartz veining in the Pepe North and the Pepe West Limb areas, most of which is already mined out. The sulphide concentration in the fresh ore is relatively low.

The Tarkwa milling/CIL plant has been processing fresh ores from the main Tarkwa pits for many years, with relatively low variability in throughput and consistently high metallurgical recoveries (approximately 97 % since commissioning of the new gravity circuit late in 2018). This is typical when treating such large scale palaeoplacer deposits.

The existing low-grade stockpiles represent an accumulation of lower grade material mined from the main Tarkwa pits over several years.

More recent metallurgical testwork associated with these main Tarkwa pits is limited to the recently defined Ulap Extension cutback, which is a north-eastern extension of the Akontansi pit. This testwork program is discussed in the following sections.

Plant performance expectations (volume throughput, metal recovery and costs) to process the remaining fresh ores from the main Tarkwa pits are therefore based on recent historical actual plant performance and related empirical data.

Kobada pit

The Kobada project is situated approximately 2.5 km south of Akontansi pit and 2.7 km south-west of the Pepe/Mantraim and Teberebie pits. With respect to geology, Kobada is a structurally controlled deposit, which formed at the contact zone between the Banket Footwall and the Kawere Sandstone, that developed during late stage of deformation. Gold emplacement was constrained within a bedding parallel micro-diorite that experienced an incremental introduction of hydrothermal fluids. The micro-diorite hosted gold mineralisation that is located below a conglomeratic stratigraphic marker horizon and it is characterised by the presence of quartz-tourmaline veins, sulphides, silicification and sericitisation.

Due to the significant geological and mineralisation differences between the ores associated with the Kobada hydrothermal deposit and the main Tarkwa palaeoplacer deposits, a dedicated metallurgical testwork program was undertaken, to better estimate plant performance whilst processing the mined Kobada ores. This testwork program is discussed in the following sections.

South Heap Leach Tailings

The South Heap Leach (SHL) tailings contributed approximately 60 Mt at a grade of 0.40 g/t to the end-2022 reserve at Tarkwa. This material is heap leached crushed ore (i.e., tailings), with size distribution of approximately 80 % passing 9 mm, remaining after the closure of the leaching pads. The original ore source for the heap leach material was the main Tarkwa pits.

Due to the prior recovery of gold associated with the original heap leach operation, a dedicated sampling and metallurgical testwork program was carried out on these tailings, to better estimate plant performance whilst reclaiming and processing this material through the CIL plant. A discussion of this testwork program is included in the following sections.

Importantly, based on the current planning parameters and cost assumptions, the option to re-process the SHL material at the end of the LOM plan continues to show a positive net realisable value (NRV) confirming economic viability. Notably, the SHL cutoff grade does not exceed the current in situ cutoff grade for the pits. In addition, the SHL volume has been surveyed to confirm the total tonnage to be processed.

The Qualified person is of the opinion that there has been no known or documented alteration of the material through weathering that necessitates any further metallurgical testwork to confirm gold content.

10.1.2 Akontansi Pit Underlap Extension (Ulap) 2019 Testwork

In 2019, eight core samples from the proposed Ulap orebody extension were submitted under commercial terms to the University of Mines and Technology in Tarkwa for metallurgical testwork.

The testwork program included the following:

- Head analysis, including multi-elemental scan and quantified x-ray diffraction (QXRD) analyses.
- Comminution characteristics - rock SG, Bond BWI (Ball Work Index) and SMC SAG milling parameters.
- Gravity (Knelson followed by mercury amalgamation) / cyanide leaching (direct leach) of gravity tails.

The samples were selected from diamond drill core in order to obtain single continuous mineralised intercepts (including expected internal and external ore dilution) from a known single spatial location representing single geological domains and lithologies.

The relevant results are summarised in Section 10.2.

10.1.3 Kobada Project 2016 Testwork

In 2016 six core samples from the Kobada project area were submitted to the University of Mines and Technology in Tarkwa for metallurgical testwork.

The testwork program included the following:

- Head analysis, including multi-elemental scan and quantified x-ray diffraction (QXRD) analyses.
- Comminution characteristics - rock SG, Bond BWI (Ball Work Index) and SMC SAG milling parameters.
- Gravity (Knelson followed by mercury amalgamation) / cyanide leaching (direct leach) of gravity tails.
- Acid mine drainage (AMD) analysis, being Total S, Acid Neutralisation Capacity (ANC), Net Acid Generation (NAG), Total Acid Production Potential (TAPP), Net Acid Production Potential (NAPP), Net Acid Generation (NAG) and pH.

The samples were selected from diamond drill core to obtain single continuous mineralised intercepts (including expected internal and external ore dilution) from a known single spatial location representing single geological domains and lithologies.

The relevant results are summarised in Section 10.2.

10.1.4 South Heap Leach Tailings 2012 Testwork

In 2012 ninety-two (92) drill sample composites from the South Heap Leach facility were submitted to the University of Mines and Technology in Tarkwa for bottle roll metallurgical testwork.

The testwork program included the following:

- Head analysis.
- 106 µm P_{80} grind, followed by cyanide leaching (direct leach).
- Size-by-size analysis.

The relevant results are summarised in Section 10.2.

10.2 Relevant results

The following sections summarise key results from the Ulap (2019), Kobada (2016) and SHL (2012) Tarkwa University of Mines and Technology testwork programs, and describes the approaches taken to estimate recoveries and mill throughputs for the LOM plan.

10.2.1 Ulap

Table 10.2.1 provides a summary of the key species assays of the metallurgical samples used for the Ulap study. Some observations of the data in Table 10.2.1 suggest that the organic carbon concentration is slightly enriched in general for Ulap, with copper (Cu) and silver (Ag) enriched in the A-Fresh and H-Fresh samples.

Table 10.2.2 shows a summary of hardness test results for the Ulap area samples. The SAG and Ball work index results are reasonably consistent with hardness test results undertaken on the Tarkwa plant feed samples (June 2016).

Table 10.2.1: Ulap metallurgical samples head analyses – key species

Sample name	Total sulphur (%)	Sulphide sulphur (%)	Total carbon (%)	Organic carbon (%)	Inorganic carbon (%)	Ag (ppm)	Cu (ppm)	As (ppm)	Sb (ppm)	Pb (ppm)	Hg (ppm)	Cd (ppm)
A-Oxide. Trans	<0.05	<0.01	0.18	0.18	<0.01	<1	9.8	3	<3	4	<1	<0.3
A-Fresh	0.05	<0.01	0.15	0.13	<0.01	40	4200	<2	<3	5	<1	0.3
B-Fresh	<0.05	<0.01	0.14	0.13	<0.01	<1	5.5	<2	<3	3	<1	<0.3
C-Fresh	<0.05	<0.01	0.16	0.16	<0.01	<1	6.1	<2	<3	4	<1	0.3
E-Fresh	<0.05	0.01	0.23	0.20	0.03	<1	25	<2	<3	1	<1	<0.3
F-Fresh	<0.05	0.01	0.15	0.18	0.02	<1	20	<2	<3	3	<1	<0.3
G-Fresh	<0.05	<0.01	0.24	0.23	0.02	<1	6.6	<2	<3	3	<1	<0.3
H-Fresh	0.07	0.04	0.17	0.16	<0.01	700	9900	<2	<3	6	<1	0.4

Source: Tarkwa CPR, 2022

Table 10.2.2: Ulap metallurgical samples hardness test results

Sample IDs	Rock SG (t/m^3)	Drop weight index (Axb)	SAG Work Index, Mia (kWh/t)	Bond Ball Work Index (kWh/t)
A-Oxide. Trans	2.66	79.5	11.3	13.1
A-Fresh	2.68	37.9	20.6	15.2
B-Fresh	2.67	76.3	11.6	12.1
C-Fresh	2.68	57.6	14.6	13.1
E-Fresh	2.67	52.5	15.6	14.2
F-Fresh	2.67	58.5	14.4	14.5
G-Fresh	2.68	57.6	14.6	13.4
H-Fresh	2.68	64.8	13.3	14.5
Average	2.68	61.2	14.0	13.6

Source: Tarkwa CPR, 2022

Table 10.2.3 provides a summary of the gravity/leach test results for the Ulap samples, with grind size P_{80} of 106 µm. The test results returned recoveries between 95.1 % to 98.1 %, which is reasonably consistent with the Tarkwa plant's historical performance when processing ores from the Tarkwa main pits.

Table 10.2.3: Ulap metallurgical samples gravity/leach test results

Sample	Calculated head grade (Au g/t)	Gravity recovery (%)	Final tails grade (Au g/t)	Overall recovery (%)	Lime (kg/t)	Cyanide (kg/t)
A-Oxide. Trans	2.50	50.9	0.07	97.2	0.75	0.35
A-Fresh	1.63	51.0	0.08	95.1	0.45	0.15
B-Fresh	1.30	35.5	0.04	96.9	0.63	0.26
C-Fresh	2.57	57.6	0.05	98.1	0.50	0.14
E-Fresh	2.22	30.1	0.06	97.3	0.55	0.18
F-Fresh	2.65	50.2	0.08	97.0	0.56	0.16
G-Fresh	1.57	28.8	0.06	96.2	0.54	0.28
H-Fresh	1.08	56.5	0.04	96.3	0.55	0.21

Source: Tarkwa CPR, 2022

Leach recoveries are high, despite the presence of some organic carbon in the samples in the absence of activated carbon. The cyanide consumption for samples A-Fresh and H-Fresh is relatively low, despite the high concentrations of copper in the samples. This indicates that the copper is not significantly reacting with the added cyanide during leaching.

In summary, the metallurgical testwork for the Ulap samples has returned results that are reasonably consistent with the recent historical Tarkwa plant feed characteristics and performance. As such, it is recommended that the processing assumptions adopted for Ulap ores for the end-2022 reserves are the same as those used for ore from the main Tarkwa pit.

10.2.2 Kobada

Table 10.2.4 provides a summary of the key species assays of the metallurgical samples used for the Kobada study. The samples (which were jointly selected by geological and metallurgical representatives) were composited from diamond drill core to obtain single continuous mineralised intercepts, including expected internal and external ore dilution, from a known single spatial location, and where possible representing single geological domains and lithologies.

Table 10.2.4: Kobada metallurgical samples head analyses – key species

Sample name	Total sulphur (%)	Sulphide sulphur (%)	Total carbon (%)	Organic carbon (%)	Inorganic carbon (%)	Ag (ppm)	Cu (ppm)	As (ppm)	Sb (ppm)	Pb (ppm)	Hg (ppm)	Cd (ppm)
GDKD058	0.32	0.28	1.95	0.13	6.85	<1	53	310	<3	8	<1	<0.3
GDKD059	0.57	0.47	2.14	0.06	10.4	<1	55	1600	3	10	<1	0.6
GDKD060	0.58	0.52	2.03	0.05	9.9	<1	38	320	<3	8	<1	<0.3
GDKD061	0.38	0.14	1.85	0.07	8.9	<1	49	82	<3	7	<1	<0.3
GDKD065	0.51	0.24	2.06	0.11	9.75	<1	59	38	3	9	<1	<0.3
GDKD066	0.42	0.33	1.92	0.11	9.05	<1	53	64	<3	8	<1	<0.3

Source: Tarkwa CPR, 2022

Some observations of the data in Table 10.2.4 suggest that the organic carbon concentration is slightly elevated at Kobada, with elevated arsenic (As) in the samples from GDKD059, GDKD060 and GDKD061. All Kobada samples are significantly enriched in inorganic carbon (i.e., carbonates).

A summary of hardness test results for the Kobada samples is presented in Table 10.2.5 the bond ball work index results are generally slightly softer than typical fresh Tarkwa pit ores and hardness test results undertaken on the Tarkwa plant feed samples (June 2016).

Table 10.2.5: Kobada metallurgical samples hardness test results

Sample name	Rock SG (t/m³)	Bond Ball Work Index (kWh/t)
GDKD058	2.65	12.7
GDKD059	2.63	12.7
GDKD060	2.63	12.6
GDKD061	2.65	10.7
GDKD065	2.64	12.0
GDKD066	2.62	11.9
Average	2.64	12.1

Source: Tarkwa CPR, 2022

Table 10.2.6 provides a summary of the gravity/leach test results for the Kobada samples, with grind size P_{80} of 106 µm. No gravity recovery step was included in the testing procedure, as the Tarkwa plant was not equipped with a gravity circuit at the time that the study was undertaken. The Tarkwa plant is now equipped with a gravity circuit.

The testwork results returned recoveries between 84.2 % to 94.0 %, which is lower than the Tarkwa plant's historical performance while processing ores from the Tarkwa main pits. This is anticipated based on the significant geological and mineralisation differences between Kobada and the main Tarkwa pits.

Table 10.2.6: Kobada metallurgical samples gravity/leach test results

Sample name	Calculated head grade (Au g/t)	Final tails grade (Au g/t)	Overall recovery (%)	Lime (kg/t)	Cyanide (kg/t)
GDKD058	3.16	0.19	94.0	1.17	0.32
GDKD059	2.02	0.32	84.2	1.25	0.37
GDKD060	2.88	0.18	93.8	1.17	0.34
GDKD061	4.66	0.31	93.3	1.02	0.35
GDKD065	0.85	0.08	90.5	1.31	0.40
GDKD066	2.18	0.19	91.3	1.13	0.34
Average	2.63	0.21	91.9	1.18	0.35

Source: Tarkwa CPR, 2022

Given the significant geological differences encountered at Kobada coupled with the lower recoveries from the testwork undertaken, a dedicated recovery estimation model was developed for reserve cutoff grade calculations and plant production forecasting using the testwork results:

- Kobada recovery = (Au – 0.1089 * Au^0.6761-0.01) / Au * 100
- Where, Au=gold head grade (g/t)

10.2.3 Maximum recovery estimation model is constrained to 94.0 %, being the highest test result obtained from the testwork. South Heap Leach

Cyanide leaching testwork was undertaken on ninety-two (92) drill composite samples by the Tarkwa University of Mines and Technology in 2012. These were collected from a combination of air core and RC drilling at the South Heap Leach facility.

After grinding the heap leach tailings samples to 80 % passing (P_{80}) 106 µm, leaching extraction results ranged from 80 % to 100 %, with an average of 92.6 %.

Financial assessments and mill feed scheduling for the life of mine Mineral reserve, assumes that an average recovery of 90 % is achieved for the South Heap Leach facility material.

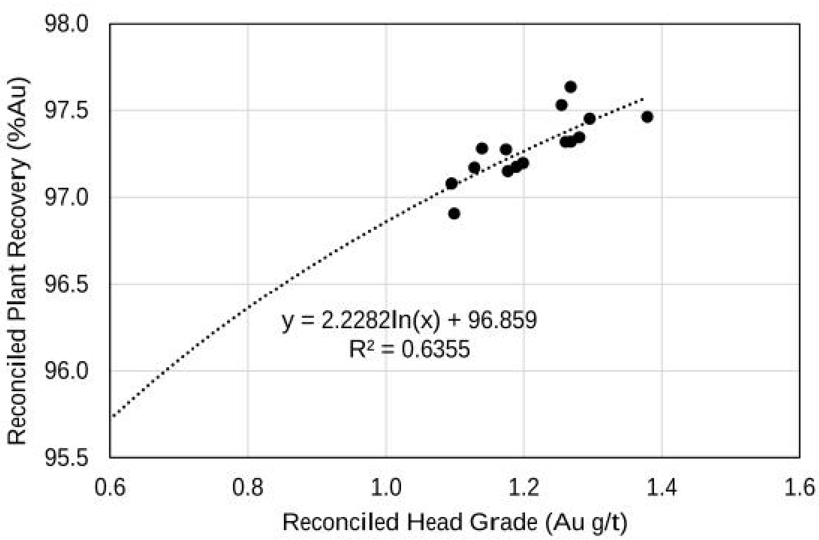
The mill throughput rate estimated and scheduled for processing the South Heap Leach facility material is 14.5 Mt per annum, which is slightly higher than that adopted for treating ores from the main Tarkwa Pits. The higher throughput is assumed to be achievable based on the relatively fine crush size distribution of the material to be fed (P_{80} of approximately 8 mm), coupled with the potential to slightly coarsen the milled product grind size distribution, due to the relatively low head grade of the material.

10.2.4 Main Tarkwa Pits

The metallurgical characteristics of the main Tarkwa open pits (Akontansi, Teberebie, Kottraverchy and Pepe/Mantraim) for the life of mine plan are assumed based upon recent actual plant performance results.

The gold recovery estimation relationship is based upon a natural logarithm model fit to the monthly reconciled plant results from October 2018 through to December 2019, shown in Figure 10.2.1. Plant results prior to October 2018 were not used in the analysis as the plant was upgraded at that time with the installation of a new gravity recovery circuit (Knelson concentrators and Acacia Reactor).

Figure 10.2.1: Tarkwa monthly plant recovery model fit chart



Source: Tarkwa CPR, 2022

For comparison purposes, the plant recovery achieved in 2021 was 97.1 % with a head grade of 1.21 g/t, and for 2022 a plant recovery of 97.0 % with a head grade of 1.20 g/t was achieved.

The mill throughput estimate for scheduling the processing of ores mined from the main Tarkwa pits is 14 Mt per annum. This is based on recent plant performance, with 13.9 Mt processed in 2021, and 14.0 Mt processed in 2022. The slightly higher productivity level and increased volume throughput was achieved (i.e., compared to 13.7 Mt processed in 2019) through targeted debottlenecking upgrades to the CIL intertank screens and mill discharge and tailings pumps undertaken over the past three years, together with the installation of the new gravity circuit.

Figure 10.2.1 shows the Tarkwa plant recovery model chart for plant recovery plotted against head grade clearly showing the relationship.

10.3 Plant sampling and reconciliation

Plant feed tonnage is measured via weigh scales (weightometers) on the mill feed conveyors. Plant feed is sampled for moisture determination only. Leach feed and residue samples are taken automatically using two stage automatic samplers. In certain cases, hand cut samples are collected. Shift composites are accumulated and prepared in accordance with site-specific procedures.

The analytical laboratory for carrying out the process plant sample analysis is situated on the mine site. Management of the onsite laboratory is contracted out to SGS who are ISO 14001 compliant. The samples undergo preparation and analysis by slurry pressure filtration (to separate the solids and solution), solids oven drying, splitting, pulverisation, weighing, aqua regia digestion, DIBK extraction and AAS reading.

Laboratory QA/QC checks are carried out at the SGS laboratory in Tarkwa, Ghana.

In accordance with the Gold Fields Plant Metal Accounting Standard, a gold in circuit inventory is undertaken monthly to reconcile (by mass balance) the back-calculated gold grade of the mill feed with the mill feed grade estimates obtained using daily plant samples and assays. The monthly variance between the assayed grade and the back-calculated grade is monitored, and an investigation is initiated if this variance exceeds the minimum allowable levels (thresholds) outlined in the Gold Fields Plant Metal Accounting Standard.

10.4 Deleterious elements

The testwork procedures include elemental and mineralogical analysis for elements that could be deleterious to plant recovery (e.g., arsenic, tellurium, antimony, organic carbon).

The Tarkwa and Kobada pit metallurgical samples tested contain some levels of organic matter (carbon), with concentrations ranging from 0.05 % to 0.23 % (refer to Table 10.2.1 and Table 10.2.4). The levels are relatively low compared to other (non-Gold Fields) known problematic preg-robbing ores, and based on the testwork results, the activity of the natural carbon at Tarkwa appears to be relatively low. The Tarkwa and Kobada pit metallurgical recovery tests were undertaken as direct cyanidation leaching tests (not carbon-in-leach) therefore providing potentially conservative recoveries in the presence of active organic matter.

Three of the Kobada metallurgical samples contained arsenic at concentrations greater than 100 ppm. Sample GKD059 had the highest arsenic grade of 1,600 ppm and had the lowest gold leach recovery of 84.2 %.

There is no known high density multi-elemental assay data for the Tarkwa deposits or Kobada, so it is not possible to develop a geological distribution model for species other than gold.

10.5 Metallurgical Risks

In the opinion of the Qualified person, the combination of a well-established processing plant with a known operating history of treating ores mined from the associated mining leases, together with the recent metallurgical testwork undertaken to assess core samples selected from future local mineralisation areas (as outlined in the previous report sections), provides a reasonable basis for estimating the associated metallurgical and processing modifying factors underpinning the Tarkwa Mineral reserves.

However, the reader should be aware that some uncertainty remains that could introduce risk. These are discussed in detail in the following sections.

10.5.1 Sample Representativity

Metallurgical sample selection is an important aspect of the process of converting Mineral resources into reserves. The results of the testwork undertaken on those samples are often directly used as inputs into plant performance estimates used for LOM and reserve financial evaluations. Therefore, it is important that the selected metallurgical samples are representative and that they cover a suitable range of gold head grades. The samples must also consider the various geological lithologies and domains expected to be encountered, and they must appropriately incorporate any anticipated internal and external material dilution expected during the mining process. Individually testing different head grades ranges and geological domains improves the ability to gauge the metallurgical response to expected variability within the orebody. This allows for better judgements and estimates to be made on how the material to be processed will perform in the processing plant.

As new potentially economic mineralised areas are identified at the mine, the site's exploration geologists and metallurgists will select several representative core composite samples for each new mineralisation area and submit these to a commercial metallurgical laboratory for a defined testwork programme including, head assays, recovery and physical property analyses.

While care is taken with the sample selection process, there are practical constraints to samples numbers due to core availability and the costs of testwork. Based on this it is not possible for the Qualified person to guarantee that the proposed reserves have been fully representatively sampled, and therefore some inherent uncertainty will remain.

The recovery estimation models used for Mineral reserve determination at Tarkwa were developed based upon both recent past plant performance and metallurgical testwork results, as discussed in this report chapter.

10.5.2 Laboratory Test Methods and Scale-up

The laboratory test results require scale-up to estimate performance through the industrial processing facility. In the case of Tarkwa Mineral reserves for the main open pits, the assumed plant parameters are based upon recent historical plant performance, while the recovery predictions for the South Heap Leach facility material and Kobada pit are based upon results obtained from the metallurgical testing.

The metallurgical testing regime adopted has been specifically tailored to provide results that reasonably and practically represent the actual installed processing facility. This regime has been developed from experience gained over many years of undertaking such work at several Gold Fields operations, culminating in eventual mining, and processing of ores that have been historically metallurgically tested.

There is potential risk associated with the delivery of these metallurgical testing results. This is a result of differences between laboratory methods and full-scale processes, and miscellaneous unidentified errors associated with the testing procedures.

The selected laboratory (Tarkwa University of Mines and Technology, Ghana) that has undertaken the metallurgical testwork is not certified by any standards association, but is well regarded by the Qualified person and has an established history of performing well for Gold Fields both at Tarkwa and elsewhere. Furthermore, samples analysed by the Tarkwa University of Mines and Technology are used to characterise processing parameters and are not incorporated into any geological or grade models produced for Tarkwa. The University is local to the mine, and support of local facilities is important in maintaining good relationships with the community.

Despite reasonable efforts and care in the application of laboratory testwork scale-up factors and determination of recovery estimation modelling methods from historical plant results, there remains some inherent uncertainty in predictions of future actual performance of the industrial facility.

10.5.3 Deleterious Elements

The routine metallurgical testwork programs include detailed head analysis (multi-element ICP-MS scan) and mineralogical analyses to check for the presence and quantities of potential deleterious elements to the plant, such as mercury, arsenic, organic carbon, antimony, tellurium, base metals, etc.

Whilst this assessment is carried out on the limited number of metallurgical composite samples, it is not typically undertaken on individual exploration samples.

The multi-elemental assay results obtained from the metallurgical samples are used as a guide to identify if there are any deleterious elements at high enough concentrations that would be of reasonable concern and that could materially impact plant performance. If such a species is identified then the option to submit a larger number of individual exploration samples for detailed analysis, to better quantify and locate the deleterious species, is readily available.

However, given the relatively low number of metallurgical samples checked for deleterious elements, it means that some inherent risk remains to unexpectedly encounter such a species during subsequent mining and processing operations, despite such elements not being identified during metallurgical testing.

11 Mineral resource estimates

Tarkwa's Mineral resources undergo an initial assessment through the application of a range of assumed technical and economic factors to ensure reasonable prospects for economic extraction. The open pit Mineral resource is constrained to an optimal pit shell defined by a Mineral resource gold price of $1,600/oz and relevant unit costs and modifying factors. The in-situ cutoff grade has modifying factors applied and all material within the pit shell above the calculated cutoff grade is judged to meet the requirement of having reasonable prospects for economic extraction. The point of reference for the Mineral resources is over a mining width, with dilution applied to the selection of the optimised pit shell. The grades and tonnages are reported in-situ and undiluted and Mineral resources are 90 % attributable to Gold Fields.

11.1 Mineral resource estimation criteria

11.1.1 Geological model and interpretation

Geological modelling is initially based on the exploration DD data and forms the basis of the Mineral resource estimate. However, where closer spaced RC drilling has been carried out for grade control purposes, the assay results and drill logs from the RC data are combined with the DD data. In-pit mapping data, most commonly in the form of survey pickups of geological structures and reef boundary contacts, is incorporated into the structural interpretation.

Conglomerate horizons that host the gold mineralisation can be visually identified and they are sampled to an accuracy of a few centimetres in DD holes. Reef thickness estimates are accurate in DD holes and accurate to within approximately 1 m in RC holes. Logging of RC holes is performed on 1 m composite samples.

The orebodies at Tarkwa are cut by numerous predominantly reverse faults, which generally run perpendicular to strike and are predominantly reverse faults. Initially, structural interpretations using sections extracted from the drillhole database is carried out prior to the modelling of the individual reef horizons. 3D wireframe planes of the structural discontinuities (faults) are constructed during the structural interpretation.

Several igneous intrusions cut the orebodies. These can cause areas to be sterilised for mining. The major intrusions are identified during exploration and subsequent infill RC drilling and are modelled as 3D wireframes.

One of two processes is used for modelling each individual reef horizon within the orebody:

- In the first process, each reef is modelled as a series of 3D hanging wall and foot wall surface section strings using the results from the available drilling. These are projected past the modelled structural wireframe surfaces and are linked to create closed wireframes.
- Each reef is modelled as a 3D wireframe based on interpolation of the reef thickness. The first stage is to create a footwall surface by triangulation using reef intersection points in each drillhole and projecting the modelled surface beyond discontinuities. The vertical thickness of the reef is then calculated for each drillhole and this variable is interpolated into a 25 m x 25 m grid using an ID^2 sample weighting. The interpolated vertical thickness value is added to the elevation attribute of the foot wall triangulation surface to create a series of 25 m x 25 m spaced points. These are then triangulated to create a physical hanging wall surface. The surface is checked to ensure that all the borehole intersection points have been honoured. Hanging wall and foot wall surface boundary strings are used to close the footwall and hanging wall surfaces and create a 3D wireframe model.

The 3D wireframes produced by either method are cut on the structural discontinuities and igneous intrusions to prevent duplication or overestimation of reef volumes. The first method described above produces more reliable results in structurally complex areas but takes longer to complete. Both methods can produce auditable wireframes and both methods are currently applied as appropriate.

An additional aspect to the resource estimation process is the modelling of specific sedimentological domains within individual stratigraphic units. The domaining procedure uses several sedimentological and grade distribution characteristics to define the domain boundaries of each reef.

The 3D geological wireframes for each reef are used to constrain the block model and obtain an estimate of the reef volume. Cross sections showing current topography, DD and RC drillholes with wireframe interpretations are documented during preparation for internal and external review audits. These documents are stored with the wireframes and block model data in electronic format.

With regards to the interpretations, several factors are noted by the Qualified person:

- Minor intrusions do occur which are not picked up during initial exploration drilling at 100 m spacing. However, these are usually identified during subsequent closer spaced grade control drilling. The inclusion of grade control drilling in the modelling process has led to changes in the position of certain stratigraphic units in some areas when compared to the initial model based on wide spaced (100 m – 200 m) exploration drilling. This is largely due to the presence of small-scale structures.
- In rare instances, these changes can manifest as changes in the elevation of the individual reefs by up to 20 m due to revised interpretations adjacent to complex structures. This will influence the stripping ratio in the immediate area and therefore affect the pit optimisation. Reconciliations to date have shown that this has translated to overall gains in ore tonnage. The reasons for tonnage gains are:
  - un-modelled strike changes between the DD model and the combined RC/DD model; and/or
  - the overestimation of volume caused by the 1 m sample intervals used in the sampling of the RC drillholes compared to the precision achieved when the ore is mined during production.

The exploration drilling does not accurately define the location and shape of the orebody on a local (grade control) scale. However, the grade control drilling appears to adequately confirm local changes and depending on the pit currently runs approximately 6 to 9 months ahead of mining. This enables the modellers to adjust the model in a timely manner to accommodate for changes to the geological model between exploration and grade control for incorporation into the annual mine planning process.

11.1.2 Block modelling

3D block models of the in-situ mineralisation are constructed based on the geological interpretations. Separate block models are prepared for each deposit: Pepe-Mantraim-Teberebie, Akontansi, Kottraverchy and Kobada. The block models utilise sub-celling to ensure that the block model volume closely represents the volume of the wireframe model. At the end of the modelling process, the volume is depleted to account for mined out volumes. The block models are essentially a set of specifically sized "3D blocks" that represent a discretised (approximated) in-situ mineralised orebody that is generated by filling a geologically interpreted wireframe model.

The block size used for each model is 50 m x 50 m x 3 m. The block models utilise proportions to ensure the block model volume closely represents the volume of the wireframe model. At the end of the modelling process, the volume is depleted to account for already mined out material.

11.1.3 Bulk density

The weathering profile, hence, porosity of the ore, varies from surface due to fluctuations in groundwater levels which generally vary from 1 m to 40 m. Faulting, fracturing and primary lithological permeabilities modify the depth to porosity relationship. Individual core samples taken at 50 cm intervals are composited per reef zone and a manual method of contouring the different porosity values (P Codes) is used per reef. These contours are then used as constraints for estimating the P Code values into the block models per reef. The specific gravity and dissolution factors are assigned directly from the P code values. Specific gravity ranges from 2.37-2.69 t/m³ and dissolution ranges from 44-87 %. The models reconcile well with surveyed tonnages and heap leach recoveries.

Stockpiled ore is assigned a specific gravity of 2.0 t/m³.

Unmineralised, waste material below the weathering surface is assigned a specific gravity of 2.65 t/m³. This interface between weathered and fresh material typically sits 20 to 30 m below surface. Lower values of 2.3 t/m³ to 1.6 t/m³ are assigned to material above the weathered/fresh interface surface.

All the values are based on historical field measurements and they are periodically validated. All dilution skins assume the specific gravity of the mineralised zone.

11.1.4 Compositing and domaining

One metre gold grade composites are produced from the reef hanging wall intersection. The compositing process is optimised to ensure that minimal data is excluded by allowing composite lengths to vary.

Statistical studies are most meaningful when dealing with data from geologically homogenous populations. To assign data effectively to the various spatially defined geological populations, Sedimentological studies of the detailed stratigraphy within potential reef units have led to the recognition of both vertical and lateral facies variations. The data shows variations in both grade and thickness along the palaeoflow direction (strike) of the orebody. Full reef compositing for grade and thickness is done for each individual reef horizon. A combination of these two attributes is also computed to obtain the accumulation. Changes in gold accumulation, gold grade and reef thickness along the flow direction are further used to delineate geologically homogeneous local facies or geozones. These geozones or domains are used to constrain the statistical and geostatistical analyses on a soft boundary domaining basis. The hard domain boundaries are relaxed by 50 metres into the adjacent domains to form the soft domain boundaries.

11.1.5 Top cuts

Top cuts are used to control grade outliers during estimation. Grades above a selected threshold are capped to a selected threshold, therefore retaining the high-grade nature locally whilst constraining the influence of the outlier on the estimation. Top cuts are determined per domain through analysis of probability plots, histograms and by reviewing the samples at the top end of the grade distribution. Descriptive statistics are applied to develop an understanding of the statistical characteristics and sample population distribution relationships. Histograms and probability plots (to evaluate the normality and lognormality of the distribution) are used to establish an understanding of the statistical relationships within each reef domain. In most cases, the number of high-grade values is less than 2 % of the population and these are "top cut" for the purpose of appropriate and realistic semi-variogram modelling and evaluation.

- Akontansi top cuts range from 2.5 g/t to 18 g/t
- Pepe, Atuabo, Mantraim, Teberebie, Awunaben (PAMTA) top cuts range from 2.5 g/t to 30 g/t

Table 11.1.1: Summary of Mineral resource estimation parameters

Mineral resource	Search distances [1]	Min, Max samples	Parent cell sizes (X, Y, Z)	Domains	Estimator	Sample types	Composite length	Top cuts [2]
A1	174	25,50	50 x 50 x 3	1	SK	DD/RC	1 m	999
	128	25,50	50 x 50 x 3	2	SK	DD/RC	1 m	30
	170	25,50	50 x 50 x 3	3	SK	DD/RC	1 m	12
	124	25,50	50 x 50 x 3	4	SK	DD/RC	1 m	12
	124	25,50	50 x 50 x 3	5	SK	DD/RC	1 m	12
A3	167	30,60	50 x 50 x 3	1	SK	DD/RC	1 m	15
	148	30,60	50 x 50 x 3	2	SK	DD/RC	1 m	10
	169	30,60	50 x 50 x 3	3	SK	DD/RC	1 m	11
	169	30,60	50 x 50 x 3	4	SK	DD/RC	1 m	9
AFc	152	20,40	50 x 50 x 3	1	SK	DD/RC	1 m	999
	153	20,40	50 x 50 x 3	2	SK	DD/RC	1 m	999
	151	20,40	50 x 50 x 3	3	SK	DD/RC	1 m	999
	164	20,40	50 x 50 x 3	4	SK	DD/RC	1 m	13
	137	20,40	50 x 50 x 3	5	SK	DD/RC	1 m	18
	137	20,40	50 x 50 x 3	6	SK	DD/RC	1 m	18
AFc[1]	114	20,40	50 x 50 x 3	1	SK	DD/RC	1 m	999
AFc[3]	152	20,40	50 x 50 x 3	1	SK	DD/RC	1 m	25

Mineral resource	Search distances [1]	Min, Max samples	Parent cell sizes (X, Y, Z)	Domains	Estimator	Sample types	Composite length	Top cuts [2]
C	136	20,40	50 x 50 x 3	1	SK	DD/RC	1 m	999
	175	20,40	50 x 50 x 3	2	SK	DD/RC	1 m	7
	175	20,40	50 x 50 x 3	3	SK	DD/RC	1 m	999
CDE	133	35,60	50 x 50 x 3	1	SK	DD/RC	1 m	13
E	184	20,40	50 x 50 x 3	1	SK	DD/RC	1 m	2.5
	136	20,40	50 x 50 x 3	2	SK	DD/RC	1 m	6
G	150	35/6	50 x 50 x 3	1	SK	DD/RC	1 m	999
	148	35/60	50 x 50 x 3	2	SK	DD/RC	1 m	11

Notes:

1. Based on variogram model and reef orientation, varies by domain/reef. The search distances for only the primary reef are shown in the table.
2. Based on statistical analysis by domain/reef, varies by domain/reef. The range of top cuts is shown in the table.
3. SK refers to the Simple kriging technique which is finally used which is further post-processed to obtain recoverable Mineral resources for pit optimisation. The ordinary kriging technique (OK) is also run for further checks
4. 999 in the table represents areas where no top cuts are applied

Source: Tarkwa CPR, 2022

11.1.6 Variography

A variogram is a description of the spatial continuity of the data. The estimation methods employed at Tarkwa rely on the properties of the variograms and therefore this is an important aspect of the estimation process. Variogram studies are carried out on composited data for individual domains. The variogram analysis is used to evaluate the spatial continuity of the mineralisation and to create a three-dimensional 3D model of how grades change with distance. The analysis of the variography is used to determine the search parameters in the grade estimation process.

Variogram studies are carried out on composited data for individual domains. A search region or ellipse is defined based on observed directional grade continuity and is usually oriented in agreement with geological observations. Surpac software is used to model the ellipse angles for variogram modelling using the ZXYLLL Datamine angles of rotation axes.

The parameters used for both the downhole and planar variograms are setup in tables in the Minesoft RES database. Historically, two-structure anisotropic variograms have been modelled in all areas at Tarkwa, with the major axis direction defined by the palaeo directions or by secondary reworking of reef horizons during episodes of uplift (often perpendicular to the palaeoflow directions).

The first structure in the variograms is associated with the local channelling within the braided river system during conglomerate deposition (15 m – 60 m). The long-range structures may be up to 500 m in the more channelised reefs but generally range from 200 m – 400 m. During anisotropy determination, all angles are checked, and the final ellipse angles are rechecked once the major direction for variogram modelling has been selected. The search angles for the major reefs ranges from 10 to 160 and they are listed in Table 11.1.2 below.

Table 11.1.2: Tarkwa Open Pit search parameters

Deposit	DOM	Angle	Dip	Plunge	Range 1	Range 2
A	11	150	8	28	151	300
	21	150	8	20	151	300
	31	150	9	16	151	300
	41	160	5	15	202	399
	51	160	5	11	153	311
	61	160	5	13	136	232
	71	130	6	9	249	494

	81	130	5	12	249	494
	91	130	8	17	249	494
C	11	10	1	-13	162	271
	21	20	9	-10	162	271
	31	20	7	-10	184	365
	41	10	9	-11	178	325

Source: Tarkwa CPR, 2022

The Qualified person's opinion is that the variographies are practical reflection of the spatial continuity of the respective mineralization grades and their application to the geostatistical analysis is adequate to minimize uncertainty and to derive appropriate resource block models for use by the planning engineers to complete both mine design and production scheduling.

11.1.7 Grade estimation

Grade is estimated using the Gold Fields Minesoft RES system. Gold grade is interpolated into 50 m x 50 m x 3 m blocks using simple kriging (SK) and ordinary kriging (OK) to generate the panel estimation grade models

A minimum of 20 composites are used for estimation, which may increase depending on reef thicknesses. If the number of composites used to estimate a block is insufficient, the zone mean for the geological-grade domain is used for SK. The boundary of the domain is treated as a hard boundary for calculation of the local mean. Search parameters are based on the individual semi-variograms produced for each reef in each of the domains. A dip-domain model is created for each domain based on the strike and dip of the triangulation surfaces of a particular reef model within the domain. The dip model is used to correct apparent thickness to true thickness when performing dilution calculations in the block model. No corrections for true thickness are made in the primary database.

Kriging is carried out using all available data (both RC and DD composites) within the search radius. However, the algorithm treats the domain boundary as a soft boundary and for blocks near the edge of the domain, the search can include composites within a 50 m skin of the adjoining domain (i.e., a soft boundary). This reduces the edge effect and any conditional bias for blocks around the edge of the domain.

The SK panel grades are used for post-processing of the recoverable resources used for mine planning and Mineral resource reporting. SK estimates produce higher kriging efficiencies for the panel estimates in most relevant areas of the operation, and especially in areas of limited data. Post processing using an Indirect Localised Conditioning method for seven cutoffs ranging from 0.5 g/t - 2.0 g/t Au is carried out for the calculation of recoverable resources using selective mining unit (SMU) size of 10 m x 5 m x 3 m. The SMU size is based on an assumption of a 25 m x 25 m grade control drill spacing and a lognormal grade distribution (the original 50 m x 50 m x 3 m panel estimates are run based on untransformed data).

For the purposes of resource reporting, a tonnage factor of +10 % is applied to that portion of the resource that is informed by DD drillholes only, with a minimum DD spacing of 100 m x 100 m. A factor is also applied to the proportion of waste to account for the increased tonnage of ore within the block (i.e., the waste tonnage is reduced to maintain total tonnage within the block). A tonnage factor of -5 % is applied to the portions of the model informed by a combination of DD and RC drillholes. These tonnages factors are based on historical production reconciliations.

11.1.8 Selective mining units

The selective mining unit (SMU) size (i.e., the smallest volume of material on which ore / waste classification is determined and is defined according to practical mining selectivity based on a combination of mine design and the mining equipment configuration) of 10 m x 5 m x 3 m is selected in consideration of the mining equipment, mining method and mining selectivity, together with the geology of the orebody as well as the size at which reliable kriging estimates can be produced based on and an assumed RC grade control drilling grid of 25 m x 25 m.

11.1.9 Model validation

Visual inspection and documented model reconciliation reviews/reporting are the main validation procedures employed. This includes a review of sections and plans where models are checked for proper coding of drillhole intervals and block model cells. Interpolated grades are examined relative to drillhole composite values.

The Minesoft RES® software produces audit trail log reports at each stage of the modelling process to validate that the process has run correctly. The log file reports include krige model average outputs, including average raw data versus average krige values, minimum and maximum values and SK versus OK values.

Additional checks are performed on the krige block models to ensure that grades are correctly assigned to the model cells, including:

- Viewing the composite drillhole data with the block model cells to check that the grade values in the drillholes correspond to block model cell values.
- The number of samples used in the estimation, kriging efficiencies, regression slopes, block distance from samples and search values.
- Comparative statistics
- Global bias and local trends in the estimate
- Swath plots

Recent reconciliation performance at Tarkwa is summarised in Table 11.1.3 below:

Table 11.1.3: Tarkwa Mineral resource reconciliation

	Grade control model GCM			Resource model (RM)			GCM vs. RM		
	Tonnes	Grade	Ounces	Tonnes	Grade	Ounces	Tonnes	Grade	Ounces
2021 Q4	3,544,692	1.31	149,766	3,545,587	1.30	148,565	100 %	101 %	101 %
2022 Q1	3,282,486	1.14	122,897	3,360,255	1.15	124,354	98 %	101 %	99 %
2022 Q2	3,043,261	1.11	108,960	3,218,000	1.12	115,974	95 %	99 %	94 %
2022 Q3	3,986,798	1.25	159,812	3,856,024	1.27	157,556	103 %	98 %	101 %
Total	13,857,238	1.22	541,435	13,979,866	1.22	546,450	99 %	100 %	99 %

Source: Tarkwa CPR, 2022

11.1.10 Cutoff grades

Cutoff grades are influenced by the operating strategy, modifying factors, design and scheduling and certain costs including the ore / waste cost differential. These are calculated annually in alignment with the Gold Fields cutoff grade guidelines.

The cutoff grades for the open pit Mineral resources by deposit are summarised in Table 11.1.4.

Table 11.1.4: Tarkwa open pit resource cutoff grades

Open pits	Resource cutoff (g/t Au) RoM	Resource mining recovery (%)	Resource mining dilution (cm)[1]
Akontansi	0.34	94.6	30/20
Pepe_Mantraim	0.34	94.6	30/20
Teberebie	0.34	94.6	30/20
Kottraverchy	0.34	94.7	30/20
Kobada	0.43	83.3	30/20

Notes:

1. Dilution is 30 cm within hanging wall and 20 cm from the footwall.

Source: Tarkwa CPR, 2022

The open pit resources are constrained to an optimal shell defined by a resource price of $1,600/oz, and relevant unit costs and modifying factors. Optimisation of the resource pit shell carried out using Geovia Whittle software. The cutoff grade is calculated for the material within the pit shell using the following formula:

$$\frac{[\text{Ore Premium Mining Costs (\$/t)} + \text{Process Costs (\$/t)} + \text{Site G\&A Costs (\$/t)}]}{[\text{Price x (100 \% - Ad valorem Royalty Rate)} - \text{All product related costs] x PRF x MCF x 0.03215075}}$$

Where:

- Ore Premium Mining Costs cover adjustments in ore haulage distances and differences in ore and waste drill and blast costs. All other mining costs are accounted for during the pit shell generation phase.
- Process Costs including sustaining capital.
- Site G&A Costs including off-site general and administration (G&A) costs directly related to site (e.g., accounting or payroll services).
- Price is the gold price per ounce ($1,600/oz).
- The ad valorem Royalty Rate is 4 %.
- All product related costs include management fees, refining costs and contributions to the Gold Fields Foundation per ounce.
- PRF is the plant recovery factor or metallurgical recovery as a percentage estimated at a grade close to the cutoff grade.
- MCF is the mine call factor or the percentage of actual mill produced metal against the claim of metal produced.
- 0.03215075 is the ratio of troy ounces per gram.
- Mining dilution and mining recovery is used to get the cutoff grades from 'run-of-mine' (ROM) to in-situ. In-situ is the point of reference for Mineral resources

All material within the pit shells is generated using the calculated cutoff grade and is judged to have reasonable prospects for economic extraction. The Mineral resource is declared at an in-situ grade and tonnage within an optimum, diluted pit shell (i.e., dilution is applied during the pit optimisation process but the undiluted tonnes and grade of the in-situ mineralisation are reported). The parameters are the same for the Mineral Reserve (Section 12.2) with exception of the gold price which is set at $1,400/oz for reserves.

Gold Fields conducts an annual review of metal prices for Mineral resources and Mineral reserves reporting to monitor any significant changes that would warrant re-calibration of the price deck for strategic and business planning purposes. This review takes into account prevailing economic, commodity price and exchange rate trends, together with market consensus forecasts and Gold Fields' strategy and expectations for the mine operations.

The Mineral resources and Mineral reserves gold prices have been selected and justified by the Qualified person at $1,600 per troy ounce (oz) for resource and $1,400 per troy ounce (oz) for reserves (LOM planning and reserves techno-economic modelling). This metal price deck has also been reviewed and endorsed by the Company executive team. For more information on the rationale applied to deriving the Mineral resource and Mineral reserve metal price deck refer to Chapter 16.

The selected resource gold price of $1,600/oz is at a circa 14 % premium to the reserve price with the differential being in general alignment with Gold Fields standard practice for setting the Mineral resource. The 14 % premium on resources is to provide useful information on the sites resource potential at higher gold prices and to indicate possible future site infrastructure, permitting, licencing, mining footprint and tailings and waste storage requirements. This information is important to determine the reasonable prospects of economic extraction for the Mineral resource.

11.1.11 Reasonable prospects of economic extraction

The Qualified person has concluded that reasonable prospects for economic extraction have been demonstrated through the application of an appropriate level of consideration of the potential viability of the Mineral resources. These considerations include a reasoned assessment of the geological, engineering (including mining and processing parameters), metallurgical, legal, infrastructural, environmental, marketing, socio-political and economic assumptions which, in the opinion of the Qualified Person, are likely to influence the prospect of economic extraction.

Although all permitting may not be finalised for some Mineral resources, there is no reason to expect that these permits will not be granted based on existing processes and protocols.

11.1.12 Classification criteria

Tarkwa's in-situ Mineral resources are classified as either measured, indicated or inferred in accordance with the definitions in SK 1300. Only measured and indicated Mineral resources are modified to generate Mineral reserves.

Increasing levels of geoscientific knowledge and confidence are generally based on geological understanding, grade continuity, drillhole/sample spacing, sample data quality, estimation quality, physical characteristics, mining development (i.e., amount of exposed and mapped mineralisation) and mining history.

Classification at Tarkwa is based on drillhole density, and geological confidence of both structural and geological domains. Kriging efficiencies, regression slopes and 90 % confidence limits of the mean estimate are also considered during resource classification. Although kriging efficiencies and confidence limits provide reasonable guidelines for resource classification, geological confidence remains the guiding principle in the classification process. Geological confidence in the geological model is based on commonly accepted geological interpretation practices for the Tarkwa palaeoplacer stratabound orebody. In general, the following criteria are used as a guide to definition of resource classification.

- Measured Mineral resource: Up to 25 m x 25 m RC drill spacing and/or 100 m x 100 m DD drill spacing, but also depending on geological and grade continuity. 25 m x 25 m RC drilling is always undertaken before mining commences.
- Indicated Mineral resource: Maximum DD drill spacing of 200 m on strike and 100 m on dip, but also depending on geological and grade continuity.
- Inferred Mineral resource: Maximum drill spacing of 400 m on strike and 200 m on dip, but also depending on geological and grade continuity.

Surface sources are comprised of lower grade ore stockpiles. Tarkwa calculates and reports that stockpiles are managed and monitored as mining occurs. The surface sources are supported by adequate sampling, survey and end of month reconciliation and they are therefore classified as measured Mineral resources.

The Mineral resource classification criteria by resource area are summarised in Table 11.1.5.

Table 11.1.5: Tarkwa Mineral resource classification criteria by area

Mineral resource	Mineral resource category	Nominal drillhole grid spacing range length (m) x width (m)	Geological setting
PAMTA	Inferred	400 x 200	Palaeoplacer
	Indicated	200 x 100	
	Measured	25 x 25 to 100 x 100	
Kottraverchy	Inferred	100 x 200	Palaeoplacer
	Indicated	100 x 100	
	Measured	25 x 25 to 100 x 100	
Akontansi	Inferred	400 x 200	Palaeoplacer
	Indicated	200 x 100	

	Measured	25 x 25 to 100 x 100	
Kobada	Inferred	40 x 40	Hydrothermal
	Indicated	40 x 20	
	Measured	10 x 10	

Notes:

a) Geological considerations include mineralisation continuity and grade.

b) Resource classification is based on geological continuity, grade continuity, drillhole/sample spacing, sample data quality, estimation quality, mining development (amount of exposed and mapped mineralisation) and mining history. The Measured category also requires adjacent face sampling and mapping.

c) PAMTA refers to Pepe, Atuabo, Mantraim, Teberebie, Awunaben areas

Source: Tarkwa CPR, 2022

Stockpile tonnages are based on survey measurement and grade estimates are based on trucking records and sample grades collected during the mine life and are therefore considered sufficiently accurate to be classified as measured Mineral resources. Active pit stockpiles are surveyed every month and necessary adjustments are made for end of month reporting. Run-of-mine (ROM) stockpile tonnages are reconciled to survey volumes every quarter.

The Qualified person is of the opinion that:

a) Inferred Mineral resources have at least an even chance of converting to indicated Mineral resources through continued exploration, additional empirical data and evolving geoscientific modelling.

b) The Mineral resource demonstrates reasonable prospects for economic extraction over the indicated study time frame

c) Routine mine reconciliation monitoring and reporting, as a minimum on a quarterly basis utilising the Group's Mine Reconciliation Reporting standard, provides empirical data to endorse the classification criteria applied

d) The Mineral resource gold price of $1,600/oz is at a circa 14 % premium to the reserve price with the differential being in general alignment with Gold Fields standard practice for setting the Mineral resources. The 14 % premium is to provide information on Tarkwa's resource potential at higher gold prices and to indicate possible future site infrastructure, permitting, licensing, SLO, mining footprint and infrastructure requirements.

The Qualified person's opinion is that, whilst effort and care are taken with the resource estimation and classification processes, increase in geological knowledge and available data will reduce the level of uncertainty, and therefore some inherent uncertainty will remain.

11.2 Mineral resources as of 31 December 2022

The Tarkwa Mineral resources exclusive of Mineral reserves as at 31 December 2022 are summarised in Table 11.2.1. The Mineral resources are stated at 90 % attributable to Gold Fields and are net of production depletion up to 31 December 2022. The point of reference for the Mineral resources is in-situ with dilution applied.

Table 11.2.1: Tarkwa - summary of gold Mineral resources at the end of the fiscal year ended 31 December 2022 based on a gold price of $1,600/oz

	Resources (exclusive of Mineral reserves)			Cutoff grades	Metallurgical recovery
	Amount/	Grade	Amount		
	(kt)	Au/ (g/t Au)	Au/ (koz Au)	(g/t Au)	(%)
Open pit Mineral resources					
OP measured Mineral resources	9,535	1.5	453	0.34 - 0.43	89.5 - 97
OP indicated Mineral resources	51,763	1.3	2,240	0.34 - 0.43	89.5 - 97
OP measured + indicated Mineral resources	61,298	1.4	2,692	0.34 - 0.43	89.5 - 97
OP inferred Mineral resources	5,425	1.5	255	0.34 - 0.43	89.5 - 97
Stockpile Mineral resources					
SP measured Mineral resources	80	0.3	1	0.34	90
SP indicated Mineral resources					
SP measured + indicated Mineral resources	80	0.3	1	0.34	90
SP inferred Mineral resources					
Total Tarkwa Mineral Resources					
Total measured Mineral resources 2022	9,615	1.5	453		
Total indicated Mineral resources 2022	51,763	1.3	2,240		
Total measured + indicated Mineral resources 2022	61,378	1.4	2,693		
Total inferred Mineral resources 2022	5,425	1.5	255		
Total measured + indicated Mineral resources 2021	68,932	1.4	3,054		
Total Inferred Mineral resources 2021	6,904	1.5	322		
Total measured + indicated Year on year difference (%)	-11 %	-1 %	-12 %		
Total Inferred Year on year difference (%)	-21 %	1 %	-21 %		

Notes:

a) Mineral resources are exclusive of Mineral Reserves. Rounding of figures may result in minor computational discrepancies.

b) Mineral resources categories are assigned with consideration given to geological complexity, grade variance, drillhole intersection spacing and proximity of mining development. See Section 11.1.12 for more information.

c) Quoted as diluted in-situ metric tonnes and grades. Metallurgical recovery factors have not been applied to the Mineral resource estimates. The approximate range metallurgical recovery factor is 89.5 % to 97 % for open pit feed. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product recovered from ore treated at the process plant to its total specific mineral content before treatment. Tarkwa mining operations vary according to the mix of the source material (e.g., oxide, transitional, fresh and ore type blend).

d) The gold metal price used for the 2022 Mineral resources are based on a gold price of $1,600 per ounce. Open pit Mineral resource shells for Ghanaian operations are similarly based on revenue factor 1 pits unless otherwise stated. The gold price used for Mineral resources is approximately 14 % higher than the selected Mineral reserve price. The gold price used for Mineral resources is detailed in more clarity in Chapter 16 Marketing.

e) The cutoff grade may vary per open pit mine, depending on the respective costs, depletion schedule, ore type, expected mining dilution and expected mining recovery. The average or range of cutoff grade values applied to the Mineral resources are: Tarkwa 0.34 g/t to 0.43 g/t Au mill feed (open pit). The cutoff grade for the spent ore heap leach is estimated at 0.32 g/t to 0.42 g/t.

f) The Mineral resources are based on initial assessments at the resource price of $1,600/oz and consider estimates of all Tarkwa costs, the impact of modifying factors such as mining dilution and mining recovery, processing recovery and royalties. Mineral resources are taken through the application of Environmental, Social and Governance (ESG) criteria to demonstrate reasonable prospects for economic extraction.

g) The Mineral resources are estimated at a point in time and can be affected by changes in the gold price, US Dollar currency exchange rates, permitting, legislation, costs and operating parameters.

h) Tarkwa is 90 % attributable to Gold Fields.

Source: Tarkwa CPR, 2022

The Mineral resources are based on initial assessments at the resource price of $1,600/oz and consider estimates of all Tarkwa costs, the impact of modifying factors such as mining dilution and recovery, processing recovery and royalties to demonstrate reasonable prospects for economic extraction.

11.3 Audits and reviews

The Tarkwa Mineral resource was completed by site personnel and the estimate was subject to internal review and scrutiny by the relevant Qualified Persons and regional technical and financial disciplines, and peer reviewed for technical assurance and compliance in reporting by Gold Fields' Corporate Technical Services (CTS), Sustainable Development and Head Office Finance teams.

External Mineral resource and Reserve audits are performed on a rolling minimum three-year cycle. An external review of the Mineral resources was completed in January 2022 by an independent and external auditor, Golder, who deemed the estimate compliant with prevailing reporting Codes with no material issues flagged.

The Mineral resource estimate is underpinned by appropriate Mineral resource management processes and protocols to ensure requisite corporate governance in respect of the intent of the Sarbanes-Oxley Act of 2002 (SOX). Technical and operating procedures that have been developed on site are designed to be compliant with the SOX framework as adopted by the Gold Fields' Mineral resource Management, resource and reserve estimation, reporting and auditing.

The Company uses K2Fly RCubed® propriety software in combination with SharePoint to ensure accuracy, governance and auditability in the reporting of Mineral resources and Mineral reserves.

11.4 Comparison with 31 December 2021 against 31 December 2022 Mineral resource

The net difference in attributable measured and indicated Mineral resources between 31 December 2021 and 31 December 2022 is 361 koz gold or -12 %. The corresponding changes for inferred Mineral resources are -67 koz gold or -21 %. See Table 11.2.1

There is no change due to mined depletion for exclusive Mineral Resources. Resource addition of (2 %) due to Exploration drilling and conversion. Economic factors of (-4 %) due to mining cost increase. Resource interpretation and modelling resulted in (-3 %). Resource conversion to reserve also resulted in (-7 %).

12 Mineral reserve estimates

12.1 Level of assessment

Tarkwa's Mineral reserves are that portion of the Mineral resources which have been demonstrated through appropriately detailed and engineered annual life of mine planning processes to be technically and economically viable and justified for extraction.

Tarkwa's Mineral reserves are that portion of the Mineral resources which, as technical and economic studies have demonstrated and with the support of annualised life of mine planning, scheduling and costing, can justify economically viable extraction.

The Mineral reserves are based on appropriately detailed and engineered life of mine plans and are supported by relevant studies completed to a minimum pre-feasibility study level. The life of mine plan is based on measured and indicated Mineral resources converted through the application of appropriate modifying factors to derive Mineral reserves estimates.

A pre-feasibility study has an estimated accuracy for operating and capital costs of ±25 % with a contingency of no more than 15 %.

All mine designs and scheduling are undertaken by experienced mining engineers using appropriate mine planning software and incorporates relevant modifying factors, cutoff grades and the results from other techno-economic investigations.

Mining rates, fleet productivities, operational and plant capacities and constraints are accounted for in the plan and are typically based on historical performance trends. All geotechnical protocols and constraints are accounted for in the plan, including the provision for suitable mining geometries, mining losses, mining recovery and dilution. The point of reference for the Mineral reserves is ore delivered to the processing facility, also known as the run-of-mine or ROM.

Provision is also made for sufficient waste rock and tailings storage with plans in place to meet the life of mine requirements. The Company's mine closure plans comply with in-country legal requirements and are approved by the regulator. Integrated mine closure plans provide appropriate cost parameters for operational and life of mine planning as well as end of life mine closure commitments.

The Qualified person's opinion of the Mineral reserve estimates is:

a) The modifying factors are based on recent mining and processing extraction history and performance and are reasonable and appropriate to derive the reserves from the resources and minimise any estimation errors. The modifying factors are aligned with leading industry technical practice, for example, blended process recovery is used in the reserve estimate.

b) Tarkwa has grown its Mineral reserves net of depletion over the past three reporting cycles, however in this cycle (2022) reserves have decreased, largely due to mining depletion and increased mining costs. Infrastructure, environmental, permitting, closure, utilities and baseline studies are all aligned to support continued Mineral reserves growth. Tarkwa's study pipeline is proactive and maintains a focus on progressing all key work integral to supporting ongoing life of mine extensions to avoid any potential production delays. For example, a study has been completed to extend tailings disposal capacity.

c) The indicated and measured Mineral resources are sufficient in terms of geoscientific confidence to complete final life of mine designs. However, it is usual to complete a final phase of infill drilling to determine a high confidence 'mine defined' resource supported by detailed geoscientific information prior to detailed production scheduling.

d) The reported Mineral reserve is at a 'point in time' or snapshot of the life of mine plan as at 31 December 2022. It is supported by technically valid and economically viable mine designs and schedules. The techno-economic work does not exceed the estimated error of ±25 % and or require more than 15 % contingency for both operating and capital costs.

e) Environmental compliance and permitting requirements have been assessed in detail, with supporting baseline studies and relevant preliminary internal impact assessments completed. Detailed tailings disposal, waste disposal, reclamation and mine closure plans are incorporated into the life of mine plan.

f) The life of mine plan, in total, is completed to a minimum pre-feasibility level of study, although certain components of the plan have been completed to a feasibility level of study.

12.2 Mineral reserve estimation criteria

12.2.1 Recent mine performance

The recent performance of the Tarkwa mine is summarised in Table 12.2.1.

Table 12.2.1: Tarkwa - recent operating statistics

	Units	2022	2021	2020
Total mined	kt	87,631	88,904	92,523
Waste mined	kt	73,585	77,027	77,494
Ore mined	kt	14,046	11,877	15,029
Mined grade	g/t Au	1.21	1.40	1.23
Strip ratio (tonnes)	waste:ore	5.2	6.5	5.2
Tonnes treated	kt	14,016	14,234	13,749
Head grade	g/t Au	1.21	1.19	1.20
Yield	g/t Au	1.18	1.15	1.17
Plant recovery factor	%	97.1	97.1	97.3
Total gold production	koz Au	532	526	519
	kg Au	16,534	16,370	15,977
Gold price received	$/oz	1,806	1,763	1,385
Operating cost	$/oz	771	564	608
Total cash cost	$/oz	764	647	640
Capital expenditure	$ million	229	147	126
	$/oz	431	280	242
All in sustaining cost (AISC)	$/oz	1,248	1,017	958
Total Employees Costed (TEC)	number	4,458	4,322	4,457

Notes:

a) The operating statistics are based on annual fiscal year measurements.

Source: Tarkwa CPR, 2022

12.2.2 Key assumptions and parameters

Diluted planning resource block models are used by the planning engineers for optimisation, mine design and production scheduling. No additional dilution or ore loss is applied in the optimisation process since they are included in the modifying factors which are applied to the diluted planning resource. Assumptions for the application of modifying factors include their application per structural domain, lithology type, mineralisation style, mining method and metallurgical response type etc.

The assumptions and parameters considered in the Mineral Reserve estimate are summarised in Table 12.2.2 and have been derived from historical performance.

Table 12.2.2: Tarkwa – summary of material modifying factors

	Units	2022	2021	2020
Gold price	$/oz	1,400	1,300	1,200
Dilution skin above reef	cm and g/t Au	30 cm and 0.15 g/t Au	30 cm and 0.15 g/t Au	30 cm and 0.15 g/t Au
Dilution skin below reef	cm and g/t Au	20 cm and 0.15 g/t Au	20 cm and 0.15 g/t Au	20 cm and 0.15 g/t Au
Tonnage factor	%	-5 % for RC & DD informed areas, +10 % for DD informed areas	-5 % for RC & DD informed areas, +10 % for DD informed areas	-5 % for RC & DD informed areas, +10 % for DD informed areas
Grade Factor	%	No grade factors are used i.e., 100 % for RC & DD informed areas, 100 % for DD informed areas	No grade factors are used i.e., 100 % for RC & DD informed areas, 100 % for DD informed areas	No grade factors are used i.e., 100 % for RC & DD informed areas, 100 % for DD informed areas
Mining recovery - open pits	%	100	100	100
Mine call factor	%	97	97	97
Plant recovery fresh ore	%	See Figure 12.2.1	See Figure 12.2.1	97.2
Plant recovery oxide ore	%	97.2	97.2	97.2
Processing throughput per year	Mt per annum	14.0	14.0	13.9
Pit wall batter angles - Oxides	degrees	45-55	45-55	45-55
Pit wall batter angles - Fresh	degrees	75-90	75-90	75-90
Bench Height	m	12-18	12-18	12-18

Notes:

a) The 2022 fiscal modifying factors are valid as at 31 December 2022.

b) The cutoff grades are the lowest grade of mineralised rock which determines as to whether it is economic to recover its gold content by further concentration, calculated as per the Gold Fields cutoff grade guidance on methodology and protocol; see Section 11.1.10 for more information on cutoff grade calculation methodology.

c) The metal prices selected have increased $100 between the last two annual Mineral reserve and Mineral resource estimates

d) Relevant modifying factors are reported in ranges and vary based on the open pit being considered and estimated unit costs for depth mined and distance hauled.

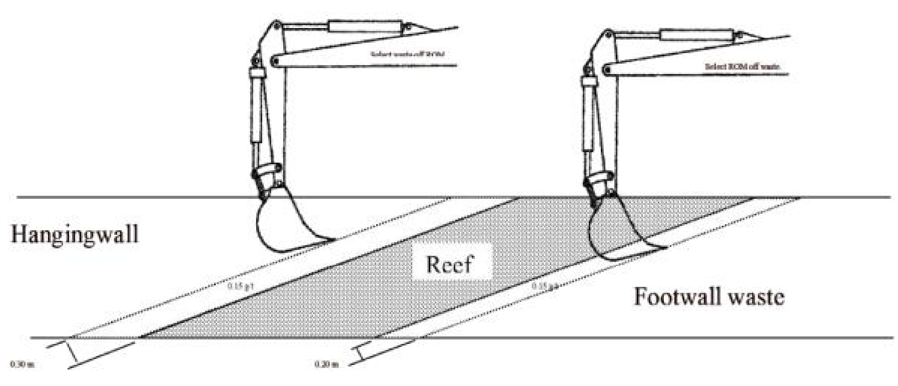
e) Geotechnical and hydrogeological factors are discussed in Chapter 13.

f) Details of the forecast operating and capital expenditures are provided in Chapter 18.

Source: Tarkwa CPR, 2022

Mining dilution is applied to all resource models; hence, additional dilution factors are not applied in the Whittle optimisation. Figure 12.2.1 illustrates the 30 cm and 20 cm dilution skins applied to the hanging wall and the footwall contacts, respectively. The sum of 50 cm dilution skin is applied to the resource at an average grade of 0.15 g/t. This has proven to be a realistic and reliable modifier applied over many years.

Figure 12.2.1: Illustration of dilution skins applied to reef zones



Source: Tarkwa CPR, 2022

Operating expenditures comprise:

- Cash Cost Components: these include direct mining costs, direct processing costs, direct G&A (general and administration) costs, consulting fees, management fees, transportation and realisation charges.
- Total Cash Costs: these include additional components such as royalties (excluding taxes where appropriate).
- Total Working Costs: these include terminal separation liabilities, reclamation and mine closure costs (the net difference between the total environmental liability and the current trust fund provision) but exclude the salvage value on closure and non-cash items such as depreciation and amortisation.
- Total Costs: these include total working costs plus net movement in working capital plus capital expenditure.
- Major Capital Projects: In addition to long-term capital projects, the life of mine capital expenditure programs generally include detail based on approved expenditure programs.

Mining costs are based on unit rates for the preceding 6 to 12 months actual snapshot, applied to the planned physicals, with alignment to the key cost centres that drive the operating costs.

Processing costs include tailings and waste disposal costs, as well as the cost of maintaining key on-mine infrastructure.

G&A costs are largely based on the required and necessary technical and administrative support services required to sustain current and future mining production. In most instances these are assigned with fixed and variable cost components per tonne of ore within both the reserve estimation and corresponding financial models. Corporate costs are assigned as variable with ounces sold in the financial model.

Capital expenditure estimates beyond the next two years are based on pre-feasibility estimates for infrastructure and development requirements for individual projects, and unit-rate average historical costs where applicable. A pre-feasibility study has an estimated accuracy for operating and capital costs of ± 25 % with a contingency of no more than 15 %.

The terminal benefits liabilities are not included in overhead costs as per Company policy and directives. Rehabilitation and appropriate mine closure costs are included following completion of mining.

Details of the forecast operating and capital expenditures are provided in Chapter 18.

12.2.3 Gold Price

As disclosed in Chapter 11.1.10 and in Chapter 16.1, Gold Fields conducts an annual review of metal prices for Mineral resource and Mineral Reserve reporting to monitor any significant changes that would warrant re-calibrating the price deck for strategic, business or life of mine planning purposes. This review considers prevailing economic, commodity price and exchange rate trends, together with market consensus forecasts and Gold Fields' strategy and expectations for the mine operations.

The Mineral reserves gold price of $1,400/oz is detailed in particularity in Chapter 16, Market Studies.

The Qualified person is of the opinion that the gold price applied to the estimation of the Mineral reserves is reasonable and suitable for life of mine planning and is an appropriate reflection of recent historical trends and importantly provides a metal price that mitigates the risk of short to medium term price fluctuations in price that could have the potential to impact on the execution of the life of mine reserve plans. The gold price used provides a reasonable long-term delta to current spot prices and incorporates into the life of mine plan appropriate contingency to offset possible short term lower price cycles.

For the operating mines, 6 to 18 month trailing average actual costs form the basis of the unit rates applied to the reserve financial model, with consideration for expected variations in operating and capital costs. This timeframe is selected based on alignment with recent business planning data. For new mines, costs are based on estimates from a range of recent sources and are deemed appropriate and representative by the Qualified person.

The Mineral reserve estimates may be materially affected based on changes to the cost and price assumptions, in addition to changes in the modifying factors. The reserve is assessed at multiple scales, including individual pit, level, orebody, mine and operation. As such, the Qualified person is of the opinion that the reserve plan should be viewed as a consolidated entity, as removal of key components of the reserves may have a material and disproportionate impact on the overall value and viability of the plan.

In addition to changes to modifying factors, additional data acquired into the future may materially impact the Mineral reserves estimate. Examples include, but are not limited to, acquisition of additional drilling data, changes to interpretation of the data, mining studies, internal and external approvals and operating strategies.

12.2.4 Risks

Tarkwa has consistently delivered on production and cashflow plans under both the previous 'owner mining' and the current 'contractor mining' operational models. Contractor performance, especially in terms of equipment availability and utilisation, is a potential risk. This risk is mitigated by ensuring adherence to comprehensive maintenance and equipment replacement plans. The high rainfall pattern in Tarkwa is a potential risk that can temporarily impact mining operations. However, the mine has developed a dewatering plan to ensure effective management of water in and around the pits. There is a risk of pit wall instability as the pits increase in depth. However, mitigation measures such as controlled blasting, geotechnical mapping and radar monitoring technology have been put in place. To mitigate any tailing storage capacity constraints the mine has developed a long-term tailings construction schedule with a corresponding budget and financial provisions, which are in line with the planned throughput of the processing plant.

12.2.5 Cutoff grades

Cutoff grades are influenced by the operating strategy, cost base and design and scheduling. They are therefore calculated annually in alignment with the Gold Fields cutoff grade guidelines. The purpose of the guideline is to ensure consistency in the cutoff definitions and cutoff processes across all company properties. Cutoff grades are not only calculated globally for a mining operation, but also for separate ore deposits and mining areas depending on factors such as ore type, mining method, haul distances, recoveries and the mining, processing and general and administration costs.

The cutoff grades used for the open pit Mineral Reserve estimate are calculated using the same methodology described in Section 11.1.10 at a gold price of $1,400/oz. The cutoff grades are calculated by deposit as summarised in Table 12.2.3.

Table 12.2.3: Tarkwa open pit reserves cutoff grades

Description	BECO Grade (g/t)	Minimum Recovery (%)	Recovery Formula
Akontansi	0.40	94.6	2.2282 x LN (AU) + 96.86
Kottraverchy	0.40	94.7	2.2282 x LN (AU) + 96.86
Pepe	0.41	94.6	2.2282 x LN (AU) + 96.86
Teberebie	0.41	94.6	2.2282 x LN (AU) + 96.86
Kobada	0.50	83.3	AU - 0.1089 x AU0.6761-0.01) / AU x 100
Stockpiles	0.42	94.7	2.2282 x LN (AU) + 96.86

Notes:

a) The cutoffs are estimated based on the reserve price, reserve modifying factors and are not expected to change materially over the life of mine reserve.

b) The cutoff grades, price and modifying factors are incorporated in the estimation of the reserve shell.

c) The Qualified person is of the opinion that the design of the selected reserve shells used in the reserve estimation minimise estimation errors.

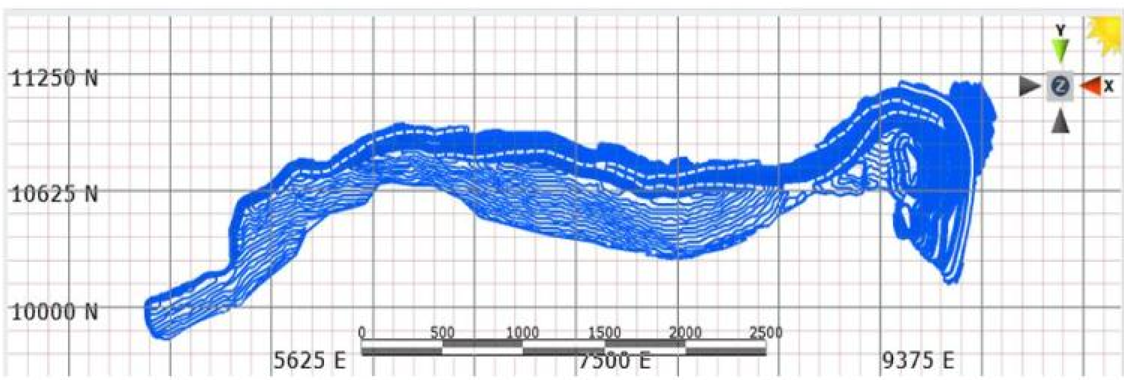
Source: Tarkwa CPR, 2022

12.2.6 Mine design

The mine planning process involves pit optimisations in Whittle software to generate a series of nested pits from which an optimal shell is selected. Prior to the optimisation in Whittle, the block model is prepared in Surpac software by applying technical (e.g., slopes zones) and economic (e.g., mining and processing cost) parameters to the model. Detailed designs of the selected shell are undertaken in Surpac software taking cognisance of the recommended geotechnical parameters and constraints to ensure safety of personnel and equipment as well as the stability of the pit walls. Various iterations are done until an acceptable level of correlation is achieved between the optimal shell and the detailed mine design.

The batter face angles are 45 ° - 55 ° and 75 ° - 90 ° in oxide and fresh, respectively. The ramps are designed at 10 % gradient and are 25 m – 30 m wide. The Akontansi open pit mine design is shown in Figure 12.2.2.

Figure 12.2.2: Akontansi pit design



Source: Tarkwa CPR, 2022

Details on the mining methods are provided in Chapter 13

12.2.7 Mine planning and schedule

The Company's annual mine planning process is anchored by a corporate planning calendar that sets out the sequence of events to be followed that ensures a strong linkage between the strategic planning phase and the life of mine plan itself that defines the Mineral reserves. During the first half of the year the preferred strategic plan is confirmed and approved by the company Executive Committee. This provides guidance for required investment and business and operational planning to position the mine to deliver on the strategic intent for the property. The detailed two-year operational plan and budget is informed by financial parameters determined by the Executive Committee and is the anchor to the longer-term planning and equates to the first two years of the life of mine plan.

The overall planning process schedules key work to be completed and stage gated before subsequent work can be continued. It includes the metal prices, geology and estimation models, resource models, mine design, depletion schedules, environmental and social aspects, capital and operating costs and finally the cashflow model and financial valuation. Capital planning is formalised pursuant to Gold Fields' capital investment and approvals process.

Projects are categorised and reviewed in terms of total expenditure, return on investment, net present value (NPV) and impact on All-in Costs (AIC) per ounce and all projects involving amounts exceeding $40 million are submitted to the Board for approval. Material changes to the plans are referred back to the Executive Committee and the Board. Post-investment reviews are conducted to assess the effectiveness of the capital approvals process and to leverage continuous improvement opportunities going forward.

The Mineral reserve estimates are based on an appropriately detailed and engineered life of mine plan that is supported by relevant studies completed to a minimum PFS level of work. All design and scheduling is completed by experienced engineers using appropriate mine planning software and incorporates all relevant modifying factors, the use of cutoff grades and the results from other techno-economic investigations.

Mining rates, fleet productivities and all key operational and plant capacities and constraints are accounted for in the plan and are typically based on historical performance trends. All geotechnical protocols and constraints are accounted for in the plan, including the provision for suitable mining geometries and ground support, mining losses in pillars, mining recovery and dilution. The provision of sufficient waste storage and tailings capacity is engineered into the plans to meet the life of mine requirements.

Mine planning is primarily driven by personnel at the mine who are best positioned to determine the technical and commercial objectives for the site based on the parameters, objectives and guidelines issued by the corporate office. The site-based planning is supported by Regional Technical Services functions, as well as from Corporate Technical Services (CTS) and the corporate finance and sustainable development teams which provide overall oversight and assurance.

Open pit mine design and scheduling is based on 3D Mineral resource block models. The ore is assigned to selective mining unit (SMU) mining shapes based on equipment size and practical selectivity. The SMUs are accumulated into ore dig plans. The selected pit shells are subjected to detailed mine design and extraction sequencing to optimise the waste: ore strip ratio and with benches recovering ore above the reserve cutoff grade. The open pits are sequenced to derive the best possible integrated plan and to blend feed to the plant to assist with life of mine tail end management.

Mine scheduling is completed using Alastri software. The yearly maximum vertical rate of advance (VRA) is restricted to 72 m per annum. The equipment assumptions and constraints applied to the mining schedule are summarised in Table 12.2.4 while the mining schedule is summarised in Table 12.2.5

Table 12.2.4: Mining equipment assumptions (efficiencies and constraints)

Parameters		Unit	Value	No. of Equipment
Equipment availability	Excavators & shovels	%	85	12
	Dump trucks	%	82-85	89
	Drill rigs	%	81	26
Equipment utilisation	Excavators & shovels	%	82	12
	Dump trucks	%	82	89
	Drill rigs	%	82	27
Equipment production rate	Liebherr 984	t/hr	700	1
	Liebherr 9200	t/hr	1,200	2
	Liebherr 9350	t/hr	1,500	3
	Liebherr 9400	t/hr	1,600	4
	CAT 6040	t/hr	1,900	2
	Sandvik DP1500i drill	m/hr	25	19
	Epiroc C50 drill	m/hr	25	7
Truck factors	Cat 777F	t / load	90	8
	Cat 785C/D	t / load	135	81
	Rain delays	hr/annum	744	744

Notes:

a) The estimated mining equipment fleet is expected to vary over the life of mine based on the open pit to underground mining ratios.

b) The heavy mobile equipment fleet is renovated based on manufacturers specification or on regular maintenance records.

c) The Qualified person is of the opinion that the prescribed mining fleet supports the life of mine reserves.

Source: Tarkwa CPR, 2022

Table 12.2.5: Tarkwa mining schedule to 2032

Description		Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
AKO	Total Material	kt	51,073	67,514	57,332	54,401	53,481	59,241	67,040	24,699	14,590	4,755
	RoM	kt	7,557	10,528	9,951	4,941	7,209	5,256	13,108	6,115	3,713	1,055
	Mined Grade	g/t Au	1.10	1.31	1.38	1.51	1.30	1.26	1.14	1.48	1.42	1.39
	Metal	koz Au	268	443	440	241	302	214	479	292	170	47
KOT	Total Material	kt	1,693	3,999	3,915	9,250	10,744	12,840				
	RoM	kt	78	358	484	1,602	268	2,006				
	Mined Grade	g/t Au	1.30	1.07	1.29	1.55	0.89	1.59				
	Metal	koz Au	3	12	20	80	8	102				
PEP	Total Material	kt	9,849	8,204	3,667			4,282	15,558	61,923	33,337	3,802
	RoM	kt	931	1,658	1,364			41	213	4,368	10,397	1,636
	Mined Grade	g/t Au	1.15	0.94	1.09			0.76	0.72	0.85	1.06	1.15
	Metal	koz Au	34	50	48			1	5	120	354	60
TEB	Total Material	kt	22,643	7,307	22,320	23,936	22,602	10,963	5,100			
	RoM	kt	6,748			3,131	191	3,745	2,117			
	Mined Grade	g/t Au	1.21			1.27	1.50	1.53	1.18			
	Metal	koz Au	262			128	9	184	80			
KBD	Total Material	kt	805									
	RoM	kt	208									
	Mined Grade	g/t Au	2.38									
	Metal	koz Au	16									
Totals	Total Material	kt	86,062	87,024	87,234	87,587	86,827	87,326	87,697	86,622	47,926	8,557
	RoM	kt	15,522	12,544	11,800	9,674	7,668	11,048	15,437	10,483	14,110	2,691
	Mined Grade	g/t Au	1.17	1.25	1.34	1.44	1.29	1.41	1.14	1.22	1.15	1.24
	Metal	koz Au	584	506	508	448	319	501	565	412	524	107

Notes: Rounding of figures may result in minor computational discrepancies

Source: Tarkwa CPR, 2022

A time-based economic evaluation is undertaken of the completed mining and processing schedule to ensure economic viability of the Reserve life with the requisite rehabilitation and end of life mine closure costs also incorporated into the financial assessment. Refer to Chapter 19.1 for details on the life of mine cost schedule.

The Qualified Person is of the opinion that the mine plan and schedule incorporate appropriate assessment of all relevant technical, environmental, social and financial aspects to ensure the Mineral Reserve complies with the SK rule instructions and requirements. After reasonable assessment there is no unresolved material matter that could have a significant impact on the mines ability to execute the LOM plan. The mine plan and schedule incorporate consideration of the following key criteria:

- Production depletion up to 31 December 2022.
- Application of cutoff grades to determine mineable ore.
- Application of appropriate modifying factors to convert resource to Reserve.
- Allocation of suitable mining equipment and costs.
- Incorporation of realistic mining rates and efficiencies.
- Practical and realistic mine design and mining methods.
- Integrated production scheduling taking account of capacities, constraints and bottlenecks.

- Integrated project management and execution.
- Security of water and energy for the life of mine.
- Provision for mine rehabilitation and mine closure costs.
- Consideration of all environmental, social and legal aspects to enable life of mine plan execution.
- Appropriate life of mine tail end management.
- Security of current and future land tenure and agreements, permits and licenses.
- Life of mine cashflow model and economic viability.

12.2.8 Tarkwa Plant Processing schedule

Table 12.2.6: Summary of processing schedule

Description		Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
AKO	Ore processed	kt	5,977	8,099	8,548	4,700	7,131	5,256	11,944	6,115	3,713	1,055			
	Head grade	g/t Au	1.22	1.50	1.50	1.56	1.31	1.26	1.19	1.48	1.42	1.39			
	Recovered gold	koz Au	221	367	388	223	283	201	432	275	160	44			
KOT	Ore processed	kt	70	257	429	1,525	266	2,006							
	Head grade	g/t Au	1.40	1.25	1.39	1.60	0.90	1.59							
	Recovered gold	koz Au	3	10	18	74	7	96							
PEP	Ore processed	kt	653	944	1,101			41	161	4,368	10,291	1,636			
	Head grade	g/t Au	1.38	1.19	1.22			0.76	0.79	0.85	1.07	1.15			
	Recovered gold	koz Au	27	34	41			1	4	113	332	57			
TEB	Ore processed	kt	5,579			2,877	191	3,745	1,900						
	Head grade	g/t Au	1.32			1.33	1.50	1.53	1.25						
	Recovered gold	koz Au	224			116	9	174	72						
KBD	Ore processed	kt	208												
	Head grade	g/t Au	2.38												
	Recovered gold	koz Au	13												
Stockpiles	Ore processed	kt	1,513	4,775	3,922	4,899	6,413	2,998	0	3,522		11,833	14,482	14,482	12,122
	Head grade	g/t Au	1.24	0.83	0.76	0.61	0.53	0.40	0.87	0.47		0.40	0.40	0.40	0.40
	Recovered gold	koz Au	57	121	90	91	102	35	0	49		137	168	168	140
Total	Ore processed	kt	14,000	14,075	14,000	14,000	14,000	14,046	14,005	14,005	14,005	14,524	14,482	14,482	12,122
	Head grade	g/t Au	1.25	1.21	1.23	1.15	0.92	1.16	1.16	1.00	1.13	0.55	0.40	0.40	0.40
	Recovery	%	97	97	97	97	97	97	97	97	97	93	90	90	90
	Recovered gold	koz Au	545.55	532.05	536.55	503.51	401.55	507.07	507.71	437.01	492.39	238.53	167.62	167.62	140.30

Notes: Rounding of figures may result in minor computational discrepancies

Source: Tarkwa CPR, 2022

12.2.9 Classification criteria

Tarkwa's Mineral reserves are classified as either proven or probable in accordance with the definitions in SK 1300. Mineral reserves statements include only measured and Indicated Mineral resources modified to produce Mineral reserves contained in the LOM plan.

In general, proven Mineral reserves are derived from a measured Mineral resource and existing stockpiles. The probable Mineral reserve is derived from indicated Mineral resource material.

12.2.10 Economic assessment

The basis for establishing economic viability is discussed in Chapter 19.

12.3 Mineral reserves as at 31 December 2022

The Tarkwa Mineral reserves as at 31 December 2022 are summarised in Table 12.3.1.

Table 12.3.1: Tarkwa - summary of gold Mineral reserves at the end of the fiscal year ended 31 December 2022 based on a gold price of $1,400/oz

	Amount/	Grades/	Amount/	Cutoff grades/	Metallurgical recovery/
	(kt)	(g/t Au)	(koz Au)	(g/t Au)	(%)
Open Pit Mineral Reserves					
OP proved Mineral reserves	33,601	1.3	1,357	0.4 - 0.5	89.5 - 97.2
OP probable Mineral reserves	66,374	1.2	2,549	0.4 - 0.5	89.5 - 97.2
OP total Mineral reserves	99,975	1.2	3,906	0.4 - 0.5	89.5 - 97.2
Stockpile Mineral Reserves					
SP proved Mineral reserves	9,726	0.8	255	0.42	97.2
SP probable Mineral reserves	53,964	0.4	694	0.32	90
SP total Mineral reserves	63,690	0.5	949	0.32 - 0.42	90 - 97.2
Total Mineral reserves					
Total proved Mineral reserves	43,327	1.2	1,612		
Total probable Mineral reserves	120,339	0.8	3,243		
Total Tarkwa Mineral reserves 2022	163,666	0.92	4,856		
Total Tarkwa Mineral reserves 2021	174,246	0.93	5,224		
Year on year difference (%)	-6 %	-1 %	-7 %		

Notes:

a) Rounding of figures may result in minor computational discrepancies.

b) Refer to Table 12.2.6 for year-on-year Mineral reserve comparison.

c) Quoted as mill delivered metric tonnes and run-of-mine grades, inclusive of all mining dilutions and gold losses except mill recovery. Metallurgical recovery factors have not been applied to the reserve figures. The approximate range metallurgical recovery factor is 89.5 % to 97.2 % for open pit feed. The metallurgical recovery is the ratio, expressed as a percentage, of the mass of the specific mineral product recovered from ore treated at the process plant to its total specific mineral content before treatment. The recoveries for Tarkwa vary according to the mix of the source material (e.g., oxide, transitional fresh and ore type blend) and method of treatment.

d) The gold price used for the 2022 LOM Mineral reserves is $1,400 per ounce. Open pit Mineral reserves at Tarkwa are based on optimised pits using appropriate mine design and extraction schedules. The gold price used for Mineral reserves is detailed in particularity in Chapter 16 Marketing.

e) Dilution relates to planned and unplanned waste and/or low-grade material being mined and delivered to the process plant. Ranges are given for those operations that have multiple orebody styles and mining methodologies. The mine dilution factors are 30 cm hanging wall and 20 cm foot wall skins.

f) The mining recovery factor relates to the proportion or percentage of ore mined from the defined orebody at the gold price used for the declaration of Mineral reserves. This percentage will vary from mining area to mining area and reflects planned and scheduled reserves against actual tonnes, grade and metal mined, with all modifying factors, mining constraints and pillar discounts applied. The mining recovery factors are100 % (open pit CIL plant).

g) The cutoff grade may vary per open pit, depending on the respective costs, depletion schedule, ore type, expected mining dilution and expected mining recovery. The average or range of cutoff grade values applied in the planning process are: Tarkwa 0.32 g/t to 0.5 g/t Au mill feed.

h) A gold ounces-based Mine Call Factor (metal called for over metal accounted for) determined primarily on historic performance but also on realistic planned improvements where appropriate is applied to the Mineral reserves. A Mine Call Factor of 97 % has been applied at Tarkwa.

i) The Mineral reserves are estimated at a point in time and can be affected by changes in the gold price, US Dollar currency exchange rates, permitting, legislation, costs and operating parameters.

j) Tarkwa is 90 % attributable to Gold Fields and is entitled to mine all declared material located within the properties mineral leases and all necessary statutory mining authorisations and permits are in place or have reasonable expectation of being granted.

Source: Tarkwa CPR, 2022

The Mineral reserves are 90 % attributable to Gold Fields and are net of production depletion up to 31 December 2022. The point of reference for the Mineral reserves is ore delivered to the processing facility.

The Tarkwa Mineral Reserves are the economically mineable part of the measured and indicated Mineral resources based on life of mine schedules and minimum pre-feasibility level studies completed at the reserve gold price of $1,400/oz to justify their economic viability at 31 December 2022 (refer to Chapter 19 for details on the supporting economic analysis).

12.4 Audits and reviews

The Mineral reserves estimate was subject to internal review and scrutiny by the relevant Qualified Persons and regional technical and financial disciplines, and peer reviewed for technical assurance and compliance in reporting by Gold Fields' Corporate Technical Services (CTS), Sustainable Development and Head Office Finance teams.

The Mineral Reserves is underpinned by appropriate Mineral resources management processes and protocols to ensure requisite corporate governance in respect of the intent of the Sarbanes-Oxley Act of 2002 (SOX). Technical and operating procedures developed on site are designed to be compliant with the SOX framework as adopted by Gold Fields' Group Mineral Resource and Reserve Committee for and reserve estimation, reporting and auditing.

External Mineral resources and reserves audits are performed on a minimum rolling three-year cycle. The Mineral reserves was last audited externally and independently by AMC in January 2022, who reported no fatal flaws with recommendations provided for implementation of continuous improvements where appropriate. Tarkwa's Mineral reserves estimation process, acceptance and documentation of modifying factors, supporting data and underlying assumptions were rated as being in the upper portion of the 'high performance' bracket and close to industry best practice by the auditor.

Gold Fields uses K2Fly RCubed® propriety software in combination with SharePoint® to ensure accuracy, governance and auditability in the consolidation and reporting of Mineral reserves.

No significant adverse findings or any material non-compliances were recorded from any of the audits. Ongoing compliance with minor improvement, adjustments and best practice continue to be implemented. Records of audits are filed electronically on site in relevant departments and folders with major audit signoffs reported in the Gold Fields annual report.

12.5 Comparison 31 December 2021 with 31 December 2022 Mineral reserves

The net difference in Mineral reserves between 31 December 2021 and 31 December 2022 is 368 koz gold or -7 %, see Table 12.5.1.

A series of overlapping internal processes exist at Gold Fields to review and validate the modifying factors, input assumptions, cutoff grades, designs, schedules, economic evaluation and other technical assessments. These reviews include site, regional and group technical assessments, internal audits, and trained Competent Person/Qualified Person authorisations.

Table 12.5.1: Net difference in Mineral Reserves between 31 December 2021 and 31 December 2022

Proved and Probable Mineral reserve	Unit	% Change	Gold on ROM
As at 31 December 2021	koz		5,224
Production depletion 2022	koz	-9 %	-488
Gold price	koz	0 %	0
Production cost	koz	0.1 %	-6
Discovery - Exploration	koz	4 %	186
Conversion	koz	0 %	0
Inclusion / exclusion	koz	-1 %	-60
As at 31 December 2022	koz	-7 %	4,856

Notes: Rounding of figures may result in minor computational discrepancies.

Source: Tarkwa CPR, 2022

The overall 7 % decrease in reserves is primarily due to depletion.

13 Mining methods

13.1 Mining methods

In open pit mining, access to the orebody is achieved by stripping the overburden in benches of fixed height to expose the ore below. This is most typically achieved by drilling and blasting an area, loading the broken rock with excavators into dump trucks and hauling the rock and/or soil to dumps. The overburden material is placed on designated waste rock dumps.

Extraction of the orebody involves a similar activity as for stripping the overburden. Lines are established on the pit floor demarcating ore from waste material and the rock is then drilled and blasted. Post blasting, the ore is loaded into dump trucks, based on a defined 'dig plan'. The dig plan demarcates the position of the ore and waste boundaries post the heave and throw movement caused by the blasting. Ore is hauled to interim stockpiles or directly to the crusher at the process plant, while the waste is hauled to waste rock dumps.

Mining at Tarkwa is carried out using conventional selective open pit mining methods which have been highly successful over the life of asset. Backhoe excavators are used to select waste from the ore, and vice versa, to an average accuracy of 30 cm on the hanging wall and 20 cm on the footwall of a reef. Ore is classified as either run-of-mine (ROM) or low grade. The ROM is delivered to one of two primary crushers while the low-grade ore is stockpiled near the primary crushers. Waste, on the other hand, is hauled to the designated waste dump. Capital waste stripping usually precedes ore mining.

Oxide materials in the upper elevations of the pit are free-dug or blasted at relatively low powder factors. These free digging zones are relatively small in volume. Fresh rock and transitional zones are drilled and blasted. Generally, Nonel detonators are used in blasting both oxide and fresh material. However, in areas where there are constraints such as proximity to a community, electronic blasting is used to mitigate the impact of blasting in such zones. Presplit wall control methods and trim blasting are also used where appropriate in the fresh zones where appropriate, to ensure pit wall stability.

Truck allocation (dispatching) is done using a GPS assisted Modular Mining Fleet Management System (FMS). The mine uses Connected Mine, an intranet-based system, to access and retrieve equipment performance and production data from the FMS for analysis and reporting.

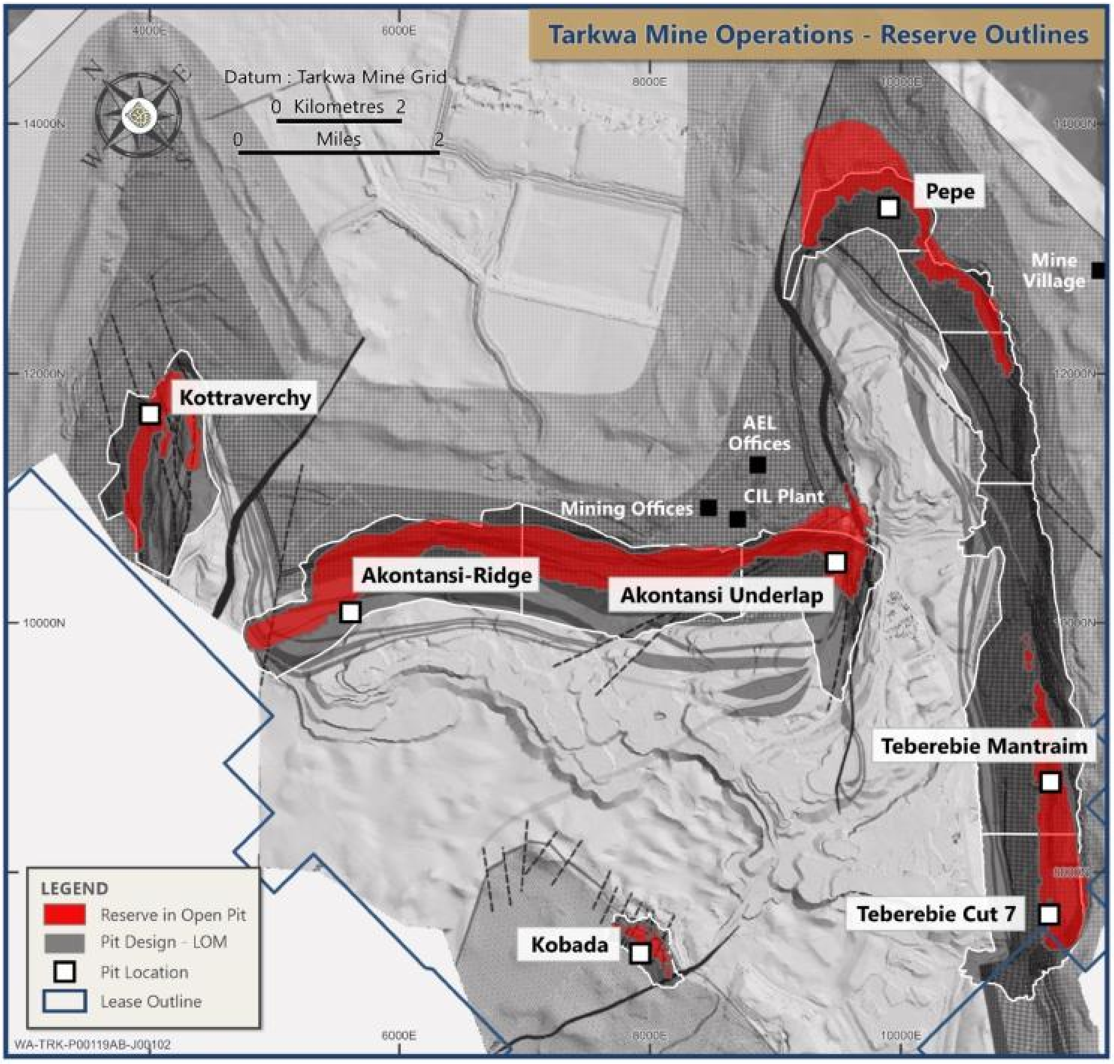
Tarkwa's LOM is based on a contractor mining model. The pits across the Property have been zoned into two major areas differentiated for the mining contractors. Each contractor takes responsibility for one zone and undertakes drilling, blasting, loading, hauling and all other associated ancillary activities required for safe and efficient production.

The Qualified person's opinion is that the Mineral reserve modifying factors including strip ratios and the open pit cutoff grades are realistic and appropriate for life of mine planning. Further, the mining fleet configuration, equipment specifications, practical mining rates, selective mining unit dimensions, mining dilution and mining recovery assumptions and inputs to the mine design and schedule are suitable in support of the Mineral reserve estimates and present no material risk.

13.2 Final Reserve outline

The final open pit reserve outline is displayed below in Figure 13.2.1.

Figure 13.2.1: Final Pit Life of Mine Mineral reserve



Source: Tarkwa CPR, 2022

13.3 Geotechnical models

Determination of rock slope parameters for Tarkwa is largely based on empirical, structural assessment and numeric modelling. This is necessary to ensure that all designs conform to acceptable design criteria for the mine. Mapping and core logging data, observations from previous mining and sound engineering judgment are also useful in the determination of the rock slope parameters. Site visits by Gold Fields Corporate Technical Services and occasional review by Geotechnical Review Board members provides independent, expert oversight and opinions on the currently implemented designs. Any potential hazards identified are managed by advanced radar slope monitoring systems and robust geotechnical hazard management systems.

Any adverse interaction between significant geological structures and the pit wall slopes have been factored into the slope stability analysis and on the inter ramp and overall scale criteria.

Domains are created to evaluate the conditions expected to affect the rock mass during mining. This allows for the definition and subdivision of the rock mass based on similar geomechanical characteristics. It is based on the formulation of a comprehensive geotechnical model which comprise structural, rock mass, hydrogeological and geological components.

The geotechnical model domains are further sub-divided into sectors with similar characteristics based on the strength of the material, orientation of the controlling structures and potential failures which controls the bench-batter configuration.

Geotechnical hazards are identified, evaluated and analysed through visual inspections, slope monitoring, mapping and risk assessments. Hazards are managed through robust geotechnical hazard management systems. Hazard maps are generated and these are periodically updated. The controls for managing the hazards are communicated to ensure the safety of personnel and equipment. Slope monitoring systems also assist with the effective management of these hazards.

13.4 Hydrogeological models

The hydrogeology of the Tarkwa mine area occurs in distinct hydraulically connected aquifer systems; an upper weathered zone aquifer, a deeper un-weathered aquifer, fractured zones and dyke contacts. The fresh quartzites, conglomerates, siltstones and dolerite intrusives within Tarkwa do not have adequate primary porosity. They are largely inherently impermeable unless fractured or weathered. Groundwater occurrence is therefore associated with the development of secondary porosity and permeability. The zones of secondary permeability are often discrete and irregular and occur as fractures, faults, lithological contacts and zones of deep weathering.

The Tarkwa dewatering strategy is targeted at achieving multiple benches at different depths prior to the start of each rainy season. This sequence of mining facilitates the establishment of sumps at lower pit elevations to serve as collection points for rainwater, which mitigates the risk of flooding and the impact of rains on production. There are also surface drains and sumps constructed along the perimeter of the pits to control the inflow of water from the surroundings. In addition, wells, piezometers and depressurisation holes are used to monitor and lower the phreatic levels.

The controlled sequence of mining facilitates the establishment of sumps at lower pit elevations to serve as collection points for rainwater. This creates an opportunity for mining activities to be carried out at relatively higher elevations whilst water is being pumped out from the lower elevations. Tarkwa's dewatering plan focusses on the availability of pumps and the establishment of sumps prior to the start of the wet season. The average water discharge capacity is about 40 Mm^3. Water pumped from Akontansi Central, Ridge and Ulap pits is released into the environment after appropriate environmental clearance. Water pumped from Teberebie pit and cutback and Mantraim is pumped into the environment by means of a lined drain.

Flood management trigger-action-response plans are in place at the site. The dewatering strategy is targeted at achieving multiple benches at different depths prior to the start of each rainy season to facilitate the establishment of sumps at lower pit elevations. These serve as collection points for rainwater to mitigate the risk of flooding and any significant impact of rains on production

The Qualified person's opinion is that all appropriate geotechnical and hydrogeological parameters have been suitably considered and risk assessed to support the mining method selection and extraction sequencing at Tarkwa and this information is embedded in the sites ground control management plan which is routinely updated as new empirical information becomes available.

13.5 Site layout

See Figure 3.4.1 for a plan of the Tarkwa Property showing operating sites, TSF's, WSF's, SHL, pits, general site infrastructure and mine lease boundary.

13.6 Equipment and labour requirements

The list of equipment required for execution of the life of mine plan is in Chapter 12.2.7 and Table 12.2.4. The excavators are planned at 85 % availability while the availability of the haul trucks ranges between 82 % and 85 %. The drill rigs are planned at an 81 % availability. The planned utilisation for all major equipment is 82 %. These assumptions to the mine plan have proved appropriate and realistic over many years of production.

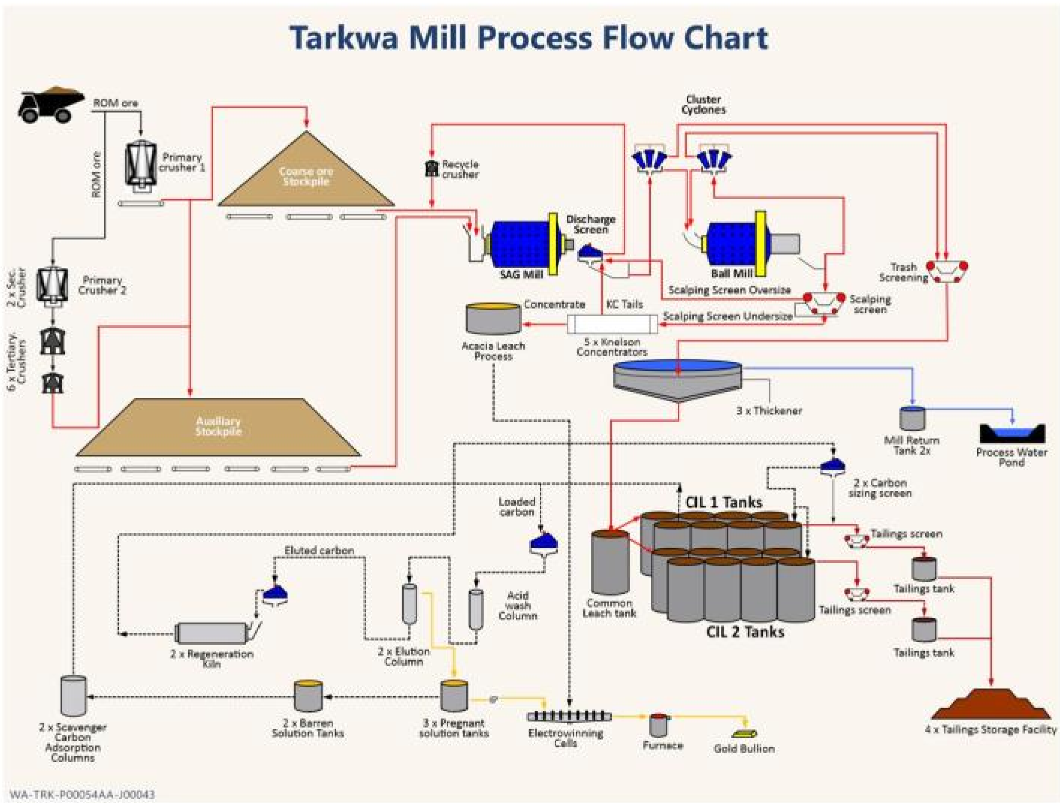
Tarkwa's mining operation is a continuous 24-hour operation with 2 x 12-hour shifts and three crews on rotation. The total labour requirement for the mining operation including owner's technical personnel is 2,085 staff.

14 Processing and recovery methods

14.1 Flow sheet and design

The 14 Mt per annum Tarkwa CIL process plant is a conventional crush-grind-leach circuit as all ore sources are amenable gold extraction using cyanide. A schematic process flow sheet for the process plant is shown in Figure 14.1.1.

Figure 14.1.1: Schematic flow diagram of Tarkwa mill process plant



Source: Tarkwa CPR, 2022

Ore is transported from the mine pits to the crusher pad and tipped directly or reloaded by front-end loaders into an Allis Gyratory Superior 54" x 75" gyratory crusher. The crushed ore (80 % passing 150 mm) then passes into a bin, which feeds an apron feeder. The apron feeder feeds the ore via a dual stockpile system consisting of the original coarse ore stockpile and a new auxiliary stockpile with a combined live storage capacity of 45,000 t (30 hours).

Additional ore transported from the pits to the crusher pad is directly tipped by dump trucks or reloaded by front-end loaders into the NHL 50" x 65" M Π Sandvik Superior primary gyratory crusher. The crushed product (80 % passing 150 mm) gravitates to a 1,829 m x 6,815 m D4 Jacques A Terex apron feeder, which feeds two secondary screens via a conveyor. The oversize from the two 2,440 mm x 7,320 mm Nordberg double deck scalping screens of aperture sizes 50 mm and 32 mm for the upper and lower deck respectively feed two Superior gyratory secondary crushers (S6000). The undersize joins the final product to the new CIL auxiliary stockpile via a series of overland conveyors.

The secondary crushing product is fed to the tertiary hopper via series of conveyors. Ore withdrawn from this hopper is fed by six 750 mm x 1,800 mm Nordberg vibratory feeders to six 2.4 m x 7.3 m Nordberg double deck scalping screens operating in closed circuit with six tertiary H4000 hydrocone crushers. The oversize from the upper and lower decks (32 mm and 25 mm respectively) feed the tertiary crushers and the discharge from the tertiary crushers is conveyed back to the tertiary bin. The undersize from the tertiary screens join the final crushing product (80 % passing 25 mm) to the new CIL auxiliary stockpile.

Underneath each stockpile is a reclaim tunnel, with apron feeders that feed onto a conveyor belt, which in turn feeds the milling circuit. The mill feed consists of 30 % fine material from the NHL crushing circuit and 70 % coarse material from the CIL crusher. The milling circuit consists of a SAG and ball mill with recycle crushing in closed circuit with the SAG mill. The SAG mill has an Effective Grinding Length (EGL) of 42 feet with an internal diameter of 27 feet and 14 MW of installed power (2 x 7,000 kW twin drive motors). The ball mill has an EGL of 36 feet with an internal diameter of 26 feet and 14 MW of installed power (2 x 7,000 kW twin drive motors).

The milling circuit is operated at a capacity of 1,600 t/hr (1 Mt/month). The crushed ore from the dual stockpile system is fed into the SAG mill where the primary milling is performed. The SAG mill discharge is screened at 12 mm with the oversize fraction being fed to a recycle crusher. The crushed product is recycled to the SAG mill feed. The SAG mill discharge screen undersize is classified in a cluster of consisting of twelve 26-inch Krebs cyclones with the underflow reporting to the ball mill feed. The ball mill discharge is classified as a cluster of twenty-six 20-inch Krebs cyclones with the underflow reporting back to the ball mill feed. The overflow from both cyclone clusters reports to three 32 m Outotec thickeners via the linear trash removal screens.

During 2018 Gold Fields added a gravity recovery circuit to the Tarkwa plant, with the aim to increase plant recoveries. The gravity circuit consisted of 3x 48" Knelson concentrators and an Acacia Reactor. Following the successful results achieved by the addition of this circuit, during 2020 Gold Fields added an additional 2x Knelson concentrators.

The cyclone overflow slurry is thickened from 25 % solids to 55 % solids in the thickeners from where it is pumped to the CIL tanks. The clear water from the thickener overflow is reused in the plant. The CIL consists of two trains of eight tanks in series fed from a common leach tank. Seven of these tanks in each train contain activated carbon for gold adsorption. Cyanide is added to the circuit to ensure stability of the dissolved gold complex which is then adsorbed onto the carbon. The residue slurry overflowing the last CIL tank forms the tailing, which is analysed for weak acid dissociable (WAD) cyanide with an online analyser and then pumped to any of the three TSFs (TSF 1, 2 and 5).

The carbon loaded with gold is recovered over the loaded carbon screen where it is cleaned of slurry. The loaded carbon passes into a 15 t acid wash column where it is washed with hydrochloric acid solution to remove calcium. The gold is recovered from the loaded carbon in two 15 t elution circuits of which applies the AARL stripping method.

The eluted carbon is passed through the regeneration kiln, which operates at a temperature of 700 °C to remove any organic foulants from the carbon. The gold bearing solution from the elution circuits is pumped through the electrowinning cells where the gold plates onto stainless steel cathodes as gold particles. The gold is then removed from the cathodes with high pressure sprays and dried before being smelted in an induction furnace at 1,400 °C. Fluxes are added before smelting to assist in the separation of the impurities from the gold. The molten gold is then poured into moulds and allowed to cool down. Once the doré bar is cooled it is cleaned, stamped and transported to a refinery.

During the period 2019 to 2021 Gold Fields have been implementing debottlenecking projects, which included upgrading the SAG and Ball mill discharge pump sets, the tailings pumps and the CIL intertank screens. This debottlenecked CIL plant can treat approximately 14 Mtpa, as demonstrated by actual performance achieved in both 2021 and 2022.

An allowance for the recovery of lock-up gold has been made based on the design lock-up of 200 kg and this gold will be recovered as part of final closure of the operation. Generally adequate attention is given to sampling and sample preparation and acceptable accounting procedures are in place.

The Tarkwa gold processing plant, originally constructed in 2004 and upgraded in 2009, is a relatively young plant, comparatively. It was installed with modern automated control systems and has been reasonably well maintained and updated.

As per the Mineral Reserves LOM plan, there is no further major plant upgrades planned or required. On-going normal maintenance and upgrade activities will be required and are planned for.

14.2 Recent process plant performance

The recent performance of the Tarkwa process plant is provided in Table 12.2.1.

14.3 Process plant requirements

The key process plant requirements estimated for the Mineral reserve life of mine plan are summarised in Table 14.3.1.

Table 14.3.1: Tarkwa process plant – key requirements

	Unit	2022	2023	2024	2025	2026	2027	2028
Ore processed	kt	14,000	13,869	14,005	14,019	14,019	14,019	14,057
Plant power draw	GWhr	327	325	327	327	327	327	327
Sodium cyanide	t	3,010	2,982	3,011	3,014	3,014	3,014	3,022
Grinding media	t	19,460	19,555	19,748	19,906	19,906	20,046	20,101
Lime	t	11,900	11,789	11,905	11,916	11,916	11,916	11,948
Caustic	t	2,635	2,635	2,635	2,635	2,635	2,635	2,635
Activated carbon	t	490	485	490	491	491	491	492

Source: Tarkwa CPR, 2022

14.4 Processing Risks

In the opinion of the Qualified person, the combination of a well-established processing plant with a known operating history of treating ores mined from the associated mining leases, together with the recent metallurgical testwork programs assessing core samples selected from future local mineralisation areas (as outlined in the previous report sections), provides a reasonable basis for estimating the associated metallurgical and processing modifying factors underpinning the Tarkwa Mineral reserves.

However, the reader should be aware that uncertainties remain, and some key potential areas of risk and uncertainty remain and are discussed in the following sections.

14.4.1 Major Equipment Failure

Industrial mineral processing plants consist of a series of dedicated unit processes, e.g., crushing, grinding, leaching, carbon-in-leach (CIL) and carbon elution. There is inherent risk associated with catastrophic failure of one (or more) of the key equipment items associated with these unit processes. This could lead to a significant period of plant downtime until repairs are completed, resulting either in the inability of the processing plan or forecast not being achieved and/or higher operational costs being incurred.

Catastrophic failures could be associated with the structural, mechanical, or electrical components of the key processing equipment items. Key equipment items could include the crushers, grinding mills, or leach/CIP tanks.

Risk amelioration activities to reduce the likelihood of such occurrences adopted by Tarkwa includes:

- Dedicated on-site maintenance department which undertakes condition monitoring activities, preventative maintenance and repairs.
- Critical spares (e.g., spare mill motors and gearboxes).
- Contingency operational plans (e.g., contract/mobile crushing plant, leach/CIP tank by-passing).
- Fire suppression systems.
- Insurances.

Decisions associated with asset management, critical spares, insurances, etc. are outside the responsibility and accountability of the Qualified person. It is considered that some inherent risk and uncertainty associated with catastrophic failure of processing equipment remains.

14.4.2 Plant Operational Management

The processing facilities are managed and operated by dedicated teams of personnel, who are required to make many operational and maintenance decisions daily. These decisions can directly impact the performance of the plant while processing the future Mineral reserves.

For example, a decision to process ores at a higher throughput could result in a coarser grind size from the grinding circuit, resulting in a lowering of the plant recoveries. Similarly, the choice to operate the leaching circuit at lower free cyanide concentrations to reduce cyanide usage rates, could also result in lower plant recoveries than planned.

It needs to be recognised that plant management and the associated decisions made by plant operating personnel, are outside the responsibility and accountability of the Qualified person, and that such decisions and actions taken by plant management can influence the achieved performance of the plant (e.g., throughput, costs, availability and recoveries).

14.4.3 Operating Costs, Plant Consumables and Reagents

The operating cost of the processing plant represents a significant cost element to the overall financial evaluation of the reserve's life of mine plan. The processing facilities use relatively large quantities of power, reagents and consumables, including fuels, cyanide, grinding steel media, lime, caustic, etc.

The estimation of future processing costs is required as input into the cutoff-grade calculations and economic assessments of the resources and reserves and estimation of processing costs require certain assumptions to be made concerning consumption rates of consumables, as well as unit prices and inflation rates.

Metallurgical testing undertaken on the future reserves provides reasonable guidance of potential reagent consumption rates and mill throughput expectations, and this information is considered and reviewed by the plant metallurgist and the Qualified person.

Tarkwa, like many other operating gold processing plants that have a reasonable operating history, do not allow for a discreet operating cost contingency in their future operating cost forecast. The absence of contingency is considered by the Qualified Person as being a common and reasonable approach to operational process plant cost forecasting.

Consumables, commodity pricing and inflation are subject to external influences that are outside the control or predictive capability of the Qualified person.

Further to this, operational decisions made by plant management, or unexpected variances in the nature of the ores being processed could unexpectedly impact reagent and consumables usage rates. Such variances are outside the control or predictive expectations of the Qualified person.

The Qualified person's opinion is that all appropriate parameters have been suitably considered and risk assessed to support the processing and recovery methods incorporated in the Tarkwa LOM plan. The processing flow sheet, plant design, equipment and specifications are all within demonstrated operating ranges experienced at the mine over an extended operating history. Meeting all requirements for energy, water, process materials and staff are viewed as reasonable.

15 Infrastructure

Details on each major item of non-process infrastructure is discussed in this section. See Figure 3.4.1for a plan of the Tarkwa Property showing operating sites, TSF's, WSF's, SHL, open pits, general site infrastructure and mine lease boundary.

15.1 Tailings storage facilities (TSF)

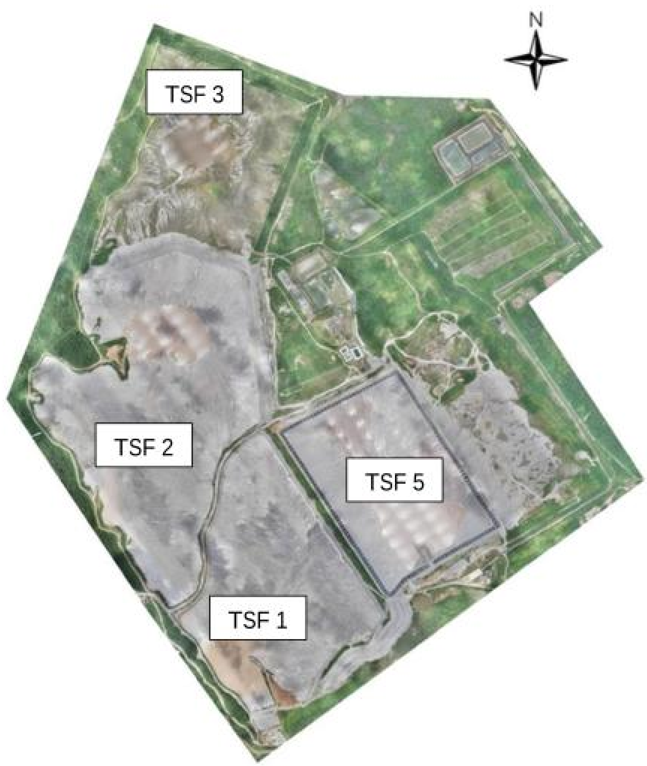
15.1.1 Background

Tarkwa currently operates four purpose-built engineered TSFs: TSF 1, 2, 3 and 5. TSF 1, 2 and 5 are active, while TSF 3 is inactive and under care and maintenance. The facilities are located about 1.5 km northwest of the process plant.

TSFs 1, 2 and 3 are typical hillside valley impoundments. A sloping east-west trending ridge provides containment with earth fill, rockfill embankments constructed parallel to the ridge, and short earth fill and rockfill embankments constructed at right angles to the main embankments abut into the ridge. TSF 5 is a paddock-type impoundment raised downstream using run-of-mine waste rock. TSF 5 is also fully lined with an HDPE geomembrane.

SLR Consulting (SLR) is the Engineer of Record (EoR) for TSF 1, 2 and 3. Knight Piésold (KP) is the EoR for TSF 5. The TSF locations are depicted in Figure 15.1.1 below.

Figure 15.1.1: Tarkwa TSFs



Source: Tarkwa CPR, 2022

15.1.2 GISTM

The Tarkwa TSFs 1, 2 and 3 must comply with the Global Industry Standard on Tailings Management (GISTM) by August 2023. A gap analysis has been completed, and the GISTM compliance program is underway in collaboration with the Engineer of Record.

15.1.3 LOM Capacity

TSF 1 was commissioned in 2004 and has been in operation for about 18 years. The facility covers a footprint area of ~135 ha and has an ultimate capacity of 90.0 Mt. The starter embankment was constructed to an elevation of 88.5 mRL. Ten staged raises have subsequently been completed after its establishment. The most recent raise (Stage 11A) was a two-metre lift during which the confining embankments were raised in a centreline manner from the Stage 10 elevation of 109.5 mRL to 111.5 mRL. The construction of Stage 11A, including the eastern buttress, was completed in August 2022 and provided an additional capacity of 3.4 Mt.

TSF 2 was constructed as part of the CIL expansion project in 2008. SLR Consulting (previously Metago Environmental Engineers) designed and oversaw the construction of this facility. The facility has been designed with an ultimate capacity of 88 Mt. The TSF 2 starter embankment was constructed to an elevation of 73 mRL, an initial embankment height of 15 m, and a crest width of 46 m. In 2010, the second phase of the starter embankment was completed to an elevation of 80 mRL. The third and fourth four-metre raises were completed in July 2012 and November 2014. The fifth four-metre raise to 92 mRL was carried out in September 2016, and Stage 6 raise to 97 mRL was completed in December 2018. The facility has a current surface area of ~190 ha. The Stage 7 wall raise to 101 mRL was completed in April 2022 for an additional capacity of ~9.3 Mt. The Stage 8 design was completed in October 2022, and construction commenced in November 2022.

A contract to design TSF 3 to the west of TSF 2 was awarded to Metago, and preparatory groundwork and stream diversion works commenced in 2010. The facility currently covers a surface area of ~127 ha, and its design ultimate capacity is 35 Mt. The Stage 2 raise, comprising a 3.75 m lift to 76.25 mRL, was completed in June 2015. The final lift to 80 mRL was completed in April 2017, and the available capacity was depleted in 2019. The decommissioning process on TSF 3 has commenced with grassing the dry beach to reduce fugitive dust generation, remove some slurry pipelines, and introduce nitrogen-fixing plants. Tree crops and plants were introduced in 2021.

TSF 5 is located between the north wall of TSF 1 and the south wall of the NHL pads. Construction commenced in February 2016 and was completed in February 2018. Deposition commenced in 2018. Stage 1 was constructed to an elevation of 80 mRL and yielded a storage capacity of ~11.5 Mt. The facility is fully lined with an HDPE geomembrane liner and raised downstream. Construction of the Stage 2 raise was completed in June 2022. TSF 5 was recommissioned in June 2022 after a fallow period due to the remediation of the sinkhole that occurred in early 2021. The Stage 3 lift design is underway, and construction will commence in Q1 2023.

The current TSF LOM capacity is 186.6 Mt to the end of 2034, compared to a LOM Mineral reserve of 181.2 Mt. A PFS study was recently completed to provide storage for an additional 20 Mt of tailings.

15.1.4 QP assessment

The Qualified person believes that the tailings infrastructure for the Tarkwa operation is fit for the life of mine reserve estimation and that the Mineral reserve quantities are tested against available tailings capacities.

15.2 Waste rock dumps

The planning of waste rock dumps is based on several factors, primarily to minimise haul distances. In addition to environmental and strategic planning criteria, the geotechnical factors accounted for in dump planning and design are mainly concerned with the dump foundations and dump material properties.

See Figure 3.4.1 for locations of waste rock dumps (waste storage facilities WSF).

Waste dumps at Tarkwa mine are constructed under the Environmental Protection Agency (EPA) of the Minerals Commission (MINCOM) guidelines. These are designed to certain degrees of stability and reliability. Dumps are generally segregated with oxide dumps usually separated from transitional and fresh waste materials. In areas where these must be combined, the rock will form the foundation (base), which is overlain by the oxide material. Dumps are designed at 15 m lifts with an inter-lift berm of approximately 15 m, this is sufficient to achieve an overall slope of 2.5:1 (22 degrees) angle. This requirement is critical in order to reduce the sedimentation of surface waters during the active life of the waste rock dump. Dump lifts (operational and final) are designed wherever practical with a minimum 1:200 gradients away from dump faces and towards natural ground or the access ramp in the case of free-standing dumps not built laterally from natural ground. This requirement is to ensure that rainwater collecting on the dump will naturally flow away from dump slopes and towards natural ground.

Due to the shallow dipping (15-25 º) of the footwalls, Tarkwa mine uses these as footwall waste dumps. A windrow (safety band) of at least 2 m high is constructed just outside the active mining level, to safeguard against boulders that may roll out further than anticipated from dump toes.

The surface asperity of the footwall slopes is generally rough undulating and generally free from clayey material, this provides more competent dump foundations than natural hillsides. Footwall dumps are generally constructed at approximately 30 m high. These are mostly rocky dumps. Very weak and clayey waste are not dumped unto footwalls, from where such material may wash down onto pit floors during rainstorms.

15.3 Water

Tarkwa is located in a high rainfall area hence there is a positive water balance, which means that water security for the LOM is assured. This is anchored in the corporate strategy of increasing water reuse and recycling while reducing freshwater intake. Excess water is treated using water clarifiers units with a capacity of about 2,000 cubic metres per hour and wastewater is recycled for reuse. A Reverse Osmosis Unit is employed to treat water that is not needed for processing and this is discharged when it meets the Water Effluent Discharge Standard. Potable water supply is mainly from groundwater boreholes. Water from boreholes located at various points on the mine are pumped through treatment systems to all areas of the mine including the camp, offices, workshops and the process plant for portable purposes.

15.4 Power

Ghana's electricity generation company VRA, the bulk transporter GridCo, and Ghana's distribution company ECG supplies power to Tarkwa. Power is supplied from three different areas at two voltage levels: 161 kV from Prestea and Takoradi to the plant area, and 33 kV to the mine village substation. An internal 11 kV overhead line network distributes power to the various plants. The mine village electricity distribution system is a combination of 11 kV aerial bundle conductors and mini-subs connected to a ring network. Emergency power generation systems are installed at strategic positions to facilitate power to essential and critical machinery and equipment in the event of a mains power failure.

The mine has four Independent Power Producer (IPP) gas turbines with a total generation capacity of about 40 MW. This ensures that the mine takes 94 % of electricity for mine consumption from the IPP. Tarkwa's monthly power consumption is about 25 GWh. The average demand is 38 MW.

15.5 Accommodation

Employees are accommodated in four GFGL-owned accommodation areas namely Green Compound, AVS, Apinto Ridge and the Atuabo view, as well as privately owned houses in the town of Tarkwa. Recreational facilities include two recreation clubs, restaurant, swimming pool, golf course, tennis court, gymnasium and squash court. The mine also has a fully equipped hospital and a school located within the mine accommodation.

15.6 Site access

There is a tarred road connecting the main Tarkwa town to the residence and recreational facilities. An untarred road connects the residences to the main mining areas and offices.

15.7 Other infrastructure

Other infrastructure on site includes:

- HME fleet maintenance workshops currently being used by the mining contractor.
- Fuel storage facilities.
- Offices and stores.
- Genser gas power generation plant is also located next to the HME workshop.

Notwithstanding the age, all surface infrastructure and equipment are adequately maintained and equipped. In conjunction with planned maintenance programs and specific remedial action systems, the general infrastructure is considered sufficient to satisfy the requirements of the LOM plan.

The Qualified person is of the opinion that, notwithstanding the age, all surface infrastructure and equipment are adequately maintained and equipped. In conjunction with planned maintenance programs and specific remedial action systems the infrastructure for the Tarkwa mining operation is considered sufficient to satisfy the requirements of the LOM plan and that the Mineral reserve quantities have been tested and satisfied for dump and disposal capacities.

16 Market studies

16.1 Preliminary market study

A review of metal prices for planning purposes is undertaken annually to monitor any significant changes in price trends or exchange rates that would warrant re-calibrating the price deck before the Strategic Planning process transitions into the Business Planning cycle.

This review of the metal price deck has taken account of the prevailing economic, commodity price and exchange rate (Fx) trends, together with market consensus forecasts, in addition to consideration of the Gold Fields' strategy and expectations for the operations.

Our strategy is to (1) mitigate annual volatility by holding planning metal prices as long as warranted to support stability in mine planning, notably regarding the underground MSO and open pit shell selections; (2) maintain appropriate margins on spot and long-term price forecasts to support the Group's BSC metrics; (3) protect against accelerating mining sector inflation and, (4) to confirm a separate gold price to be used specifically for the Operational Pan (budget) revenue streams and cashflows in Q3 each year.

The outcome of the pricing analysis was to use a gold price of $1,400/oz for Mineral reserves and $1,600/oz for gold Mineral resources for disclosure of estimates as shown below in Table 16.1.1.

Table 16.1.1: Mineral reserves and resources metal prices

Metal	Unit	December 2022 Metal price Deck	
		Mineral reserve 31 Dec 2022	Mineral resource 31 Dec 2022
Gold	$/oz	1,400	1,600

Source: Tarkwa CPR, 2022

The above price deck comparison to market long-term forecasts assessed at the time of analysis is consistent with the Registrants approach to retaining good discipline in support of the Company strategy. This ensures Gold Fields' Mineral resources and reserves are not too volatile year-on-year and that the company is protected against possible downside scenarios if the gold price falls up to ~25 % in any specific year. Ensuring sufficient flying height to maintain our margins at prices that could be incrementally lower than the spot price ranges seen in 2022 is also important. Equally, with annual mining sector inflation estimated at $30-40/oz, we need to ensure mitigation against potential inflationary escalation risk in the LOM plans and Mineral reserve estimates.

Sensitivity analyses on gold price for project financial evaluation is done to provide flexibility/range analysis for all regional studies and site growth opportunities and for investment purposes.

The Mineral resources gold price premium to the Mineral reserves price is circa 15 % and the differential is in general alignment to our peer group and industry standard practice. The Mineral resource premium is to provide information on each operation's potential at higher gold prices and to indicate possible future site infrastructure and mining footprint requirements.

GFGL and Abosso Goldfields Limited (AGL) have existing refining, sales & marketing agreements (the Refinery Agreements) with MKS. The Refinery Agreements are arm's length transactions negotiated by the parties acting independently and the terms meet all requirements under applicable law. Furthermore, Gold Fields' treasury department in the corporate office in Johannesburg, South Africa sells all the refined gold produced by the operating company. On collection of the unrefined gold from the mine site, the relevant operating company will notify Gold Fields' treasury department of the estimated refined gold content, expressed in troy ounces, available for sale. After such confirmation, the treasury department sells the refined gold to authorised counterparties at a price benchmarked against the London Bullion Market Association (LBMA) PM gold auction price.

Gold Fields may periodically use commodity or derivative instruments to protect against low gold prices with respect to its production. Variations in gold price, currency fluctuations and world economics can potentially impact on the revenue received. No derivative instruments are in place at the date of this report.

Most gold production is used for jewellery and for investment purposes, in the latter case because the market views it as a store of value against inflation. In addition, certain physical properties of gold, including its malleability, ductility, electric conductivity, resistance to corrosion and reflectivity, make it the metal of choice for several industrial and electronic applications.

Supply of gold consists of new production from mining, the recycling of gold scrap and releases from existing stocks of bullion. Mine production represents the most important source of supply, typically comprising 75 % each year. Annual demand requires more gold than is newly mined and the shortfall is made up from recycling. Management believes that long-term gold supply dynamics and global economy trends will support the gold price at levels above or aligned to $1,400 per ounce in the long-term.

The market for gold is relatively liquid compared to other commodity markets, with London being the world's largest gold trading market. Gold is also actively traded via futures and forward contracts. The price of gold has historically been significantly affected by macroeconomic factors, such as inflation, exchange rates, reserves policy and by global political and economic events, rather than simple supply/demand dynamics. Gold is often purchased as a store of value in periods of price inflation and weakening currency. The price of gold has historically been less volatile than that of most other commodities.

The Qualified person has relied on information provided by the Company in preparing its findings and conclusions regarding market studies related to gold sales from Tarkwa. Refining services are based on well-established long-term agreements and expediting gold sales over the life of the asset does not represent any significant uncertainty. The service contracts, lease agreements and goods contracts (e.g., diesel, cyanide, etc.) necessary to develop the Property as planned, are in place and have the capability to support the full projected cashflow period. All such material contracts are arm's length transactions negotiated by parties independently and are in compliance with applicable law.

16.2 Metal Price history

Gold prices London Metals Exchange afternoon close

- Gold spot 29 December 2022 - $1,813.75/oz
- Gold spot 24 month average - $1,799.3/oz
- Gold spot 36 month average - $1,789.4/oz
- Gold spot 60 month average - $1,605.5/oz

17 Environmental studies, permitting and plans, negotiations, or agreements with local individuals or groups

Climate change is an integral part of the Mineral reserves generation process and incorporating relevant costs associated with climate change, primarily decarbonisation, mitigation and adaptation to the changing climate, is a key theme for the Company. Integration of these key elements into the Mineral reserve process is being carried out progressively and simultaneously across all Gold Fields' sites.

17.1 Permitting

The EPA Act, 1994 (Act 490) and the Environmental Assessment Regulations, 1999 (LI 1652), regulate activities which affect the environment in Ghana and are administered by the Environmental Protection Agency (EPA). Mining companies are also required under the Minerals and Mining Act, 2006 (Act 703), Minerals and Mining (amendment) Act, 2015 (Act 900) and their attendant Minerals and Mining Regulations (e.g., LI 2182, 2012) to have due regard to the effect of their operations on the environment, and to take steps to prevent pollution of the environment.

Under Schedule 2 of the Environmental Assessments Regulations (LI 1652, 1999), mining is considered an undertaking for which registration, environmental impact assessment and permitting is mandatory. Mining companies are therefore required to obtain an environmental permit before commencing mining operations and an environmental certificate within 24 months of the date of the commencement of operations after the submission of an environmental management plan (EMP).

To obtain a permit, the EPA require the submission of a completed environmental assessment registration form (Form EA 2), which should provide an overview and preliminary environmental assessment of the proposed undertaking. After receipt and review of the application, the EPA undertakes a review and issues a screening report which stipulates a determination by the Agency that, an application at the initial assessment, is approved, objected to, requires the submission of a preliminary environmental report or the submission of an environmental impact statement (EIS). This decision is normally communicated to the applicant within 25 days from the date of the receipt of the application for an environmental permit.

In respect of a proposed mining undertaking, the mining company (applicant) shall submit an EIS which shall be outlined in a scoping report to the Agency. A scoping report sets out the scope or extent of the environmental impact assessment to be carried out by the applicant, and includes a draft term of reference, which shall indicate the essential issues to be addressed in the environmental impact statement. The Agency shall upon receipt of a scoping report examine it and inform the applicant within 25 days of the receipt of the report whether it is acceptable or not acceptable.

Where a scoping report is accepted by the Agency, it requests the applicant to submit an environmental impact statement based on the scoping report. Where a scoping report is not acceptable to the Agency, the applicant is advised by the Agency to revise the report as appropriate and resubmit it. Where an applicant has been asked to submit an EIS it is the responsibility of the applicant to advertise the Scoping Notice to the general public and make available copies of the scoping report for inspection by the general public in the locality of the proposed undertaking.

- The Regulations require the EPA to advertise the EIS and to hold a public hearing if it appears that, there is "great adverse public reaction" to the proposed activities, to hear comment and objections from interested and affected parties. The EIS may therefore be reviewed in the light of these comments, and may be approved, or returned to the applicant for modification and re-submission. Once the EIS, if required, is approved, the EPA issues an environmental permit for the project. Environmental permits, which are valid for 18 months from the date of issue, normally contain several conditions and commitments made in the EIS documents and these are considered as legal commitments. Within 24 months after the commencement of operations, and every three years thereafter, the company must submit an environmental management plan (EMP) to the EPA that describes how the company will manage the environmental aspects of the project over the following three years. Resource Other reporting conditions stipulated in environmental reports include the submission of monthly environmental monitoring returns, annual environmental reports and on a biennial basis, a biennial costed reclamation and closure plan and any other specialized report that may be requested by the Agency.

- In addition to an environmental permit and environmental certificate, several other authorisations may be required, as indicated below:
  - Ghana Minerals Commission (MINCOM) issues a Mining Operating Permit for all mining projects on an annual basis. A mine cannot operate in Ghana without this approval.
  - Road construction requires approval from the Ghana Highway Authority and the EPA.
  - Water abstraction, pit dewatering and water discharge permits are required from the Water Resource Commission (WRC) to sink boreholes, impound water and abstract groundwater or surface water, dewater pits and discharge water into a receiving environment. Permission is also required from the WRC for diversion of watercourses.
- Should mining take place within a Forest Reserve, permission is required from the Forestry Services Division, in accordance with the Environmental Guidelines for Mining in Productive Forest Reserves (2001). The guidelines also require that the EPA hold a public hearing at the end of scoping (this is in addition to the one required at the end of the EIA).
- Approval is required from the EPA and Land Valuation Board for the relocation of people, dwellings and crop compensation.
- Chemical purchases require the EPA's Chemical Clearance Certificate on an annual basis.
- Various building and construction permits, from various regulators, typically development permits from Regional, District Assemblies like Tarkwa-Nsuaem Municipality.
- Factory facilities on the mine site like the OTR Tyre Re-tread Facility require approval from the Factories Inspectorate Division (Ministry of Employment and Social Welfare) which administers the Factories, Offices and Shops Act 1970.

In line with the requirements of the EPA Act of 1994 (Act 490), the Agency may suspend or revoke an Environmental Permit, or Environmental Certificate, in certain circumstances, including where the holder breaches any of the provisions of the Regulations, or of the conditions of the permit or certificate, or where the holder fails to comply with any of its mitigation commitments in the EMP.

Tarkwa operates in accordance with Ghanaian environmental requirements, as administered by the EPA, and the WRC, as applicable, and holds the required Environmental Permits and valid Environmental Certificates.

A summary of all current significant Tarkwa permits is provided in Table 17.1.1.

Mining operations are required by Ghana's environmental laws to rehabilitate disturbed lands as a result of mining operations, pursuant to a Reclamation Security Agreement (RSA), reclamation criteria and action plan agreed with the Ghanaian environmental authorities. This obligation is secured by posting reclamation bonds, which serve as a security deposit against default. Reclamation bonds are assessed every two years (biennial) based on agreed estimated rehabilitation costs incurred to date and expected to be incurred during the two years until the next reclamation plan is submitted to the EPA.

Tarkwa submitted its revised EMP to the EPA in November 2021 (for the 2022-2024 period). Tarkwa paid the requisite processing and permit fees and is waiting for the environmental certificates to be issued by the EPA.

Gold Fields is obliged to provide security to the EPA as a guarantee against the reclamation of disturbed land because of its operations. Tarkwa have a bank guarantee, a restricted cash account established in line with EPA requirements and have set aside cash as part of their financial provision for closure.

Table 17.1.1: List of Tarkwa permits

Date issued	Title	Purpose	Status	Comment
May 2019	Kobada Pit Development	To mine a pit outside the existing pit shell	Permit Expired	Pit Development on going. Pit Now part of our EMP
December 2019	Water Use Permit. Ground Water Abstraction	Abstract groundwater for both domestic and industrial use	Permit Expired	Valid Until December 2022
December 2019	Water Use Permit Pit Dewatering	Dewater pits for mining	Permit Expired	Valid Until December 2022
December 2019	Water Use Permit – Discharge	Discharge water which are within the applicable GSA Standards	Permit Expired	Valid Until December 2022
October 2021	Tailings Storage Facility 1 (TSF 1) Stage 11A Wall Raise	Construction and operation of TSF 1 Stage 11A wall raise	Construction Completed.	Both EPA and Minerals Commission Approvals obtained
May 2021	TSF 2 Stage 7 Wall Raise	Construction and operation of TSF 2 Stage 7 wall raise	Construction On-going	Construction ongoing. Both EPA and Minerals Commission Approvals obtained
August 2021	TSF 5 Annex	Construction and operation of a new TSF (TSF 5 Annex)	New Project	Permit Fee Paid – Awaiting Issuance of Permit
January 2022	Environmental Management Plan	Environmental Certificate	Permit Expired in January 2022	Updated EMP submitted and permit fee paid– Awaiting Issuance of Permit
June 2022	Akontansi Ulap Pit Expansion	Extend the mining of the Akontansi Ulap pit	New Project	Supplementary EIS and permit fee paid– Awaiting Issuance of Permit
January 2023	TSF 2 Stage 8 Wall Raise	Construction and operation of TSF 2 Stage 8 wall raise	Construction On-going	Both EPA and Minerals Commission Approvals obtained
January 2023	Water Use Permit. Ground Water Abstraction	Abstract groundwater for both domestic and industrial use	Permit Renewed	Valid Until December 2025
January 2023	Water Use Permit Pit Dewatering	Dewater pits for mining activities	Permit Renewed	Valid Until December 2025
January 2023	Water Use Permit – Discharge	Discharge water which are within the applicable GSA Standards	Permit Renewed	Valid Until December 2025

Notes:

a) The Qualified person has selected significant permits to demonstrate permitting.

b) The Qualified person is of the opinion that the licenses are in good standing and that any current or future licensing can and will be obtained for the Mineral reserve or the Mineral resource.

c) The Qualified person is of the opinion that Tarkwa has a good standing with licensing authorities, community groups and that licensing is not expected to be material to Mineral reserves or Mineral resources.

d) Tarkwa is conducting continuous rehabilitation and has a large closure liability. The Qualified person is of the opinion that the closure estimates and duration are reasonable and practical and that appropriate funding provisions are in place to expedite all obligations.

Source: Tarkwa CPR, 2022

17.2 Environmental Provision

Environmental management at Tarkwa is conducted within the framework of the ISO14001:2015 certified Environmental Management System (EMS). The foundation of the EMS is the Tarkwa Environmental Policy, which is aligned with the Gold Fields Limited Environmental Policy. Current environmental studies at Tarkwa mine include a biodiversity study, Acid Rock Drainage, update of the water management plan and water balance and an update of the mine closure plan and closure cost estimate.

Tarkwa has expanded the environmental studies in the EIS through conducting a Biodiversity Assessment, from which a Biodiversity Management Plan has been produced. The Biodiversity Management Plan aims to guide management of flora and fauna in active mining areas.

The total reclamation bond for Tarkwa as at November 2022 Environmental management at Tarkwa is conducted within the framework of the ISO14001:2015 certified Environmental Management System (EMS). The foundation of the EMS is the Tarkwa Environmental Policy, which is aligned with the Gold Fields Limited Environmental Policy.

Tarkwa has expanded the environmental studies in the EIS through conducting a Biodiversity Assessment, from which a Biodiversity Management Plan has been produced. The Biodiversity Management Plan aims to guide management of flora and fauna in active mining areas.

Annual update of the Closure Cost Estimate (CCE) was conducted. The total reclamation liability for Tarkwa as at December 2022 is $112.98 million. A total provision of $105.51 million comprising $36.8 million Bank Guarantee and $68.73 million cash has been made for LOM closure activities.

The Qualified person is of the opinion, after due consultation with in-house experts, that current plans to address issues relating to environmental compliance, permitting and communities are adequate.

17.3 Waste disposal, monitoring and water management

17.3.1 Tailings storage facilities (TSF)

Consequence classification

The GISTM consequence classifications of the TSFs are as follows:

- TSF 1 – Very High
- TSF 2 – Very High
- TSF 3 – Very High
- TSF 5 – High

Regarding storm holding capacity, the TSFs are designed as closed circuits with enough capacity to contain extreme storm events commensurate with their classification. The TSFs pond freeboard measurements are recorded to confirm the adequacy of storm storage capacity. Pond freeboard measurements were within the design and regulatory limits at the end of Q3 2022. Adequate beach lengths from confining embankments were also maintained. The elevation of the TSF ponds at the complex is controlled by electrical submersible and horizontal pumps, complemented by diesel pumps when required. The elevation is monitored daily using a level gauge mounted at the decant stations and confirmed with month-end GPS measurements.

Phreatic surface

The phreatic surfaces within the embankments and tailings are monitored using standpipe and vibratory wire piezometers.

Vibratory wire piezometers reacted to active deposition at TSF 1 on the east and west walls. The pore pressures at the north remained relatively flat throughout the quarter.

Sensors within the tailings mass continued to respond to active tailings deposition at TSF 2, especially along its northern embankment. The phreatic surface along the northern flank of TSF 2 has risen and remained relatively high over the last 6 to 12 months as a result of receiving additional throughput due to TSF 5 being out of operation over the last 18 months. However, a very small pond has been maintained, and some of the steady piezometer trends reflect that.

The phreatic surface trends at TSF 3 remained consistent throughout the first quarter. Water levels have remained unchanged since closure tailings deposition ceased in 2019. The facility has been decommissioned and is being rehabilitated.

Existing DT Link VWPs were converted to RSTAR-type piezometers at TSF 5. Additional VWPs were also installed in the foundations of the downstream waste rock buttresses. Monitoring pore pressure in the heap leach mass continued through the quarter without notable variations.

All the piezometer trigger levels are being evaluated as part of EoR studies this year.

Embankment movement

Tarkwa is in the process of complementing embankment movement measurements with In-place Incinometers (IPI) Shape Acceleration Arrays (SAA). Drilling and installation at 4 locations at TSF 1 have been completed. Drilling is ongoing at TSF2. Monitoring and calibration of the installed units are ongoing.

Groundwater

Several boreholes have been established around the downstream perimeter of the TSF Complex and are sited to intercept any pollution plumes from the existing TSFs. Water samples are collected from these boreholes and tested monthly as part of the operations' groundwater monitoring regime. Laboratory testing includes physical parameters, nutrients, chemicals and dissolved trace metals.

For Q3 2022, results indicate non-contamination of the groundwater systems from the TSFs. This was confirmed by comparing results to baseline and the EPA portable water threshold limits. Sampling was undertaken at about 21 points along the downstream areas of the Complex. Water levels within the boreholes are also measured monthly to check groundwater level fluctuations.

Stability

A buttress has been completed along the TSF 1 east wall to improve the factors of safety of the wall in addition to achieving the ANCOLD requirements. The recommendation was made as part of the Stage 11A design, which has also been completed. The downstream raise construction method will be adopted on future raises along the TSF 1 east wall.

For the TSF 1 north wall, the rapid development of the south wall of TSF 5 or a rock buttress along the south wall on the TSF 5 beach was assessed. After careful consideration, the former was adopted. However, further buttressing and downstream embankment construction will be required in the future to reduce the probability of failure at the north and east walls. As a contingency and to allow for more redundancy in the tailing's deposition plan, the EoR has been requested to investigate the feasibility of developing a cyclone buttress along the TSF 1 northern flank.

The phreatic surface along the northern flank of TSF 2 has risen over the last 6 to 12 months as a result of increased deposition rates due to TSF5 being out of operation over the last 18 months. This has resulted in the FoS along this flank being marginally below the LI2812 and ANCOLD requirements. Therefore, the TSF 2 stage 8 design includes a buttress that will address the FoS issue and eliminate credible failure modes. Construction work has commenced on the buttress works and is ongoing.

TSFs 2 (remaining embankments), 3 and 5 have factors of safety above the minimum requirements of the L.I. 2182 and ANCOLD.

WAD Cyanide

WAD Cyanide levels at the TSF Complex remain below the compliance limit of 50 ppm prescribed by the ICMC. As a result, no exceedances were recorded in Q3 of 2022. The average discharge level at the complex within the quarter was 19.2 ppm, with a minimum and maximum of 1.2 and 39.4 ppm, respectively.

Construction

Construction of the TSF 1 Stage 11A and TSF 2 Stage 7 wall raises was completed in April and August 2022, respectively. The TSF 5 Stage 2 wall raise was completed in June 2022. The TSF 2 Stage 8 construction early works comprising boxcut and buttress construction along the north and west walls commenced in November 2022.

The TSFs at Tarkwa are well managed from a dam safety and governance perspective.

Audits and inspection

As part of their EoR responsibilities, SLR Consulting and Knight Piesold (KP) undertakes quarterly and annual audits of the TSFs. In addition, an Independent Technical Review Board (ITRB) meeting was held on-site in June 2022. The inspection, audit and meeting yielded no dam safety concerns. However, some operational deficiencies and governance items need to be addressed.

In addition, Glocal has also been contracted to undertake independent third-party quarterly and annual audits of the facilities. Glocal's quarterly audits and findings, per the TSF permit conditions, are submitted to the Ghana Environmental Protection Agency (EPA).

In addition to the regular EoR and third-party audits, Golder Associates Pty Ltd. (Golder) was contracted in 2020 to conduct a triannual third-party operational review of the Tarkwa TSFs. The next audit is scheduled for 2023.

17.3.2 Waste rock dumps

Testwork of waste rock by subjecting samples to acid-base accounting is ongoing. Results to date show no indication of the potential for significant ARD generation from mine waste. These results are confirmed by ongoing environmental monitoring, and no special measures have been necessary.

In line with the mine's concurrent rehabilitation policy, the Health, Safety and Environmental department re-slopes portions of waste rock dumps (WRD) that have reached completion stage. The re-sloped phases are then covered with subsoil or oxide material and topsoil as per regulatory requirement. Construction of crest and stone pitched drains are other rehabilitation activities that are done on re-sloped WRD phases before the completion of revegetation on the phases. Rehabilitation maintenance activities such as weeding, pruning, replacement of dead seedlings, pest control and fertiliser application are rehabilitation maintenance activities that are done on ongoing bases at the mine. Cost estimates for WRD phases that are not at the completion stage for concurrent rehabilitation are captured in the mine's closure cost estimates every year.

The Qualified Person is of the opinion that the waste rock dumps at Tarkwa are adequate for this LOM Reserve plan. Regular waste rock inspections are performed to assess safety.

17.3.3 Water management

The Water Resources Commission (WRC) was established through an Act (Act 522) in 1996 and was given the mandate to regulate all activities relating to water in Ghana. The Legislative Instrument (LI) 1692 indicates what needs to be permitted by the WRC. Any activity which is carried out by the mine on any water body be it a stream or a wetland will need to be permitted by the WRC. This includes abstraction, diversion, damming or discharge into the water body. Also required to be permitted is any activity on groundwater, including boreholes used for domestic purposes and supplement the process plant.

Tarkwa is required to indicate the estimated volume of water it intends to use for the years within the permit cycle and the WRC is mandated to charge a fee. The mine has valid groundwater abstraction, water discharge and pit dewatering permits valid from January 2023 to December 2025.

Tarkwa has constructed numerous silt traps to prevent sediment load from entering streams in the mine concession. Sediment control dams are also constructed at selected vantage points. Currently, there are three clarifiers on the mine (CIL and NHL) and a water treatment plant to improve the quality of water recycled for reuse or discharge from the mine. Additional containment bunds and contingency pond storage exist within the process plant to provide emergency storage and containment of spilled tailings material.

In many of the pits, water level rises may spill into natural watercourses. Pit water quality meets applicable standards and Tilapia fish are multiplying. This supports the favourable projections for future water quality and future use of the pits for fish farming.

Ground water boreholes both shallow and deep have been drilled around the tailing's storage and the heap leach facilities to monitor groundwater quality and serve as surveillance monitoring networks to detect any possible pollution of groundwater and enable the mine to adopt the appropriate mitigation measures. Currently there is no significant impact on groundwater quality which can be attributed to mining operations.

Potable water for the mine and residential areas is abstracted from boreholes located at the plant site and the residential area.

The site-wide water balance has been reviewed by an external consultant. The final report was submitted in June 2022. Tarkwa's strategy is to maximise water reuse and recycling while reducing freshwater usage and discharging minimum volumes where necessary.

The Qualified person has the opinion that the procedures, monitoring and execution of the water management plan are adequate for supporting the life of mine Mineral Reserve estimate.

17.4 Social and community

Large resettlement programs, in line with good international practice, were carried out in collaboration with the local community and authorities. Tarkwa maintains a positive relationship with nearby communities.

Sustainable development responsibilities for the operations are split between Environment, Health and Safety, and Community Relations Departments at the operation and the Corporate Affairs and Social Development Offices in Accra. Particular attention is paid to engagement with stakeholders such as the Municipal Assembly, Traditional Authority, NGOs and the media in sustainable development activities.

The Company is committed to ensuring that the host communities realise genuine and lasting benefits from its presence. To affect this, the Gold Fields Foundation ensures development of the nine catchment communities. The Foundation is funded by $1/oz of gold produced and a 1.5 % pre-tax profit. The Foundation supports development programs in education, health, water and sanitation, agriculture and micro-enterprises and infrastructure. The programs are extensively discussed with beneficiary communities for their buy-in prior to implementation. Since inception, the Foundation has contributed about $44 million to Tarkwa's host community development.

An amount of $6.6 million was used for social development programs in the Company's primary stakeholder communities during the 2022 fiscal year.

The mine sets annual targets for host community procurement and employment.

17.5 Mine closure

Tarkwa has an up-to-date mine closure plan, submitted to the EPA and Minerals Commission in 2022. The plan has been developed in accordance with legal requirements and Gold Fields guidance, which aligns with the International Council on Mining and Metals (ICMM) guidance The Mine Closure Plan determines the mine closure requirements and calculates the financial or closure cost liability associated with closure.

The Mine Closure Plan identifies the baseline description, the closure vision or objectives, risks and opportunities, and closure activities, which include stakeholder engagement, decontamination, dismantling, re-profiling and revegetation of land or landforms, maintenance and monitoring, including post closure water monitoring (after rehabilitation is completed). Commitment in EIS, EMP and Environmental Permit schedules are considered as Compliance Obligation and are included in the mine closure liability estimates. This includes the restoration of the Teberebie - Awunaben pillar after mining.

The operation has a Progressive Rehabilitation Plan (PRP), developed in accordance with the approved Mine Closure Plan and Group guidance. The operation sets annual targets for the implementation of the PRP and tracks their performance against these targets.

Tarkwa have developed their closure cost estimate using the Standardised Reclamation Cost Estimator (SRCE) model. Closure costs are reviewed every year to reflect actual and proposed disturbances and changes in closure requirements. The estimated closure cost for life of mine was estimated, as at 31 December 2022, as $112.68 million (excluding taxes). The SRCE closure cost estimate, developed for Day of Assessment (DoA) purposes, is updated and reviewed every two years by an independent external consultant. It is also reviewed annually as part of the Group financial assurance.

Tarkwa's closure cost estimate is aligned to the 2003 Reclamation Security Agreement (RSA) and the Minerals and Mining (Health, Safety and Technical) Regulations (2012) requirements. The RSA between the operation and the EPA ensures that Gold Fields is obliged to provide security to the EPA as a guarantee against the reclamation of disturbed land because of its operations. Tarkwa have a bank guarantee, a restricted cash account established in line with EPA requirements and have set aside cash as part of their financial provision for closure. The Qualified person is of the opinion that the closure estimates and duration are reasonable and practical and appropriate plans, including continuous rehabilitation and funding provisions are in place, as regulated, to support execution of the life of mine plan and to meet the closure liabilities.

18 Capital and operating costs

18.1 Basis and accuracy

Capital and operating costs for Tarkwa are based on items incorporated in the life of mine plan to secure the stated Mineral reserve stated.

The operating and capital cost estimates are based on consideration of recent historic performance and the components of the Mineral reserve life of mine plan to generate a realistic and appropriate life of mine financial model. The levels of accuracy are the same as or better than a pre-feasibility study at an estimated accuracy of ± 25 % and require no more than 15 % contingency. The specific engineering estimation methods are equal to or better than estimated above.

Gold Fields' two-year business planning cycle captures operating and capital costs along with key physicals and revenue. The business plans are internally reviewed and presented to the executive for approval prior to being sanctioned by the Gold Fields board of directors. The business plans are aligned with the Registrant's strategic direction for operating properties and provide the base for the first two years of the life of mine plan.

Capital expenditure once sanctioned must follow the Company's capital reporting standard.

18.2 Capital costs

Based on stated Mineral reserves, capital expenditures will continue until 2032. The capital expenditures are based on detailed requirements and assessment for the next two years. Capital estimates beyond the first two years are based on pre-feasibility or better estimates for infrastructure, equipment and development requirements for individual projects, with nominal allowances made for general overheads and processing capital requirements.

Table 18.2.1 summarises the forecast sustaining and project capital costs for Tarkwa.

Table 18.2.1: Sustaining and project capital costs forecast (100 %)

Capital cost item	Units	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Mining MP&Dev	$ million	188.0	141.0	146.0	173.0	247.0	175.0	148.0	144.0	43.0	0.0	0.0	0.0	0.0	0.0
Mining Capital Works	$ million	9.0	1.0	2.0	4.0	4.0	2.0	2.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Processing (incl. TSFs)	$ million	31.0	46.0	38.0	19.0	5.0	31.0	5.0	30.0	15.0	7.0	8.0	12.1	0.0	0.0
G&A Capital	$ million	5.0	7.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	0.7	0.0	0.0
Infrastructure	$ million	4.0	10.0	10.0	11.0	20.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capital	$ million	237.1	205.0	198.0	209.0	278.0	237.0	156.0	178.0	59.0	8.8	9.0	12.8	0.0	0.0

Notes:

a) The capital costs are based on the 31 December 2022 life of mine schedule for proven and probable reserves and are on 100 % basis.

b) No inferred Mineral resource is included in the LOM processing schedule or techno-economic evaluation.

c) Tailing storage facilities are costed according to the LOM requirements. The current in-pit tailings storage facility is expected to have reached capacity before the reserve life of mine is consumed. The cost of the replacement facility is included in the LOM financial model.

Source: Tarkwa CPR, 2022

18.3 Operating costs

Operating costs are based on the 2022 plant and infrastructure operational and business plan cost schedules until 2035, inclusive of overheads and mining rates. Gold metal prices are adjusted to incorporate royalties paid to the Government.

Operating costs are divided into:

- Tarkwa's mining operations are based on contractor mining, which means that mining costs are mainly driven by contract rates. These vary depending on the volume of material mined, pit depth and other factors considered during the tender process. In addition, Tarkwa's owner mining and technical services costs and dayworks are included in the mining cost.

- Mining costs, including ore handling costs: Mining costs are based on approved contractor rates from the primary mining contractors being BCM for Zone 1 (Teberebie and Pepe) and E&P for Zone 2 (Akontansi, Kottraverchy and Kobada). Other costs (e.g., G&A) are derived from past costs (i.e., January 2019 to June 2020) and anticipated future escalations. The 2022 LOM surface sources costs are based on approved contracts rates (E&P). These are quoted per location and distance to the crushers.
- Processing costs, including tailings and waste disposal costs: For 2023 and beyond, processing costs are based on 2022 actuals and escalations.
- Centrally allocated costs: For 2023 and beyond, administration costs (G&A) are based on 2022 actual costs and escalations where necessary.
- The G&A cost is made up of onsite and offsite overhead costs. The onsite cost includes all service departments on the mine, including human resource, finance, community affairs, environment, safety and protection services. Offsite costs include Accra office overhead costs, management fees and Gold Fields charges.

The operating costs forecast is summarised in Table 18.3.1.

Table 18.3.1: Operating costs forecast (100 %)

Operating cost item	Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Mining	$ million	227.8	245.3	215.3	196.4	119.3	176.8	191.0	187.1	118.7	77.3	0.0	0.0	0.0	0.0
Processing	$ million	135.4	136.2	135.4	135.4	135.4	135.9	134.7	134.6	129.2	133.5	129.2	148.1	129.9	0.0
G&A Operating	$ million	75.8	76.5	76.6	76.8	76.5	76.5	76.5	76.5	34.3	30.6	13.7	13.0	9.5	0.0
Other operating costs	$ million								0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating costs	$ million	439.0	458.0	427.3	408.6	331.2	389.2	402.1	398.2	282.2	241.5	142.9	161.1	139.4	0.0

Notes:

a) The operating costs are based on the 31 December 2022 life of mine schedule for proven and probable reserves and are on 100 % basis.

b) No inferred Mineral resource is included in the life of mine processing schedule or techno-economic evaluation.

c) Exploration costs required to replace depleted reserves are not included in this techno-economic assessment.

d) No inferred Mineral resource is included in the life of mine processing schedule or techno-economic evaluation.

e) Costs are first principles based on the Mineral reserve life of mine schedule.

f) This operating cost summary estimate is for the Mineral reserve life of mine schedule.

Source: Tarkwa CPR, 2022

Table 18.3.2 shows the post life of mine closure costs provided for in support of the Mineral Reserve.

Table 18.3.2: Post LOM costs 100 % Basis

Sources	Units	2035	2036	2037	2038 onwards
Post Reserve LOM Closure	$ million	20.4	17.1	5.3	5.8

Source: Tarkwa CPR, 2022

The Qualified Person's opinion on capital and operating costs is summarised below:

b) The financial schedule is linked to the life of mine plan to ensure the provision of capital is coupled to when the major budgeted items need to be funded.

a) The capital and operating costs applied are appropriate to derive a realistic and meaningful LOM financial model that supports the Mineral reserve.

b) The capital, operating and closure cost estimation levels of accuracy meet the minimum pre-feasibility study requirements at an estimated accuracy of ±25 % and require no more than 15 % contingency. The specific engineering estimation methods have an accuracy equal to or better than this range.

c) Tarkwa has improved capital estimation and capital delivery through the application of Group Capital Standards and capital projects review by a select team with improved implementation planning. Gold Fields also perform regular post investment reviews across all major capital studies and share key learnings.

d) Gold Fields' two-year business planning cycle captures operating and capital costs along with key physicals and revenue. The business plans are internally reviewed, presented to the Executive Committee for approval, prior to sanctioning by the Gold Fields board of directors. The business plans are aligned with the Registrant's strategic direction and equate to the first two years of the life of mine plan.

e) Capital expenditure, once sanctioned, must follow the company capital reporting standard. Monthly and quarterly reviews are held to assess capital programs, operating unit costs, mine physicals, plan execution and revenue streams.

f) Operating unit costs are based on recent valid historical performance and where necessary take account of future changing circumstances that are anticipated to impact future operating costs.

19 Economic analysis

19.1 Key inputs and assumptions

The economic analysis that confirms the cashflow, revenue, financial viability and valuation for Tarkwa is based on:

- All assumptions are in 'Publication Date' money terms, which is consistent with the valuation date.
- Royalties on revenue are consistent with the relevant legislation.
- Taxable income is calculated in terms of local relevant legislation.
- A real base case discount rate which is determined by the Gold Fields Corporate Finance team annually.
- The discounted cashflow (DCF) applied to post-tax, pre-finance cashflows and reported in financial years ending 2035.

The input parameters for the economic analysis are based on:

- The Mineral reserves disclosed in Section 12.3, with no inferred Mineral resources included in the economic analysis.
- The mining and processing schedule disclosed in Chapter 12.2.
- Metallurgical process recoveries disclosed in Chapter 12.2.
- Capital costs disclosed in Chapter 18.2.
- Operating costs disclosed in Chapter 18.3.
- Royalty rates disclosed in Chapter 3.5.
- A Mineral reserve gold price of $1,400/oz as discussed in Chapter 12.2.
- A real discount rate of 15.9 %.
- A corporate tax rate of 32.5 %.

The LOM physical, operating cost and capital cost inputs, including rehabilitation, leasing and closure costs and revenue assumptions for the economic analysis to 2035 are summarised in Table 19.1.1.

Table 19.1.1: LOM physical, operating cost and capital cost inputs and revenue assumptions 100 % basis

Sources		Units	2023	2024	2025	2026	2027	2028	2029
Open Pit	LOM Processed	koz	493.2	369.6	409.4	374.9	218.8	431.9	481.3
	Recovery	%	97.1	97.2	97.2	97.2	97.2	97.2	97.0
	Sold	koz	478.9	359.3	398.0	364.4	212.7	419.8	467.0
Stockpiles	LOM Processed	koz	68.6	176.0	141.1	127.6	222.7	92.9	39.5
	Recovery	%	97.1	97.2	97.2	97.2	97.2	97.2	97.0
	Sold	koz	66.2	171.0	137.2	124.0	216.5	90.3	38.4
	Total Sold	koz	545.5	530.3	535.1	488.4	429.2	510.1	505.3
Costs, Revenue and Cashflow	Revenue	$ million	763.8	742.4	749.2	683.8	600.8	714.1	707.5
	Operating Costs	$ million	439.0	458.0	427.3	408.6	331.2	389.2	402.1
	Capital Costs	$ million	237.1	204.6	198.4	208.6	277.6	236.5	156.1
	Other	$ million	18.1	50.0	14.6	12.6	-2.3	-3.5	13.4
	Royalties	$ million	27.8	26.0	26.2	24.1	21.3	24.7	24.8
	Government levies	$ million	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Interest (if applicable)	$ million							0.0
	Total Costs	$ million	722.0	738.6	666.5	653.9	627.8	646.9	596.4
	Taxes	$ million	37.2	2.5	10.2	3.4	0.3	1.3	28.1
	Cashflow	$ million	4.6	1.3	72.5	26.5	-27.2	65.9	83.0
	Discounted cashflow at 15.9 % (NPV)	$ million	4.2	1.0	50.2	15.8	-14.0	29.3	31.8
	Cashflow (CF)	$ million	4.6	1.3	72.5	26.5	-27.2	65.9	83.0

Unit	2030	2031	2032	2033	2034	2035	2036

Open Pit	LOM Processed	koz	437.4	198.6	115.9	0.0	0.0	0.0	0.0
	Recovery	%	97.0	95.6	94.7	90.0	90.0	90.0	
	Sold	koz	424.3	189.9	109.7	0.0	0.0	0.0	
Stockpiles	LOM Processed	koz	36.1	177.3	228.6	186.2	186.2	163.4	
	Recovery	%	97.0	95.6	94.7	90.0	90.0	90.0	
	Sold	koz	35.0	169.5	216.4	167.6	167.6	147.0	
	Total Sold	koz	459.3	359.3	326.1	167.6	167.6	147.0	
Costs, Revenue and Cashflow	Revenue	$ million	643.0	503.1	456.5	234.7	234.7	205.9	
	Operating Costs	$ million	398.1	282.2	241.4	142.9	161.1	139.4	
	Capital Costs	$ million	177.7	59.1	8.8	8.9	12.8	0.0	
	Other	$ million	14.6	30.7	34.4	25.7	10.7	16.3	
	Royalties	$ million	22.7	18.0	16.1	8.9	8.2	7.9	
	Government levies	$ million	0.0	0.0	0.0	0.0	0.0	0.0	
	Interest (if applicable)	$ million						0.0	
	Total Costs	$ million	613.2	389.9	300.7	186.3	192.9	163.6	
	Taxes	$ million	16.6	40.0	53.4	24.7	14.4	17.2	
	Cashflow	$ million	13.2	73.2	102.4	23.7	27.4	25.0	
	Discounted cashflow at 15.9 % (NPV)	$ million	4.4	20.9	25.2	5.0	5.0	4.0	
	Cashflow (CF)	$ million	13.2	73.2	102.4	23.7	27.4	25.0	

Notes:

a) The capital costs are based on the 31 December 2022 LOM schedule for proved and probable Mineral reserves only. The Mineral resource and exploration required to replace depletion is not included in this techno-economic assessment.

b) No inferred Mineral resources are included in the life of mine processing schedule or techno-economic evaluation.

Source: Tarkwa CPR, 2022

The attributable (90 %) gold, free-cashflow (FCF) and Net Present Value (NPV) for the Tarkwa LOM Mineral reserve is summarised in Table 19.1.2.

Table 19.1.2: Gold Fields 90 % Attributable Gold, FCF and NPV

Sources	Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
90 % Attributable gold	koz	490.1	477.3	481.6	439.6	386.3	459.0	454.8	413.4	323.4	293.5	150.9	150.9	132.3	
90 % Cashflow	$ million	4.1	1.2	65.3	23.8	-24.5	59.3	74.7	11.9	65.8	92.2	21.3	24.6	22.5	
Discounted cashflow at 15.9 % (NPV)	$ million	164.5													

Source: Tarkwa CPR, 2022

The expenditure for the Environmental, Social and Governance (Sustainable Development) commitments in the LOM as included in Table 18.2.1, Table 18.3.1 and Table 19.1.1 are presented in Table 19.1.3 focused on the progressive mine closure expenditure over the life of mine.

Table 19.1.3: Breakdown of ESG expenditure included in Table 18.2.1, Table 18.3.1 and Table 19.1.1

Sources	Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Progressive Closure	$ million	3.6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	

Source: Tarkwa CPR, 2022

19.2 Economic analysis

Tarkwa's NPV based on discounting the cashflow in Table 19.1.1 at a 15.9 % discount rate is $182.8 million. Given the mine is operating and cashflow positive, the IRR and payback period are not relevant measures for the Property.

The Tarkwa assets are tested for impairment in accordance with International Accounting Standards (IAS 36). The impairment calculation determines an updated carrying value, or recoverable value, based on the fair value less cost of disposal (FVLCOD). The calculation uses a combination of the market (resource value) and income approach using level 3 of the fair value hierarchy (2022 life of mine plan) with the following assumptions:

- Gold price - $ per ounce.
- 2023 –$1,740.
- 2024 –$1,730.
- 2025 –$1,700.
- 2026 –$1,650.
- Long-term –$1,620.
- Resource price of $71 per ounce.
- Resource ounces of 3.3 million ounces.
- Life of mine of 13 years.
- Discount rate of 15.9 %.

The December 2022 impairment test in Table 19.2.1 shows that the carrying value of the Tarkwa cash-generating unit (CGU) exceeded the recoverable amount, resulting in impairment of the asset of $325 million (grossed up for tax) or $220 million before tax.

Table 19.2.1: Tarkwa Impairment Calculation

Impairment Testing	$ million 2021 8.3 % DCF	$ million 2022 15.9 % DCF	$ million 2022 8.3 % DCF	Comments
Discounted cashflow	1,297	589	800	Lower NPV due to inflation drivers, higher applied discount rate and 1 year depletion of LOM.
Resource value	701	232	610	Reduction in EMR and lower applied resource price.
	1,998	821	1,410	
Less cost to sell	-20	-8	-14	
Recoverable value	1,979	812	1,396	
Carrying value	1,034	1,032	1,032	
Carrying value > recoverable value	No	Yes	No	Impairment required (IAS 36).
Amount impaired	-	220	-	Net impairment amount
Gross impairment	-	325	-	Grossed up for taxation at applicable rate of 32.5 %

The 2022 impairment is attributed to the following changes from 2021:

- Higher operating and capital costs brought about by the general inflation pressures experienced in 2022 and affecting LOM costs (fuel, explosives, parts, reagent prices).
- Higher discount rate of 15.9 % applied in 2022, to account for Ghana country risk premium and the risk free rate (8.3 % used in 2021).
- Depletion of the 100 % Exclusive Mineral resource (EMR) from 3,751 koz to 3,263 koz.
- Lower applied EMR price of $71 per ounce ($187 per ounce applied in 2021).
- 1 year depletion of the LOM.

The higher discount rate resulted in lower discounted cashflows (NPV). The NPV would have been 36 % higher in 2022 if the 2021 discount rate of 8.3 % had been applied. The impact of the lower resource price applied in 2022 is about $378 million (100 % EMR, including inferred, 3,263 koz ($187/oz to $71/oz)).

The carrying value after impairment, or recoverable value, for the Tarkwa CGU is $812 million. The information underlying the impairment calculation may be subject to further adjustments in the future.

19.3 Sensitivity analysis

Various sensitivity analyses were performed to ascertain the impact of changes in discount rates, operating cost forecasts and gold prices on NPV.

Table 19.3.1 to Table 19.3.5 illustrates the different NPVs at a range of discount rates, operating cost forecasts and gold prices.

Table 19.3.1: NPV sensitivity to changes in gold price 90 % attributable

Gold Price - real	-15 %	-10 %	-5 %	0 %	+5 %	+10 %	+15 %	+25 %
Gold Price ($/oz)	1,190	1,260	1,330	1,400	1,470	1,540	1,610	1,750
NPV ($ million)	-224.0	-69.0	47.0	164.5	262.0	370.0	479.0	694.0

Source: Tarkwa CPR, 2022

Table 19.3.2: NPV sensitivity to changes in grade 90 % attributable

Grade	-15 %	-10 %	-5 %	0 %	+5 %	+10 %	+15 %
NPV ($ million)	-238.0	-81.0	47.0	164.5	273.0	382.0	491.0

Source: Tarkwa CPR, 2022

Table 19.3.3: NPV sensitivity to changes in capital costs 90 % attributable

Capital costs	-15 %	-10 %	-5 %	0 %	+5 %	+10 %	+15 %
NPV ($ million)	270.0	234.0	199.0	164.5	130.0	94.0	57.0

Source: Tarkwa CPR, 2022

Table 19.3.4: NPV sensitivity to changes in operating costs 90 % attributable

Operating costs	-15 %	-10 %	-5 %	0 %	+5 %	+10 %	+15 %
NPV ($ million)	371.0	302.0	233.0	164.5	93.0	14.0	-67.0

Source: Tarkwa CPR, 2022

Table 19.3.5: NPV sensitivity to changes in discount rate 90 % attributable

Discount Rate	8.3 %	10 %	12 %	15.9 %	17 %	20 %
NPV ($ million)	253.0	228.0	203.0	164.5	155.0	134.0

Notes: NPV measured at 15.9 % discount rate

Source: Tarkwa CPR, 2022

The Qualified person's opinion is that:

a) The key assumptions, input parameters and methods applied to the economic analysis are realistic, appropriate and suitable for LOM financial modelling.

b) The techno-economic model is correctly based on the relevant Mineral reserve mine plan physicals.

c) The recent historic assumptions used to test the Mineral reserve economic assumptions are appropriate.

d) The material assumptions have been found to be valid and used correctly in the techno-economic studies. The discounted cashflow confirms economic viability with a NPV of $182.8 million at a discount rate of 15.9 %.

e) The techno-economic study for the Mineral reserves excludes all inferred Mineral resource material.

20 Adjacent properties

AngloGold Ashanti's (AGA) Iduapriem Gold Mine (Iduapriem) is directly to the south of the Tarkwa Mine, whilst the Damang Gold Mine is to the north. Both properties are currently operating.

Damang is owned and operated by AGL of which GFGL holds a 90 % interest and the Ghanaian Government the remaining 10 %. AGL manages five Prospecting Licences (renewal currently pending) as well as two Mining Leases, namely the Damang Mining Lease and the Lima South Mining Lease covering 8,710 ha. The mine exploits oxide and fresh hydrothermal mineralisation in addition to Witwatersrand style palaeoplacer mineralisation via conventional open pit mining methods. The hydrothermal mineralisation is hosted in Tarkwaian sediments and is located on the eastern side of the Ashanti Belt in southwest Ghana. The Damang CIL plant processes 4.5 Mt/a. As of December 2022 the Damang attributable Mineral resources exclusive of Mineral reserves are reported at 43,383 kt at 2.1 g/t Au for 2,895 koz (measured and indicated) and 9,201 kt at 1.9 g/t for 549 koz gold (inferred). Attributable Mineral reserves are reported at 10,328 kt Mt at 0.9 g/t Au for 307 koz gold.

According to AGA's website, Iduapriem is wholly owned by AGA. Iduapriem comprises four mining leases covering 13,967 ha. As with Tarkwa, Iduapriem is located within the Tarkwaian Group which forms part of the West African Craton that is covered, to a large extent, by metavolcanics and metasediments of the Birimian Supergroup. In Ghana, the Birimian terrane consists of northeast-southwest trending volcanic belts separated by basins, and the Tarkwaian Group was deposited in these basins as shallow water deltaic sediments. Iduapriem is a conventional open pit operation that currently sources ore from the Block 3W, Ajopa, Block 7 and 8 and Block 5 pits. Processing of ore is through a 5.2 Mt per annum capacity CIL plant. As of December 2021, the total Mineral resources exclusive of Mineral reserves were reported as 42,910 kt at 1.35 g/t Au for 1,860 koz gold (measured and indicated) and 27,340 kt at 1.47 g/t for 1,290 koz gold (inferred). Mineral reserves were reported to be 59,400 kt at 1.36 g/t Au for 2,600 koz.

The Qualified person is unable to verify the information listed for the properties adjacent to Tarkwa and that the information is not necessarily indicative of the mineralisation on the Property that is the subject of this Technical Report Summary. Tarkwa is essentially stand alone and has no or little reliance of neighbouring properties and the proximity of any legal workings are not expected to interact in any way with Tarkwa. There are no overlapping lease and permit areas. In addition, it was not possible to verify the publicly disclosed information pertaining to Iduapriem.

21 Other relevant data and information

The Qualified person is not aware of any additional information or explanation that should be disclosed to provide a more complete and balanced presentation of the value of the Tarkwa Property. The content of this Technical Report Summary is deemed to provide all appropriate and relevant information that is viewed as material to enable a full understanding of the technical and economic aspects of the Property in support of the Mineral resources and Mineral reserves disclosure.

Gold Fields' commitment to materiality, transparency and competency in its disclosure of its Mineral resources and Mineral reserves to regulators and in the public domain is of paramount importance to the Qualified person and the Registrants Executive Committee and Board of Directors continue to endorse the company's internal and external review and audit assurance protocols. This Technical Report Summary should be read in totality to gain a full understanding of Tarkwa's Mineral resource and Mineral reserve estimation and reporting process, including data integrity, estimation methodologies, modifying factors, mining and processing capacity and capability, confidence in the estimates, economic analysis, risk and uncertainty and overall projected property value.

However, to ensure consolidated coverage of the Company's primary internal controls in generating Mineral resource and Mineral reserve estimates the following key point summary is provided:

a) A comprehensive quality assurance and quality control (QA/QC) protocol is embedded at Tarkwa and all Gold Fields operations. It draws on industry leading practice for data acquisition and utilises national standards authority accredited laboratories which are regularly reviewed. Analytical QA/QC is maintained and monitored through the submission of sample blanks, certified reference material and duplicates and umpire laboratory checks.

b) Corporate Technical Services (CTS), based in Perth, comprises subject matter experts across the disciplines of geology, resource estimation, geotechnical, mining, engineering, modernisation, capital projects, processing, metallurgy, tailings management and Mineral resource and Mineral reserve reporting governance. The CTS team budget for regular site visits to all operating mines when emphasis is placed on-site inspection and direct engagement with the technical staff to drive protocols and standards and enable on-site training and upskilling. CTS provides technical oversight and guidance to the operating Regions and mines and ensures an additional level of assurance to the Mineral resource and Mineral reserve estimates to supplement the mine sites and Regional technical teams.

c) Independent audit review of fixed infrastructure is conducted annually with the appointed insurance auditor focused on plant, machinery and mine infrastructure risks. An effective structural and corrosion maintenance program with benchmark inspections is in place supported by equipment condition monitoring major critical component spares. Focus areas include the primary jaw crusher, ball mill shell or motor failure, structural failure of plant or conveyor, process tank failure and large transformer failure. Critical spares are well resourced and there are no large items not supported by on-site spares holdings.

d) Mobile equipment is largely owned and well maintained by the mining contractor and there is some spare capacity in most of the fleets, or alternatively, hire units are readily available in the region.

e) Processing controls include the preparation of quarterly plant metal accounting reconciliation reports by the mine sites which are reviewed by the Regional Metallurgical Manager and VP Metallurgy in the CTS team. Any monthly reconciliation variance outside the limits provided within the Gold Fields Plant Metal Accounting Standard is flagged for follow up assessment and remediation if warranted.

f) Tarkwa has a tailings management plan that promotes risk minimisation to operators and stakeholders over the lifecycle of each tailings storage facility (TSF). Tarkwa's TSF's are operated in accordance with the company TSF Management Guidelines which are aligned with the International Council on Metals & Mining's (ICMM) Position Statement on preventing catastrophic failure of TSFs (December 2016). Active TSFs are subject to an independent, external audit every three years, as well as regular inspections and formal dam safety reviews by formally appointed Engineers of Record (EoR). Further improvements in tailings management are expected through achievement of compliance with the independently developed Global Industry Standard for Tailings Management (GISTM).

g) The integration of Environmental, Social and Governance (ESG) themes into the estimation process continues as an important consideration for modifying factors, reasonable prospects for economic extraction (RPEE) assessments and to underpin the integrity of the Mineral resources and Mineral reserves. The company's ESG Charter, issues and priorities are fully considered in the life of mine plan with particular emphasis on tailings management, integrated mine closure planning, security of energy and water and the social and regulatory license to operate.

h) Gold Fields also follows an embedded process of third-party reviews to provide external, expert, independent assurance regarding Mineral resource and Mineral reserve estimates and compliance with relevant reporting rules and codes. In line with Gold Fields policy, every material property is reviewed by an independent third-party on average no less than once every three years, or when triggered by a material year-on-year change. Certificates of compliance are received from the companies that conduct the external audits which are also configured to drive continuous improvement in the estimation process.

i) Importantly, Gold Fields endorses a well embedded risk and control matrix (RACM) configured to provide an annual assessment of the effectiveness of the registrants' internal controls concerning the life of mine planning process and Mineral resource and reserve estimation and reporting.

j) The internal controls include coverage of the following (inter alia):

   i Reasonableness of parameters and assumptions used in the Mineral resource and reserve estimation process.

   ii Reasonableness of the interpretations applied to the geological model and estimation techniques.

   iii Integrity in the mine design and scheduling, including reasonableness of the mine planning assumptions, modifying factors, cutoff grades, mining and processing methods and supporting key technical inputs such as year on year reconciliation, geotechnical, mining equipment, infrastructure, water, energy and economic analysis.

   iv Provision of the necessary skills, experience and expertise at the mine sites and the Regions to undertake and complete the work with the required level of technical ability and competency, including professional registration as a Qualified person.

   v Alignment with the SK 1300 rule (guidance and instruction) for the reporting of Mineral resources and reserves.

   vi Review of the disclosure of the registrants' Mineral resources and reserves process.

k) Because of its inherent limitations, internal controls may not prevent or detect all errors or misstatements. Also, projections of any valuation of effectiveness to future periods are subject to risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with policies and procedures may deteriorate.

RCubed® is a proprietary cloud-based reporting system adopted by Gold Fields to enhance the level governance and data security concerning Mineral resource and reserve reporting across all company properties. It ensures transparency and auditability for all data verification checks, information stage gating, the approvals process and confirmation of Qualified person credentials. The RCubed® reporting system is being incorporated into the SOX RACM matrix to support the Mineral resource and Mineral reserve reporting.

22 Interpretation and conclusions

22.1 Conclusions

Tarkwa continues to operate as a world-class, long-life surface mining operation with robust Mineral reserves supporting a 13-year life-of-mine (LOM). The current LOM is based on in-pit mining activities continuing until 2031, the SHL material is then treated fully through the CIL plant until 2035. It is estimated that the current Mineral reserves will be depleted in 2035 (14 years). Potential life extensions to the open pits will require additional exploration and completion of relevant studies.

On-lease palaeoplacer exploration, resource extensional and infill drilling will continue and more conversion to Mineral reserves is envisaged proximal to the Akontansi Ulap south, as well as the Teberebie down dip extension of the existing pits. Tarkwa's exploration program in 2022 remained focused on the on-lease palaeoplacer potential by delineating new resources upgrading known resource areas at Ulap East and South, Teberebie East and Akontansi-Ridge.

Efforts will be made to test early-stage targets with the view to defining additional gold Mineral resources which could potentially be of higher grade and lower strip ratio for conversion to Mineral reserves. Opportunities for resource conversion in the near-mine space, especially in Teberebie East, is also envisaged. Tarkwa's exploration programme in 2022 focused on conducting target definition work (Ground Geophysics-IP) over early-stage targets, as well as initial drilling to test for extensions to the Kobada orebody and resource definition drilling to define additional resources in the Ulap South area.

The modernisation innovation and technology (I&T) program for Tarkwa Mine remains on course with the backbone infrastructure which is a key enabler to anchor innovation & technology programs in the region. As part of this infrastructure, the construction of two Telecom masts are expected to be completed in May 2023 as well as delivery of the major network components and equipment. Phase 1 of this project is 100 % complete with Phase 2 which will involve project commissioning expected by end of Q3 2023.

The re-installation of the collision avoidance system was completed in December 2022. The operational readiness review is expected to be completed within Q2 2023, in line with EMESRT guidelines. The support and maintenance strategy to maintain this system has also been defined with the identification of a dedicated team. While the Millslicer integration has been completed with ongoing milling optimisations to maximise value at the processing plant, through monitoring mill liner damage levels in real time. The project to trial liquefied natural gas (LNG) dynamic gas blending (DGB) on two CAT 785C dump trucks was halted indefinitely when the OEM confirmed the technology would not be available in the CAT 785D dump trucks, scheduled to replace the CAT 785C's. Importantly, the methane slip associated with the use of LNG, and for which CAT are yet to develop a resolution, does not align with Gold Fields' decarbonisation strategy.

Regarding the Environmental, Social and Governance (ESG) aspect of the business, all necessary licenses required for execution of the LOM plan are in good standing and any current or future licensing can and will be obtained timeously to ensure delivery of the plan and Mineral reserve estimate. Tarkwa has a good relationship with licensing authorities and community groups, as such licensing is not expected to be material to the Mineral reserves or Mineral resources. Tarkwa is conducting continuous rehabilitation and has a large closure liability, however, the closure estimates and duration are reasonable and practical and appropriate funding provisions are in place to expedite all obligations.

The Tarkwa attributable EMR (Exclusive Mineral resource) estimate is 61,378 kt at 1.4 g/t Au for 2,693 koz gold (measured and indicated) and 5,425 kt at 1.5 g/t for 255 koz gold (inferred). The Tarkwa Mineral reserve estimate is 163,666 kt at 0.92 g/t Au for 4,856 koz gold. The Mineral reserve currently supports a 13-year LOM plan that values the operation at an NPV of $182.8 million using an 15.9 % discount rate and the reserve gold price of $1,400/oz.

22.2 Risks

The views expressed in this Technical Report Summary are based on the fundamental assumption that the required management resources and management skills are in place to achieve the LOM plan projections for Tarkwa.

Climate change is an integral part of the Mineral reserve generation process. Incorporating relevant costs associated with climate change, primarily decarbonisation, mitigation and adaptation to the changing climate, is a key theme for the Company. Integration of these key elements into the Mineral reserve process is being carried out progressively and simultaneously across all of Gold Fields' sites.

The Mineral reserve estimates contained in this report should not be interpreted as assurances of the economic life or the future profitability of Tarkwa. Mineral reserves are by definition estimates based on the factors and assumptions described herein, thus future Mineral reserve estimates may need to be revised. For example, if production costs increase or metal prices decrease, a portion of the current Mineral resources, from which the Mineral reserves are derived, may become uneconomic resulting in a reduction in Mineral reserves. The LOM plans include forward-looking technical and economic parameters and involve a number of risks and uncertainties that could cause actual results to differ materially.

The LOM plan for Tarkwa has been reviewed in detail for appropriateness, reasonableness and viability, including the existence of and justification for departure from historical performance. The Qualified person considers that the techno-economic model and the financial cashflow model are based on sound reasoning, engineering judgement and it is a technically achievable mine plan, within the context of the risks associated with the gold mining industry. The LOM plan includes forward-looking technical and economic parameters and involve various risks and uncertainties that could cause actual results to differ materially.

The business of gold mining by its nature involves significant risks and hazards, including environmental hazards and industrial accidents. Hazards associated with Gold Fields' mining operations generically include:

- Ground and surface water pollution as a result of spillage or seepage from tailings storage facilities, heap leach processing operations and the use of hazardous substances to facilitate the gold extraction process.
- Contractor mining performance.
- Incidents associated with the operation of large waste and ore transportation equipment.
- Incidents associated with ore blasting operations.
- Failure of the open pit walls.
- Failure of a TSF embankment and inundation of downstream areas.
- Production disruptions due to inclement weather.
- Incidents associated with operating waste rock dumps, production stockpiles and associated crushing and conveyor equipment.

The operation may also be subject to actions by labour groups or other interested parties who object to perceived conditions at the mines or to the perceived environmental impacts. These actions may delay or halt production or may create negative publicity. They include amongst others:

- The inability of the operation to hire and retain sufficient technically skilled employees may result in its business being adversely affected. This has been mitigated by the recent downturn in the mining industry and the subsequent increased availability of skills.
- Power stoppages, fluctuations and power cost increases may adversely affect the financial viability of the Mines. This is offset by a direct link into the VRA power circuit and the onsite establishment of an independent power plant in 2016.
- Illegal mining operations in the vicinity of the Property could disrupt mining operations. There are however no illegal operations on site due to the stable relationship the operation has with the surrounding community.

The occurrence of any of these hazards could delay or impact production, increase production costs and result in certain liability for Tarkwa.

Financial risks are assessed through sensitivity analysis.

The potential major risks and related mitigation actions at Tarkwa based on a formal risk review and assessment using CURA risk ranking software and methodology are summarised in Table 22.2.1. Senior management review and update the risk register on routine basis and is reported on a quarterly basis.

Table 22.2.1: Tarkwa potential risks and mitigating strategy

Potential Risk	Mitigation Strategy
Mining costs and reduced Mineral reserves	Contractor management and mining costs remain a challenge to increasing Mineral reserves. Gold Fields has initiated a prefeasibility study to evaluate expansion opportunities at Tarkwa. This study is investigating the potential of reducing mining unit costs through larger fleet sizes, technology and alternative mining methods, with the ultimate objective of reducing the AIC/oz and life extension at Tarkwa.
Short Mine Life	Project 2030 – Aggressive exploration; See prefeasibility study above assessing potential to expand the pits. Wall steepening; Tarkwa Mine optimisation. Innovation and technology opportunities. Resource range analysis being carried out to determine the full potential of Tarkwa lease.
Contractor Management	Ensure contractor commits to execution plans. Equipment replacement for Zone 2; All 30 Dump Trucks, 7 Excavators, 6 Track Dozers, 2 Motor Graders, 3 Telehandlers, 3 992K Loaders and 2 Cranes (100T and 250T) are fully assembled and in operation. Management of 3rd party vendors – Tripartite payment arrangement with Contractors and critical Suppliers.
Capital Waste Strip and Spatial Compliance	Medium- and Short-term planning to ensure alignment with the LOM plan. Includes spatial compliance, reducing ore loss and dilution as part of Contractors' KPI. Improve equipment availability and capacity - fleet replacement complete for 7 x Liebherr excavators and 30 CAT 785D trucks.
Tailings capacity – Insufficient capacity to support required throughput	Review and update of TSF LOM storage plan. Investigate potential future facilities. Detailed study for extended raises on existing TSFs (1 & 2). TSF 1 stage 10 wall raise has been completed and deposition is ongoing. Design for TSF 1 Stage 11A 2 m wall raise has also been completed and approved. Construction has commenced and about 75 % completed. Draft TSF LOM Tonnage profile completed. TSF 5 Optimisation review confirmed additional capacity available for LOM and for future mine production. TSF 5 Stage 2 construction ongoing, 75 % completed. TSF 2 toe buttress construction has been completed. Tarkwa EOR is also reviewing the dam breach assessment by SRK Consulting.
Financial Viability	Negotiate favourable prices for critical production items and review major contracts for cost efficiency. Optimise production to reduce low grade stockpile volumes processed upfront. Conduct Tarkwa mining study to review opportunities to improve production cost. DA plan implemented to ensure full benefits realisation. Mining Contract - Rate adjustment approved.
Pit Wall Stability	Controlled blasting practice close to pit wall. Pit wall monitoring – Slope radar installed.
Dewatering - Pits flooding	Improve pumps availability. Maintain multiple mining pit benches and creation of sumps. Stock critical pump spares. Procurement of back-up pumps by Gold Fields - 2 x Diesel XH 200 and 3 x Submersible pumps.
Mine Call Factor (MCF)	Focus on drill and blast practices – minimise blast movement and improve on fragmentation. Blast monitoring technology (BMT) implemented and ongoing. Improved by implementation of Ore Pro 3D. Improve selectivity in order to minimise dilution.
Stakeholder Relations	Stakeholder engagement – Municipal Assembly, CHRAJ, Community Chiefs and opinion leaders, etc. Restricted blasting activity to minimise stakeholder complaints. Mining area limits established and monitored. Compensation procedure aligned with current needs and requirements. First cycle of Graduate training program closed; 2nd batch commenced.
Global Commodities Price Escalations	Continue the current Supply Chain sourcing strategy of bulk purchases, framework orders and forward pricing agreements with strategic OEMs and commodity suppliers. Liaise with Finance to implement favourable payment terms to achieve competitive prices.

Source: Tarkwa CPR, 2022

23 Recommendations

The Tarkwa Mineral reserves currently support a 13-year LOM plan that values the operation at an NPV of $182.8 million using 15.9 % discount rate and the reserve gold price of $1,400/oz. It is recommended that further exploration is carried out on reef extensions which have good probability of extending mine life, while the longer term hydrothermal mineralisation potential is assessed as described in the exploration section.

The Tarkwa Mineral resource and Mineral reserve are reasonable estimates. The Qualified person is of the opinion that there are no additional phases of work required to enhance this disclosure.

24 References

The primary reference documents that have written consent to be used by the appointed Gold Fields Lead Qualified persons Technical Report Summary are.

Primary reference is the Tarkwa Competent Person Report 31 December 2022 for Mineral Resources and Mineral Reserves. This report has written consent from Steven Robins who is the Gold Fields appointed Lead Competent Person or Qualified person for Tarkwa Gold Mine. Steven has accepted responsibility for the Competent Person Report 31 December 2022 for Mineral Resource and Mineral reserves as a whole.

The Tarkwa Competent Person Report 31 December 2022 for Mineral Resources and Mineral reserves is referred to in this document as "Tarkwa CPR, 2022".

25 Reliance on information provided by the Registrant

The Qualified person has not identified any information provided by the Registrant for Tarkwa that requires noting under the reliance on information provided.

GOLD FIELDS

26 Definitions

26.1 Adequate geological evidence

When used in the context of Mineral resource determination, means evidence that is sufficient to establish geological and grade or quality continuity with reasonable certainty.

26.2 Conclusive geological evidence

When used in the context of Mineral resource determination, means evidence that is sufficient to test and confirm geological and grade or quality continuity.

26.3 Cutoff grade

Is the grade (i.e., the concentration of metal or mineral in rock) that determines the destination of the material during mining. For purposes of establishing "prospects of economic extraction," the cutoff grade is the grade that distinguishes material deemed to have no economic value (it will not be mined in underground mining or if mined in surface mining, its destination will be the waste dump) from material deemed to have economic value (its ultimate destination during mining will be a processing facility). Other terms used in similar fashion as cutoff grade include net smelter return, pay limit and break-even stripping ratio.

26.4 Development stage issuer

Is an issuer that is engaged in the preparation of Mineral reserves for extraction on at least one Material property.

26.5 Development stage property

Is a property that has Mineral reserves disclosed, pursuant to this subpart, but no material extraction.

26.6 Economically viable

When used in the context of Mineral reserve determination, means that the Qualified person has determined, using a discounted cashflow analysis, or has otherwise analytically determined, that extraction of the Mineral reserve is economically viable under reasonable Investment and market assumptions.

26.7 Exploration results

Are data and information generated by mineral exploration programs (i.e., programs consisting of sampling, drilling, trenching, analytical testing, assaying and other similar activities undertaken to locate, investigate, define or delineate a mineral prospect or mineral deposit) that are not part of a disclosure of Mineral resources or Mineral reserves. A Registrant must not use exploration results alone to derive estimates of tonnage, grade and production rates, or in an assessment of economic viability.

26.8 Exploration stage issuer

Is an issuer that has no Material property with Mineral Reserves disclosed.

26.9 Exploration stage property

Is a property that has no Mineral Reserves disclosed.

26.10 Exploration target

Is a statement or estimate of the exploration potential of a mineral deposit in a defined geological setting where the statement or estimate, quoted as a range of tonnage and a range of grade (or quality), relates to mineralisation for which there has been insufficient exploration to estimate a Mineral resource.

26.11 Feasibility study

Is a comprehensive technical and economic study of the selected development option for a mineral project, which includes detailed assessments of all applicable Modifying factors, as defined by this section, together with any other relevant operational factors, and detailed financial analysis that are necessary to demonstrate, at the time of reporting, that extraction is Economically viable. The results of the study may serve as the basis for a final decision by a proponent or financial institution to proceed with, or finance, the development of the project.

1. A feasibility study is more comprehensive, and with a higher degree of accuracy, than a Preliminary feasibility study (or pre-feasibility study). It must contain mining, infrastructure and process designs completed with sufficient rigor to serve as the basis for an investment decision or to support project financing.
2. The confidence level in the results of a feasibility study is higher than the confidence level in the results of a Preliminary feasibility study (or pre-feasibility study). Terms such as full, final, comprehensive, bankable, or definitive feasibility study are equivalent to a feasibility study.

26.12 Final market study

Is a comprehensive study to determine and support the existence of a readily accessible market for the mineral. It must, at a minimum, include product specifications based on final geologic and metallurgical testing, supply and demand forecasts, historical prices for the preceding five or more years, estimated long term prices, evaluation of competitors (including products and estimates of production volumes, sales and prices), customer evaluation of product specifications and market entry strategies or sales contracts. The study must provide justification for all assumptions, which must include assumptions concerning the Material contracts required to develop and sell the Mineral reserves.

26.13 Indicated Mineral resource

Is that part of a Mineral resource for which quantity and grade or quality are estimated based on adequate geological evidence and sampling. The level of geological certainty associated with an indicated Mineral resource is sufficient to allow a Qualified person to apply modifying factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Because an indicated Mineral resource has a lower level of confidence than the level of confidence of a measured Mineral resource, an indicated Mineral resource may only be converted to probable Mineral reserve.

26.14 Inferred Mineral resource

Is that part of a Mineral resource for which quantity and grade or quality are estimated based on limited geological evidence and sampling. The level of geological uncertainty associated with an inferred Mineral resource too high to apply relevant technical and economic factors likely to influence the prospects of economic extraction in a manner useful for evaluation of economic viability. Because an inferred Mineral resource has the lowest level of geological confidence of all Mineral resources, which prevents the application of the modifying factors in a manner useful for evaluation of economic viability, an inferred Mineral resource may not be considered when assessing the economic viability of a mining project, and may not be converted to a Mineral reserve.

26.15 Initial assessment

Is a preliminary technical and economic study of the economic potential of all or parts of mineralisation to support the disclosure of Mineral resources. The initial assessment must be prepared by a Qualified person and must include appropriate assessments of reasonably assumed technical and economic factors, together with any other relevant operational factors, that are necessary to demonstrate at the time of reporting that there are reasonable prospects for economic extraction. An initial assessment is required for disclosure of Mineral resources but cannot be used as the basis for disclosure of Mineral reserves.

26.16 Investment and market assumptions

When used in the context of Mineral reserve determination, includes all assumptions made about the prices, exchange rates, interest and discount rates, sales volumes and costs that are necessary to determine the economic viability of the Mineral reserves. The Qualified person must use a price for each commodity that provides a reasonable basis for establishing that the project is Economically viable.

26.17 Limited geological evidence

When used in the context of Mineral resource determination, means evidence that is only sufficient to establish that geological and grade or quality continuity are more likely than not.

26.18 Material

Has the same meaning as under Part 230.405 or Part 240.12b-2.

The term material, when used to qualify a requirement for the furnishing of information as to any subject, limits the information required to those matters to which there is a substantial likelihood that a reasonable investor would attach importance in determining whether to purchase the security registered.

26.19 Material of economic interest

When used in the context of Mineral resource determination, includes mineralisation, including dumps and tailings, mineral brines and other resources extracted on or within the earth's crust. It does not include oil and gas resources resulting from oil and gas producing activities, as defined in Part 210.4-10(a)(16)(i) of this chapter, gases (e.g., helium and carbon dioxide), geothermal fields and water.

26.20 Measured Mineral resource

Is that part of a Mineral resource for which quantity and grade or quality are estimated based on Conclusive geological evidence and sampling. The level of geological certainty associated with a measured Mineral resource is sufficient to allow a Qualified person to apply modifying factors, as defined in this section, in sufficient detail to support detailed mine planning and final evaluation of the economic viability of the deposit. Because a measured Mineral resource has a higher level of confidence than the level of confidence of either an indicated Mineral resource or an inferred resource, a measured Mineral resource may be converted to a Proven Mineral reserve or to a Probable Mineral reserve.

26.21 Mineral reserve

Is an estimate of tonnage and grade or quality of indicated Mineral resources and Measured Mineral resources that in the opinion of the Qualified person, can be the basis of an Economically viable project. More specifically, it is the economically mineable part of a measured or indicated Mineral resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted.

26.22 Mineral resource

Is a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for economic extraction. A Mineral resource is a reasonable estimate of mineralisation, considering relevant factors such as cutoff grade, likely mining dimensions, location or continuity, that, with the assumed and justifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralisation drilled or sampled.

26.23 Modifying factors

Are the factors that a Qualified person must apply to indicated Mineral resources and measured Mineral resources and then evaluate in order to establish the economic viability of Mineral reserves. A Qualified person must apply and evaluate modifying factors to convert Measured Mineral resources and indicated Mineral resources to Proven Mineral Reserves and Probable Mineral reserves. These factors include but are not restricted to: Mining; processing; metallurgical; infrastructure; economic; marketing; legal; environmental compliance; plans, negotiations, or agreements with local individuals or groups; and governmental factors. The number, type and specific characteristics of the modifying factors applied will necessarily be a function of and depend upon the mineral, mine, property, or project.

26.24 Preliminary feasibility study (or pre-feasibility study)

Is a comprehensive study of a range of options for the technical and economic viability of a mineral project that has advanced to a stage where a Qualified Person has determined (in the case of underground mining) a preferred mining method, or (in the case of surface mining) a pit configuration, and in all cases has determined an effective method of mineral processing and an effective plan to sell the product.

1. A pre-feasibility study includes a financial analysis based on reasonable assumptions, based on appropriate testing, about the Modifying factors and the evaluation of any other relevant factors that are sufficient for a Qualified Person to determine if all or part of the Indicated Mineral resources and Measured Mineral resources may be converted to Mineral reserves at the time of reporting. The financial analysis must have the level of detail necessary to demonstrate, at the time of reporting, that extraction is Economically viable.
2. A pre-feasibility study is less comprehensive and results in a lower confidence level than a Feasibility study. A pre-feasibility study is more comprehensive and results in a higher confidence level than an Initial assessment.

26.25 Preliminary market study

Is a study that is sufficiently rigorous and comprehensive to determine and support the existence of a readily accessible market for the mineral. It must, at a minimum, include product specifications based on preliminary geologic and metallurgical testing, supply and demand forecasts, historical prices for the preceding five or more years, estimated long term prices, evaluation of competitors (including products and estimates of production volumes, sales and prices), customer evaluation of product specifications and market entry strategies. The study must provide justification for all assumptions. It can, however, be less rigorous and comprehensive than a Final market study, which is required for a full Feasibility study.

26.26 Probable Mineral reserves

Is the economically mineable part of an indicated Mineral resource and, in some cases, a measured Mineral resource.

26.27 Production stage issuer

Is an issuer that is engaged in material extraction of Mineral reserves on at least one material property.

26.28 Production stage property

Is a property with material extraction of Mineral reserves.

26.29 Proven Mineral reserve

Is the economically mineable part of a measured Mineral resource and can only result from conversion of a Measured Mineral resource.

26.30 Qualified person

Is an individual who is:

1. A mineral industry professional with at least five years of Relevant experience in the type of mineralisation and type of deposit under consideration and in the specific type of activity that person is undertaking on behalf of the Registrant; and
2. An eligible member or licensee in good standing of a recognised professional organisation at the time the technical report is prepared. For an organisation to be a recognised professional organisation, it must:
   - i Be either:
     - A. An organisation recognised within the mining industry as a reputable professional association; or
     - B. A board authorised by U.S. federal, state or foreign statute to regulate professionals in the mining, geoscience or related field;
   - ii Admit eligible members primarily on the basis of their academic qualifications and experience;
   - iii Establish and require compliance with professional standards of competence and ethics;
   - iv Require or encourage continuing professional development;
   - v Have and apply disciplinary powers, including the power to suspend or expel a member regardless of where the member practices or resides; and
   - vi Provide a public list of members in good standing.

26.31 Relevant experience

Means, for purposes of determining whether a party is a Qualified person, that the party has experience in the specific type of activity that the person is undertaking on behalf of the Registrant. If the Qualified person is preparing or supervising the preparation of a technical report concerning Exploration results, the relevant experience must be in exploration. If the Qualified person is estimating, or supervising the estimation of Mineral resources, the relevant experience must be in the estimation, assessment and evaluation of Mineral resource and associated technical and economic factors likely to influence the prospect of economic extraction. If the Qualified person is estimating, or supervising the estimation of Mineral reserves, the relevant experience must be in engineering and other disciplines required for the estimation, assessment, evaluation and economic extraction of Mineral reserves.

1. Relevant experience also means, for purposes of determining whether a party is a Qualified person, that the party has experience evaluating the specific type of mineral deposit under consideration (e.g., coal, metal, base metal, industrial mineral, or mineral brine). The type of experience necessary to qualify as relevant is a facts and circumstances determination. For example, experience in a high-nugget, vein-type mineralisation such as tin or tungsten would likely be relevant experience for estimating Mineral resources for vein-gold mineralisation, whereas experience in a low grade disseminated gold deposit likely would not be relevant.

   Note 1 to paragraph (1) of the definition of relevant experience: It is not always necessary for a person to have five years' experience in every type of deposit to be an eligible Qualified person if that person has relevant experience in similar deposit types. For example, a person with 20 years' experience in estimating Mineral resources for a variety of metalliferous hard-rock deposit types may not require as much as five years of specific experience in porphyry-copper deposits to act as a Qualified person. Relevant experience in the other deposit types could count towards the experience in relation to porphyry-copper deposits.

2. For a Qualified person providing a technical report for Exploration results or Mineral resource estimates, relevant experience also requires, in addition to experience in the type of mineralisation, sufficient experience with the sampling and analytical techniques, as well as extraction and processing techniques, relevant to the mineral deposit under consideration. Sufficient experience means that level of experience necessary to be able to identify, with substantial confidence, problems that could affect the reliability of data and issues associated with processing.

3. For a **Qualified Person** applying the **modifying factors**, as defined by this section, to convert **Mineral resources** to **Mineral reserves**, relevant experience also requires:

   i Sufficient knowledge and experience in the application of these factors to the mineral deposit under consideration; and

   ii Experience with the geology, geostatistics, mining, extraction and processing that is applicable to the type of mineral and mining under consideration.

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Qualified Person	Signature	Date
Dr Julian Verbeek	/s/ Dr Julian Verbeek	7 March 2023
Jason Sander	/s/ Jason Sander	7 March 2023
Dr Windfred Assibey-Bonsu	/s/ Dr Windfred Assibey-Bonsu	8 March 2023
Andrew Engelbrecht	/s/ Andrew Engelbrecht	8 March 2023
Peter Andrews	/s/ Peter Andrews	7 March 2023
Daniel Hillier	/s/ Daniel Hillier	7 March 2023
Johan Boshoff	/s/ Johan Boshoff	7 March 2023
Andre Badenhorst	/s/ Andre Badenhorst	7 March 2023
Steven Robins	/s/ Steven Robins	10 March 2023
Joseph Nyan	/s/ Joseph Nyan	10 March 2023
Godfred Baba Avane	/s/ Godfred Baba Avane	13 March 2023
Matthew Aboagye	/s/ Matthew Aboagye	7 March 2023
Kwame Appau	/s/ Kwame Appau	7 March 2023