Centamin Plc

National Instrument 43-101 Technical Report for the Doropo Gold Project, Northeastern Cote d'Ivoire

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FORWARD-LOOKING STATEMENTS

This National Instrument 43-101 Technical Report (including information incorporated by reference) contains "forward-looking statements" and "forward- looking information" under applicable securities laws (collectively, "forward-looking statements"), including statements with respect to future financial or operating performance. Such statements include "future-oriented financial information" or "financial outlook" with respect to prospective financial performance, financial position, earnings before interest, taxes, depreciation and amortization (EBITDA), cash flows and other financial metrics that are based on assumptions about future economic conditions and courses of action. Generally, these forward-looking statements can be identified by the use of forward-looking terminology such as "believes", "expects", "expected", "budgeted", "forecasts" and "anticipates" and include production outlook, operating schedules, production profiles, expansion and expansion plans, efficiency gains, production and cost guidance, capital expenditure outlook, exploration spend and other mine plans. Although Centamin believes that the expectations reflected in such forward-looking statements are reasonable, Centamin can give no assurance that such expectations will prove to be correct. Forward-looking statements are prospective in nature and are not based on historical facts, but rather on current expectations and projections of the management of Centamin about future events and are therefore subject to known and unknown risks and uncertainties which could cause actual results to differ materially from the future results expressed or implied by the forward-looking statements. In addition, there are a number of factors that could cause actual results, performance, achievements or developments to differ materially from those expressed or implied by such forward-looking statements; the risks and uncertainties associated with direct or indirect impacts of COVID-19 or other pandemic, general business, economic, competitive, political and social uncertainties; the results of exploration activities and feasibility studies; assumptions in economic evaluations which prove to be inaccurate; currency fluctuations; changes in project parameters; future prices of gold and other metals; possible variations of ore grade or recovery rates; accidents, labour disputes and other risks of the mining industry; climatic conditions; political instability; decisions and regulatory changes enacted by governmental authorities; delays in obtaining approvals or financing or completing development or construction activities; and discovery of archaeological ruins. Financial outlook and future-ordinated financial information contained in this news release is based on assumptions about future events, including economic conditions and proposed courses of action, based on management's assessment of the relevant information currently available. Readers are cautioned that any such financial outlook or future-ordinated financial information contained or referenced herein may not be appropriate and should not be used for purposes other than those for which it is disclosed herein. The Company and its management believe that the prospective financial information has been prepared on a reasonable basis, reflecting management's best estimates and judgments at the date hereof, and represent, to the best of management's knowledge and opinion, the Company's expected course of action. However, because this information is highly subjective, it should not be relied on as necessarily indicative of future results. There can be no assurance that forward-looking statements will prove to be accurate, as actual results and future events could differ materially from those anticipated in such information or statements, particularly in light of the current economic climate and the significant volatility, the risks and uncertainties associated with the direct and indirect impacts of COVID-19. Forward-looking statements contained herein are made as of the date of this announcement and the Company disclaims any obligation to update any forward-looking statement, whether as a result of new information, future events or results or otherwise. Accordingly, readers should not place undue reliance on forward-looking statements.

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1.0 SUMMARY

1.1 Introduction

This Technical Report was prepared by Centamin Plc (Centamin) and Lycopodium Minerals Pty Ltd (Lycopodium) to summarise the Pre-feasibility Study (PFS) of Centamin's Doropo Gold Project (Doropo or Project) in Northeastern Cote d'Ivoire. The report was prepared in compliance with the disclosure requirements of the Canadian National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101) and in accordance with the requirements of Form 43-101 F1.

The purpose of this technical report is to provide a Mineral Resource Estimate (MRE) update and declare Doropo's maiden Mineral Reserve under the NI 43-101 disclosure requirements. The report demonstrates the potential to progress the Project into a Definitive Feasibility Study (DFS).

This Technical Report incorporates the work of Qualified Persons (QPs) from Centamin, Lycopodium, Cube Consulting Pty Ltd (Cube), Orelogy Consulting Pty Ltd (Orelogy) and Knight Piésold Pty Ltd (Knight Piésold). The effective date of this Technical Report is August 10, 2023, and information in this Technical Report is current of that date unless otherwise specified.

1.2 Site Location

The Project is located in north-eastern Côte d'Ivoire, in the Bounkani region, 480 km north of the capital Abidjan and 50 km north of the city of Bouna.

The Project currently covers thirteen deposits over an area of 1,847 km^2 named Souwa (SWA), Nokpa (NOK), Chegue Main (CHG Main), Chegue South (CHG South), Tchouahinin (THN), Kekeda (KEK), Han (HAN), Enioda (ENI), Hinda (HND), Nare (NAR), Kilosegui (KSG), Attire (ATI) and Vako (VAKO). Most of the deposits (11) are within a 7 km radius with Vako and Kilosegui at a ~15 km and ~30 km radius, respectively.

1.3 Property Description, Location and Ownership

The Project is contained within seven current exploration permits that were granted to Ampella Mining Côte d'Ivoire and Ampella Mining Exploration Côte d'Ivoire, which are both 100% owned Ivoirian subsidiaries of Centamin. The block of permits covers a total area of 1,847 km^2.

The Doropo prospects listed above are located on five out of the seven exploration permits. The thirteen deposits that comprise the Mineral Resource occur within a ~25 km radius centred on UTM 482,450 mE and 1,074,951 mN (WGS84, zone 30N).

1.4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

The Project area is accessible by a national sealed road called the A1 which crosses through the centre of the Project. The A1 is a major road that links Abidjan and Ouagadougou, the capitals of Côte d'Ivoire and Burkina Faso, respectively. A dense network of small dirt / sandy roads allows easy access to all parts of the Project, even during the wet season. The sandy nature of the soil allows a rapid drainage of the water on the access roads generally.

The Doropo area has relatively subdued relief, due to the nature of the underlying granite rocks. The surface soils are mostly sandy and outcrops are rare. The ridges form small plateaus and are covered by laterites and occasionally duricrust of limited thickness.

The climate is of Sudanese type, with two distinct seasons, a rainy season and a dry season. The rainy season extends from May / June to September / October when rainfall totals between 1,100 mm and 1,200 mm. The dry season extends from September / October to May / June. The Harmattan, a hot dry wind coming from the Sahara regions, generally blows in December and January, sometimes extending to March, and brings dust clouds, which reduce visibility. The average annual temperature is 28°C, ranging between 21°C and 33°C. The hottest times of the year occur at the change of seasons.

Local infrastructure remains limited, therefore the Project development will need to include reasonable expenditure in access roads, power, water, accommodation and communications.

The power grid is available from the Bouna substation, south of Doropo, which is fed a 90 kV transmission line from the 225 kV Bondoukou substation. The power master plan includes a future connection from the Bole substation in Ghana which will provide reliable and redundant power for the Project.

The mobile phone network is well deployed, from at least two main national providers. Internet access has overall proven reliable, via the general 3G mobile connections, or dedicated microwave connections for the sites.

Water studies have indicated that underground water may not be sufficient for the Project's demand, therefore surface water harvesting will be used as a basis for the Project's supply requirement. Further hydrological studies are ongoing to build up a full season of information for better informed design solutions. Water supply is not seen as a risk, however early construction planning is required.

Due to the rural aspect of the area, the specialised professional skills and trade skills are very limited in the near vicinity, but adequate workforces are available from elsewhere in the country.

1.5 History

The first exploration permits of the area were granted to Ampella Mining Côte d'Ivoire, then an Ivoirian subsidiary of Ampella Mining Ltd, in June 2013. Prior to that time, no mineral exploration had ever been conducted.

Some evidence of historical gold mining during the colonial times (under the French management) are seen at Varale, where a small open pit type operation occurred. However, this operation seems to not have been documented.

At the end of 2013, Ampella Mining Ltd undertook a preliminary reconnaissance program, leading to the highlighting of the various prospects, with initial high grade rock chips.

Centamin acquired Ampella Mining Côte d'Ivoire via the takeover of Ampella Mining Ltd in March 2014. Exploration activities then started on the Doropo Project from mid-2014.

1.6 Geology and Mineralisation

The block of exploration permits lie entirely in the Tonalite-Trondhjemite-Granodiorite (TTG) orthogneiss suite of the Birrimian domain in the Leo-Man shield. The TTG is bounded on its eastern side by the Boromo-Batie greenstones belt, in Burkina Faso, and by the Tehini greenstones belt on the west.

At the Project scale, the geology consists of fairly homogeneous medium to coarse grained granodiorite. Several of the deposits are intersected by regional, post-mineralisation diorite dykes.

Gold mineralisation occurs associated with discrete structurally controlled zones of intense silica-sericite alteration, focused within and along the margins of narrow (5-10 m wide to locally 20-25 m) shear zones. Outside of the mineralised zones, the granodiorite is fairly undeformed. The mineralised zones generally form clearly identifiable tabular bodies although this is complicated where two structures intersect, such as at the Nokpa deposit.

Gold grades within the mineralised zones are generally very variable and exhibit positively skewed grade distributions with relatively high Coefficients of Variation (CoVs).

1.7 Status of Exploration, Development and Operations

Centamin has continuously conducted exploration activities on the Doropo Project since acquiring the Project in 2014. Preliminary exploration activities have included geological mapping and rock chip sampling surveys, an airborne aeromagnetic and radiometric survey, extensive soil sampling and auger drilling programs and Gradient Array Induced Polarisation (GAIP) surveys.

Targets identified by the preliminary exploration activities have been continuously followed up by trenching and aircore drilling programs, followed by Reverse Circulation (RC), Diamond Drilling (DD) and RC with diamond core tails (RCD) programs. To date, thirteen deposits have been drilled with RC and diamond drilling to a sufficient level of detail to support mineral resource estimates. The exploration strategy continues to be applied to the pipeline targets within the Project permit area.

Centamin started RC and diamond drilling in November 2015. Some 4,089 RC holes totalling 414,191 m, 289 DD holes for 30,685 m and some 92 RCD holes for 16,052 m had been drilled at the Project as at 25 July 2022 for all prospects.

Centamin has set up a relatively well-developed permanent exploration camp and sample preparation facility in the village of Danoa, which is located about 4 km south of Enioda and 14 km east-south-east of Souwa. The majority of exploration activities are conducted from this site. Centamin also maintains an office and smaller exploration camp in the town of Doropo. The regional exploration work is based out of fly camps or other temporary camps depending on the location of the programs.

1.8 Data Verification, Sample Preparation, Analysis and Security

All QPs are expected to verify the data that they base their design and cost estimates on. The extent to which the various QPs have verified the data and any limitations with respect to achieving the technical report update objectives, is discussed more fully in Section 12.0.

1.9 Mineral Processing and Metallurgical Testing

Metallurgical testwork to a PFS level has been completed on the various deposits to date and what has been completed largely covers the oxide, transition and fresh material from each source with limited reagent and gold extraction optimisation.

Two main phases of metallurgical testwork were undertaken in order to validate previous testwork against the PEA flowsheet.

Phase one was largely to validate the PEA flowsheet which required the following testwork programme:

- HQ / NQ drill core required for all eight pits for oxide, transition and fresh lithologies.
- Comminution testing included UCS, BWi, RWi, Ai and SMC JK suite.
- Grind establishment at 125 µm, 106 µm and 75 µm.
- Detailed head assays.
- Diagnostic gold analysis.
- Composite per pit and lithology type homogenised where applicable.
- Gravity separation and direct cyanidation test work.
- Sighter and bulk flotation test work, followed by fine grind establishment and leach test work on the concentrate.
- Variability test work.

Fresh sample masses required from site for sulphide flotation was 450 – 500 kg, which allows for approximately 45 – 50 kg of concentrate mass to test further. This implies approximately 10% flotation concentrate needing to be floated for the subsequent leach test work phases. However, head assay results showed low sulphide sulphur and grind establishment samples that were subsequently leached showed higher than anticipated gold extractions, mostly above 90%.

The metallurgical testwork programme was subsequently changed to target a conventional whole-of-ore process design which excludes the requirement for flotation, ultrafine grinding and concentrate leaching.

Phase two then commenced and additional samples were obtained from site to allow for the second phase of the metallurgical testwork campaign. This fundamental change delayed the metallurgical testwork campaign and commencement of the process design.

The comminution work has been completed and resulted in a SABC circuit being selected as being most suited to ore hardness. The following points have been concluded from the comminution testwork:

- The 85th percentile specific energy was found to be a suitable design point for high level modelling of the primary crush SABC circuit. Given the range of SAG mill specific energy for each deposit (ranging from ~7 kWh/t to 11.5 kWh/t) it is recommended to review the suitability of the 85th percentile as a design point with respect to the mining schedule such that the SAG mill is not undersized for the initial period of operation.

- A suitable primary crusher is a 200 kW C150 jaw crusher, or equivalent.

- A suitable SAG mill is a 6,800 kW, 8.53 m Ø x 5.05 m EGL variable speed drive. The SAG mill selection for both P_{80} 106 and 75 µm grind size scenarios is identical.

- At a target grind of 75 µm, a suitable ball mill is a 9,000 kW, 6.71 m Ø x 11.12 m EGL fixed speed drive. A smaller 6,800 kW, 6.40 m Ø x 9.60 m EGL ball mill would be suitable for the 106 µm grind size.

- A suitable pebble crusher is a 132 kW HP200 cone crusher, or equivalent.

Based on the PFS leach testwork results available to date, Table 1.9.1 summarises the extraction rates and reagent consumptions for the Doropo deposits and varying weathering types.

Table 1.9.1 Doropo Metallurgical Recoveries and Reagent Consumptions

Deposit	Ore Type	Sample ID	Grind P80 (µm)	CIL Residence Time (h)	Total Extraction (%)	Cyanide[1]		Lime[2] kg/t
						Dose	kg/t	
Chegue Main	Oxide	MC3	106	24	92.3	200	0.20	1.12
Chegue Main	Oxide	MC14	106	24	95.7	300	0.24	1.85
Chegue Main	Transitional	MC4	106	24	95.3	400	0.24	0.58
Chegue Mai	Fresh	MC15	75	36	92.7	500	0.24	0.44
Chegue South	Transitional	MC5	106	24	90.2	400	0.27	0.79
Chegue South	Transitional	MC16	106	24	84.9	500	0.30	0.70
Chegue South	Fresh	MC17	75	36	85.9	500	0.30	0.30
Enioda	Oxide	MC21	106	24	98.9	500	0.36	0.92
Han	Transitional	MC19	106	24	96.4	500	0.27	0.32
Han	Fresh	MC20	75	36	95.4	500	0.30	0.48
Kekeda	Transitional	MC6	106	24	94.0	500	0.39	0.39
Kekeda	Fresh	MC18	75	36	94.8	500	0.30	0.45
Kilosegui	Transitional	MC25	106	24	92.8	500	0.24	0.48
Kilosegui	Fresh	MC7	75	36	87.9	400	0.18	0.52
Nokpa	Transitional	MC12	106	24	93.3	500	0.30	0.87
Nokpa	Fresh	MC13	75	36	90.4	500	0.24	0.38
Souwa Oxide	Oxide	MC8	106	24	95.1	400	0.30	0.74
Souwa Oxide	Oxide	MC9	106	24	97.3	400	0.33	0.74
Souwa Oxide	Oxide	MC26	106	24	96.7	400	0.30	1.12
Souwa	Transitional	MC2	106	24	93.9	300	0.26	2.67
Souwa	Transitional	MC10	106	24	95.5	400	0.27	0.79
Souwa	Fresh	MC11	75	36	92.0	500	0.26	0.36

1 Includes allowance for residual cyanide in the CIL tail solution. A CIL tails allowance of 100mg/L NaCN has been allowed. 2 Testwork was conducted with commercial lime having a CaO availability of approximately 60%

1.10 Mineral Resource Estimates

The Doropo MRE update has an effective date of 25 October 2022. The MRE reported herein is in accordance with NI 43-101. The Mineral Resource is generated in conformity with generally accepted CIM 'Estimation of Mineral Resource and Mineral Reserves Best Practice Guidelines' (CIM Council, 2003) and CIM 'Definition Standards for Mineral Resources and Mineral Reserves' (CIM Council, 2014). The Doropo MRE update is summarised in Table 1.10.1 and Table 1.10.2.

The Mineral Resource is reported within optimised pit shells using a gold metal price assumption of USD2,000/oz Au, and is reported above a grade cut-off of 0.5 g/t Au. The cut-off grade of 0.5 g/t gold is used for reporting as it is believed that the majority of the reported resources can be mined at that grade. The Mineral Resource cut-off grade of 0.5g/t was established prior to the PFS study, confirming the economic viability of a smaller portion of lower-grade oxide resources. As Centamin proceeds with the DFS, a review and revision of the Mineral Resource cut-off grades for oxide resources will be conducted.

Centamin and Cube believe this is a reasonable approach in terms of Reasonable Prospects for Eventual Economic Extraction (RPEEE), considering the potential mine life and considerations for reporting Mineral Resources in compliance with NI 43-101 and to the CIM Definition Standards on Mineral Resources and Mineral Reserves (CIM Council, 2014).

Cube made use of Geoaccess Professional, Leapfrog Geo, Surpac, Supervisor and Isatis v2018.4 software to undertake the MRE update. Grade estimation was undertaken for Au. Bulk dry density was also assigned.

Table 1.10.1 Doropo Updated Indicated Mineral Resource Estimate (CIM Definition Standards), October 2022

Indicated Mineral Resources			
Prospect	**Mt**	**Au g/t**	**Au Moz**
Attire	-	-	-
Chegue Main	4.89	1.22	0.19
Chegue South	1.67	1.40	0.07
Enioda	2.06	1.46	0.10
Han	3.57	2.09	0.24
Hinda*	-	-	-
Kekeda	3.34	1.40	0.15
Kilosegui	18.37	1.29	0.76
Nare*	-	-	-
Nokpa	4.21	1.93	0.26
Souwa	13.39	1.73	0.74
Tchouahinan*	-	-	-
Vako*	-	-	-
Total	**51.51**	**1.52**	**2.52**

*** - prospect models not updated in this MRE; models as per the 2021 MRE**

Notes:

- **Some numerical differences may occur due to rounding.**
- **RPEEE is defined by optimised pit shells based on a gold price of USD2,000/oz.**
- **Reported a gold grade cut-off of 0.5 g/t Au.**
- **Includes drill holes up to and including 25 July 2022.**
- **Includes Mineral Reserves.**

Table 1.10.2 Doropo Updated Inferred Mineral Resource Estimate (CIM Definition Standards), October 2022

Inferred Mineral Resources			
Prospect	**Mt**	**Au g/t**	**Au Moz**
Attire	0.60	1.96	0.04
Chegue Main	0.44	1.24	0.02
Chegue South	0.04	0.83	0.001
Enioda	1.95	1.19	0.07
Han	0.32	1.51	0.02
Hinda*	0.55	1.01	0.02
Kekeda	0.18	1.10	0.01
Kilosegui	5.75	1.09	0.20
Nare*	0.09	1.13	0.003
Nokpa	0.11	0.74	0.003
Souwa	0.04	0.92	0.001
Tchouahinan*	0.97	1.36	0.04
Vako*	2.63	0.95	0.08
Total	**13.67**	**1.14**	**0.50**

*** - prospect models not updated in this MRE; models as per the 2021 MRE**

Notes:

- **Some numerical differences may occur due to rounding.**
- **RPEEE is defined by optimised pit shells based on a gold price of USD2,000/oz.**
- **Reported a gold grade cut-off of 0.5 g/t Au.**
- **Includes drill holes up to and including 25 July 2022.**
- **No Mineral Reserves included.**

Prior to interpolation, any assays flagged as below detection limit had a value of half the detection limit assigned to them. In both the case of the grade variables and density, unsampled intervals were treated as absent. The vast majority of the unsampled grade intervals fall outside of the mineralised shears, usually in the hanging wall.

Broadly tabular mineralisation / estimation domains were modelled using Leapfrog Geo, based on a nominal 0.2 g/t Au cut-off, which was observed to be approximately coincident with zones of the most intense alteration, the presence of sulphide minerals and quartz veining. The geostatistical interpolations were run using Dynamic Anisotropy (DA) in order to reflect the geometry of the mineralisation using the hanging wall surfaces of the shear mineralisation domains.

Raw samples were composited to a target length of 1 m to produce interpolation datasets with a consistent sample support size.

Grade caps for gold grade were chosen per estimation domain, in order to mitigate risk of propagation of statistical outlier values. Truncations were applied to the density variable, utilising bar histogram plots to identify outliers. The grade caps and density truncations had only a minor impact on global mean values for the economically most important elements and estimation domains, hence the risk to the MRE due to these actions is considered to be low. An additional distance limiting constraint was applied to high-grade composites to mitigate against over-propagation of high-grade sample values. The grade threshold for distance limiting was chosen based on identification of prominent inflexion points in the log-probability plots of the grade distribution per estimation domain that are believed to represent the onset of the anomalously high-grade sub-population.

Variogram models for the gold grade variable, per estimation domain, were produced by transforming the capped composite data to Gaussian space, modelling the spatial structure, and then back-transforming the model to real space for use in estimation. This process reduces the impact of outliers on the experimental variogram calculation, allowing for elucidation of the true underlying spatial structure. For density, the truncated composite data were used to assign dry density values to the transported cover sequence and the underlying rocks, broken down by weathering intensity.

Gold grade interpolation was undertaken using the Localised Uniform Conditioning (LUC) method, which is well suited to the diffusive characteristics of the mineralisation at Doropo and appropriate for undertaking open pit mining studies.

No mining has taken place at the Project to date and hence no depletion is recorded in the block model.

MRE validation was undertaken by the following means:

- Global statistical comparisons of mean estimated block grades to mean compo-site grades. Inverse Distance Squared (ID2) check estimates were also undertaken for gold grade.
- Using swath plots to compare estimated block grades to the informing composite grades.
- By visual validation, both in cross-section and 3D isometric views, of the estimated block grades overlaid on drill assay data.

The block estimates were observed to honour the input sample data satisfactorily.

1.11 Mineral Reserve Estimates

The Mineral Reserves were estimated for the Doropo Gold Project as part of this PFS by Orelogy. The total Probable Mineral Reserve is estimated at 40.6 Mt at 1.44 g/t Au with a contained gold content of 1,871 koz.

The Mineral Reserve for the Project is reported according to the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012) and CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). The Mineral Resource was converted by applying Modifying Factors. The Probable Mineral Reserve estimate is based on the Mineral Resource classified as Indicated. Table 1.11.1 presents a summary of the Mineral Reserves on a 100% Project basis at a USD1,500/oz gold price.

Table 1.11.1 Doropo Gold Project – Mineral Reserve Estimate

Classification	Weathering	Tonnes (Millions)	Grade (Au g/t)	Contained Gold (koz)
Probable	Oxide and Transition	15.0	1.30	626
	Fresh	25.5	1.52	1,246
	Total	40.6	1.44	1,872

Notes:

The Mineral Reserve conforms with and uses the JORC Code (2012) and CIM (2014) definitions.
The Mineral Reserve was evaluated using a gold price of USD1,500 per ounce.
The Mineral Reserve was evaluated using variable cut-off grades as described in Section 15.3.3.
Ore block grade and tonnage dilution was incorporated into the model.
All figures are rounded to reflect appropriate levels of confidence.
Apparent differences may occur due to rounding.
Mineral Reserves Effective Date June 27, 2023.

1.12 MINING METHODS

The mine design and associated Mineral Reserve estimate for the Doropo Gold Project is based on the Cube Mineral Resource Estimate (MRE) with an effective date of 25 October 2022.

Open pit optimizations were run in Whittle 4X using a USD1,500/oz gold price to define the geometry of the economic open pit shapes. Mining costs were derived from submissions from mining contractors to a Request for Budget Pricing. Other modifying factors such as processing operating costs and performance, general and administrative overheads, project capital and royalties were provided by Centamin.

Optimisation shells were selected for Souwa, Nokpa, Chegue Main, Chegue South, Han, Kekeda, Enioda and Kilosegui. Pit designs were then completed for these shells, along with associated waste storage landforms, mine haul roads and other mining infrastructure. Some internal mining stages were developed for Souwa.

The Mineral Reserve reported in the Preliminary Feasibility Study is a sub-set of the Indicated Mineral Resource which can be extracted from the mine and processed with an economically acceptable outcome.

Mining of the Doropo project will be undertaken utilising medium-scale using open pit mining equipment (90 t haul trucks, 150 t to 300 t hydraulic excavators) typical for West Africa. The mining process will be based on a conventional drill, blast, load and haul operation, with an allowance for 50% of the oxide material to be free-dig (i.e., not require drilling and blasting) utilising the large excavator. Mining areas of disturbance (i.e., pits, dumps, roads etc.) will be cleared of vegetation and topsoil which will be stockpiled for subsequent rehabilitation purposes. Centamin will have a management and technical team which will supervise the mining contract and undertake all technical activities such as grade control, survey and mine planning.

A Life of Mine (LOM) mining schedule was generated detailing the movement of ore and waste on 5 m mining benches for a mine life of approximately 10 years. This includes haulage of the ore from the satellite pits (Han, Kekeda, Enioda and Kilosegui) to the process plant located at Souwa. The schedule indicates that the design process feed rate can be met for the entire mine life.

Approximately 40.5 Mt of ore is processed, of which approximately 80% is direct fed to the plant and 20% is stockpiled as low-grade material.

1.13 Recovery Methods

The key project and ore specific design criteria that the plant design must meet are as follows:

- 4,000,000 t/y of primary ore (fresh).
- Primary crushing plant mechanical availability of 80% (7,008 h/y).
- Mechanical availability for the remainder of the plant of 91.3% (8,000 h/y) supported by crushed ore storage and standby equipment in critical areas.
- Sufficient automated plant control to minimise the need for continuous operator interface and allow manual override and control if and when required.

1.13.1 Selected Process Flowsheet

The treatment plant design incorporates the following unit process operations:

- Primary crushing with a jaw crusher to produce a coarse crushed product.
- A live stockpile.
- A SABC comminution circuit comprising a SAG mill in closed circuit with a pebble crusher and a ball mill in closed circuit with hydrocyclones to produce an 80% passing (P_{80}) 75 µm grind size (primary fresh ore) and 106 µm oxide and transition ores.

- The cyclone overflow slurry will gravitate via trash screening to a pre-leach thickener.
- Trash screen to remove any trash before the pre-leach thickener.
- Pre-leach thickening of the milled slurry will increase the slurry density feeding the carbon in leach (CIL) circuit to minimise slurry tank volume requirements and reduce overall reagent consumption.
- Pre-oxidation and Carbon in Leach (CIL) circuit consisting of a pre-oxidation tank, followed by a leach tank and six CIL tanks to provide 36 hours of leaching residence time when processing primary ore at design plant throughput. Sodium cyanide solution will be added to the first leach tank slurry to start the gold leaching process in the presence of the elevated dissolved oxygen levels. An acid wash column to remove inorganic contaminants from the carbon with hydrochloric acid.
- A split AARL elution circuit, electrowinning and gold smelting to recover gold from the loaded carbon to produce doré.
- Two electrowinning cells for gold recovery on to cathodes and sludge smelting to doré.
- Carbon reactivation kiln to remove organic contaminants from the carbon with heat.
- Tailings treatment incorporating cyanide destruction using the INCO SO2 / air process (sodium metabisulphite / oxygen) in line with International Cyanide Management Code standards.
- Tails thickening of the leached slurry will increase the slurry density and minimise the volume of tailings to be handled.
- Tailings pumping to the tailings storage facility (TSF).
- Reagent mixing, storage and distribution facilities.

1.14 PROJECT INFRASTRUCTURE

1.14.1 Site Development

Knight Piésold Pty Ltd (KP) was commissioned to undertake a Pre-feasibility Study (PFS) of the following site infrastructure for the Doropo Gold Project:

- Tailings Storage Facility (TSF).
- Water Storage Dam (WSD).
- Water Harvest Dam (WHD).
- Sediment Control Structures (SCS).

- Haul Access Road (HAR).
- Site Access Road (SAR).
- Site Airstrip.

The TSF has been designed to ANCOLD guidelines and is consistent with Centamin's Group commitment to be in conformance with the Global Industry Standard on Tailings Management

1.14.2 Design Summary

The TSF will comprise a cross valley storage formed by multi-zoned earth fill embankments, comprising a total footprint area (including the basin area) of approximately 166 ha for Stage 1 increasing to 394 ha for the final stage facility.

The TSF is designed to accommodate a total of 41 Mt of tailings. The Stage 1 TSF is designed for 18 months storage capacity. Subsequently, the TSF will be constructed in annual raises to suit storage requirements. This may be adjusted to biennial raises to suit mine scheduling during the operation. Downstream raise construction methods will be utilised for all TSF embankment raises.

1.14.3 Water Management

The water balance modelling included the TSF, WHD, WSD and process plant, with a view to determining site water storage requirements. Design wet conditions were modelled to ensure that the TSF is designed with sufficient storage capacities to comply with design criteria. Key findings from the water balance modelling are as follows:

- The TSF is designed to hold the tailings plus the design rainfall conditions and thus has sufficient stormwater storage capacity for all design storm events and rainfall sequences.
- The supernatant pond volume peaks in September each year (at the end of the wet season).
- Decant return / process water shortfall is expected to occur under average and design dry climatic conditions.
- All make-up water requirements can be provided by the WSD reservoir, supplemented by the WHD for design dry conditions. It is necessary that the WSD is completed early to allow a full wet season of filling prior to commissioning.
- A WSD storage capacity of 2,000,000 m^3 is required to provide sufficient make-up water, supplemented by an abstraction rate of 125 L/s from the WHD.
- A WHD capacity of 500,000 m^3 is required to reduce the risk of shortfalls under design dry conditions.

1.14.4 Water Harvest Dam

The Water Harvesting Dam (WHD) will be the primary water collection structure and be able to store up to 500,000 m^3 of water at the maximum operating level. The design intent of the WHD is that the reservoir is frequently pumped to the WSD during each wet season, with a view to filling the WSD reservoir to its maximum storage level prior to each dry season. The WHD will have a catchment area of 4,742 ha.

1.14.5 Water Storage Dam

The Water Storage Dam (WSD) will be the primary storage pond for clean process water on site and be able to store up to 2,000,000 m^3 of water during Stage 1. The current design assumes the WSD will be raised along with the TSF for each stage.

The WSD has a catchment area of 1,110 ha. The WSD is intended to be recharged by water abstracted from the Water Harvesting Dam (WHD) and rainfall runoff from its upstream catchment. Pit dewatering will be pumped to the WSD, and it was assumed that dust suppression and wash down water will be sourced from the WSD. The water collected in the WSD will be pumped back to the plant to supply plant raw water requirements and process make-up water requirements. Water will be recovered from the WSD by a floating pump.

1.14.6 Access Roads

The following were proposed as part of the road design:

- Haul roads have been designed to connect the Chegue / Nokpa pit and Souwa pits in the north and the Kilosegui Ore bodies in the south with the proposed process plant (total distance of 30 km). An overpass is proposed where the haul road intersects the existing highway (sealed national road A1). It is expected that the access road connecting the highway with the Kilosegui ore bodies will be developed at a later stage.

- Site access road has been designed to connect the national road A1 with the proposed plant site, with a total distance of 16 km. The site access road runs parallel to the haul access road.

Where the proposed haul road meets the national A1 road, a corrugated metal overpass is proposed.

1.14.7 Airstrip

The airstrip was designed to Civil Aviation Safety Authority (CASA) and International Civil Aviation Organization (ICAO) guidelines. The design aircraft for the project was a Cessna Caravan. The runway surface will be 850 m and 20 m wide, and the surrounding runway strip 80 m wide (including the runway). Cut to fill operations are expected to achieve a design compliant with CASA guidelines.

1.14.8 Power Supply and Distribution

The power supply for the project will be via Côte d'Ivoire national High Voltage (HV) electricity grid. The grid supply within Côte d'Ivoire is by world standards economically priced and much more financially favourable than other options including self-generation as the tariff is based on a mix of hydro and thermal generation with a large portion of hydro. Centamin commits to reduce our contribution to climate change and grid connection provides an opportunity for increasing the renewable proportion of our power supply through Cote d'Ivoire's commitments to prioritise increasing renewable energies in electricity production set out in their Nationally Determined Contributions. Additionally, a stable supply of electricity partly generated by renewable sources enables other lower-carbon technologies.

The company La Société des Energies de Côte d'Ivoire (CI-ENERGIES) own the National Interconnected Transmission System in Côte d'Ivoire, and Compagnie Ivoiriennne d'Electricite (CIE) manages the electricity generation and transmission network for the Government.

The proposed power supply solution for the project is via the existing Bouna Substation which is approximately 55km southeast of the project area. The Bouna substation is fed via a 90 kV transmission line from the 225 / 90 kV Bondoukou Substation further south.

The Power System Master Plan contains a future connection between the Bouna Substation and the Bole Substation in Ghana which is part of a 161 kV ring main system around the country where various sources of generation are connected and being a ring main offers a great deal of redundancy. This planned interconnection from Bouna to Bole is expected to be completed in 2025.

The project power demand is summarised as follows:

Table 1.14.1 Power Demand

Total Installed kW	Peak kW	Average kW
30,691	22,901	20,009

Selecting the national electricity grid for stationary power is aligned with Centamin's Energy and Climate Change Policy and our commitment to integrate climate considerations into our strategic decisions and capital allocation. Approximately 39% of the CIE network is sourced from hydro with an increase in the renewable fraction expected following commitments in Cote d'Ivoire's Nationally Determined Contributions. The Doropo Project will help Centamin achieve a material reduction in its group-level GHG emissions intensity. Estimated average annual emissions for the Project are 83,494 tCO2-e.

1.15 MARKET STUDIES AND CONTRACTS

Gold is a readily traded market that operates internationally. Major trading centres are located across all time zones with most global gold trading volumes passing through the London Over The Counter (OTC) market, US futures market and the Shanghai Gold Exchange. In 2022, London Bullion Market Association (LBMA) gold prices closed broadly flat at USD1,816/oz, starting the year at USD1,800/oz. Similarly, with annualised average prices, 2022 average prices averaged USD1,802/oz versus an average price of USD1,799/oz in 2021. Despite this relative stability on an annual basis there was a wide spread of USD428/oz between the low of USD1,628/oz and the high of USD2,056/oz in 2022.

1.16 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

The Doropo Gold Project currently covers nine discrete mineral resources, located over four of the seven Ampella exploration tenement areas of 1,847 km^2, named Souwa, Nokpa, Chegue Main, Chegue South, Kekeda, Han, Enioda, Kilosegui, and Atirre.

It is proposed that the development strategy is underpinned by a staged mine development commencing with a ‘starter’ project with extension to satellite pits in subsequent years.

The preferred development scenario involves the mining of ore via open pits, processing of ore through a gravity separation and carbon in leach (CIL) process plant proximal to the most significant defined resources, and construction of supporting infrastructure including waste rock dumps, a tailings storage facility (TSF), water storage dam (WSD), water harvest dam (WHD), power plant, airstrip and accommodation camp.

A substantial environmental and social baseline has been developed for the Project with extensive field studies having been undertaken as part of the PFS, including Socio-Economic, Land and Water Use Baseline, Surface and Groundwater Resources Baseline, Ecology and Biodiversity Baseline, and Archaeology and Cultural Heritage Study. This work provides an excellent basis for examining the environmental and social aspects associated with the potential development of the Doropo Project and will allow for more targeted specialist studies to be conducted during the Environmental and Social Impact Assessment (ESIA) phase.

Project Setting

Four of the prospects are clustered in the sub-prefecture of Kalamon, which includes the largest prospect of Souwa. This is the proposed location of the processing plant, TSF, airstrip and office facilities. Four of the satellite prospects are located within 7 km of this main cluster, with Kilosegui located approximately 30 km to the southwest, all of which would require haul roads to truck ore to the processing plant.

The area around the mineral deposits is gently undulating with old erosional and weathered surfaces. Small land holding agriculture dominates the area with artisanal mining often found in the mineralised areas.

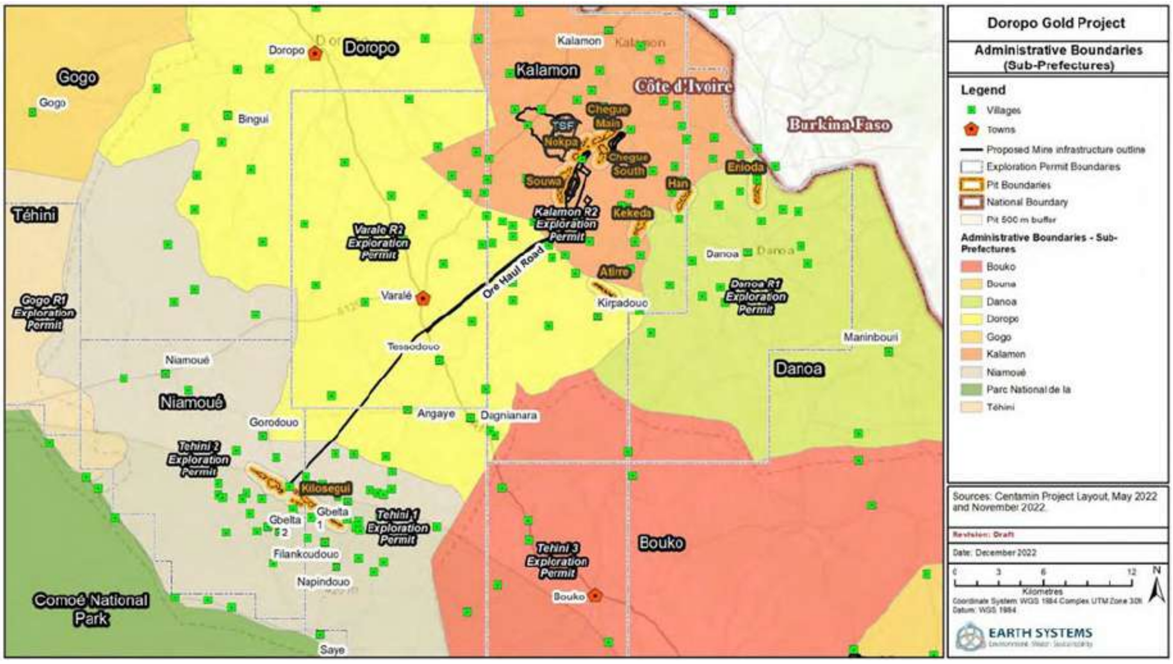
There is a distinct dry and wet season with surface water flow at the Doropo area consisting of a network of non-perennial streams and smaller tributaries.

A majority of the Project Area is comprised of modified habitats, predominantly agricultural areas such as cashew plantations as well as artisanal mining, settlements, roads and tracks. Four principal natural vegetation types occur within the Project Area, these are wooded savannah, shrub savannah, gallery forest and swampy thicket. All habitats are highly degraded due to agricultural, grazing and artisanal mining activities.

The Project is located in a poor and underserviced part of Côte d'Ivoire. Education, health, transport, water supply, energy and communication services are basic. There are very few job opportunities apart from within agriculture and artisanal mining.

The Bounkani Region is administered by a Regional Prefect who is supported in this role by Department- level Prefects and Sub-Prefects and various governmental technical agencies. The Region is characterised by a customary system of land governance held by the Koulango authorities, according to which land resources are the exclusive property of the King of Bounkani. The King entrusts administrative responsibilities for land management to local-level Canton Chiefs. Within the Project area, legal land title has yet to be implemented and the customary system of land tenure is the only established land management mechanism.

Figure 1.16.1 Doropo Gold Project Administrative Boundaries, Exploration Permit Boundaries and Settlements



1.17 CAPITAL AND OPERATING COSTS

1.17.1 Capital Costs

The project Capital Cost Estimate (CCE) was compiled by Lycopodium with input from Knight Piésold on roads, airstrip, water infrastructure and the tailings storage facility. Centamin PLC provided project specific portions of mining, Owners costs and HV power supply. The CCE reflects the Project scope as described in this study report.

The CCE is summarised in Table 1.17.1 as follows.

Table 1.17.1 Capital Cost Estimate Summary (USD, 1Q2023, +20 / -10%)

Main Area	Capital (USD000)
Treatment Plant	98,552
Reagents & Plant Services	18,001
Infrastructure	73,070
Mining	19,408
Contractor and Construction Distributables	25,922
Subtotal	234,953
Management Costs (inc Vendor Reps)	27,168
Owners Project Costs	53,688
Subtotal	80,856
Contingency	33,628
Project Total	**349,437**

All costs are expressed in USD dollars unless otherwise stated and based on 1Q23 pricing. The estimate is deemed to have an accuracy of +20 / -10%.

1.17.2 Operating Costs

Introduction

The operating costs have been compiled by Lycopodium based on costs developed by:

- Lycopodium - Processing costs.
- Knight Piésold – TSF and Infrastructure.
- Centamin – Site general and administration costs.
- Centamin – Mining Costs.

The estimate is considered to have an accuracy of +20 / -10%, is presented in USD and is based on information obtained during the first quarter of 2023 (Q1 2023).

1.17.3 Process Plant Operating Costs

Processing operating costs have been developed by Lycopodium for a life of mine (LOM) blend. It is expected that the plant will operate on a range of mineralised material blends. The LOM processing costs are a weighted average of the various mineralised material type processing costs based on the LOM blend.

Processing operating costs have been developed for a plant with an annual throughput equivalent to 4,000,000 tonnes of fresh mineralised material plant feed at a P_{80} grind size of 75 µm, based on a 24 hour per day operation, 365 days per year.

The processing operating cost estimate is summarised in Table 1.17.2.

Table 1.17.2, calculated off a 100% LoM blend averaging at 4,647,242 tonnes per annum. The relative proportions of each operating cost centre for the processing and process plant (processing plus G&A) operating costs are shown in Table 1.17.2.

Table 1.17.2 Operating Cost Summary (USD, 1Q2023, +20 / -10%)

COST CENTRE	USD/y	USD/t
Power excluding grinding	7,540,934	1.62
Grinding Power	12,213,444	2.63
Operating Consumables	26,262,289	5.65
Maintenance Materials	5,161,685	1.11
Laboratory	1,931,568	0.42
Process and Maintenance Labour	4,517,320	0.97
Total Processing	**57,627,240**	**12.40**
Administration Labour	6,312,000	1.36
G&A Costs	8,225,641	1.77
Total G&A	**14,537,641**	**3.13**
Total OPEX (Excl. Mining)	**72,164,881**	**15.53**

(Mining Tech Services Labour & Grade Control included in Centamin's Financial Model)

1.17.4 Mine Operating Costs

Mining costs were sourced from the submission to a mining contract Request for Budget Pricing received in Q3 2022. The mining contractors provided rates for all relevant mining activities including:

- Mining contractor infrastructure such as workshops, admin offices, warehousing etc.
- Mobilisation and demobilisation.

- Clearing, grubbing and topsoil stockpiling.
- Haul road construction.
- Drilling and blasting for fully weathered, partially weathered and fresh material.
- Loading and hauling ore and waste to ROM Pad, satellite and low-grade stockpiles, and waste rock dumps as appropriate.
- Overheads and fixed costs
- Rehabilitation works.

Centamin developed a cost for the owner's management, technical services, grade control and their associated activities. Centamin also applied a 5% dayworks allowance to the mining contractor costs.

All mining costs are from 2022 and are expressed in US dollars (unless noted otherwise).

Table 1.17.3 Mining Operating Cost Summary (USD, 3Q2022, +20 / -10%)

COST CENTRE	USDM LoM	USD/t Mined	USD/t Milled
Management and Site Preparation	112	0.54	2.76
Ore Mining	124	0.60	3.07
Waste Mining	411	1.99	10.14
Dayworks	28	0.13	0.68
Sub-Total Ex-Pit Mining Costs	676	3.28	16.66
Satellite Pit Ore Haulage	90	0.44	2.23
Stockpile Reclaim/ROM	19	0.09	0.46
Sub-Total Contractor Costs	785	3.81	19.35
Technical Services	31	0.15	0.76
Grade Control	20	0.10	0.49
Sub-Total Owners Costs	**51**	**0.25**	**1.26**
Total Mining Costs	**836**	**4.05**	**20.61**

1.18 ECONOMIC ANALYSIS

1.18.1 Introduction

An economic analysis has been undertaken by Centamin and incorporates Study outputs including milled tonnages and grades for the ore and the associated recoveries, gold price (revenue), operating costs, bullion transport and refining charges, government royalties and capital expenditures (both initial and sustaining). The purpose is to provide an estimate of project cashflows and overall economics for evaluation.

The evaluation method considers the Project has been evaluated on a 100% ownership basis, with no debt financing. The outputs are a Project Cashflow, Net Present Value ("NPV") at a 5% discount rate ("NPV5%") and the Internal Rate of Return ("IRR"). The basis of the estimate utilises inputs from Orelogy (Project physicals namely mining and processing, and mining operating costs), Lycopodium (Process infrastructure, processing operating costs and site G&A costs), Knight Piésold (Infrastructure) and Centamin (Site G&A and economic analysis).

Centamin will continue to review their tax position regarding corporate income tax, withholding taxes and VAT to ensure that the DFS accurately reflects the most suitable and relevant taxation for the asset.

1.18.2 Summary

The results of the economic model show potential within the asset. The model applies a long-term gold price of USD1,600/oz, below consensus forecasts, on a flat line basis from commencement of production. The Project is estimated to produce 173 Koz per annum over its 10 year mine life, at an average cash cost of USD869/oz gold produced and an average all-in sustaining cost (ASIC) of USD1017/oz gold sold. The initial capital is expected to be USD349M.

The project economics are:

A pre-tax NPV5% of USD418M and an IRR of 31%;

A post-tax NPV5% of USD330M and an IRR of 26%

Table 1.18.1 shows a summary of the physical, financial and economics of the project.

Table 1.18.1 Economic Summary

Economic Summary	Units	Value
Mine Life	Years	10
LOM ore processed	kt	40,554
LOM strip ratio	w:o	4.1
LOM feed grade processed	Au g/t	1.44
LOM gold recovery	%	92.4%
LOM gold production	koz	1,729
Upfront capital cost	USDM	349
Life of Mine average:		
Gold, average annual production	oz	173
Cash costs per ounce	USD/oz	869
AISC per ounce	USD/oz	1,017
Project years 1 to 5		
Gold, average annual production	oz	210
Cash costs per ounce	USD/oz	813
AISC per ounce	USD/oz	963
Pre-Tax Economics		
Net present value - 5%	USDM	418
Internal Rate of Return	%	31%
Post-Tax Economics		
Net present value - 5%	USDM	330
Internal Rate of Return	%	26%
Payback period	Years	2.3

1.19 SCHEDULE, PROJECT IMPLEMENTATION AND OTHER RELEVANT INFORMATION

The approach to project implementation outlined in this study was used as the basis for the preliminary implementation schedule and the build-up of the capital cost estimate. The proposed approach is to engage a suitable Engineering, Procurement and Construction Management (EPCM) contactor for design and construction management of the process plant and infrastructure, which will then be handed over to the Owner's operating team. The construction of the mining operations, tailings dam, water storage and harvest dams, power supply / 90 kV switchyard and the camps / non process infrastructure blockwork buildings.

An engineering consultant will be appointed to project manage the implementation of the HV power supply. The components of the power supply will be divided into Engineering, Procurement and Construction (EPC) packages and competitively tendered.

The HV power will be supplied from the electricity grid in Cote D'Ivoire and involves installation of a 90 kV transmission line. The power supply will be operational prior to the commencement of dry commissioning of the processing plant to enable commissioning to proceed.

1.20 CONCLUSIONS AND RECOMMENDATIONS

Cube has produced a MRE update for the Doropo Gold Project in line with the scope of its engagement by Centamin. The Mineral Resource has been reported in accordance with CIM Definition Standards – For Mineral Resources and Mineral Reserves (CIM Council, 2014) and is effective 25 October 2022.

The Mineral Resource is reported within pit shells using a metal price assumption of USD2,000/oz Au, and is reported above 0.5 g/t Au in-pit. The qualified person believes this is a reasonable approach, considering the potential mine life and considerations for reporting Mineral Resources in accordance with the CIM Definition Standards (CIM Council, 2014).

The Mineral Resource is furthermore considered to have RPEEE on the following basis:

- The Project is located in a mining jurisdiction with multiple operating gold mines, with no known impediments to land access or tenure status.

- The volume, orientation and grade of the Mineral Resource is amenable to mining extraction via traditional open pit methods.

- Current metallurgical recovery based on available preliminary metallurgical test work was used in a pit optimisation to generate the resource pit shells.

The Mineral Resource Qualified Person is of the opinion that the data used in the preparation of the MRE were collected in a manner consistent with industry good practice and are therefore fit-for-purpose. The MRE was undertaken using a range of appropriate statistical, geostatistical and 3D visual analysis tools and methods, using reliable and proven software. The Doropo mineralisation is still open, especially at depth; the potential therefore exists to further extend it.

Given the comprehensive mining study undertaken for the Doropo Pre-feasibility Study and considering the conditions provided in this report, Orelogy's Qualified Person considers the Doropo Gold Project to be technically and economically viable.

- Mining selectivity and ore definition will be important to the success of the mining operation to ensure ore loss and dilution is minimised.

- The geotechnical wall slope criteria has been developed to a high level of detail based on the modelled weathering surfaces. These surfaces are based on relatively limited information and show considerable variability in depth and thickness. It is likely that during operations these surfaces will change and therefore the resulting wall slopes will vary, particularly through the weathered zones.

- Due to the multiple pit mining operation, careful selection of a reliable mining contractor will need to be made to ensure strong management of the multiple working faces and fleets. The Owners mining team will need to adequately staffed to manage the multiple working areas and contractors.

- The multiple pit scheduling may require some ore being mined in advance and stockpiled to ensure the ore is available for processing. If this ore is stockpiled at the pits, it may present a potential ore security risk. Therefore, the ore should be transported and stockpiled at the central stockpiling area adjacent to the processing plant. Although this mitigates the security risk of the ore, it will be at the cost of incurring the ore transport costs in advance of the ore being required for feed.

- A fifty percent (50%) free-dig has been assumed for the highly weathered zones which needs to be validated as part of the next phase of study.

- The interaction of both mining extraction activities and the ore haulage activities from the satellite pits will need to be carefully and systematically managed to minimise any negative impacts on regional communities.

- The large number of satellite pits that require ore transported to the processing facility mean there is a potential risk to ore continuity.

1.21 Recommendations

Metallurgical Testwork Recommendations

Metallurgical testwork is to continue for the Doropo project as part of the next study phase. Lycopodium recommends the definitive feasibility study level programme includes the following testwork.

Ore Type Composite Testwork

Testwork should be conducted on the ore type composites to provide detailed information on each of the main ore types. Testwork should include:

- Oxygen uptake rate tests.

- Pre-oxidation assessment.

- Air / oxygen assessment.

- Cyanide optimisation.

- Slurry density optimisation.

- Slurry rheology.

- Cyanide detoxification.
- Demonstration tests (repeatability).
- Mineralogy and diagnostic leach tests as required.

Master Composite Testwork

Master composites should be made up from the ore type composites to represent the LOM blend or another 'design' blend as specified by the client.

Master Composite testwork will include:

- Head assay.
- Grind establishment.
- The financial benefits a finer grind for oxide and transitional ores should be investigated immediately after the PFS in order to improve definition of the next phase of the Project.
- Demonstration leach (optimised conditions).
- Sequential CIP tests.
- Carbon loading capacity (Freundlich's Isotherm).
- All tailings should be retained for possible further metallurgical investigations.

Engineering Composite Testwork

- Tailings sample preparation for additional tailings testwork.
- Pre-leach and tailings thickening.

Variability Testwork

Samples should be selected which will allow an assessment of how gold recovery is impacted by the expected mineralised material types (lithology and oxidation level), depth and location within the deposit and head grade. Testwork should be conducted using the optimised conditions determined from the ore type composite testwork.

- Head assay.
- Grind establishment (optimum grind size).
- Duplicate extraction tests.

All tailings should be retained for possible further metallurgical investigations.

Mineral Resource Recommendations

Cube recommends the following with respect to the Doropo Gold Project:

- Undertake additional metallurgical test work, primarily to inform processing recovery estimates, but also possibly to enhance the understanding of the mineralisation model.
- As a follow-on from the previous recommendation, Centamin should give consideration to constructing a geo-metallurgical model to support future studies.
- Once studies identify a preferred mining process, consideration should be given to pre-production work, such as the drilling of close-spaced grade control patterns in key areas to deliver short-range information. Consideration could then be given to how to best set up a fit-for-purpose mine geology system.

Mineral Reserve Recommendations

Orelogy recommends the following with respect to the Doropo Gold Project.

- Mining selectivity and ore definition will need be mitigated through the use of industry standard ore control techniques such as:
  - In-advance and detailed RC grade control drilling and modelling.
  - Digital ore mark-out combined with ore spotting where required.
  - The use of smaller excavators and blast balls are recommended for highly selective zones.
  - A robust mining contractor tender process is required in the next phase to ensure the eventual contractor selection has the capacity, capability and experience to undertake the work to the required complexity and quality.
  - The free-dig assumption for the highly weathered zones will need to be validated as part of the next phase of study. This will need to be included as part of the scope for the subsequent geotechnical assessments.

Doropo Gold Project

Pre-feasibility Study

National Instrument 43-101 Technical Report

2234-GREP-001

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2.0 INTRODUCTION AND PROJECT BACKGROUND

2.1 Issuer

Centamin plc ('Centamin' or 'the Company') commissioned Lycopodium Minerals Pty Ltd (Lycopodium) to compile a Technical Report on the Doropo Gold Project ('the Project' or 'the Property') located in the Bounkani Region, north-eastern Côte d'Ivoire. This report is to comply with disclosure and reporting requirements set forth in NI 43-101.

Centamin (the 'Issuer') is a public company whose shares trade on both the London Stock Exchange (LSX) under the ticker CEY, and on the Toronto Stock Exchange (TSX) under the ticker CEE. The Company is headquartered in St Helier, Jersey.

2.2 Scope and Terms of Reference

This Technical Report follows the collection of a significant amount of additional drill data from the Property intended to inform the Pre-feasibility Study (PFS). In addition to this, a significant quantity of metallurgical core drilling, logging, sampling and testing was undertaken to support the PFS. Pit and infrastructure geotechnical drilling, logging and sampling was also completed.

The Mineral Resource Estimate (MRE) work was undertaken by Cube Consulting (Cube) in stages between February 2022 and August 2022, as drill assay data became available from successive prospects in the Project area. The prospects for which Mineral Resources were updated are Souwa (SWA), Nokpa (NOK), Chegue Main and Chegue South (CHG), Kekada (KEK), Han (HAN), Enioda (ENI), Kilosegui (KILO) and Attire (ATI).

Cube undertook the following general tasks as part of the MRE update:

- Modelling of weathering / oxidation and mineralisation wireframe models.
- An independent review of the Centamin Quality Assurance-Quality Control (QAQC) processes and outcomes.
- Validation of the drill database.
- Statistical and geostatistical analysis of the supplied assay and density data to establish estimation domains and interpolation parameters. The Au grade variable was estimated using geostatistical interpolation. Bulk dry density was assigned following a statistical analysis by relevant domains.
- Classification of the MRE.

Centamin, Lycopodium, Knight Piésold Consulting Pty Ltd (Knight Piésold) and Orelogy Consulting Pty Ltd (Orelogy) are co-authors of this Technical Report and the individuals presented in Table 2.6.1., by virtue of their education, experience and professional association are considered Qualified Persons (QPs) as defined by NI 43-101 for this report.

This Technical Report details the work undertaken to complete the PFS and documents the results of the work.

2.3 Sources of Information

Lycopodium has undertaken the work based mostly on data provided by Centamin, but also on public domain information and third-party technical reports and relevant published and unpublished third-party information (see references in Section 27).

Lycopodium has made all reasonable endeavours to confirm the authenticity and completeness of the technical data on which this report is based; however, Lycopodium cannot guarantee the authenticity or completeness of such third-party information.

2.4 Statement of Independence

Lycopodium is an independent engineering company contracted by Centamin to carry out this PFS. Lycopodium has no (nor previous) material interest in Centamin or the mineral properties in which Centamin has an interest. The relationship with Centamin is solely one of professional association between client and independent consultant.

This Report was prepared in return for professional fees based upon agreed commercial rates and the payment of these fees is not contingent on the results of this Report. No member or employee of Lycopodium is or is intended to be a director, officer or other direct employee of Centamin.

In the preparation of this Technical Report, Lycopodium has used information provided by Centamin and other experts, as described in Section 3. The Authors have verified this information, making due inquiry of all material issues that are required in order to comply with NI 43-101 requirements.

The positive result of this PFS is such that it is likely that the Doropo Gold Project will continue to progress towards further studies to a Feasibility Study of a multiple open pit mine and process plant, with ongoing drilling and preparatory works, while meeting all required permits and approvals, to add significant value to the northeastern region of Cote d'Ivoire.

2.5 Risks and Forward-looking Statements

The business of mining and mineral exploration, development and production by its nature has significant operational risks. The business depends upon, amongst other things, successful prospecting programmes and competent management. Profitability and asset values can be affected by unforeseen changes in operating circumstances and by technical issues.

Factors such as political and industrial disruption, currency fluctuation and interest rates could have an impact on the proposed project's future operations, and potential revenue streams can also be affected by these factors. The majority of these factors are, and will be, beyond the control of Centamin or any other operating entity.

This Technical Report contains forward-looking statements. These forward-looking statements are based on the opinions and estimates of Centamin, Lycopodium and other specialist consultants at the date the statements were made. The statements are subject to a number of known and unknown risks, uncertainties and other factors that may cause actual results to differ materially from those anticipated in the forward-looking statements. Factors that could cause such differences include changes in world gold markets, equity markets, costs and supply of materials relevant to the Project, and changes to regulations affecting them.

Although the Authors believe the expectations reflected in the forward-looking statements to be reasonable, they do not guarantee future results, levels of activity, performance or achievements.

2.6 Qualified Persons

The QPs responsible for the preparation of this technical report and the sections under their responsibility are provided in Table 2.6.1.

Table 2.6.1 Qualified Persons

Qualified Person	Position	Employer	Professional Designation	Report Sections
Michael Millad	Principal Geologist	Cube Consulting	MAIG	1.9,1.11,2,3,4,5, 10,11,12,14,25.1
Ross Cheyne	Principal Consultant	Orelogy	FAusIMM	1.12,1.13,15,16,21.3,21.4 ,25.2
David Morgan	Director	Knight Piesold	MIEAust	1.15,18
Stephan Buys	Group Manager - Process	Lycopodium	FAusIMM	1.10,1.14,13,17,21.1,21.2
Craig Barker	Group Mineral Resource Manager	Centamin	FAIG	1,6,7,8,9,19,20,22,23,24, 25,26

2.7 Site Visits and Purpose

Site visits to the Property were undertaken by the QPs indicated in Table 2.7.1

Table 2.7.1 Site Visits by QPs

Qualified Person	Employer	Dates
Michael Millad	Cube	29-30 August 2021
David Morgan	Knight Piésold	29-31 January 2022
Craig Barker	Centamin	29-30 August 2021

Mr Michael Millad of Cube, and Mr Craig Barker of Centamin visited the Property on the 29 and 30 August 2021, while the primary assay laboratory, Bureau Veritas (Abidjan) was visited on 4 September 2021.

The following activities and inspections were undertaken:

- View selected drill cores and discuss geological framework and mineralisation controls.
- Discuss and note data capture, storage and management processes.
- QAQC and sampling discussion - procedures and processes.
- Tour of facilities, including site of the under-construction Danoa sample preparation building.
- View outcrops and orpaillage workings in the prospecting area.
- Observe current drilling activities, including drilling methods, sample collection and sample security procedures.
- Independently check several drill collar positions and azimuth / inclinations.
- Observation and direction of the collection of independent drill samples.
- Inspection of the sample storage, sample preparation and sample analysis sections of the Bureau Veritas (Abidjan) laboratory.

The facilities and equipment were considered fit for purpose, and the procedures were well-designed and being implemented consistently. The sample preparation and analytical laboratories were well equipped and operated to a high standard, with the only concerning issue noted being the over-crowded sample storage area at Bureau Veritas in Abidjan, which was explained to be due to late collection of sample residue by various mining companies. A few minor issues were noted within the sample preparation area, but the overall impression was of a well-run and sufficiently clean environment.

In the Qualified Person’s opinion, the methods, procedures and processes for sample collection and analysis are fit-for-purpose and the geology of the deposits are well understood, ensuring the suitability of the Project data for Mineral Resource estimation.

Mr David Morgan conducted a site from the 29 to 31 January 2022 to inspect the Property and, in particular, the sites for the key infrastructure. In addition, typical core was inspected and discussions were held with the site exploration team regarding the ore characteristics, hanging and foot wall attributes as well as sterilisation drilling progress.

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3.0 RELIANCE ON OTHER EXPERTS

This Technical Report was prepared by Lycopodium, Cube, Knight Piesold, Orelogy and Centamin under the supervision of the authors of the Technical Report who are qualified persons (QPs) pursuant to NI 43-101 for Centamin. The information, conclusions, opinions, and estimates contained herein are based on:

- Information available to the QPs at the time of this Report.
- Assumptions and conditions as set forth in this Report.
- Data, reports, and opinions supplied by Centamin and other third-party sources referred to in the References section of this Report.

In preparing this Report, the QPs have fully relied upon certain work, opinions and statements of experts concerning legal, political, environmental, or tax matters relating to the Project. The authors consider the reliance on other experts as being reasonable based on their knowledge, experience, and qualifications.

The QPs believe the information provided by the third parties to be reliable, but cannot guarantee the accuracy of conclusions, opinions or estimates that rely on such third-party sources for information that is outside their area of technical expertise. This Report is intended to be used by Centamin as a Technical Report for Canadian securities regulatory authorities pursuant to applicable Canadian provincial securities laws.

The QPs have fully relied upon, and disclaim responsibility for, information derived from Centamin and experts retained by Centamin for information in Section 20.0 related to:

- Environmental, Social and Permitting Studies., reference document:
  - Environmental and Social Pre-feasibility Study, DOROPO2339_E&SPFS_Rev0, dated March 2023, prepared by Earth Systems.

Sections 4, 5, 6, 7, 8, and 9 have remained largely unchanged from the H&SC PEA 43-101 lodged on SEDAR on 29 of March 2019.

Sections 19, 20 and 22 to 27 have been compiled by Centamin.

Section 14 was based off Cube Consulting's Mineral Resource Estimate report completed in June 2022 for Centamin.

Section 15 and 16 was prepared by Orelogy for Centamin as a component of the Doropo PFS for the purposes of Public Reporting. The information, conclusions, opinions, and estimates contained therein are based on:

- Information available to Orelogy at the time of preparation of this report.
- Assumptions, conditions, and qualifications discussed in this report.

- Data, reports, and other information supplied by Centamin and other third parties, as documented and referenced in this PFS Report (Section 27).

For the purpose of this report Cube Consulting, Knight Piesold, Lycopodium and Orelogy have relied on ownership information in and other local knowledge provided by Centamin as described in Section 4.0 of this Technical Report. Cube Consulting, Knight Piesold, Lycopodium and Orelogy have no independent information regarding property title or mineral rights for the Doropo Gold Project and expresses no opinion as to the ownership status of the property.

Except for the purposes legislated under Canadian or other securities laws, any use of this report by any third party is at that party's sole risk.

The major components of this PFS comprise of:

- Resource modelling based on available data.
- Preliminary mine design and production scheduling.
- Mining cost estimation; metallurgical testwork.
- Preliminary process design and process plant cost estimation.
- Environmental assessment.
- Preliminary financial analysis and other supporting studies on geology.
- Hydrogeology.
- Hydrology.
- Rock mechanics for pit slope design and geotechnical engineering.

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4.0 PROPERTY DESCRIPTION AND LOCATION

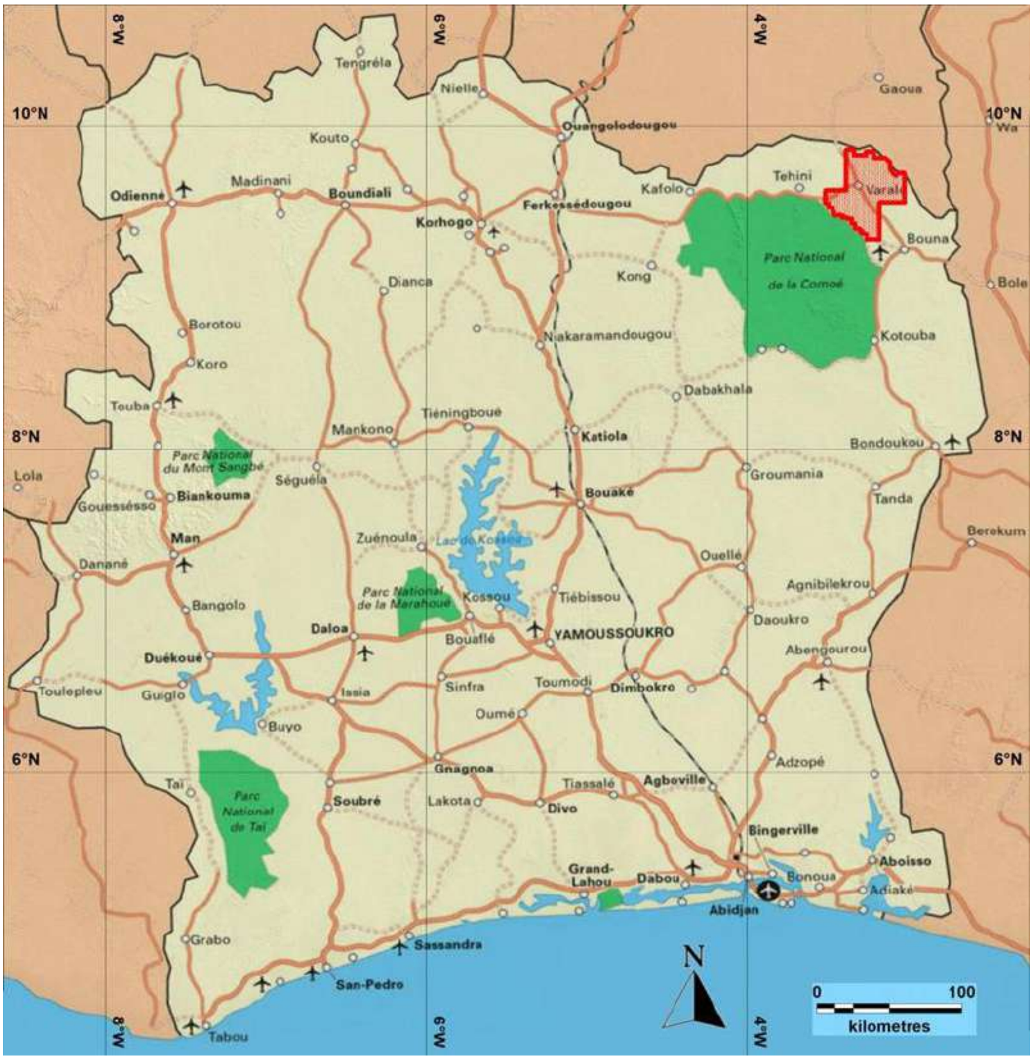
Much of the content in this section is source from Osborn (2019) and Centamin (2021) and has been updated only where necessary.

4.1 Location

The Doropo Project is located in north-eastern Côte d'Ivoire, in the Bounkani region, 480 km north of the capital Abidjan and 50 km north of the city of Bouna. The block of permits lies between the border with Burkina Faso and the Comoe National Park (Figure 4.1.1).

The Mineral Resource area, which fits in a 30 km radius, is centred on about UTM 482,450 mE and 1,074,951 mN, otherwise Latitude 9°43'28'' N and Longitude 3°9'36'' W.

Figure 4.1.1 Location of the Doropo Project – Map of Côte d'Ivoire (Source: Centamin, 2021)



4.2 Tenure

The block of permits includes seven granted exploration permits, all covering granitic rocks. Ampella Mining Côte d'Ivoire and Ampella Mining Exploration Côte d'Ivoire, both 100% owned Ivorian subsidiaries of Centamin, own these permits, as detailed in Table 4.2.1. The block of permits covers a total area of 1,847 km^2.

The mineral resources reported in this report are located in five out of the seven exploration permits. The permits are owned through two Centamin group subsidiaries, Ampella Mining Côte d'Ivoire (AMCI) and Ampella Mining Exploration CI SA (AMEXCI). All of the exploration permits are subject to the 2014 Ivorian Mining Code.

The 2022 MRE update considered nine prospects/deposits namely: Souwa (SWA), Nokpa (NOK), Chegue Main and Chegue South (CHG), Kekada (KEK), Han (HAN), Enioda (ENI), Kilosegui (KILO) and Attire (ATI).

Table 4.2.1 Summary of the Exploration Permits – as of June 2023

Permit Name	Permit ID	Surface (km2)	Status	Company	Date Granted	Expiry Date
Varale	PR 335	284.9	Granted	Ampella Mining Côte d'Ivoire S.A.	13.06.2013	12.06.2024
Kalamon*	PR 334	398.9	Granted	Ampella Mining Côte d'Ivoire S.A.	13.06.2013	12.06.2024
Danoa*	PR 559	240.3	Granted	Ampella Mining Côte d'Ivoire S.A.	10.06.2015	09.06.2025
Tehini 1*	PR 535	253.0	Pending	Ampella Mining Exploration C.I. S.A.	08.03.2017	07.03.2024
Tehini 2*	PR 536	228.0	Pending	Ampella Mining Exploration C.I. S.A.	01.03.2017	28.02.2024
Tehini 3	PR 778	241.0	Granted	Ampella Mining Exploration C.I. S.A.	16.04.2018	15.05.2025
Gogo	PR 633	201.93	Granted	Ampella Mining Exploration C.I. S.A.	19.10.2016	18.10.2023

***These permits host the estimated mineral resources and reserves reported in this document**

4.3 Datum and Projection

The coordinate system utilised for the Project is the Universal Transverse Mercator (UTM) projection, WGS84, zone 30 north. It is centred on about UTM 475,000 mE and 1,068,000 mN, otherwise Latitude 9°39'42'' N and Longitude 3°13'40'' W.

4.4 Royalties

Royalties payable to the Côte d'Ivoire government are calculated on a sliding scale from 3% to 6% based on the gold price at the time of calculation.

The corporate income tax is payable at a rate of 25% to the Côte d'Ivoire government.

Centamin has not entered into any contracts for mine development, mining, processing, transportation, handling, sales and hedging, or forward sales contracts or arrangements. The Qualified Person recommends that contact be made with third parties to determine an accurate estimate of the financials associated with this project.

4.5 Environmental Liabilities

Compensation for crop destruction is paid to local communities. These compensations are paid according to the guidelines set by the Ministry of Agriculture directly to the landowners.

4.6 Permitting

Each presidential decree sets minimum expenditure requirements and type of work by year in order to maintain the rights on the permits. The total expenditures, the work achieved and the results are summarised in bi-annual and annual reporting to the Direction of Mines. Regular field visits are conducted by representatives of the Direction of Mines in order to reconcile the reports.

The exploration activities, including the drilling, need no other specific permitting in the field other than the aforementioned compensation for crop destruction to the local communities.

4.7 Other Significant Factors and Risks

Environmental, permitting, legal, title, taxation, socio-economic, marketing, security and political or other relevant issues could potentially materially affect access, title or the right or ability to perform work on the Property. However, as of the Effective Date of this report, the Qualified Person(s) is unaware of any such potential issues affecting the Property.

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5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

Much of the content in this section is source from Osborn (2019) and Centamin (2021), and has been updated only where necessary.

5.1 Accessibility

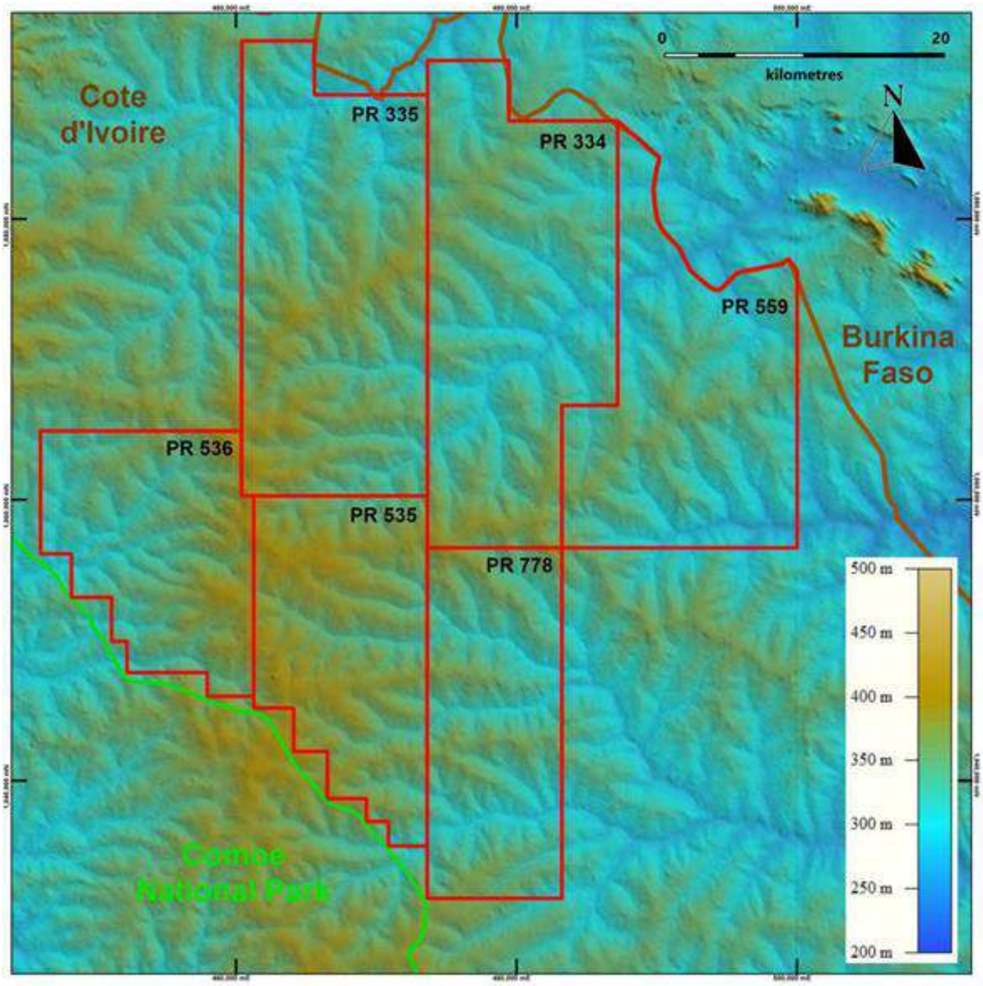
The Project area is accessible by a national sealed road called the A1 which crosses through the centre of the Project. The A1 is a major road that links Abidjan and Ouagadougou, the capitals of and Côte d'Ivoire and Burkina Faso, respectively. Doropo prefecture is 76 km (about 1.5 hours' drive) from Bouna, the Capital of the Bounkani Region. It is also 240 km (about 3.5 hours' drive) from Bondoukou, the capital of District and 645 km (about 10 to 11 hours' drive) from Abidjan, the economic capital. A dense network of small dirt / sandy roads allows easy access to all parts of the Project, even during the wet season. The sandy nature of the soil allows a rapid drainage of the water on the access roads generally.

5.2 Physiography

The Doropo area has relatively subdued relief, due to the nature of the underlying rocks – the granites. The surface soils are mostly sandy and outcrops are rare. The ridges form small plateaus and are covered by laterites and occasionally duricrust of limited thickness. Large peneplains bound the area on the north and on the south, while hill chains bound the eastern and the western sides where greenstone belts crop out (the Tehini-Hounde belt on the West and the Bonomo / Batie belt on the East).

Elevations range from about 250 m to 407 m at the highest point, which is more or less in the middle of the Doropo Project, and forms a drainage divide between the Volta Noire basin on the East and the Comoe basin on the West as shown in Figure 5.2.1. Streams and rivers on the Project are seasonal.

Figure 5.2.1 Elevations Over the Project Area – SRTM Data (Source: Centamin, 2021)



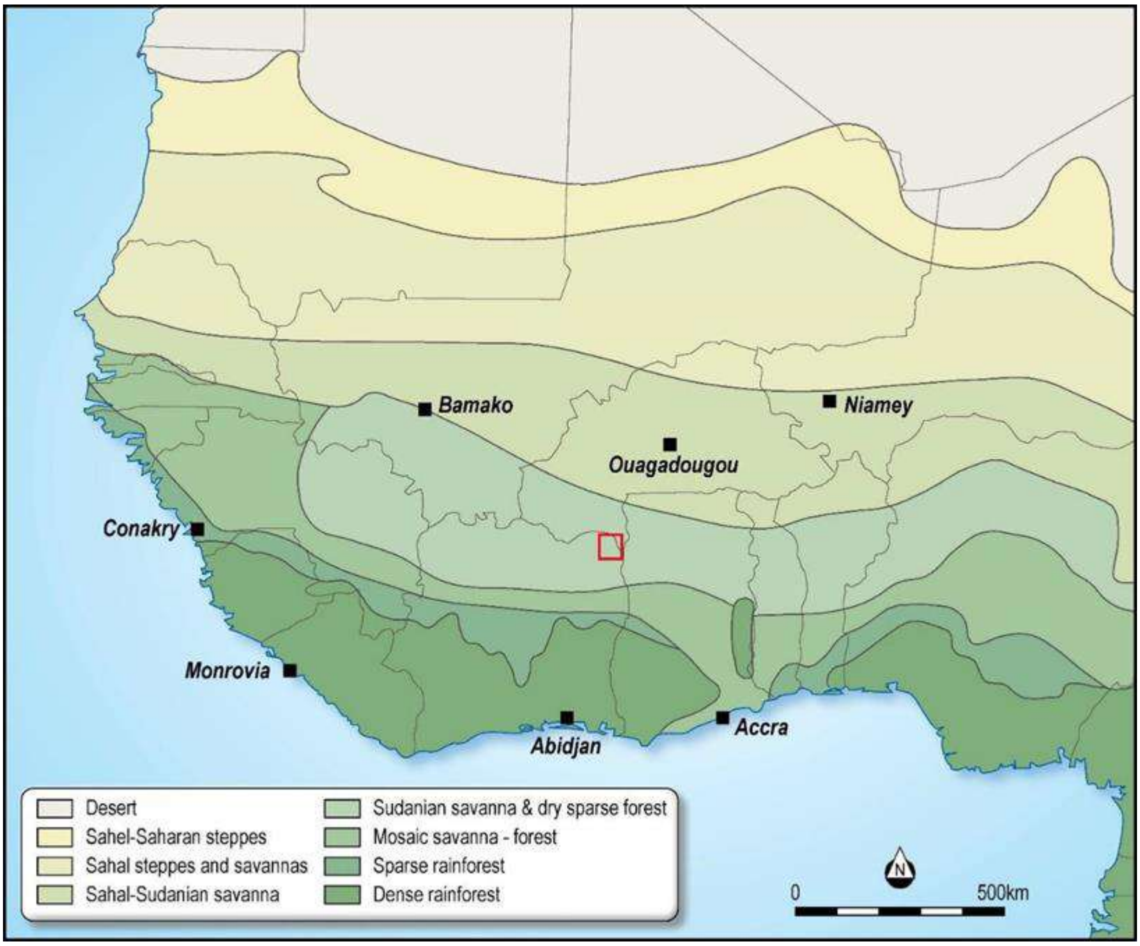
The vegetation is characterised by the sparse forests and savannah where natural environment exists, as shown in Figure 5.2.2. However, a large extent of ground is covered by seasonal crops, mostly yams, peanuts, rice, millet and sorghum and plantations of cashew trees – Côte D'Ivoire is one of the main producers of cashew nuts in the world.

The National Comoe Park limits the Project all along its south-west side. The park covers 11,500 km^2, which is the largest protected area in West Africa. It is a biosphere reserve and a UNESCO world heritage site since 1983.

There is a dense network of rural villages in the area of the Project, mostly populated by the ethnic group of Lobi. Bigger villages, such as (but not only) Danoa, Kalamon, Kodo, Varale, Niamoin, are mostly populated by the Koulango ethnic group. The third ethnic group present in the area is the Fula, who are often nomads, living from cattle farming.

The main economic activity is represented by rural agriculture and farming. However, for several years, mostly since the civil war times, some villagers also live from artisanal gold mining (mostly superficial rocks digging and laterite panning). To some certain extents, the illegal mining increased more recently with the arrival of nomadic Burkinabes (Mossi and Dioula ethnic groups mainly).

Figure 5.2.2 Main Vegetation Zones in West Africa (Source: Centamin, 2021)



5.3 Climate

The climate is of Sudanese type, with two distinct seasons, a rainy season and a dry season. The rainy season extends from May / June to September / October when rainfall totals between 1,100 mm and 1,200 mm. The dry season extends from September / October to May / June. The Harmattan, a hot dry wind coming from the Sahara regions, generally blows in December and January, sometimes extending to March, and brings dust clouds, which reduce visibility.

The average annual temperature is 28°C, ranging between 21°C and 33°C. The hottest times of the year occur at the change of seasons.

5.4 Local Resources and Infrastructure

Local infrastructure remains limited so the Project development will have to include a self-sufficient aspect or backup options.

The company La Société des Energies de Côte d'Ivoire (CI-ENERGIES) own the National Interconnected Transmission System in Côte d'Ivoire, and Compagnie Ivoiriennne d'Electricite (CIE) manages the electricity generation and transmission network for the Government. The 90 kV high voltage grid supply at Bouna should be of good quality and reliable. The recently constructed 90 kV transmission line from Bondoukou to Bogofa and Bouna is lightly loaded. The supply at Bondoukou is from the 225 kV network and is part of a ring-main system which is very reliable and based on the HV power consultant risk assessment, it is not expected that a full back-up power station is required as part of the grid connection works.

The mobile phone network is well deployed, from at least two main national providers. Internet access has overall proven reliable, via the general 3G and 4G mobile connections, or dedicated microwave connections for the sites.

Underground water is not abundant in the Project area and hence hydrological studies completed have indicated that water harvesting via a water harvest dam and distribution pumps is required is supply the required water demand of the Project. A suitably sized water storage dam has been designed to cater for long term supply of water to the Project.

Due to the rural aspect of the area, the specialised professional skills and trade skills are very limited in the near vicinity, but adequate workforces are available from elsewhere in the country.

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6.0 HISTORY

Much of the content in this section is source from Osborn (2019) and Centamin (2021) and has been updated only where necessary.

The first exploration permits of the area were granted to Ampella Mining Côte d'Ivoire, Ivoirian subsidiary, in June 2013. Prior to that time, no systematic mineral exploration had ever been conducted in the area.

The region (the north-eastern part of the country) was first mapped by French Geologists from 1950 to 1958, in order to produce the first Geological map at the scale 1:500,000, prepared by the Bureau de Recherche Geologique et Minière (BRGM), printed in 1963.

Some evidence of historical gold mining during the Colonial times (under the French management) are seen at Varale, where a small open pit type operation occurred, most likely shallow surface workings on outcropping quartz veins. However, this operation seems to not have been documented.

The granitic domain that characterises the Doropo Project had always been considered as not prospective for gold deposits.

Ampella Mining Ltd made application for the Kalamon, Varale and Doropo Ouest permits in 2010 based on the area's close proximity with Ampella's Batie West project in neighbouring Burkina Faso, and reports of artisanal gold mining (ASM) in the Doropo area. The permits were granted in June 2013, and this was followed by a reconnaissance visit to the Doropo area at the end of 2013 and the identification of several exploration targets based on rock chip sampling of exposures in artisanal pits. The Doropo Ouest permit was later relinguished in August 2019 due to a lack of positive soils and rock chip sample results. The Kalamon and Varale permits cover the area of the Main Cluster of gold deposits. A further 7 exploration permits were granted to Ampella between 2015 and 2018 (Danoa, Gogo, Bouna, Bouna Nord and the 3 Tehini permits). Bouna and Bouna Nord were also relinguished in August 2019 and May 2017, respectively due to the same reasons as Doropo Ouest.

Centamin acquired Ampella Mining Côte d'Ivoire via the takeover of Ampella Mining Ltd. in March 2014. Exploration activities then started on the Doropo Project from mid-2014.

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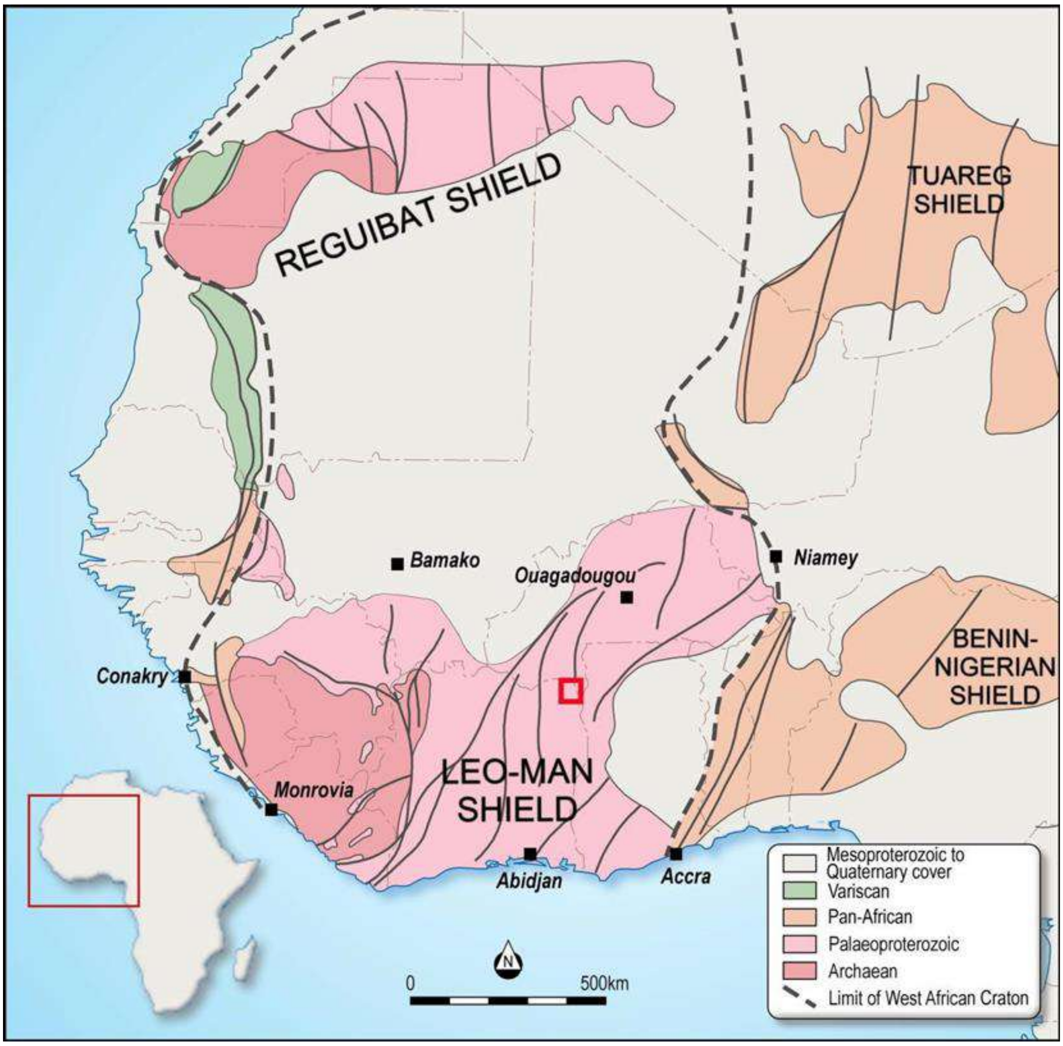
7.0 GEOLOGICAL SETTING AND MINERALISATION

Much of the content in this section is source from Osborn (2019) and Centamin (2021) and has been updated only where necessary.

7.1 Regional Scale Geology

The West African craton covers a surface area of 4.5 million km^2, extending from the northern portion of Mauritania in the north, to the southernmost West African countries of Liberia, Côte d'Ivoire and Ghana in the south. It crops out in two major areas, the Reguibat shield in the north and the Leo-Man shield in the south, as shown in Figure 7.1.1. The Leo-Man shield includes the major gold producing provinces in Ghana, Burkina Faso, Southern Mali, Guinea and Côte d'Ivoire.

Figure 7.1.1 Map of West African Craton (Source: Centamin, 2021)

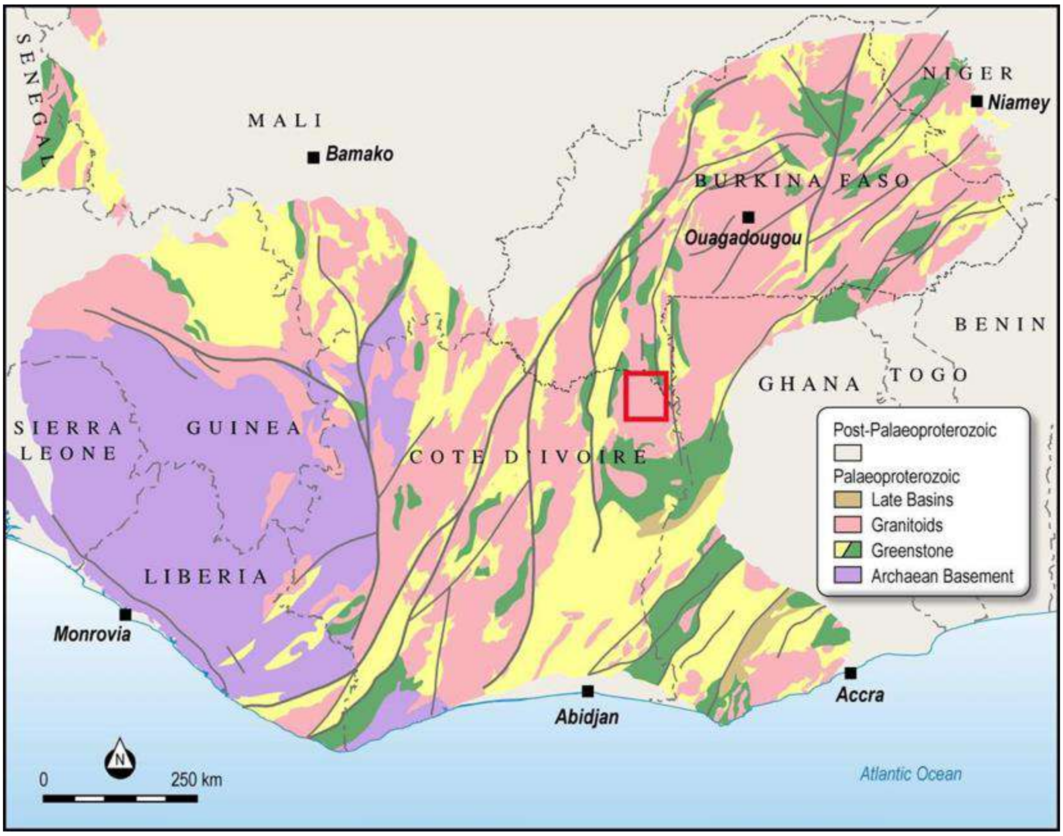


In the Leo-Man shield, shown in Figure 7.1.1, Paleoproterozoic rocks, known as the 'Birimian domain' are tectonically juxtaposed to the Archaean basement, separated by the Sassandra fault. The gold deposits largely lie within the Birimian domain, which covers about 85% of the Côte d'Ivoire ground.

The structure within the Birimian domain was formed during the Eburnean megacycle between 2.5 to 1.6 billion years ago and the main tectono-metamorphism events occurred between 2.2 to 2.0 billion years ago. This Paleoproterozoic domain includes greenstones belts (volcano-sediments) bounded by large areas of tonalitic granite-gneiss, trondhjémite and granodiorite (TTG orthogneiss suite, Tonalite- Trondhjemite-Granodiorite). Later stages of alkaline and calc-alkaline granitic plutons intrude this rock package.

The post Eburnean deformation events ended with large regional brittle deformation, often of a NW-SE orientation marked by the doleritic dykes.

Figure 7.1.2 Geology of the Leo-Man Shield – from the BRGM Interpretations (Source: Centamin, 2021)

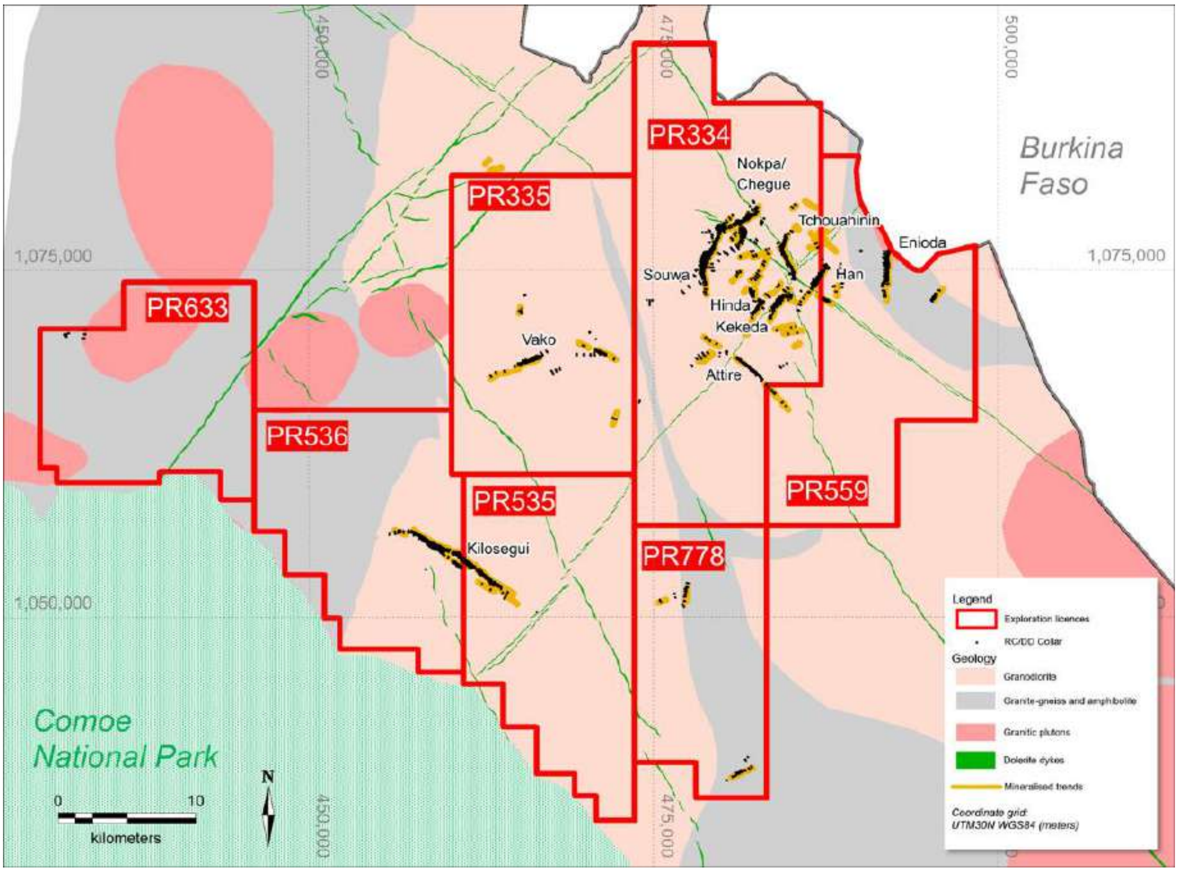


The Doropo permits, shown in red in Figure 7.1.2 and Figure 7.1.3, lie entirely within the Tonalite-Trondhjemite-Granodiorite (TTG) domain, bounded on its eastern side by the Boromo-Batie greenstone belt, in Burkina Faso, and by the Tehini greenstone belt in the west. At the Project scale, the geology consists of granite-gneiss terrain, the granite being mostly of granodioritic composition. Outcrop is sparse, and generally confined to some slope sides with the flat ridge tops and low-lying areas being covered by lateritic soils and transported sediments (alluvium and colluvium). The transitions with the greenstone belts, on both sides of the granitic domain, span progressive changes in the lithologies, encompassing layers of volcanic rocks (greenstones), as pyroxenites, amphibolites or more generally migmatites (mostly on the western side).

The granites are intruded by an abundant series of pegmatitic veins and quartz veins, ranging from the decimetre scale to several hundreds of metres scale. Some of this veining hosts gold mineralisation, often as primary native gold, across the entire area. This generates regular dispersed gold anomalism in the surface geochemistry; it is also the main source of the gold extracted by the artisanal miners but is mostly uneconomic at the industrial scale.

Large, late doleritic dykes criss-cross the whole domain at the regional scale.

Figure 7.1.3 Geology Map of Doropo (Source: Centamin, 2023)



7.2 Project Scale Geology

7.2.1 Lithology

The MRE update presented in this document covers nine deposits named Souwa (SWA), Nokpa (NOK), Chegue Main and Chegue South (CHG), Kekada Kekeda (KEK), Han (HAN), Enioda (ENI), Kilosegui (KILO) and Attire (ATI). Most of the deposits (7) are within a 7 km radius with Enioda ~10 km east of and Kilosegui ~30km southwest of the main deposit camp.

The main rock types across the Doropo area were initially distinguished based on aeromagnetic, radiometric and soil geochemical attributes into broad domains. However, a Centamin supported PhD research programme by Wilfried Digbeu at the Felix Houphouët-Boigny University of Abidjan, has provided further information on the regional scale litho-structural context of the Doropo project area.

One of the aims of the PhD research is to accurately map, interpret and date the various granitic facies, which comprise biotite granites, granodiorites and tonalites, plus some amphibole enclaves.

The geochemical composition of the granitoid rocks characterise the suite as calc-alkaline and the REE signatures are like Archaean age TTG granitoids.

Age dating of the rocks (U-Pb dating of zircons) suggests a long history of evolving continental crust during the Palaeoproterozoic from 2,450 Ma to 2,100 Ma.

The timing of gold mineralisation has not been determined although if typical of Birimian orogenic gold deposits the gold mineralising events are likely to be late in the magmatic-tectonic evolution of the Doropo terrane, around 2,100 Ma. Figure 7.2.1.

The host rocks of the Doropo gold deposits comprise a homogeneous medium to coarse grained granite-granodiorite complex, which has been locally intruded by late-stage gabbro-dolerite dykes (clearly seen in airborne magnetic data) and some pegmatite veins. In addition, there are occasional biotite rich or aplitic dykes, the latter mostly associated with the Enioda deposit, which also shows some amphibolite layers. Outcrop of recognisable rock is rare, but is generally confined to erosional valley sides. Interfluvial ridge lines are often covered by hard laterite cuirasse, while drainage lines are filled with lateritic soils and transported sediments (alluvium, colluvium).

The main rock types across the Doropo area were initially distinguished based on aeromagnetic, radiometric and soil geochemical attributes into broad domains. However, a Centamin supported PhD research programme by Wilfried Digbeu at the Felix Houphouët-Boigny University of Abidjan, has provided further information on the regional scale litho-structural context of the Doropo project area.

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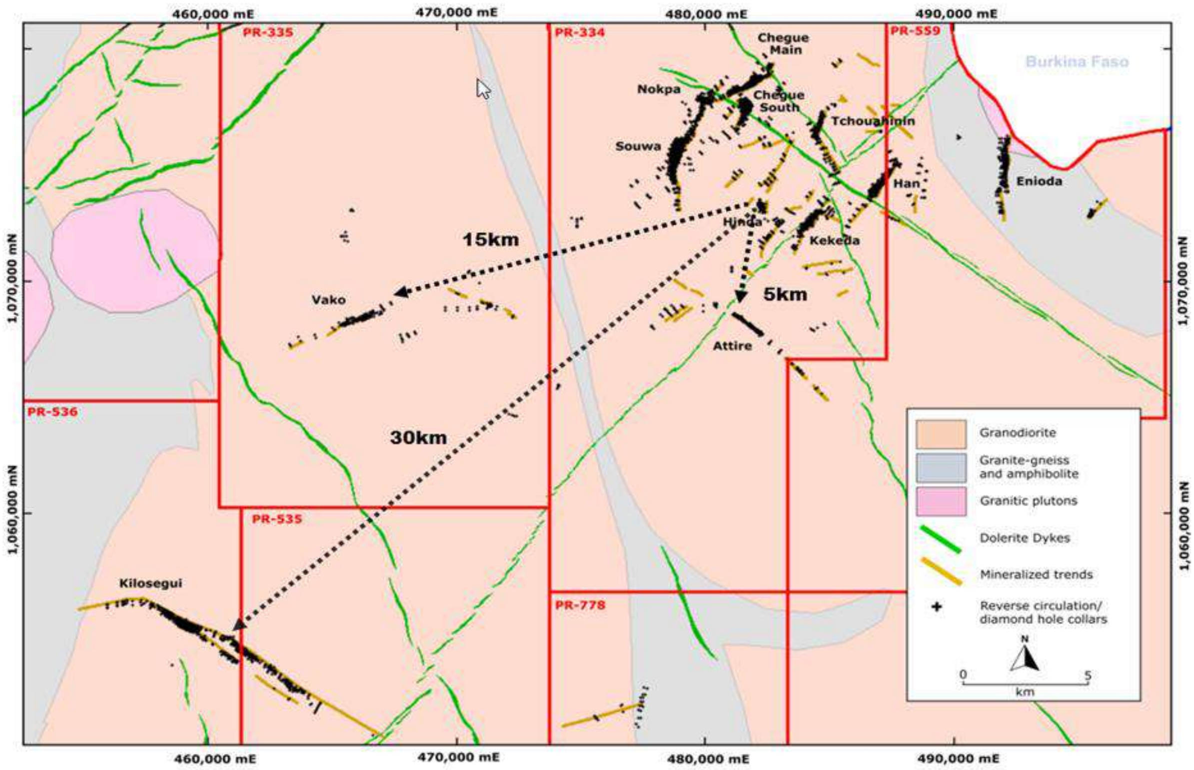
The timing of gold mineralisation has not been determined although if typical of Birimian orogenic gold deposits the gold mineralising events are likely to be late in the magmatic-tectonic evolution of the Doropo terrane, around 2,100 Ma.

Figure 7.2.1 Deposit Scale Geology and Prospect Locations (Source: Centamin, 2021)



7.2.2 Structure and Mineralisation

The granites are intruded by an abundant series of pegmatitic veins and quartz veins, ranging from the decimetre scale to several hundreds of metres scale. Some of this veining hosts gold mineralisation, often as primary native gold, across the entire area. This generates regular dispersed gold anomalism in the surface geochemistry; it is also the main source of the gold extracted by the artisanal miners but is mostly uneconomic at the industrial scale.

Economically interesting mineralisation is associated with discrete structures of intense silica-sericite alteration, focused within and along the margins of narrow (5 - 10 m wide to locally 20 - 25 m wide) dextral shear zones. Outside of the mineralised zones, the granodiorite is fairly undeformed.

The planar zones of mineralisation define a great circle on the stereonet with a plunge of 30->295 (excluding Kilosegui). This direction appears to be coincident with the linear shoot directions within the planar zones of mineralisation and can be used to further explore the deposits (e.g. Nokpa).

Even though Kilosegui appears to be in a completely different strike orientation to the planar zones of gold mineralisation at Doropo, the trend could well be related and may have been formed under the same stress conditions. If Kilosegui is completely unrelated to Doropo, the poles of the planar grade continuity would not lie close to the great circle defined by the poles of the Doropo zones. With the inclusion of Kilosegui, the average pole to the great circle that fits through the local planar orientations is 25->266. Further drilling will support or negate this hypothesis.

When comparing the grade distributions with 1VD magnetic data it is evident that the gold mineralisation is laterally terminated by NE and NW striking late-stage fractures, some of which are intruded by younger dykes. Most of the prospects are not along these trends but are more NNE-SSW striking. Some observed patterns are as follows:

- The eastern extent of CHG North prospect is terminated by a NW-striking transverse fracture.
- CHG South prospect is terminated to the south by NW-striking fracture.
- HAN is terminated to the SW by a NW-striking fracture.
- ATI is terminated to the NW by a NE-striking transverse fracture.

Also, some prospects are parallel to the transverse fractures.

- VAKO appears to run along a NE-striking fracture.
- KLG and ATI are both running parallel to a NW-striking transverse fracture.

These patterns of gold mineralisation are common in Archean belts where the gold is locally continuous along the tectonic grain but are terminated by fractures and faults that clearly post-date and crosscut the tectonic grain. This means that the gold mineralisation itself is very late in the orogenic process. If gold is found to be laterally non-continuous at Doropo, it is highly likely that they are terminating against these late fractures. By recognising this relationship, it would save in drilling costs by drilling wider spaced drill fences on the 'barren' side of these fractures.

7.2.3 Alteration and Mineralisation

Mineral assemblages distal to the mineralised zones include epidote-chlorite and haematite. Examples of these can be seen in Figure 7.2.2 and Figure 7.2.3. Haematite alteration is then pervasive at weak to medium intensity. This haematite alteration can be very strong in the vicinity of the doleritic dykes, making the vectoring towards mineralisation difficult in such areas; this is particularly demonstrative at the Nokpa deposit.

Figure 7.2.2 Distal Epidote-Chlorite-Weak Hematite Alteration on Granodiotite (from Footwall Zone at Souwa – DPDD1382 @ 103.4 m Depth) (Source: Centamin, 2021)

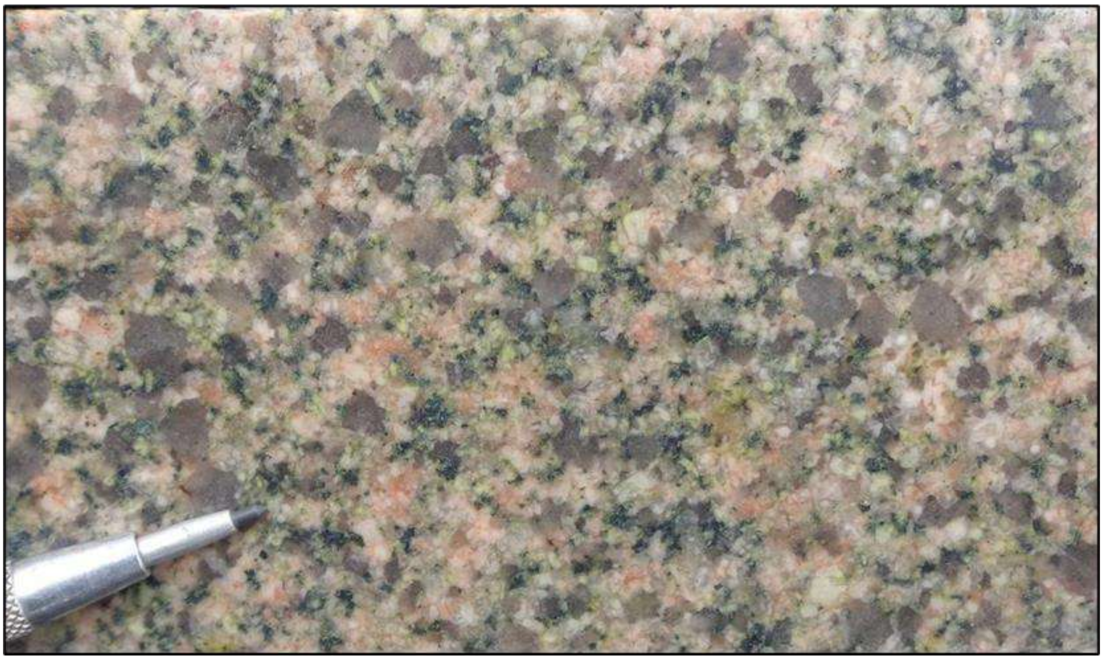


Figure 7.2.3 Distal Alteration: Haematite-Chlorite Pervasive Alteration (from Direct Footwall of Mineralisation at Souwa – DPRC0504 @ 157 m Depth) (Source: Centamin, 2021)

Proximal mineral assemblages, as shown in Figure 7.2.4 and Figure 7.2.5, include strong silica-sericite alteration that often overprints earlier haematite and silica alteration. The sulphides, mostly pyrite, are abundant throughout the core of the shear zone; they host part of the gold mineralisation. The other portion of the gold mineralisation occurs as native gold in the quartz veins and selvages.

Figure 7.2.4 Proximal Intense Sericite and Fine Grained Disseminated Pyrite Alteration (from the Han Deposit – DPRD0470 @ 94 m Depth) (Source: Centamin, 2021)

Figure 7.2.5 shows a photograph of a sheared granite with strong silica-sericite overprinting earlier weak haematite alteration. This interval contains disseminated coarse pyrite and returned a gold assay of 3.9 g/t.

Figure 7.2.5 Strong Silica-Sericite Alteration - High Grade Mineralisation (from the Han Deposit – DPRD0470 @ 98.7 m Depth) (Source: Centamin, 2021)

7.2.4 Weathering Profiles

The weathering profiles encountered across the gold deposits in the Doropo project area includes a surficial layer or soil profile, which has some degree of transported material but is dominated by sandy granite-derived soils. The surficial layer rests on a mottled or unmottled saprolite layer and a saprock layer which then transitions to fresh rock. The weathered, in situ bedrock is divided in to two reasonably distinct material types for the purposes of drill hole logging and modelling of the weathered zone, which overlies fresh granite. The transition from saprock to fresh rock is generally a sharp contact zone.

The characteristics of the constituent parts of the weathered bedrock are as follows:

- **Surficial material (soil profile)**: In situ and transported sandy soils, colluvium and alluvium in drainage lines and limited areas of hard laterite cuirasse on stable interfluvial areas. The soil profiles vary in thickness from 0 m to 5 m with an average thickness (outside the drainage lines) of 2 m. The BOT code (base of transported / soil profile) is used for geological modelling.

- **Saprolite**: Highly weathered insitu rock (mainly granite), which is reduced to an orange-brown clayey sand. The original granitic texture is barely recognisable but some of the constituent minerals are present, mainly a skeletal framework of quartz grains with some remnant feldspars and clay minerals. The saprolite layer varies in thickness from 2 m to 40 m with an average thickness of 18 m. The BOS code (base of saprolite) is used for the geological modelling.

- **Saprock** (transition material): Weathered granite which retains it's original rock texture. Most of the constituent minerals are recognizable, including quartz, milky, partially weathered feldspars and any mica is only partially altered. The saprock layer varies in thickness from 10 m to 30 m with an average thickness of 16 m.

- **Fresh rock**: None of the mineral components are altered. The TPFR code (top of fresh rock) is used for geological modelling.

The following photographs illustrate typical weathered rock material seen at the Doropo project gold deposits.

Figure 7.2.6 Two Examples of Doropo Saprolite Showing Quartz Vein Fragments in the Right Hand Photograph (Source: Centamin, 2021)

The saprolite, example shown in Figure 7.2.7, has very little to no fabric preserved. The granitic origin can be interpreted by the remaining coarse quartz grains that are supported by clay matrix. Thickness of saprolite varies from 2 to 40 m, being very irregular across the drill sections and the various gold deposits. Overall, the thickest saprolite section is found at the Souwa and Enioda deposits and the thinnest saprolite section at the Han deposit.

Figure 7.2.7 Saprock (Original Fabric and Mineralogy is Partially Preserved) (Source: Centamin, 2021)

The saprock example shown in Figure 7.2.8, while retaining much of the original granitic rock texture and being reasonably consolidated can still be broken by hand. Thickness of the saprock layer is less variable than saprolite, varying from about 10 - 30 m.

Figure 7.2.8 Saprock (Source: Centamin, 2021)

The transition from saprock to fresh rock, shown in Figure 7.2.9, is generally sharp, typically no more than 1 – 3 m thick. A maximum thickness of about 10 m can be found in a few places where weathering is controlled by the fractures in the rock. Figure 7.2.10 shows a photograph of fresh granodiorite drill core for comparison.

Figure 7.2.9 Transition Zone Between Lower Saprolite and Fresh ROCK (Source: Centamin, 2021)

Figure 7.2.10 Fresh Granodiorite (Source: Centamin, 2021)

7.2.5 Genesis

From August 2017 Centamin commissioned Orefind, an Australian based structural geology and geological modelling consulting company, to investigate the geological history of the Doropo Project area. The following text is an extract of their detailed report (Davis, 2017):

"All granite hosted mineralised structure examined have developed via the same fluid-structural history, comprising three broad cycles. Overprinting relationships indicate a massive deformation-controlled fluid flow system acting in tandem with a deformation regime that progressed from ductile through to brittle / brittle-ductile in the waning stages of fluid ingress. Broadly similar sequences of quartz-carbonate veining were introduced at all prospects and indicate the following history:

- Ductile shear zone initiation.
- Ingress of the first silica-dominated fluid phase during ductile deformation.
- Hiatus in fluid flow.
- Ingress of the second major silica dominated fluid phase with deposition of base metals and gold in the waning stages of this fluid deformation cycle. Deformation caused pervasive brecciation of the first stage of quartz-dominant veins, with cementation and silicification of the breccias being facilitated by massive second-stage silica inflow.
- Hiatus in fluid flow.

- Deformation progresses to a dominantly brittle system. Deformation of the earlier silica stages, with breccia being cemented / silicified by the final major silica-dominant fluid phase.

The progressive / repeated reactivation of the host structures has channelled numerous fluid cycles. Each of the three major silica-dominated fluid flow episodes described above will have comprised many individual fluid pulses, resulting in progressive increases in vein volume. Silicification of the host structures will have modified the rheology of the host rock, resulting in strain accumulation and ongoing localisation of deformation.

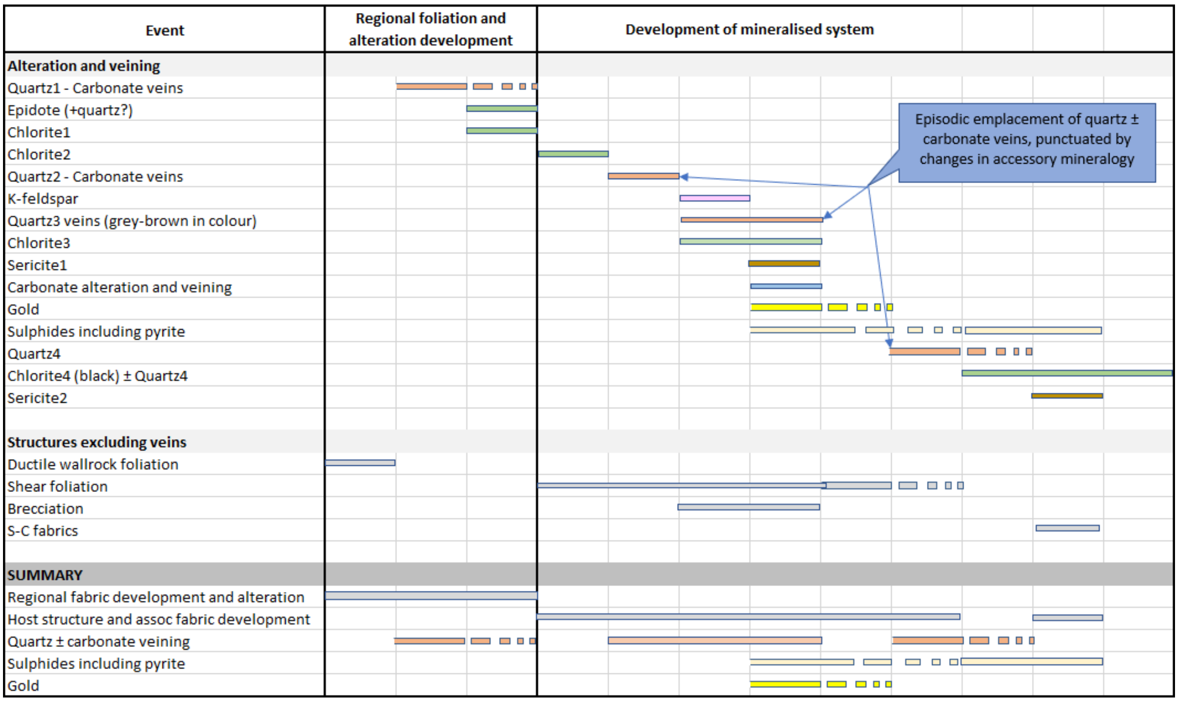
The first major stage of quartz rich fluid is inferred as being controlled by permeability associated with the accommodation of strain on structures that initiated as ductile shears in the granite. These structures likely also accommodated the greatest volume of silica bearing fluids, resulting in incremental formation of the largest white quartz veins seen in the deposits.

The second largest stage of quartz rich fluid was coeval with cycles of brittle deformation that overprinted the large, first-generation quartz veins. Angular breccia fragments were produced and then ‘cemented’ by a matrix of translucent to grey to black quartz infill and veining. The distinctive dark-coloured veins are commonly the host to sulphides and are inferred as coeval with, and host to, gold mineralisation. Accumulation of shearing strain at the margins of the first-generation veins commonly produced shear-induced lamination. Brecciation was sponsored in zones where the strain rate was great to accommodate ductile deformation. Overall, the special distribution of highest grades coincides with the deformed margins of the early formed veins.

The third major stage of quartz rich fluid was the volumetrically smallest, and manifests as cross-cutting white to translucent veins that inferred as forming under dominantly brittle conditions.”

The geological history for Souwa, Kekeda and Han were established through the documentation of overprinting and geometric relationships in diamond core with Souwa displayed below in Figure 7.2.11. In 2023, geological histories were also developed for Kilosegui and Enioda. Note that evolution of the gold mineralising event overprints regional epidote-chlorite alteration. Sulphide deposition is coeval with gold, with the exception if pyrite manifests as several generations. Both sulphides and gold occupy structural sites, including fractures and stylolites, that are spatially associated with deformed portions of the first-generation veins. These spatial relationships, and the common alignment of sulphide grain accumulations, indicate deposition of gold under an imposed stress. The S-C fabrics represent the final stage of foliation development noted in Souwa diamond core and have accommodated a sinistral sense of movement.

Figure 7.2.11 Souwa Prospect Geological History (Source: Davis, 2017)



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8.0 DEPOSIT TYPE

8.1 Introduction

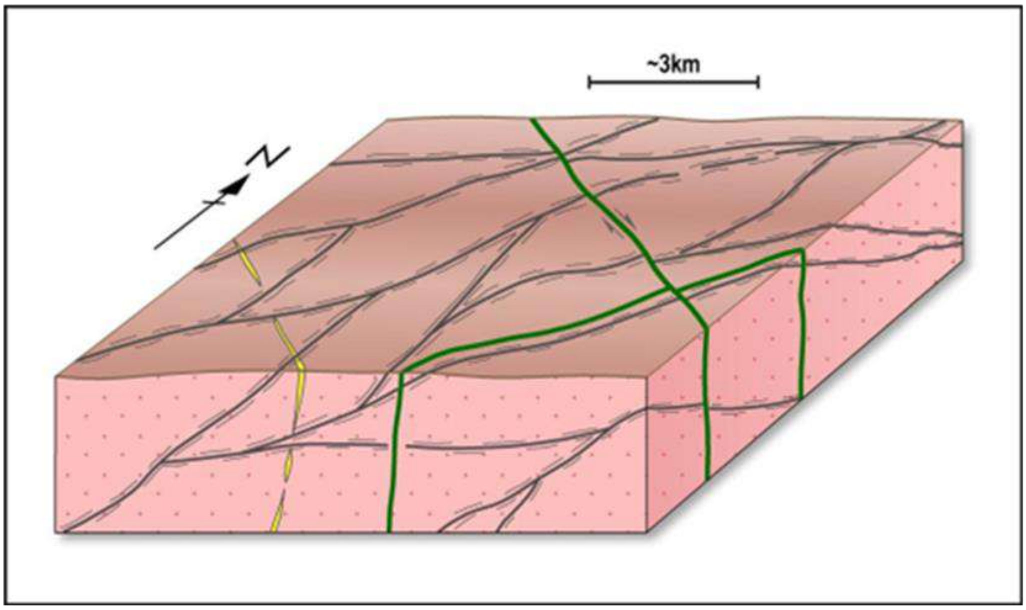
The Doropo Project currently includes thirteen distinct mineralised bodies that host the actual resource plus numerous prospects and geochemical surface anomalies yet to be tested, fitting an area of about 170 km^2, or within a circular area of 28 km radius.

The mineral occurrences tested to date include two model types, a ‘classic’ orogenic shear-hosted gold deposit model and a quartz vein hosted gold deposit model (Figure 8.1.1). Both these models are coherent in nature with the majority of the other West African deposits, except on the issue of the host lithology (the granitic domain).

The granitic complex displays lozenge-shaped arrays of anastomosing shear zones. The shears have a broad south-southwest to north-northeast orientation, dipping shallowly towards the northwest. This interpreted model has been developed by several authors but was formalised in 3D by the Orefind geologists. The mineralisation occurs all along the shears, which were all channel ways for the fluid flows, however, at a generally low-grade gold deposition. Significant higher-grade mineralisation occurs on specific localised trend orientations, or when shears intersect, and are often spatially associated with doleritic dyke swarms (Davis, 2017).

The quartz veins mainly occur along the NW-SE orientation, and are sub-vertical or steeply dipping towards the SW. These veins show significant gold grades and often visible gold but have a limited width.

Figure 8.1.1 Schematic Geological Model Interpretation of the Resource Area (Shear Zones in Black, Quartz Veins in Yellow and Doleritic Dykes in Green) (Source: Centamin, 2021)



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FIGURES

9.0 EXPLORATION

Much of the content in this section is source from Osborn (2019) and Centamin (2021) and has been updated only where necessary.

Only minor exploration work was conducted before Centamin took over the Doropo Project in 2014. This work was limited to field reconnaissance and rock chip sampling and was carried out by Ampella Mining Ltd. Centamin started exploration work in 2014, progressing from regional field mapping, to the surface geochemistry sampling, via soils and auger, to the geophysical surveys, ground surveys and airborne surveys, to trenching, aircore drilling and then Reverse Circulation (RC) and Diamond Drilling (DD).

The above strategy currently remains unchanged and continues to be applied to the pipeline of targets within the permitted area.

All exploration work has started from a fixed base setup in the Doropo town. Following up the momentum in drilling activities on the prospects host of the actual resource, a second camp was set up in the Danoa village, located closer to the drill sites, about 45 km by tracks from Doropo. The regional exploration work (mapping, soil sampling, auger sampling, aircore drilling) is based out of fly camps or other temporary camps depending on the location of the programs.

9.1 Coordinates, Survey Controls and Topographic Surveys

The default coordinates system used on the Project is based on the UTM coordinates, Zone 30 North in the World Geodetic System (WGS) 84. The Shuttle Radar Topography Mission (SRTM) digital data is used as the topographic reference for all the exploration work carried out to date.

GEDES International SARL Surveyors (Geo-Engineering Design and Surveying) is an accredited surveying company that is contracted to carry all ground surveys on the Project, including recording the location of all drill hole collars.

Ground fixed control points are regularly established, to follow the exploration progress. At the end of 2018, height control points were setup by GEDES. They are cemented in the ground, generally located on duricrust plateaus in the vicinity of the major prospects.

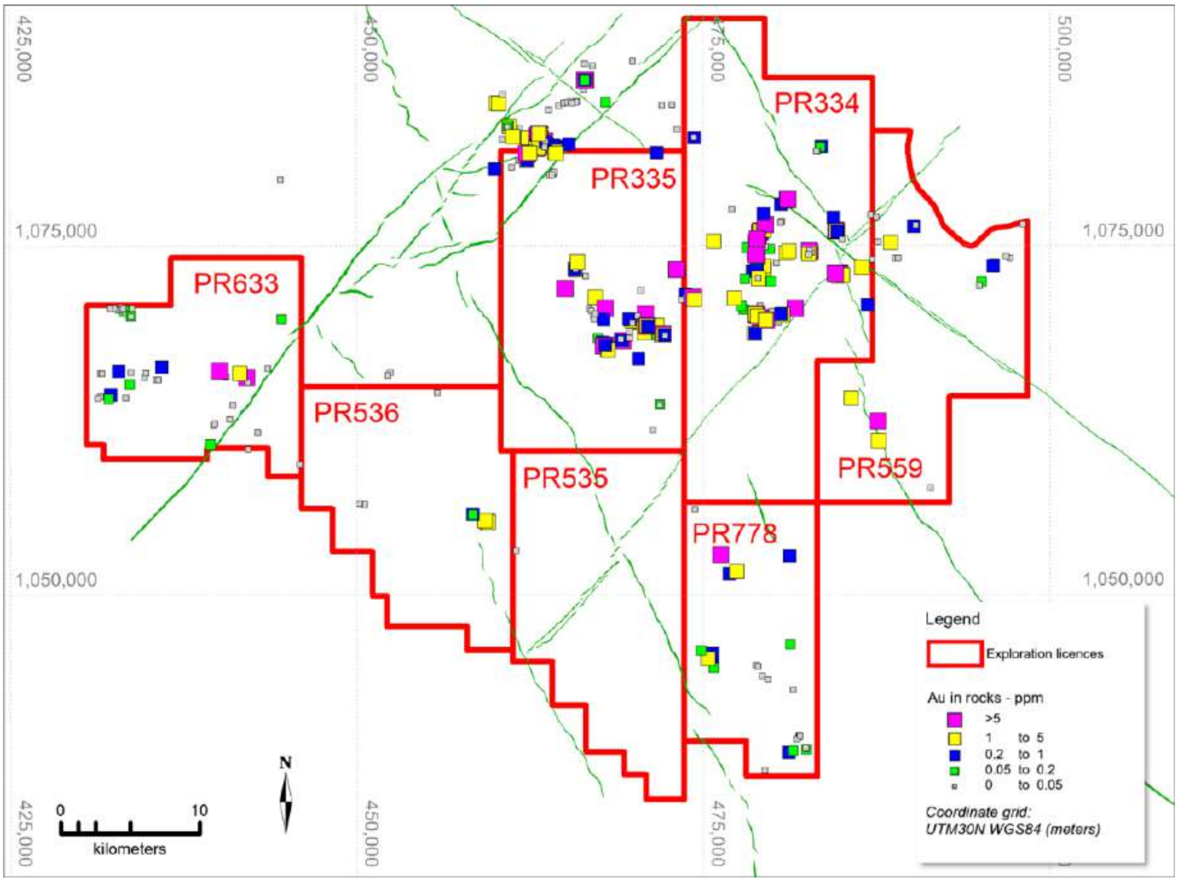
All drill hole collars (including RC and diamond collars) are surveyed using differential GPS unless accuracy is deemed to be low due to issues such as poor satellite coverage or abundant vegetation cover. In these cases, a total station is used to record the location of the collars. All other programs including soil samples, rock samples, auger collars, trenches, aircore collars are located using hand-held GPS units. The collar elevations are linked to the NGCI system (Nivellement General de Côte d'Ivoire), that is the standard system for recording elevation in Côte d'Ivoire.

9.2 Geological Reconnaissance, Mapping and Rock Chip Sampling

Outcrops on the Project area are uncommon due to the granitic nature of the underlying rock. In the resource area, the main access to outcrops is generated by the artisanal mining.

The initial reconnaissance focused on mapping all the artisanal mining spots, the outlines of the excavations and any data on the quartz veins that were mined. All quartz vein, and the veins selvages were sampled by rock chipping. A total of 519 rock chip samples have been taken up until January 2022 with results of the rock chip sampling programmes shown in Figure 9.2.1.

Figure 9.2.1 Location and Results of Rock Chip Sampling Programs (Source: Centamin, 2023)

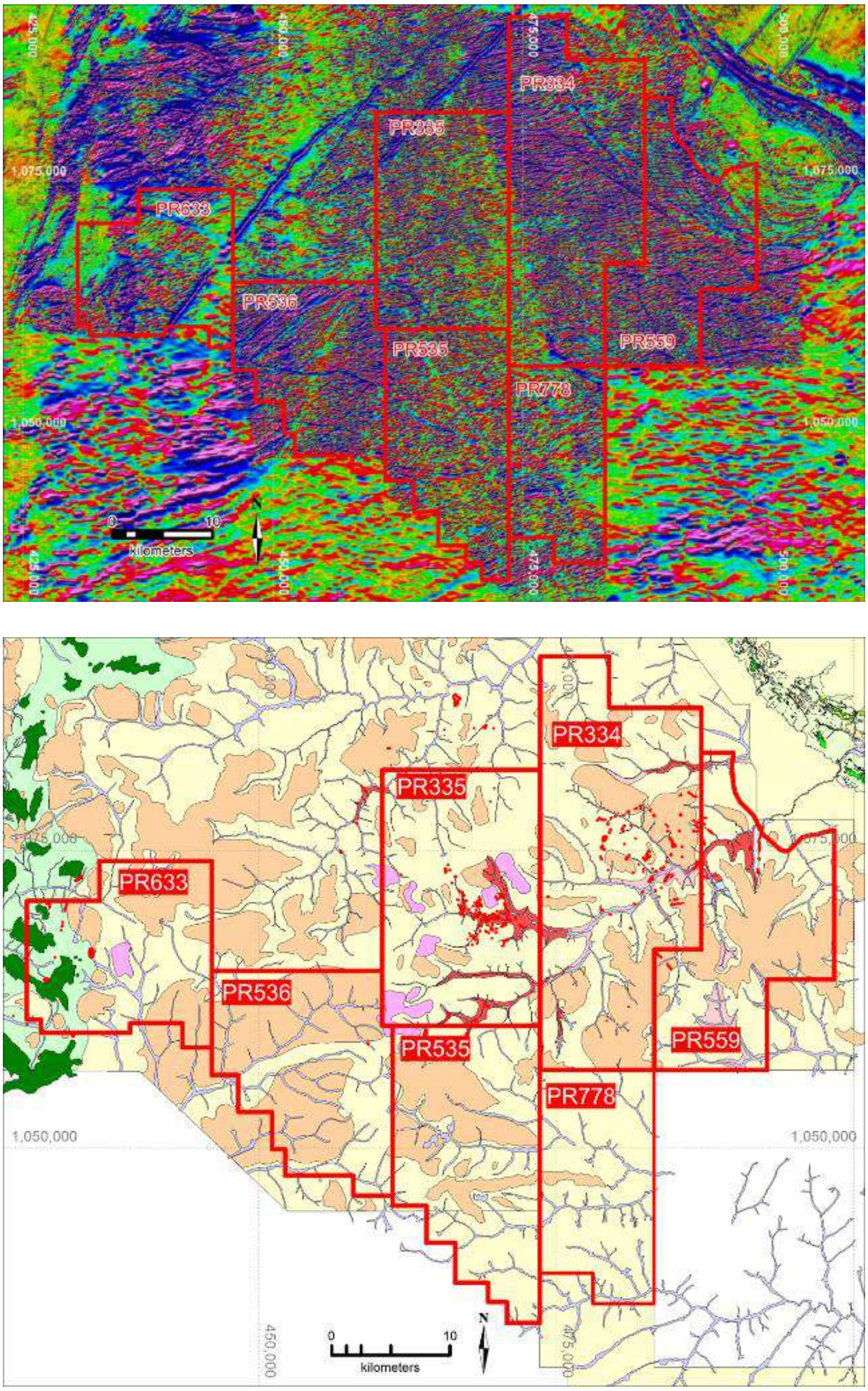


9.3 Airborne Geophysical Survey

A regional aeromagnetic and radiometric survey, with additional detailed infill surveying over the Doropo Project, was flown by UTS Geophysics / Geotech Airborne Limited (UTS) between March 24 and May 27 in 2015 (Wood, 2015). The survey was flown using NNW-SSE oriented survey lines spaced either 200 m or 100 m apart, and covered a total of 21,827 line km.

The resulting imagery supported the initial regional interpretations and then the first regional exploration programs. The results of the magnetic imagery can be seen in Figure 9.3.1.

Figure 9.3.1 Exploration Data: Magnetic Imagery (top) and Regolith Mapping (Source: Centamin, 2023)



9.4 Soil Sampling

Soil sampling remains an efficient reconnaissance tool on the granitic domain, and has proven to return representative results.

Several orientation surveys were originally conducted within the permit areas, across zones of artisanal mining activity as well as areas with no specific activity. The results showed that the upper most surface material, of sandy composition and often transported, is not representative at the prospect scale and returned irregular widespread dispersions of the gold anomalism. However, the horizon of mottle zone, or sometimes stripped top of saprolite, returned more coherent and reliable gold anomalism in the vicinity of the mineralised structures.

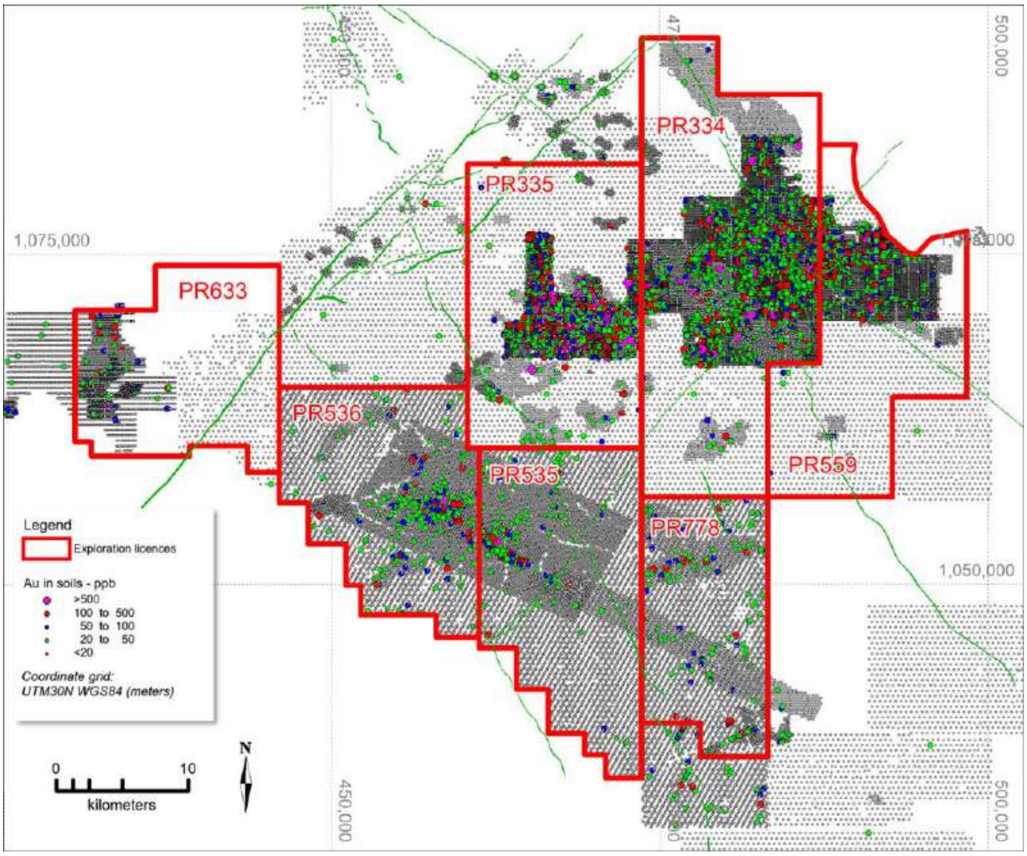
All subsequent soil sampling surveys sampled these representative levels, which are accessible from about 0.5 m depth to about maximum 3 m depth by quick pitting. Beyond this depth, the auger drilling methods are more efficient.

The regional soil grid is set on a staggered 400 m x 400 m grid. Infill sampling is then carried out where necessary on 200 m or 100 m spaced grids.

All soil samples (and geochemistry samples in general) are analysed using a standard 50 g gold fire assay with an atomic absorption finish at Bureau Veritas Laboratories in Abidjan. Multi-elements are also analysed by four-acid digest with ICP-AES and ICP-MS finish at the ACME Laboratories in Vancouver.

In total, 92,307 soil samples were collected between 2014 and December 2022, including 20,815 samples on infill grids on the Project. Most of the deposits and current prospects are well highlighted by the soils results. A map showing the location and results of the soil sampling programs can be seen in Figure 9.4.1 and the combined results of the soil sampling and auger drilling surveys can be seen as a colour contour map in Figure 9.5.1.

Figure 9.4.1 Location and Results of Soil Sampling Programs (Source: Centamin, 2023)



9.5 Auger Drilling

Auger drilling was largely used on the Project to complete the soil grid surveys where the thickest lateritic plateaus cover the in-situ material and where the transported horizons (alluvium, sand) average over 3 m thickness.

The powered augers, mounted on Land Cruisers, from Sahara Mining Services have been used on the Project to date. Generally, one sample from the top of the saprolitic horizon is collected per auger hole and is analysed for gold only (same analysis methods as the soils). In some cases, a second sample is also collected at the base of the lateritic horizon, aiming to test for mineralised lateritic layers. The samples collected from the auger drilling carried out in 2014 were analysed for gold by aqua regia digest with atomic absorption finish at SGS Laboratory in Ouagadougou.

A total of 27,999 auger holes have been drilled up until January 2022 with an average depth of 6.22 m and a maximum grade of 28 g/t Au. A map showing the location and results of the auger drilling programs can be seen in Figure 9.5.1 and the combined results of the soil sampling and auger drilling surveys can be seen as a colour contour map Figure 9.5.2.

Figure 9.5.1 Location and Results of AUGER Sampling Programs (Source: Centamin, 2023)

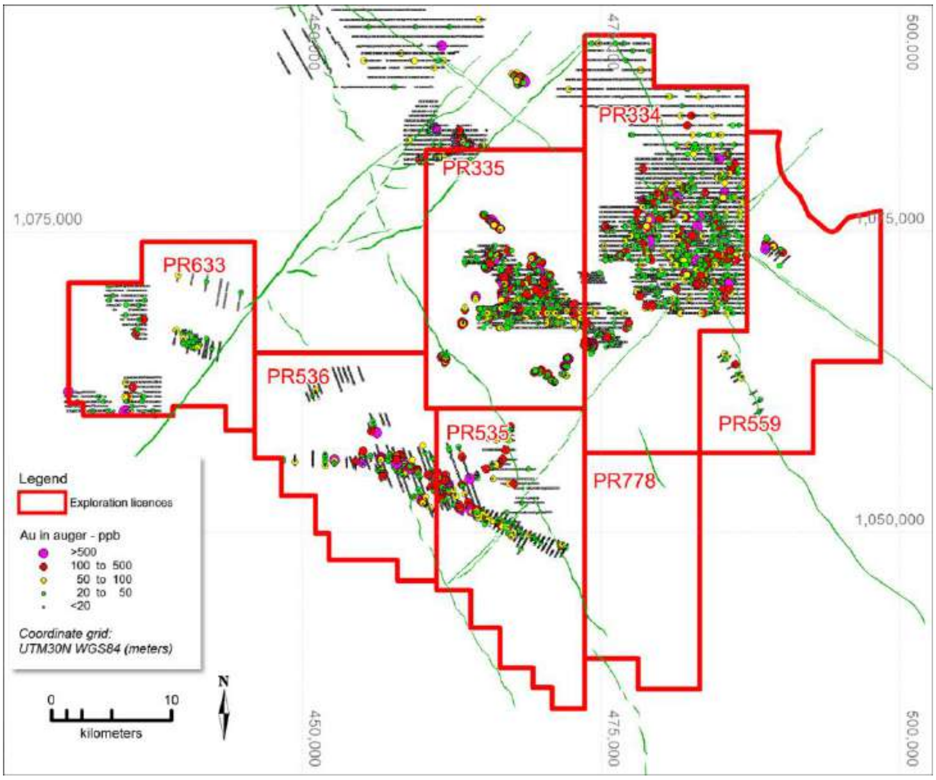
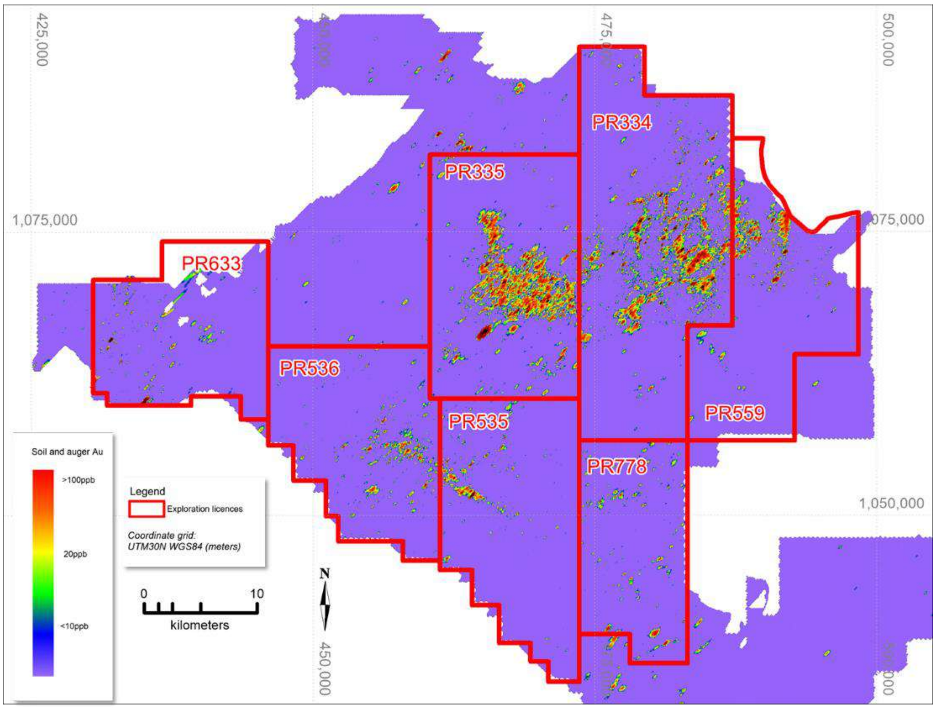


Figure 9.5.2 Exploration Data: Gridded Gold Values in Surface Geochemistry (Merged Soils and Auger Data) (Source: Centamin, 2023)



9.6 Trenching

Trenching was employed in certain remote areas to validate in-situ mineralized structures that had been identified through geochemical sampling. In total, 32 trenches were dug over two separate periods – 2015/2016, and 2022. Among these, 21 trenches were excavated in four phases around the Vako deposit and to the south of Doropo town during 2015 and 2016. Additionally, in 2022, ten trenches were completed to assess the northwest extension of Kilosegui.

Despite the extensive effort, the results from most of the trenches did not yield positive outcomes. Only two trenches excavated south of Doropo town exhibited promising mineralization with grades of 15 m@1.4g /t and 9 m@0.7 g/t. Unfortunately, the area covered by the permit containing these promising trenches had already been relinquished to the government.

9.7 Regolith Mapping and Interpretation

The regolith map was generated to cover the entire Project area, using a combination of satellite imagery, radiometrics, soils database and field checking.

Weathering processes result in the depletion of potassium and relative enrichment of thorium and uranium, therefore radiometric maps including Th, K and U are extremely useful in identifying lateritic plateaus, as well as areas with little to no weathering profile. Large areas of lateritic plateaus, rivers and alluvial deposits can be easily identified using satellite imagery.

The soil sample descriptions, that include comments on the surface landscape, also provided good insight into the profile of the regolith.

9.8 Gradient Array Induced Polarisation Survey

Gradient Array Induced Polarisation (GAIP) surveys are regularly used to interpret the continuity of structures when already highlighted by other methods. Multiple blocks were surveyed in 2015 and 2016 in the resource area (Toni, 2017). The Nokpa deposit was targeted directly from the interpretation of the GAIP imagery. SAGAX is used to run the ground survey while Resource Potentials (RESPOT) worked on the QAQC and data processing.

9.9 Aircore Drilling

Campaigns of Aircore (AC) drilling are regularly conducted to quickly test coherent geochemical gold anomalism, conceptual targets or extensions to known mineralised structures. From June 2015 to December 2019, 142,947 m were drilled at an average length of 29.27 m and predominant dip of -55 degrees. No aircore drilling has been conducted since then.

A map showing the combined aircore, RC and diamond drill hole locations can be seen in Figure 10-5. Aircore drilling is used as an exploration tool but is not included in the database used for resource estimates due to issues relating to sample representivity. All the drilling completed to date was conducted by Geodrill Ltd. The aircore holes are usually planned on lines across the targets to test; collars are planned heel to toe based on ground refusal along the lines.

The aircore programs identified several mineralised structures which have now been followed up by RC and diamond drilling, including Souwa, Kekeda and, Enioda. The samples are composited on 2 m lengths and analysed for gold by fire assay at the Bureau Veritas Laboratories in Abidjan.

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10.0 DRILLING

10.1 Drilling Summary

The Reverse Circulation (RC) and Diamond Drilling (DD) drill programs have been undertaken using a phased approach on the Doropo Project since the end of November 2015, following the first significant hits from the aircore (AC) drill programs. Drill procedures are well documented and have been specifically adapted to the Project from the experience gained by the team on previous projects.

All the drilling to date has been largely undertaken by two drilling companies, both are reputable contractors who respect good industry practices (Geodrill Ltd and Energold Drilling Ltd). The drill rigs are well maintained and the maintenance crew is quickly responsive. All the staff, from the drillers to the offsiders, are well trained and operate smoothly. The drill rigs used on the Project are UDR200 (for diamond drilling only), UDR650 (small multipurpose rig, truck mounted, Figure 10.1.1) and UDR900 (big multipurpose rig, track mounted).

The drill programs are planned using on-site cross-sectional interpretations, which are based on previous exploration programs, surface geochemistry, aircore drilling or other previous drilling completed, geophysical imageries and on conceptual interpretations.

The latest database provided to Cube contained a total of 3,735 holes relating to the prospects updated and comprises DD, RC and RC pre-collar holes with DD tails (RCD holes). No AC holes have been used for Mineral Resource modelling due to quality concerns associated with this method, which is better suited to exploration target and sterilisation drilling. A summary of the hole types and metreage is provided in Table 10.1.1, with a more detailed breakdown per updated prospect given in Table 10.1.2. A full listing of the drill holes at the updated prospects is contained in Appendix 1.

The drill sites are prepared by hand clearing or dozer depending on the areas. By default, infill lines are cleared by dozer. The drill pad sizes are set according to the needs of the drilling contractor.

After the completion of a drill hole, the drill site is cleaned and any contaminated soil is removed. A concrete plinth of approximatively 40 cm x 40 cm x 20 cm is set around the PVC casing for future reference (Figure 10.1.2).

Figure 10.1.1 The Geodrill UDR650 Multipurpose Drill Rig with Compressor Visible in the Background

Figure 10.1.2 An Example of a Concrete Plinth Set Around PVC Casing at Souwa

Table 10.1.1 Summary of DD, RC and RCD Holes Provided to Cube for Mineral Resource Estimation at Doropo for the Updated Prospects Only, as at 25 July 2022

Hole Type	No. Holes	Total Length (m)	Ave. Depth (m)
DD	289	30,685	106
RC	3,354	336,593	100
RCD	92	16,052	174
TOTAL	3,735	383,330	103

Table 10.1.2 Breakdown of Available Drill Data for the Mineral Resource Estimate Update of the Updated Prospects Only, as at 25 July 2022

Prospect	Hole Type	No. Holes	Total Length (m)
ATI (Attire)	DD	11	851.3
	RC	12	1,504.0
	RCD	1	228.1
CHG (Chegue)	DD	46	5,002.4
	RC	148	13,194.0
	RCD	12	1,667.8
ENI (Enioda)	DD	23	2,234.2
	RC	145	8,891.0
	RCD	2	210.5
HAN (Han)	DD	21	1,838.1
	RC	79	4,869.0
	RCD	9	1,087.5
KEK (Kekeda)	DD	17	1,424.1
	RC	105	7,244.0
	RCD	7	1,101.1
KLG (Kilosegui)	DD	73	8,633.1
	RC	325	27,366.0
	RCD	6	858.5
NOK (Nokpa)	DD	14	1,492.7
	RC	43	5,649.0
	RCD	1	98.0
SWA (Souwa)	DD	34	3,908.1
	RC	172	17,542.0
	RCD	4	719.5

10.1.2 Reverse Circulation Drilling

RC drilling comprises the primary drilling method on the Project from the end of November 2015. One to three multipurpose rigs (to keep the opportunity to switch to diamond drilling) are rotating, depending on the program. Some 4,089 RC holes totalling 414,191 m have been drilled up to 25 July 2022 at all Doropo prospects, with the additional infill drilling used to inform the current Mineral Resource update being a subset of this total. The numbers quoted in Table 10.1.1 refer only to the prospects updated in this study.

The drilling is dominantly dry and the moisture content (dry, moist or wet) of the bulk sample has been recorded since the end of 2016. For resource definition drilling, the drilling stops when the water table is reached and the booster air pressure cannot keep the samples dry. The hole may then be continued by DD if the targeted mineralisation has not been intersected yet.

The RC drilling uses hammer bits of nominally 5 ¼, 5 ½ and 5 ¾ inch diameter; the bit size was poorly recorded by drill holes until November 2016. From this time onward, the bit sizes used by depth and by hole has been recorded.

10.1.3 Diamond Drilling

A total of 289 DD holes for 30,685 m and some 92 RCD hole for 16,052 m had been drilled at the Project as at 25 July 2022 for all prospects, including those not updated in this estimate. The DD is used as drilling tails after RC pre-collar in the case of the deepest drilling (over about 180 m depth) as well as holes drilled to obtain structural data. Some DD was also completed to collect composite samples for metallurgical test-work samples. Either quarter or half core is retained in metallurgical holes and analysed for gold assays that are used in resource estimation.

10.2 Collar Surveys

The initial location of drill collars is undertaken by the geologist using a hand-held GPS, to rapidly enter the data into the database. Regular surveying campaigns are subsequently undertaken by an independent surveyor company (GEDES International) to accurately pick up collar coordinates with either a Total Station or differential GPS.

10.3 Downhole Surveys

The initial downhole survey reading is taken at 12 m depth, and then at every subsequent 30 m depth interval. A single shot Reflex EZ SHOT system has been used to undertake the downhole surveys (Figure 10.4.1). The drill inclination and azimuth are set using a compass and clinometer by the geologist, and this is recorded as the survey reading at the collar. Every survey is validated at the rig site by the geologist before being entered into the database.

10.4 Drill Coverage and Orientation

The drill coverage for the Project as a whole is shown in Figure 10.4.2. The latest infill drilling has reduced the nominal drill collar spacing to between 30 m and 40 m, especially in areas identified as being of most economic interest at the preceding 60 m to 80 m grid. The drill lines and azimuths are orientated so as to be near-perpendicular to the strike of each prospect. Drill inclination is most commonly at -60°, which for the vast majority of the lodes in the updated prospects results in an intersection angle to the lode planes that is orthogonal or sufficiently close to orthogonal to avoid significant sample bias.

Zoomed in plots of the drill plan and a representative cross-section, overlaid on the latest interpreted mineralised lodes, are shown in Figure 10.4.3 through Figure 10.4.19.

It is the Qualified Person’s opinion that the drilling configuration is appropriate for the geometry and orientation of the planar lodes at Doropo and is therefore suitable for Mineral Resource estimation.

Figure 10.4.1 The Reflex EZ Shot Tool About to be Inserted into a Drill Hole to Take a Downhole Survey Reading

Figure 10.4.2 Plan View of the Project Area Showing Drilling at the Various Prospects

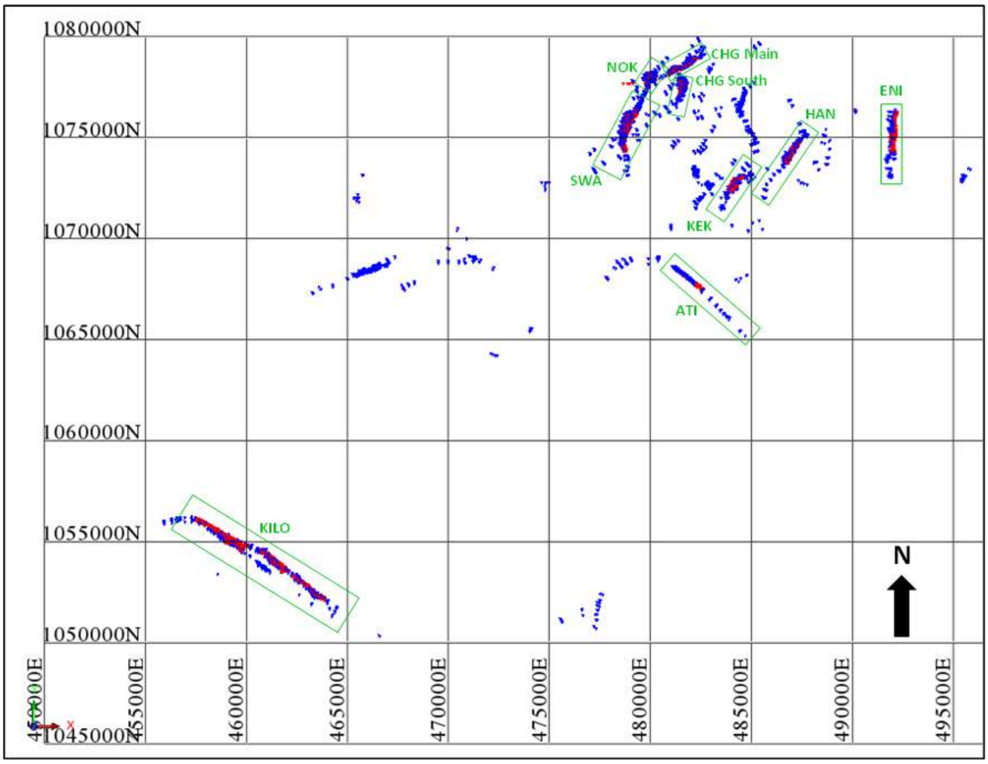
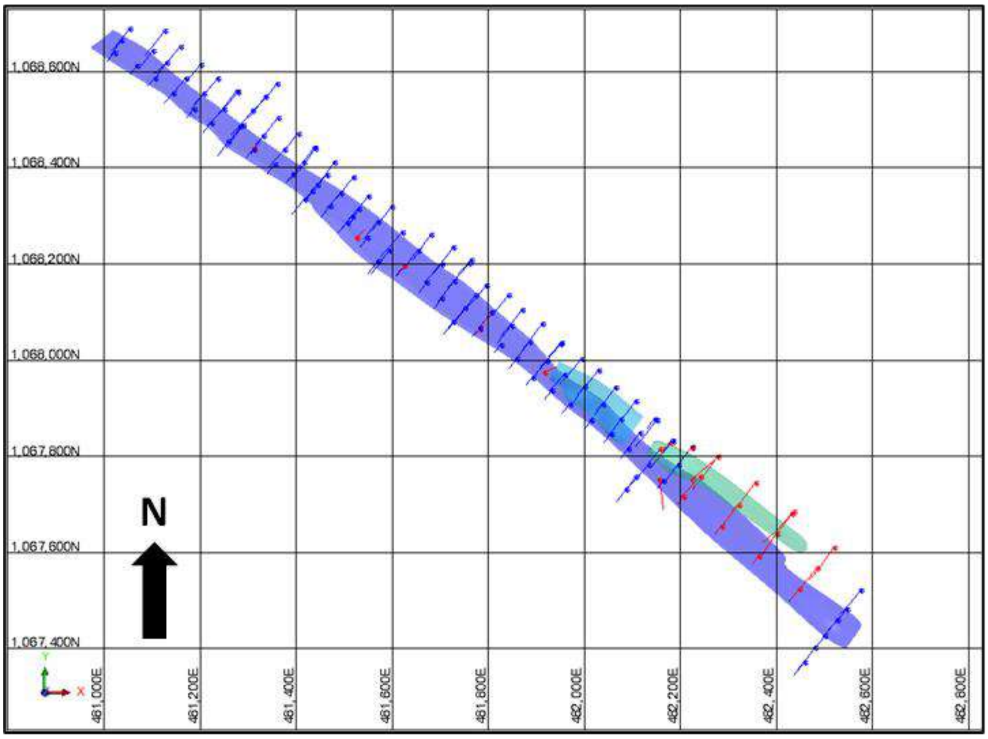
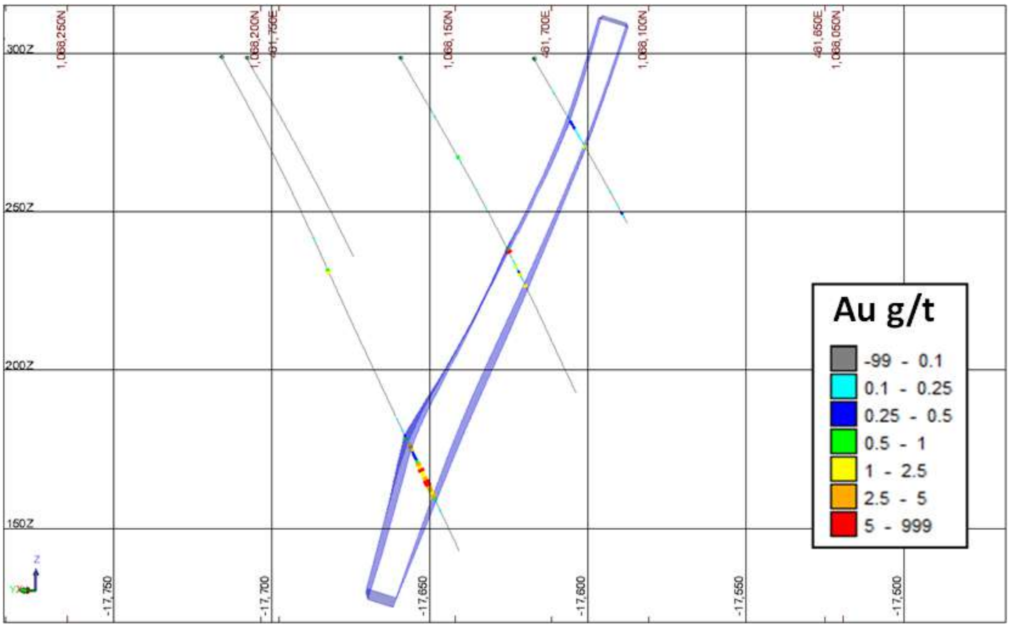


Figure 10.4.3 Plan View of the Drill Holes and Mineralisation Domain Wireframes at ATI



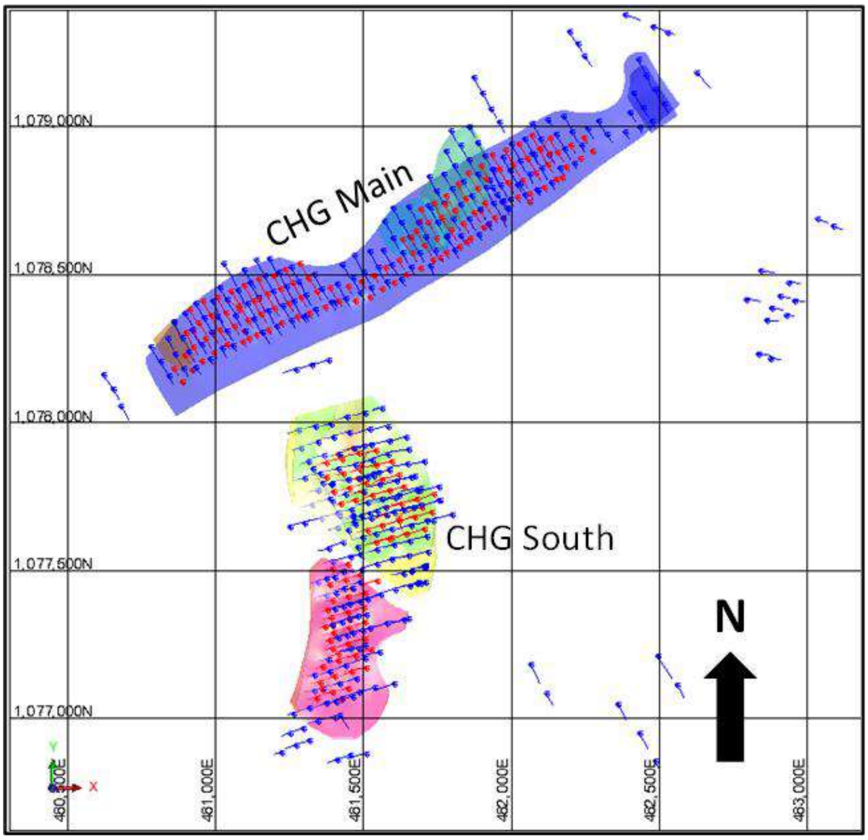
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.4 Cross-Section View at ATI Looking South-East



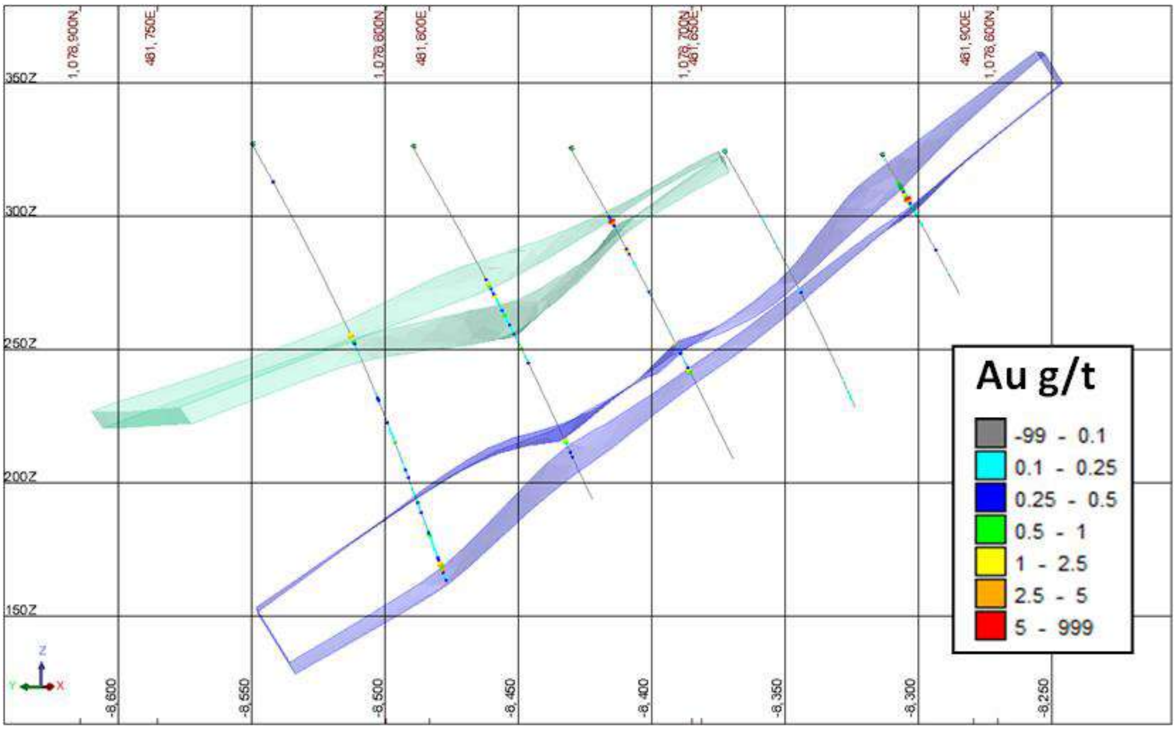
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.5 Plan View of the Drill Holes and Mineralisation Domain Wireframes at CHG



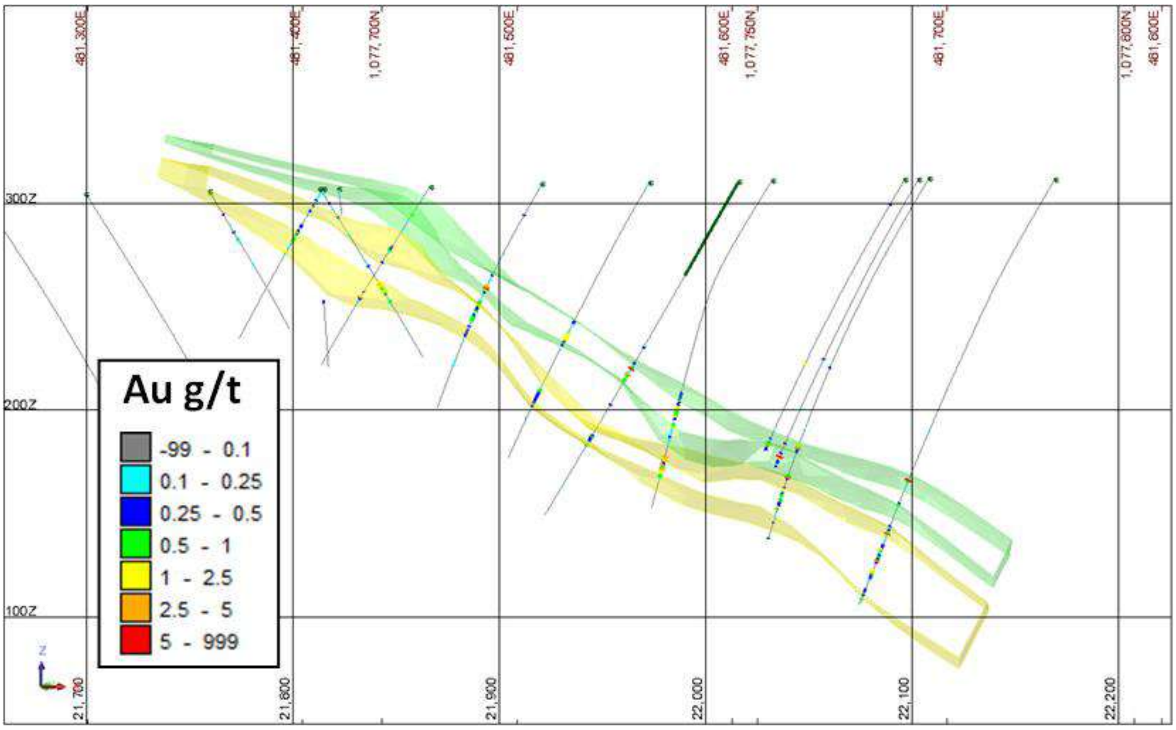
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.6 Cross-Section View at CHG Main Looking North-East



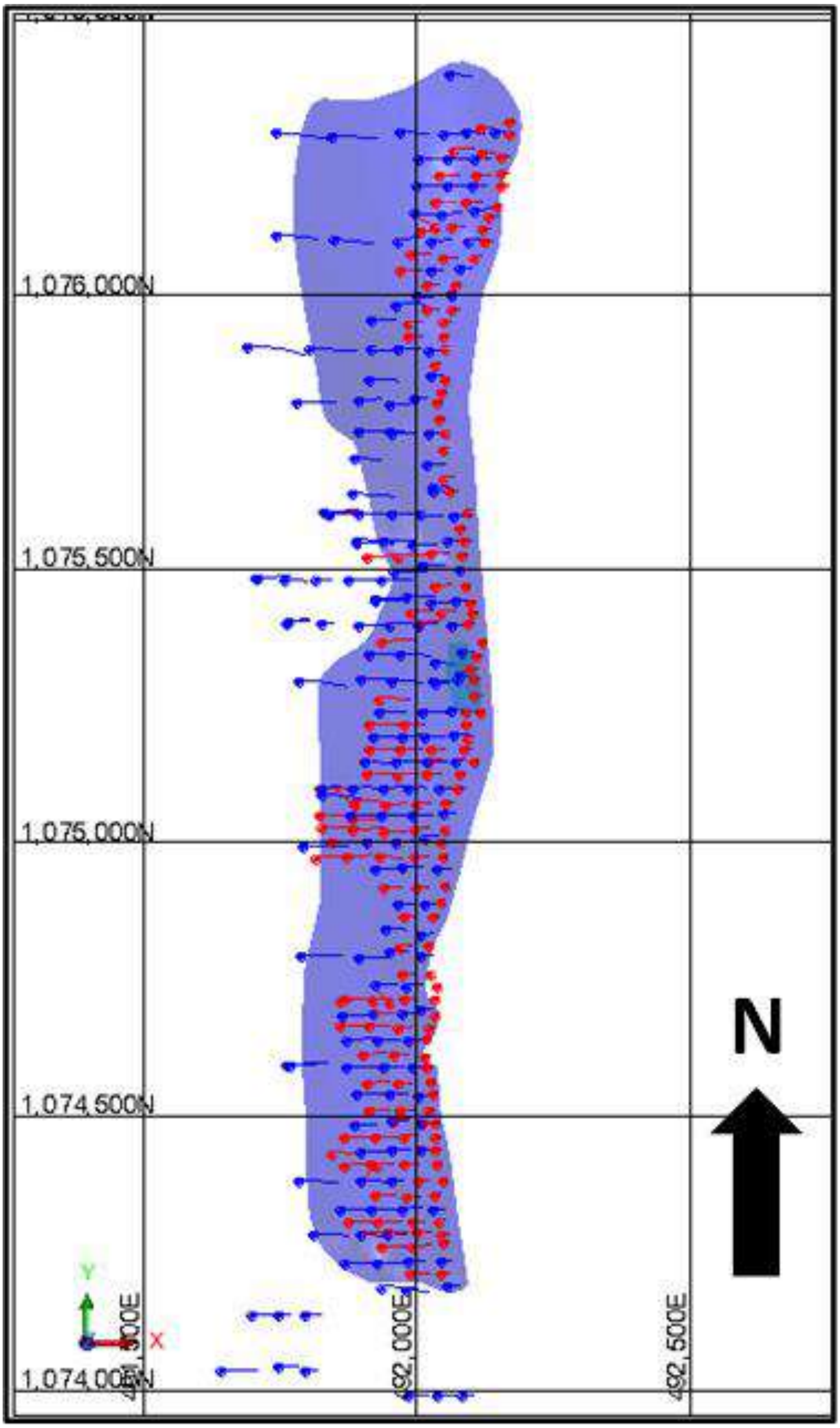
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.7 Cross-Section View at CHG South Looking North-Northwest



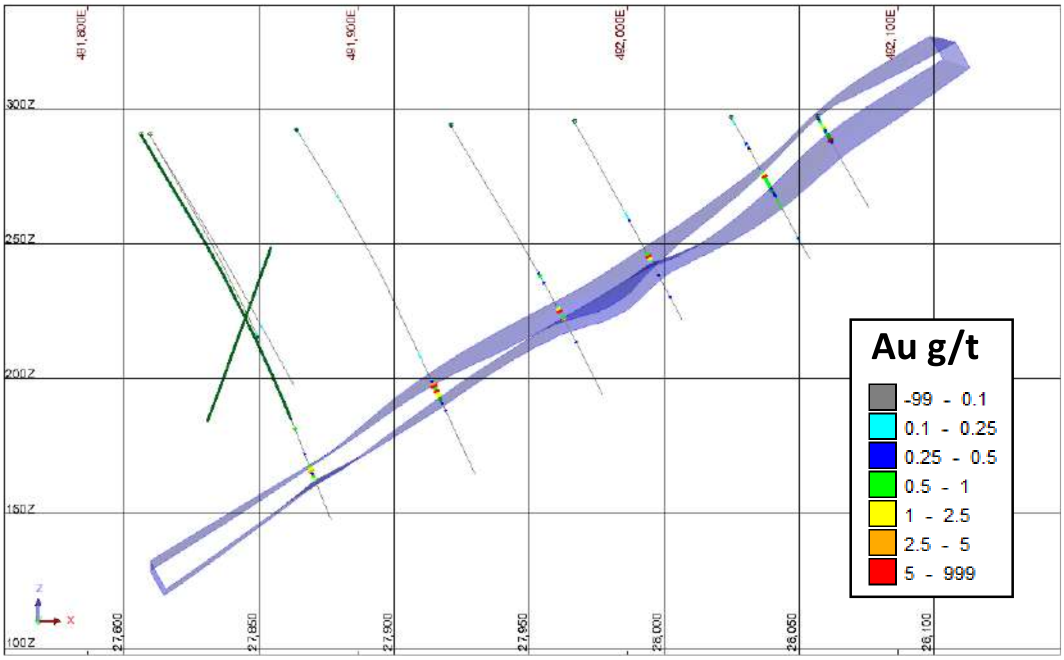
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.8 Plan View of the Drill Holes and Mineralisation Domain Wireframes at ENI



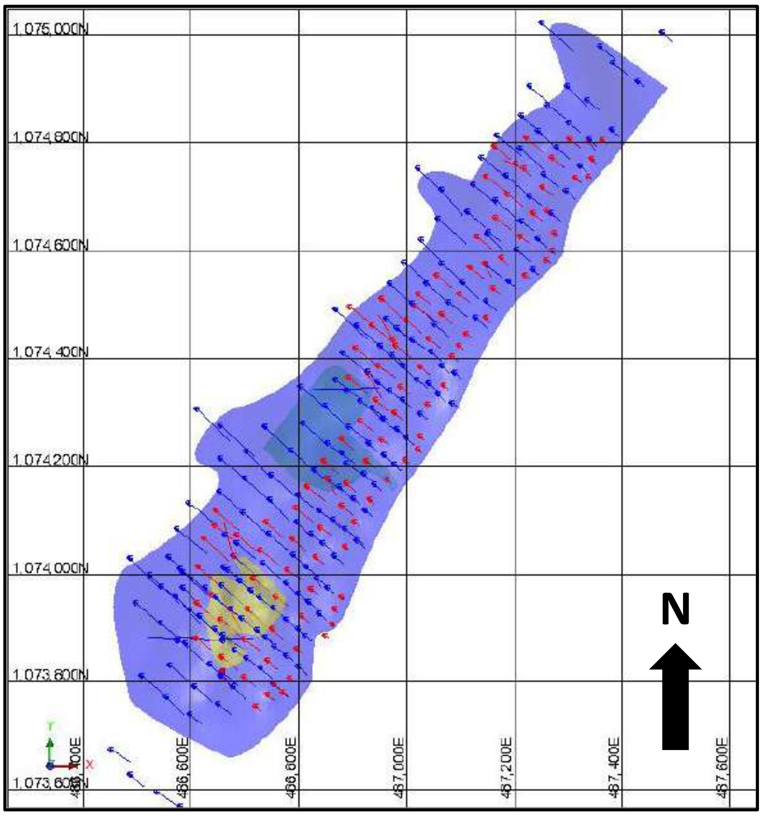
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.9 Cross-Section View at ENI Looking North



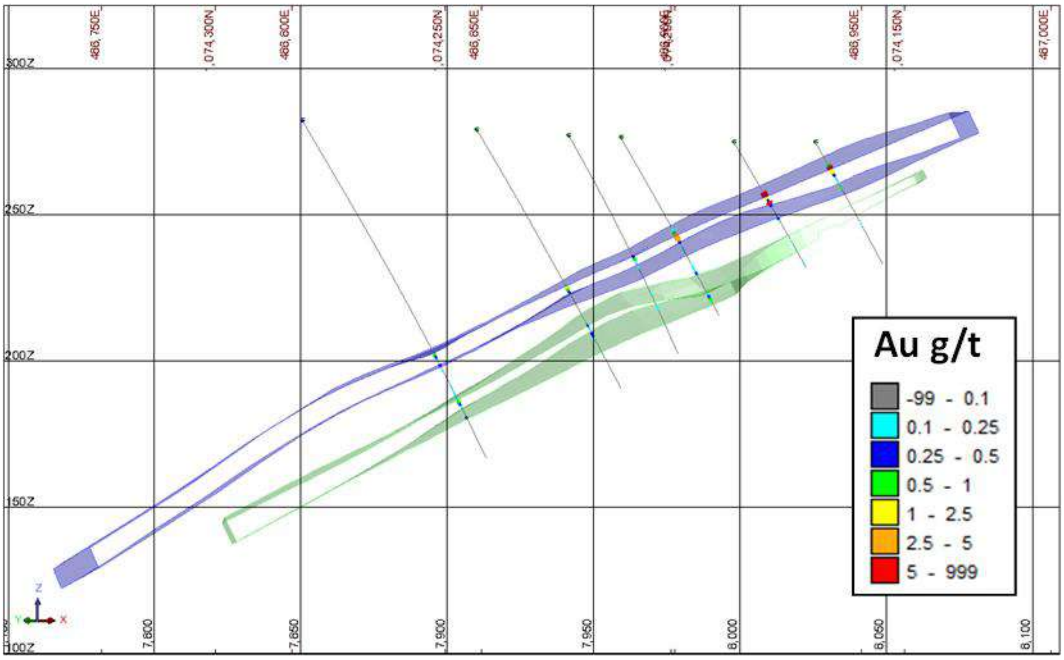
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.10 Plan View of the Drill Holes and Mineralisation Domain Wireframes at HAN



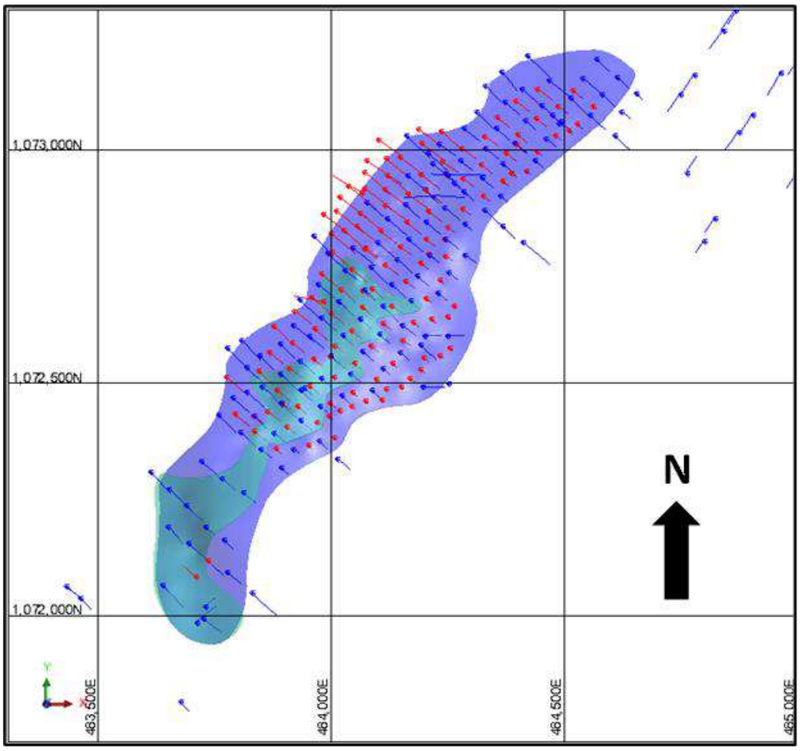
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.11 Cross-Section View at HAN Looking North-East



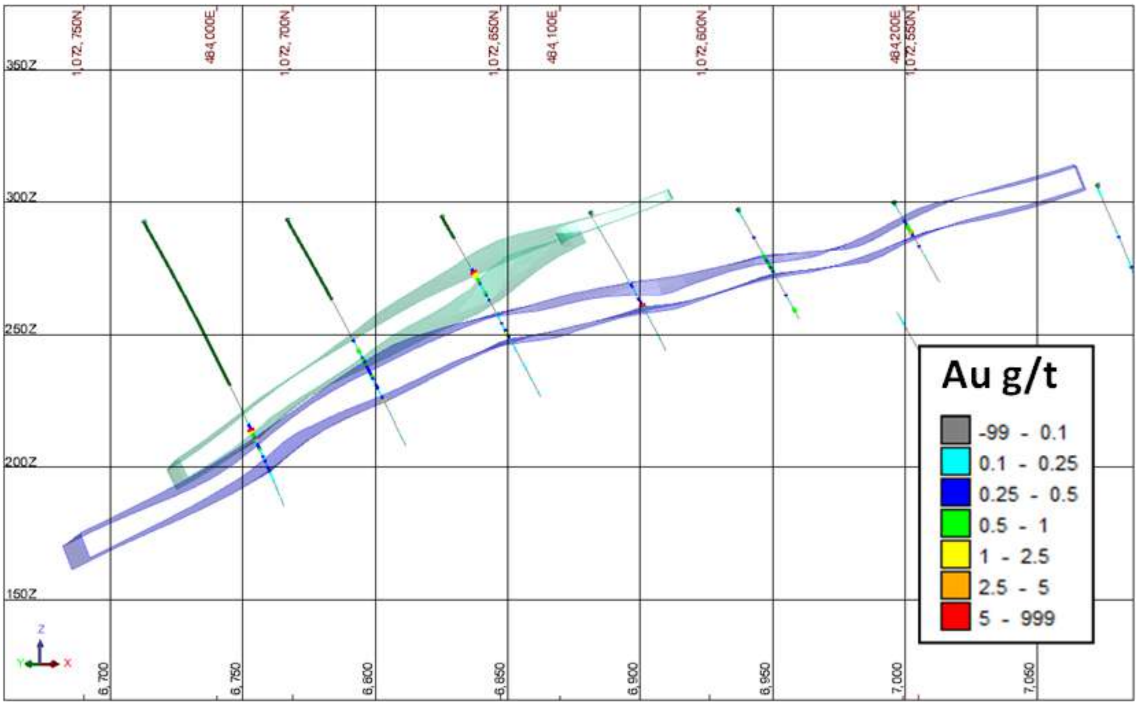
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.12 Plan View of the Drill Holes and Mineralisation Domain Wireframes at KEK



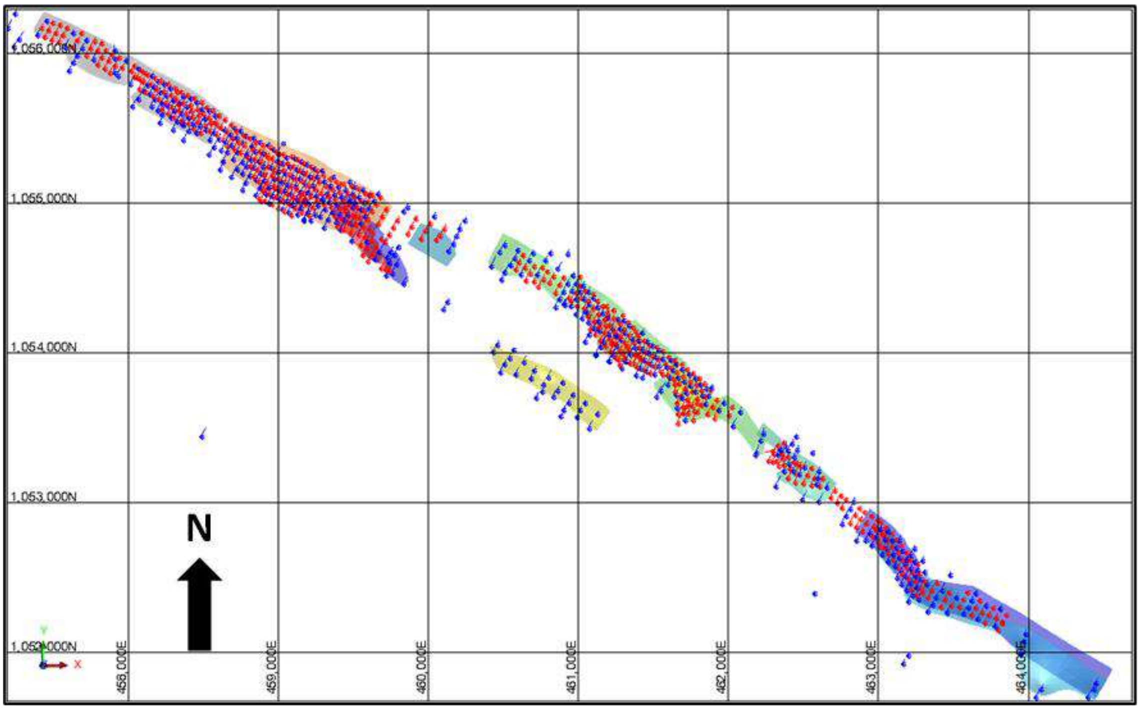
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.13 Cross-Section View at KEK Looking North-East



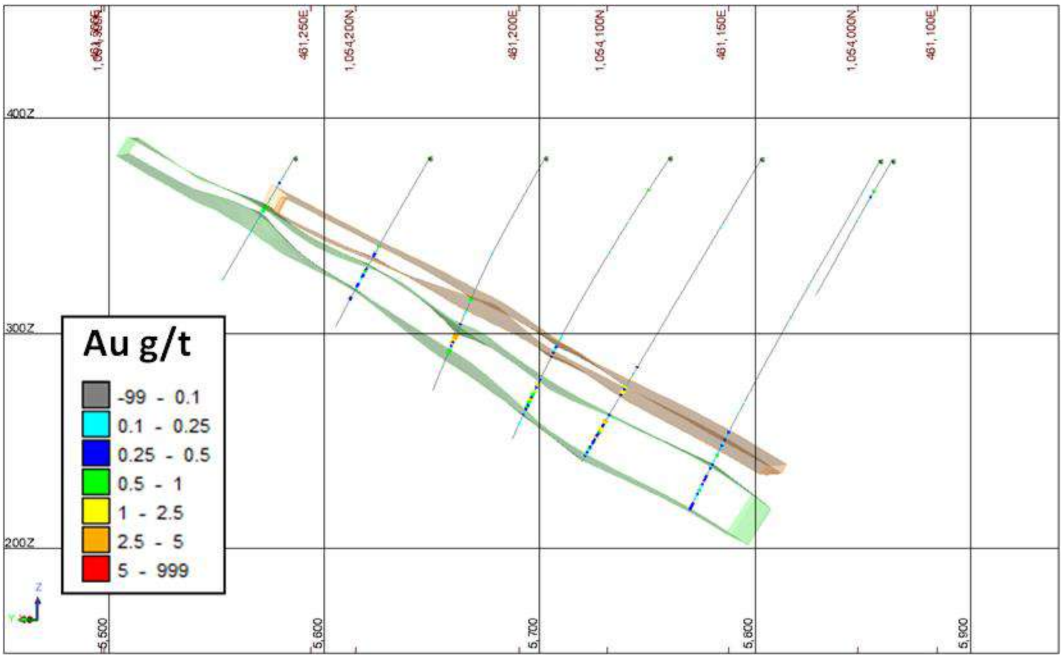
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.14 Plan View of the Drill Holes and Mineralisation Domain Wireframes at KILO



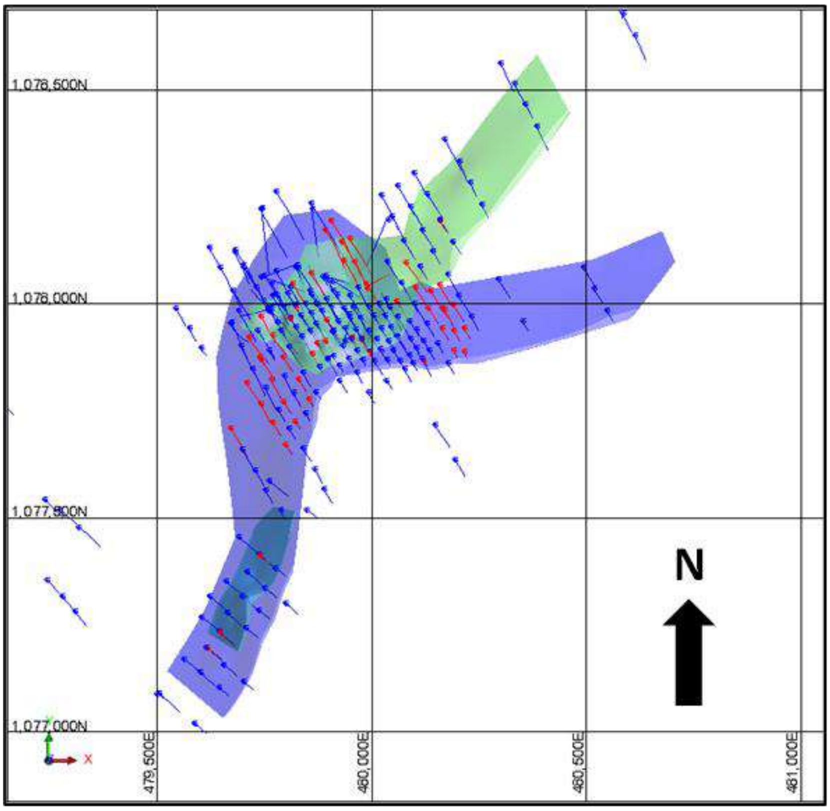
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.15 Cross-Section View at KILO Looking South-East



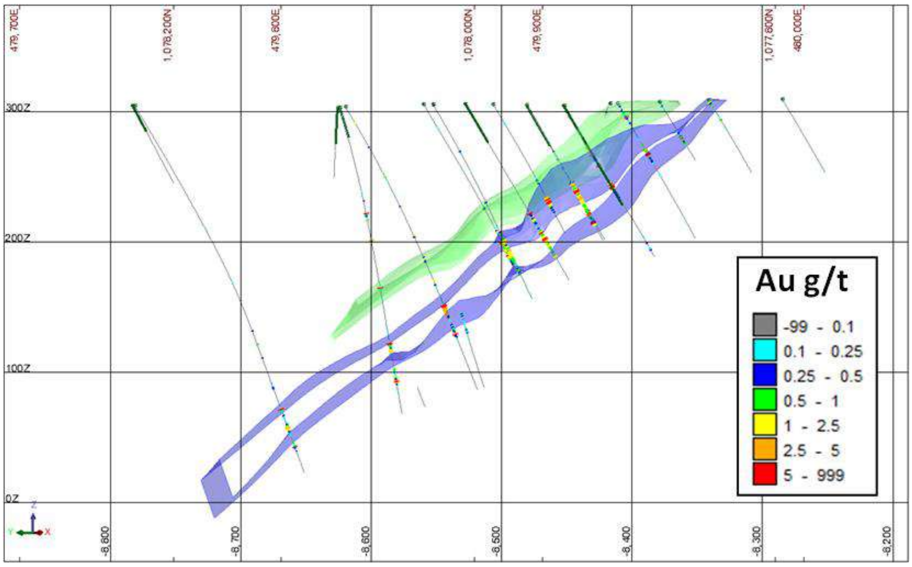
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.16 Plan View of the Drill Holes and Mineralisation Domain Wireframes at NOK



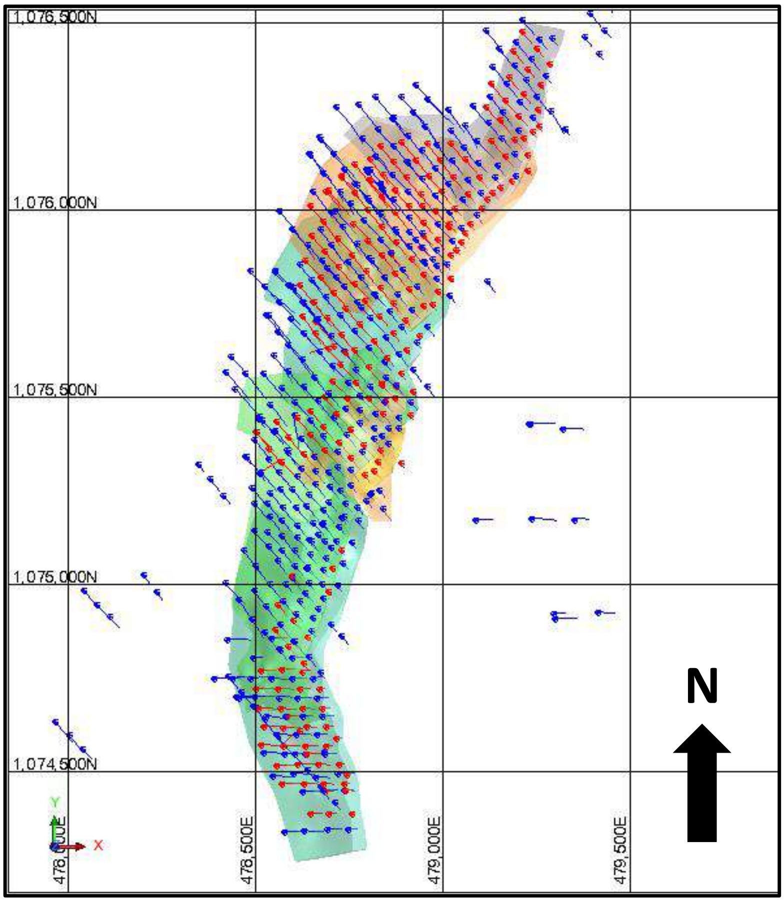
Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.17 Cross-Section View at NOK Looking North-East



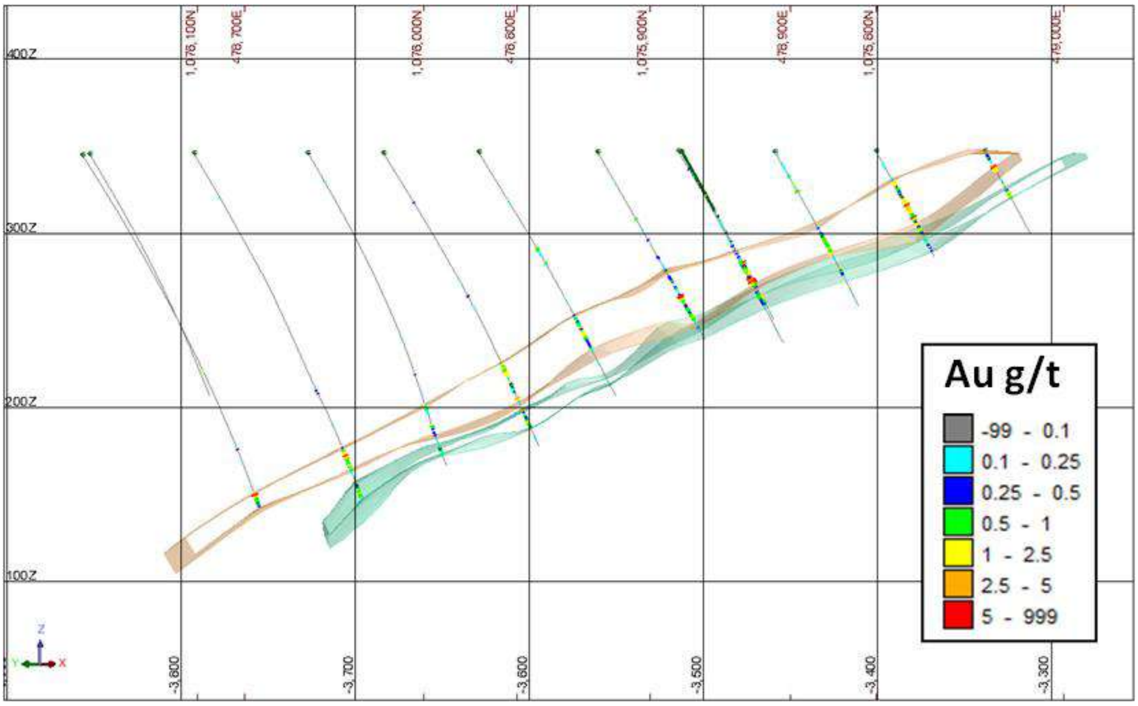
Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

Figure 10.4.18 Plan View of the Drill Holes and Mineralisation Domain Wireframes at SWA



Note: Blue traces represent pre-existing holes and red traces are the additional holes drilled subsequent to the 2021 resource estimate, which were utilised in this update.

Figure 10.4.19 Cross-Section View at SWA Looking North-East



Note: Drill holes coloured by gold assay grade with mineralisation domain wireframe outlines shown. Slicing window is 15 m either side of the section line.

10.5 Sample Recovery and Grade

A study examining both RC and DD sample recovery with respect to gold grade was undertaken as part of a 2019 MRE by Osborn (2019). That study concluded that there was no significant bias brought about either by selective loss of gangue or ore material in the drill hole dataset as it stood at that time. The only issue picked up was that there was a slight reduction in gold grade in DD samples with lower core recovery. Cube has undertaken some additional checks in this study, given that additional drilling has been undertaken since 2019.

10.5.1 RC Holes

A total of 419,992 RC sample weight records were provided to Cube, and of these, some 380,764 had accompanying gold assay records. A plot of RC sample weights against downhole depths shows that the sample weight initially increases with depth before levelling out to between 30 kg and 40 kg (Figure 10.5.1). The lower weights in the upper part of the holes are probably mostly due to lower densities in the highly weathered zone but could also include a component of sample loss, which would be more prevalent in the less competent soils and saprolites. The relationship between the RC sample weights and gold grade shows evidence of a slight trend of lower grades with lower weight at grades below 1 g/t Au, but this correlation is very weak **(**Figure 10.5.2) within the grade range that would typify the modelled mineralisation zones (i.e. at grades approximately above 0.2 g/t Au). It is therefore concluded that there is no problematic gold grade bias on the basis of RC sample weights.

Figure 10.5.1 Scatter Plot of RC Sample Weight Versus Downhole Depth

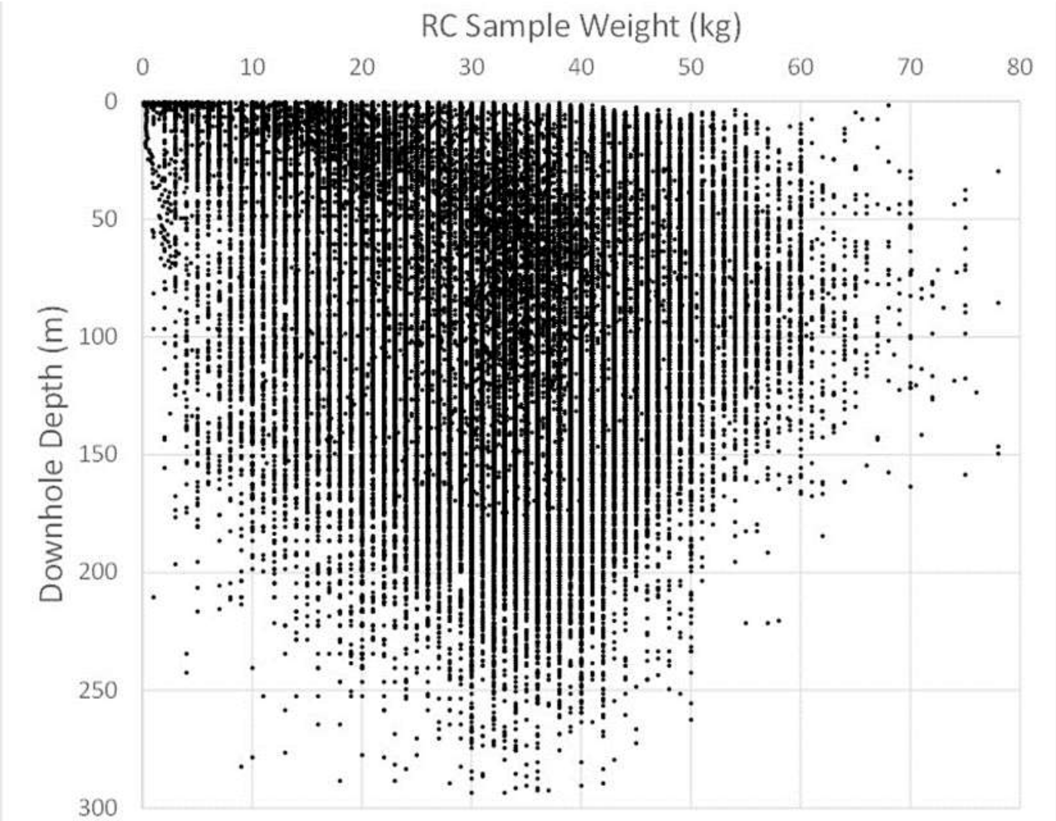
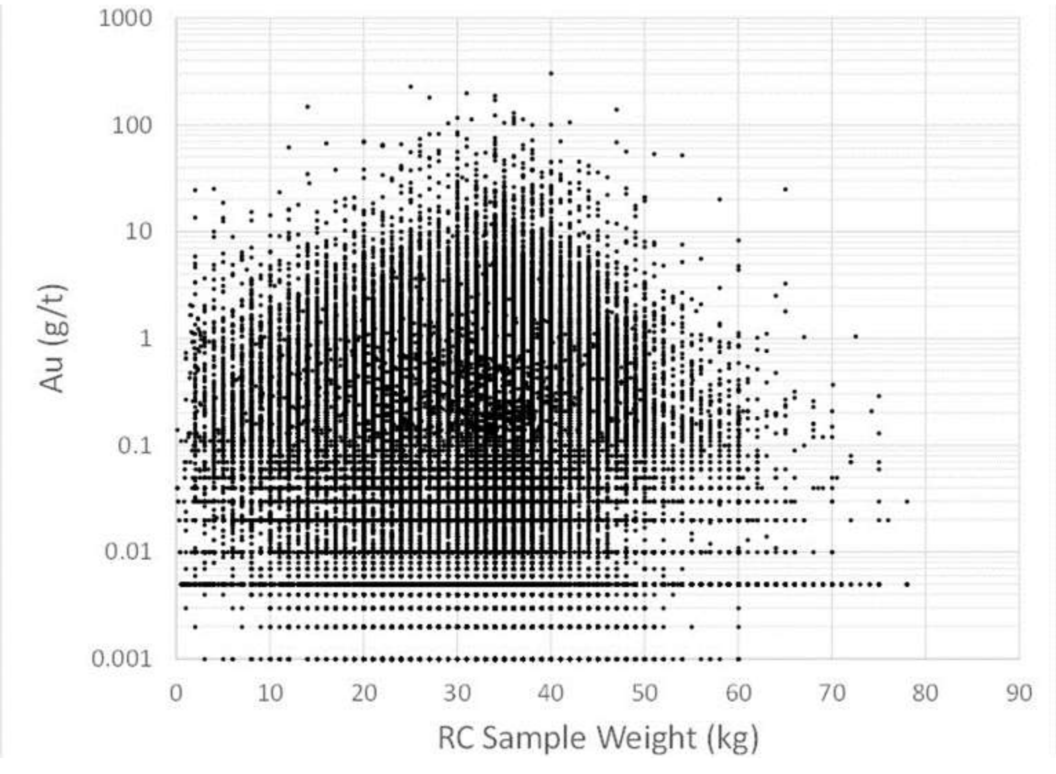


Figure 10.5.2 Scatter Plot of RC Sample Weight Versus Gold Grade



10.5.2 DD Holes

A total of 20,552 DD core recovery records are available for analysis at Doropo, with some 13,886 having corresponding gold assays. The average core recovery is ~96% (Figure 10.5.3), and a plot of downhole depth against core recovery shows that a significant proportion of the lower recoveries are at shallower depths (Figure 10.5.4). The proportion of samples with core recovery greater than 90% is 89.5% overall, but this rises to 97.5% at downhole depths greater than 50 m. This is to be expected since the drilling mud tends to wash away fines in the weathered zone. When gold grade is plotted against core recovery, no significant correlation trend can be observed (Figure 10.5.5). The evidence suggests there is no systematic grade bias resulting from under-recovery of drill core, and the proportion of intervals reflecting lesser core recovery is small.

Figure 10.5.3 Histogram of Drill Core Recovery Percentage for Doropo DD Holes

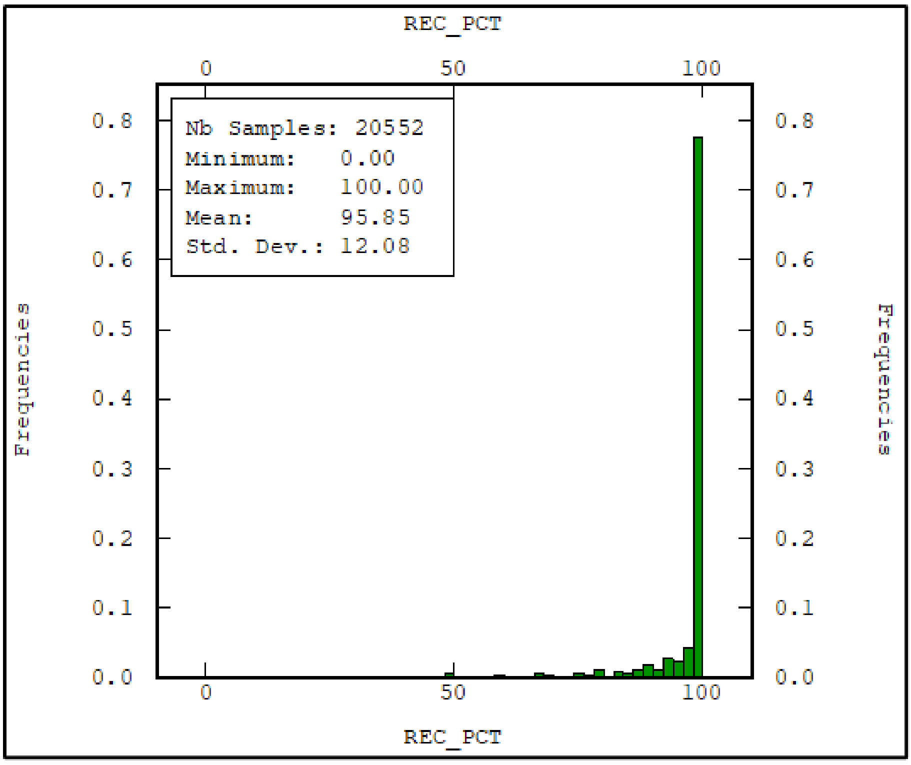


Figure 10.5.4 Scatter Plot of DD Core Recovery Percentage Versus Downhole Depth

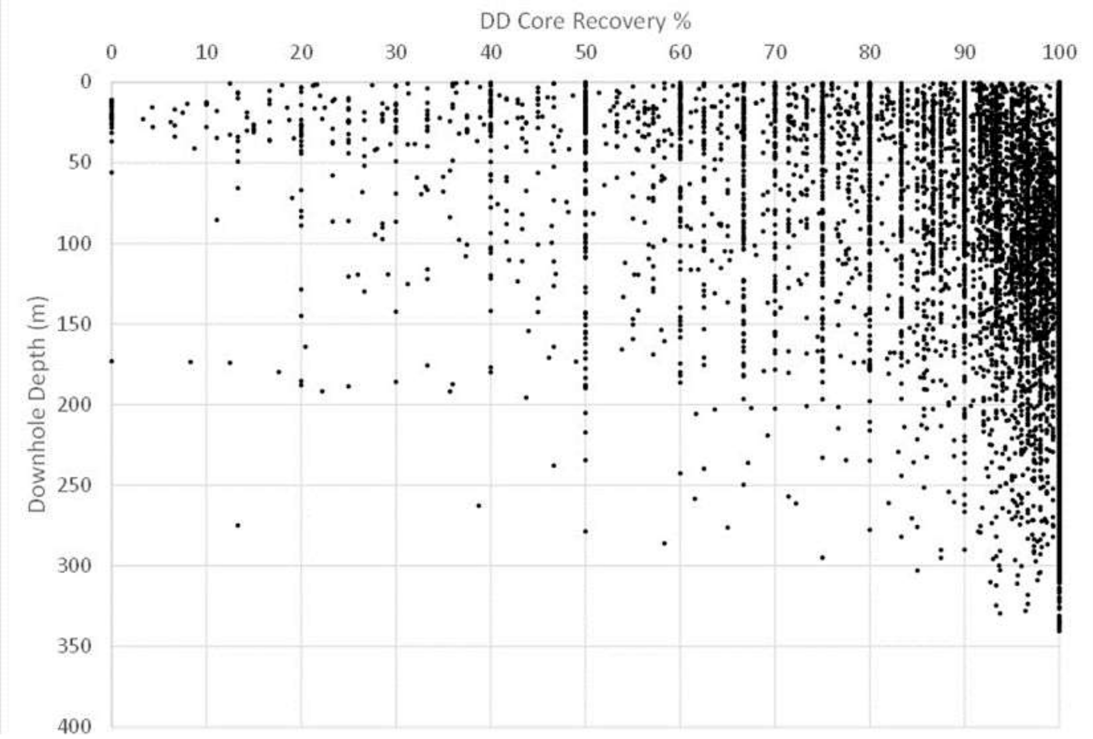
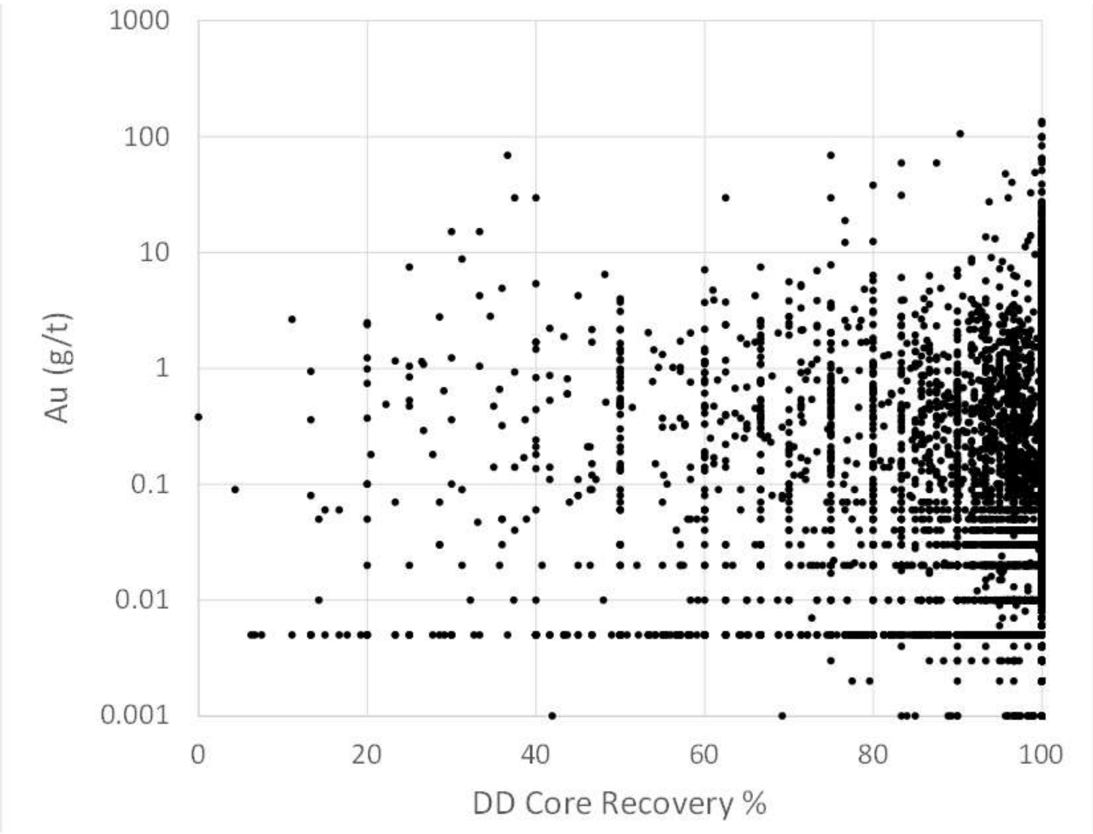


Figure 10.5.5 Scatter Plot of Gold Grade Versus DD Core Recovery Percentage



10.6 Paired Statistics – DD vs RC

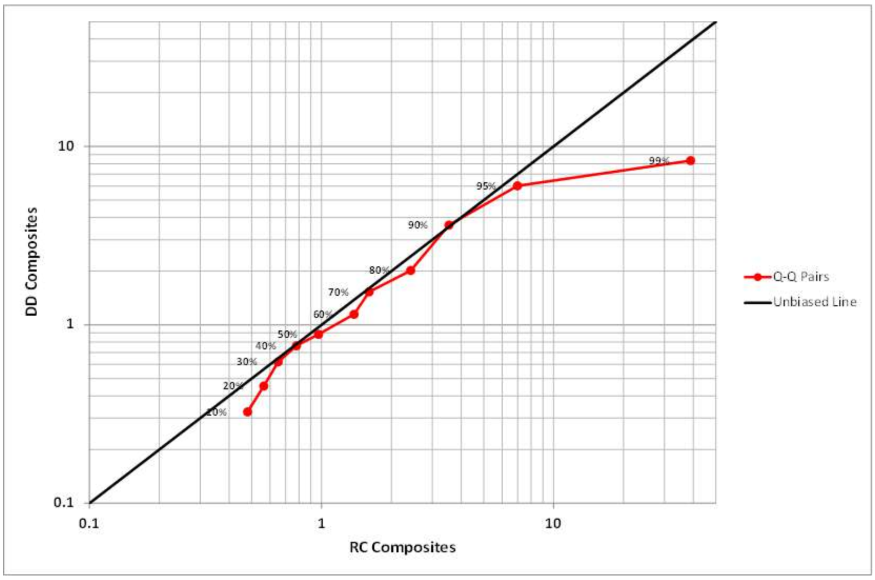
Osborn (2019) undertook a comparison of eight DD holes that were each within 15 m of an RC drill hole, in order to compare the two drill types. It was concluded that while the mean RC grades were slightly higher within the mineralised domains (~ 0.1 g/t Au higher), there was no major difference between the two drill types, with any local discrepancies being put down to the nuggety nature of gold mineralisation.

Cube has undertaken a paired statistical analysis of the RC and DD gold grades, to within a distance of just 2 m, across the entire Doropo Project area. The results are shown in Figure 10.6.1, with all RC and DD assay results less than 0.2 g/t Au ignored, to better reflect the boundary conditions of the mineralised domains used for estimation. It is evident that across the bulk of the grade distribution, the RC reports slightly higher grade than the DD, except at the lower and upper tails where the RC gold grades are significantly higher. This is interpreted as being primarily a function of the larger sample support size of the 5¼" RC holes against the much smaller half-core DD samples. In Cube's experience it is not unusual in nuggety gold deposits to observe that larger samples more accurately define the grade at the lower and upper tail of the grade distribution, due to a more representative sample being collected during drilling. The risk, in Cube's opinion, is therefore that the DD may be underestimating grades at the upper tail, rather the RC overestimating them. The risks of this discrepancy are mitigated by the following:

- The DD and RCD drill metres comprise only ~12% of the total, with RC thus being dominant.
- Gold grade caps and high-grade distance limiting have been implemented for grade interpolation, thus reducing significantly the risk of undue propagation of outlier high grade samples.

The RC and DD samples are therefore considered to be sufficiently compatible for use in Mineral Resource estimation.

Figure 10.6.1 Q-Q Plot of RC and DD Samples Paired Within 2 m Distance of One Another



10.7 Wet RC Samples

During the site visit undertaken by the Qualified person, RC drilling operations were observed for several hours, with the late-August date being at the end of the wet season. The booster system was observed to be highly effective at keeping the RC samples dry and cleaning of the cyclone after each 1 m sample and at the rod changes was seen to be satisfactory. These observations are supported by the drill logs show that dry samples comprise ~96% of all the RC assay samples while moist samples comprise ~3% and wet samples ~1%. The vast majority of the RC samples have been logged for moisture content.

A selection of RC hole traces containing wet intervals were inspected, with gold grade displayed, and no significant evidence of downhole contamination due to the wet samples was detected. This, along with the fact that wet samples comprise a very small proportion of logged samples, lead the Qualified Person to conclude that wet RC samples pose an insignificantly small risk to the veracity of the RC assay data.

10.8 Logging

All drill holes were logged geologically and geotechnically, with information recorded including:

- Weathering.
- Lithology.
- Structure.
- Texture.
- Alteration.
- Mineralisation.
- Rock Quality Designation.

All holes were geologically logged in full. Diamond drill core is photographed wet before cutting.

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2234-GREP-001

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11.0 SAMPLE PREPARATION, ANALYSES AND SECURITY

Bureau Veritas Minerals Laboratory (BVML) in Abidjan, Côte d'Ivoire (BV Abidjan), was the primary analytical laboratory used for gold fire assay on the Doropo project. BVML Abidjan is currently acquiring its accreditation (completion expected Q2 2024) while aligned with ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 held by head office. BVML Abidjan also uses the same standard operating procedures as BVML Vancouver who are accredited under ISO 17025. BVML Abidjan actively participates every year in the CANMET and Geostats round-robin proficiency tests. The BVML head office is in Paris, France, and BVML is independent of Centamin.

The OMAC Laboratories Ltd ALS Loughrea laboratory in Galway, Ireland was used as a secondary laboratory. OMAC Laboratories Ltd ALS Loughrea is accredited by the Irish National Accreditation Board (INAB) to undertake testing as detailed in the scope bearing the registration number 173T, in conformity with ISO/IEC 17025:2017. OMAC Laboratories Ltd ALS Loughrea is independent of Centamin.

Centamin established an on-site sample preparation laboratory at Danoa in late 2021, the construction of which was observed by the Qualified Person in August 2021. Prior to this preparation facility becoming operational, all samples were prepared at either BV Abidjan or ALS Loughrea.

The drilling campaigns can broadly be split into two phases:

- Pre-PFS - all drilling that took place up to October 2020, which informed the previous, 2021 Mineral Resource update.
- PFS - all subsequent drilling, starting in August 2021, which has informed this Mineral Resource update in combination with the pre-PFS drill data.

11.1 Reverse Circulation Sampling Methods

For the pre-PFS RC drilling, samples were collected from the cyclone attached to the drill rig at 1 m intervals in large plastic bags. Each individual sample was weighed and then run through multi-stage riffle splitter until the sample was reduced to approximately 5 kg in weight. The sample was then passed through a single stage 50/50 splitter so that the final sample, weighing between 2 and 3 kg was sent to the laboratory. Small plastic bags were used to bag the samples. A sample number was written on the outside of the bag with black marker and a stub from a sample ticket stapled to the top of the bag.

PFS campaign RC drill holes are sampled in 1 m intervals. Each 1 m bulk sample is collected from the cyclone splitter, placed in a large plastic bag, and labelled with Hole ID and a sampling interval number. The bulk sample weight is recorded. The 1 m bulk sample is passed through a 3-tier riffle splitter and the primary split sample is collected in a plastic sample bag, labelled with a Sample ID and sent to the laboratory for assay analysis. The secondary split of 1/8th of the remaining 7/8th is taken for storage in the camp or submitted as a field duplicate. The sample condition (Dry, Wet or Moist) is also recorded.

The final stubs of the sample tickets are stored at the site office. The sample bags that go to the laboratory are weighed and stored in polyweave bags containing 10 to 15 samples each. At the end of every day, Centamin personnel transport these samples back to the processing area. The batch of samples are collected by a laboratory truck from the exploration camp once a week.

11.2 Diamond Core Sampling Methods

DD is typically drilled using an HQ bit from the surface down to the top of fresh rock material, then NTW or NQ to the end of the hole. Core is oriented and placed in plastic core trays at the drill site. Rock Quality Designation (RQD) and core recovery are measured at the rig and core trays returned by Centamin personnel to the processing facility. DD sampling intervals are defined after geological logging is completed.

Once logged, the core is placed in a cradle and cut with a core saw. The cut is made to the left of the orientation line and both halves returned to the core tray. The right side of the core is then sampled and put in a calico bag. Sample intervals are at the discretion of the logging geologist but are regularly at 1 m intervals, except in the case of quartz veins, which are selectively sampled if 0.5 m or greater in width. The sample number is written on the outside of the bag and a sample ticket sub placed in the bag with the sample. The core trays with the remaining half-core are then moved to the core storage area.

If a field duplicate is to be submitted, the remaining half core is sawn again to submit quarter core for duplicate analysis.

11.3 Chain of Custody and Transport

All RC samples and core trays are transported by Centamin personnel between the drill sites and the sample processing facility. The processing area consists of an open logging area for core trays and a covered sample handing area for the staging of the RC and DD samples for transport. The sample processing area is adjacent to the main office and in the main compound. The compound is completely fenced and under 24 hour guard.

The core is laid out, logged and sampled by Centamin personnel. After RC and core samples are prepared, they are placed in sealed polyweave in groups of 10 – 15 samples per sack.

Samples are transported to Abidjan by a BVML truck directly to the lab facility. A sample submission form accompanies each shipment of samples. An email copy of the submission form and sample list is also sent to the laboratory. BV Abidjan signs and sends back a scanned copy of the submission form to acknowledge formal receipt of the samples when they take custody of the samples.

All pulp rejects are returned by BV Abidjan transport to the site office and stored in locked shipping containers.

For shipments of samples to ALS Loughrea, Ireland, a systematic and secure packaging process is followed. The samples are first packed in lots of 20 sample packets, which are then placed into plastic bags and securely sealed. These sample bags are further organized into sturdy blue plastic 44-gallon barrels with screw-top lids, each capable of holding up to 200 pulp samples. To ensure proper identification and tracking, each barrel is labelled with the despatch number, sample interval, destination address, and barrel number. The barrels are then transported from the site to the Centamin office in Abidjan. They are kept securely in a locked room until all the export documents are complete.

To facilitate the shipping process, a comprehensive sample shipment checklist is prepared. This includes a sample submission form, sample list, and an invoice, which may be required for customs purposes. The shipment also involves several essential documents, such as:

- Commercial Invoice: This document clarifies that the samples hold no commercial value.
- Declaration of Non-Radioactivity: To confirm that the contents i.e., drill pulps, are not radioactive.
- Sample Shipment Details: This document contains all the necessary information about the samples being shipped.
- Sample Export Authorisation: Obtained from the General Directorate of Mine and Geology in Abidjan, this authorization allows for the legal export of the samples.

Once the export authorization is received, the barrels, along with all relevant documents, are dispatched to DHL for shipment to Loughrea, Ireland, via aircraft. DHL provides a waybill via email to enable easy tracking of the shipment. At the same time, all the documents and waybill are sent to ALS Loughrea by email as well.

Typically, an email from ALS Loughrea is sent to Centamin indicating that all samples have been received. No formal receipt is received. On completion of the analytical process by ALS the samples remain after the free storage period, and then the laboratory responsibly disposes of the pulp rejects.

11.4 Sample Preparation

11.4.1 RC Samples

For the Pre-PFS (December 2015 to October 2020) phase, chip samples were transported to BV Abidjan. BV sample preparation procedures were as follows:

- Oven dry RC chip samples.
- Crush sample to 70% passing 2 mm.
- Riffle split to 1,000 g, retain coarse reject.
- Pulverise 1,000 g to 85% passing 75 µm.

- Collect 250 g for analysis from the pulp.
- Retain pulp reject.

For the PFS (September 2021 to July 2022) phase, chip samples were transported to BV Abidjan up until December 2021. The onsite sample preparation laboratory then became operational at Danoa. Pulp samples were subsequently submitted to BV Abidjan and ALS Loughrea, Ireland for analysis. Danoa Laboratory sample preparation procedures are as follows:

- Oven dry RC chip samples.
- Crushed sample to 75% passing 2 mm.
- Riffle split to 800 g – 1,000 g, retain coarse reject.
- Pulverise 800 g – 1,000 g to 85% passing 75 µm.
- Collect 150 g for analysis from the pulp.
- Retain pulp reject.

11.4.2 DD Samples

For the Pre-PFS campaign, core sample was transported to BV Abidjan. BV sample preparation procedures were as follows:

- Oven dry core samples.
- Crushed core to 70% passing 2 mm.
- Riffle split 1,000 g, retain coarse reject.
- Pulverise 1,000 g to 85% passing 75 µm.
- Collect 250 g for analysis from the pulp.
- Retain pulp reject.

For the PFS campaign, core samples were transported to BV Abidjan until December 2021, when the onsite facility was commissioned. Pulp samples were subsequently generated at the Danoa onsite preparation facility before being submitted to BV Abidjan and ALS Loughrea, Ireland for analysis. Danoa Laboratory core sample preparation procedures are as follows:

- Oven dry core samples.
- Crushed core to 75% passing 2 mm.

- Riffle split to 800 g – 1,000 g, retain coarse reject.
- Pulverise 800 g – 1,000 g to 85% passing 75 µm.
- Collect 150 g for analysis from the pulp.
- Retain pulp reject.

11.5 Sample Analysis at Laboratory:

A standard fire assay for gold was undertaken at both BV Abidjan and ALS Loughrea, but with different finishes. A 50 g sub-sample is taken from the pulverised material, mixed with flux and then fired. The resultant lead button is then transformed to a prill using cupellation. The prill is dissolved in Aqua Regia solution and the resultant liquor read by either AAS (BV Abidjan) or ICP-AES (ALS Loughrea). Fire assay is considered to be a total gold content assaying technique. For over-range results, typically 10 g/t Au or above, a gravimetric finish was undertaken and used in preference to the AAS or ICP-AES reading. The analytical methods used are summarised in Table 11.5.1.

Table 11.5.1 Analytical Methods Used in the Doropo Project for Gold Assays

Laboratory	Period	Generic Method	Lab Code	Detection Limit (g/t)
BV Abidjan	PFS (2021 – 2022)	Au_FA450_ppm	FA450	0.010
BV Abidjan	PFS (2021 – 2022)	Au_FA550_ppm	ICP22	0.001
ALS Loughrea	PFS (2021 – 2022)	Au_ICP22_ppm	ICP22	0.001
ALS Loughrea	PFS (2021 – 2022)	Au_GRA22_ppm	GRA22	0.050
BV Abidjan	Pre PFS (2015– 2020)	Au_FA450_ppm	FA450	0.010
BV Abidjan	Pre PFS (2015– 2020)	Au_FA550_ppm	FA550	0.05

A more detailed description of the analytical methods is as follows:

- Au_FA450_ppm - BV Fire Assay using a 50 g charge with AAS finish.
- Au_FA550_ppm - Over range method for Au_FA450_ppm; BV Fire Assay using a 50 g charge, Gravimetric Finish using a Micro – Balance.
- Au_ICP22_ppm - ALS Fire Assay and ICP-AES finish.
- Au_GRA22_ppm - ALS Fire Assay and gravimetric finish for over range results.

11.6 Bulk Density Determinations

Bulk density measurements were undertaken on either full, half or quarter drill core using the immersion / Archimedean method at site. Weathered core samples were coated in wax prior to the immersion process. The core was dried prior to the measurement process; all measurements and the resultant density estimates are therefore on a dry basis.

11.7 Quality Assurance and Quality Control Sampling

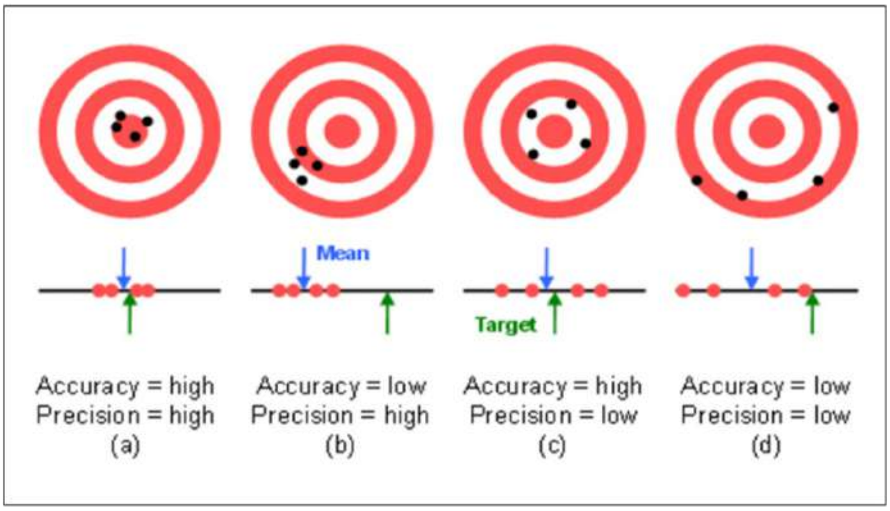
Cube has reviewed and independently assessed the provided QAQC sample data that were collected from 2015 to July 2022 from the Doropo Gold Project.

Gold assay values are reported in units of ppm and values less than the lower detection limit have been replaced with a value of half the detection limit for the QAQC review.

The quality of the assay data was assessed by analysing the Certified Reference Material (CRM or Standards) and duplicate samples in terms of accuracy and precision. The precision analysis determines how closely the results can be repeated, while the accuracy analysis determines how similar the results are to the reported CRM value.

All projects and every assay batch should strive to achieve both high precision and accuracy. It is possible to have good accuracy without good precision or conversely good precision without good accuracy as shown in Figure 11.7.1. Precision analysis is measured by the use of duplicate and replicate assays, whereas accuracy analysis is measured through the use of CRMs. Calculations defining acceptable levels of accuracy and precision are based on Abzalov (2011).

Figure 11.7.1 Accuracy and Precision Concepts



The QAQC for Doropo Gold Projects involves insertion of CRM Standards and Blank material with a set of company Standard Operating Procedures (SOPs). The geologist is responsible for the insertion of the CRM and blanks, adhering to the SOPs.

For CRM standards, the pulp is transferred from the original sachet into a new plastic sachet and stapled. The standard ID is written on the new ticket and stapled on the new plastic sachet. The standards are then sent to the geologist on the rig. The geologist writes the standard sample ID on the sample sachet and photographs it. The ticket is then stapled in the sample booklet. The standard is then placed in the sample bag.

For Blank material, the samples are prepared at the camp, weighed, placed in plastic bags and stapled and then sent to the rig where the geologist assigns a sample ID.

For RC Field Duplicates, the samples are collected after the primary RC split of 1/8th is taken. The bulk sample is once again run through the 3-tier riffle splitter to obtain a second sample that is a split of 1/8th of the remaining 7/8th material.

In February 2022, the above QAQC processes were changed due to the establishment of the onsite Danoa preparation laboratory. The standards are provided to the geologist at the rig. The geologist photographs the standard with an assigned sample ID with the original packaging in the field, then inserts it into the sample bag and submits it to the preparation lab. The onsite preparation lab is responsible for transferring the standards into the new packet as soon as the batch's sample preparation process has been completed.

For Blanks, an empty sample bag with an assigned sample ID ticket staple on the bag is submitted to the preparation lab, and after pulverising, the Blank sample is inserted.

For DD samples, the original half core sample is submitted to the laboratory including an empty sample bag with a duplicate sample ID ticket stapled on the bag; after crushing and pulverising, a Pulp Duplicate is sampled according to the reserved sample ID. Field Duplicates are collected from the remaining half core, which is sawn to produce a quarter core duplicate sample.

A list of samples containing the QAQC is submitted to the preparation lab to allow them to identify the different quality control samples. CRMs, Blanks, and Duplicates were initially inserted every 20 m. The nominal insertion rates in place for Doropo Gold Project are listed in Table 11.7.1.

In November 2021, the method was changed to insert QAQC samples consecutively within the mineralisation zone only, following discussions between the site personnel, Mr Michael Millad and Mr. Craig Barker of Centamin. In addition, a recommendation to use a limited range of CRMs was adopted, in order to allow for improved analysis of each CRM’s results. A Pulp Blank has been introduced into the sequence. The samples are inserted in the following order:

- Field Duplicate.
- Coarse Blank.
- Standard.
- Pulp Blank.

Table 11.7.1 Nominal QAQC Sample Insertion Rates for Doropo

Sample Type	CRMs	Duplicates	Coarse Blank
DD	5% (1 every 20 samples with Sample ID ending 5, 25, 45, 65, 85)	5% (1 every 20 samples with sample ID ending 15, 35, 55, 75, 95)	5% (1 every 20 samples in ODD multiples of 10)
RC	5% (1 every 20 samples with Sample ID ending 5, 25, 45, 65, 85)	5% (1 every 20 samples with sample ID ending 15, 35, 55, 75, 95)	5% (1 every 20 samples in ODD multiples of 10)

A comparison for all results reported by updated prospect is presented in Table 11.7.3and shows the breakdown of achieved QAQC insertion rates. These figures show that the achieved insertion rates have typically met or surpassed the nominal rates and are considered adequate.

Table 11.7.2 Actual QAQC Sample Insertion Rates for the Doropo Gold Project

Prospect	Routine Samples	Duplicates		Standards		Blanks	
		N	%	N	%	N	%
ATI	16,911	675	4%	585	3%	755	4%
CHG	43,935	2,633	6%	2,281	5%	3,254	7%
ENI	19,519	1,393	7%	1,374	7%	1,573	8%
HAN	22,661	1,241	5%	307	1%	523	2%
KEK	16,530	1,026	6%	907	5%	1,272	8%
KLG	54,818	3,912	7%	4,710	9%	5,325	10%
NOK	27,266	1,343	5%	1,308	5%	1,798	7%
SWA	55,472	3,048	5%	2,629	5%	3,265	6%
Grand Total	**257,112**	**15,271**	**6%**	**14,101**	**5%**	**17,765**	**7%**

11.7.2 Certified Reference Materials (Standards)

A number of CRMs have been used at the Doropo Project over time. A breakdown of the standard ID's and their first and last reported analysis date is presented in Table 11.7.3. Selected results are presented in the sections following, while control charts for each standard are included in the full QAQC review report in Appendix 2. The analysis has, in addition to breaking down the results by drill type and laboratory, also considered a split based on the latest phase of drilling, termed here the Pre-Feasibility Study (PFS) phase of drilling and the results that pre-date this latest campaign. Standards provide an important measure of analytical accuracy error.

Table 11.7.3 Listing of CRMs Used in the Doropo Gold Project

LAB_ID	Standard_ID	Standard Type	Expected Au ppm	First Use	Last Use
VER_AB	G312-7	CRM	0.220	11-Dec-15	03-Apr-16
VER_AB	G300-8	CRM	1.070	17-Dec-15	03-Apr-16
VER_AB	G396-8	CRM	4.820	11-Dec-15	12-Apr-16
VER_AB	OREAS204	CRM	1.040	06-Feb-16	13-Feb-17
VER_AB	OREAS205	CRM	1.244	19-Nov-16	08-Mar-17
VER_AB	OREAS208	CRM	9.250	26-Nov-16	14-Mar-17
VER_AB	OREAS201	CRM	0.514	12-Nov-16	08-Apr-17
VER_AB	OREAS203	CRM	0.871	12-Nov-16	25-Apr-17
VER_AB	OREASH5	CRM	0.047	12-Aug-16	06-Dec-17
VER_AB	OREAS220	CRM	0.866	08-Apr-17	14-Jan-18
VER_AB	OREAS228	CRM	8.730	20-Jul-17	02-Sep-18
VER_AB	OREAS200	CRM	0.340	06-Feb-16	19-Sep-18
VER_AB	OREAS260	CRM	0.016	21-May-19	28-May-19
VER_AB	OREAS262	CRM	0.099	03-Jul-19	30-Aug-19
VER_AB	OREAS908	CRM	0.187	14-Jan-20	23-Jan-20
VER_AB	OREAS214	CRM	3.030	19-Nov-16	20-Aug-20
VER_AB	OREAS221	CRM	1.060	15-Apr-17	09-Oct-20
VER_AB	OREAS254	CRM	2.550	04-Apr-20	09-Oct-20
VER_AB	OREAS210	CRM	5.490	11-Feb-16	14-Oct-20
VER_AB	OREAS217	CRM	0.338	06-Dec-17	14-Oct-20
VER_AB	OREAS263	CRM	0.214	07-Nov-18	14-Oct-20
VER_AB	OREAS252	CRM	0.674	08-Mar-19	14-Oct-20
VER_AB	OREAS232	CRM	0.902	04-Apr-20	14-Oct-20
VER_AB	OREAS238	CRM	3.030	09-Oct-20	14-Oct-20
VER_AB	OREAS215	CRM	3.540	11-Feb-16	16-Oct-20
VER_AB	OREAS250	CRM	0.309	12-Feb-16	16-Oct-20
VER_AB	OREAS218	CRM	0.531	08-Apr-17	16-Oct-20
VER_AB	OREAS222	CRM	1.220	08-Apr-17	16-Oct-20
VER_AB	OREAS224	CRM	2.150	19-Aug-18	16-Oct-20
VER_AB	OREAS251	CRM	0.504	09-Oct-20	18-Dec-21
VER_AB	OREAS235	CRM	1.590	13-Sep-21	18-Dec-21
ALS_IRL	OREAS250b	CRM	0.332	01-Mar-22	19-May-22
ALS_IRL	OREAS253	CRM	1.220	01-Mar-22	21-May-22
ALS_IRL	OREAS219	CRM	0.760	01-Mar-22	26-May-22
ALS_IRL	OREAS237	CRM	2.210	01-Mar-22	26-May-22
ALS_IRL	OREAS239	CRM	3.550	01-Mar-22	26-May-22
ALS_IRL	OREAS256b	CRM	7.840	02-Mar-22	26-May-22
ALS_IRL	OREAS22h	CRM Blank	0.005	01-Apr-22	26-May-22
VER_AB	OREAS256b	CRM	7.840	13-Sep-21	19-Jul-22
VER_AB	OREAS253	CRM	1.220	07-May-18	23-Jul-22
VER_AB	OREAS219	CRM	0.760	13-Sep-21	23-Jul-22
VER_AB	OREAS237	CRM	2.210	13-Sep-21	23-Jul-22
VER_AB	OREAS239	CRM	3.550	13-Sep-21	23-Jul-22
VER_AB	OREAS250b	CRM	0.332	13-Sep-21	23-Jul-22
VER_AB	OREAS22h	CRM Blank	0.005	03-May-22	23-Jul-22

PFS Phase Results

A summary of CRM performance for the gold standards for the PFS campaign is presented in Table 11.7.4. The results show that all standards pass the accuracy test but some failed the precision assessment. Samples suspected of being misallocated or incorrectly identified have been removed from the overall statistics. Review of the gold standard reveals a different trend for VER_AB (BV Abidjan) and ALS_IRL (ALS Loughrea). The VER_AB laboratory is typically stable for all standards compared to those reported by ALS_IRL, with the latter showing a pattern of negative bias, although still predominantly within two standard deviations of the expected value and almost completely within three standard deviations.

Example control charts for some CRMs analysed by ALS_IRL laboratory are presented in Figure 11.7.2 to Figure 11.7.4 (Oreas 256b, 239, and 250b). All samples were analysed using the Au_ICP22_ppm method. While the results for most ALS_IRL standards fall within two standard deviations of the expected value, each of these standards reports a clear negative bias, with results consistently plotting below the expected value. A few samples are noted outside three standard deviations for Oreas 256b in Figure 11.7.2. Doropo has actioned and requested re-assay of these samples and it seems likely that these can be attributed to analytical accuracy issues.

Figure 11.7.4 and Figure 11.7.5 show results for Oreas 250b reported from ALS_IRL and VER_AB, respectively. The ALS_IRL results show a clear negative bias which also appears in the VER_AB from September 2021 to April 2022. Both results frequently reported outside of the two standard deviation limits for the standard. The results highlight a potential issue with the certified expected value provided for Oreas 250b and is recommended that the result is validated to the standard certifier, although it must be noted that this is a low-grade standard (expected value = 0.332 ppm Au).

Table 11.7.4 Doropo Gold Project CRMs – PFS Phase – Performance Summary by Type and Laboratory – Au ppm

Std ID	Laboratory	Expected Value	SD	No. Assays	Actual Mean	Actual SD	Bias %	Accuracy Test	Precision Test	No. Outside 2SD	% Outside 2SD	No. Outside 3SD	% Outside 3SD	Misallocated
OREAS256b	VER_AB	7.840	0.207	210	7.806	0.219	-0.43%	PASS	PASS	7	3.33%	-	-	0
OREAS256b	ALS_IRL	7.840	0.207	112	7.705	0.212	-1.73%	PASS	PASS	4	3.57%	3	2.68%	0
OREAS239	VER_AB	3.550	0.086	660	3.579	0.100	0.81%	PASS	FAIL	58	8.81%	1	0.15%	2
OREAS239	ALS_IRL	3.550	0.086	193	3.495	0.136	-1.55%	PASS	PASS	9	4.66%	3	1.55%	0
OREAS253	VER_AB	1.220	0.044	265	1.235	0.041	1.22%	PASS	PASS	8	3.02%	-	-	0
OREAS253	ALS_IRL	1.220	0.044	135	1.205	0.031	-1.24%	PASS	PASS	2	1.48%	2	1.48%	0
OREAS237	VER_AB	2.210	0.054	731	2.223	0.071	0.58%	PASS	FAIL	107	14.70%	-	-	3
OREAS237	ALS_IRL	2.210	0.054	263	2.182	0.066	-1.26%	PASS	PASS	14	5.32%	5	1.90%	0
OREAS235	VER_AB	1.590	0.038	117	1.581	0.053	-0.59%	PASS	FAIL	24	20.51%	-	-	0
OREAS251	VER_AB	0.504	0.015	91	0.512	0.018	1.65%	PASS	FAIL	11	12.09%	-	-	0
OREAS219	VER_AB	0.760	0.024	667	0.768	0.028	1.07%	PASS	FAIL	77	11.56%	-	-	1
OREAS219	ALS_IRL	0.760	0.024	239	0.755	0.026	-0.67%	PASS	PASS	4	1.68%	3	1.26%	1
OREAS250b	VER_AB	0.332	0.011	284	0.323	0.015	-2.61%	PASS	FAIL	40	14.13%	-	-	1
OREAS250b	ALS_IRL	0.332	0.011	121	0.317	0.007	-4.47%	PASS	PASS	17	14.05%	-	-	0
OREAS22h (Blank)	VER_AB	0.003	0.010	960	0.005	0.002	-	PASS	PASS	3	0.21%	1	0.07%	0
OREAS22h (Blank)	ALS_IRL	0.005	0.010	553	0.001	0.005	-	PASS	PASS	1	0.18%	1	0.18%	0
Total				**5,601**						**386**	**7%**	**19**	**0.3%**	
VER_AB (excl. Blanks)				**3,985**						**335**	**8%**	**2**	**0.1%**	
VER_AB (Blanks)				**960**						**3**	**0.3%**	**1**	**0.1%**	
ALS_IRL (excl. Blanks)				**1,616**						**51**	**3%**	**17**	**1.1%**	
ALS_IRL (Blanks)				**553**						**1**	**0.2%**	**1**	**0.2%**	

Figure 11.7.2 OREAS 256b – ALS_IRL Results – Au ppm

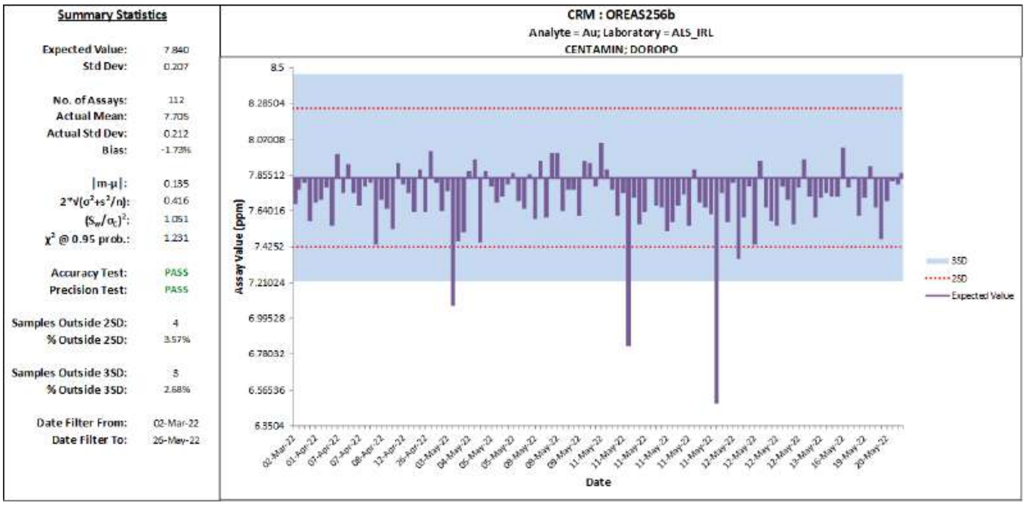


Figure 11.7.3 OREAS 239 – ALS_IRL Results – Au ppm

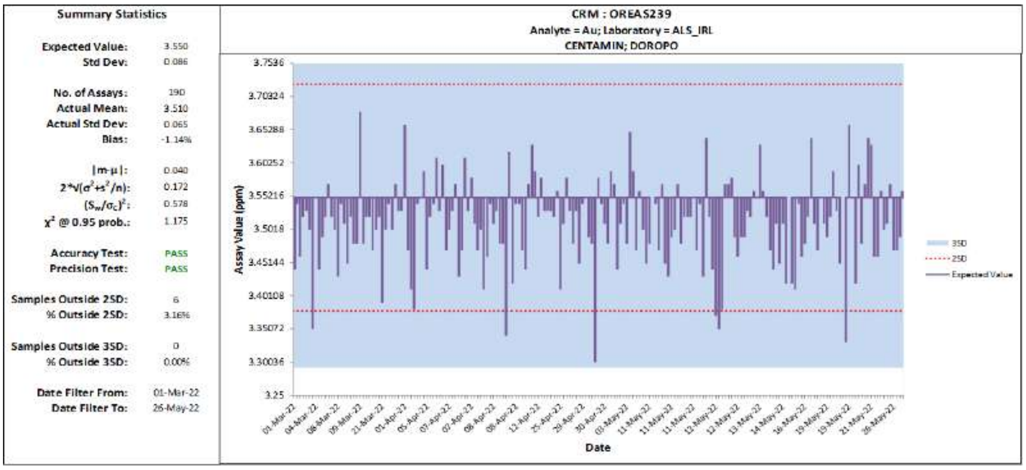


Figure 11.7.4 OREAS 250b – ALS_IRL Results – Au ppm

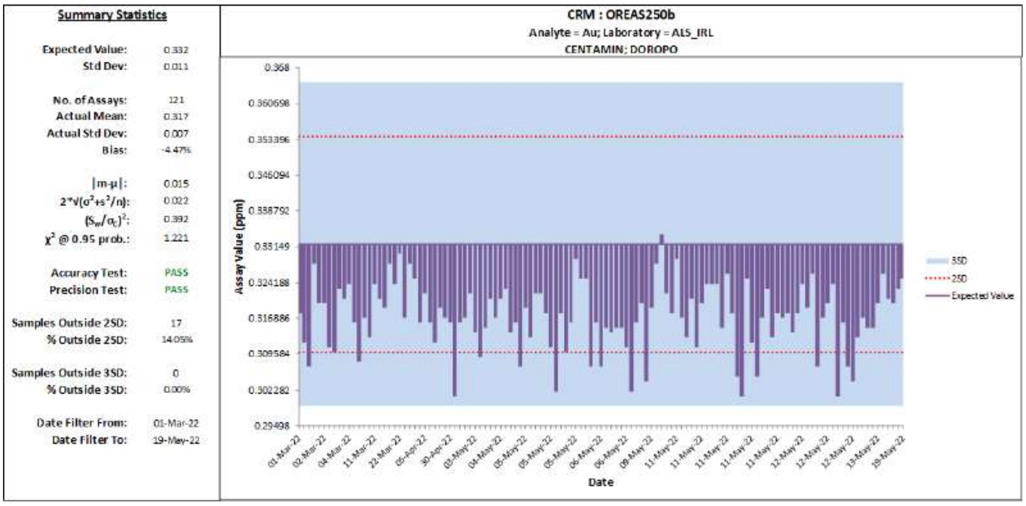
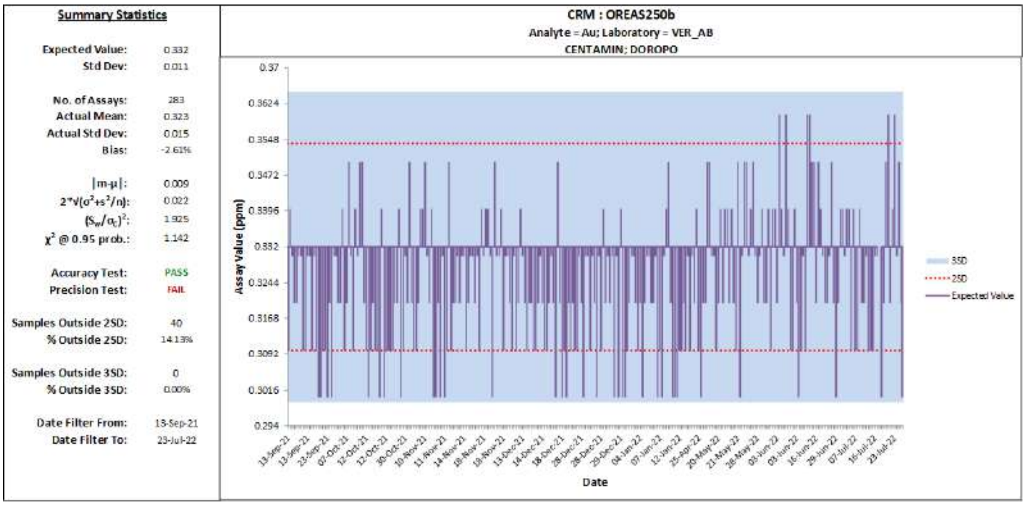


Figure 11.7.5 OREAS 250b – VER_AB Results – Au ppm



Pre-PFS Phase Results

A summary of CRM performance for the gold standards in the pre-PFS period is presented in Table 11.7.5. The result shows that all standards pass the accuracy test but some failed the precision assessment. Samples suspected of being misallocated or incorrectly identified have been removed from the overall statistics. All samples during Pre-PFS Period were analysed by VER_AB laboratory.

High grade standard Oreas 208 in Figure 11.7.6 shows a trend of negative bias for the whole period that it was utilised. Oreas 215 in Figure 11.7.7reveals a marked change in reported CRM results for a portion of the time it was in use, with samples from approximately Nov 2016 to Sep 2017 consistently plotting outside the two standard deviation control limits before reverting again to the expected value range. A review of the standard Oreas 215 was conducted on-site on the 1 February 2019. It was suspected that the issue might have been a sample switch to Oreas 214. “There remains yet a question of whether the lab analyses for these two standards were biased low for OREAS 215 or high for OREAS 214 during this period” (Kelemen, 2019). Further review of the standard performance highlights a potential issue with the analytical accuracy. Misallocation, however, does not seem to entirely account for the observed issues. Cross-checking other CRMs used during this period was not helpful since the closely aligned CRMs (Oreas 238 and 214) have expected values of 3.03 ppm Au, which are too different to the low bias results. The results are therefore possibly due to analytical accuracy issues.

Table 11.7.5 Doropo Gold Project CRMs – Pre-PFS Phase – Performance Summary by Type and Laboratory – Au ppm

Std ID	Laboratory	Expected Value	SD	No. Assays	Actual Mean	Actual SD	Bias %	Accuracy Test	Precision Test	No. Outside 2SD	% Outside 2SD	No. Outside 3SD	% Outside 3SD	Misallocated
OREAS208	VER_AB	9.250	0.440	90	9.086	0.271	-1.78%	PASS	PASS	-	0.00%	-	-	0
OREAS228	VER_AB	8.730	0.279	47	8.801	0.231	0.82%	PASS	PASS	2	4.26%	-	-	0
OREAS210	VER_AB	5.490	0.152	1378	5.453	0.139	-0.67%	PASS	PASS	42	3.05%	1	0.07%	0
G396-8	VER_AB	4.820	0.290	143	4.874	0.176	1.12%	PASS	PASS	-	0.00%	-	-	0
OREAS215	VER_AB	3.540	0.100	1072	3.514	0.136	-0.75%	PASS	FAIL	126	11.75%	30	2.80%	0
OREAS214	VER_AB	3.030	0.082	826	3.023	0.095	-0.23%	PASS	FAIL	51	6.20%	10	1.22%	3
OREAS254	VER_AB	2.550	0.076	136	2.526	0.082	-0.94%	PASS	PASS	6	4.44%	-	-	1
OREAS224	VER_AB	2.150	0.053	486	2.135	0.069	-0.70%	PASS	FAIL	78	16.08%	1	0.21%	1
OREAS205	VER_AB	1.244	0.053	188	1.254	0.032	0.82%	PASS	PASS	-	0.00%	-	-	1
OREAS222	VER_AB	1.220	0.033	367	1.232	0.041	0.98%	PASS	FAIL	49	13.39%	7	1.91%	1
OREAS253	VER_AB	1.220	0.044	810	1.230	0.043	0.84%	PASS	PASS	32	3.96%	4	0.49%	1
G300-8	VER_AB	1.070	0.060	129	1.055	0.041	-1.38%	PASS	PASS	-	0.00%	-	-	0
OREAS221	VER_AB	1.060	0.036	517	1.066	0.039	0.55%	PASS	FAIL	6	1.16%	3	0.58%	1
OREAS204	VER_AB	1.040	0.040	488	1.039	0.035	-0.06%	PASS	PASS	1	0.20%	-	-	0
OREAS232	VER_AB	0.902	0.023	193	0.892	0.032	-1.08%	PASS	FAIL	38	19.69%	4	2.07%	0
OREAS203	VER_AB	0.871	0.030	303	0.878	0.029	0.79%	PASS	PASS	8	2.64%	-	-	0
OREAS220	VER_AB	0.866	0.020	349	0.871	0.030	0.63%	PASS	FAIL	49	14.04%	6	1.72%	0
OREAS252	VER_AB	0.674	0.022	488	0.678	0.025	0.60%	PASS	FAIL	32	6.57%	-	-	1
OREAS218	VER_AB	0.531	0.017	397	0.524	0.018	-1.29%	PASS	PASS	34	8.63%	-	-	3
OREAS201	VER_AB	0.514	0.017	288	0.520	0.015	1.15%	PASS	PASS	-	0.00%	-	-	0
OREAS200	VER_AB	0.340	0.012	453	0.341	0.013	0.20%	PASS	FAIL	6	1.33%	-	-	2
OREAS217	VER_AB	0.338	0.010	527	0.337	0.015	-0.32%	PASS	FAIL	96	18.22%	15	2.85%	0
OREAS250	VER_AB	0.309	0.013	807	0.327	0.016	5.94%	PASS	FAIL	259	32.13%	105	13.03%	1
G312-7	VER_AB	0.220	0.010	130	0.214	0.010	-2.76%	PASS	PASS	-	0.00%	-	-	0
OREAS263	VER_AB	0.214	0.010	373	0.206	0.012	-3.69%	PASS	FAIL	68	18.23%	9	2.41%	0
OREASH5	VER_AB	0.047	0.006	297	0.051	0.010	8.10%	PASS	FAIL	102	34.34%	24	8.08%	0
Total				**11,282**						**1,085**	**9.6%**	**219**	**1.9%**	

Figure 11.7.6 OREAS 208 – VER_AB Results – Au ppm

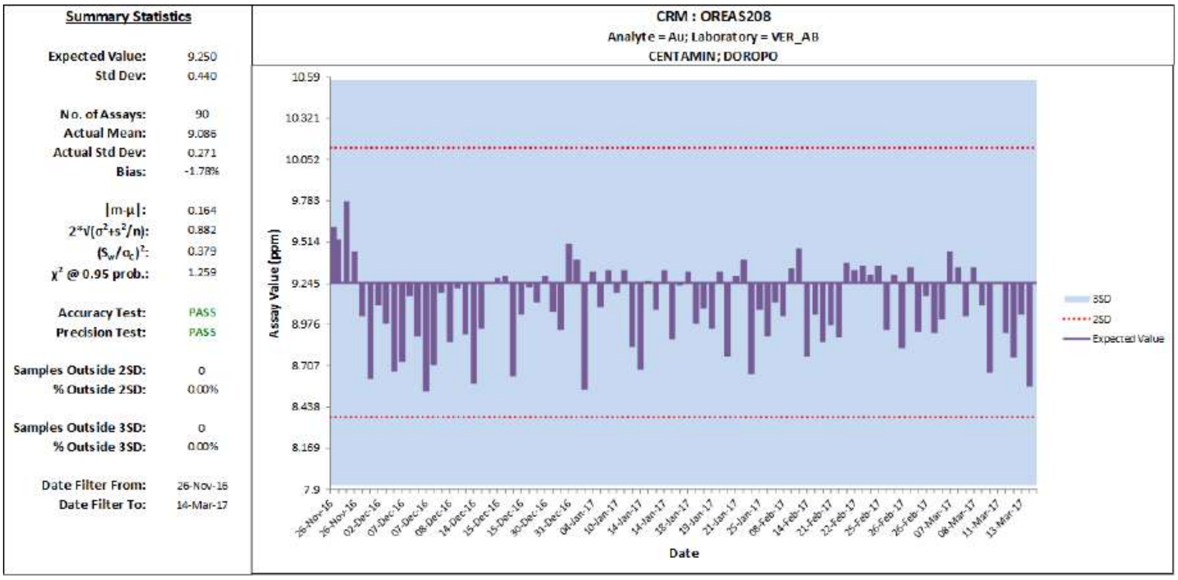
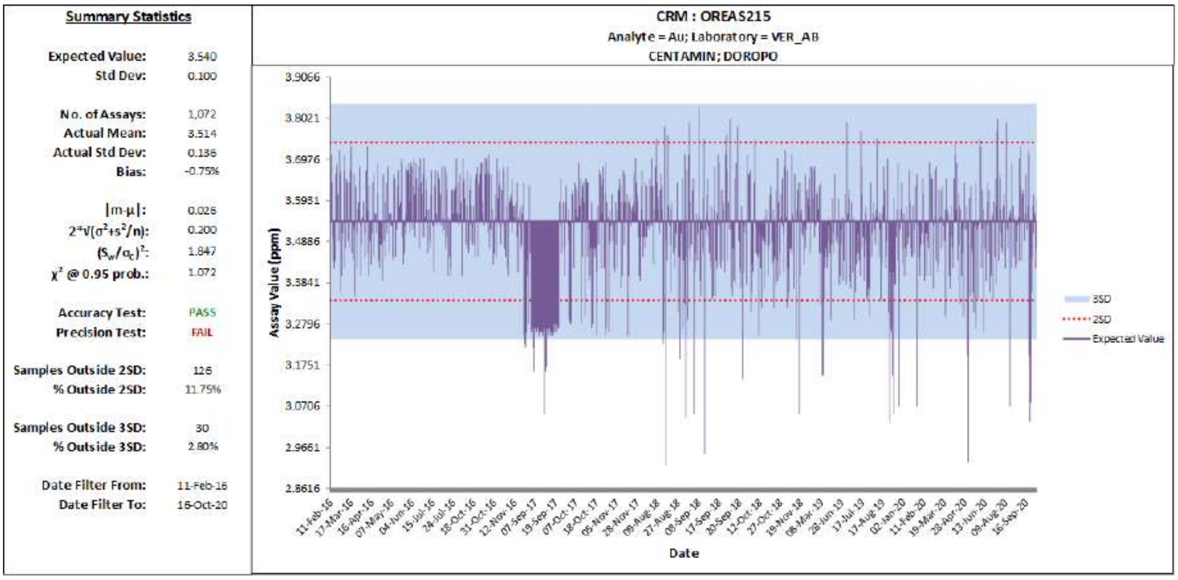


Figure 11.7.7 OREAS 215 – VER_AB Results – Au ppm



For a short period in November 2016, the results for Oreas 203 demonstrated a range of values consistently plotting below the expected value outside two standard deviations (Figure 11.7.8). Further cross-checking showed possible misallocation with samples reporting at close to the Oreas 220 expected value of 0.86 ppm Au.

An opposite scenario is observed for Oreas 250, where a range of results is above the expected value outside three standard deviations from February to November 2016. The same bias trend was observed when the standard was utilised intermittently between May 2018 to August 2019 before reverting to the normal range of expected value (Figure 11.7.9). The bias showed possible misallocation of the CRM used, with samples reporting close to Oreas 250b with an expected value of 0.332 ppm Au.

Figure 11.7.8 OREAS 203 – VER_AB Results – Au ppm

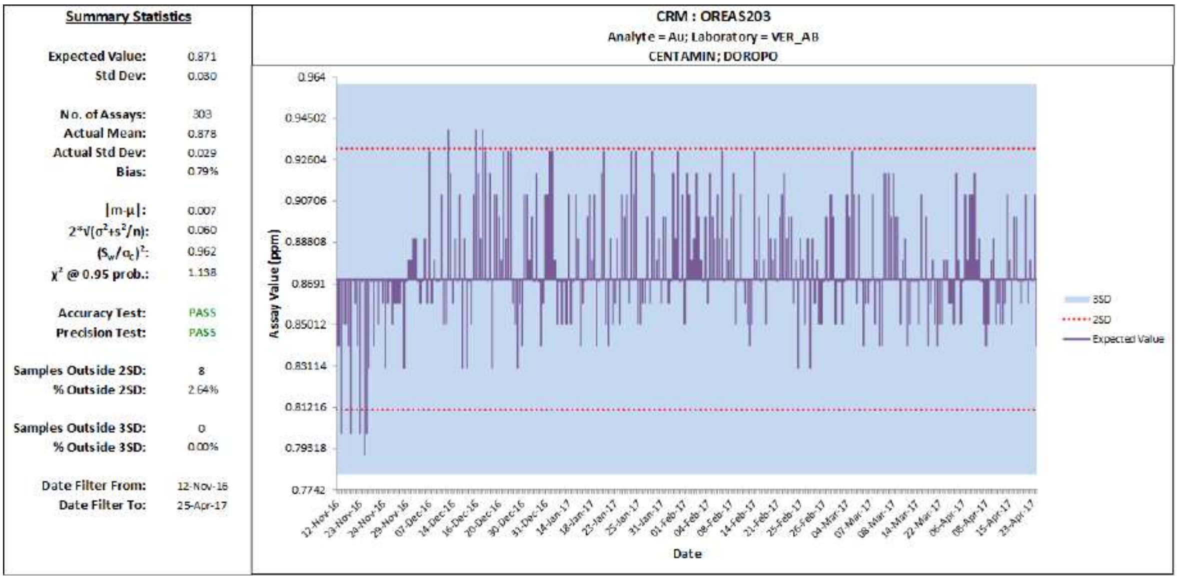
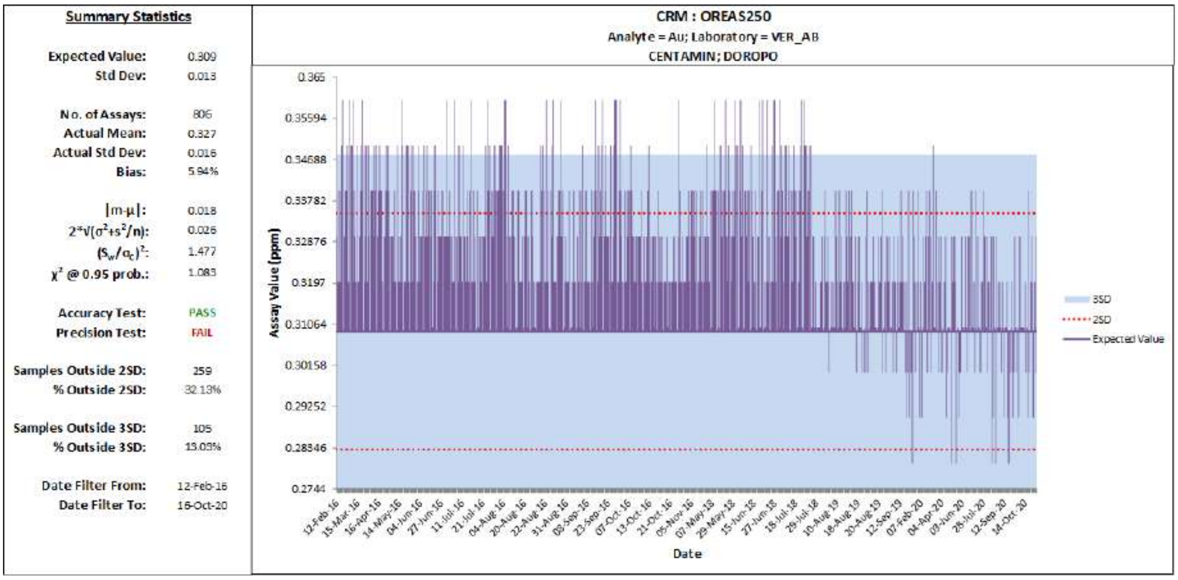


Figure 11.7.9 OREAS 250 – VER_AB Results – Au ppm



CRM Performance Comments

The following points summarise the observations for the overall CRM performance:

- Overall performance from ALS shows good accuracy and precision. CRM results are in within control limits, with the majority of samples being within two standard deviations, however, a degree of negative bias is still evident. The negative bias has no significant impact to the overall analysis but it is recommended that this trend is raised with ALS_IRL.

- General performance from BV shows good accuracy and precision in both periods Pre-PFS and PFS. CRM results are within control with the majority of the samples being within two standard deviations.

- High grade standard Oreas 208, analysed by BV Abidjan, are within control with all samples being within two standard deviations; however, some negative bias is still evident.

- Control chart results for ALS analysis of Oreas 250b is potentially an issue with the certified expected value provided and it is recommended that the result is validated to the standard certifier.

- A positive bias is reported for CRM Oreas 250 analysed by BV. The bias showed possible misallocation of the CRM used, with samples reporting close to Oreas 250b with an expected value of 0.332 ppm Au.

- Consistent low bias results for Oreas 215, analysed by BV during November 2016 to September 2017, is possibly due to analytical accuracy issues.

- As a general comment, the CRM results are reporting with the given accuracy error limits. While some slight low bias issues have been highlighted, as well as some precision fails, the sample data are considered to suitable from an accuracy perspective for use in Mineral Resource estimation.

11.7.3 Blanks

Blank samples (i.e. a material with a very low grade) are usually inserted after high-grade mineralisation samples. The primary purpose of using blanks is to monitor the laboratory for possible contamination of samples mainly caused by poor housekeeping and insufficiently thorough cleaning of equipment. If equipment has not been appropriately cleaned, the Blank samples will be contaminated, which is reflected on the diagram as increased values of the element of interest.

During the PFS period, Blank samples at the Doropo Gold Project consisted of certified Blank (CRM) Oreas 22h and a non-certified coarse Blank. The coarse Blank (CBLK) is sourced from the RC samples where Au assays return values less than the detection limit. A pulp Blank (PBLK) was also introduced later in the PFS program. The pulp Blanks were sourced from the laboratory returned pulps with assay values less than the detection limit.

In February 2022, the coarse Blank from RC barren bulk samples was replaced with the coarse blank (CBLKY) from Yamoussoukro; forty samples were assayed at BV Abidjan, and all samples returned values less than the Au ppm detection limit.

In the Pre-PFS period, blank material consisted of certified coarse Blanks (BLK04172) and non-certified coarse Blanks (CBLK) source from the RC samples with returned assay Au ppm values less than the detection limit.

Details of the blanks submitted are presented in Table 11.7.6 and Table 11.7.7 by drilling campaign period. Selected results are presented in the sections following, while control charts for each blank are included in the full QAQC report.

Table 11.7.6 Doropo Gold Project Blanks Breakdown – PFS Phase – Au ppm

Blank ID	Laboratory	No. Samples	Mean Au (ppm)	Max Au (ppm)
OREAS22h	VER_AB	1,448	0.005	2.310
OREAS22h	ALS_IRL	552	0.001	0.121
CRM Blank Total		**2,001**		
CBLK	VER_AB	519	0.006	12.900
CBLK	ALS_IRL	1,580	0.008	13.100
CBLKY	VER_AB	1,449	0.012	2.470
CBLKY	ALS_IRL	544	0.010	2.380
PBLK	VER_AB	1,079	0.006	0.540
PBLK	ALS_IRL	510	0.004	0.555
Non-Certified Coarse Blank Total		**1,589**		
Grand Total		**3,590**		

Table 11.7.7 Doropo Gold Project Blanks Breakdown – Pre-PFS Phase – Au ppm

Blank ID	Laboratory	No. Samples	Mean Au (ppm)	Max Au (ppm)
Certified Coarse Blank	VER_AB	1,034	0.007	0.140
Coarse Blank	VER_AB	13,341	0.008	1.170
Total		**14,375**		

PFS Phase Results

Overall performance for VER_AB and ALS_IRL for CRM Oreas 22h is acceptable, with the overwhelming majority of results plotting well below the Au ppm threshold (Figure 11.7.10 and Figure 11.7.11). Two cases of values are out of range could not be confirmed as misallocated, since the re-assay has returned the same values as the original assay.

Figure 11.7.10 OREAS 22h Blank – VER_AB Results – Au ppm

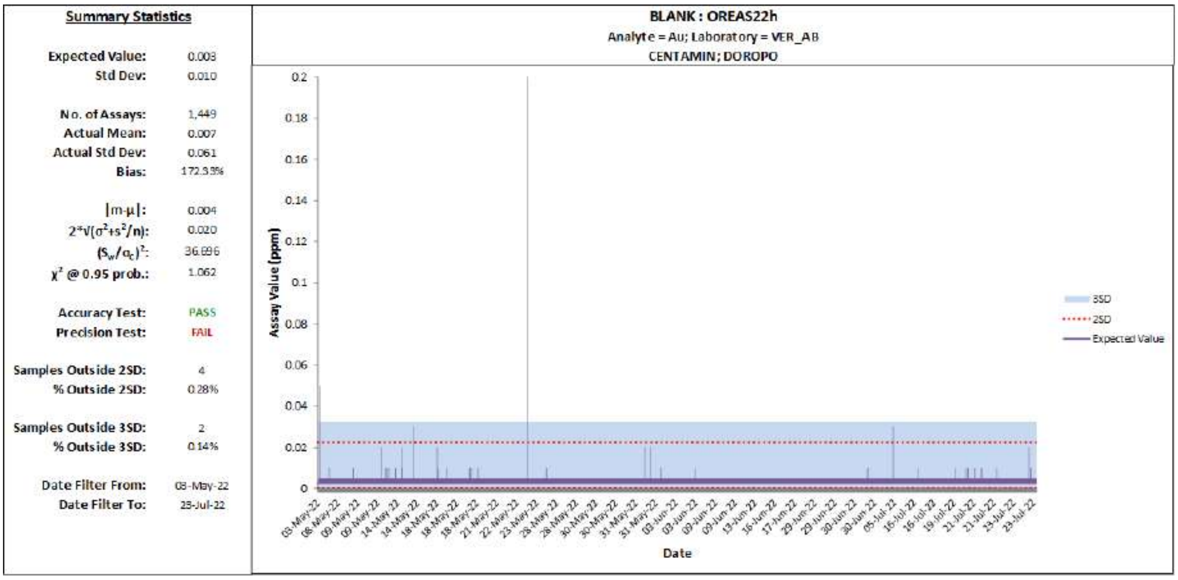
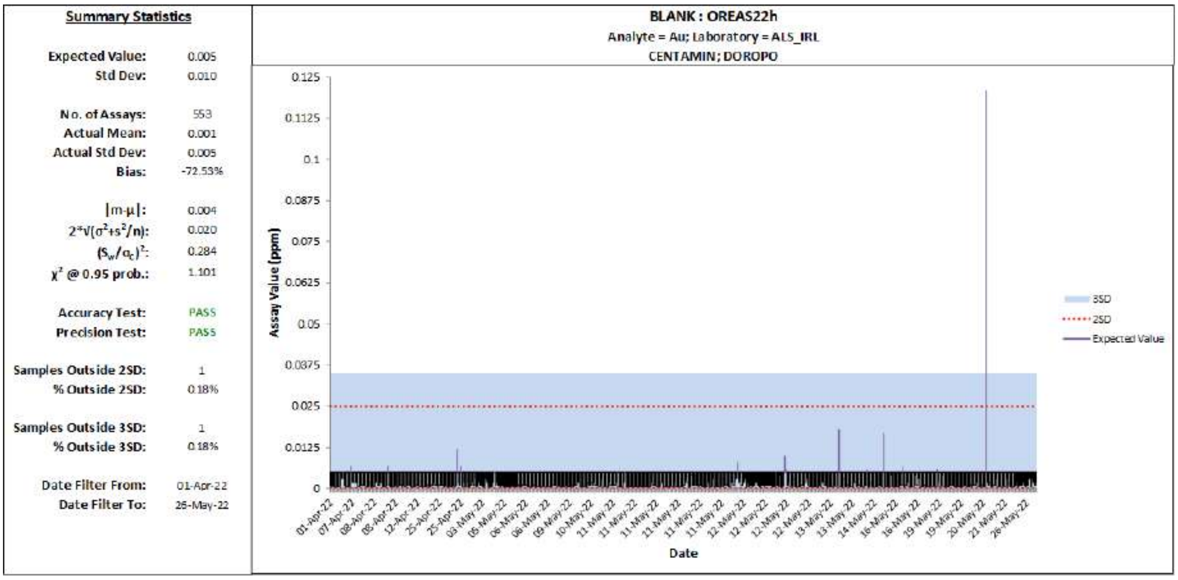


Figure 11.7.11 OREAS 22h Blank – ALS_IRL Results – Au ppm



Blank performance for the coarse Blanks (CBLK and CBLKY) is acceptable, with results typically reporting below the detection limits (Figure 11.7.12 to Figure 11.7.15). Few instances of potential contamination are observed, with only two values as high as 13.1 ppm Au and 12.9 ppm Au evident. The issue was raised in the laboratory. However, re-assay returned the same value as the original assay. Potential misallocation was determined for sample ID CIS705533 to be a swap between the blank and the sample ID CIS7055331 with an original value of 0.18 ppm and a check value of 14.3 ppm.

Pulp Blank performance is acceptable for VER_AB and ALS_IRL with only three outliers – less than 1% of the total samples.

Figure 11.7.12 CBLK Blank – VER_AB Results – Au ppm

Summary Statistics	
Expected Value:	0.005
Std Dev:	0.010
No. of Assays:	1,581
Actual Mean:	0.016
Actual Std Dev:	0.329
Bias:	229.10%
$\lvert m-\mu \rvert$:	0.011
$2*\sqrt{(\sigma^2+s^2/n)}$:	0.026
$(S_w/\sigma_c)^2$:	1,085.463
χ^2 @ 0.95 prob.:	1.059
Accuracy Test:	PASS
Precision Test:	FAIL
Samples Outside 2SD:	52
% Outside 2SD:	3.29%
Samples Outside 3SD:	4
% Outside 3SD:	0.25%
Date Filter From:	13-Sep-21
Date Filter To:	14-Jun-22

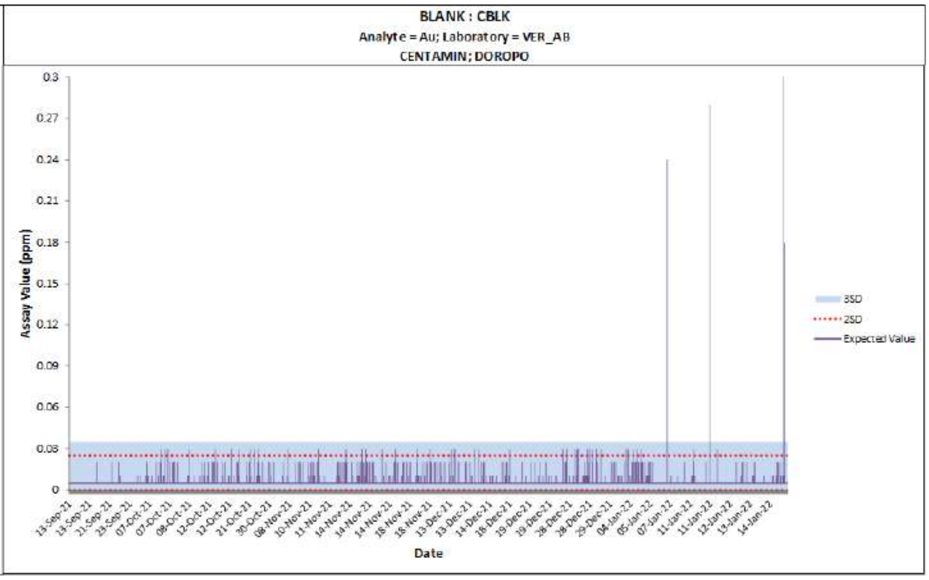


Figure 11.7.13 CBLK Blank – ALS_IRL Results – Au ppm

Summary Statistics	
Expected Value:	0.005
Std Dev:	0.010
No. of Assays:	523
Actual Mean:	0.056
Actual Std Dev:	0.719
Bias:	1017.86%
$\lvert m-\mu \rvert$:	0.051
$2*\sqrt{(\sigma^2+s^2/n)}$:	0.066
$(S_w/\sigma_c)^2$:	5,175.620
χ^2 @ 0.95 prob.:	1.104
Accuracy Test:	PASS
Precision Test:	FAIL
Samples Outside 2SD:	14
% Outside 2SD:	2.68%
Samples Outside 3SD:	11
% Outside 3SD:	2.10%
Date Filter From:	01-Mar-22
Date Filter To:	19-May-22

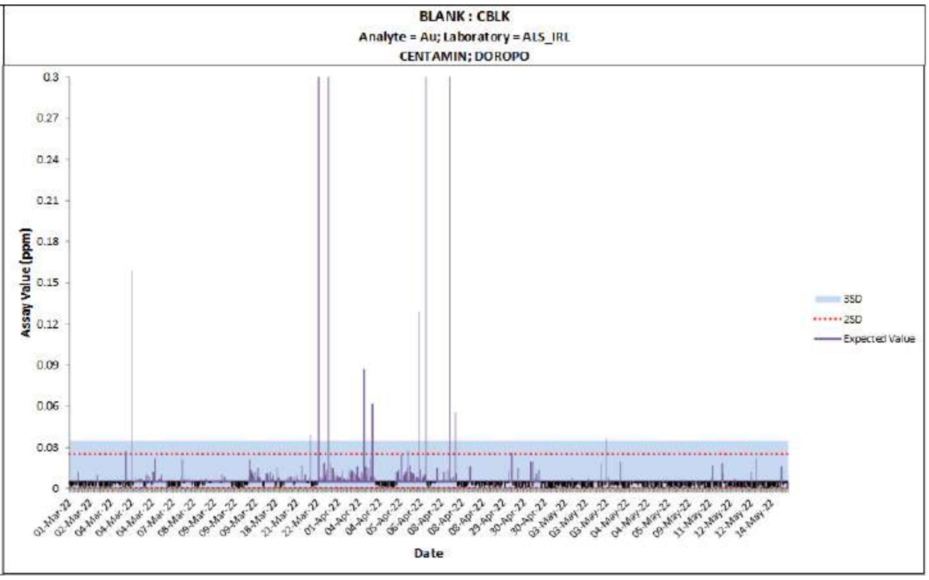


Figure 11.7.14 CBLKY Blank – VER_AB Results – Au ppm

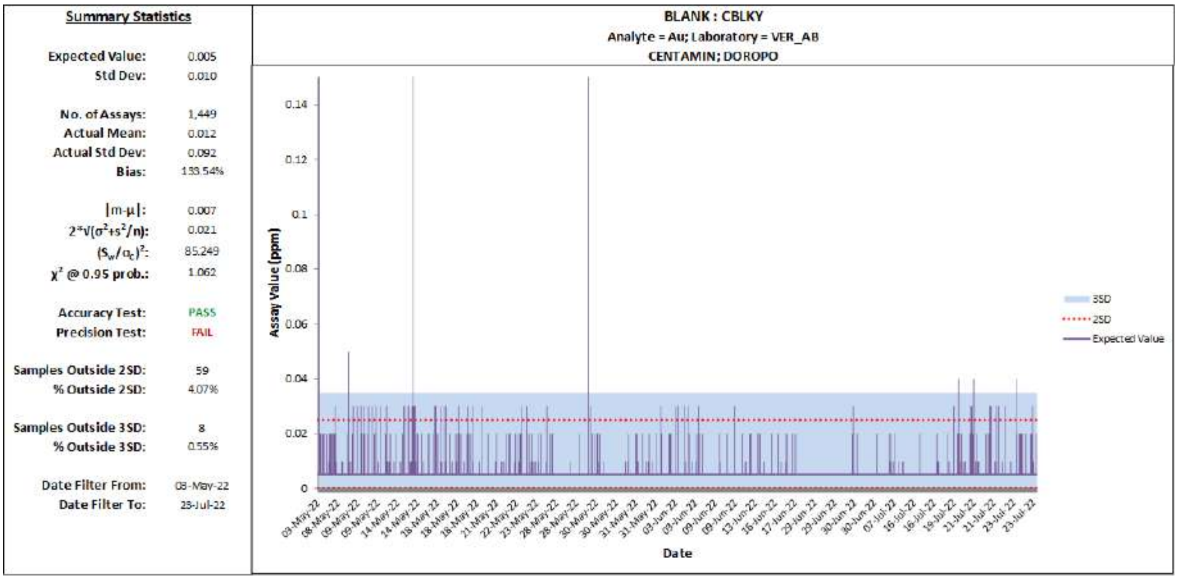
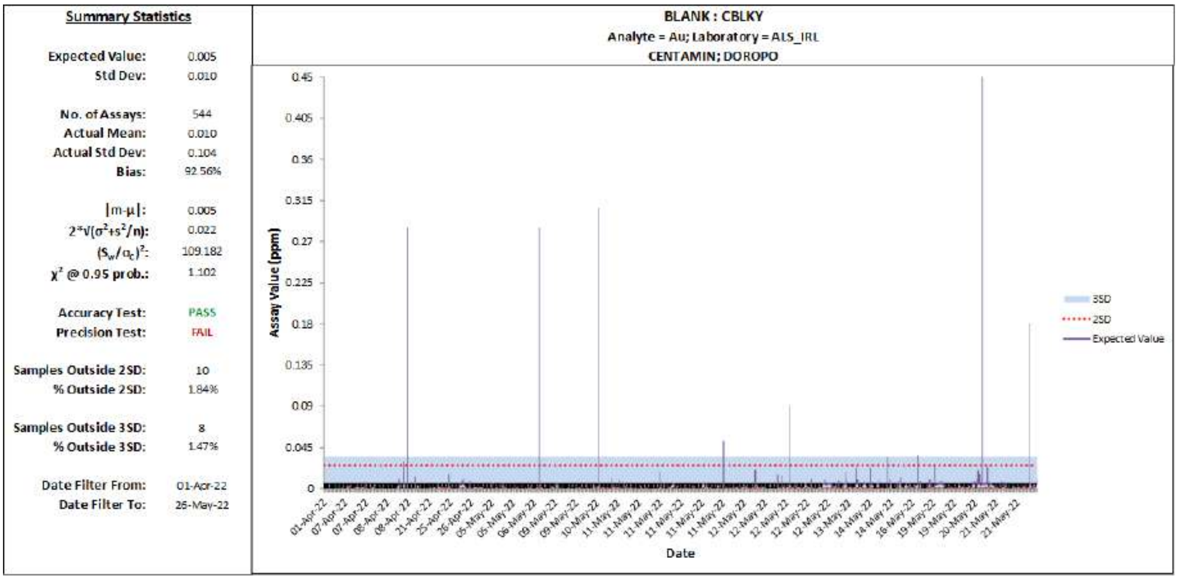


Figure 11.7.15 CBLKY Blank – ALS_IRL Results – Au ppm



Pre-PFS Phase Results

For the Pre-PFS drilling period 2015-2020, the overall performance for blank samples is acceptable for both laboratories VER_AB and ALS_IRL. Certified blank (BLK04172) shows less than 1% of samples that are outside three standard deviations. The coarse blank, however, reveals minor instances of contamination, with the highest contamination grade at 1.17 ppm Au. Overall, coarse blank performance shows less than 1% of samples are outside three standard deviations (Figure 11.7.16 and Figure 11.7.17).

Figure 11.7.16 BLK04172 Certified Coarse Blank – VER_AB Results – Au ppm

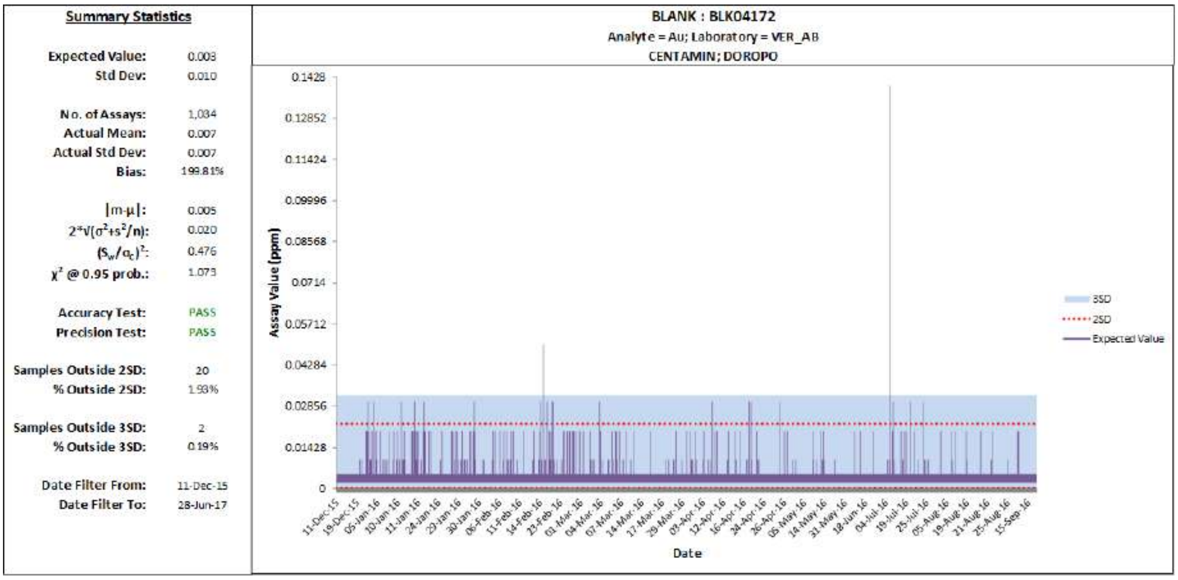
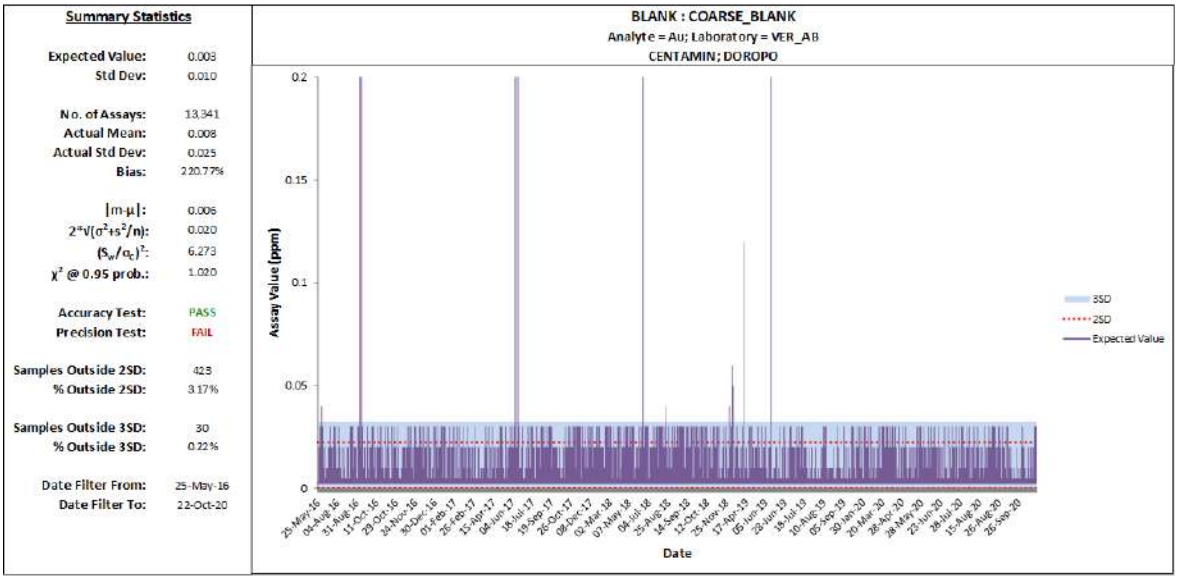


Figure 11.7.17 Coarse_Blank – VER_AB Results – Au ppm



Blank Performance Comments

The following points summarise the relevant observations for the overall coarse blank performance for the Doropo Gold Project.

- Overall Blank performance is considered acceptable, with little evidence of persistent contamination observable in the results for the PFS and Pre-PFS periods.

- For the PFS period, coarse Blank (CLBK and CBLKY) performance is good with 98% of samples being within the pass limit. CRM Oreas 22 h and Pulp Blank (PLK) performance is good with 99% of samples being within the pass limit. Some potentially misallocated samples were observed. These should be further investigated, and their results corrected in the database.

- For the Pre-PFS period, certified Blank (BLK04172) and coarse Blank performance is good with 99% of samples falling within the pass limits.

11.7.4 Duplicates

Duplicates (or sample pairs) represent the most common type of matching pairs of data and are an important measure of precision error. Field duplicate samples for the Doropo Gold Project are collected at the first stage of sub-sampling for RC chips and DD core.

The RC field duplicates were collected after the primary RC sample of 1/8th was taken from the first split using a 3-tier riffle splitter. The remaining 7/8th of bulk sample is run through the 3-tier riffle splitter once again to obtain a second sample for the field duplicate.

For diamond core, two types of sample duplicates are collected; Field Duplicates (DUPL) and Pulp Duplicates (PDUP). Field duplicates (DUPL) are collected during the pre-PFS and PFS phases, while core Pulp Duplicates (PDUP) were introduced during the later stage of the PFS period (April 2022). Field Duplicates are sampled as quarter core of the retained half core sample and then sent to the laboratory for analysis. In April 2022, Pulp Duplicates were introduced. The pulp duplicate is collected as pulp after crushing and pulverising during the laboratory sampling process. The primary half-core sample is submitted to the laboratory accompanied by an empty sample bag with a Duplicate sample ID ticket stapled on the bag, which indicates that a Duplicate (half of the pulp) sample must be collected.

Duplicate data is assessed via various methods including:

- Relative Mean Paired Difference (RMPD) – estimated as the differences between matching pairs of data which are normalised to the means of the corresponding pairs of the data.

- Scatter plot – The original and duplicate values are plotted as an XY scatter and compared to a 1:1 unbiased relationship.

- Quantile-Quantile (Q-Q) plot – Original and duplicate populations are assessed overall and ranked by value, with resulting corresponding quantile values plotted on an XY scatter against an unbiased 1:1 trend line. Deviation from the 1:1 line indicates a bias between results.

A breakdown of the overall sample Duplicate data is presented in Table 11.7.8 and Table 11.7.9, while detailed statistics for Original versus Duplicate performance per prospect are presented in Table 11.7.10 to Table 11.7.15. Results show generally good correlation between the Original and Duplicate samples across all prospects for those instances where enough Duplicate samples were collected to provide statistical stability. The DD precision appears to be somewhat lower than the RC, with the Field Duplicate CV% statistic, which one would expect to be below 40% for most nuggety gold deposits (Abzalov, 2011), sometimes being above 40% for the DD while being uniformly below 40% for the RC Field Duplicates. However, some of the high CV% values in the DD Field Duplicates are not supported by sufficient sample numbers to be considered reliable. The improved precision in the numerically predominant RC samples is interpreted to be a function of the greater sample size relative to the DD, which means that repeatability in the RC is better than the DD.

Table 11.7.8 Doropo Gold Project – PFS Phase – Duplicates Breakdown by Prospect

Prospect	Period	No. Samples			Mean Assay Au (ppm) - Original			Mean Assay Au (ppm) - Duplicate		
		RC (Field)	DD (Field)	DD (Pulp Repeat)	RC (Field)	DD (Field)	DD (Pulp Repeat)	RC (Field)	DD (Field)	DD (Pulp Repeat)
ATI	PFS	33	-	-	1.075	-	-	1.063	-	-
CHG	PFS	517	24	213	0.403	0.364	1.227	0.475	0.359	1.591
ENI	PFS	354	-	68	0.823	-	3.258	0.884	-	3.381
HAN	PFS	212	-	74	1.829	-	4.449	1.931	-	4.519
KEK	PFS	265	13	52	0.667	0.552	1.040	0.650	0.438	1.062
KLG	PFS	1,260	10	329	0.622	0.552	1.907	0.616	0.426	2.084
NOK	PFS	271	36	36	0.367	0.983	5.643	0.369	1.295	5.938
SWA	PFS	607	139	38	0.402	0.402	6.051	0.402	1.219	6.189

Table 11.7.9 Doropo Gold Project – Pre-PFS Phase – Duplicates Breakdown by Prospect

Prospect	Period	No. Samples			Mean Assay Au (ppm) - Original			Mean Assay Au (ppm) - Duplicate		
		RC (Field)	DD (Field)	DD (Pulp Repeat)	RC (Field)	DD (Field)	DD (Pulp Repeat)	RC (Field)	DD (Field)	DD (Pulp Repeat)
ATI	Pre PFS	639	-	-	0.447	-	-	0.466	-	-
CHG	Pre PFS	1,879	-	-	8.211	-	-	7.609	-	-
ENI	Pre PFS	967	-	-	0.353	-	-	0.368	-	-
HAN	Pre PFS	936	6	-	0.486	0.486	-	0.557	0.005	-
KEK	Pre PFS	700	-	-	0.894	-	-	0.794	-	-
KLG	Pre PFS	2,314	-	-	0.327	-	-	0.322	-	-
NOK	Pre PFS	896	-	104	0.931	-	0.051	0.958	-	0.058
SWA	Pre PFS	2,229	35	-	0.754	0.754	-	0.707	0.016	-

Table 11.7.10 RC Field Original versus Duplicate Statistics – PFS Phase

Statistic	Prospect															
	ATI		CHG		ENI		HAN		KEK		KLG		NOK		SWA	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
No. Pairs	33		517		354		212		265		1,260		271		607	
RMPD																
% Assays within 10%	22		244		136		87		125		717		176		298	
% Assays within 20%	24		348		199		131		185		939		206		386	
% Assays within 50%	25		449		286		184		240		1,122		239		491	
Average RMPD%	-0.136		-0.007		-0.027		-0.052		-0.024		-0.019		-0.028		-0.054	
Average CV%	39.2		31.2		38.1		25.2		21.6		25.7		23.6		34.6	
Scatter Plot																
Ori. Mean	1.07	1.06	0.40	0.48	0.82	0.88	1.83	1.93	0.67	0.65	0.62	0.62	0.37	0.37	0.40	0.40
Average Diff. %	-0.01		0.18		0.07		0.06		-0.03		-0.01		0.00		0.00	
Coeff. Correlation	1.00		0.61		0.99		0.98		0.99		0.99		0.98		0.98	
Q-Q																
10th %	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
25th %	0.01	0.01	0.02	0.03	0.02	0.04	0.04	0.05	0.08	0.11	0.03	0.05	0.01	0.01	0.01	0.01
50th %	0.01	0.01	0.11	0.12	0.16	0.17	0.24	0.23	0.25	0.26	0.20	0.19	0.04	0.04	0.06	0.05
75th %	0.02	0.04	0.38	0.41	0.54	0.52	0.84	0.81	0.57	0.52	0.75	0.71	0.35	0.34	0.25	0.25
90th %	2.50	2.55	0.90	0.99	1.62	1.55	2.88	2.13	1.18	1.00	1.65	1.71	0.97	0.94	0.78	0.86

Table 11.7.11 DD Field Original versus Duplicate Statistics – PFS Phase

Statistic	Prospect															
	ATI		CHG		ENI		HAN		KEK		KLG		NOK		SWA	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
No. Pairs	-		24		-		-		13		10		36		139	
RMPD																
% Assays within 10%	-		11		-		-		4		6		19		37	
% Assays within 20%	-		14		-		-		7		7		24		52	
% Assays within 50%	-		20		-		-		11		8		24		83	
Average RMPD%	-		0.050		-		-		-0.239		0.026		0.012		-0.001	
Average CV%	-		20.8		-		-		50.1		50.4		48.1		47.5	
Scatter Plot																
Ori. Mean	-	-	0.40	0.48	-	-	-	-	0.55	0.44	0.55	0.43	0.98	1.30	0.56	1.22
Average Diff. %	-		0.18		-		-		-0.21		-0.23		0.32		1.16	
Coeff. Correlation	-		0.61		-		-		0.74		0.76		0.90		0.80	
Q-Q																
10th %	-	-	0.01	0.01	-	-	-	-	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
25th %	-	-	0.02	0.02	-	-	-	-	0.04	0.02	0.02	0.10	0.01	0.01	0.02	0.02
50th %	-	-	0.06	0.06	-	-	-	-	0.13	0.11	0.23	0.22	0.14	0.14	0.16	0.21
75th %	-	-	0.45	0.43	-	-	-	-	0.73	0.58	0.81	0.45	1.12	1.34	0.76	0.63
90th %	-	-	1.11	1.14	-	-	-	-	1.77	1.21	1.75	1.09	1.51	3.51	1.10	1.66

Table 11.7.12 DD Pulp Original versus Duplicate Statistics – PFS Phase

Statistic	Prospect															
	ATI		CHG		ENI		HAN		KEK		KLG		NOK		SWA	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
No. Pairs	-		213		68		52		329		329		36		38	
RMPD																
% Assays within 10%	-		96		44		35		25		225		14		22	
% Assays within 20%	-		136		58		52		38		277		30		26	
% Assays within 50%	-		183		66		68		43		308		34		36	
Average RMPD%	-		0.066		-0.071		0.041		0.120		0.030		0.054		-0.047	
Average CV%	-		35.9		14.1		27.2		26.6		21.6		12.8		16.9	
Scatter Plot																
Ori. Mean	-	-	1.23	1.59	3.26	3.38	4.45	4.52	1.04	1.06	1.91	2.08	5.64	5.94	6.05	6.19
Average Diff. %	-		0.30		0.04		0.02		0.02		0.09		0.05		0.02	
Coeff. Correlation	-		0.73		1.00		1.00		1.00		0.87		0.99		0.99	
Q-Q																
l	-	-	0.01	0.02	0.11	0.08	0.01	0.02	0.03	0.05	0.03	0.04	0.21	0.28	0.22	0.22
25th %	-	-	0.08	0.19	0.19	0.20	0.14	0.15	0.12	0.14	0.36	0.52	0.95	1.29	0.53	0.52
50th %	-	-	0.45	0.49	0.48	0.49	0.56	0.57	0.32	0.35	1.24	1.34	3.87	3.80	1.20	1.24
75th %	-	-	1.26	1.33	3.08	2.92	2.80	2.88	0.86	1.10	2.59	2.61	9.63	9.94	10.00	10.00
90th %	-	-	3.88	3.12	11.49	13.71	12.50	12.84	1.83	2.17	4.32	4.73	13.35	14.25	16.70	19.36

Table 11.7.13 RC Field Original versus Duplicate Statistics – Pre-PFS Phase

Statistic	Prospect															
	ATI		CHG		ENI		HAN		KEK		KLG		NOK		SWA	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
No. Pairs	639		1,879		967		936		700		2,314		896		2,229	
RMPD																
% Assays within 10%	441		1,154		528		604		382		1,495		572		1,368	
% Assays within 20%	482		1,323		590		684		446		1,679		636		1,550	
% Assays within 50%	540		1,546		721		784		536		1,922		734		1,823	
Average RMPD%	-0.011		-0.019		-0.010		-0.007		-0.050		-0.014		-0.012		-0.020	
Average CV%	29.9		31.5		39.4		30.8		36.5		29.6		33.9		31.7	
Scatter Plot																
Ori. Mean	0.45	0.47	8.21	7.61	0.35	0.37	0.49	0.56	0.89	0.79	0.33	0.32	0.93	0.96	0.75	0.71
Average Diff. %	0.04		-0.07		0.04		0.15		-0.11		-0.02		0.03		-0.06	
Coeff. Correlation	0.95		1.00		0.95		0.95		1.00		0.97		0.98		0.99	
Q-Q																
10^{th} %	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
25^{th} %	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
50^{th} %	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.01
75^{th} %	0.05	0.04	0.15	0.16	0.10	0.09	0.16	0.15	0.14	0.13	0.15	0.15	0.11	0.11	0.14	0.14
90^{th} %	0.56	0.56	0.84	0.80	0.52	0.55	0.80	0.85	0.61	0.62	0.94	0.92	0.92	0.96	0.73	0.73

Table 11.7.14 DD Field Original versus Duplicate Statistics – Pre-PFS Phase

Statistic	Prospect															
	ATI		CHG		ENI		HAN		KEK		KLG		NOK		SWA	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
No. Pairs	-		-		-		-		-		-		-		35	
RMPD																
% Assays within 10%	-		-		-				-		-		-		30	
% Assays within 20%	-		-		-				-		-		-		30	
% Assays within 50%	-		-		-				-		-		-		30	
Average RMPD%	-		-		-				-		-		-		-0.044	
Average CV%	-		-		-				-		-		-		21.5	
Scatter Plot																
Ori. Mean	-	-	-	-	-	-			-	-	-	-	-	-	0.02	0.02
Average Diff. %	-		-		-				-		-		-		-0.06	
Coeff. Correlation	-		-		-				-		-		-		1.00	
Q-Q																
10^{th} %	-	-	-	-	-	-			-	-	-	-	-	-	0.01	0.01
25^{th} %	-	-	-	-	-	-			-	-	-	-	-	-	0.01	0.01
50^{th} %	-	-	-	-	-	-			-	-	-	-	-	-	0.01	0.01
75^{th} %	-	-	-	-	-	-			-	-	-	-	-	-	0.01	0.01
90^{th} %	-	-	-	-	-	-			-	-	-	-	-	-	0.02	0.02

Table 11.7.15 DD Pulp Original versus Duplicate Statistics – Pre-PFS Phase

Statistic	Prospect															
	ATI		CHG		ENI		HAN		KEK		KLG		NOK		SWA	
	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate	Original	Duplicate
No. Pairs	-		-		-		-		-		-		104			
RMPD																
% Assays within 10%	-		-		-		-		-		-		82			
% Assays within 20%	-		-		-		-		-		-		84			
% Assays within 50%	-		-		-		-		-		-		87			
Average RMPD%	-		-		-		-		-		-		0.052			
Average CV%	-		-		-		-		-		-		31.7			
Scatter Plot																
Ori. Mean	-	-	-	-	-	-	-	-	-	-	-	-	0.05	0.06		
Average Diff. %	-		-		-		-		-		-		0.13			
Coeff. Correlation	-		-		-		-		-		-		1.00			
Q-Q																
10th %	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01		
25th %	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01		
50th %	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01		
75th %	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.01		
90th %	-	-	-	-	-	-	-	-	-	-	-	-	0.04	0.05		

Duplicate Performance Comments

The following points summarise the relevant observations for the overall duplicate performance for Doropo Gold Project.

- RC Field Duplicate performance for all prospects shows acceptable correlation and precision; the average mean difference is 3% - Duplicate is higher than original mean and an average CV of 30% which is within the acceptable ≥20% ≤40% for orogenic gold deposits (Abzalov, 2011).

- DD Pulp Duplicate performance for all prospect shows acceptable correlation with an average mean difference of 8.6% - Duplicate is higher than original mean. The precision is relatively poor with average CV of 26% which is above the acceptable <20% for orogenic gold deposits (Abzalov, 2011). However, relatively few DD Pulp Duplicates were submit-ted.

- Diamond drill field duplicate sample pairs are insufficient to form a definitive conclusion of precision, although they do suggest that DD precision is somewhat lower than RC precision.

11.7.5 Summary Opinion of Qualified Person

Cube has independently assessed the QAQC data for the Project.

Based on an assessment of the available data, the Qualified Person considers the dataset collected by Centamin to be acceptable for resource estimation, with QA protocols and QC results posing minimal risk to the overall confidence level of the MRE.

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12.0 DATA VERIFICATION

12.1 Site Visit

A site visit to the Project was undertaken by Mr Michael Millad of Cube, accompanied by Centamin's Group Mineral Resource Manager, Mr Craig Barker. The site visit took place on the 29 and 30 August 2021, while the primary assay laboratory, BV Abidjan, was visited on 4 September 2021.

The following activities and inspections were undertaken:

- View selected drill cores and discuss geological framework and mineralisation controls. The core was compared to logs of lithology and to assay results contained in the drill database.
- Discuss and note data capture, storage and management processes.
- QAQC and sampling discussion - procedures and processes.
- Tour of facilities, including site of the under-construction Danoa sample preparation building.
- View outcrops and orpaillage workings in the prospecting area.
- Observe current RC drilling activities, including drilling methods, sample collection and sample security procedures.
- Independently check several drill collar positions and azimuth / inclinations.
- Observation and direction of the collection of independent drill samples.
- Inspection of the sample storage, sample preparation and sample analysis sections of the Bureau Veritas (Abidjan) laboratory.

The facilities and equipment were considered fit for purpose, and the procedures were well-designed and being implemented consistently. The sample preparation and analytical laboratories were well equipped and operated to a high standard, with the only concerning issue noted being the over-crowded sample storage area, which was explained to be due to late collection of sample residue by various mining companies. A few minor issues were noted within the sample preparation area, but the overall impression was of a well-run and sufficiently clean environment.

12.1.1 Drill Collar Checks

A selection of drill collar positions, azimuths and inclinations at Doropo were checked using an Apple iPhone 12, with relevant applications downloaded from the Apple App Store. The results were compared to the surveyed values in the drill database (Table 12.1.1).

Table 12.1.1 Drill Collar Position, Azimuth and Inclination Checks

Hole ID	Area	Cube Site Check				Centamin/Ampella Database				Distance Difference (m)
		UTM X (m)	UTM Y (m)	Azimuth	Dip	UTM X (m)	UTM Y (m)	Azimuth	Dip	
DPRC0437	HAN	486,818.0	1,074,199.7	125	61	486,825.8	1,074,195.3	129.8	59.8	9.0
DPRC0039	SWA	478,982.8	1,075,966.2	143	63	478,981.8	1,075,965.5	140.9	60.0	1.2
DPRC0843	SWA	478,688.2	1,074,547.7	91	59	478,680.9	1,074,549.2	87.9	60.7	7.5
DPRC0837	SWA	478,604.5	1,074,702.5	97	53	478,608.3	1,074,699.2	89.2	59.8	5.1
DPRC0836	SWA	478,661.4	1,074,701.7	92	57	478,661.4	1,074,699.1	91.5	59.9	2.6
DPDD1443	NOK	479,896.4	1,077,874.9	150	65	479,894.4	1,077,873.7	148.7	59.4	2.3
DPRC2261	NOK	479,904.6	1,077,883.8	143	57	479,907.3	1,077,881.4	152.1	58.0	3.6
DPRC2120	CHG	481,746.6	1,078,683.9	146	58	481,748.3	1,078,677.4	151.9	60.5	6.7
DPRC1451	CHG	482,082.9	1,078,784.9	150	58	482,085.0	1,078,787.0	150.6	58.1	3.0

The check collar positions were found to be within 10 m in all instances and within 5 m for five out of the nine collars checked. The check azimuths and inclinations were also within a reasonable margin of the database values, given that the cemented PVC piping used to do the check readings may have shifted slightly since they were set. The database values are considered to be more accurate, given they were measured using precision survey methods and because the hole azimuths and inclinations were set at the time of drilling.

12.1.2 Independent Samples

The Qualified Person, Mr Michael Millad, directly observed the collection of a set of independent samples in hole DPRC3081, which was targeting the Souwa mineralised zone close to where it outcrops, hence the mineralisation intercept was relatively shallow. The independent samples were collected on 30 August 2021. Some 22 duplicate samples were collected and sealed in polyweave bags for delivery to BV Abidjan for preparation and then onto ALS Loughrea in Ireland for analysis. The multi-purpose Geodrill UDR900 rig (can drill RC and DD [PQ, HQ & NQ] holes) was used to collect the RC samples, which were collected from the cyclone before being passed through a three-tier riffle splitter to produce a 2 to 3 kg sample.

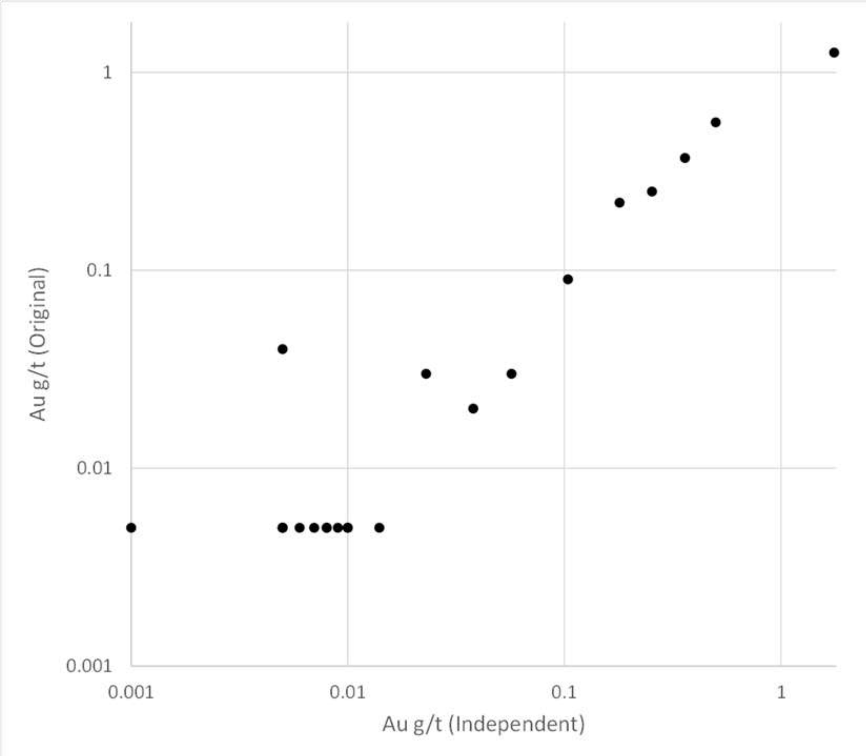
The results are summarised in Table 12.1.2 below and a scatter plot is shown in Figure 12.1.1. The agreement between the original and independent samples is good.

Table 12.1.2 Listing of Original versus Independent Sample Results from Hole DPRC3081

Samp Id Independent	Samp ID Original	Depth From (m)	Depth To (m)	Au ppm Independent	Au ppm Original
CIS384973	CIS671836	4	5	0.18	0.22
CIS384974	CIS671837	5	6	1.76	1.26
CIS384953	CIS671838	6	7	0.5	0.56
CIS384954	CIS671839	7	8	0.361	0.37
CIS384955	CIS671840	8	9	0.254	0.25
CIS384956	CIS671841	9	10	0.104	0.09
CIS384957	CIS671842	10	11	0.01	0.005
CIS384958	CIS671843	11	12	0.009	0.005
CIS384959	CIS671844	12	13	0.008	0.005
CIS384960	CIS671846	13	14	0.01	0.005
CIS384961	CIS671847	14	15	0.005	0.005
CIS384962	CIS671848	15	16	0.005	0.005
CIS384963	CIS671849	16	17	0.007	0.005
CIS384964	CIS671851	17	18	0.008	0.005
CIS384965	CIS671852	18	19	0.038	0.02
CIS384966	CIS671853	19	20	0.006	0.005
CIS384967	CIS671854	20	21	0.057	0.03
CIS384968	CIS671856	21	22	0.014	0.005
CIS384969	CIS671857	22	23	0.005	0.04
CIS384970	CIS671858	23	24	0.023	0.03
CIS384971	CIS671859	24	25	0.005	0.005
CIS384972	CIS671860	25	26	0.001	0.005

Note: Mineralised zone highlighted.

Figure 12.1.1 Log Scatterplot of the Independent vs Original Sample Results from Hole DPRC3081



12.2 Data Verification and Validation

The exploration database has been maintained on site in acQuire since the beginning of the project. Field data is collected on paper and transcribed to excel spreadsheets by field geologists and a dedicated data entry person. Spreadsheets are then imported to acquire by a dedicated database manager.

Data is internally validated by acQuire as it is entered and ensures:

- Collar, survey, assay and geology end of hole depths are compatible.
- No overlapping intervals are allowed.
- No repeat sample identification numbers can occur within the database.
- Laboratory assays are loaded to the correct sample identification number.
- All analytical results are stored in the database as reported by the laboratory. Assay values below detection are converted to half detection limit for reporting and modelling purposes.
- All logged codes adhere to the accepted libraries.

The Qualified Person undertook spot checks of assay values in the database against laboratory certificates while on the site visit and no errors were found.

Database validation checks completed by Cube include the following work:

- Checking for absent collars.
- Flagging of collars with no survey and/or assay data.
- Sample data exceeding the recorded depth of hole.
- Checking for out-of-range assay or density values.
- Checking for sample interval overlaps.
- Reporting missing assay intervals.
- Visual validation of downhole survey data by inspection of drill traces.
- Visual validation of geological models against the drill logs.

No major issues were detected, and the files were considered suitable for use in the MRE.

12.3 Topography

The topographic models supplied to Cube by Centamin for use in the MRE are based on the surveyed drill collars over each deposit. Cube has visually checked the topography DTM against the drill collars and observed a high degree of spatial correspondence between the two datasets. The relief is subdued in the Project area, and so the use of the drill collars to generate the topographic surface models is not considered to pose a significant risk. It is recommended though that a higher resolution survey is undertaken to inform more advanced mining studies.

12.4 Summary Opinion of Qualified Person

Based on an assessment of the data verification procedures undertaken by Centamin, and the Qualified Person’s own verification and validation checks, it is the Qualified Person’s opinion that the input data are of the required quality and integrity for Mineral Resource estimation.

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FIGURES

13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

The pre-feasibility study (PFS) for Centamin's Doropo Gold Project is based on developing nine open pit mines. The ore will be processed in a conventional CIL circuit.

A metallurgical testwork programmed was developed for the PFS with the following objectives:

- Selection of an appropriate processing flowsheet that maximises gold recovery.
- Assessment of gold recovery and reagent usage variability throughout the deposit.
- Provide metallurgical design parameters for development of a robust processing flowsheet.

13.1 Lycopodium / ALS Metallurgy Testwork (2021 – 2023)

13.1.1 Overview

Lycopodium was retained by Centamin in November 2021 to initiate and oversee metallurgical testwork on samples from the Doropo gold deposit. The intention was that these results would be used to design, size, and cost a flowsheet for use in a PFS for the Project. The PFS testwork was carried out by ALS Metallurgy in Perth (ALS Perth).

To ensure that the processing characteristics of all major ore lithologies over the Life of Mine (LoM) are understood, Centamin, with assistance from Lycopodium, selected appropriate core samples as part of the PFS testwork programme. Drill core sample selection for this testwork programme is documented in Section 13.2.

The majority of the testwork was carried out between May 2022 and May 2023. The testwork programme was managed by Lycopodium.

Comminution testwork undertaken included:

- Bond Ball Mill Work Index (BBWi).
- Bond Rod Mill Work Index (BRWi).
- Crushability Work Index (BCWi).
- Abrasion Index (Ai).
- Uniaxial Compressive Strength (UCS).
- SMC and JKTech Drop Weight.

The following recovery testwork was undertaken:

- Sample Head Analysis.
- Leach Tests (with and without carbon).
- Grind Size vs Gold Recovery Testwork.
- Leach Kinetics Testwork.

The results of the most recent testwork programme formed the basis for the development of a series of design criteria for the PFS, which was performed on the basis of 4.0 Mt/a of primary ore through the process plant.

13.2 PFS Testwork Sample Selection

13.2.1 Background

The Doropo Project is comprised on nine deposits. Based on the Resource pit grades provided by Centamin (August 2022), the deposits by weathering state are summarised in Section 14.0.

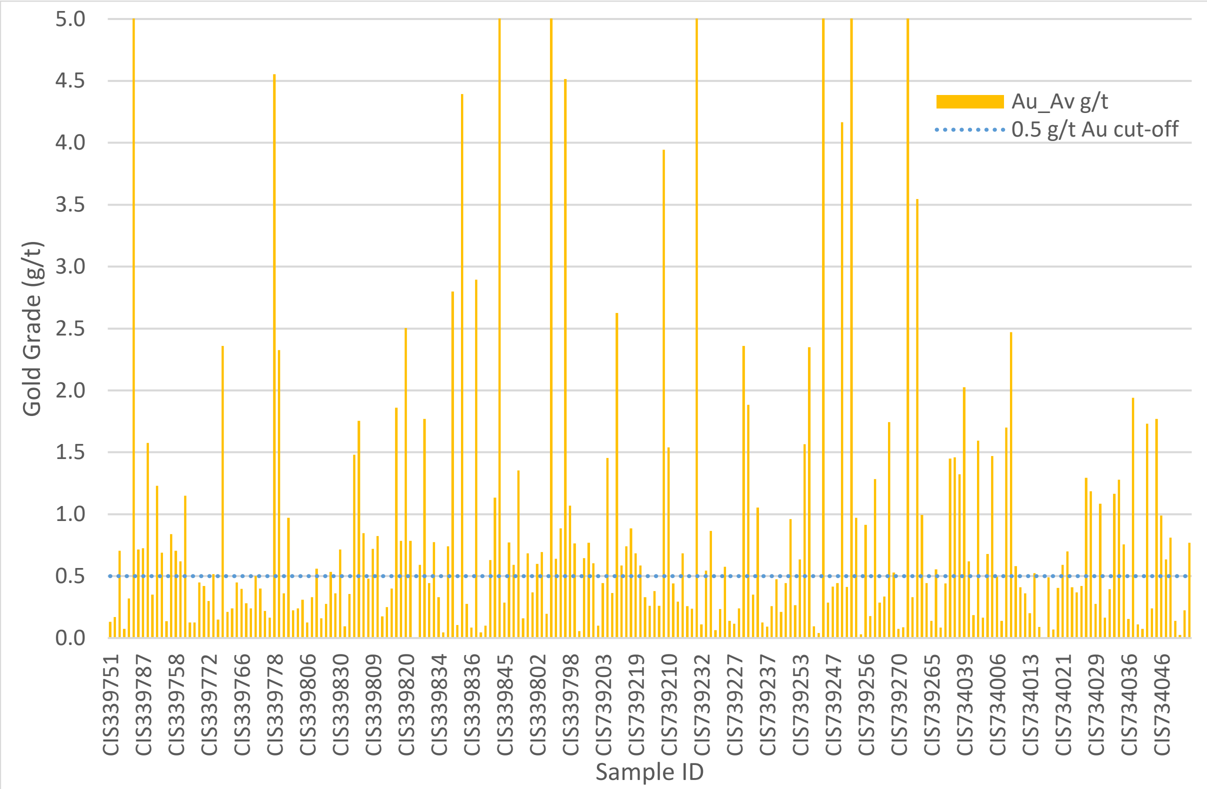
For the PFS testwork program, whole NQ drill core samples provided by Centamin arrived at ALS over four separate deliveries between December 2021 and April 2022. The intervals selected by Centamin were from metallurgical drill holes 'twinned' with existing drill holes. Assay data for the original 'twinned' drill holes was provided to Lycopodium for determining the make-up of the master composites. Samples were sourced from the nine Doropo deposits representing Oxide, Transition and Fresh weathering material types.

Having arrived at ALS, the sample bags were removed from their respective drums and a full sample inventory was taken and cross-checked against the accompanying sample list. Other than minor discrepancies between the despatched sample mass and the sample mass recorded by ALS, no anomalies were reported.

Where possible, the expected gold assays of the samples were estimated and compared against the assays reported. The majority (67.6 %) of the gold and sulphur (total) assays reported by ALS for the metallurgical testwork samples were lower than expected. It is noted that the presence of 'spotty' gold was potentially affecting some of the assays. Approximately 50% of the samples provided were below the cut-off grade of 0.5 g/t Au.

Figure 13.2.1 summarises the gold assay results for the initial PFS metallurgical testwork samples provided by the client. For clarity, the vertical axis has been limited to 5.0 g/t Au. Seven samples reported assays greater than 5.0 g/t Au.

Figure 13.2.1 Doropo PFS Testwork Samples – Gold Head Grade



Total sulphur assays for the fresh samples ranged from < 0.02 % to a maximum of less than 1 % with an average of approximately 0.3 %. Sulphur content for the samples selected did not appear to be sufficient for the successful operation of a sulphide flotation circuit as previously assumed for the Doropo Project.

To ensure that the processing characteristics of all major ore lithologies over the Life of Mine (LoM) are understood, Centamin, with assistance from Lycopodium, selected additional samples as part of a fifth delivery of samples which arrived at ALS in November 2022.

It should be noted that the Attire resource was tested, but is not included the the Mineral Reserves.

13.2.2 PFS Master Composites

Table 13.2.1 summarises the composites available for the PFS testwork programme.

Table 13.2.1 Doropo PFS Testwork Composites

Deposit	Oxide	Transition	Fresh
Souwa	MC1, MC8, MC9, MC26	MC2, MC10	MC11
Nokpa	No sample	MC12	MC13
Chegue Main	MC3	MC14	MC15
Chegue South	No sample	MC5, MC16	MC17
Kekeda	No sample	MC6	MC18
Han	No sample	MC19	MC20
Enioda	MC21	MC22	MC27
Attire	No sample	MC23	MC24
Kilosegui	No sample	MC25	MC7

Drill core intervals and samples masses were selected from the available material to target the Resource pit and were confirmed by Centamin to be within the resource pits of each deposit as defined at the time. Table 13.2.2 to Table 13.2.28 detail the drill core intervals used to form the composites and the average head grade assay for the composite.

Table 13.2.2 Souwa Oxide Master Composite – MC1

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339751	DPDD1517	0	10
CIS339757	DPDD1462	6	12.5
CIS339768	DPDD1460	11	20
CIS339781	DPDD1524	20	30
CIS339782	DPDD1524	30	38
CIS339783	DPDD1524	38	43
CIS339787	DPDD1526	18	28
CIS339788	DPDD1526	28	33
CIS339789	DPDD1526	33	39
		Resource Au (g/t)	Head Grade Assay (Avg Au g/t)
		1.23	0.27

Table 13.2.3 Souwa Oxide Master Composite – MC8

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339768	DPDD1460	11	20
CIS339782	DPDD1524	30	38
CIS339783	DPDD1524	38	43
CIS339787	DPDD1526	18	28
CIS339788	DPDD1526	28	33
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.23	0.41

Table 13.2.4 Souwa Oxide Master Composite – MC9

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339768	DPDD1460	11	20
CIS339782	DPDD1524	30	38
CIS339783	DPDD1524	38	43
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.23	0.42

Table 13.2.5 Souwa Oxide Master Composite – MC26

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339768	DPDD1460	11	20
CIS339782	DPDD1524	30	38
CIS339783	DPDD1524	38	43
CIS339789	DPDD1526	33	39
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.23	0.50

Table 13.2.6 Souwa Transitional Master Composite – MC2

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339752	DPDD1517	10	20
CIS339753	DPDD1518	18	28
CIS339754	DPDD1518	28	37
CIS339755	DPDD1518	37	42
CIS339758	DPDD1462	12.5	22.5
CIS339759	DPDD1462	22.5	32.5
CIS339760	DPDD1519	39	44
CIS339769	DPDD1460	20	30
CIS339770	DPDD1460	30	40
CIS339771	DPDD1521	37	47
CIS339772	DPDD1521	47	52
CIS339784	DPDD1524	43	51
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.54	0.73

Table 13.2.7 Souwa Transitional Master Composite – MC10

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339752	DPDD1517	10	20
CIS339753	DPDD1518	18	28
CIS339755	DPDD1518	37	42
CIS339758	DPDD1462	13	23
CIS339759	DPDD1462	23	33
CIS339760	DPDD1519	39	44
CIS339784	DPDD1524	43	51
CIS790004	DPDD1473	44	47
CIS790007	DPDD1584	40	45
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.54	0.52

Table 13.2.8 Souwa Fresh Master Composite – MC11

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339761	DPDD1519	44	54
CIS339778	DPDD1523	133	143
CIS339785	DPDD1525	51	61
CIS339790	DPDD1527	86	96
CIS790001	DPRD1102	136	147
CIS790002	DPDD1382	79	100
CIS790003	DPDD1386	90	116
CIS790005	DPDD1473	72	77
CIS790006	DPDD1473	80	94
CIS790008	DPDD1584	50	65
CIS790009	DPDD1586	72	90
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.94	2.45

Table 13.2.9 Nokpa Transitional Master Composite – MC12

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339802	DPDD1533	12.5	21.5
CIS 790039	DPDD1589	25	36
CIS 790040	DPDD1588	26	35
CIS 790041	DPDD1491	28	34
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.64	2.10

Table 13.2.10 Nokpa Fresh Master Composite – MC13

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339796	DPDD1531	88	98
CIS339797	DPDD1531	98	108
CIS339798	DPDD1531	108	118
CIS339799	DPDD1531	118	128
CIS339801	DPDD1532	55	65
CIS790017	DPDD1425	100	107
CIS790018	DPDD1425	112	137.7
CIS790020	DPDD1587	78	109
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.85	1.74

Table 13.2.11 Chegue Main Oxide Master Composite – MC3

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339816	DPDD1458	3.5	13
CIS339826	DPDD1541	0	5
CIS339827	DPDD1541	5	11
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		0.85	1.21

Table 13.2.12 Chegue Main Oxide Master Composite – MC14

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339826	DPDD1541	0	5
CIS339827	DPDD1541	5	11
CIS790014	DPDD1592	0	10
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		0.85	1.12

Table 13.2.13 Chegue Main Transitional Master Composite – MC4

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339804	DPDD1535	0	10
CIS339805	DPDD1535	10	20
CIS339817	DPDD1458	13	23
CIS339818	DPDD1458	23	33
CIS339819	DPDD1458	33	40
CIS339823	DPDD1540	53	60
CIS339828	DPDD1541	11	16
CIS339829	DPDD1541	16	26
CIS339830	DPDD1542	53	61
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		0.98	0.47

Table 13.2.14 Chegue Main Fresh Master Composite – MC15

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339809	DPDD1537	47	57
CIS339810	DPDD1537	57	67
CIS339833	DPDD1543	60	70
CIS790010	DPDD1487	82	87
CIS790011	DPDD1494	50	58
CIS790012	DPDD1501	84	97
CIS790015	DPDD1594	52	56
CIS790037	DPDD1594	45	52
CIS790038	DPDD1591	36	40.8
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.63	2.30

Table 13.2.15 Chegue South Transitional Master Composite – MC5

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339838	DPDD1545	20	30
CIS339842	DPDD1548	35	40
CIS339850	DPDD1551	8	18
CIS339851	DPDD1551	18	28
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.05	1.46

Table 13.2.16 Chegue South Transitional Master Composite – MC16

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339838	DPDD1545	20	30
CIS339842	DPDD1548	35	40
CIS790016	DPDD1595	7	20
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.05	1.53

Table 13.2.17 Chegue South Fresh Master Composite – MC17

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS339837	DPDD1544	64.5	74.5
CIS339843	DPDD1548	40	45
CIS339844	DPDD1548	45	52
CIS339847	DPDD1550	62.5	72.5
CIS339848	DPDD1550	72.5	82.5
CIS 790035	DPDD1487	70	72
CIS 790036	DPDD1597	66	68
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.56	4.27

Table 13.2.18 Kekeda Transitional Master Composite – MC6

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739206	DPDD1555	17	22
CIS739213	DPDD1557	6	16
CIS739214	DPDD1557	16	24
CIS739215	DPDD1557	24	29
CIS739218	DPDD1559	29	39
CIS739219	DPDD1559	39	46
CIS739220	DPDD1455	10	20
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.14	1.05

Table 13.2.19 Kekeda Fresh Master Composite – MC18

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739208	DPDD1555	32	42
CIS739210	DPDD1556	39	49
CIS739216	DPDD1558	58	68
CIS790024	DPRD1373	58	72
CIS790025	DPDD1436	24	32
CIS790026	DPDD1436	39	43
CIS790027	DPDD1439	44	59
CIS790028	DPDD1479	44	50.3
CIS790029	DPDD1598	36	45
CIS790030	DPDD1599	67	77
CIS790031	DPDD1600	18	29
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.40	3.56

Table 13.2.20 Han Transitional Master Composite – MC19

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739231	DPDD1562	22	31
CIS739239	DPDD1566	21	31
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		2.04	13.31

Table 13.2.21 Han Fresh Master Composite – MC20

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739225	DPDD1561	47	57
CIS739233	DPDD1563	48	58
CIS790022	DPRD0470	86	107
CIS790023	DPRD1502	51.85	59.5
CIS790042	DPDD1602	18.9	23.5
CIS790043	DPDD1503	38.15	42.35
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.97	3.68

Table 13.2.22 Enioda Oxide Master Composite – MC21

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739253	DPDD1572	10	20
CIS739254	DPDD1572	20	25
CIS739255	DPDD1572	25	31
CIS739260	DPDD1574	20	28
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.09	1.09

Table 13.2.23 Enioda Transitional Master Composite – MC22

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS 790032	DPDD1604	47.07	60
CIS 790033	DPDD1605	40	54
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.24	2.53

Table 13.2.24 Enioda Fresh Master Composite – MC27

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS 790034	DPDD1513	99	106
CIS 790085	DPRC3709	83	86
CIS 790086	DPRC3704	74	82
CIS 790087	DPRC3703	53	56
CIS 790088	DPRC3700	67	77
		LOM Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.37	5.47

Table 13.2.25 Attire Transitional Master Composite – MC23

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739262	DPDD1576	16	21
CIS739268	DPDD1579	14	24
CIS739269	DPDD1580	15	25
CIS739273	DPDD1581	11	20
CIS739275		30	36
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.98	2.24

Table 13.2.26 Attire Fresh Master Composite – MC24

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS739261	DPDD1575	73	81
CIS739266	DPDD1578	60	70
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		2.37	1.29

Table 13.2.27 Kilosegui Transitional Master Composite – MC25

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS734027	DPDD3009	18	25
CIS734037	DPDD3012	13	23
CIS734038	DPDD3012	23	33
CIS734039	DPDD3012	33	38
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.12	1.79

Table 13.2.28 Kilosegui Fresh Master Composite – MC7

ALS ID	Drill Hole	Interval	
		From (m)	To (m)
CIS734002	DPDD3001	11.3	20
CIS734004	DPDD3002	26	36
CIS734005	DPDD3002	36	46
CIS734008	DPDD3003	17	27
CIS734009	DPDD3003	27	37
CIS734010	DPDD3003	37	42
CIS734028	DPDD3009	25	35
CIS734030	DPDD3010	13	23
CIS734033	DPDD3011	38	48
CIS734034	DPDD3011	48	58
CIS734035	DPDD3011	58	68
CIS734040	DPDD3012	38	48
CIS734043	DPDD3013	76	86
CIS734045	DPDD3014	38	48
CIS734046	DPDD3014	48	58
CIS734053	DPDD3016	39	49
		Resource Au (g/t)	**Head Grade Assay (Avg Au g/t)**
		1.42	1.37

13.3 Comminution Testwork

13.3.1 Overview

Comminution testwork was conducted on 43 samples of oxide, transition and fresh material from the nine deposits to determine the variability of comminution parameters throughout the deposit / orebody and allow parameters for design of the comminution circuit to be derived. The 43 samples consisted of 4 oxide, 30 fresh and 9 transition selected from throughout the Doropo mineralised zones.

Comminution tests conducted included the following:

- Unconfined Compressive Strength (UCS).
- Bond Crushing Work Index (BCWi).
- Bond Rod Mill Work Index (BRWi).
- Bond Ball Mill Work Index (BBWi).

- SAG Mill Comminution value (SMC).
- Abrasion index (Ai).
- In-situ Specific Gravity (SG).

All tests were conducted at ALS Perth and the results from the SMC tests were interpreted and ranked by JKTech.

13.3.2 Sample Selection

A summary of the samples selected for the PFS comminution testwork programme is provided in Table 13.3.1.

Table 13.3.1 Comminution Testwork Samples

Deposit	Sample Name	Drill Hole	Depth		Weathering	Lithology	Alteration
			From (m)	To (m)			
Souwa	Souwa Oxide	DPDD1517	0	10	Oxide		
	Souwa Transition	DPDD1462	22.5	32.5	Transition		
	Souwa Fresh 1	DPDD1520	60	70	Fresh	Granodiorite	Sericite
	Souwa Fresh 2	DPDD1523	133	143	Fresh	Granodiorite	Veining
	Souwa Fresh 3	DPDD1527	96	103	Fresh	Granodiorite	Hematite
	Souwa Fresh 4	DPDD1382	79	90	Fresh	Granodiorite	Chlorite & Hematite & Silica
	Souwa Fresh 5	DPDD1473	80	87	Fresh	Granodiorite + Vein	Silica & Sericite
Nokpa	Nokpa Transition	DPDD1533	12.5	21.5	Transition	Saprolite	Veining
	Nokpa Fresh 1	DPDD1528	81	88	Fresh	Granodiorite	
	Nokpa Fresh 2	DPDD1531	108	118	Fresh	Granodiorite	Veining
	Nokpa Fresh 3	DPDD1425	120	137.7	Fresh	Granodiorite + Vein	Hematite & Silica

Deposit	Sample Name	Drill Hole	Depth		Weathering	Lithology	Alteration
			From (m)	To (m)			
Chegue Main	Chegue Main Oxide	DPDD1541	5	11	Oxide	Saprolite	Clay Undiff
	Chegue Main Transition	DPDD1541	21	26	Transition	Saprock	Limonite
	Chegue Main Fresh 1	DPDD1536	75	80	Fresh	Granodiorite	Sericite
	Chegue Main Fresh 2	DPDD1537	52	57	Fresh	Stockwork veins	Silica
	Chegue Main Fresh 3	DPDD1538	78	83	Fresh	Granodiorite	Hematite
	Chegue Main Fresh 4	DPDD1543	65	70	Fresh	Vein (>10cm)	Silica
	Chegue Main Fresh 5	DPDD1494	50	58	Fresh	Granodiorite + Vein	Silica & Sericite
Chegue South	Chegue South Transition	DPDD1551	23	28	Transition	Saprock + Vein	Limonite + Clay
	Chegue South Fresh 1	DPDD1544	55	61	Fresh	Granodiorite	Hematite
	Chegue South Fresh 2	DPDD1549	82	90	Fresh	Granodiorite + Vein	Chlorite + Sericite
Kekeda	Kekeda Transition 1	DPDD1554	38	47	Transition	Saprock & Stockwork Veins	Epidote & Limonite
	Kekeda Transition 2	DPDD1559	39	46	Transition	Granodiorite	Silica & Sericite
	Kekeda Fresh 1	DPDD1554	57	64	Fresh	Granodiorite with Veins	Sericite
	Kekeda Fresh 2	DPDD1556	49	53	Fresh	Vein	Silica
	Kekeda Fresh 3	DPDD1558	68	73	Fresh	Granodiorite	Sericite & Hematite
	Kekeda Fresh 4	DPDD1479	44	50.3	Fresh	Granite + Vein	Sericite & Hematite & Silica & Epidote
Han	Han Transition	DPDD1562	12	17	Trans / Fresh	Granodiorite	Sericite
	Han Fresh 1	DPDD1564	81	86	Fresh	Granodiorite	Hematite
	Han Fresh 2	DPDD1561	61	67	Fresh	Granodiorite	Chlorite & Hematite bands
	Han Fresh 3	DPDD1565	48	54	Fresh	Granodiorite	Chlorite
Enioda	Enioda Oxide 1	DPDD1571	20	27	Oxide	Saprock & Vein	Hematite & Limonite
	Enioda Oxide 2	DPDD1574	10	20	Oxide	Saprolite	Hematite & Limonite
	Enioda Fresh 1	DPDD1567	79	86	Fresh	Granodiorite	Chlorite & Hematite
	Enioda Fresh 2	DPDD1573	78	85	Fresh	Granodiorite	Sericite & Hematite & Silica

Deposit	Sample Name	Drill Hole	Depth		Weathering	Lithology	Alteration
			From (m)	To (m)			
Attire	Attire Transition	DPDD1580	30	39	Transition	Saprock	Hematite
	Attire Fresh 1	DPDD1578	55	60	Fresh	Granodiorite	Chlorite & Hematite
	Attire Fresh 2	DPDD1575	73	81	Fresh	Granodioritic, Gneiss & Vein	Sericite & Hematite & Silica
Kilosegui	Kilosegui Transition	DPDD3012	23	28	Transition	Saprock	Sericite & Hematite & Silica
	Kilosegui Fresh 1	DPDD3008	37	42	Fresh	Granodiorite with small Veins	Sericite & Hematite & Silica
	Kilosegui Fresh 2	DPDD3010	28	33	Fresh	Granodiorite	Hematite
	Kilosegui Fresh 3	DPDD3011	63	68	Fresh	Granodiorite with large Qtz Vein	Sericite & Hematite & Silica
	Kilosegui Fresh 4	DPDD3013	91	96	Fresh	Granodiorite	Hematite

13.3.3 SMC Tests

A series of SMC tests were performed on 36 of the comminution samples. A summary of the SMC test results and the derived parameters is presented in Table 13.3.2 and Table 13.3.3.

Table 13.3.2 SMC Tests

Test Sample	DWi (kWh/m^3)	DWi (%)	Mia (kWh/t)	Mih (kWh/t)	Mic (kWh/t)	S.G.
Attire Fresh 1	6.8	52	19.7	14.6	7.6	2.69
Attire Fresh 2	7.4	60	21	15.8	8.2	2.71
Attire Trans	2.3	6	8.6	5.1	2.7	2.57
Chegue Main Fresh 1	6.8	53	20	14.8	7.7	2.68
Chegue Main Fresh 2	6.4	46	18.8	13.8	7.1	2.67
Chegue Main Fresh 3	6	41	18.2	13.2	6.8	2.65
Chegue Main Fresh 4	5.8	38	17.4	12.5	6.4	2.68
Chegue Main Trans	0.5	<1	2.7	1.2	0.6	2.48
Chegue South Fresh 1	7.2	58	20.8	15.7	8.1	2.68
Chegue South Fresh 2	7.4	60	21	15.8	8.2	2.72
Chegue South Trans	3.3	12	11.5	7.4	3.8	2.56
Enioda Fresh 1	8.6	74	23.6	18.4	9.5	2.7
Enioda Fresh 2	6.9	53	19.7	14.6	7.6	2.73
Enioda Oxide 1	2.5	7	10.4	6.3	3.3	2.29
Han Fresh 1	5.8	38	17.5	12.5	6.5	2.67
Han Fresh 2	7.3	59	20.9	15.7	8.1	2.7
Han Fresh 3	5.7	38	17.2	12.4	6.4	2.69
Han Trans/Fresh	3.2	12	11	7	3.6	2.65
Kekeda Fresh 1	6.1	43	18.1	13.2	6.8	2.7
Kekeda Fresh 2	4.5	23	14.2	9.7	5	2.68
Kekeda Fresh 3	5.7	38	17.1	12.2	6.3	2.72
Kekeda Trans 1	1.5	3	6.3	3.4	1.8	2.58
Kekeda Trans 2	2.8	9	10.2	6.3	3.3	2.58
Kilosequi Fresh 1	4.8	27	15.7	10.8	5.6	2.57
Kilosequi Fresh 2	4.3	21	13.9	9.4	4.9	2.63
Kilosequi Fresh 3	5.1	30	15.8	11	5.7	2.68
Kilosequi Fresh 4	5.5	35	17.3	12.3	6.4	2.58
Kilosequi Trans 1	2.6	8	9.4	5.7	3	2.6
Nokpa Fresh 1	3.1	11	10.7	6.8	3.5	2.66
Nokpa Fresh 2	4.7	25	14.8	10.2	5.3	2.67
Nokpa Transition	3.1	11	11	7	3.6	2.58
Souwa Fresh 1	5.8	39	17.6	12.6	6.5	2.67
Souwa Fresh 2	6.8	51	19.7	14.6	7.6	2.69
Souwa Fresh 3	7.5	61	21.3	16.1	8.3	2.68
Souwa Oxide	0.8	1	4	1.9	1	2.32
Souwa Transition Saprolite	2.6	8	9.6	5.8	3	2.56

Table 13.3.3 SMC Parameters

Test Sample	A	b	A * b	ta	SCSE (kWh/t)
Attire Fresh 1	73.6	0.54	39.7	0.38	9.88
Attire Fresh 2	75	0.49	36.8	0.35	10.29
Attire Trans	68.8	1.64	112.8	1.14	6.57
Chegue Main Fresh 1	66	0.59	38.9	0.38	9.96
Chegue Main Fresh 2	66.4	0.63	41.8	0.41	9.62
Chegue Main Fresh 3	63.4	0.69	43.7	0.43	9.4
Chegue Main Fresh 4	65.4	0.71	46.4	0.45	9.2
Chegue Main Trans	77.1	6.23	480.3	5.02	4.88*
Chegue South Fresh 1	77.8	0.48	37.3	0.36	10.15
Chegue South Fresh 2	69.7	0.53	36.9	0.35	10.29
Chegue South Trans	61.8	1.28	79.1	0.80	7.38
Enioda Fresh 1	80.2	0.39	31.3	0.30	11.1
Enioda Fresh 2	69.7	0.57	39.7	0.38	9.96
Enioda Oxide 1	67.6	1.36	91.9	1.04	7.24
Han Fresh 1	75	0.62	46.5	0.45	9.18
Han Fresh 2	78.2	0.47	36.8	0.35	10.27
Han Fresh 3	73.4	0.64	47	0.45	9.17
Han Trans/Fresh	69.6	1.19	82.8	0.81	7.28
Kekeda Fresh 1	76	0.58	44.1	0.42	9.44
Kekeda Fresh 2	72.6	0.82	59.5	0.58	8.28
Kekeda Fresh 3	69.9	0.68	47.5	0.45	9.17
Kekeda Trans 1	68.1	2.47	168.2	1.69	5.87
Kekeda Trans 2	69.9	1.31	91.6	0.92	7.02
Kilosequi Fresh 1	73.2	0.73	53.4	0.54	8.57
Kilosequi Fresh 2	77.5	0.79	61.2	0.60	8.15
Kilosequi Fresh 3	70.5	0.75	52.9	0.51	8.7
Kilosequi Fresh 4	70.9	0.66	46.8	0.47	9.06
Kilosequi Trans 1	73.4	1.37	100.6	1	6.81
Nokpa Fresh 1	60	1.42	85.2	0.83	7.22
Nokpa Fresh 2	69.3	0.82	56.8	0.55	8.43
Nokpa Transition	69.1	1.21	83.6	0.84	7.24
Souwa Fresh 1	76.4	0.60	45.8	0.44	9.24
Souwa Fresh 2	79.4	0.50	39.7	0.38	9.89
Souwa Fresh 3	84.6	0.43	36.4	0.35	10.28
Souwa Oxide	74.8	4.07	304.4	3.4	5.44
Souwa Transition Saprolite	65.9	1.51	99.5	1.01	6.84

The drop weight index (DWi) is a measure of the strength of the rock when broken under impact conditions. The fresh ore has medium competency. Transition ore has moderate competency. The oxide ore has low to moderate competency.

The A x b value indicates the material's resistance to impact breakage. As there is an inverse relationship between the DWi and the product of the 'A' and 'b' rock breakage parameters, a lower A x b value represents a greater ore hardness. In general, ore types which return A x b values of less than ~40 are considered hard. JK Tech Axb results ranged from 31.3 to 480.3. The average Axb parameters in increasing order of competency were: 198 for oxide ore, 144 for transitional ore and 49 for fresh ore. An A x b of 37.2 for fresh and 84.2 for oxide were selected for design.

13.3.4 Comminution Tests

The comminution testwork results are summarised in Table 13.3.4 and illustrated graphically in Figure 13.3.1 with the following salient outcomes:

- The fresh ore has medium competency, moderate to high grinding energy requirements and is moderately abrasive. Transition ore has moderate competency with average grinding energy requirements and is moderately abrasive. The oxide ore has low to moderate competency with average to high grinding energy requirements and is low to moderately abrasive.

- Crushing work indices results ranged from 1.6 to 15.8 kWh/t, averaging 8.3 kWh/t over the complete set of samples. The crushing work indices are low to medium, indicating a low crushing energy requirement. The maximum BCWi values, ranging from 4.1 to 15.8 kWh/t were for the Kekeda ores, with an 85th percentile value of 14.9 kWh/t.

- Rod mill work indices results ranged from 7.2 to 21.4 kWh/t. A BRWi of 18.5 kWh/t for fresh and 14.9 for oxide were selected for design.

- BBWi results ranged from 11 to 22.2 kWh/t. The Bond ball mill indices are medium to high indicating a high grinding energy requirement. Selected 85th percentile data for design were 20.4 kWh/t for oxide and 18.5 kWh/t for fresh.

- The abrasion indices measured ranged from very low at 0.018 to medium at 0.38. The oxide samples demonstrated the highest abrasion indices, averaging 0.248. Selected 85th percentile data for design were 0.248 for oxide and 0.20 for fresh ores.

Table 13.3.4 Comminution Testwork Results Summary

Oxidation	Ore Type	Sample Name	Ai (g)	BRWi (kWh/t)	BBWi (kWh/t)	Avg BCWi (kWh/t)	Avg UCS (Mpa)
Transition	Attire	Attire Transition	0.122		16.6	5.0	-
Fresh	Attire	Attire Fresh1	0.116		17.2	11.3	73
Fresh	Attire	Attire Fresh2	0.072		18.7	10.8	87
Oxide	Chegue Main	Chegue Main Oxide	-	-	19.8	-	-
Transition	Chegue Main	Chegue Main Transition	0.045	7.2	12.6	1.6	-
Fresh	Chegue Main	Chegue Main Fresh1	0.120	18.2	17.7	8.8	60
Fresh	Chegue Main	Chegue Main Fresh2	0.347	18.7	16.8	11.0	44
Fresh	Chegue Main	Chegue Main Fresh3	0.125	17.2	16.9	2.1	-
Fresh	Chegue Main	Chegue Main Fresh4	0.380	17.4	17.7	12.3	40
Fresh	Chegue Main	Chegue Main Fresh5	0.191	17.3	17.8	6.5	40
Transition	Chegue South	Chegue South Transition	0.214	11.9	16.1	1.8	14
Fresh	Chegue South	Chegue South Fresh1	0.291	17.9	19.4	13.3	38
Fresh	Chegue South	Chegue South Fresh2	0.161	19.4	18.5	10.7	85
Oxide	Enioda	Enioda Oxide1	0.360	-	18.3	3.9	-
Oxide	Enioda	Enioda Oxide2	-	-	22.2	-	-
Fresh	Enioda	Enioda Fresh1	0.244	21.4	16.9	13.5	134
Fresh	Enioda	Enioda Fresh2	0.155	17.8	16.6	7.9	56
Transition	Han	Han Transition	0.168	11.8	17.0	7.8	88
Fresh	Han	Han Fresh1	0.251	16.3	19.4	14.6	98
Fresh	Han	Han Fresh2	0.223	17.4	17.8	10.6	99
Fresh	Han	Han Fresh3	0.262	15.3	17.2	9.1	94
Transition	Kekeda	Kekeda Transition1	0.135	10.6	14.0	4.1	34
Transition	Kekeda	Kekeda Transition2	0.119	12.5	15.2	12.1	37
Fresh	Kekeda	Kekeda Fresh1	0.217	18.1	16.4	13.8	106
Fresh	Kekeda	Kekeda Fresh2	0.162	14.3	17.1	7.1	83
Fresh	Kekeda	Kekeda Fresh3	0.172	17.4	17.3	15.8	93
Fresh	Kekeda	Kekeda Fresh4	0.163	13.3	16.1	6.2	93
Transition	Kilosegui	Kilosegui Transition	0.062	12.3	11.0	-	-
Fresh	Kilosegui	Kilosegui Fresh1	0.315	16.5	16.5	9.9	60
Fresh	Kilosegui	Kilosegui Fresh2	0.309	12.7	16.1	10.4	128
Fresh	Kilosegui	Kilosegui Fresh3	0.183	16.4	16.7	10.3	96
Fresh	Kilosegui	Kilosegui Fresh4	0.193	17.3	16.7	10.4	82
Transition	Nokpa	Nokpa Transition	0.326	15.9	19.7	-	-
Fresh	Nokpa	Nokpa Fresh1	0.018	15.7	18.3	3.1	-
Fresh	Nokpa	Nokpa Fresh2	0.122	16.0	17.9	5.6	22
Fresh	Nokpa	Nokpa Fresh3	0.113	18.4	19.6	4.6	22
Oxide	Souwa	Souwa Oxide	0.136	11.9	17.5	-	-
Transition	Souwa	Souwa Transition	0.148	12.7	13.6	2.9	-
Fresh	Souwa	Souwa Fresh1	0.223	16.6	15.9	4.8	22
Fresh	Souwa	Souwa Fresh2	0.267	17.9	17.8	9.3	30
Fresh	Souwa	Souwa Fresh3	0.255	18.8	17.7	10.0	54
Fresh	Souwa	Souwa Fresh4	0.169	16.5	16.9	6.9	54
Fresh	Souwa	Souwa Fresh5	0.145	16.3	17.0	5.3	54
85^{th} Percentile	All Samples		0.190	15.8	17.1	8.3	66
85^{th} Percentile	Fresh		0.199	17.0	17.4	9.2	70
85^{th} Percentile	Oxide		0.248	11.9	19.4	3.9	-
85^{th} Percentile	Transition		0.149	11.9	15.1	5.0	43

Figure 13.3.1 Ore Comminution Characteristics

13.3.5 Comminution Testwork – Results Interpretation

The results of the PFS comminution testwork programme conducted on 36 ore samples across all predominant lithologies and weathered rock types were forwarded to Orway Mineral Consultants Pty Ltd (OMC) for interpretation. Based on the testwork results and on the mine schedule information, OMC developed a milling circuit design to provide sufficient flexibility to accommodate all ore types likely to be processed. The circuit configuration and mill selection were based on a circuit treating 4,000,000 tpa of fresh ore to achieve a grind P_{80} of 75 µm.

13.4 PFS Master Composite Head Assays

Quadruplicate / replicate gold fire assay, screen fire assay and multi-element head analyses were completed on 27 master composite samples of oxide, transition and fresh material from the nine deposits are presented in Table 13.4.1. The following comments can be made in reference to these results:

- Samples showed a wide gold distribution, with head grades ranging from 0.30 g Au/t to 14.7 g Au/t. The quadruplicate / replicate gold assays for a number of composites varied significantly which may indicate the presence of coarse gold (i.e. the nugget effect). To improve the reproducibility of the testwork and minimise the impact of nuggets on head assay determination a gravity concentration step was adopted for all testwork. Preliminary testwork also highlighted the high proportion of gravity recoverable gold also verifying the requirement to use a gravity recovery stage in testwork to enhance reproducibility and potentially overall recovery.

- Han transitional (MC19) sample has the highest gold head grade with an average of 13.3 g Au/t. The Chegue Main transitional, Kekeda transitional, Souwa oxide and Souwa transitional have low head assays with Souwa oxides being the lowest grade samples (<0.5 g Au/t).

- The silver head grade was <2.0 g Ag/t over the complete set of samples. Silver extraction was monitored in the subsequent testwork however, as the head grade is not high, silver is not a significant metallurgical issue. Design of the CIL, elution and electrowinning circuits did consider the amount of silver and gold in the ore. All metallurgical testwork conducted included gold and silver assays, however, the majority of tables presented in this report only include the metallurgical performance of the value metal gold. Where applicable silver assays are reported. Full details of silver assays are included in the ALS metallurgical testwork report.

- Deleterious elements mercury, arsenic and antimony are low in the composites and should not present an environmental or occupational health risk in the elution or electrowinning circuits.

- Organic carbon levels are low for all composites (<0.04% C_{org}) and preg-robbing due to the presence of organic carbon is not expected to occur.

Table 13.4.1 Selected Elemental Head Assays of Master Composites

Ore Type	Sample ID	Au (1) (g/t)	Au (2) (g/t)	Au (3) (g/t)	Au (4) (g/t)	Au (Avg.) (g/t)	Ag (g/t)	As (ppm)	C Organic (%)	Cu ppm	$S^{(tot)}$ (%)	$S^{(2-)}$ (%)	Solid SG (kg/m^3)
Attire Trans	MC23	2.68	2.42	1.92	1.93	2.24	<2	<10	-	12	-	-	2724
Attire Fresh	MC24	0.93	0.87	1.61	1.75	1.29	<2	<10	-	18	-	-	2747
Chegue Main Oxide	MC3	0.67	1.93	1.03	-	1.21	<2	<10	<0.03	44	<0.02	<0.02	2668
Chegue Main Oxide	MC14	1.67	0.96	1.17	0.68	1.12	-	-	<0.03	-	<0.02	<0.02	2732
Chegue Main Trans	MC4	0.37	0.71	0.34	-	0.47	<2	<10	<0.03	12	<0.02	<0.02	2698
Chegue Main Fresh	MC15	1.94	1.81	2.66	2.79	2.30	-	-	-	-	-	-	2692
Chegue South Trans	MC5	1.49	1.37	1.51	-	1.46	<2	<10	0.03	16	0.06	0.06	2716
Chegue South Trans	MC16	1.43	1.37	1.64	1.69	1.53	<2	<10	-	12	-	-	2729
Chegue South Fresh	MC17	2.99	3.16	5.31	5.62	4.27	-	-	-	-	-	-	2747
Enioda Oxide	MC21	0.94	0.85	0.82	1.75	1.09	2	<10	-	48	-	-	2710
Enioda Trans	MC22	2.02	2.69	3.52	1.88	2.53	<2	<10	<0.03	46	-	-	2633
Enioda Fresh	MC27	1.97	1.33	1.46	17.10	5.47	<2	<10	(0.03	28	-	-	2673
Han Trans	MC19	14.3	9.55	14.7	14.7	13.31	<2	<10	-	20	-	-	2738
Han Fresh	MC20	4.42	3.25	3.23	3.82	3.68	-	-	-	-	-	-	2758
Kekeda Trans	MC6	0.59	0.58	0.75	0.84	0.69	<2	30	<0.03	16	0.42	0.18	2659
Kekeda Fresh	MC18	4.08	4.36	3.00	2.81	3.56	-	-	-	-	-	-	2710
Kilosegui Trans	MC25	1.57	1.42	2.07	2.09	1.79	<2	<10		10			2733
Kilosegui Fresh	MC7	1.58	1.71	0.98	1.04	1.33	<2	30	<0.03	8	0.3	0.24	2638
Nokpa Trans	MC12	2.06	1.71	2.23	2.41	2.10	-	-	-	-	-	-	2680
Nokpa Fresh	MC13	1.60	1.93	1.64	1.79	1.74	-	-	-	-	-	-	2729
Souwa Oxide	MC1	0.26	0.26	0.29	-	0.27	<2	<10	<0.03	38	<0.02	<0.03	2675
Souwa Oxide	MC8	0.33	0.31	0.37	0.30	0.33	-	-	-	-	-	-	-
Souwa Oxide	MC9	0.37	0.41	0.53	0.37	0.42	-	-	-	-	-	-	-
Souwa Oxide	MC26	0.56	0.57	0.42	0.44	0.50	-	-	-	-	-	-	-
Souwa Trans	MC2	0.55	0.80	0.83	-	0.73	<2	<10	<0.03	24	0.04	0.02	2706
Souwa Trans	MC10	0.48	0.49	0.58	0.53	0.52	-	-	-	-	-	-	2679
Souwa Fresh	MC11	2.10	2.08	2.60	3.03	2.45	-	-	-	-	-	-	2724

13.5 Carbon-in-Leach (CIL) Testwork – Comminution Samples

All comminution samples were subjected to cyanidation testwork conducted as CIL (i.e. carbon used in leach tests) under the following test conditions:

- P_{80} grind of 106 µm.
- Bottle roll leaches at pulp density of 45% solids in Perth tap water.
- pH was adjusted to >9.8 with commercial lime (60% available CaO).
- Initial cyanide dosage of 0.9-1.25 kg/t NaCN with residual cyanide levels maintained at or above 250 ppm.
- Oxygen sparging to achieve dissolved oxygen level of 20 ppm or greater.
- 20 g/L activated carbon (CIL).
- 40 hour leach duration with samples at 2, 4, 8, 12, 24, 36 and 40 hours.

The samples were tested in the presence of activated carbon. Results from testwork are shown graphically in Figure 13.5.3.

Testwork results indicate:

- Gold recoveries are high at an average of 90.7% for oxide, 92% for transition and 83.5% for fresh ores. Gold extraction for oxides and transitional ores were effectively complete in approximately 24 hours, however, gold extraction for some fresh ores was not complete until 40 hours leach time.
- The gold extraction rate for all composites was very fast with 99% of the leachable gold extracted within the first 8 hours as shown in Figure 13.5.3. The silver leaching rate was lower with an average recovery of 32.5%. Silver extraction was essentially completed in 24 hours.

An average cyanide consumption of 0.75 kg/t was observed for the samples with a range of 0.24 to 1.37 kg/t (Figure 13.5.1). An average lime consumption (60% available CaO) of 0.26 kg/t was observed with a range of 0.13 kg/t to 1.32 kg/t (Figure 13.5.2).

Figure 13.5.1 Cyanide Consumption for Comminution Samples - CIL tests

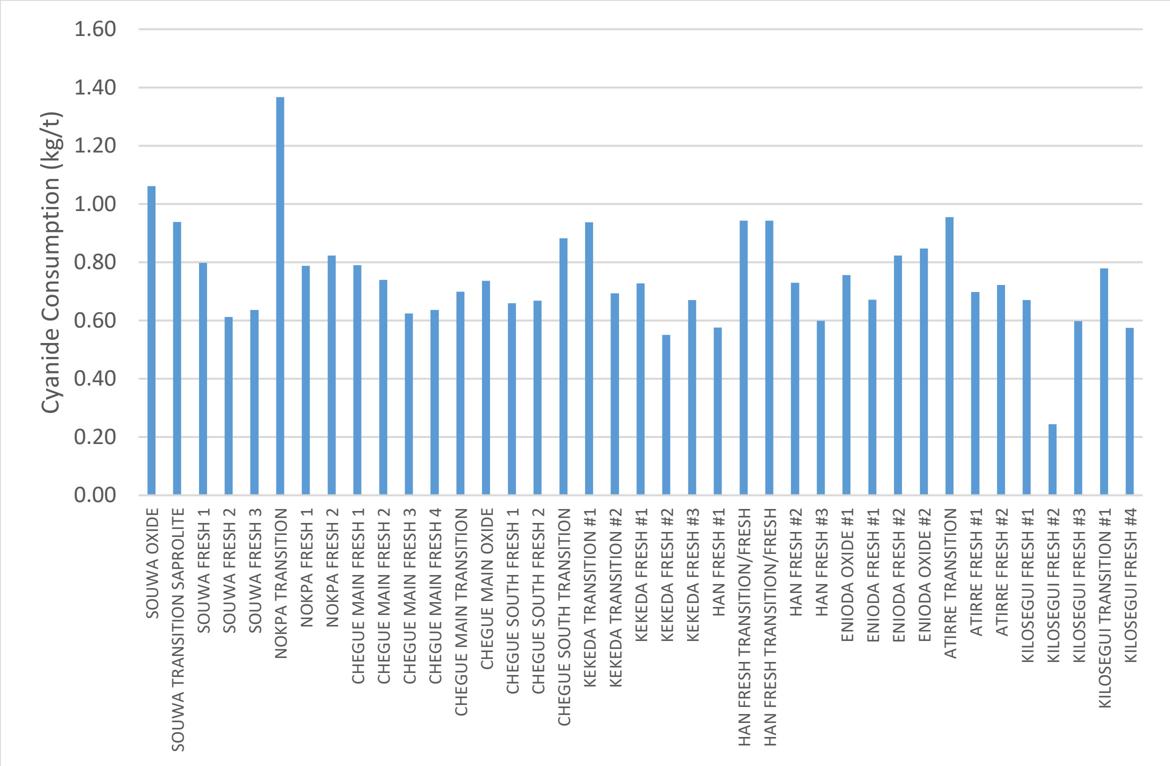


Figure 13.5.2 Lime Consumption for Comminution Samples - CIL tests

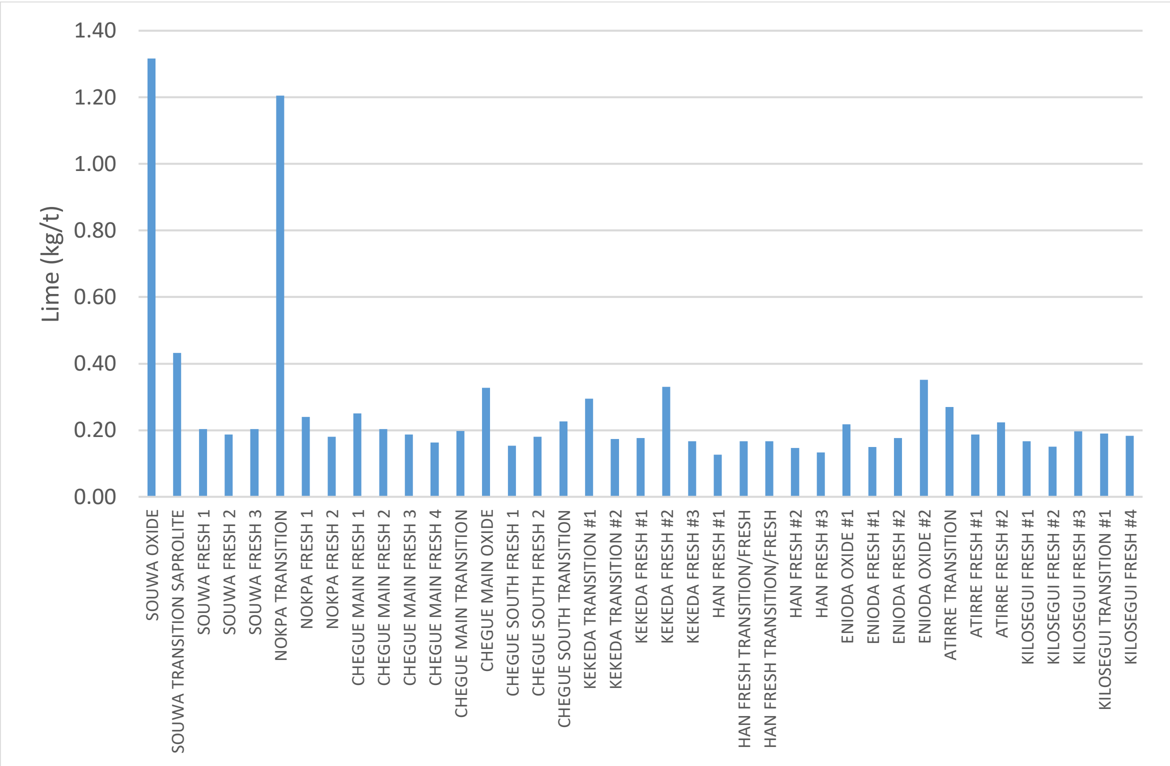
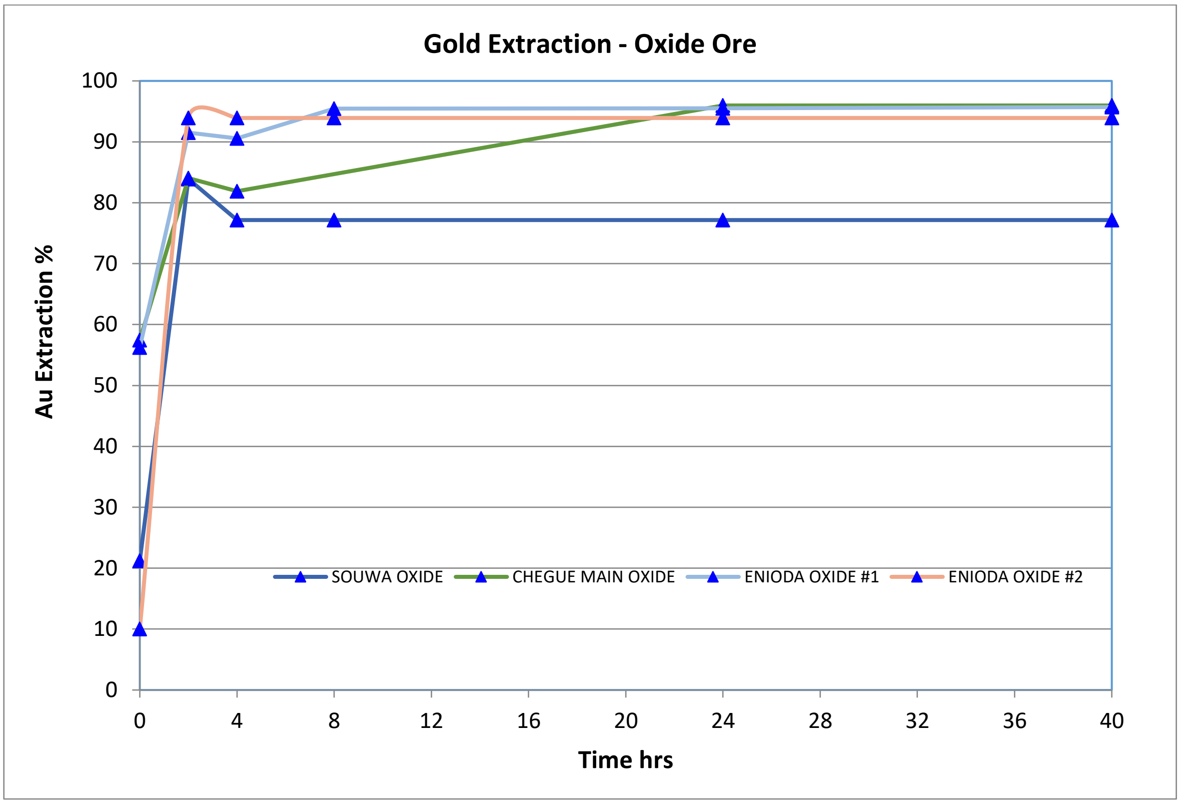
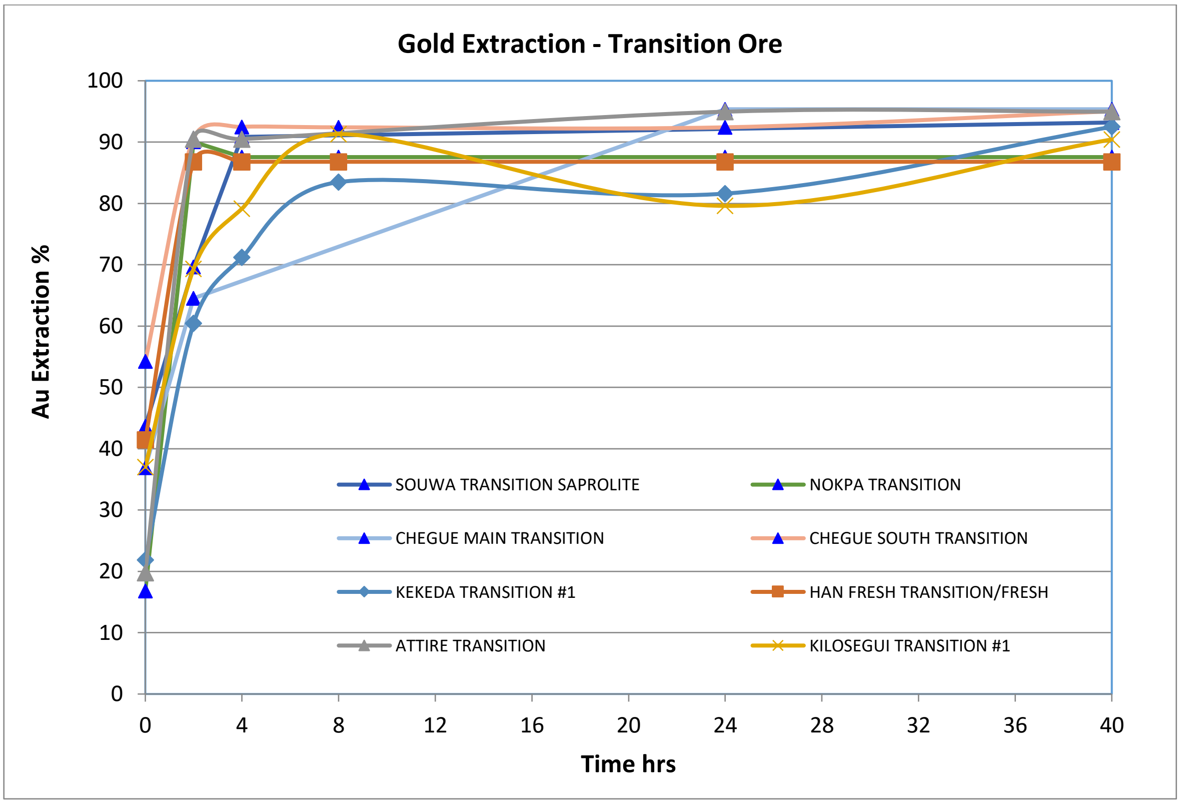
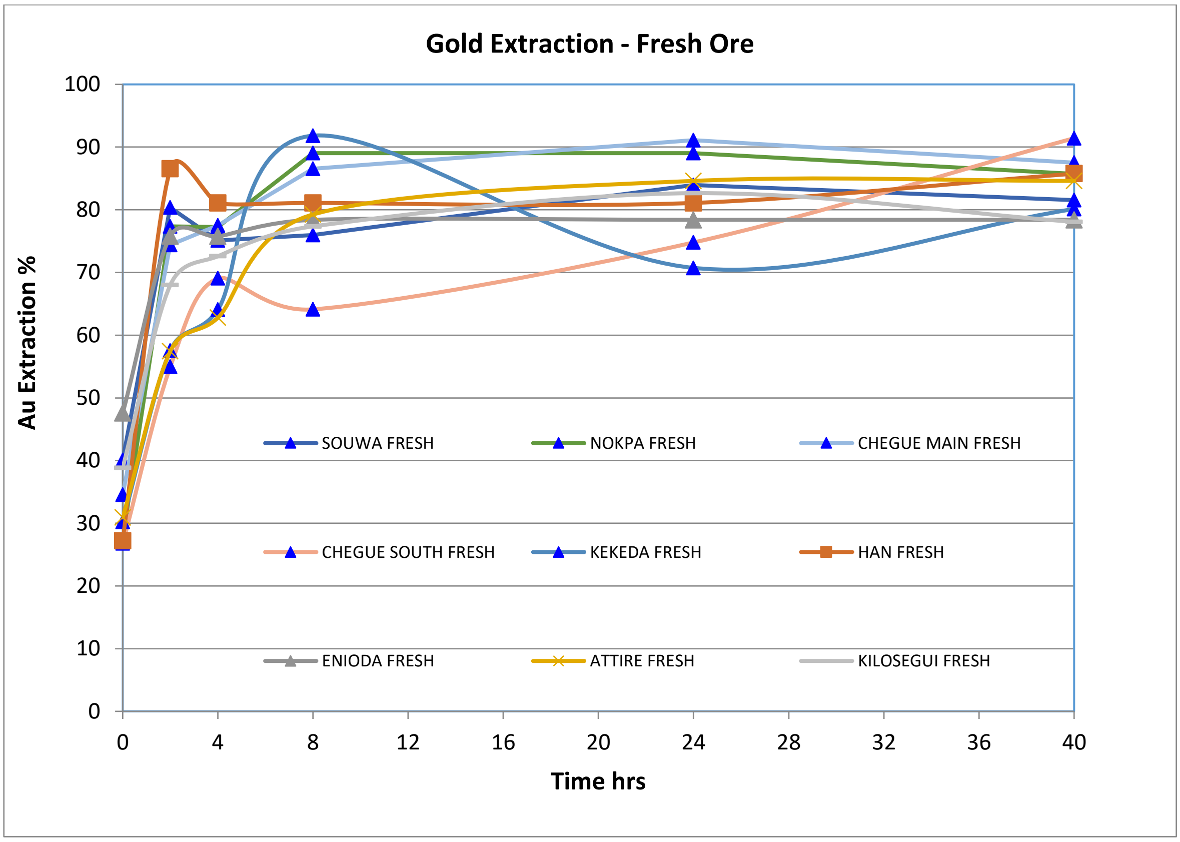


Figure 13.5.3 Gold Extraction for Comminution Samples - CIL Tests







13.6 Grind / Extraction Testwork

Grind / extraction tests with removal of gravity gold prior to leaching were performed on the master composites at grind size P_{80}'s of 125, 106 and 75 µm to determine the effect of grind size and gravity on gold and silver extraction. This phase of testwork also allowed an assessment of the cyanidation leach time likely to be needed to ensure high dissolution of gold for all weathering types and deposits.

The cyanidation testwork was conducted as bottle rolls under the following conditions:

- Gravity concentration by Knelson concentrator, amalgamation and leaching of gravity tailings (gravity tests only).
- Bottle roll leaches at pulp density of 45% solids in Perth tap water.
- pH 10.0 to 10.5 adjusted with commercial lime (60% available CaO).
- Initial cyanide dosage of 1.22 kg/t NaCN with residual cyanide levels maintained at or above 500 ppm.
- Oxygen sparging to achieve dissolved oxygen level of 20 ppm or greater.
- 40 hour leach duration with samples at 2, 4, 8, 12, 24, 36 and 40 hours.

For the gravity testwork, each composite was ground to the coarsest grind size (P_{80} 125 µm) and processed in a Knelson concentrator to produce a gravity concentrate and tail. Free gold in the gravity concentrate was recovered using mercury with the amalgam assayed to extinction to determine the contained gold. The amount of silver in the amalgam was not determined using this method. Amalgam tails (gravity concentrate with free gold removed) and gravity tails were recombined and milled to the required grind size prior to leaching.

The gravity / leaching results are summarised in Table 13.6.4 and illustrated graphically in Figure 13.6.1 and Figure 13.6.2. The results typically indicate:

- For all samples tested, recoveries to gravity concentrate were between 16 to 84% Au (average 48%) in the ore type composites. Table 13.6.1 summarises the gravity recoveries by ore type reported for the grind sensitivity testwork. The sample Enioda Oxide (MC-21) with the calculated head grade (3.27 g Au/t) had the highest gravity recoverable gold component of 84%.

Table 13.6.1 Gravity Recovery Summary by Ore Type

Ore Type	Minimum	Average	Maximum
Oxide	38.6%	55.9%	83.8%
Transitional	16.1%	41.8%	73.1%
Fresh	36.5%	52.1%	64.4%

- The average residue grade for the samples was 0.15 g Au/t and ranged from 0.03 to 0.70 g Au/t. The average overall gold recovery (gravity + cyanide leach) was 92% (range of 82 – 99%).
- Leach rate graphs (Figure 13.6.1) show rapid gold dissolution in all cases.
- Lower residue grades and higher gold and silver recoveries with increasing fineness of grind for most of the samples.
- Faster gold and silver leaching rates with increasing fineness of grind.
- An average cyanide consumption of 0.19 kg/t was observed for the master composite samples with a range of 0.12 to 0.30 kg/t. An average lime consumption (60% available CaO) of 0.62 kg/t was observed with a range of 0.25 kg/t to 1.61 kg/t. Table 13.6.2 and Table 13.6.3 summarise the cyanide and lime consumptions reported for the grind sensitivity testwork.

Table 13.6.2 Cyanide Consumption Summary by Ore Type

Ore Type	Minimum (kg/t)	Average (kg/t)	Maximum (kg/t)
Oxide	0.18	0.22	0.30
Transitional	0.12	0.19	0.30
Fresh	0.12	0.16	0.24

Table 13.6.3 Lime Consumption Summary by Ore Type

Ore Type	Minimum (kg/t)	Average (kg/t)	Maximum (kg/t)
Oxide	0.78	1.29	1.61
Transitional	0.32	0.61	0.87
Fresh	0.25	0.37	0.52

- Cyanide and lime consumptions were comparable across the grind size range.
- Leaching is effectively completed in 24 hours for the oxide and the majority of transition samples at all three grind sizes. Leach recovery continues to increase slowly from 36 to 40 hours for fresh ore samples.
- Inclusion of a gravity step improves the reproducibility of the testwork by removing any slow leaching coarse 'spotty' gold providing consistent grade gravity tails samples for subsequent testwork.

It was agreed at the time to select a grind size of 80% passing 106 µm for Oxide and Transitional samples and 80% passing 75 µm for Fresh samples for the purposes on ongoing testwork and the PFS process design basis. Further analysis is recommended to investigate potential recovery improvements if Oxide and Transitional samples were ground to 80% passing 75 µm.

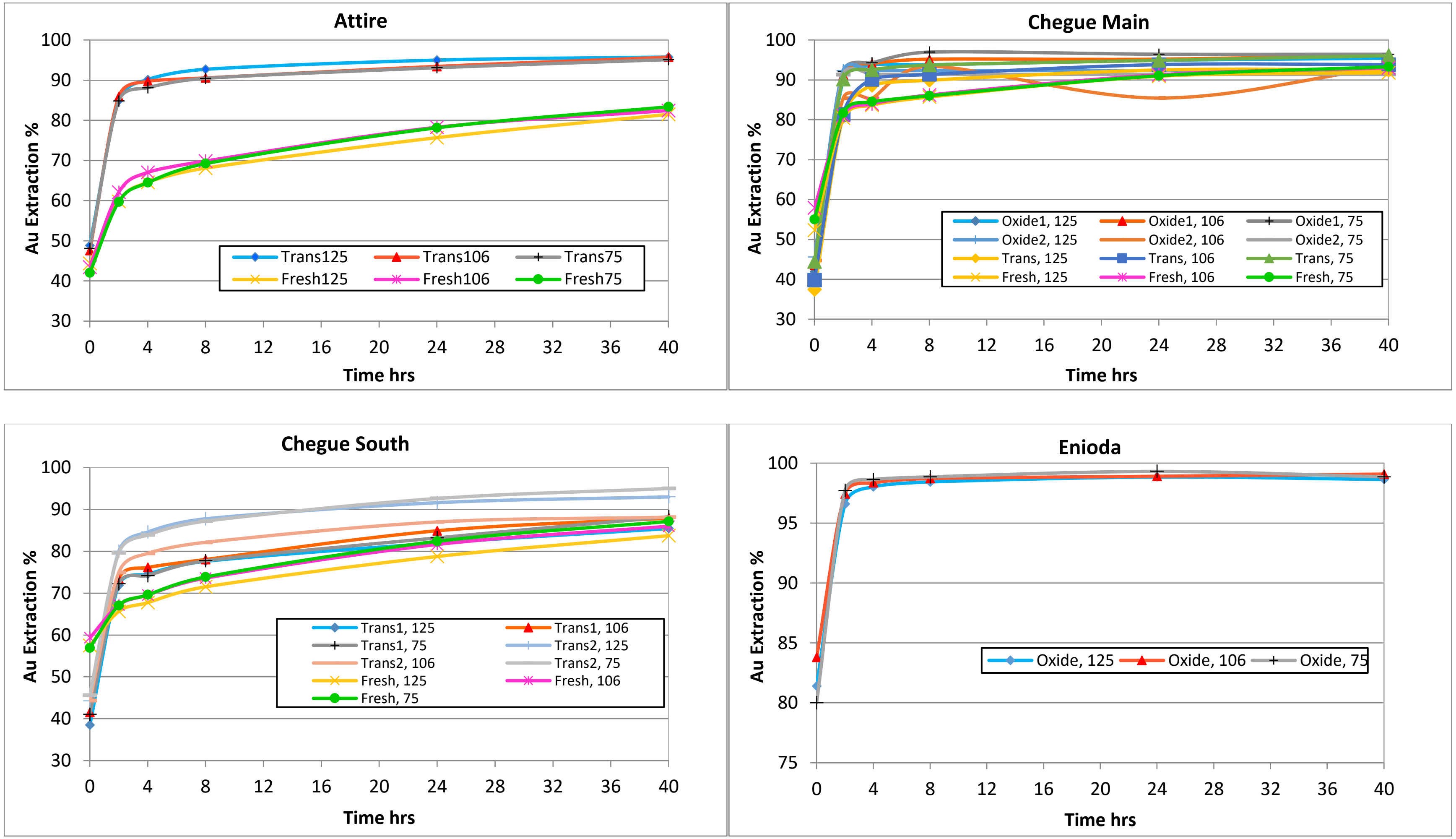
Table 13.6.4 Grind Size Sensitivity Testwork - Master Composites

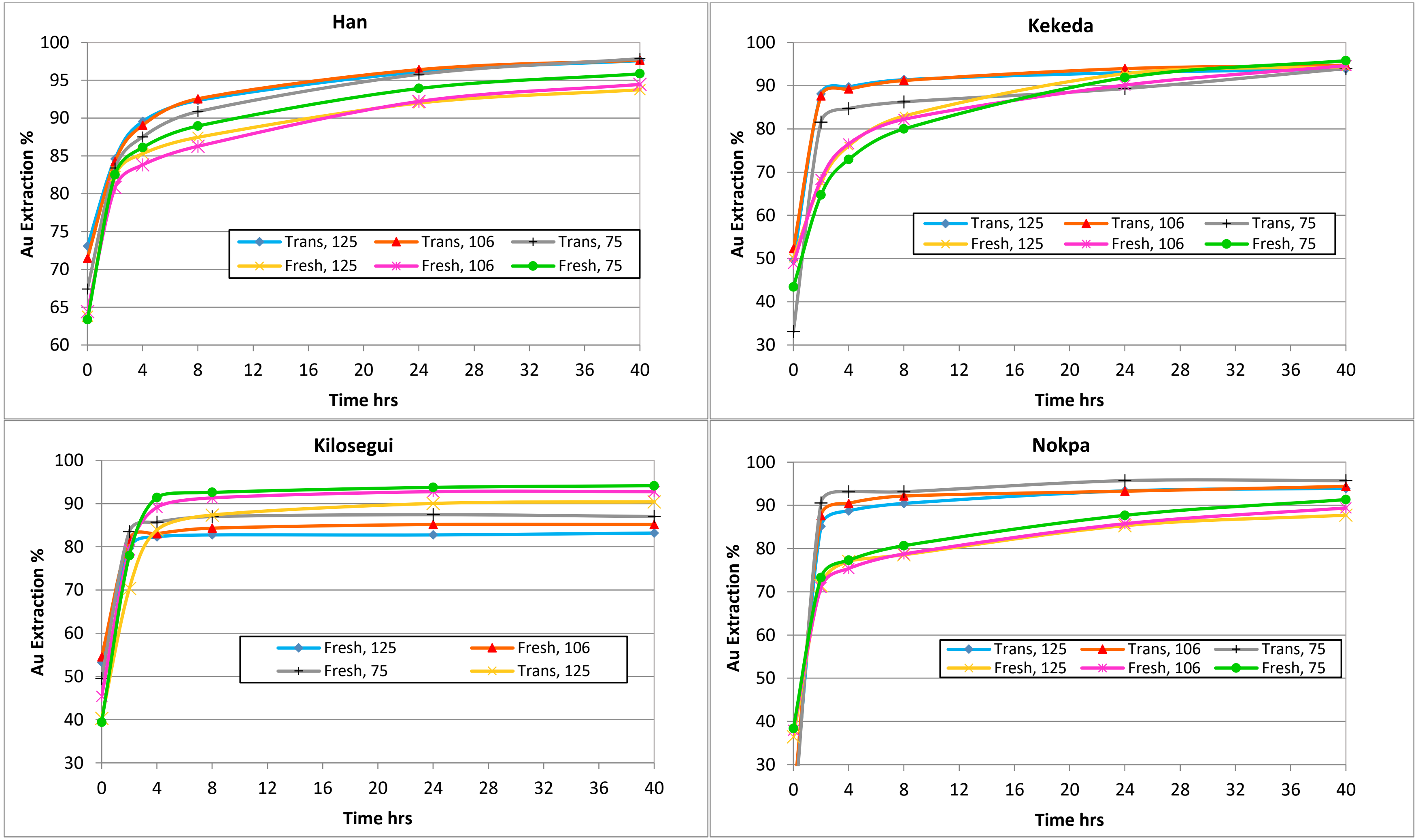
Sample ID	Cyanidation Grind P80 (µm)	Gravity Gold (%)	% Au Extraction @ hours					Au Grade (g/t)			Consumption (kg/t)	
			2	4	8	24	48	Assayed Head	Calc'd Head	Leach Residue	NaCN	Lime
MC23	125	48.8	85.0	90.1	92.7	95.0	95.7	2.24	2.35	0.10	0.25	0.59
Attire Transition	106	47.6	85.9	89.7	90.5	93.4	95.7	2.24	2.09	0.09	0.27	0.58
	75	48.1	84.8	88.1	90.5	93.1	95.1	2.24	2.05	0.10	0.27	0.52
MC24	125	44.3	59.8	64.6	68.1	75.7	81.5	1.29	1.03	0.19	0.12	0.46
Attire Fresh	106	43.5	62.1	67.0	69.9	78.3	82.4	1.29	0.85	0.15	0.14	0.48
	75	42.0	59.7	64.5	69.2	78.1	83.4	1.29	1.14	0.19	0.12	0.52
MC21	125	81.4	96.6	98.0	98.4	98.8	98.6	1.09	2.94	0.04	0.30	0.78
Enioda Oxide	106	83.8	97.4	98.4	98.7	98.9	99.1	1.09	3.27	0.03	0.24	0.92
	75	80.0	97.7	98.6	98.9	99.3	98.9	1.09	2.63	0.03	0.21	0.99
MC19	125	73.1	84.6	89.6	92.3	96.1	97.6	13.31	10.43	0.25	0.15	0.34
Han Trans	106	71.5	84.3	89.1	92.6	96.4	97.7	13.31	12.40	0.29	0.15	0.32
	75	67.4	83.4	87.5	90.9	95.8	97.9	13.31	12.62	0.27	0.15	0.42
MC20	125	63.8	82.3	85.3	87.5	92.0	93.8	3.68	3.04	0.19	0.15	0.52
Han Fresh	106	64.4	80.8	83.8	86.3	92.2	94.5	3.68	3.43	0.19	0.18	0.39
	75	63.3	82.5	86.1	89.0	93.9	95.9	3.68	3.38	0.14	0.18	0.48
MC7	125	53.3	79.7	82.3	82.8	82.8	83.2	1.37	1.37	0.23	0.15	0.30
Kilosegui Fresh	106	54.6	81.8	83.0	84.3	85.2	85.2	1.37	1.42	0.21	0.21	0.30
	75	49.6	83.5	85.7	87.0	87.4	87.0	1.37	1.39	0.18	0.24	0.34
MC25	125	40.3	70.3	83.9	87.4	90.0	90.4	1.79	1.57	0.15	0.12	0.49
Kilosegui Trans	106	45.4	79.3	89.2	91.3	92.8	92.8	1.79	1.66	0.12	0.12	0.48
	75	39.5	78.0	91.4	92.6	93.8	94.1	1.79	1.54	0.09	0.12	0.47
MC14	125	41.9	89.9	93.8	93.8	94.9	95.4	1.12	1.09	0.05	0.21	1.61
Chegue Main Oxide	106	43.5	91.2	94.1	95.2	95.2	96.3	1.12	1.08	0.04	0.21	1.50
	75	43.4	92.1	94.3	97.0	96.4	96.4	1.12	1.12	0.04	0.24	1.38

Sample ID	Cyanidation Grind P80 (µm)	Gravity Gold (%)	% Au Extraction @ hours					Au Grade (g/t)			Consumption (kg/t)	
			2	4	8	24	48	Assayed Head	Calc'd Head	Leach Residue	NaCN	Lime
MC3	125	45.6	92.3	92.3	92.3	92.3	92.3	1.21	0.65	0.31	0.21	1.44
Chegue Main Oxide	106	44.7	85.4	85.4	93.4	85.4	93.3	1.21	0.75	0.37	0.18	1.48
	75	38.6	91.3	101.8	91.4	91.4	91.4	1.21	0.58	0.31	0.18	1.54
MC4	125	37.4	80.8	88.6	89.9	92.5	92.5	0.47	0.47	0.04	0.15	0.79
Chegue Main Trans	106	39.8	81.4	90.1	91.4	93.8	93.8	0.47	0.49	0.03	0.21	0.59
	75	44.5	90.1	92.5	93.7	94.9	96.1	0.47	0.51	0.02	0.18	0.68
MC15	125	52.4	80.4	83.7	85.7	90.9	91.8	2.30	2.07	0.17	0.12	0.42
Chegue Main Fresh	106	57.9	81.1	84.0	86.2	91.3	93.0	2.30	2.72	0.19	0.12	0.44
	75	55.0	81.7	84.5	86.0	91.0	93.3	2.30	2.38	0.16	0.12	0.44
MC5	125	44.2	80.0	84.6	87.7	91.6	93.0	1.46	1.71	0.12	0.21	0.67
Chegue South Trans	106	44.3	74.9	79.5	82.1	87.0	88.1	1.46	1.60	0.19	0.21	0.64
	75	45.6	79.6	83.9	87.2	92.6	95.0	1.46	1.99	0.10	0.18	0.59
MC16	125	38.5	71.9	74.5	77.6	82.0	85.4	1.53	1.37	0.20	0.26	0.55
Chegue South Trans	106	41.5	73.4	76.1	78.0	84.9	87.9	1.53	1.57	0.19	0.18	0.70
	75	41.0	72.2	74.2	77.7	83.2	88.2	1.53	1.53	0.18	0.24	0.65
MC17	125	57.5	65.6	67.7	71.5	78.7	83.7	4.27	4.30	0.70	0.24	0.26
Chegue South Fresh	106	59.3	67.1	69.5	73.6	81.6	86.0	4.27	3.28	0.46	0.24	0.25
	75	56.9	67.1	69.6	73.9	82.4	87.1	4.27	3.38	0.44	0.18	0.30
MC6	125	49.6	88.1	89.7	91.4	93.0	93.8	1.05	1.46	0.09	0.24	0.43
Kekeda Trans	106	52.3	87.6	89.2	91.2	94.0	94.7	1.05	1.52	0.08	0.27	0.39
	75	33.1	81.6	84.7	86.3	89.4	94.0	1.05	1.16	0.07	0.27	0.36
MC18	125	50.1	67.6	76.1	83.0	92.8	94.4	3.56	3.66	0.21	0.15	0.47
Kekeda Fresh	106	48.9	68.3	76.5	82.2	90.1	94.6	3.56	3.17	0.17	0.15	0.43
	75	43.4	64.7	72.9	80.0	91.9	95.8	3.56	3.33	0.14	0.18	0.45
MC12	125	19.3	85.2	88.7	90.5	93.4	93.9	2.10	2.06	0.13	0.18	0.86
Nokpa Trans	106	20.9	87.6	90.5	92.2	93.3	94.4	2.10	2.14	0.12	0.18	0.87
	75	16.1	90.6	93.2	93.2	95.7	95.7	2.10	1.87	0.08	0.18	0.86

Sample ID	Cyanidation Grind P80 (µm)	Gravity Gold (%)	% Au Extraction @ hours					Au Grade (g/t)			Consumption (kg/t)	
			2	4	8	24	48	Assayed Head	Calc'd Head	Leach Residue	NaCN	Lime
MC13	125	36.5	71.5	77.0	78.6	85.3	87.7	1.74	1.96	0.24	0.15	0.28
Nokpa Fresh	106	37.9	71.0	75.4	78.8	85.8	89.4	1.74	1.79	0.19	0.14	0.34
	75	38.4	73.3	77.3	80.7	87.7	91.3	1.74	1.96	0.17	0.12	0.38
MC10	125	38.9	86.1	88.0	90.9	91.8	93.7	0.52	0.63	0.04	0.30	0.65
Souwa Trans	106	40.1	85.7	87.9	89.9	92.0	93.1	0.52	0.58	0.04	0.21	0.65
	75	45.4	86.9	89.1	92.1	94.3	95.1	0.52	0.81	0.04	0.24	0.65
MC2	125	32.6	82.1	91.9	91.9	91.9	91.9	0.73	0.62	0.05	0.14	0.83
Souwa Trans	106	35.3	93.6	93.6	93.6	93.6	93.6	0.73	0.63	0.04	0.18	0.77
	75	31.2	84.1	84.1	84.1	92.8	92.8	0.73	0.69	0.05	0.15	0.83
MC11	125	47.9	76.6	79.0	82.0	86.8	90.4	2.45	2.61	0.25	0.14	0.30
Souwa Fresh	106	53.2	80.2	82.8	85.4	89.5	92.1	2.45	2.78	0.22	0.14	0.31
	75	50.2	78.3	80.9	84.1	89.1	93.0	2.45	2.63	0.19	0.14	0.36

Figure 13.6.1 Effect of Grind Size on Gold Extraction – Master Composites




Han
Au Extraction %
Time hrs
Trans, 125
Trans, 106
Trans, 75
Fresh, 125
Fresh, 106
Fresh, 75
Kekeda
Au Extraction %
Time hrs
Trans, 125
Trans, 106
Trans, 75
Fresh, 125
Fresh, 106
Fresh, 75
Kilosegui
Au Extraction %
Time hrs
Fresh, 125
Fresh, 106
Fresh, 75
Trans, 125
Nokpa
Au Extraction %
Time hrs
Trans, 125
Trans, 106
Trans, 75
Fresh, 125
Fresh, 106
Fresh, 75

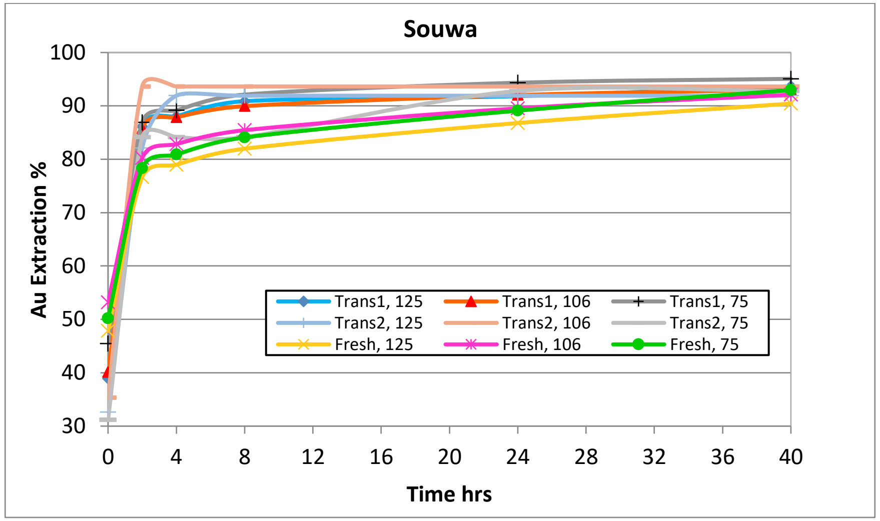
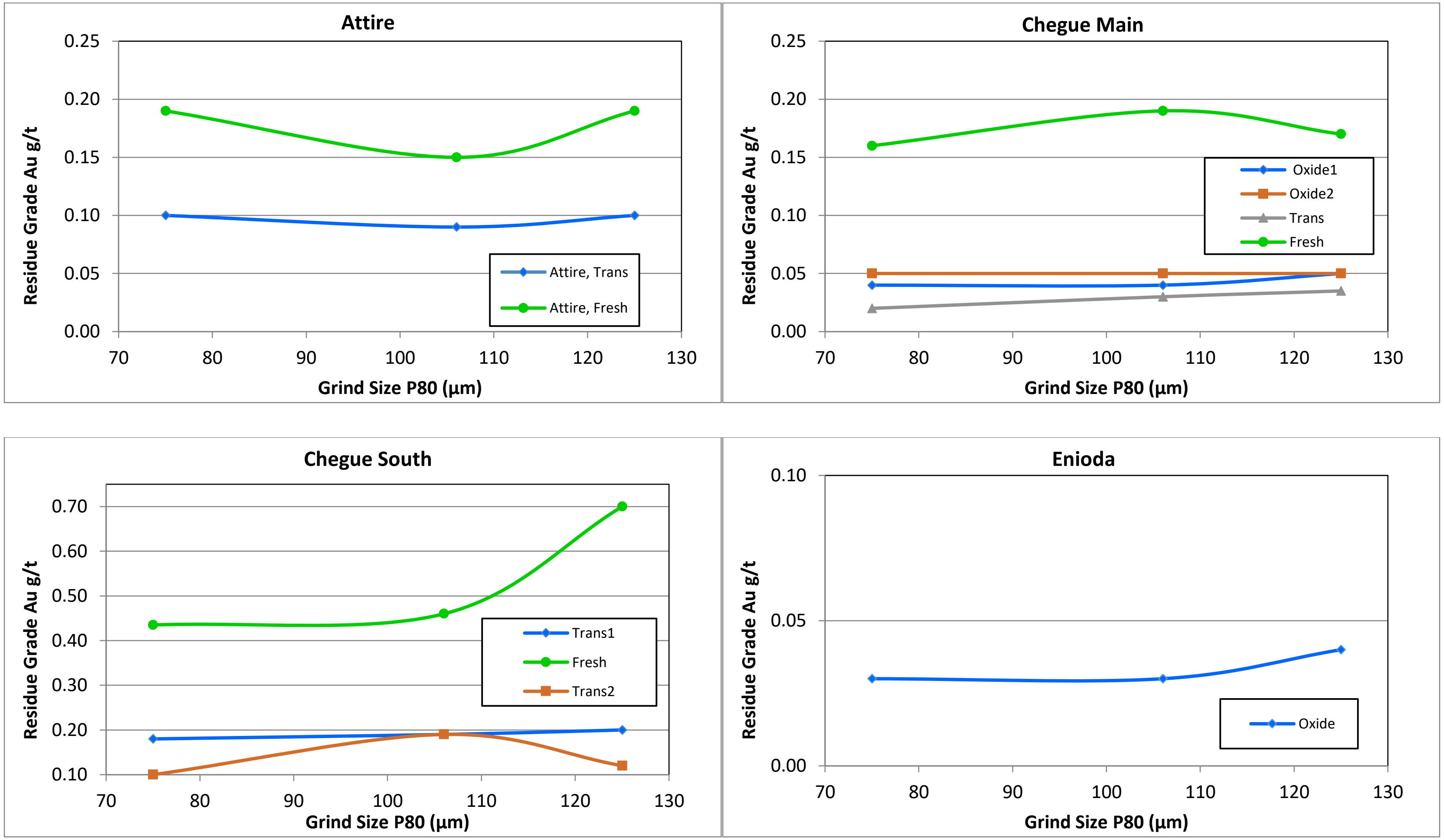
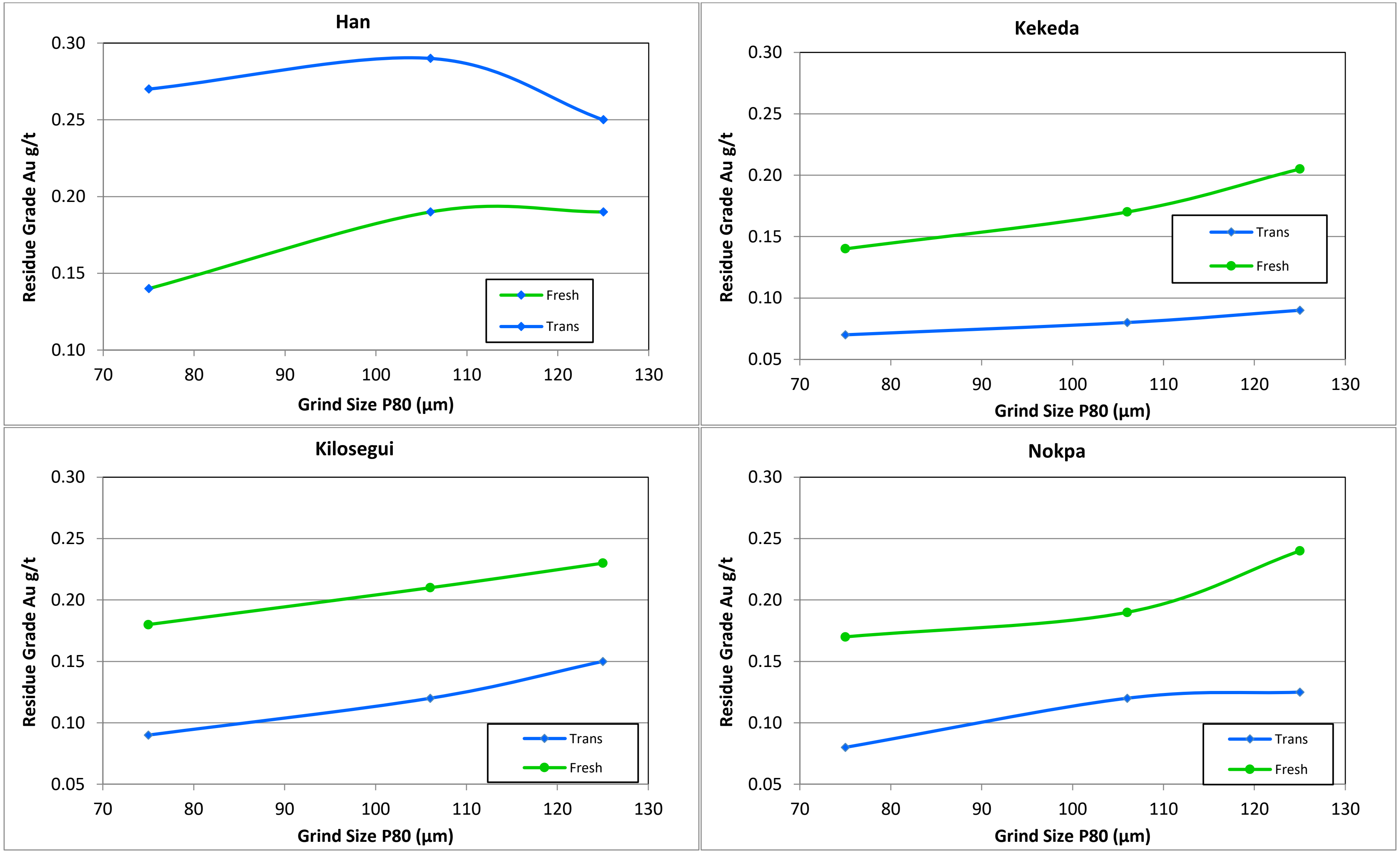
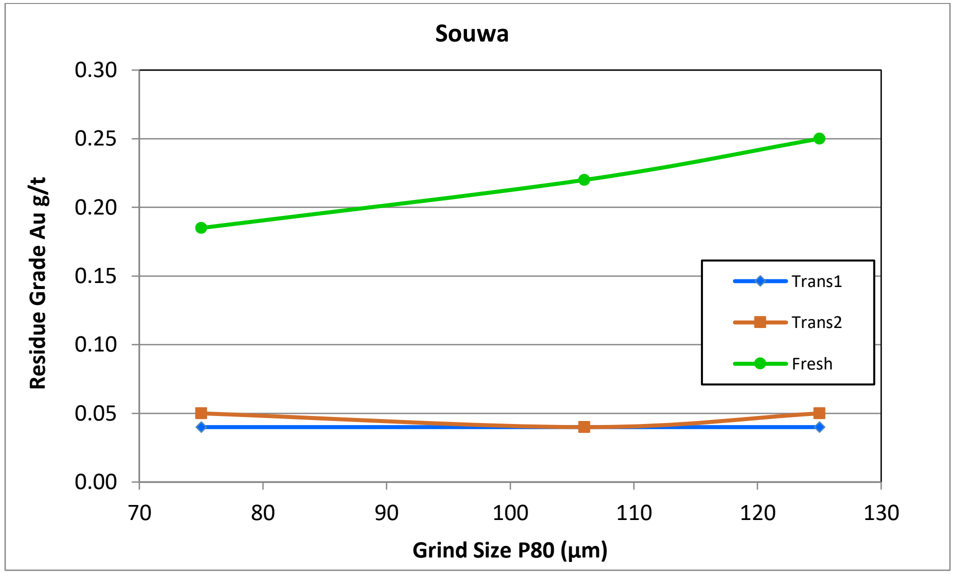

Souwa
Au Extraction %
Time hrs
100
90
80
70
60
50
40
30
0
4
8
12
16
20
24
28
32
36
40
Trans1, 125
Trans1, 106
Trans1, 75
Trans2, 125
Trans2, 106
Trans2, 75
Fresh, 125
Fresh, 106
Fresh, 75

Figure 13.6.2 Effect of Grind Size on Leach Residue Grade: Master Composites




Han
Residue Grade Au g/t
Grind Size P80 (µm)
Fresh
Trans
Kekeda
Residue Grade Au g/t
Grind Size P80 (µm)
Trans
Fresh
Kilosegui
Residue Grade Au g/t
Grind Size P80 (µm)
Trans
Fresh
Nokpa
Residue Grade Au g/t
Grind Size P80 (µm)
Trans
Fresh


Souwa
Residue Grade Au g/t
0.30
0.25
0.20
0.15
0.10
0.05
0.00
70
80
90
100
110
120
130
Grind Size P80 (µm)
Trans1
Trans2
Fresh

13.7 Residence Time Selection

A nominal leach time of 36 hours was selected as the basis of further testwork and plant design on the following basis:

- The leach results detailed in the gravity / leach testwork series were used to select the required leaching residence time (see Table 13.6.4 and in Figure 13.6.1).

- The leach curves for the selected grind size of 106 µm for oxide / transition and 75 µm for fresh were utilised to assess the incremental recovery gains with increasing leach time. The leach data shows that the increase in gold recovery from 24 to 40 hours is approximately 0.6% for oxide and 1.2% for transition ores. The increase in gold recovery for fresh samples from 24 to 40 hours is around 4%.

- For fresh ore, leaching continues to occur through to 36 hours however minimal leaching occurs after this time.

13.8 Cyanide Optimisation Tests

A suite of gravity gold recovery followed by cyanidation tests was performed on each of the Master Composites at three different starting NaCN concentrations (0.07% w/v, 0.05% w/v and 0.03% w.v), each at the selected grind size (P_{80} of 106 µm for Oxide and Transitional samples, P_{80} of 75 µm for Fresh samples), pulp density (45% w/w solids), and for a 40 h leach duration. For each of the starting NaCN concentrations above, the NaCN levels were maintained at 0.035% w/v, 0.025% w/v and 0.015% w/v respectively. The results are summarised in Table 13.8.1 and illustrated graphically in Figure 13.8.1.

Table 13.8.1 Cyanide Optimisation Testwork - Master Composites

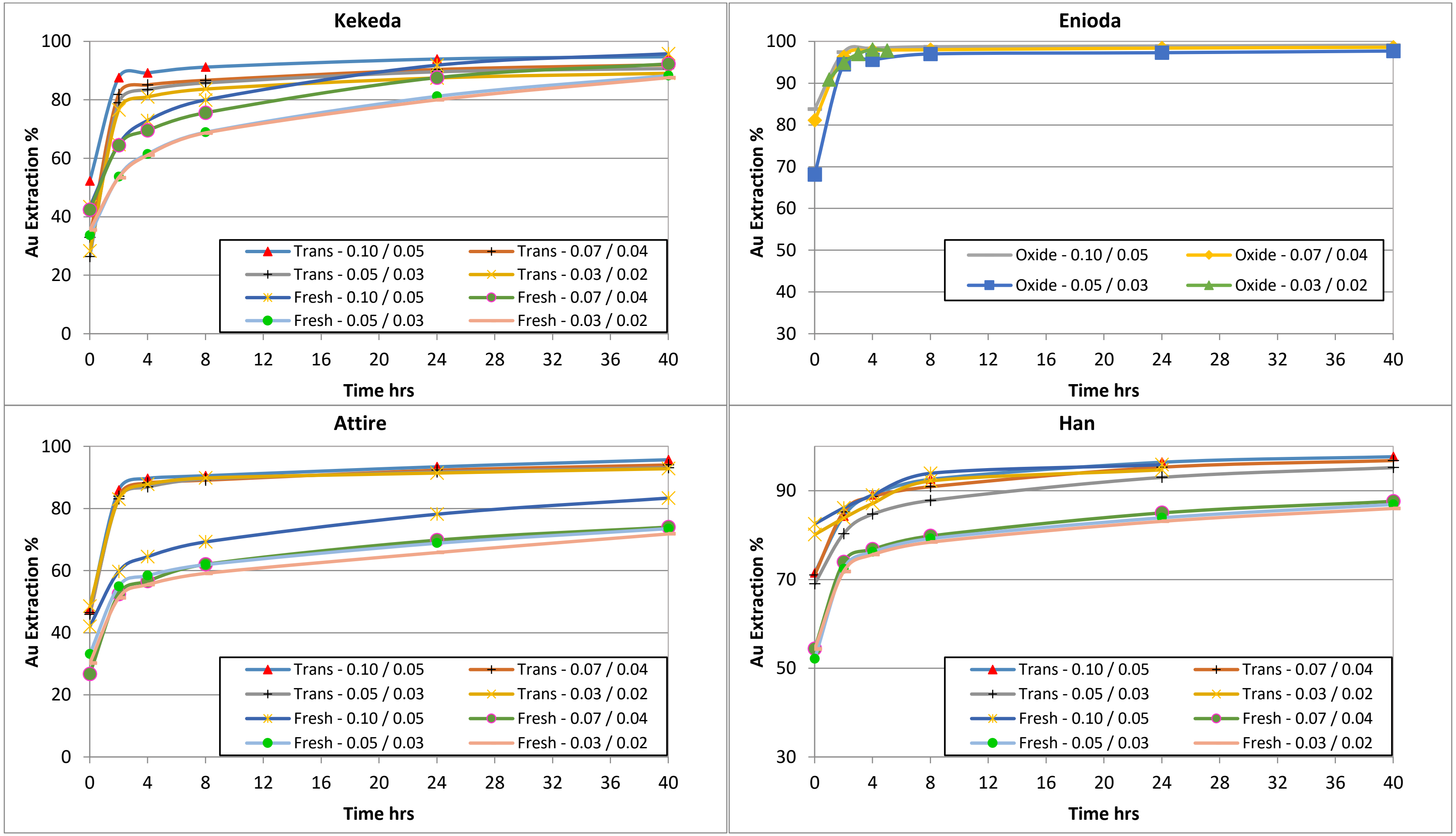
Sample ID	Grind Size (P80, µm)	% NaCN - Init/Mtn	Gold Head Grade (g/t)		Gold Distribution (g/t)			Gold Distribution (%)			Total Gold Recovery (%)	Reagents (kg/t)	
			Assayed	Calculated	Gravity	Leach	Residue	Gravity	Leach	Residue		NaCN	Lime
ATTIRE TRANS (MC-23)	106	0.10 / 0.05	2.24	2.09	0.99	1.00	0.09	47.6	48.1	4.3	95.7	0.27	0.58
ATTIRE TRANS (MC-23	106	0.07 / 0.04	2.24	2.08	0.95	1.00	0.13	45.9	48.1	6.0	94.0	0.12	1.17
ATTIRE TRANS (MC-23	106	0.05 / 0.03	2.24	2.16	1.00	1.01	0.15	46.5	46.6	6.9	93.1	0.12	0.80
ATTIRE TRANS (MC-23	106	0.03 / 0.02	2.24	2.52	1.22	1.11	0.18	48.5	44.3	7.2	92.8	0.08	0.58
ATTIRE FRESH (MC-24)	75	0.10 / 0.05	1.29	1.14	0.48	0.47	0.19	42.0	41.3	16.6	83.4	0.12	0.52
ATTIRE FRESH (MC-24)	75	0.07 / 0.04	1.29	1.00	0.27	0.47	0.26	26.7	47.3	26.0	74.0	0.24	0.38
ATTIRE FRESH (MC-24)	75	0.05 / 0.03	1.29	0.87	0.29	0.35	0.23	33.1	40.4	26.5	73.5	0.12	0.34
ATTIRE FRESH (MC-24)	75	0.03 / 0.02	1.29	0.99	0.30	0.41	0.28	30.2	41.5	28.2	71.8	0.12	0.28
CHEGUE MAIN OXIDE (MC-3)	106	0.10 / 0.05	1.21	0.75	0.34	0.37	0.05	44.7	48.6	6.7	93.3	0.18	1.48
CHEGUE MAIN OXIDE (MC-3)	106	0.07 / 0.04	1.21	0.60	0.23	0.32	0.05	37.6	54.0	8.3	91.7	0.15	1.45
CHEGUE MAIN OXIDE (MC-3)	106	0.05 / 0.03	1.21	0.63	0.24	0.34	0.05	37.6	54.5	8.0	92.0	0.12	1.37
CHEGUE MAIN OXIDE (MC-3)	106	0.03 / 0.02	1.21	0.65	0.27	0.34	0.05	40.8	51.5	7.7	92.3	0.08	1.12
CHEGUE MAIN OXIDE (MC-14)	106	0.10 / 0.05	1.12	1.08	0.47	0.57	0.04	43.5	52.8	3.7	96.3	0.21	1.50
CHEGUE MAIN OXIDE (MC-14)	106	0.07 / 0.04	1.12	1.14	0.52	0.57	0.05	45.7	49.9	4.4	95.6	0.21	1.84
CHEGUE MAIN OXIDE (MC-14)	106	0.05 / 0.03	1.12	1.31	0.62	0.63	0.05	47.6	48.6	3.8	96.2	0.12	1.85
CHEGUE MAIN OXIDE (MC-14)	106	0.03 / 0.02	1.12	1.13	0.49	0.59	0.05	43.1	52.5	4.4	95.6	0.06	1.76
CHEGUE MAIN TRANS (MC-4)	106	0.10 / 0.05	0.47	0.49	0.19	0.26	0.03	39.8	54.0	6.2	93.8	0.21	0.59
CHEGUE MAIN TRANS (MC-4)	106	0.07 / 0.04	0.47	0.51	0.19	0.30	0.03	36.0	58.2	5.8	94.2	0.12	0.58
CHEGUE MAIN TRANS (MC-4)	106	0.05 / 0.03	0.47	0.57	0.22	0.32	0.04	38.6	55.3	6.1	93.9	0.14	0.56
CHEGUE MAIN TRANS (MC-4)	106	0.03 / 0.02	0.47	0.53	0.20	0.29	0.04	37.5	55.0	7.5	92.5	0.08	0.63
CHEGUE MAIN FRESH (MC-15)	75	0.10 / 0.05	2.30	2.38	1.31	0.91	0.16	55.0	38.3	6.7	93.3	0.12	0.44
CHEGUE MAIN FRESH (MC-15)	75	0.07 / 0.04	2.30	2.47	1.31	0.92	0.23	53.2	37.5	9.3	90.7	0.14	0.37

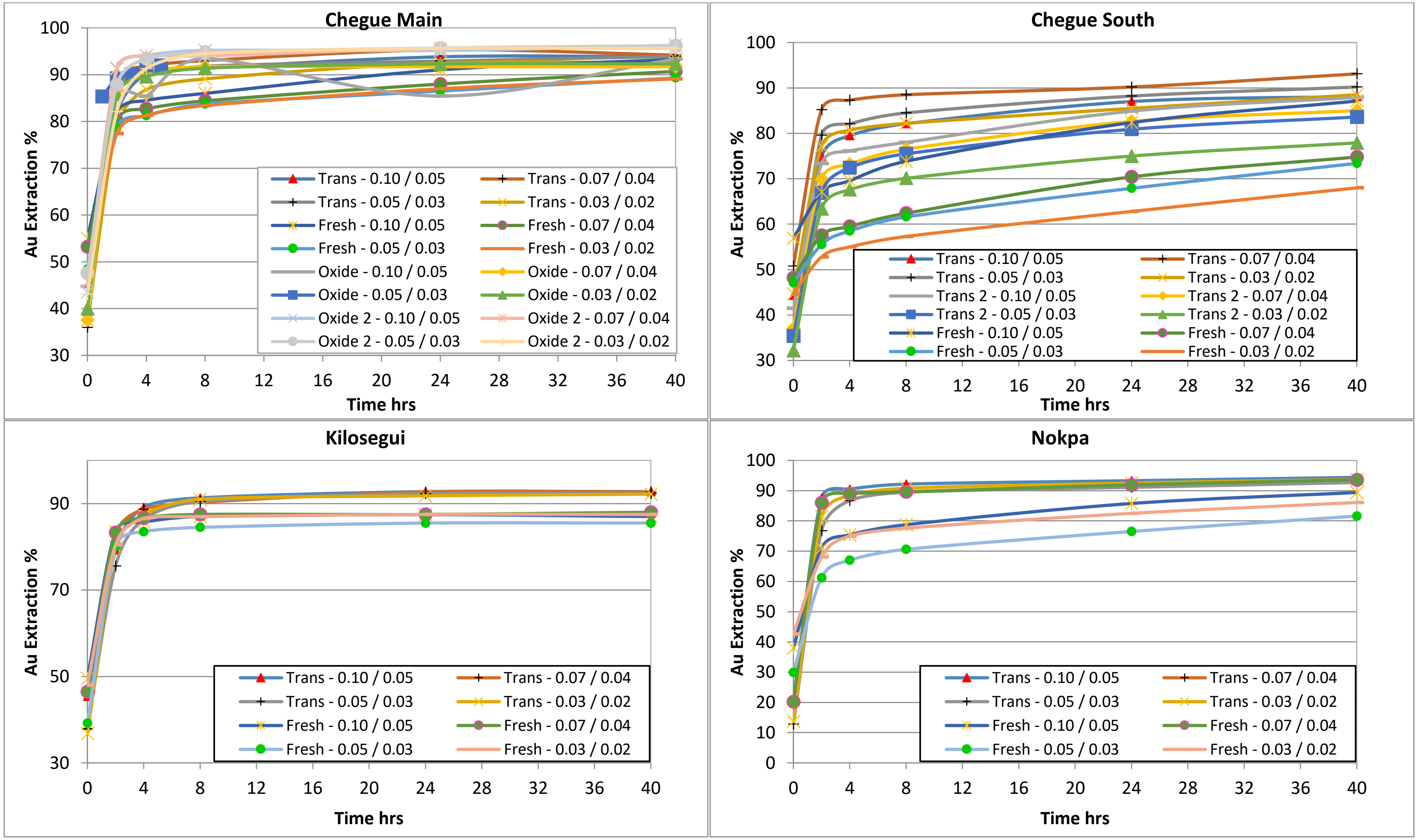
Sample ID	Grind Size (P80, µm)	% NaCN - Init/Mtn	Gold Head Grade (g/t)		Gold Distribution (g/t)			Gold Distribution (%)			Total Gold Recovery (%)	Reagents (kg/t)	
			Assayed	Calculated	Gravity	Leach	Residue	Gravity	Leach	Residue		NaCN	Lime
CHEGUE MAIN FRESH (MC-15)	75	0.05 / 0.03	2.30	2.14	1.04	0.88	0.23	48.4	40.9	10.7	89.3	0.06	0.37
CHEGUE MAIN FRESH (MC-15)	75	0.03 / 0.02	2.30	2.01	0.97	0.82	0.22	48.2	40.9	10.9	89.1	0.08	0.32
CHEGUE SOUTH TRANS (MC-5)	106	0.10 / 0.05	1.46	1.60	0.71	0.70	0.19	44.3	43.8	11.9	88.1	0.21	0.64
CHEGUE SOUTH TRANS (MC-5)	106	0.07 / 0.04	1.46	2.04	1.04	0.86	0.14	50.8	42.3	6.9	93.1	0.15	0.79
CHEGUE SOUTH TRANS (MC-5)	106	0.05 / 0.03	1.46	1.48	0.55	0.79	0.15	36.9	53.2	9.8	90.2	0.09	0.76
CHEGUE SOUTH TRANS (MC-5)	106	0.03 / 0.02	1.46	2.00	0.89	0.88	0.23	44.6	43.9	11.5	88.5	0.08	0.66
CHEGUE SOUTH TRANS (MC-16)	106	0.10 / 0.05	1.53	1.57	0.65	0.73	0.19	41.5	46.4	12.1	87.9	0.18	0.70
CHEGUE SOUTH TRANS (MC-16)	106	0.07 / 0.04	1.53	1.47	0.55	0.70	0.22	37.1	47.9	15.0	85.0	0.18	0.68
CHEGUE SOUTH TRANS (MC-16)	106	0.05 / 0.03	1.53	1.34	0.47	0.64	0.22	35.4	48.1	16.4	83.6	0.12	0.74
CHEGUE SOUTH TRANS (MC-16)	106	0.03 / 0.02	1.53	1.45	0.47	0.66	0.32	32.2	45.7	22.1	77.9	0.09	0.67
CHEGUE SOUTH FRESH (MC-17)	75	0.10 / 0.05	4.27	3.38	1.92	1.02	0.44	56.9	30.2	12.9	87.1	0.18	0.30
CHEGUE SOUTH FRESH (MC-17)	75	0.07 / 0.04	4.27	4.45	2.14	1.19	1.12	48.2	26.7	25.2	74.8	0.12	0.39
CHEGUE SOUTH FRESH (MC-17)	75	0.05 / 0.03	4.27	4.68	2.21	1.23	1.25	47.1	26.3	26.6	73.4	0.08	0.35
CHEGUE SOUTH FRESH (MC-17)	75	0.03 / 0.02	4.27	3.46	1.55	0.81	1.11	44.6	23.3	32.0	68.0	0.08	0.24
ENIODA OXIDE (MC-21)	106	0.10 / 0.05	1.09	3.27	2.74	0.50	0.03	83.8	15.3	0.9	99.1	0.24	0.92
ENIODA OXIDE (MC-21)	106	0.07 / 0.04	1.09	2.89	2.35	0.51	0.04	81.1	17.5	1.4	98.6	0.15	1.48
ENIODA OXIDE (MC-21)	106	0.05 / 0.03	1.09	1.73	1.18	0.51	0.04	68.1	29.6	2.3	97.7	0.18	1.07
ENIODA OXIDE (MC-21)	106	0.03 / 0.02	1.09	2.27	1.69	0.53	0.05	74.4	23.4	2.2	97.8	0.12	0.77
HAN TRANS (MC-19)	106	0.10 / 0.05	13.31	12.40	8.86	3.25	0.29	71.5	26.2	2.3	97.7	0.15	0.32
HAN TRANS (MC-19)	106	0.07 / 0.04	13.31	12.36	8.78	3.18	0.40	71.0	25.7	3.2	96.8	0.13	0.31
HAN TRANS (MC-19)	106	0.05 / 0.03	13.31	11.36	7.84	2.98	0.54	69.0	26.2	4.8	95.2	0.08	0.38
HAN TRANS (MC-19)	106	0.03 / 0.02	13.31	11.46	7.71	3.14	0.61	67.3	27.4	5.3	94.7	0.06	0.44
HAN FRESH (MC-20)	75	0.10 / 0.05	3.68	3.38	2.14	1.10	0.14	63.3	32.5	4.1	95.9	0.18	0.48
HAN FRESH (MC-20)	75	0.07 / 0.04	3.68	3.22	1.75	1.07	0.40	54.4	33.2	12.4	87.6	0.14	0.38

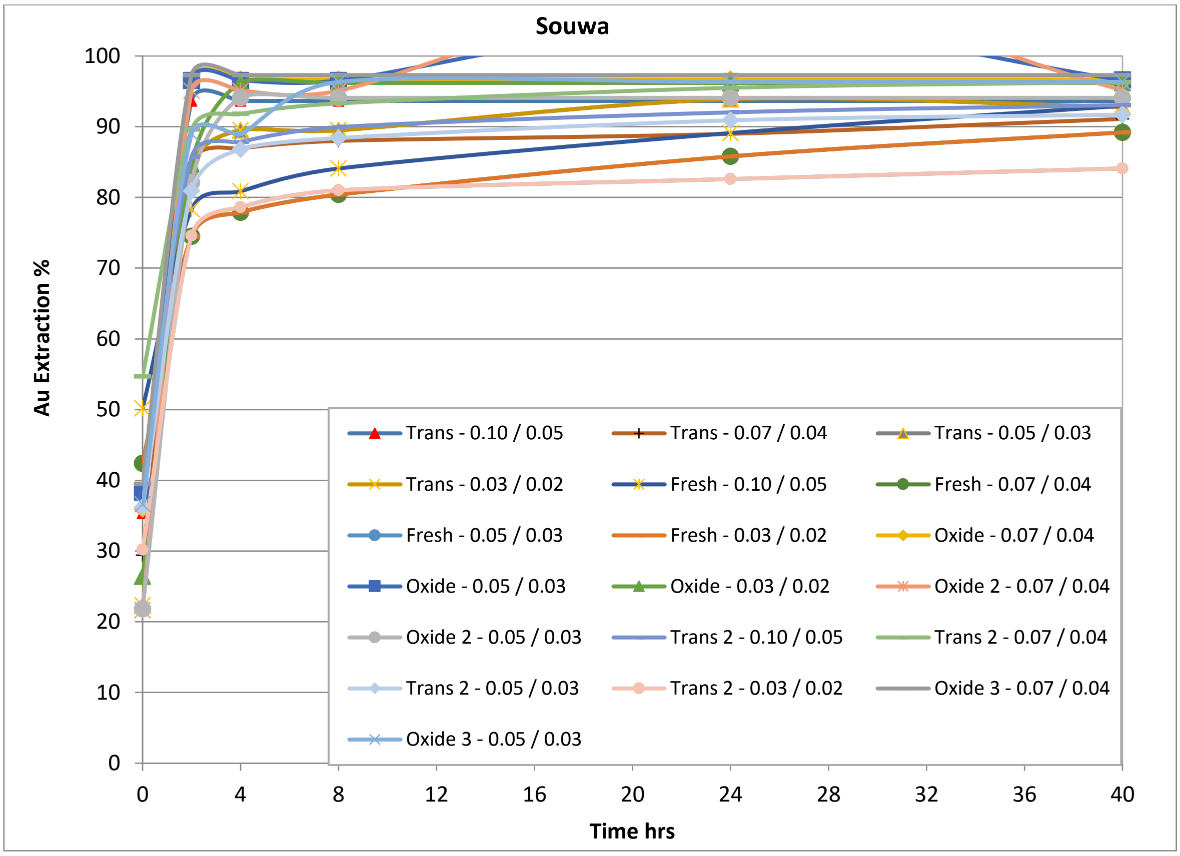
Sample ID	Grind Size (P80, µm)	% NaCN - Init/Mtn	Gold Head Grade (g/t)		Gold Distribution (g/t)			Gold Distribution (%)			Total Gold Recovery (%)	Reagents (kg/t)	
			Assayed	Calculated	Gravity	Leach	Residue	Gravity	Leach	Residue		NaCN	Lime
HAN FRESH (MC-20)	75	0.05 / 0.03	3.68	3.81	1.98	1.32	0.50	52.1	34.7	13.1	86.9	0.12	0.35
HAN FRESH (MC-20)	75	0.03 / 0.02	3.68	3.22	1.75	1.02	0.45	54.3	31.7	14.0	86.0	0.08	0.31
KEKEDA TRANSITION (MC-6)	106	0.10 / 0.05	1.05	1.52	0.80	0.65	0.08	52.3	42.5	5.3	94.7	0.27	0.39
KEKEDA TRANSITION (MC-6)	106	0.07 / 0.04	1.05	1.13	0.37	0.66	0.09	33.0	59.0	8.0	92.0	0.13	0.64
KEKEDA TRANSITION (MC-6)	106	0.05 / 0.03	1.05	1.08	0.29	0.69	0.10	26.4	64.3	9.3	90.7	0.12	0.55
KEKEDA TRANSITION (MC-6)	106	0.03 / 0.02	1.05	1.10	0.31	0.67	0.12	28.3	60.8	10.9	89.1	0.06	0.55
KEKEDA FRESH (MC-18)	75	0.10 / 0.05	3.56	3.33	1.44	1.74	0.14	43.4	52.4	4.2	95.8	0.18	0.45
KEKEDA FRESH (MC-18)	75	0.07 / 0.04	3.56	4.59	1.95	2.29	0.36	42.4	49.8	7.7	92.3	0.18	0.37
KEKEDA FRESH (MC-18)	75	0.05 / 0.03	3.56	3.34	1.13	1.82	0.39	33.7	54.6	11.7	88.3	0.12	0.33
KEKEDA FRESH (MC-18)	75	0.03 / 0.02	3.56	3.46	1.23	1.80	0.43	35.5	52.1	12.4	87.6	0.06	0.31
KILOSEGUI FRESH (MC-7)	75	0.10 / 0.05	1.37	1.39	0.69	0.52	0.18	49.6	37.4	13.0	87.0	0.24	0.34
KILOSEGUI FRESH (MC-7)	75	0.07 / 0.04	1.37	1.41	0.66	0.59	0.17	46.5	41.5	12.0	88.0	0.06	0.52
KILOSEGUI FRESH (MC-7)	75	0.05 / 0.03	1.37	1.24	0.49	0.57	0.18	39.2	46.3	14.5	85.5	0.06	0.38
KILOSEGUI FRESH (MC-7)	75	0.04 / 0.02	1.37	1.39	0.67	0.55	0.18	48.0	39.4	12.6	87.4	0.08	0.28
KILOSEGUI TRANS (MC-25)	106	0.10 / 0.05	1.79	1.66	0.75	0.79	0.12	45.4	47.4	7.2	92.8	0.12	0.48
KILOSEGUI TRANS (MC-25)	106	0.07 / 0.04	1.79	1.50	0.57	0.82	0.11	37.8	54.9	7.3	92.7	0.12	0.42
KILOSEGUI TRANS (MC-25)	106	0.05 / 0.03	1.79	1.63	0.62	0.88	0.13	38.0	54.4	7.7	92.3	0.12	0.49
KILOSEGUI TRANS (MC-25)	106	0.04 / 0.02	1.79	1.53	0.56	0.85	0.12	36.8	55.4	7.8	92.2	0.09	0.34
NOKPA TRANS (MC-12)	106	0.10 / 0.05	2.10	2.14	0.45	1.57	0.12	20.9	73.5	5.6	94.4	0.18	0.87
NOKPA TRANS (MC-12)	106	0.07 / 0.04	2.10	2.04	0.41	1.50	0.13	20.2	73.5	6.4	93.6	0.20	0.75
NOKPA TRANS (MC-12)	106	0.05 / 0.03	2.10	2.20	0.28	1.76	0.16	12.9	79.8	7.3	92.7	0.14	0.77
NOKPA TRANS (MC-12)	106	0.03 / 0.02	2.10	2.06	0.28	1.65	0.13	13.7	80.0	6.3	93.7	0.08	0.66
NOKPA FRESH (MC-13)	75	0.10 / 0.05	1.74	1.96	0.75	1.04	0.17	38.4	52.9	8.7	91.3	0.12	0.38
NOKPA FRESH (MC-13)	75	0.07 / 0.04	1.74	1.88	0.60	1.03	0.26	31.6	54.5	13.8	86.2	0.06	0.38

Sample ID	Grind Size (P80, µm)	% NaCN - Init/Mtn	Gold Head Grade (g/t)		Gold Distribution (g/t)			Gold Distribution (%)			Total Gold Recovery (%)	Reagents (kg/t)	
			Assayed	Calculated	Gravity	Leach	Residue	Gravity	Leach	Residue		NaCN	Lime
NOKPA FRESH (MC-13)	75	0.05 / 0.03	1.74	2.01	0.60	1.04	0.37	29.9	51.7	18.4	81.6	0.08	0.36
NOKPA FRESH (MC-13)	75	0.03 / 0.02	1.74	2.30	0.98	1.00	0.32	42.6	43.5	13.9	86.1	0.06	0.30
SOUWA TRANSITION (MC-2)	106	0.10 / 0.05	0.73	0.63	0.22	0.37	0.04	35.3	58.3	6.4	93.6	0.18	0.77
SOUWA TRANSITION (MC-2)	106	0.07 / 0.04	0.73	0.56	0.17	0.35	0.05	29.4	61.7	8.9	91.1	0.12	0.74
SOUWA TRANSITION (MC-2)	106	0.05 / 0.03	0.73	0.55	0.12	0.39	0.04	22.3	70.5	7.2	92.8	0.14	2.67
SOUWA TRANSITION (MC-2)	106	0.03 / 0.02	0.73	0.83	0.34	0.43	0.05	41.6	52.4	6.1	93.9	0.08	0.52
SOUWA TRANSITION (MC-10)	106	0.10 / 0.05	0.52	0.58	0.23	0.30	0.04	40.1	52.9	6.9	93.1	0.21	0.65
SOUWA TRANSITION (MC-10)	106	0.07 / 0.04	0.52	0.81	0.44	0.34	0.03	54.7	41.6	3.7	96.3	0.15	0.79
SOUWA TRANSITION (MC-10)	106	0.05 / 0.03	0.52	0.72	0.26	0.40	0.06	36.2	55.6	8.3	91.7	0.12	0.77
SOUWA TRANSITION (MC-10)	106	0.03 / 0.02	0.52	0.76	0.23	0.41	0.12	30.2	54.0	15.9	84.1	0.08	0.66
SOUWA FRESH (MC-11)	75	0.07 / 0.04	2.45	2.86	1.21	1.34	0.31	42.4	46.7	10.8	89.2	0.09	0.35
SOUWA FRESH (MC-11)	75	0.05 / 0.03	2.45	2.65	0.93	1.30	0.42	35.2	49.0	15.8	84.2	0.08	0.35
SOUWA FRESH (MC-11)	75	0.03 / 0.02	2.45	2.84	1.32	1.17	0.35	46.3	41.3	12.3	87.7	0.06	0.31
SOUWA FRESH (MC-11)	75	0.10 / 0.05	2.45	2.63	1.32	1.12	0.19	50.2	42.8	7.0	93.0	0.14	0.36
SOUWA OXIDE (MC-26)	106	0.07 / 0.04	0.50	0.60	0.22	0.37	0.02	35.9	60.8	3.3	96.7	0.18	1.12
SOUWA OXIDE (MC-26)	106	0.05 / 0.03	0.50	0.73	0.28	0.43	0.03	38.3	58.3	3.4	96.6	0.12	1.02
SOUWA OXIDE (MC-26)	106	0.03 / 0.02	0.50	0.52	0.14	0.37	0.02	26.4	69.8	3.8	96.2	0.08	0.92
SOUWA OXIDE (MC-8)	106	0.07 / 0.04	0.48	0.42	0.09	0.31	0.02	21.6	73.6	4.8	95.2	0.18	0.74
SOUWA OXIDE (MC-8)	106	0.05 / 0.03	0.48	0.51	0.11	0.37	0.03	21.8	72.3	5.9	94.1	0.15	0.86
SOUWA OXIDE (MC-9)	106	0.07 / 0.04	0.42	0.74	0.29	0.43	0.02	39.5	57.8	2.7	97.3	0.21	0.74
SOUWA OXIDE (MC-9)	106	0.05 / 0.03	0.42	0.82	0.30	0.49	0.03	36.6	59.7	3.7	96.3	0.18	0.78

Figure 13.8.1 Cyanide Optimisation Tests - Master Composites




Chegue Main
Au Extraction %
Time hrs
Trans - 0.10 / 0.05
Trans - 0.07 / 0.04
Trans - 0.05 / 0.03
Trans - 0.03 / 0.02
Fresh - 0.10 / 0.05
Fresh - 0.07 / 0.04
Fresh - 0.05 / 0.03
Fresh - 0.03 / 0.02
Oxide - 0.10 / 0.05
Oxide - 0.07 / 0.04
Oxide - 0.05 / 0.03
Oxide - 0.03 / 0.02
Oxide 2 - 0.10 / 0.05
Oxide 2 - 0.07 / 0.04
Oxide 2 - 0.05 / 0.03
Oxide 2 - 0.03 / 0.02
Chegue South
Au Extraction %
Time hrs
Trans - 0.10 / 0.05
Trans - 0.07 / 0.04
Trans - 0.05 / 0.03
Trans - 0.03 / 0.02
Trans 2 - 0.10 / 0.05
Trans 2 - 0.07 / 0.04
Trans 2 - 0.05 / 0.03
Trans 2 - 0.03 / 0.02
Fresh - 0.10 / 0.05
Fresh - 0.07 / 0.04
Fresh - 0.05 / 0.03
Fresh - 0.03 / 0.02
Kilosegui
Au Extraction %
Time hrs
Trans - 0.10 / 0.05
Trans - 0.07 / 0.04
Trans - 0.05 / 0.03
Trans - 0.03 / 0.02
Fresh - 0.10 / 0.05
Fresh - 0.07 / 0.04
Fresh - 0.05 / 0.03
Fresh - 0.03 / 0.02
Nokpa
Au Extraction %
Time hrs
Trans - 0.10 / 0.05
Trans - 0.07 / 0.04
Trans - 0.05 / 0.03
Trans - 0.03 / 0.02
Fresh - 0.10 / 0.05
Fresh - 0.07 / 0.04
Fresh - 0.05 / 0.03
Fresh - 0.03 / 0.02



The results indicate:

- The initial leaching rates of the samples typically increase with increasing initial cyanide dosage at the range of concentrations tested. The lowest gold recoveries typically coincide with the lowest initial NaCN starting concentration.
- There is a trend of decreasing tails gold grade with increased cyanide dosage rate.
- Overall cyanide consumed by the samples at different initial cyanide dosage rates increases with increased starting cyanide concentration. None of the leach tests required additional NaCN to maintain the residual target cyanide concentration, indicating that the different ore types are relatively clean with no major cyanide consumers.

13.9 Design Criteria Development

The programme of comminution and metallurgical testwork has provided information about the physical characteristics and metallurgical response of the nine Doropo deposits the associated ore weathering types. The process design criteria has been developed based on the available testwork, the relative contributions of each material type and their proposed sequence of treatment throughout the life of mine. The PFS mine schedule indicates that the process plant will typically receive a blended feed of the Doropo ores.

A primary crush circuit with SABC (open circuit SAG mill followed by closed circuit ball mill and recycle pebble crushing) comminution circuit was selected based on the treatment of fresh ore only and has the advantage of being able to accommodate the wide spectrum of ore competencies. The PFS grind sensitivity testwork showed that all nine ore types are grind sensitive with gold extraction generally increasing with fineness of grind. Additional gravity testwork including panning of the Knelson concentrate and intensive cyanidation of the pan concentrate is planned for the next stage of testwork. A P_{80} grind size of 75 µm for fresh ore and a P_{80} grind size of 106 µm for oxide and transitional ores is selected for this PFS phase.

The available ore composite testwork results indicated a significant amount of gravity gold, a gravity circuit has been included in the process plant flowsheet with the following benefits:

- The clear evidence of coarse gold or 'spotty' mineralisation with the variable assays and leach performance is best addressed by inclusion of a gravity circuit. The gravity circuit will limit potential spikes of high-grade material passing through to the leach circuit allowing more consistent operation of the adsorption and elution circuits.

- Leach kinetics are improved, particularly at the start of the leach, by removing the gravity recoverable gold. This improves the carbon profile and ensures lower gold solution losses in practice.

- If gravity recoverable gold is present in the feed and is not recovered in the milling circuit, this will tend to get trapped in launders and hoppers and become a theft risk during maintenance downtime.

The gravity circuit has been based on treating a pre-concentrated fraction of the cyclone underflow stream as there is evidence of high GRG content in some samples.

The gravity / gold leach testwork showed that cyanide leaching produced a range of extractions from 82% to 99% gold and that initial leaching rates were high with evidence of a generally small slow leaching fraction that continued to leach throughout the tests. No preg-robbing characteristics were evident. The plant design will include a pre-leach thickener, pre-oxidation tank and CIL circuit with oxygen addition to all tanks. The CIL circuit will have a residence time of 36 hours for fresh ore (at 4Mtpa) and approximately 24 hours for oxide and transitional ores.

No evidence of deleterious elements in the leach solution was noted, so operation of adsorption and desorption should be simple.

Cyanide destruction on the CIL tails and tails thickening to reduce WAD cyanide levels in the tailings stream has been included.

13.9.1 Metallurgical Recoveries and Reagent Consumption

Plant gold recoveries and reagent consumption have been estimated based on the results of leach testwork at a P_{80} grind size of 75 µm for fresh ore and 106 µm for oxide and transitional ores. A weak correlation between gold extraction and head grade was noted for the transitional samples with a slightly stronger correlation between tails grade and head grade. A strong correlation between head grade and extraction as well as between head grade and tails grade were noted for the oxide samples. For the fresh samples, a weak correlation between tails grade and head grade was observed with a slightly stronger correlation between extraction and head grade. The relationship between head grade and gold extraction or tails grade for the oxide and transitional samples is shown in Figure 13.9.1. The relationship between head grade and gold extraction or tails grade for the fresh samples is shown in Figure 13.9.2

Reagent Consumption

The reagent consumptions from the P_{80} 75 µm (fresh) and 106 µm (oxide and trans) for leach testwork were used to estimate the plant leach reagent consumptions. Overall cyanide consumption was calculated based on the average of the bottle roll leach testwork cyanide consumptions. An average cyanide consumption of 0.20 kg/t was observed for oxide and transition ores. Cyanide consumption for the fresh composites was 0.16 kg/t. The lime requirement for oxide ores is the highest with an average of 1.30 kg/t. A lime consumption of 0.60 kg/t and 0.41 kg/t was observed for transitional and fresh ores respectively.

The actual cyanide and lime addition rates to the CIL circuit differ from the testwork results due to the following:

- The cyanide requirements for the plant must make allowance for residual cyanide in the CIL tail solution. A plant CIL tails allowance of 100 mg/L NaCN has been allowed which is equivalent to an additional 0.12 kg/t NaCN at the expected CIL tailings slurry density of 44% w/w solids.

- The testwork was conducted with commercial lime having a CaO availability of approximately 60%. The lime supplied to the Doropo Project is likely to have an available CaO content in excess of 90% and the required plant lime addition must be scaled back accordingly.

Figure 13.9.1 Gold Head Grade vs Extraction and Tails Grade –106 µm Grind Size: Oxide & Transition

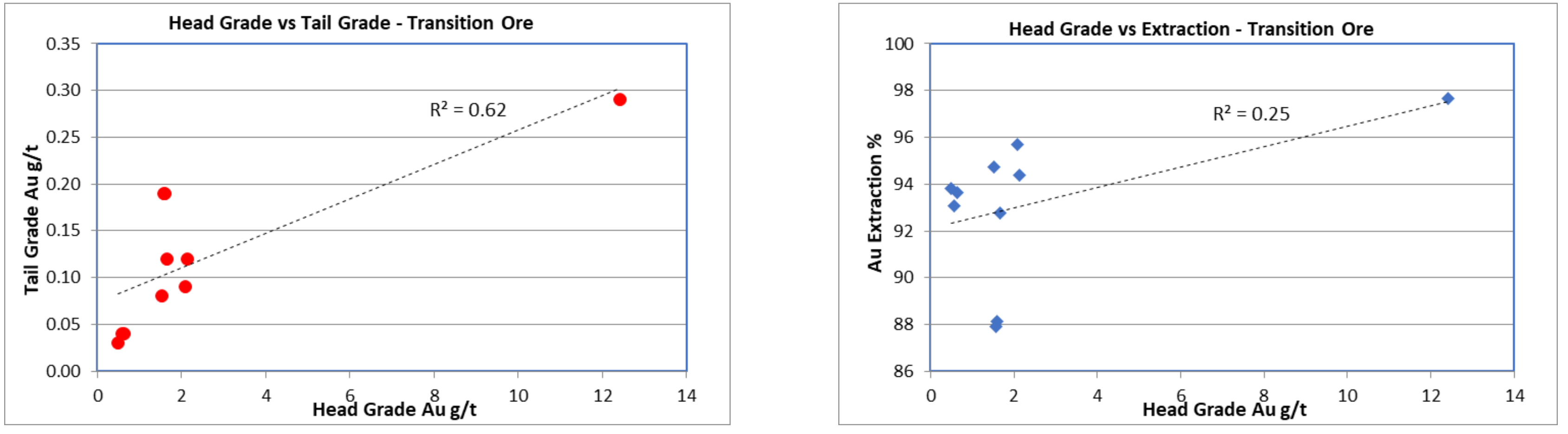
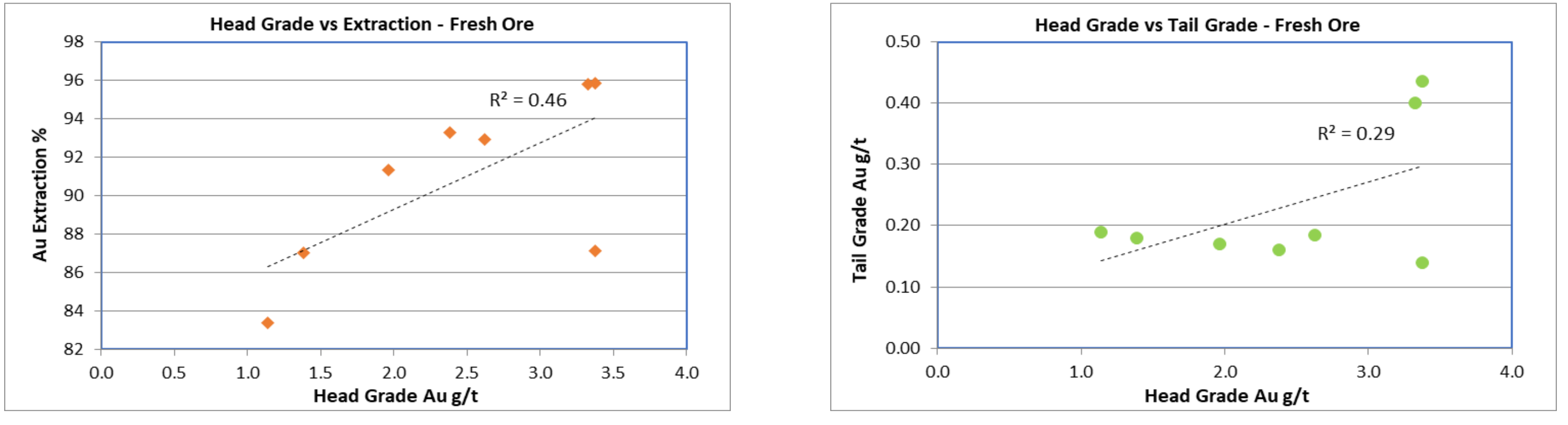


Figure 13.9.2 Gold Head Grade vs Extraction and Tails Grade –75 µm Grind Size: Fresh



Based on the PFS leach testwork results available to date, Table 13.9.1 summarises the extraction rates and reagent consumptions for the Doropo deposits and varying weathering types. The information in the table summarises the conditions of the single test that provided the highest Au extraction for each composite listed. Total Au extraction values for the Fresh composites after 36 hours were estimated from the test extraction values reported after 24 hours and 40 hours.

Table 13.9.1 Doropo Metallurgical Recoveries and Reagent Consumptions

Deposit	Ore Type	Sample ID	Test No.	Grind P_{80} (µm)	CIL Residence Time (h)	Total Extraction (%)	Cyanide[1]		Lime[2] kg/t
							Maintained Dose	kg/t	
Attire	Transitional	MC23	PW_7004	106	24	93.4	500	0.39	0.58
Attire	Fresh	MC24	PW_7008	75	36	82.0	500	0.24	0.52
Chegue Main	Oxide	MC3	PW_7185	106	24	92.3	200	0.20	1.12
Chegue Main	Oxide	MC14	PW_7165	106	24	95.7	300	0.24	1.85
Chegue Main	Transitional	MC4	PW_7160	106	24	95.3	400	0.24	0.58
Chegue Main	Fresh	MC15	PW_6981	75	36	92.7	500	0.24	0.44
Chegue South	Transitional	MC5	PW_7161	106	24	90.2	400	0.27	0.79
Chegue South	Transitional	MC16	PW_6983	106	24	84.9	500	0.30	0.70
Chegue South	Fresh	MC17	PW_6987	75	36	85.9	500	0.30	0.30
Enioda	Oxide	MC21	PW_6998	106	24	98.9	500	0.36	0.92
Han	Transitional	MC19	PW_6992	106	24	96.4	500	0.27	0.32
Han	Fresh	MC20	PW_6996	75	36	95.4	500	0.30	0.48
Kekeda	Transitional	MC6	PW_6832	106	24	94.0	500	0.39	0.39
Kekeda	Fresh	MC18	PW_6990	75	36	94.8	500	0.30	0.45
Kilosegui	Transitional	MC25	PW_7010	106	24	92.8	500	0.24	0.48
Kilosegui	Fresh	MC7	PW_7212	75	36	87.9	400	0.18	0.52
Nokpa	Transitional	MC12	PW_6971	106	24	93.3	500	0.30	0.87
Nokpa	Fresh	MC13	PW_6975	75	36	90.4	500	0.24	0.38
Souwa Oxide	Oxide	MC8	PW_7293	106	24	95.1	400	0.30	0.74
Souwa Oxide	Oxide	MC9	PW_7294	106	24	97.3	400	0.33	0.74
Souwa Oxide	Oxide	MC26	PW_7302	106	24	96.7	400	0.30	1.12
Souwa	Transitional	MC2	PW_7171	106	24	93.9	300	0.26	2.67
Souwa	Transitional	MC10	PW_7150	106	24	95.5	400	0.27	0.79
Souwa	Fresh	MC11	PW_6969	75	36	92.0	500	0.26	0.36

[1] Includes allowance for residual cyanide in the CIL tail solution. A plant CIL tails allowance of 100 mg/L NaCN has been allowed.
[2] Testwork was conducted with commercial lime having a CaO availability of approximately 60%.

13.9.2 Selected Treatment Route

The metallurgical treatment route selected has been based on the results of the current testwork programme and may be summarised as follows:

- Single stage primary crushing.
- SAG and ball mill milling with a recycle pebble crushing facility (SABC circuit).
- Gravity concentration.
- CIL feed thickening.
- Pre-oxidation and Carbon-in-leach (CIL) with oxygen addition.
- Split AARL elution circuit.
- Air / SO_2 cyanide detoxification circuit.
- Tails thickening.
- Tailings disposal.

13.10 Metallurgical Testwork Recommendations

Metallurgical testwork is to continue for the Doropo project as part of the next study phase. It is recommended the definitive feasibility study level programme includes the following testwork.

Ore Type Composite Testwork

Testwork will be conducted on the ore type composites to provide detailed information on each of the main ore types. Testwork will include:

- Oxygen uptake rate tests.
- Pre-oxidation assessment.
- Air / oxygen assessment.
- Cyanide optimisation.
- Slurry density optimisation.
- Slurry rheology.
- Cyanide detoxification.

- Demonstration tests (repeatability).
- Mineralogy and diagnostic leach tests as required.

Master Composite Testwork

Master composites will be made up from the ore type composites to represent the LOM blend or another 'design' blend as specified by the client.

Master Composite testwork will include:

- Head assay.
- Grind establishment.
- The financial benefits a finer grind for oxide and transitional ores should be investigated immediately after the PFS in order to improve definition of the next phase of the Project.
- Demonstration leach (optimised conditions).
- Sequential CIP tests.
- Carbon loading capacity (Freundlich's Isotherm).
- All tailings should be retained for possible further metallurgical investigations.

Engineering Composite Testwork

- Tailings sample preparation for additional tailings testwork.
- Pre-leach and tailings thickening.

Variability Testwork

Samples will be selected which will allow an assessment of how gold recovery is impacted by the expected mineralised material types (lithology and oxidation level), depth and location within the deposit and head grade. Testwork will be conducted using the optimised conditions determined from the ore type composite testwork.

- Head assay.
- Grind establishment (optimum grind size).
- Duplicate extraction tests.

All tailings will be retained for possible further metallurgical investigations.

Doropo Gold Project

Pre-feasibility Study

National Instrument 43-101 Technical Report

2234-GREP-001

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14.0 MINERAL RESOURCE ESTIMATES

14.1 Introduction

This Doropo update MRE has an effective date of 25 October 2022, with a drill hole data cut-off date of 25 July 2022. The MRE has been reported in accordance with the CIM Definition Standards (CIM Council, 2014).

The updated Doropo MRE has been prepared by Rindra le Grange, Patrick Adams and Michael Millad, all of Cube Consulting. Mr Millad, Cube Director and Principal Geologist / Geostatistician assumes Qualified Person responsibility for the updated MRE and the relevant sections of this report.

The reported Mineral Resources are not Ore Reserves since they do not have demonstrated economic viability. There is no guarantee that all or part of the reported Mineral Resources will be converted to Ore Reserves.

The Doropo Gold Project comprises thirteen prospects, namely Kilosegui, Vako, Attire, Souwa, Nokpa, Chegue Main, Chegue South, Kekeda, Han, Enioda, Nare, Hinda and Tchouahinin. Of these, the MREs for Kilosegui (KILO), Attire (ATI), Souwa (SWA), Nokpa (NOK), Chegue Main and South (CHG), Kekeda (KEK), Han (HAN) and Enioda (ENI) were updated in this study following the collection of the additional PFS phase drill data. The primary objective of the additional infill drilling was to raise the Mineral Resource confidence classification rating of the prospects for input into the upcoming PFS.

A cut-off grade of 0.5 g/t gold is used for reporting as it is believed that the majority of the reported resources can be mined at that grade. The Mineral Resource cut-off grade of 0.5g/t was established prior to the PFS study, confirming the economic viability of a smaller portion of lower-grade oxide resources. As Centamin proceeds with the DFS, a review and revision of the Mineral Resource cut-off grades for oxide resources will be conducted.

14.2 Software

Cube made use of Geoaccess Professional, Supervisor, Leapfrog Geo, Surpac and Isatis v2018.4 software to undertake the MRE update.

14.3 Data Used for Estimation

14.4 Drill Database

Data from the site-maintained drill database was provided to Cube as .csv format export files on a regular basis, as each prospect's PFS drilling program was completed. Ultimately, the final database provided included all drill results as at 25 July 2022, and the various tables were compiled into a MS Access estimation database file 'Cube_DRP_20220725.mdb'. The table types used for estimation included collar, survey, assay, lithology (includes weathering / oxidation codes) and density.

14.5 Actions on Undefined / Null and Below Detection Limit Samples

Undefined or null sample intervals predominantly represent hanging wall intervals that were not sampled due to being above the mineralised lodes, and so these assay intervals were ignored for modelling purposes. Below detection limit value sample intervals were set at half of the detection limit for the specific assay method.

14.6 Wireframe Models and Data Coding

14.6.1 Mineralisation

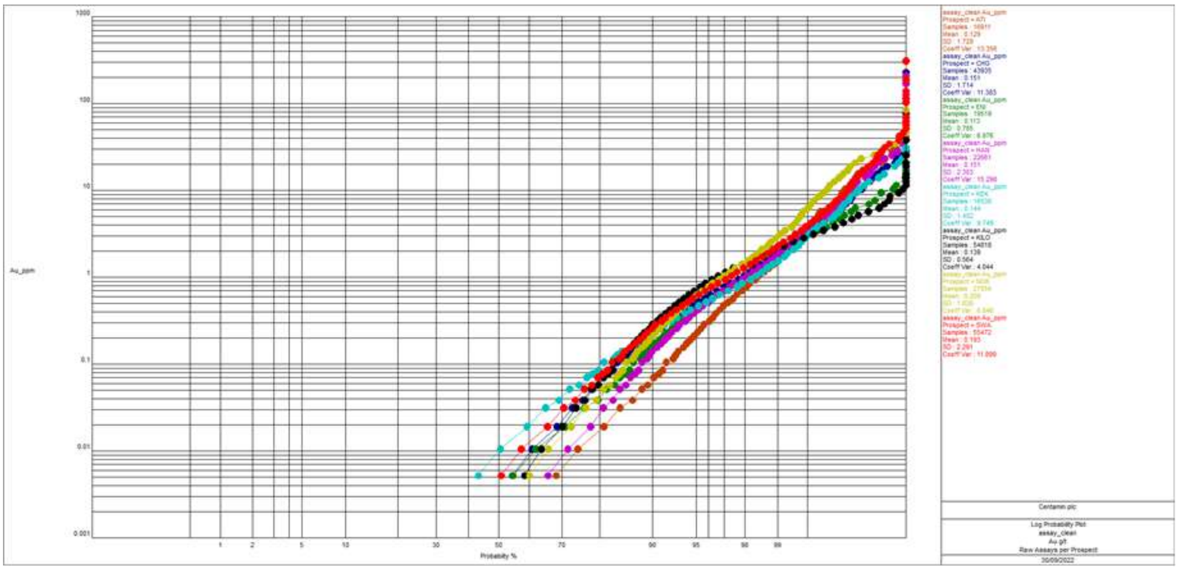
Log probability plots of the raw data indicates a 0.2 g/t to 0.3 g/t natural low threshold (Figure 14.6.1) is suitable for defining the zones of mineralisation. This threshold is often also coincident with zones of silica-sericite alteration and quartz veining, along with the presence of sulphides.

The mineralised domain wireframes generated during the 2021 MRE update were used as a guide, along with hand drawn sections provided by the Centamin field personnel. The infill drilling demonstrated that the previous 2021 mineralisation interpretations, broadly speaking, were robust. Aside from local variations in width at new drill hole locations, and some lode extensions in certain areas, the geological and mineralisation continuity has remained largely unchanged.

The intercept codes for each lode domain were defined in Surpac and then exported to Leapfrog Geo, where they were used to generate wireframe volumes using the vein modelling method. These codes were also subsequently used to generate the equal length composites for grade interpolation. The wireframes were clipped at 50 m beyond the last drill hole both down dip and along strike.

The hanging wall and footwall of each lode could be confidently defined in most cases, thus making interpretation relatively uncomplicated and supporting the view that the modelled volume and continuity of mineralisation at the lode scale is of high confidence.

Figure 14.6.1 Log Probability Plots per Prospect for Gold Grade Assays, Showing Grade Inflexions at 0.2 g/t to 0.3 g/t, the Approximate Threshold Used to Define the Mineralised Zone Boundaries



Attire (ATI)

The infill drilling at Attire targeted the south-eastern extension of the lode and extended the main shear (Domain 12001) another 450 m in this direction (Figure 14.6.2). Drill hole spacing remains on average at a relatively wide 50 m x 50 m. The lodes strike NW-SE and dip steeply to the north-east at approximately 70°, with thickness typically ranging between 5 m and 8 m. Mineralisation is open at depth.

Chegue (CHG) and Nokpa (NOK)

Chegue Main, Chegue South and Nokpa are in close proximity to one another (Figure 14.6.3). Infill PFS drilling at Nokpa reduced the drill hole spacing to an average of 20 m x 40 m. At Chegue Main and Chegue South, the drill hole spacing was reduced from a nominal 50 m x 50 m to 25 m x 50 m. The infill drilling confirms the consistency of the previously interpreted mineralised zones.

The main mineralised lode at NOK is Domain 4001 and consists of an anticline with fold axis plunging to the north-northwest. The mineralisation is concentrated on the fold axis and is open at depth. The limbs of the fold are not as well mineralised. Domain 4004 is a splay off the northern limb of Domain 4001. Domain 4002 consists of a hanging wall lode off the southern limb of Domain 4001. A NW-SE barren dyke cross-cuts the NOK anticline. The lodes at NOK dip between 30° and 35° to the northwest and north. The thickness of the main lode around the fold axis varies between 20 m and 40 m. The northern and southern limbs are thinner with an average thickness around 4 m to 5 m.

At CHG Main, information from the PFS infill drilling suggests a different interpretation for Domain 5002, where it is now split into two Domains 5002 and 5003.

The mineralised lodes at CHG South are cross-cut by a NW-SE trending barren dyke. Three lodes are interpreted north of the dyke (Domains 5004 to 5006). South of the dyke, two mineralised lodes are interpreted (Domains 5007 and 5008). North of the dyke the lodes have an average thickness varying between 15 m and 20 m and dip gently to the east at 25° to 30°. South of the dyke the thickness for Domain 5008 varies between 10 m and 16 m and for Domain 5007 is between 5 m to 10 m. Most of the gold metal for CHG South is located within Domain 5005.

Figure 14.6.2 ATI Interpreted Mineralised Lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes Without Assay Results)

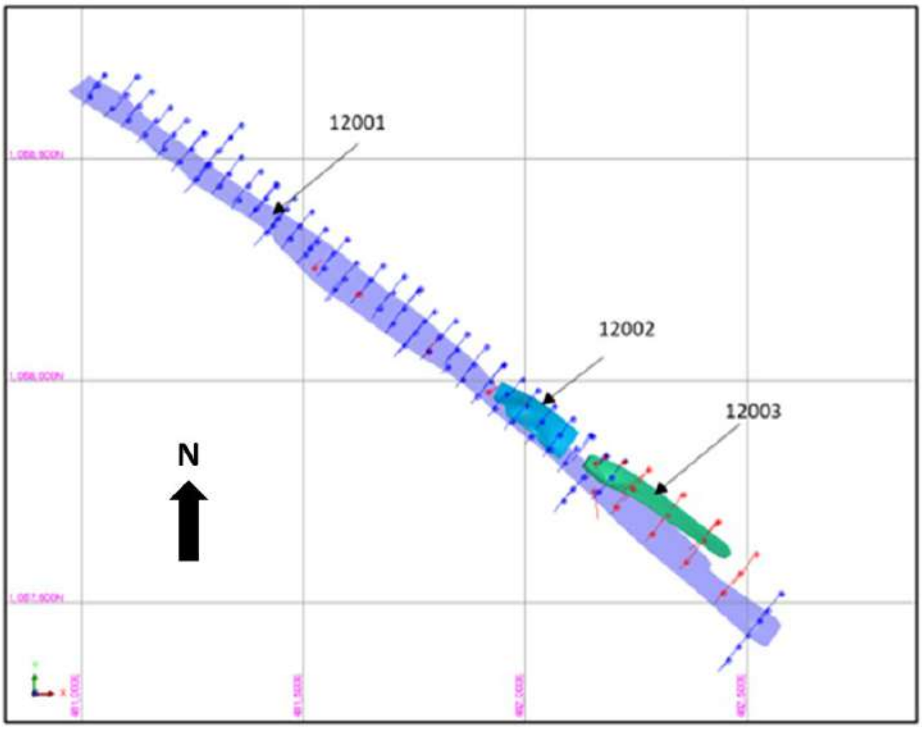
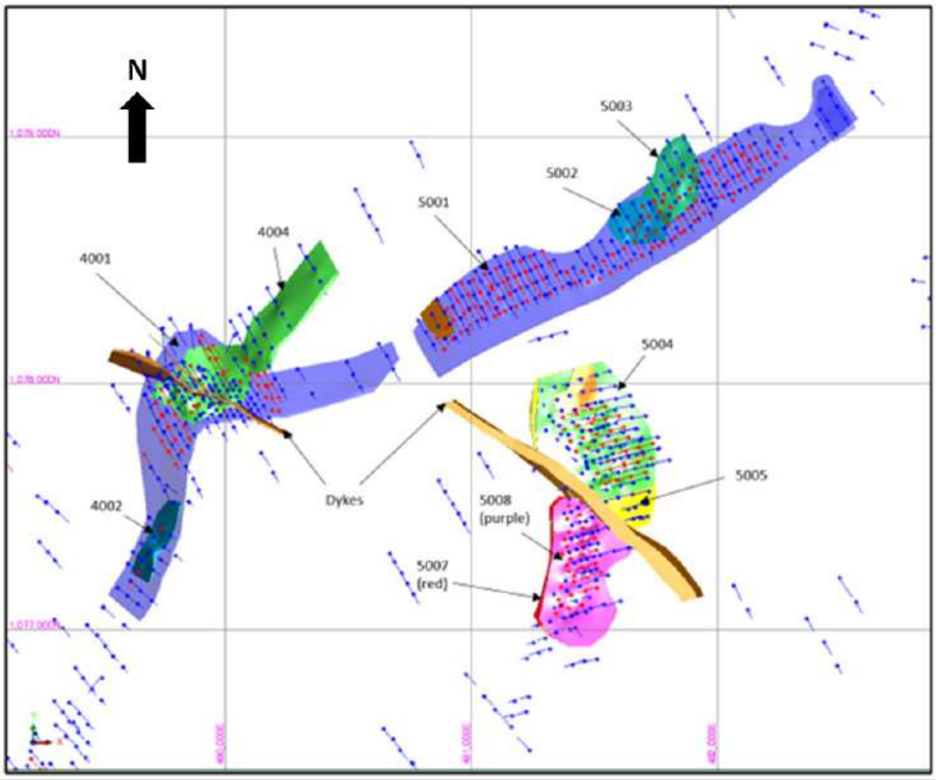


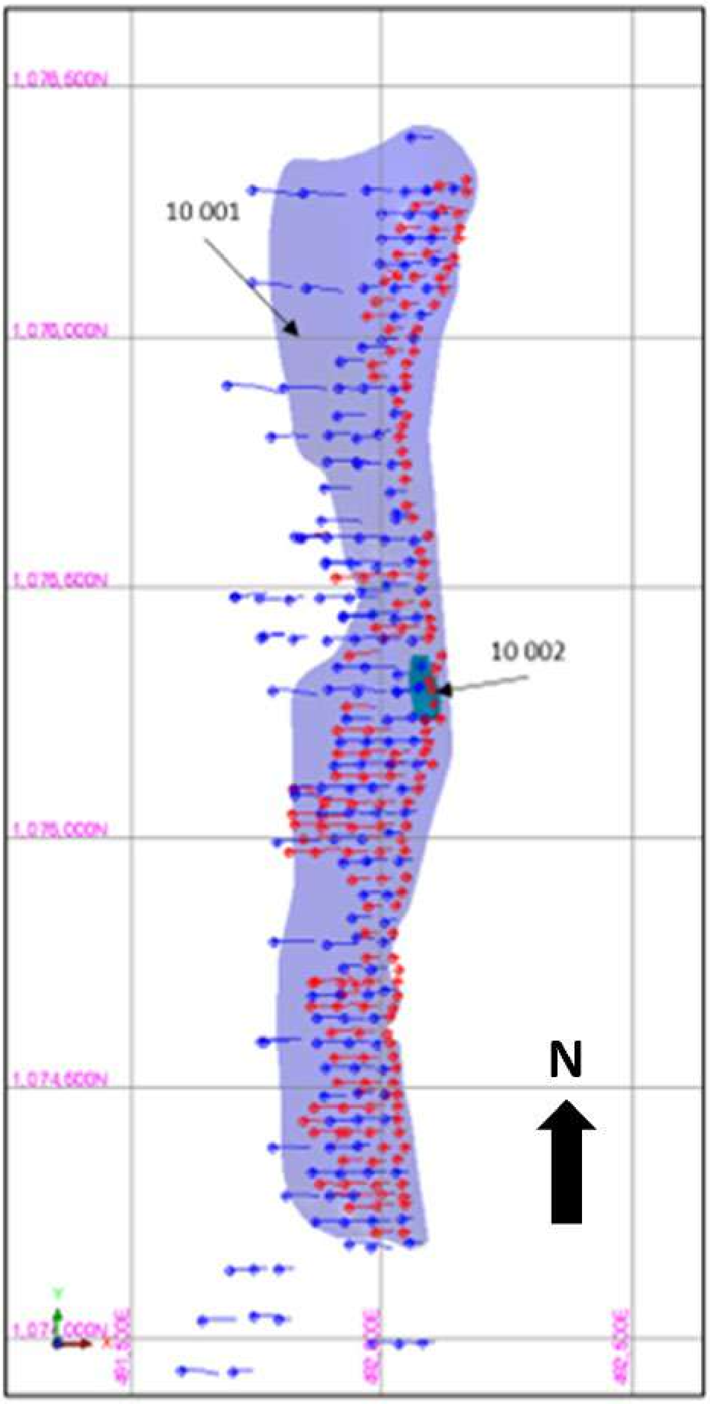
Figure 14.6.3 CHG and NOK Interpreted Mineralised lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes without Assay Results)



Enioda (ENI)

The main lode interpreted at ENI is Domain 10001, which strikes N-S, dipping gently at ~30° to the west. It covers a strike distance of 2,200 m (Figure 14.6.4) with thickness varying between 10 m and 20 m. The PFS infill drilling reduced the drill hole spacing to 25 m x 50 m and confirms the thickness and consistency of the mineralisation relative to the previous MRE update in 2021. Mineralisation remains open at depth.

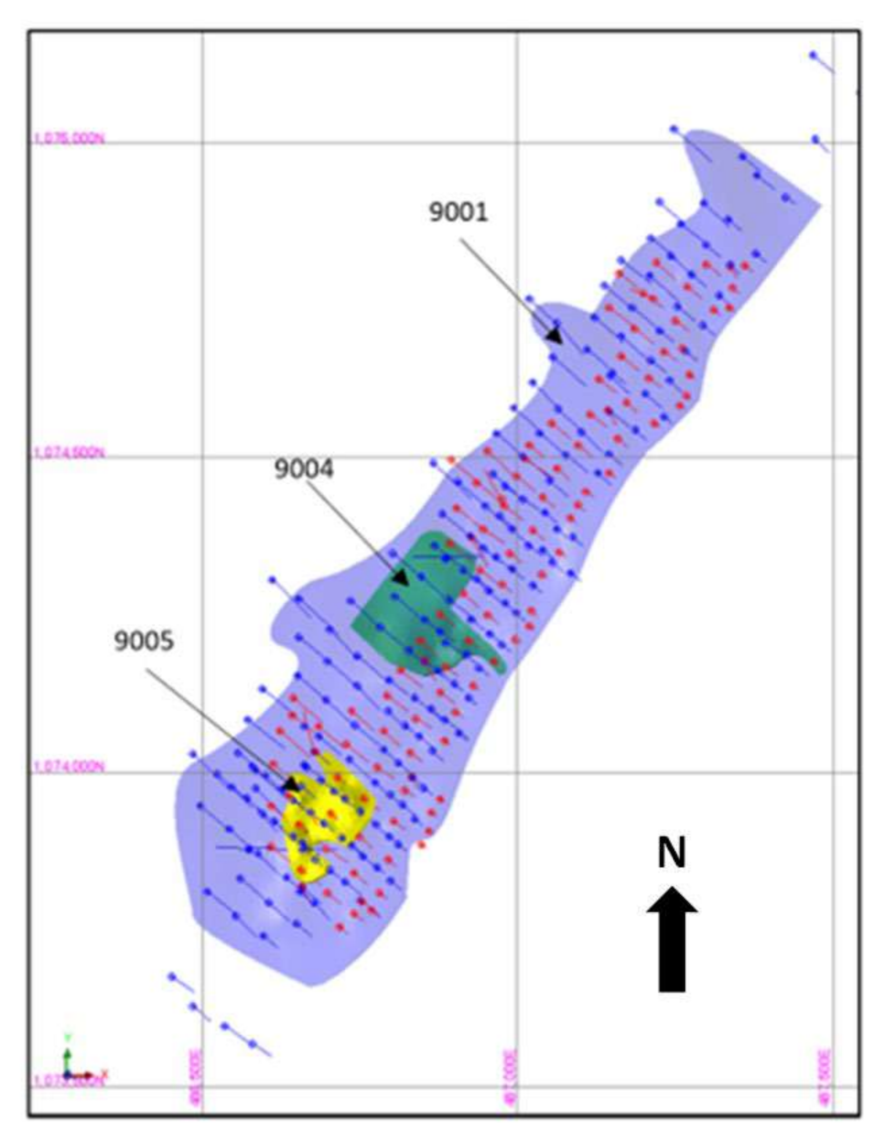
Figure 14.6.4 ENI Interpreted Mineralised Lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes Without Assay Results)



Han (HAN)

Domain 9001 is the main mineralised lode interpreted at HAN, containing most of the gold metal, with a thickness varying between 10 m and 15 m. The PFS infill drilling at Han reduced the average spacing to 25 m x 50 m. The infill drilling confirms the thickness and continuity of the mineralisation.

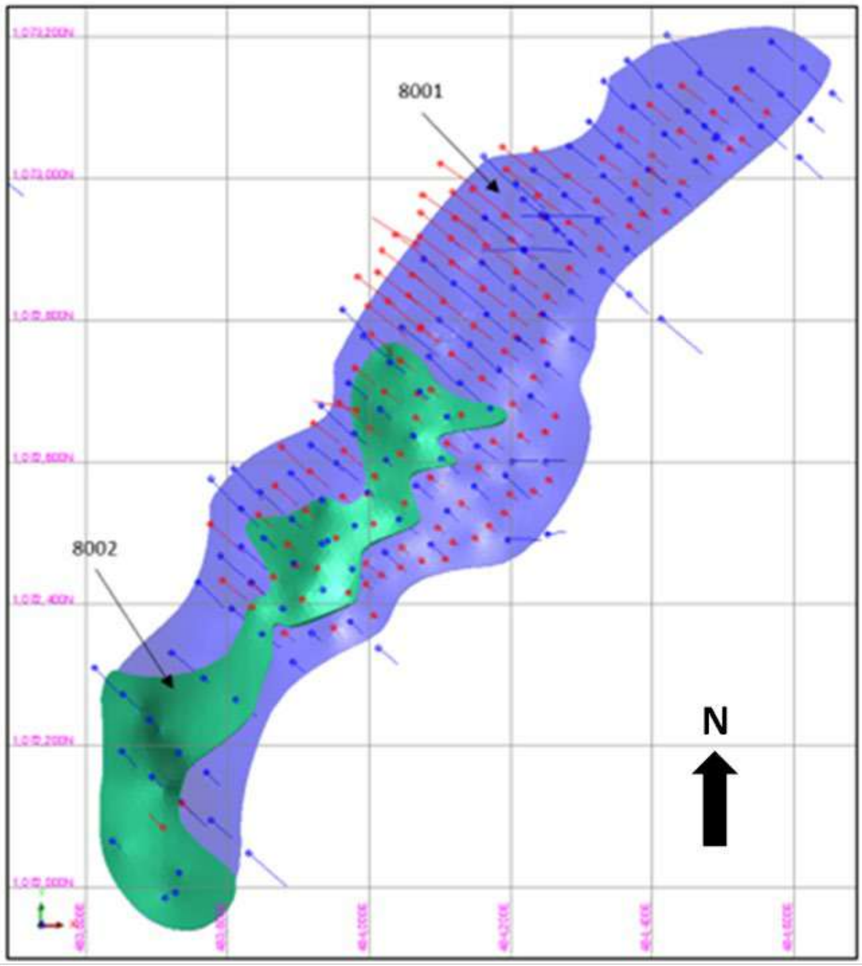
Figure 14.6.5 Han Interpreted Mineralised Lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes without Assay Results)



Kekeda (KEK)

The KEK mineralised lodes strike NE-SW with the main lode Domain 8001 extending over 1,500 m. Domain 8003 is a smaller lode off the hanging wall of Domain 8001. The main lode has a thickness varying between 10 m and 20 m. Infill drilling at KEK has confirmed the thickness and consistency of the mineralisation relative to the 2021 update and it remains open down dip. Average drill hole spacing at KEK is reduced to 25 m x 50 m.

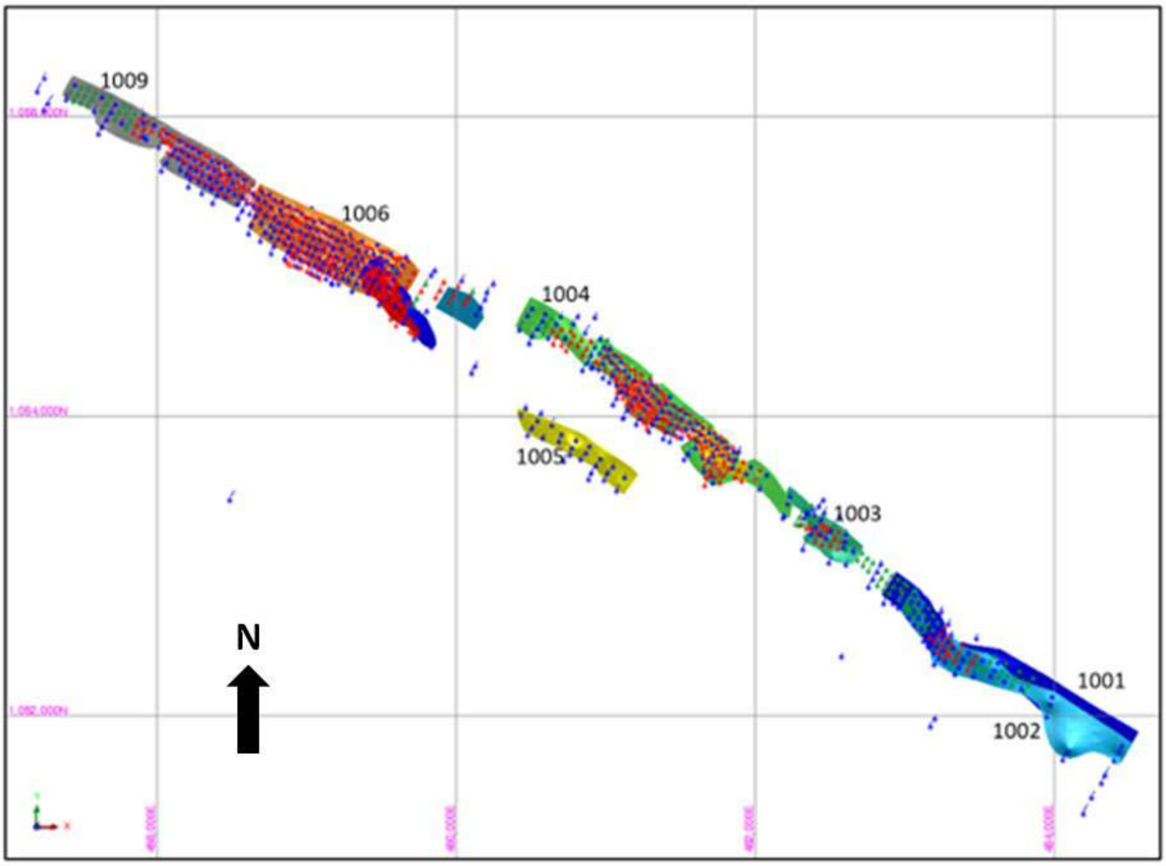
Figure 14.6.6 KEK Interpreted Mineralised Lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes without Assay Results)



Kilosegui (KILO)

The lodes at KILO extend over an 8 km strike length and dip gently to the south-west at ~30°. An average drill spacing of 25 m x 50 m has been attained following the PFS infill program. Information from infill drilling from central and northern part of the prospect were available to be used at the time of the MRE update. Additional drilling is being carried out in the southern part of the prospect and will be used for a future resource update. Fifteen mineralised lodes were updated, which include Domains 1001-1007, 1009, 1011-1012, 1015-1016 and 1021-1023. The infill drilling confirms the thickness and consistency of the mineralisation with respect to the previously interpreted mineralised zone. The wireframe interpretations were limited to 50 m beyond the last drill hole.

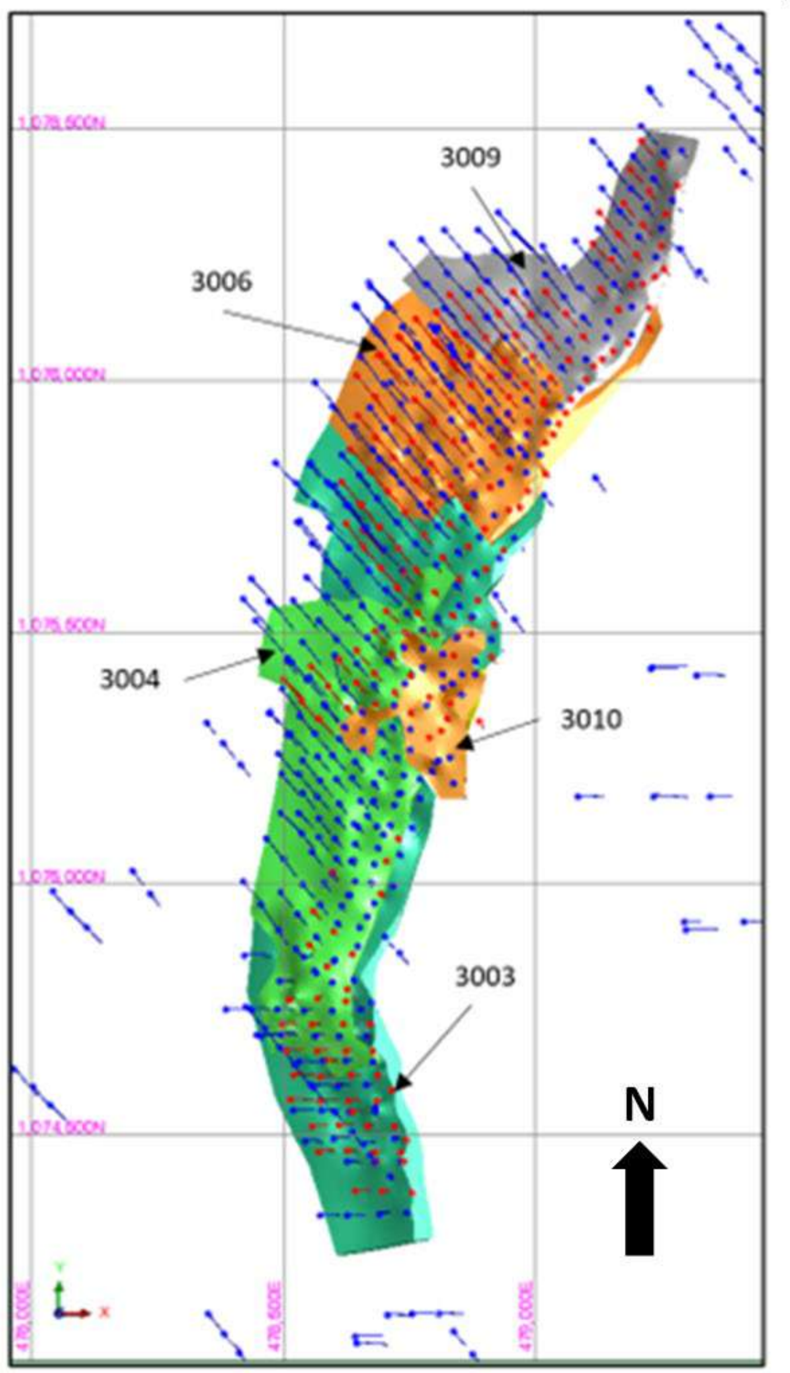
Figure 14.6.7 KILO Interpreted Mineralised Lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes without Assay Results)



Souwa (SWA)

The drilling and mineralised lodes at SWA cover a strike extent of 2.4 km. The lodes strike NNE-SSW and dip at ~35° to the west. The average drill hole spacing has been reduced to 20 m x 40 m as a result of the PFS infill drilling program. Six mineralised lodes were updated and consist of Domains 3003-3006, 3009 and 3010. The infill drilling has again confirmed the thickness and continuity of the mineralisation with respect to the previous MRE update in 2021. The wireframe interpretations were limited to 50 m beyond the last drill hole.

Figure 14.6.8 SWA Interpreted Mineralised Lodes with Drill Holes (Blue=Existing, Red= New PFS Holes, Green=New PFS Holes Without Assay Results)



14.6.2 Weathering, Oxidation and Regolith

The weathering, oxidation and regolith characteristics were modelled separately. Weathering intensity was logged as a separate item to primary lithology. Surface DTM models were created in Leapfrog Geo using the codes displayed in Table 14.6.1, Table 14.6.2 and Table 14.6.3. The weathering and oxidation zones were based on the weathering intensity logging ('WI' database field) while the regolith was modelled using the 'Lith1' logging code in the supplied database.

Table 14.6.1 Weathering Zones Modelled and the Logging Codes ('WI' Field) Used

WI Logging Code	Weathering Zone
CW	Completely Weathered
HW	Highly Weathered
MW	Moderately Weathered
FR	Fresh Rock

Table 14.6.2 Regolith Zones Modelled and the Logging Codes ('Lith1' Field) Used

Lith1 Logging Code/s	Regolith Zone
LAT, TCLY, TLAT, TPLT, TSND and TSOL	Transported Cover
SAP	Saprolite
SAPR	Saprock
All other Lithology Codes	Fresh Rock

Table 14.6.3 Oxidation Zones Modelled and the Logging Codes ('WI' Field) Used

WI Logging Code/s	Oxidation Zone
CW, HW	Oxide
MW	Transitional
FR	Fresh Rock

14.7 Sample Compositing

Cube carried out an assessment of the raw assay interval length and raw gold assays in order to determine the most appropriate length for compositing of the samples. The analysis was carried out on RC, DD and RCD samples only. A sample length of 1 m is the most common as shown in Figure 14.7.1, with almost 100% of the raw samples being exactly 1 m in length. There is also no apparent relationship between sample length and assay grade (Figure 14.7.1).

Figure 14.7.1 Histogram of Raw Assay Length (m)

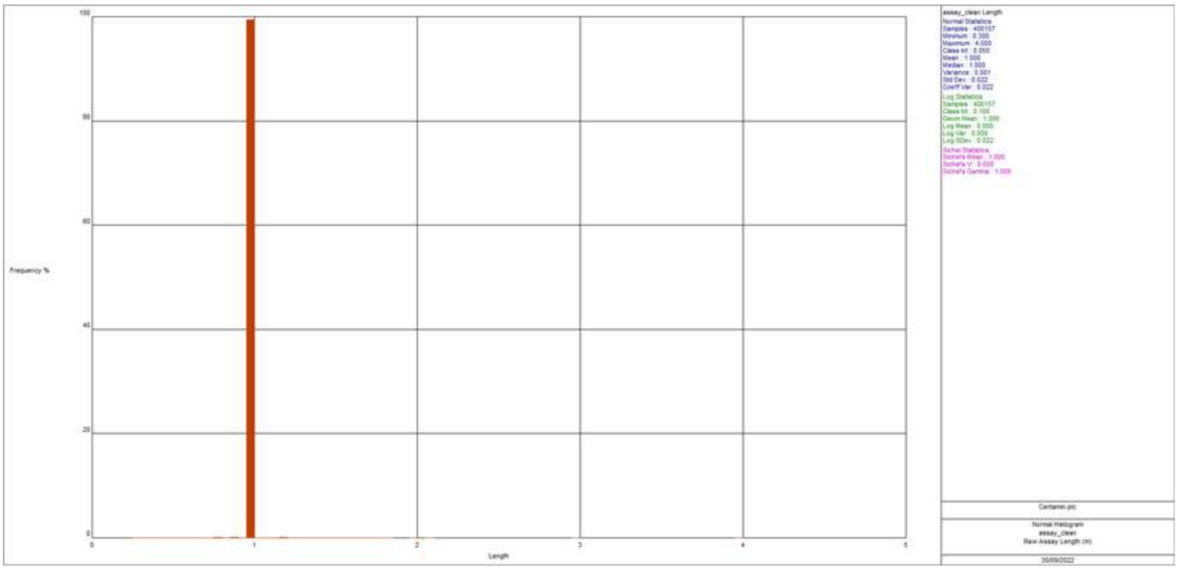
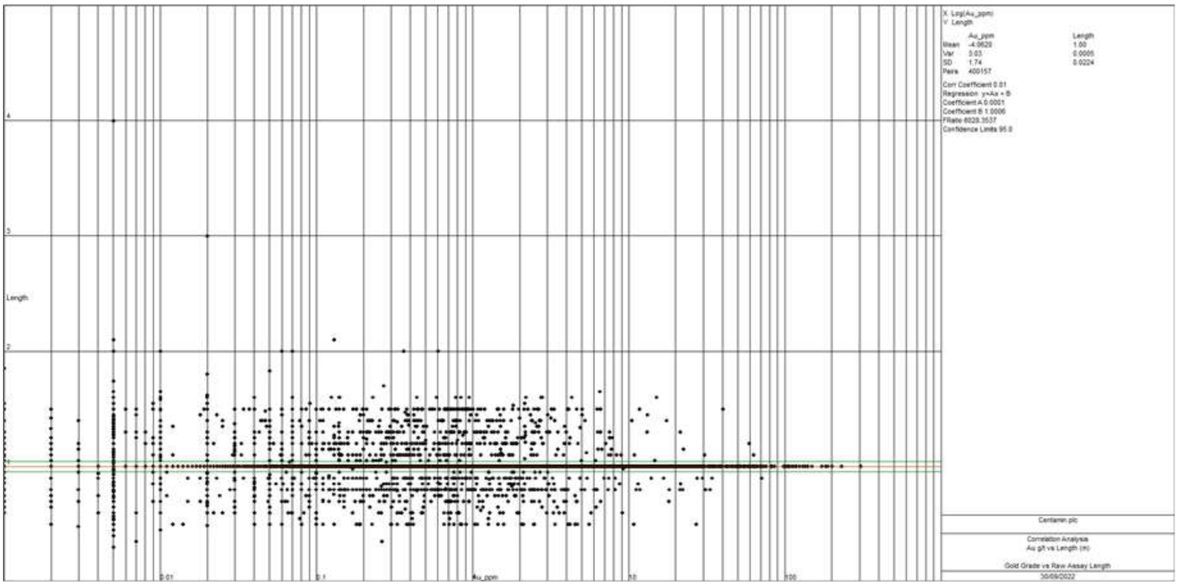


Figure 14.7.2 Scatter Plot of Raw Assay Length versus Gold Grade



A compositing target length of 1 m was selected for the following reasons:

- Since almost 100% of the raw assay and density intervals are 1 m or less in length, the use of a 1 m target length would result in minimal sample splitting.
- The composite length was considered suitable for the range of estimation block sizes under consideration.
- The 1 m target length provides an opportunity for maximum resolution to be obtained on local estimates.

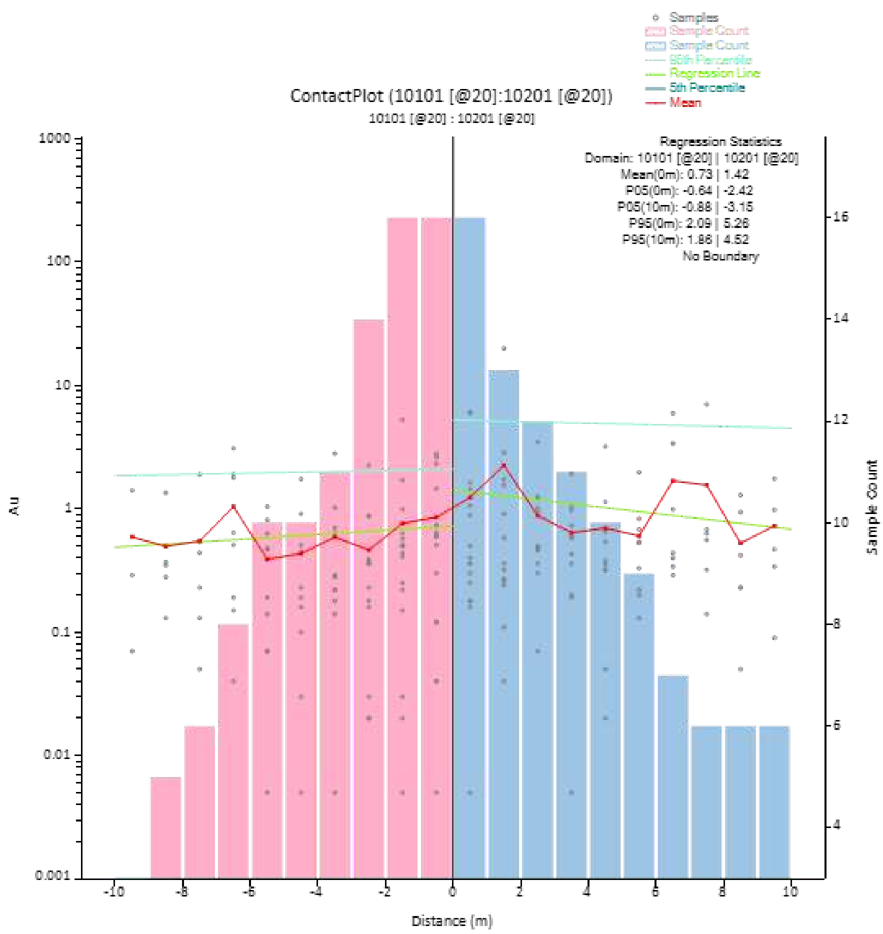
Samples were composited downhole per mineralised domain to 1 m using the best fit methodology in Surpac with a minimum threshold size of 0.75 m flagged. Residual composites less than 0.75 m were then checked for any grade bias – none was found at any of the prospects and so all residuals were included for gold grade interpolation.

14.8 Boundary Analysis on Weathering Surfaces

A boundary analysis was undertaken on the weathering zone transitions as part of the previous MRE in 2021 (Centamin, 2021) and it was not considered necessary to repeat the analysis since the prospect areas had sufficient samples in each weathering domain at the time for a meaningful analysis.

An example of the boundary analysis chart is shown in Figure 14.8.1. The analysis shows that there is not a significant difference in the mean grade between the oxide and fresh domain and the gold grade changes gradationally across the boundary. Therefore, there is no need to separate the two weathering domains and the mineralised lode domains will serve as the only hard boundary in the estimation process.

Figure 14.8.1 Boundary Analysis Between Oxide (200 Series) vs Fresh (100 series) at Enioda Prospect



14.9 Basic Statistics

Basic statistics for the 1 m gold composites are summarised in Table 14.9.1. Log-probability plots for gold grade are displayed in Figure 14.9.1 to Figure 14.9.9.

The gold grade is predominantly highly variable and shows clear evidence of multi-modality. This demonstrates that there are at least two sub-populations of gold within the lode envelopes. However, explicit sub-domaining of the higher-grade sub-population, which typically manifests at or above the 90th percentile of the grade distribution, is considered to be a risky approach, due to the limited continuity at these grade thresholds and the attendant risk that would be introduced in terms of defining the high-grade volume. It was therefore decided to use a non-linear grade interpolation method at Doropo, which is well suited to dealing with high grade variability and also provides the advantage of being able to predict the recoverable grade-tonnage relationship at a smaller Selective Mining Unit (SMU) block size. Localised Uniform Conditioning (LUC), which is a non-liner method suited open pit mining methods, was used to interpolate gold grade.

Table 14.9.1 Basic Statistics of all Domains in the Various Updated Prospect Areas

Prospect	Domain	N	Min	Max	Mean	Median	Std Dev	CoV
ATI	12001	944	0.005	123.8	1.73	0.31	6.92	3.99
	12002	58	0.005	4.6	0.54	0.34	0.82	1.53
	12003	59	0.005	6.1	0.57	0.33	0.93	1.62
CHG	5001	3,585	0.002	59.0	0.79	0.37	1.92	2.42
	5002	121	0.005	18.8	0.86	0.29	2.11	2.45
	5003	340	0.01	21.1	0.89	0.37	1.85	2.07
	5004	1,598	0.001	229.8	0.68	0.17	6.09	8.98
	5005	2,238	0.001	113.1	0.73	0.21	3.81	5.19
	5006	180	0.005	5.5	0.24	0.03	0.66	2.74
	5007	990	0.001	66.2	0.49	0.14	2.55	5.23
	5008	1,235	0.001	74.3	0.82	0.20	3.75	4.57
	5020	22	0.005	4.4	0.90	0.29	1.22	1.36
	5021	63	0.005	2.7	0.30	0.21	0.38	1.25
ENI	10001	3,339	0.001	70.6	0.97	0.39	2.79	2.89
	10002	35	0.1	5.8	0.62	0.26	1.02	1.66
HAN	9001	2,990	0.001	199.6	1.70	0.42	8.27	4.86
	9004	114	0.001	7.4	0.34	0.14	0.78	2.32
	9005	142	0.001	3.3	0.43	0.23	0.54	1.24
KEK	8001	2,915	0.003	117.1	0.87	0.35	3.59	4.14
	8003	532	0.005	55.1	0.93	0.34	3.37	3.64
KILO	1001	995	0.005	6.3	0.68	0.47	0.70	1.02
	1002	431	0.005	3.9	0.54	0.41	0.49	0.91
	1003	339	0.005	6.7	0.99	0.65	1.05	1.06
	1004	3,575	0.005	38.1	1.13	0.55	1.88	1.66
	1005	188	0.005	9.1	0.77	0.35	1.17	1.52
	1006	5,150	0.005	105.7	0.86	0.48	1.87	2.18
	1007	540	0.005	16.3	1.02	0.39	1.82	1.79
	1009	2,358	0.001	20.5	0.75	0.40	1.18	1.57
	1011	287	0.005	3.8	0.63	0.31	0.76	1.21
	1012	64	0.005	3.6	0.45	0.29	0.54	1.19
	1015	272	0.005	9.6	0.56	0.27	0.95	1.71
	1016	320	0.005	3.8	0.47	0.28	0.58	1.24
	1021	115	0.005	13.7	0.60	0.29	1.39	2.34
	1022	23	0.005	1.2	0.24	0.21	0.25	1.08
	1023	66	0.03	1.3	0.34	0.24	0.29	0.85
NOK	4001	2,724	0.005	100.5	1.74	0.59	5.11	2.94
	4002	81	0.005	2.9	0.41	0.24	0.49	1.21
	4004	944	0.005	103.9	0.99	0.23	5.13	5.17
SWA	3003	4,172	0.005	105.6	0.96	0.38	3.96	4.12
	3004	2,017	0.005	110.1	1.14	0.42	4.31	3.79
	3005	353	0.005	18.9	0.50	0.20	1.39	2.81
	3006	2,601	0.001	182.4	1.64	0.59	7.01	4.26
	3009	834	0.005	103.3	1.31	0.51	5.01	3.82
	3010	398	0.005	306.1	1.51	0.36	15.39	10.20

Figure 14.9.1 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – ATI Domains

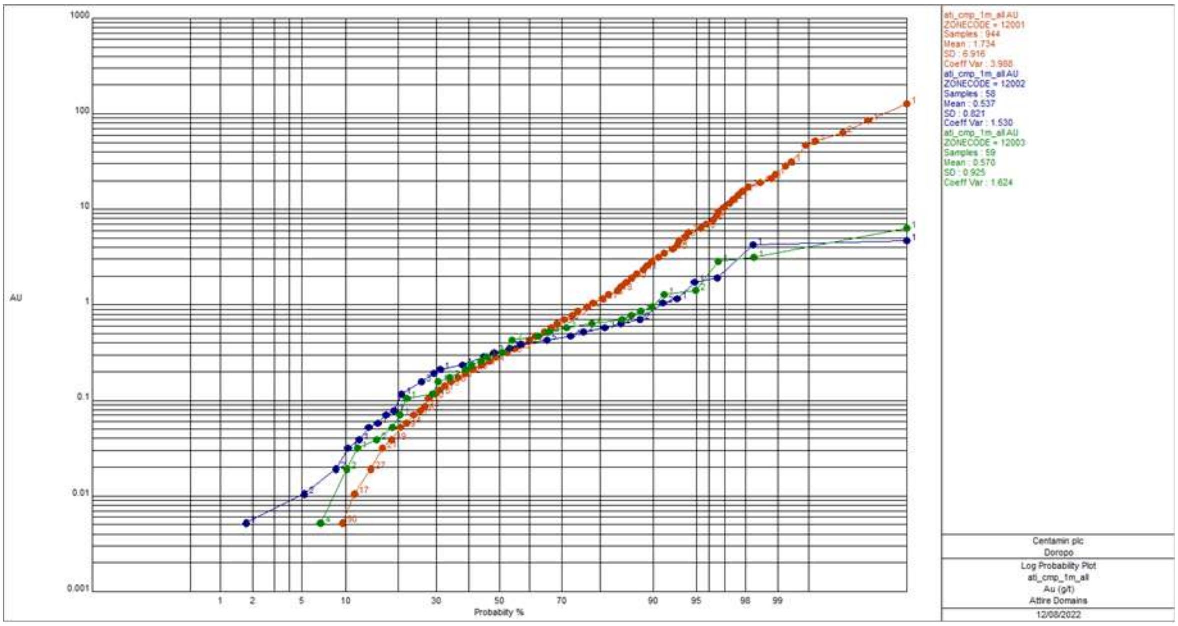


Figure 14.9.2 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – CHG Domains

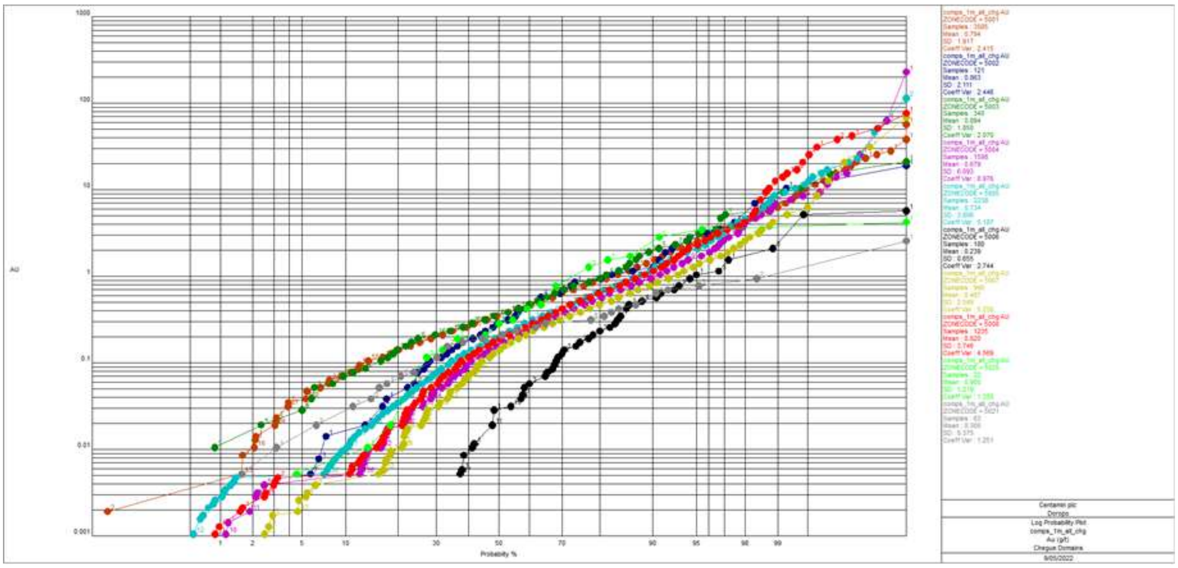


Figure 14.9.3 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – ENI Domains

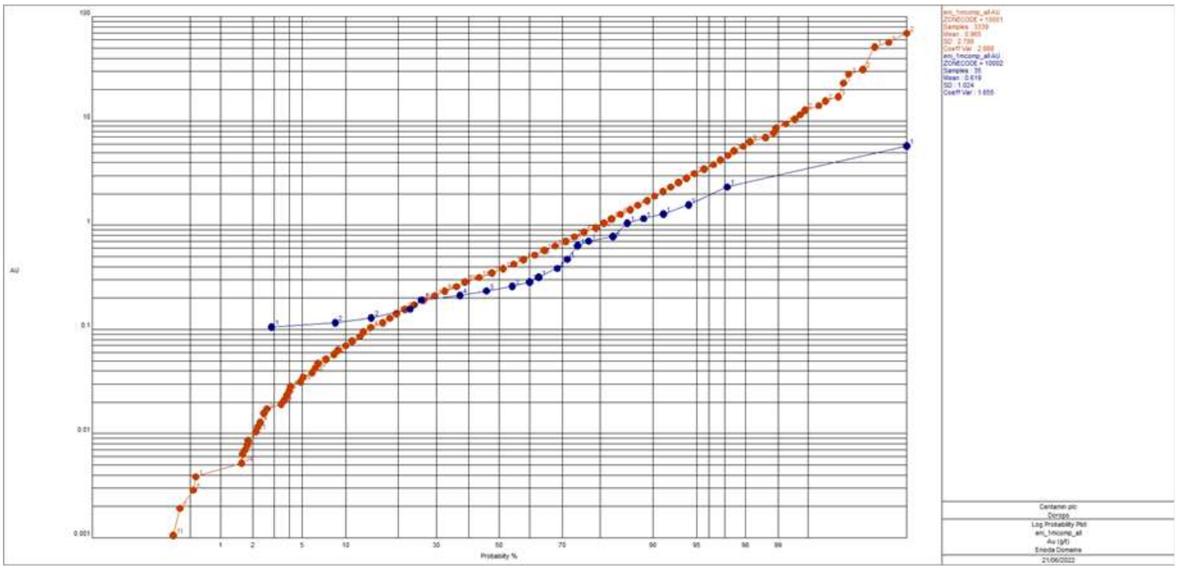


Figure 14.9.4 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – HAN Domains

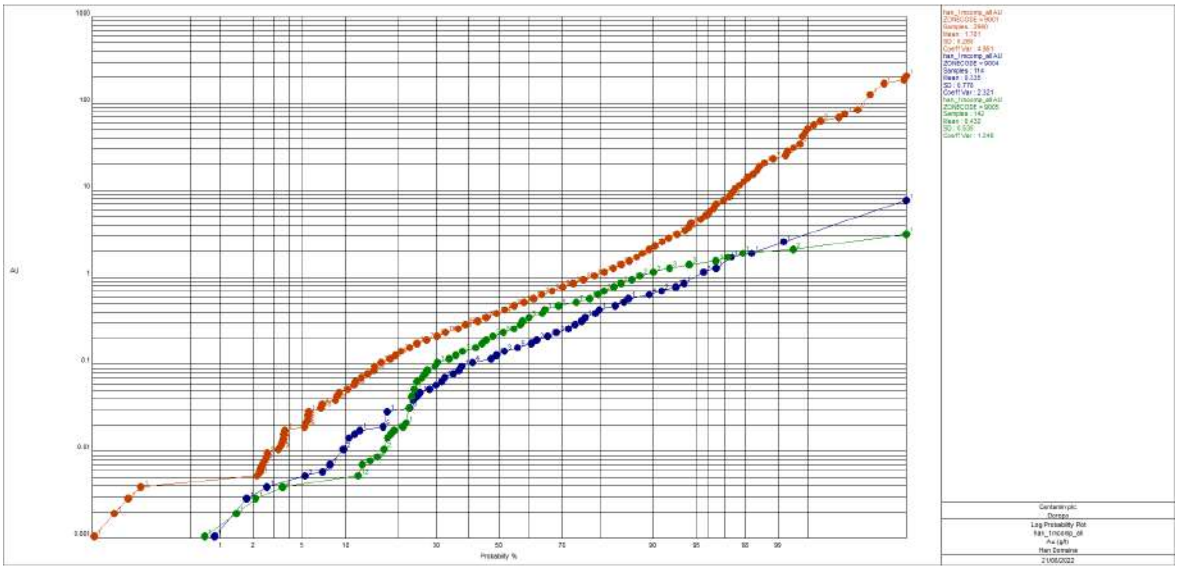


Figure 14.9.5 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – KEK Domains

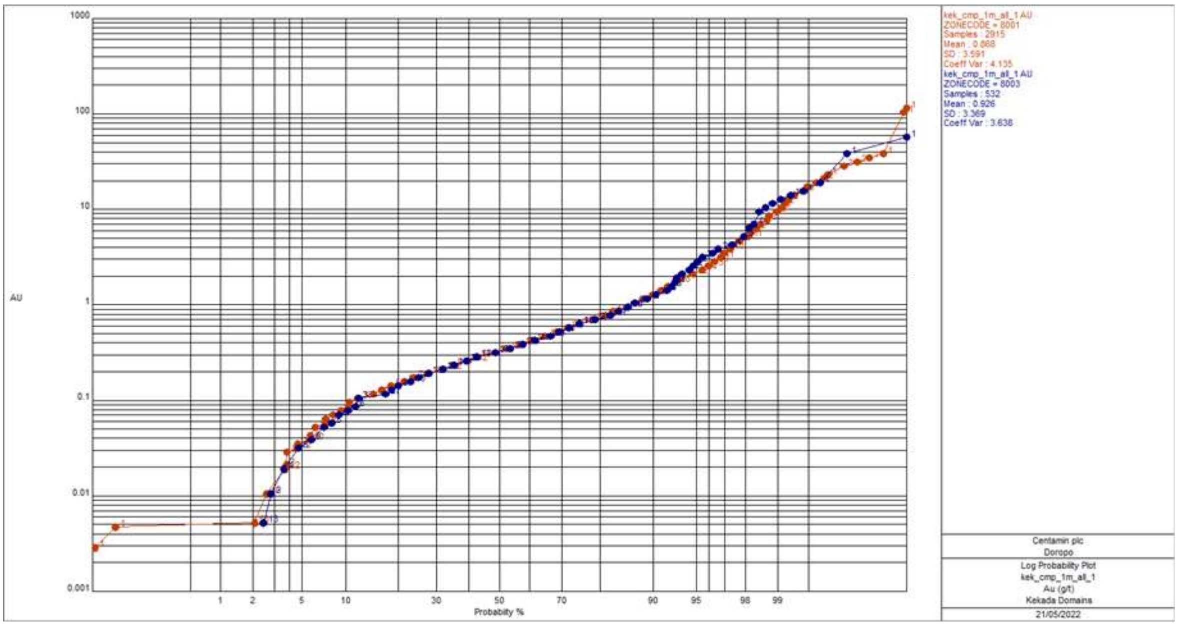


Figure 14.9.6 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – KILO Major Domains

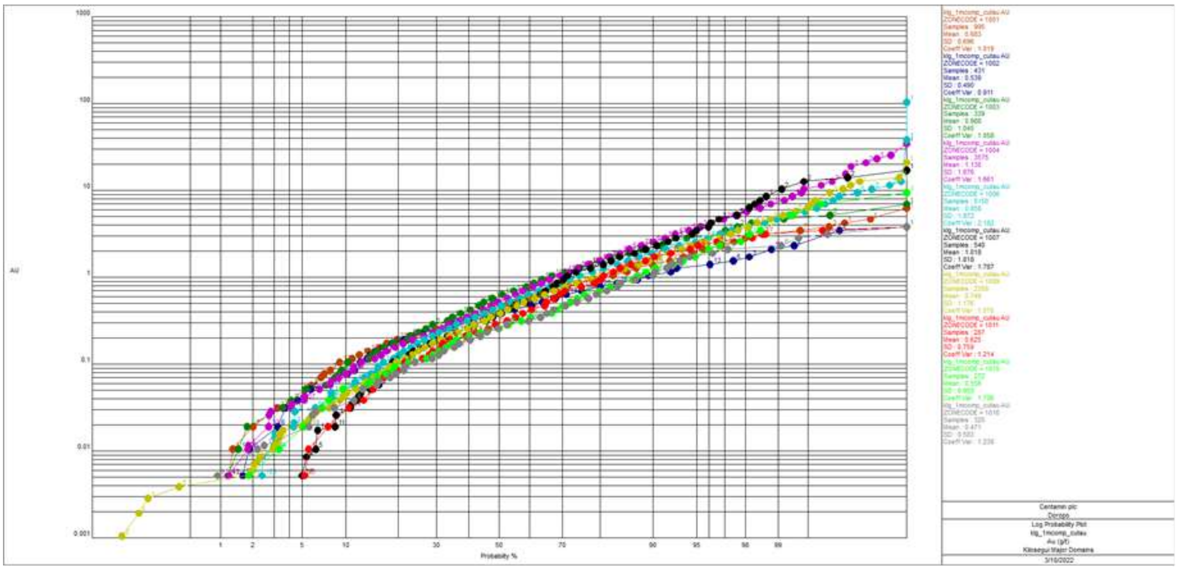


Figure 14.9.7 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – KILO Minor Domains

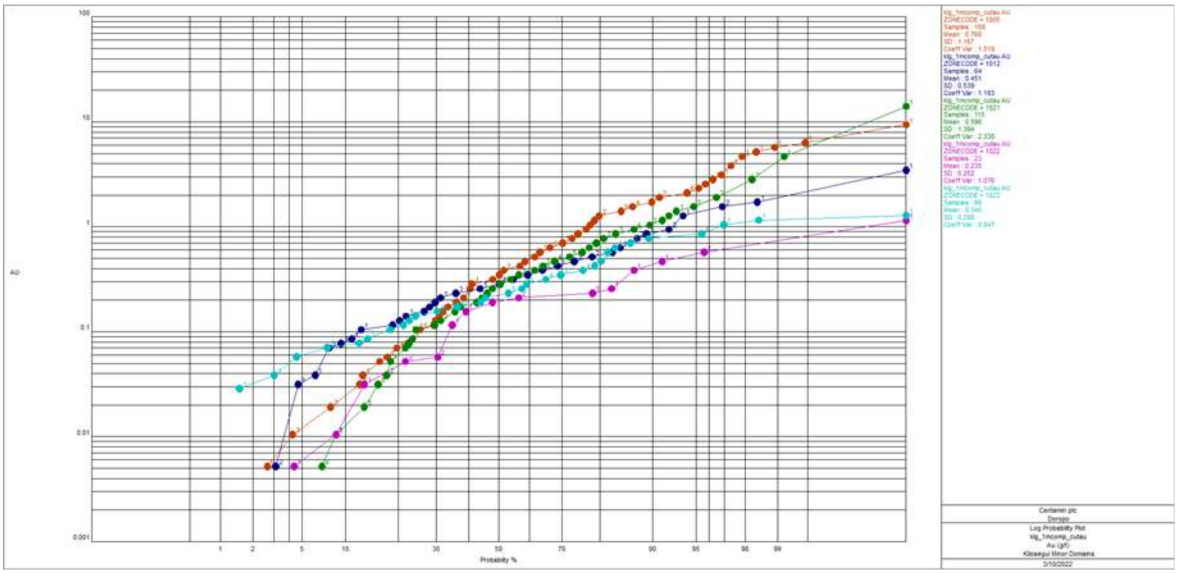


Figure 14.9.8 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – NOK Domains

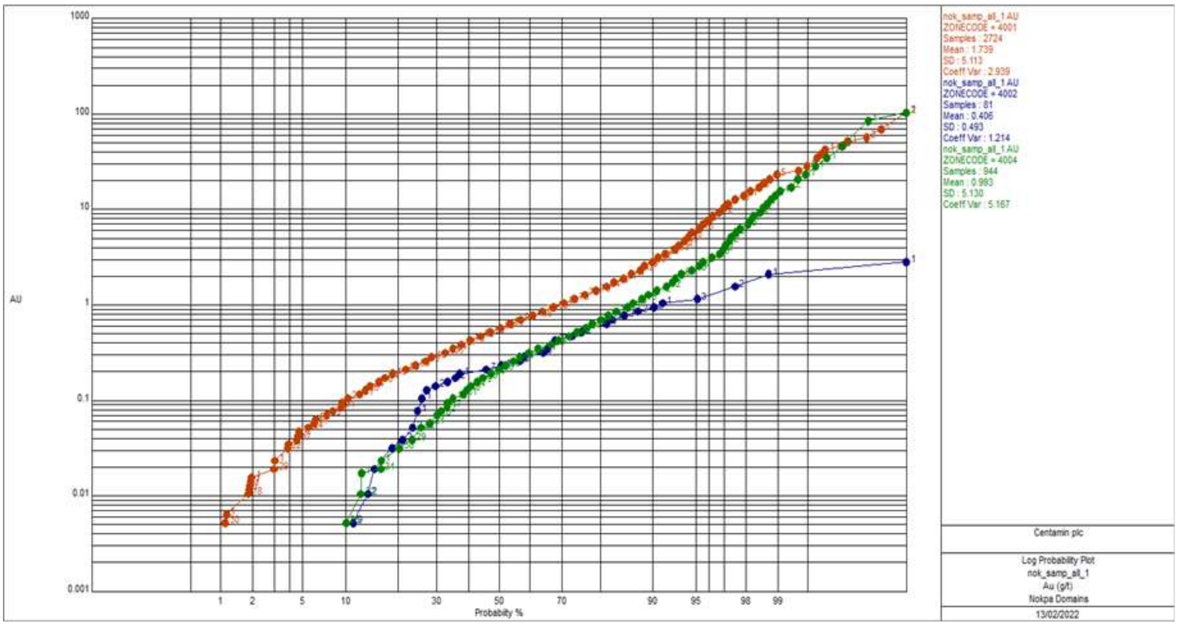
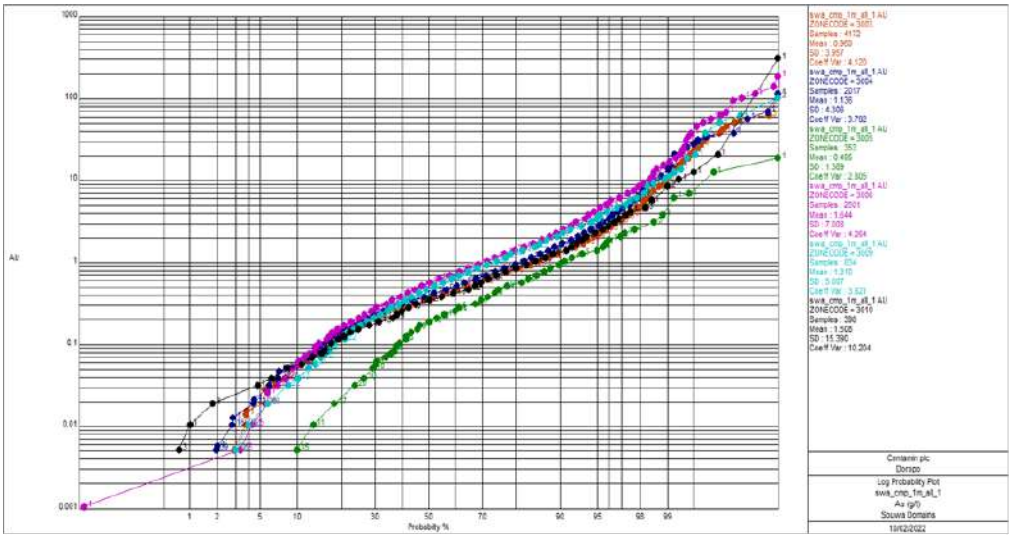


Figure 14.9.9 Log-probability Plots – 1 m Composite Gold Grade (Au g/t) – SWA Domains



14.10 Gold Grade Caps and Distance Limiting

Gold grade caps were chosen per estimation domain, based on the following criteria:

- Examination of the grade distribution for each domain, noting the point at which the upper tail of the distribution loses support.
- By taking into account the variability and mineralisation continuity of the do-main in question. More punitive caps were applied to areas of lesser continuity (chiefly in smaller, more poorly informed domains).
- By visual examination of the position of outlier values relative to surrounding samples and their values.

Generally speaking, the gold grade caps had only a minor impact on global mean values for the economically most important estimation domains, hence the risk to the MRE due to these actions is considered to be low.

An additional distance limiting constraint was applied to high grade samples in most domains. The grade threshold for distance limiting was chosen based on identification of prominent inflexion points in the log-probability plots of the grade distribution per estimation domain that are believed to represent the onset of the anomalously high-grade sub-population. Distance thresholds were generally set at the nominal along-strike drill line spacing of 50 m, except in Domain 9001 at HAN. Domain 9001 is observed to contain some extreme high grade outlier samples whose propagation was not being sufficiently contained, and where the distance limit was thus reduced to 25 m, in line with the nominal drill spacing along lines.

The grade caps, distance limiting parameters and density truncations used for estimation are listed in Table 14.10.1.

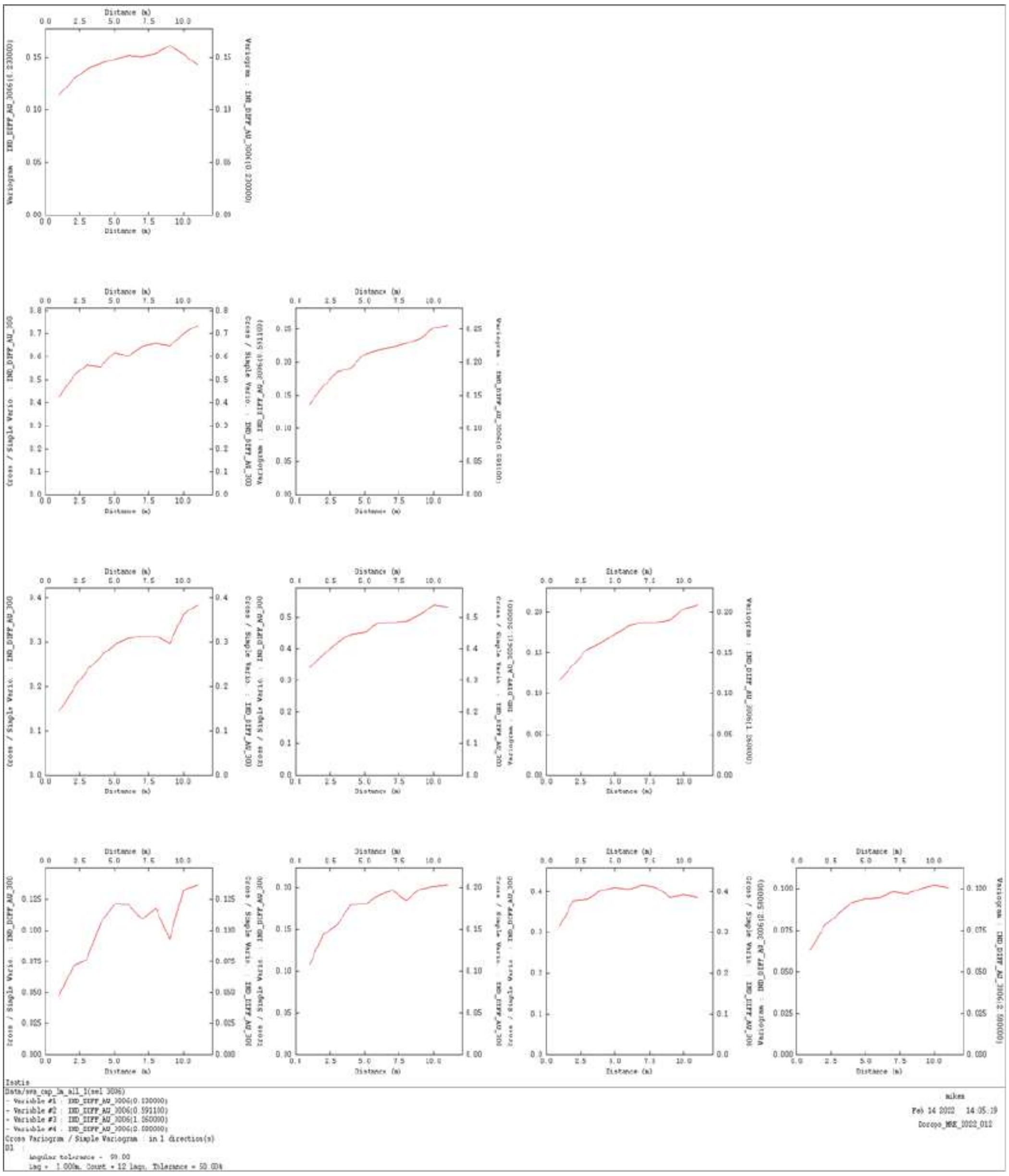
Table 14.10.1 Listing of Gold Grade Caps and Distance Limiting Parameters per Mineralisation / Estimation Domain

Prospect	Domain	Top Cap (Au g/t)	No. Capped	Uncapped Mean (Au g/t)	Capped Mean (Au g/t)	%Diff Mean	Dist Lim Threshold (Au g/t)	Distance Limit (m)
ATI	12001	40	7	1.73	1.52	-12.1%	10	50
	12002	2.5	2	0.54	0.47	-12.1%	0.7	50
	12003	2.5	3	0.57	0.49	-13.3%	0.7	50
CHG	5001	28	2	0.79	0.78	-1.5%	8	50
	5002	15	1	0.86	0.83	-3.7%	4	50
	5003	12	2	0.89	0.86	-4.3%	3.5	50
	5004	15	4	0.68	0.51	-25.3%	4.5	50
	5005	30	3	0.73	0.65	-11.0%	9	50
	5006	No Cut	0	0.24	0.24	0.0%	2	50
	5007	20	3	0.49	0.43	-12.3%	6	50
	5008	45	2	0.82	0.79	-3.8%	5	50
	5020	No Cut	0	0.90	0.90	0.0%	2	50
	5021	No Cut	0	0.30	0.30	0.0%	-	-
ENI	10001	20	8	0.97	0.91	-6.2%	7	50
	10002	4	1	0.62	0.57	-8.6%	1.5	50
HAN	9001	80	6	1.70	1.57	-7.5%	16	25
	9004	2.5	1	0.34	0.29	-12.8%	0.8	50
	9005	2.5	1	0.43	0.43	-1.4%	0.6	50
KEK	8001	35	4	0.87	0.82	-5.9%	5	50
	8003	20	3	0.93	0.82	-11.1%	5	50
KILO	1001	No Cut	0	0.68	0.68	0.0%	4	50
	1002	No Cut	0	0.54	0.54	0.0%	2.5	50
	1003	No Cut	0	0.99	0.99	0.0%	4	50
	1004	20	6	1.13	1.12	-1.1%	10	50
	1005	6	2	0.77	0.75	-2.5%	3.5	50
	1006	13	3	0.86	0.84	-2.7%	8	50
	1007	8	8	1.02	0.95	-6.4%	5	50
	1009	10	7	0.75	0.74	-1.3%	7	50
	1011	No Cut	0	0.63	0.63	0.0%	2.5	50
	1012	No Cut	0	0.45	0.45	0.0%	1	50
	1015	3.5	4	0.56	0.51	-8.1%	2.5	50
	1016	No Cut	0	0.47	0.47	0.0%	2.5	50
	1021	3	2	0.60	0.49	-18.1%	1.5	50
	1022	No Cut	0	0.24	0.24	0.0%	0.5	50
	1023	No Cut	0	0.34	0.34	0.0%	0.8	50
NOK	4001	35	13	1.74	1.64	-5.6%	5	50
	4002	No Cut	0	0.41	0.41	0.0%	1	50
	4004	35	3	0.99	0.85	-14.0%	5	50
SWA	3003	55	6	0.96	0.93	-2.9%	5	50
	3004	40	3	1.14	1.08	-5.1%	4	50
	3005	6	4	0.50	0.44	-12.1%	1.5	50
	3006	80	5	1.64	1.55	-5.6%	10	50
	3009	30	4	1.31	1.15	-12.5%	7	50
	3010	15	2	1.51	0.76	-49.5%	1.5	50

14.11 Diffusion Tests

Diffusion tests were undertaken on gold grade, for a selection of the larger domains at various prospects (Table 14.20.10). The diffusion test is based on indicator variable variograms, defined at a range of threshold grades across the grade distribution. When the cross-variogram of two of the indicators is divided by the variogram of the lower grade indicator, a measure of the diffusivity between the thresholds is measured. If the quotient has a slope, as is the case for all the tests undertaken at Doropo, this indicates that the grade is transitioning in a gradational fashion. This result justifies the use of so-called non-linear Discrete Gaussian methods for estimation (such as the LUC used here).

Figure 14.11.1 Diffusion Test for Gold Grade Based on 1 m Composites



Note: The right diagonal shows the indicator variograms at various threshold grades, and the remainder of the matrix shows the quotient of the indicator cross-variograms and variograms.

14.12 Variography

Variogram models for the gold grade variable, per mineralisation / estimation domain, were produced by transforming the capped composite data to Gaussian space, modelling the spatial structure, and then back-transforming the model to real space for use in estimation. This process reduces the impact of outliers on the experimental variogram calculation, allowing for elucidation of the true underlying spatial structure.

In all cases, the major and semi-major axis ranges were modelled with equal ranges. This is because there was, in most cases, no compelling evidence of significant anisotropy within the plane of maximum continuity, although there is sometimes visual evidence of plunging high-grade shoots, which would need to be further corroborated in the future by more dense drilling.

Variograms were modelled for those domains where robust experimental variogram could be obtained, typically larger domains containing more samples, and substitutions were made for the remainder of the domains based on proximity.

The variogram model parameters used for interpolation are summarised in Table 14.12.1, with sills normalised to 100%. An example of a gold variogram is in Figure 14.12.1.

Figure 14.12.1 Example Gaussian Variogram (Top) and Back-Transformed Variogram (Bottom) for Domain 3009 at SWA

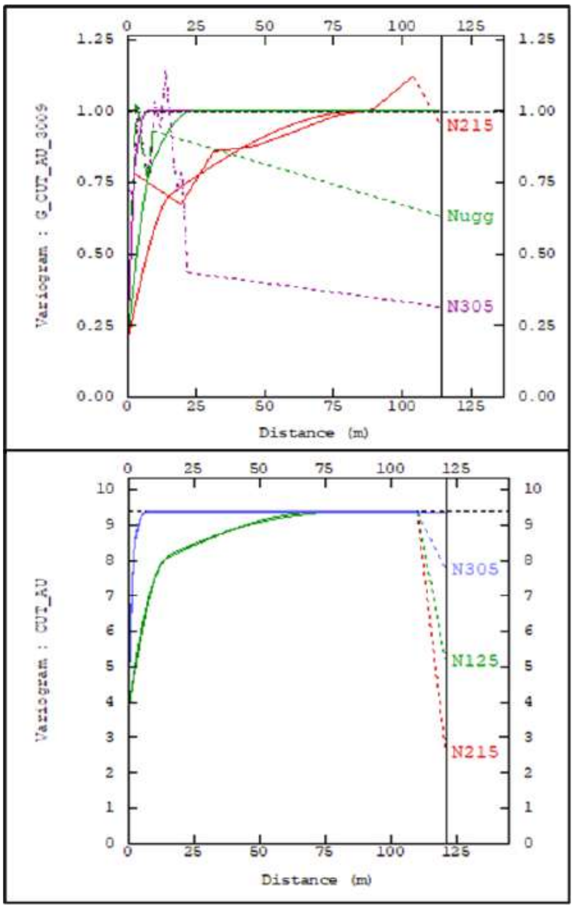


Table 14.12.1 Variogram Model Parameters per Mineralisation / Estimation Domain – Sills Normalised to 100%

Area	Domain	Nugget	Spherical 1				Spherical 2				Isatis Rotation (Geol. Pl.)		
			sill	major (m)	semi (m)	minor (m)	sill	major (m)	semi (m)	minor (m)	A	+X	-Z
ATI	12001	22.7%	42.5%	9	9	3	34.8%	70	70	7	305	75	0
	12002	16.4%	34.2%	9.5	9.5	3	49.4%	76	76	8	305	75	0
	12003	14.0%	33.5%	10	10	3.5	52.5%	77	77	8	305	75	0
CHG	5001	29.7%	55.1%	16	16	3	15.2%	158	158	18	245	35	0
	5002	29.9%	44.0%	9	9	3	26.1%	50	50	7	210	20	0
	5003	26.7%	44.0%	9	9	3	29.3%	51	51	7	195	25	0
	5004	31.8%	48.9%	7	7	3	19.3%	32	32	7	350	25	0
	5005	33.0%	48.6%	7	7	3	18.4%	30	30	7	350	25	0
	5006	30.5%	47.9%	7	7	3	21.6%	30	30	7	350	25	0
	5007	32.3%	46.0%	9	9	3	21.7%	38	38	7	5	35	0
	5008	41.7%	44.0%	8	8	3	14.3%	37	37	7	5	35	0
	5020	24.4%	54.0%	16	16	3.5	21.5%	170	170	19	245	35	0
	5021	32.9%	50.2%	16	16	3	16.9%	164	164	18	245	35	0
ENI	10001	34.9%	49.1%	9	9	3	15.9%	44	44	7	185	35	0
	10002	31.4%	48.8%	9	9	3	19.8%	47	47	8	185	35	0
HAN	9001	45.3%	46.6%	11	11	4	8.1%	45	45	8	210	25	0
	9004	29.6%	52.1%	13	13	4	18.3%	51	51	10	210	25	0
	9005	24.6%	53.9%	13	13	5	21.5%	53	53	10	210	25	0
KEK	8001	35.5%	50.4%	11	11	3	14.1%	65	65	8	225	30	0
	8003	35.9%	48.9%	10	10	3	15.2%	45	45	7	225	30	0
KILO	1001	36.5%	38.6%	23	23	4.5	25.0%	67	67	14.5	125	30	0
	1002	25.7%	53.3%	23.5	23.5	6.5	21.0%	184	184	13	125	30	0
	1003	56.4%	23.2%	19	19	4.5	20.4%	58	58	10	130	25	0
	1004	65.0%	19.9%	17.5	17.5	4	15.1%	56	56	10	130	35	0
	1005	59.6%	21.9%	18.5	18.5	4.5	18.5%	58	58	10	120	30	0
	1006	27.8%	53.7%	22.5	22.5	6	18.5%	188	188	13	120	25	0
	1007	34.8%	39.6%	14	14	4.5	25.6%	71	71	22	145	30	0
	1009	63.1%	17.4%	27	27	4.5	19.5%	72	72	19	120	30	0
	1011	31.1%	40.0%	14	14	5	28.9%	73	73	19	145	30	0
	1012	29.0%	50.9%	18	20	6	20.0%	55	84	13	145	35	0
	1015	59.3%	22.0%	19	19	4.5	18.7%	58	58	10	130	30	0
	1016	58.6%	22.3%	19	19	4.5	19.0%	58	58	10	135	30	0
	1021	25.7%	53.9%	23	23	6	20.4%	192	192	13	120	25	0
	1022	32.9%	48.4%	23	23	6	18.6%	186	186	13	120	30	0
	1023	25.7%	52.2%	23	23	6	22.1%	166	166	13	120	30	0
NOK	4001	23.9%	56.4%	7	7	3	19.6%	27	27	8	260	40	0
	4002	14.8%	52.6%	7.5	7.5	4.5	32.7%	29	29	8	210	55	0
	4004	31.9%	55.9%	6.5	6.5	2.5	12.2%	27	27	5.5	220	40	0
SWA	3003	39.3%	49.6%	12	12	2.5	11.2%	70	70	8	200	27	0
	3004	38.7%	50.5%	12	12	2.5	10.7%	70	70	7	200	27	0
	3005	34.3%	46.6%	7	7	2.5	19.1%	42	42	7	200	27	0
	3006	46.3%	36.1%	10	10	3.5	17.6%	110	110	13	210	27	0
	3009	40.8%	39.3%	14	14	2.5	20.0%	73	73	6.5	215	30	0
	3010	37.5%	43.6%	7	7	3	18.9%	59	59	8	0	0	0

14.13 Block Model Definition

A block model was defined per prospect area, except for Nokpa and Chegue which were combined in one block model as they are within close proximity of one another. Some of the block models were rotated to conform to the orientation of the lodes. The details for each block model definition are listed in Table 14.13.1

Table 14.13.1 Block Model Definition per Prospect Area

Prospect	Item	X	Y	Z
ATI	Minimum Coordinate	482,550	1,067,125	-50
	Maximum Coordinate	483,050	1,069,525	400
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	-50	0
CHG-NOK	Minimum Coordinate	478,370	1,077,200	-200
	Maximum Coordinate	481,690	1,081,670	450
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	35	0
ENI	Minimum Coordinate	491,250	1,074,000	-50
	Maximum Coordinate	492,510	1,076,600	400
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	0	0
HAN	Minimum Coordinate	485,550	1,073,780	-50
	Maximum Coordinate	486,820	1,076,080	400
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	35	0
KEK	Minimum Coordinate	483,000	1,072,030	-50
	Maximum Coordinate	484,120	1,074,080	400
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	35	0
KILO	Minimum Coordinate	464,260	1,050,710	0
	Maximum Coordinate	466,850	1,060,000	450
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	-60	0
SWA	Minimum Coordinate	478,000	1,074,000	-50
	Maximum Coordinate	479,550	1,076,700	450
	Block Size	5	5	2.5
	Minimum Sub-block Size	5	5	2.5
	Rotation	0	0	0

14.14 Ordinary Kriging Interpolation

Ordinary Kriging (OK) interpolation of gold grade was undertaken into relatively large 'Panel' blocks, for which the dimensions are listed in Table 14.14.1. The Panel blocks were rotated in exactly the same manner as the ultimate SMU block size of 5 mX x 5 mY x 2.5 mRL, as per the rotation parameters listed in Table 14.13.1.

Dynamic Anisotropy (DA) was implemented to locally orient variogram models and search ellipsoids during OK interpolation, using the hanging wall surfaces of the mineralisation/estimation domain wireframes produced in Leapfrog Geo to populate the block model with local rotation parameters.

Single pass interpolations were undertaken to fill all blocks within the lode estimation domains, in order to avoid producing artefacts in the ensuing LUC post-processing and because the domain volumes were only extended to ~50 m beyond the last drill hole.

Isotropic search ellipsoids (major : semi : minor ratio = 3 : 3 : 1 or 4 : 4 : 1) were used, with distance to the neighbours determined using anisotropic distance according to the ellipsoid shape to better reflect the generally tabular continuity geometry of the estimation variables. The search ellipsoid was divided into four sectors (quadrants), with a maximum number of samples per quadrant set in order to produce a more optimal spread of informing samples for interpolation. The choice of maximum number of allowable samples was partially informed by Kriging Neighbourhood Analysis (KNA), with an example given in Figure 14.14.1. Distance limiting parameters for the high-grade sub-population were implemented in order to mitigate against over-propagation of outlier values. The relevant interpolation parameters used are listed in Table 14.14.2.

Table 14.14.1 OK Panel Block Sizes Used for Gold Interpolation per Prospect

Prospect	Panel Size (m)		
	X	Y	Z
ATI	25	25	5
CHG	20	20	5
ENI	20	20	5
HAN	20	20	5
KEK	20	20	5
KILO	20	20	5
NOK	10	20	5
SWA	10	20	5

Figure 14.14.1 KNA Plot Using the Kriging Slope of Regression and Weight of the Mean as Criteria for Selection of Minimum and Maximum Informing Composites

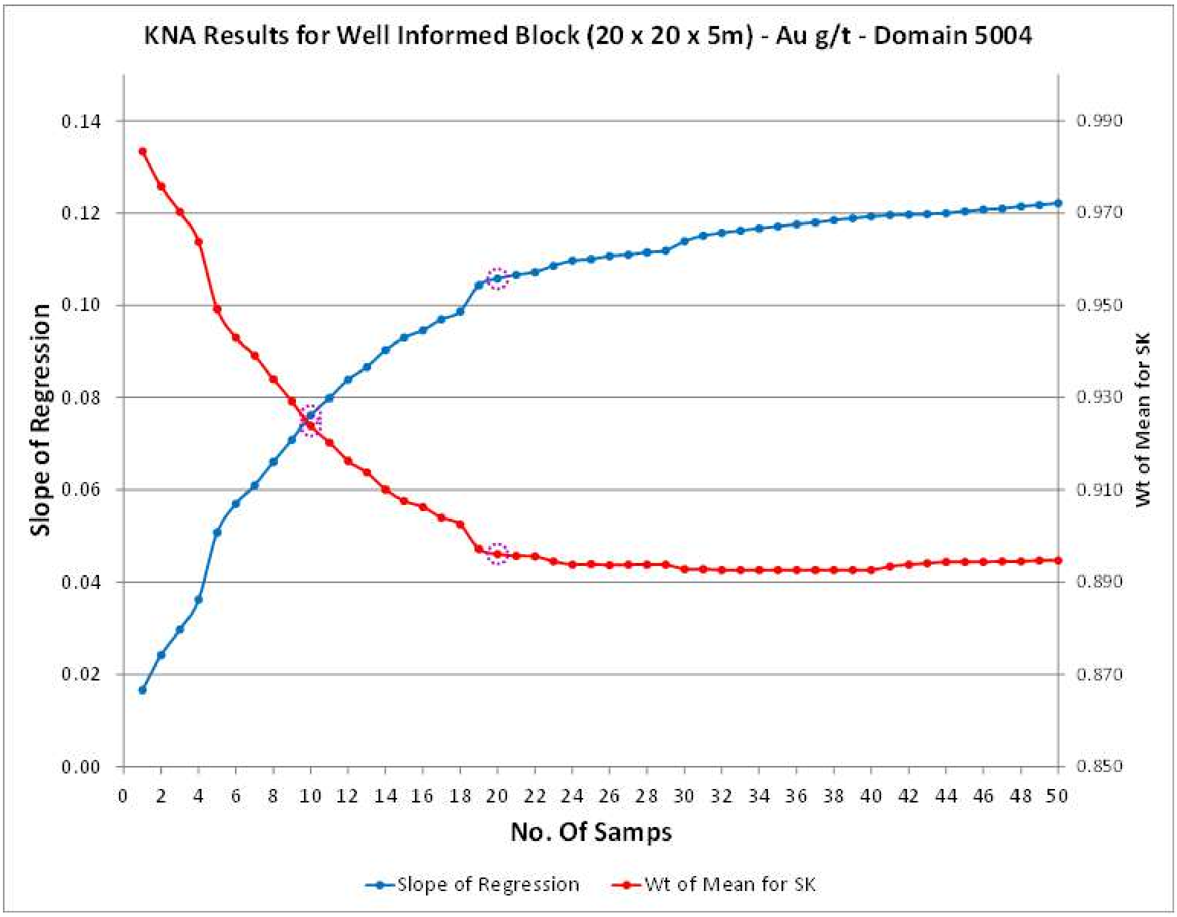


Table 14.14.2 OK Panel Block Search Parameters for Gold Grade

Area	Domain	Search radii (m)			Min Comp	No. Sectors	Max / Sector	Dist Lim Threshold (Au g/t)	Dist Limit (m)
		Major	Semi	Minor					
ATI	12001	120	120	40	8	4	5	10	50
	12002	120	120	40	8	4	5	0.7	50
	12003	150	150	50	8	4	5	0.7	50
CHG	5001	150	150	50	8	4	5	8	50
	5002	120	120	40	10	4	6	4	50
	5003	120	120	40	10	4	6	3.5	50
	5004	120	120	40	10	4	5	4.5	50
	5005	150	150	50	10	4	5	9	50
	5006	90	90	30	10	4	5	2	50
	5007	180	180	60	10	4	5	6	50
	5008	180	180	60	10	4	5	5	50
	5020	150	150	50	8	4	5	2	50
	5021	150	150	50	8	4	5	-	-
ENI	10001	165	165	55	8	4	5	7	50
	10002	75	75	25	8	4	5	1.5	50
HAN	9001	200	200	50	8	4	5	16	25
	9004	90	90	30	8	4	5	0.8	50
	9005	75	75	25	8	4	5	0.6	50
KEK	8001	105	105	35	8	4	6	5	50
	8003	105	105	35	8	4	6	5	50
KILO	1001	330	330	110	4	4	5	4	50
	1002	300	300	100	4	4	5	2.5	50
	1003	210	210	70	8	4	6	4	50
	1004	300	300	100	8	4	6	10	50
	1005	300	300	100	8	4	6	3.5	50
	1006	330	330	110	8	4	5	8	50
	1007	300	300	100	8	4	6	5	50
	1009	300	300	100	8	4	6	7	50
	1011	210	210	70	8	4	6	2.5	50
	1012	210	210	70	8	4	6	1	50
	1015	210	210	70	8	4	6	2.5	50
	1016	210	210	70	8	4	6	2.5	50
	1021	210	210	70	8	4	5	1.5	50
	1022	210	210	70	8	4	5	0.5	50
	1023	210	210	70	4	4	5	0.8	50
NOK	4001	180	180	60	8	4	5	5	50
	4002	150	150	50	8	4	5	1	50
	4004	150	150	50	8	4	5	5	50
SWA	3003	150	150	50	8	4	5	5	50
	3004	120	120	40	8	4	5	4	50
	3005	75	75	25	8	4	5	1.5	50
	3006	120	120	40	8	4	5	10	50
	3009	120	120	40	8	4	5	7	50
	3010	75	75	25	8	4	5	1.5	50

14.15 Localised Uniform Conditioning

LUC was undertaken to a target SMU block size of 5 mX x 5 mY x 2.5 mRL within the designated estimation domains for gold grade. The 'Panel' OK estimates for these variables constitute the precursor step to LUC.

The LUC estimation process is preceded by a standard Uniform Conditioning (UC) estimate of recoverable resources. The UC resource estimation process attempts to estimate the recoverable tonnage and grade based on the dimensions of the SMU, which is regarded as being practically achievable during actual mining. UC post-processing of the OK results was implemented for 5 mX x 5 mY x 2.5 mRL sized SMUs and incorporated an Information Effect correction based on an assumed ultimate grade control drill hole spacing of 10 mX x 10 mY x 2.5 mRL.

The Information Effect is a theoretical 'penalty' adjustment to the SMU grade tonnage distribution to account for anticipated ore loss and dilution incurred when making mining selectivity decisions based on likely grade control spaced data – the impact of this correction is typically small and immaterial. The result of the UC process is an estimate, per Panel, of the recoverable metal, tonnes and grade at various grade cut-offs, assuming that SMU sized blocks are ultimately selected during mining. However, the reader should note that the UC process does not assign grade estimates to individual SMU's within a panel. The UC grade estimates at a cut-off of 0 g/t conform exactly to the OK estimates per Panel, and this property was used to validate the UC block model.

The UC process applies a Change of Support correction based on the composite sample distribution and variogram model, conditioned to the Panel grade estimate, to predict the likely grade tonnage distribution at the SMU selectivity.

LUC is a post-processing step that can be applied to UC estimates to provide indicative SMU scale estimates within each panel (Abzalov, 2006). The results of the LUC are consistent with the underlying UC estimate on a per-panel basis. LUC requires initially that local "ranking" SMU estimates are made by some chosen estimation method. In this case OK was used to generate the SMU ranks within each Panel.

The local SMU estimates within each panel are ranked in order of increasing grade. A quantile-quantile type matching of the SMU grade distribution, as determined by UC, with the ranked SMU's is then made. The OK 'ranking' SMU grades are finally replaced by the corresponding grades from the UC grade distribution. This yields the LUC SMU-scale grade estimates, which conform exactly to the SMU grade distribution predicted by the UC in panels. Gold grades within the barren dykes and the transported cover were reset to background values.

It should be clearly noted that the LUC estimates are typically based on relatively wide spaced data and are therefore of low confidence at the local scale. They should be considered to be indicative of the SMU grade variability that will eventuate when the deposit is grade controlled and mined. The individual SMU grade estimates are simply a probabilistic realisation of the grade and tonnage at this selectivity scale and provide a result which simplifies the mining studies, while providing a more realistic estimation of the grade-tonnage relationship that will eventuate over the life-of-mine when production commences. It would, however, be highly inadvisable to rely on the LUC estimates for short term mine planning purposes. LUC estimates are generally only applicable to open pit scenarios, such as those currently envisioned for Doropo, and are typically unsuitable for underground mining where opportunities for local block selectivity are limited.

14.16 Density Assignments

Density assignment is based on a total of 11,123 measurements at the updated prospects that were taken by the immersion method on drill core. Table 14.16.1 shows the dry density reading statistics per prospect and a histogram of the density variable for SWA is displayed in Figure 14.16.1.

The density variability is low, even when aggregated across weathering zones, and is observed to be multi-modal. Further statistical analysis demonstrated when split by weathering intensity, the density distributions become unimodal and variability is reduced to even lower levels, sometimes markedly so. Since the bedrock lithology at Doropo is essentially granodiorite at all the prospects, no significant differentiation of density is observed when split by lithological sub-types.

As a result of the density analysis, it was decided to assign density on the basis of weathering intensity at all prospects, with the exception of the transported cover unit, which was treated separately because it has a somewhat elevated mean density; this is probably due to the fact that the cover is sometimes lateritised or contains a relatively high proportion of unweathered quartz detritus. The final density values were determined on the basis of this subdivision, with the mean density per category being assigned following a process of eliminating both low and high outlier values by inspection of density histograms (Table 14.16.2).

Table 14.16.1 Basic Statistics for Dry Density (t/m^3) per Prospect

Prospect	N	Min	Max	Mean	Median	Std Dev	CoV
SWA	1,988	1.50	5.89	2.47	2.69	0.40	0.16
NOK	1,483	1.50	3.79	2.66	2.69	0.15	0.06
CHG	1,489	1.54	3.07	2.51	2.69	0.32	0.13
HAN	1,084	1.16	2.84	2.68	2.70	0.13	0.05
KEK	883	1.56	6.96	2.60	2.70	0.30	0.11
ENI	647	1.52	3.12	2.44	2.66	0.44	0.18
ATI	266	1.80	2.78	2.50	2.69	0.28	0.11
KLG	3,283	1.19	4.38	2.61	2.67	0.20	0.08
All Prospects	**11,123**	**1.16**	**6.96**	**2.57**	**2.68**	**0.29**	**0.11**

Figure 14.16.1 Histogram of Dry Density (t/m3) for SWA

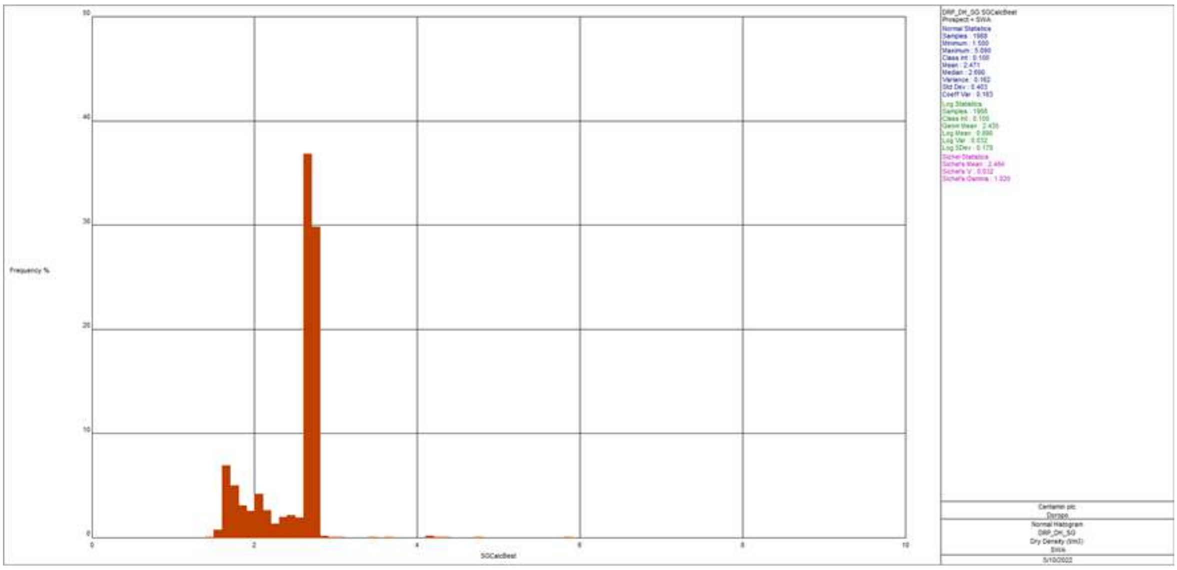


Table 14.16.2 Dry Density (t/m^3) Assignments in the Block Models for the Updated Mineral Resource

Zone	ATI	CHG-NOK	ENI	HAN	KEK	KILO	SWA
Transported Cover	2.04	2.00	2.11	1.93	2.04	1.94	2.04
Highly Weathered	2.06	1.90	1.77	1.77	1.89	1.84	1.82
Moderately Weathered	2.17	2.16	2.15	2.19	2.20	2.16	2.15
Slightly Weathered	2.49	2.51	2.57	2.56	2.52	2.57	2.50
Fresh	2.71	2.69	2.72	2.70	2.70	2.67	2.70

14.17 Mining Depletion

No mining has taken place as a consequence of the Project to date and hence no depletion is recorded in the block model. Artisanal workings do occur in the area, but these have had, at most, a negligible impact on the modelled Mineral Resource.

14.18 Mineral Resource Estimate Validation

Mineral Resource estimate validation has been undertaken by the following means:

- Global statistical comparisons of mean estimated block grades to mean compo-site grades. The results of Inverse Distance Squared (ID2) check estimates were also considered. Mean global estimated gold grades were found to match the informing composite data satisfactorily. Any larger variances could be readily explained by sample clustering effects or extrapolation of sample grades into relatively poorly informed volumes, such as around the periphery of the mineralised domains.

- Using swath plots to compare estimated block grades to the informing compo-site grades (see example in Figure 14.9.2).

- By visual validation, both in cross-section and 3D isometric views, of the estimated block grades overlaid on drill assay data (Figure 14.9.3).

The block estimates were considered to be an accurate reflection of the input sample data.

14.19 Mineral Resource Estimate Classification

14.19.1 Reasonable Prospects for Eventual Economic Extraction

The Mineral Resource is considered to have Reasonable Prospects for Eventual Economic Extraction (RPEEE) on the following basis:

- The Deposit is located in a mining jurisdiction with multiple operating gold mines, with no known impediments to land access or tenure status.

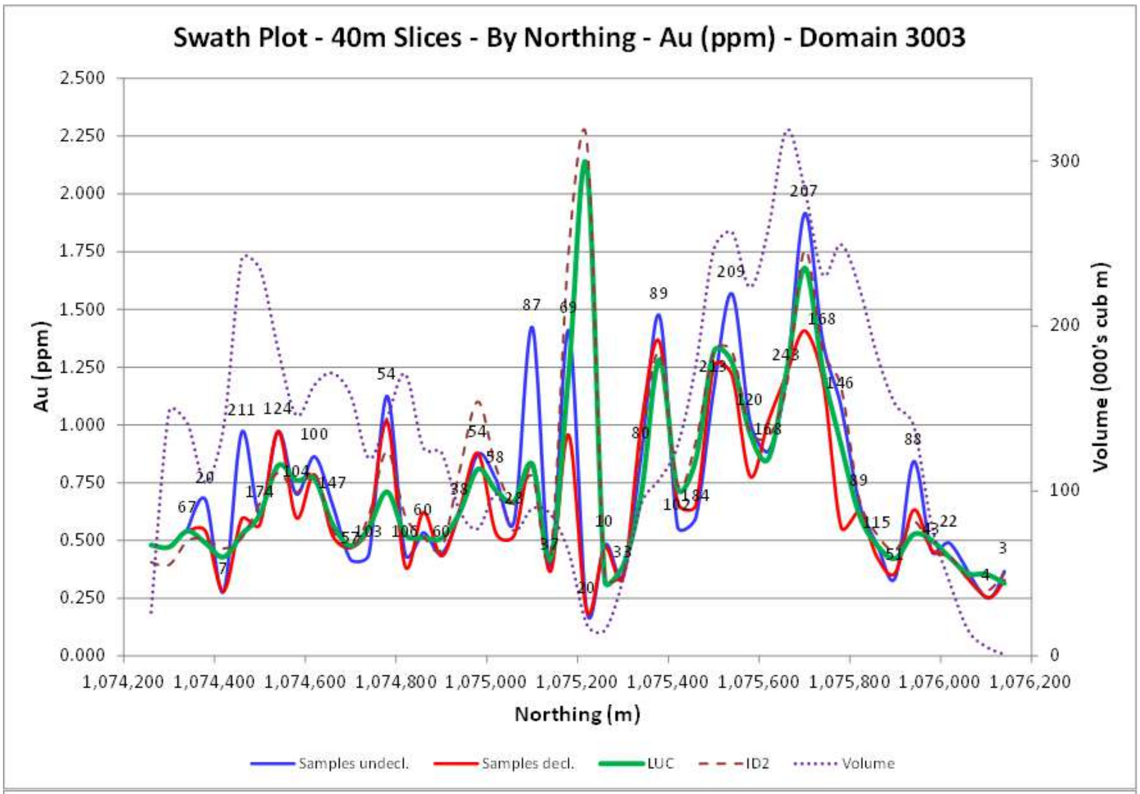
- The volume, orientation and grade of the Resource is amenable to mining extraction via traditional open pit methods.

- Current metallurgical recovery based on available preliminary metallurgical test work was used in a pit optimisation to generate the resource pit shells.

The Mineral Resource is reported within a series of pit shells using a gold metal price assumption of USD2,000/oz Au. The gold spot price at the time of writing of this report (October 2022) is ~USD1,700/oz Au.

Cube believe this is a reasonable approach, considering the potential mine life and considerations for reporting Mineral Resources in accordance with the CIM Definitions and Standards (CIM Council, 2014).

Figure 14.19.1 Example Swaths Plots for Gold Grade in Domain 3003 at SWA



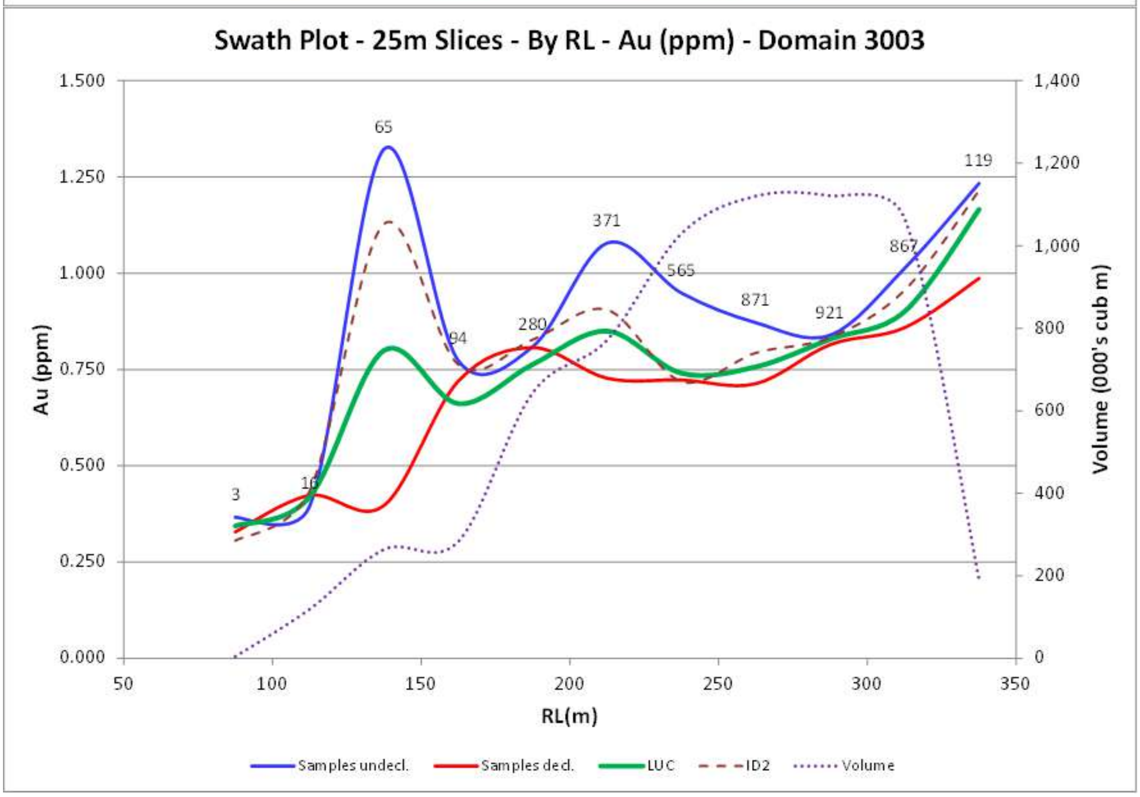
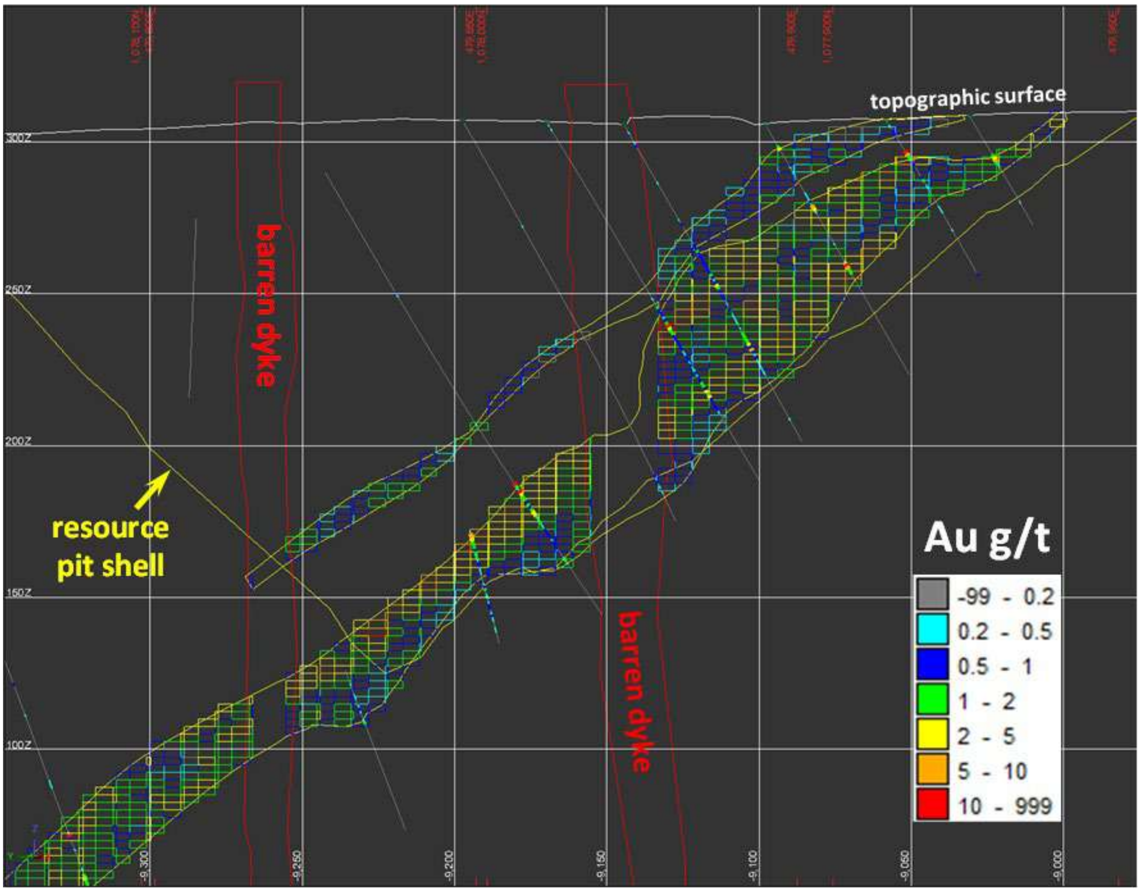


Figure 14.19.2 Cross-section View Looking NE at NOK. Block Grades and Drill Assay Grades.



14.19.2 Classification Criteria

The Doropo Mineral Resource as at 25 October 2022 is intended for public reporting and represents an update to the previous public release dated 27 May 2021. The Mineral Resource has been classified and reported in accordance with the CIM Definition Standards (CIM Council, 2014).

Cube considers the following points to be material in the classification of the Doropo Mineral Resource:

- Database Integrity – The QAQC data have demonstrated that the sampling precision and accuracy is within an acceptable range for the estimation of a Mineral Resource.

- Geological Interpretation – The current geological interpretations including mineralisation, structure, weathering and lithology are considered to be of a high standard and that the geometry of and factors controlling the mineralisation are sufficiently well understood to classify Mineral Resources.

- Drill Hole Spacing and Sampling Density – Mineralisation interpretations and attribute interpolations are based on a variable drill hole spacing. Where infill drilling has been undertaken as part of the PFS phase, the nominal drill spacing is 25 m x 50 m. Elsewhere the spacing widens to a nominal 50 m x 50 m.

- Estimation Method - Cube has undertaken LUC interpolation of gold grade, as considered appropriate per the statistical and geostatistical characteristics of the gold mineralisation and the anticipated open pit mining methods.

- Interpolation Quality – OK interpolation quality parameters, which rely primarily on data spacing and the continuity model (i.e. the variogram), have been considered in the classification of Mineral Resources.

It is Cube's conclusion that the Doropo mineralisation domains are sufficiently drilled to allow classification. As with any non-rigidly defined classification there will always be some blocks within categories that depart from defined criteria. It is Cube's view that the final outcome must reflect a practical combination of data quality, geological knowledge, and interpolation quality parameters that may be more numerical in nature. This approach to classification aims to avoid creating a complex, numerically derived 'mosaic'. Cube has considered all criteria and has classified the resource as Indicated or Inferred. No Mineral Resources at Doropo are currently considered by Cube to exceed the threshold of confidence required for classification as Measured Resources.

Indicated Mineral Resources are defined where the nominal drill spacing is 25 m x 50 m or tighter. The following factors played a major role in the definition of Indicated Mineral Resources:

- Gold grade variogram ranges always exceed 25 m and often exceed 50 m.

- Interpolation quality is observed to drop off as one moves out of the zone of 25 m x 50 m drilling towards areas drilled out at 50 m x 50 m.

- Data quality and integrity, as well as the confidence in the geological and mineralisation models, especially at a 25 m x 50 m drill spacing, is considered by the Qualified Person to be sufficient to satisfy the codified criteria for an Indicated classification.

- The Qualified Persons are satisfied that a 25 m x 50 m drill spacing is sufficient to allow for the estimation of deposit physical characteristics with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit.

Areas drilled at a wider spacing than 25 m x 50 m were classified as Inferred Mineral Resources inside the mineralisation domain envelopes, except in the transported cover and around the periphery of the drilling at a distance greater than 50 m beyond the last drill hole, where no Mineral Resource has been defined and classified.

At ATI, all of the drilling is at a 50 m x 50 m spacing or wider, and so only Inferred Mineral Resources were classified at this prospect.

Only the volume contained within the mineralisation/estimation domain were considered eligible for classification as Mineral Resources.

The Mineral Resource estimate appropriately reflects the Qualified Persons' view of the deposit (see Figure 14.19.3 to Figure 14.19.16).

Figure 14.19.3 Plan View of the Mineral Resource Classification at ATI

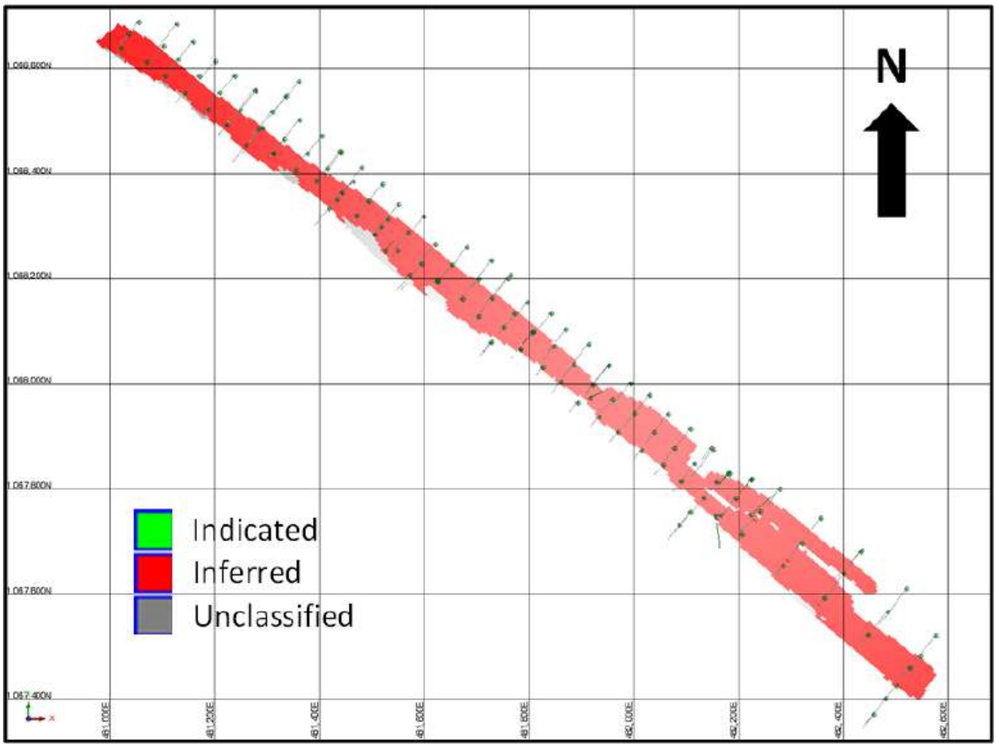


Figure 14.19.4 Isometric View Looking SW of the Mineral Resource Classification at ATI

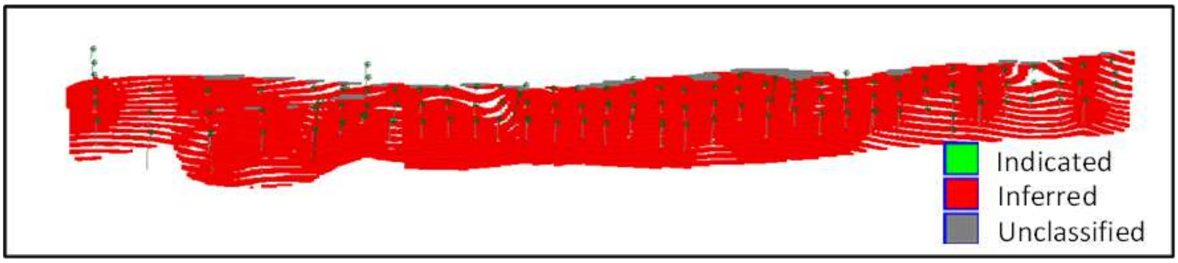


Figure 14.19.5 Plan View of the Mineral Resource Classification at CHG-NOK

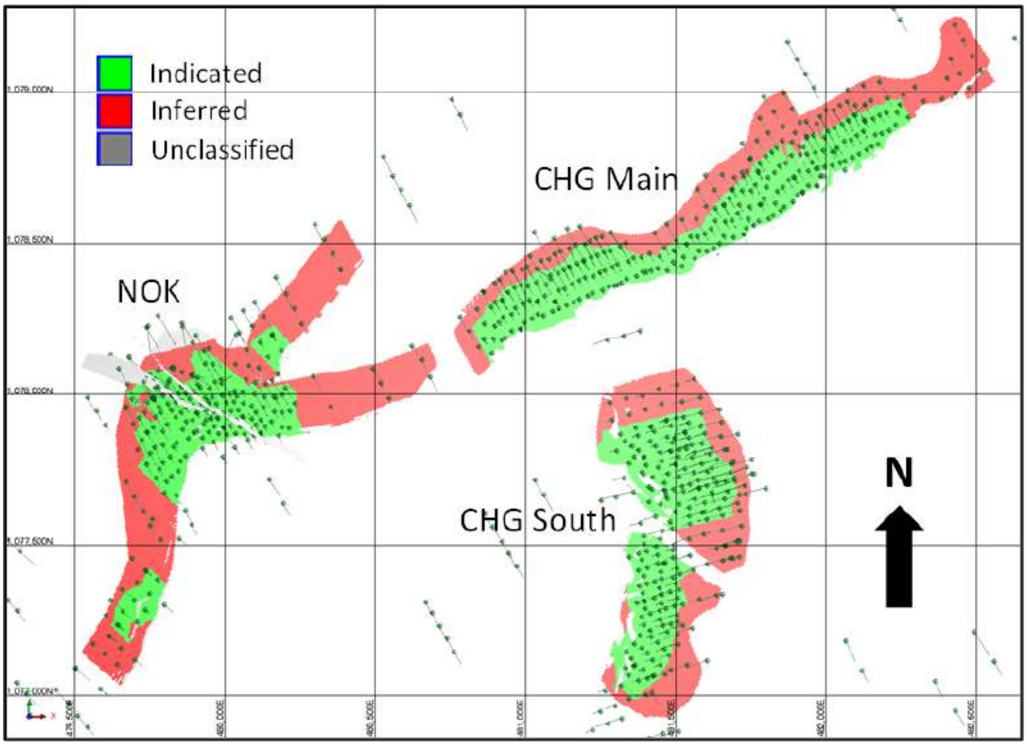


Figure 14.19.6 Isometric View Looking SW of the Mineral Resource Classification at CHG-NOK

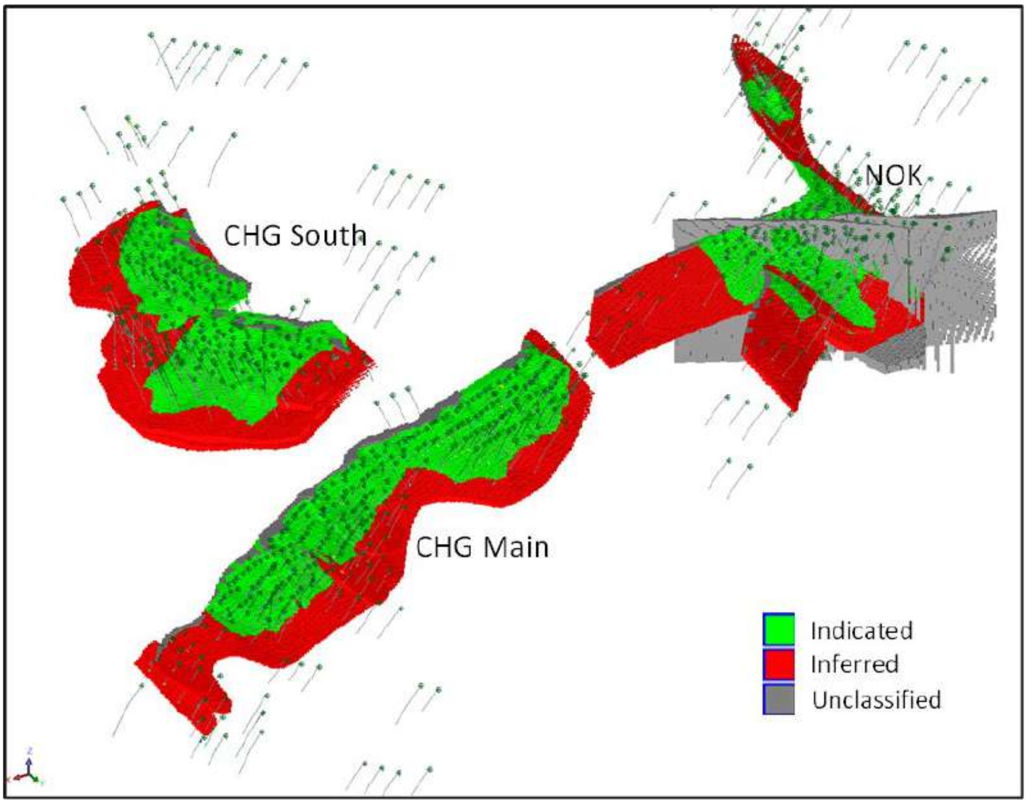


Figure 14.19.7 Plan View of the Mineral Resource Classification at ENI

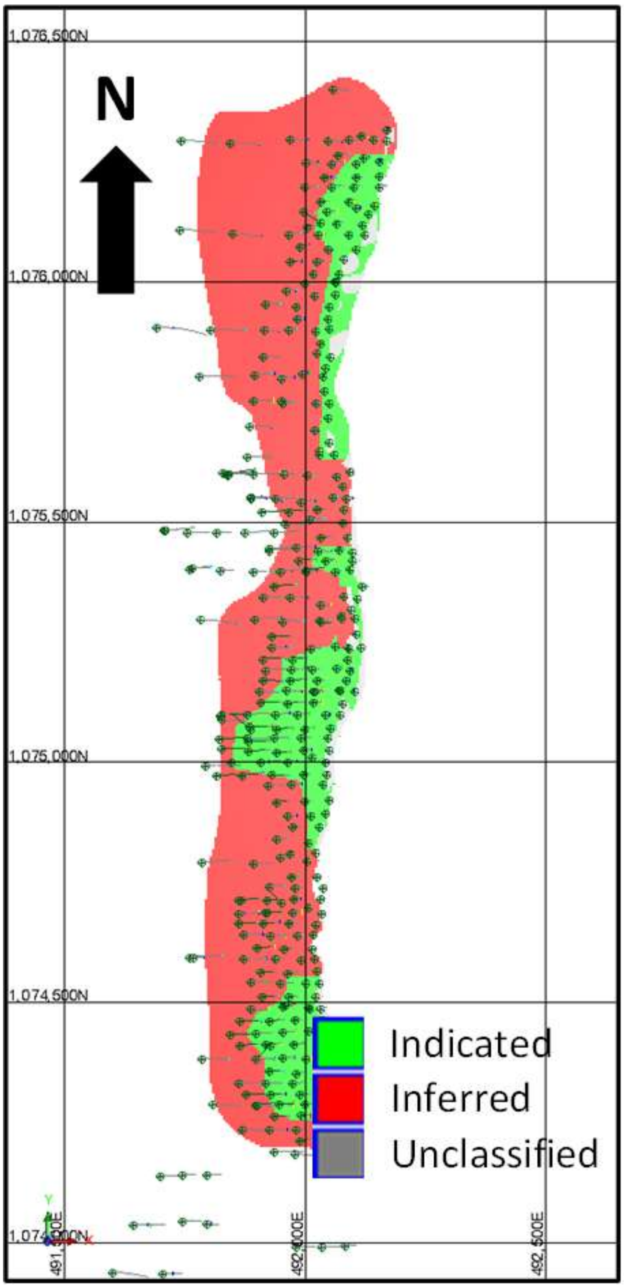


Figure 14.19.8 Isometric View Looking E of the Mineral Resource Classification at ENI

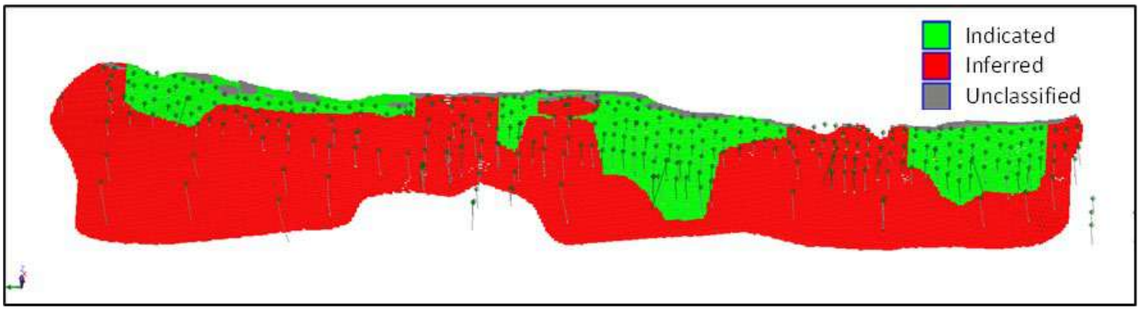


Figure 14.19.9 Plan view of the Mineral Resource Classification at HAN

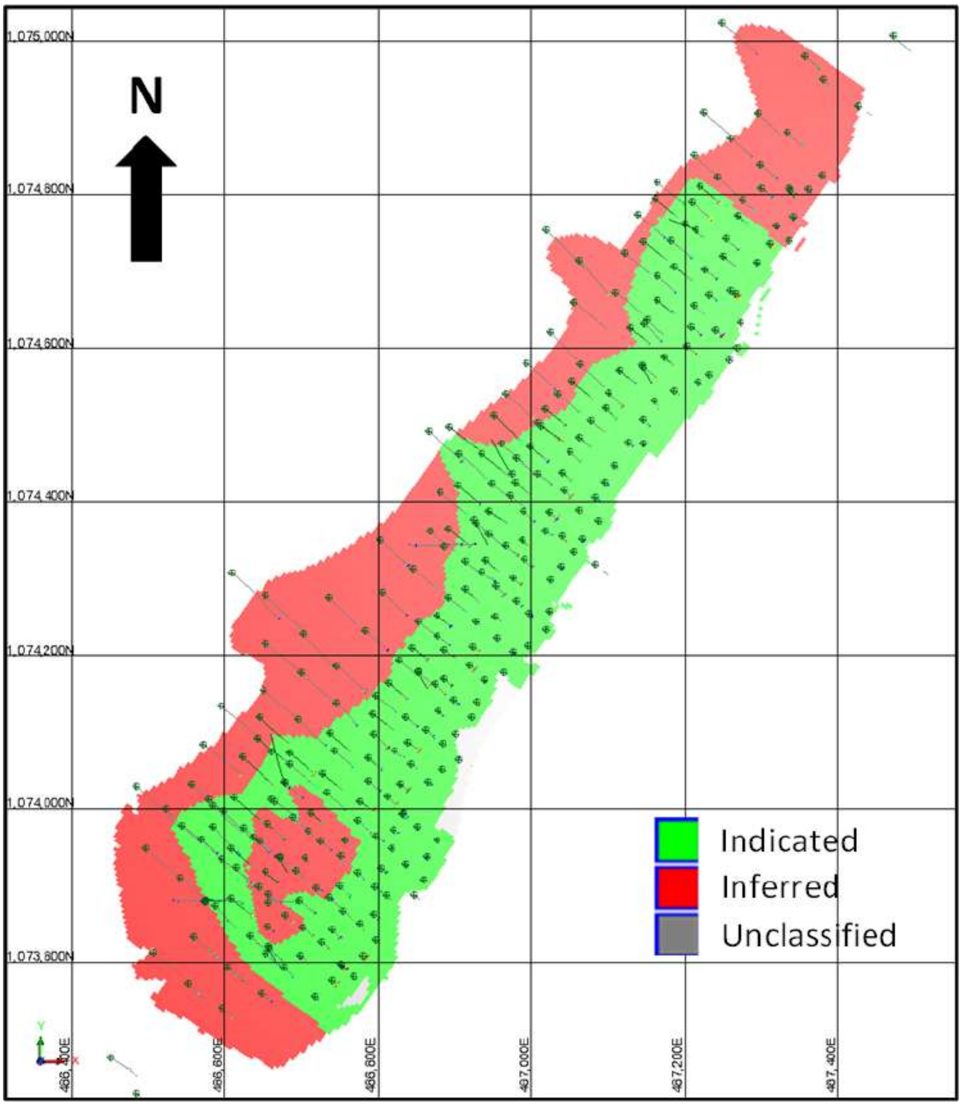


Figure 14.19.10 Isometric View Looking SE of the Mineral Resource Classification at HAN

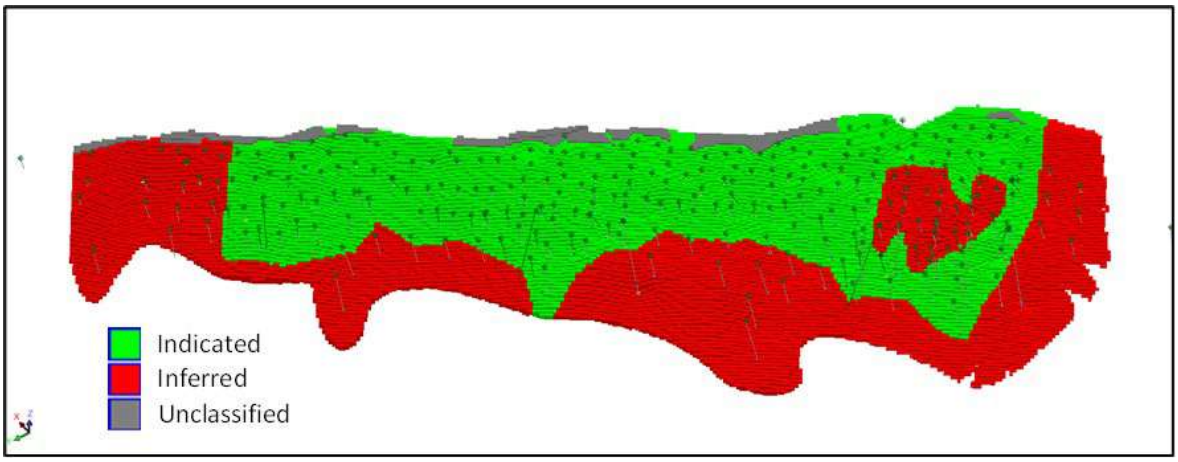


Figure 14.19.11 Plan View of the Mineral Resource Classification at KEK

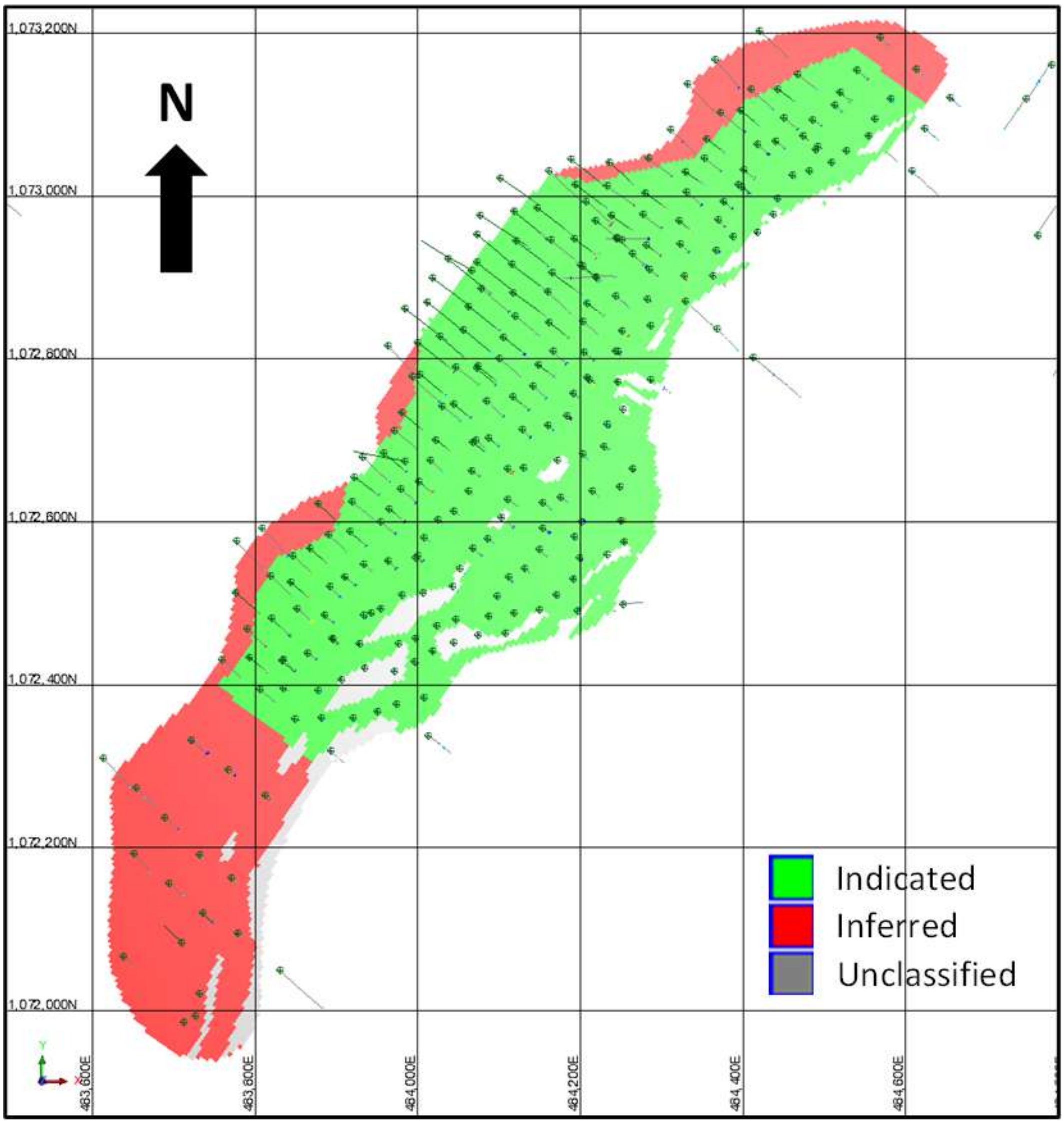


Figure 14.19.12 Isometric View Looking SE of the Mineral Resource Classification at KEK

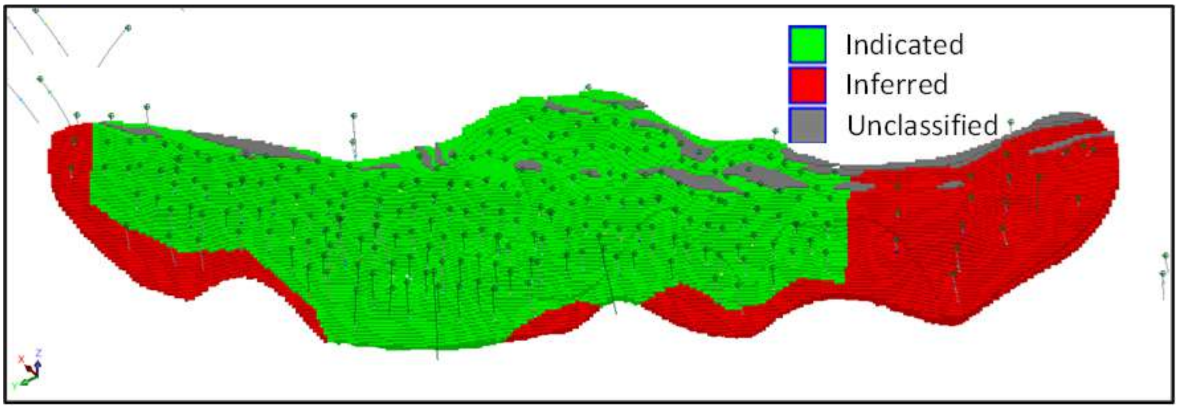


Figure 14.19.13 Plan View of the Mineral Resource Classification at KILO

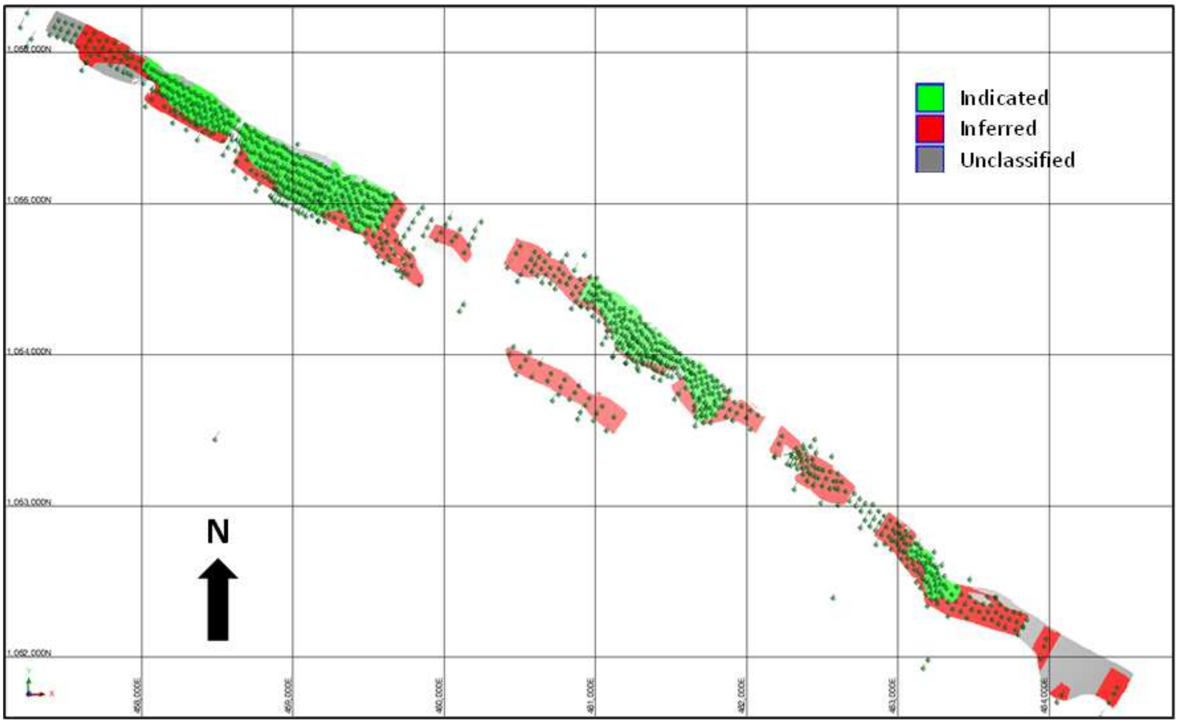


Figure 14.19.14 Isometric View looking NE of the Mineral Resource Classification at KILO

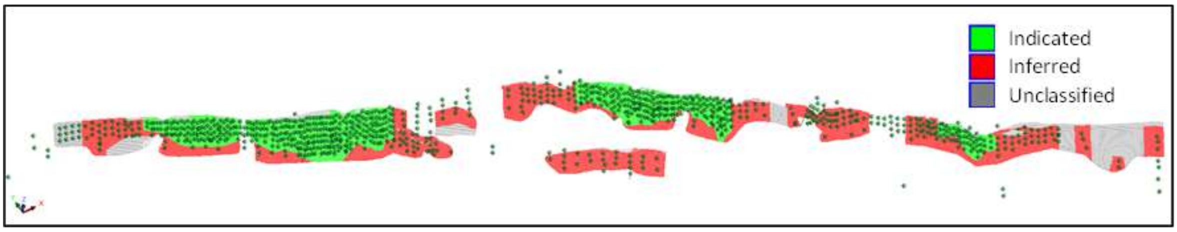


Figure 14.19.15 Plan View of the Mineral Resource Classification at SWA

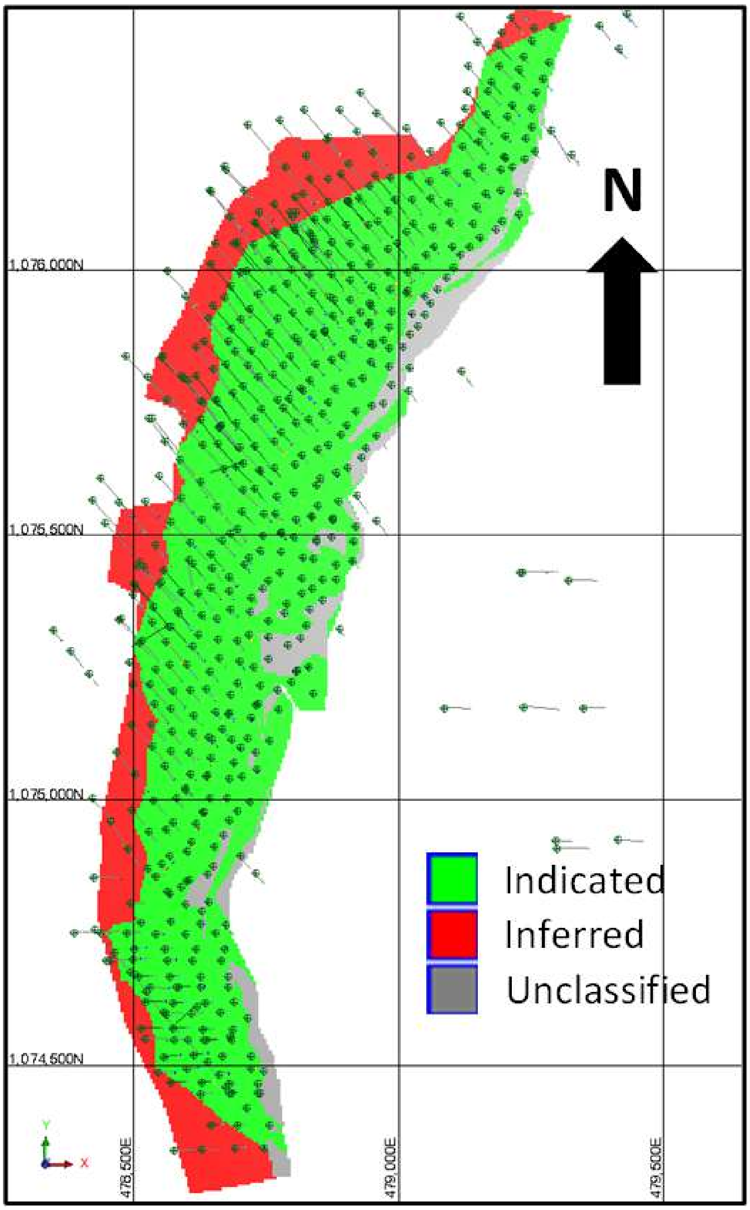
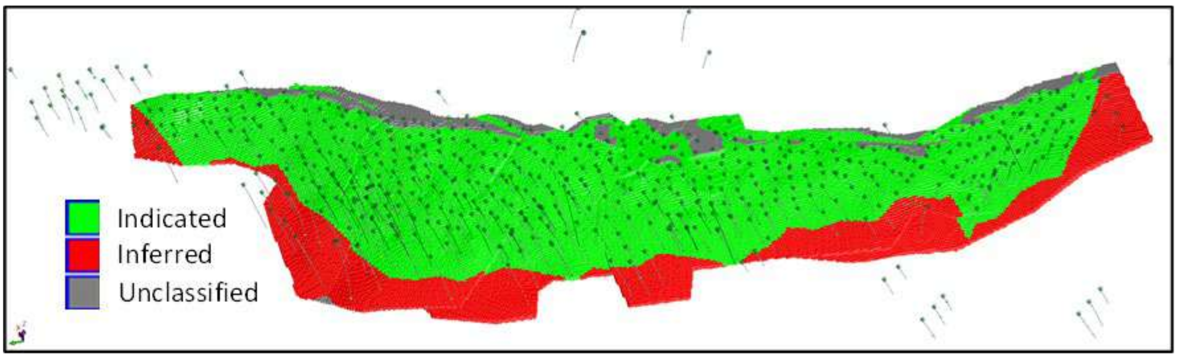


Figure 14.19.16 Isometric View Looking E of the Mineral Resource Classification at SWA



14.20 Mineral Resource Statement

14.20.1 Reporting

As a designated reporting issuer in Canada, Centamin is subject to certain Canadian disclosure requirements and standards, including the requirements of NI 43-101. The Doropo Gold Project is a material mineral project for the purposes of NI 43-101. The confidence categories are assigned according to the CIM Definition Standards — for Mineral Resources and Mineral Reserves May 2014.

14.20.2 Pit Optimisation Parameters

The pit optimisations used to constrain the Mineral Resource were generated by Orelogy Mine Consultants. Key input parameters used to produce the reporting pit shells are as follows:

- All models have been re-blocked to 10 mX x 10 mY x 5 mRL.
- Gold price assumption of USD2,000 per troy ounce.
- Overall pit wall slope angles used are:
  - 33° in oxide
  - 38° in transitional
  - 46° in fresh.
- Mining Recovery of 100% (0% ore loss).
- Mining Dilution of 5%.
- Process Recovery:
  - Oxide: 92.5%
  - Transitional: 89.8%
  - Fresh: 88.8%.
- Discount rate: 5%.
- Mill Throughput: 4.5 Mtpa (for oxide and trans material).
- Mill Throughput: 4.0 Mtpa (for fresh rock).

14.20.3 Results

The updated Doropo MRE, as constrained to the optimised pit shells, is summarised in Table 14.20.1 and Table 14.20.2. A more detailed breakdown of the Mineral Resources by oxidation are shown in Table 14.20.3 through Table 14.20.15. Grade-tonnage curves per updated prospect are presented in Figure 14.20.1through Figure 14.20.9. The tonnage and grade curves show a relatively slow change in both these parameters for all prospects except CHG South and KEK, which display steeper transitions through the range of cut-offs considered.

Four prospects, namely Hinda (HND), Nare (NAR), Tchouahinan (THN) and Vako (VAKO), were not updated in this MRE and the models as produced in the 27 May 2021 MRE update have therefore been retained and reported within the optimised pit shells.

Table 14.20.1 Doropo Updated Indicated Mineral Resource Estimate (CIM Definition Standards), ** 25 October 2022

Indicated Mineral Resources			
Prospect	**Mt**	**Au g/t**	**Au Moz**
Attire	-	-	-
Chegue Main	4.89	1.22	0.19
Chegue South	1.67	1.40	0.07
Enioda	2.06	1.46	0.10
Han	3.57	2.09	0.24
Hinda*	-	-	-
Kekeda	3.34	1.40	0.15
Kilosegui	18.37	1.29	0.76
Nare*	-	-	-
Nokpa	4.21	1.93	0.26
Souwa	13.39	1.73	0.74
Tchouahinan*	-	-	-
Vako*	-	-	-
TOTAL	**51.51**	**1.52**	**2.52**

*** - prospect models not updated in this MRE; models as per the 2021 MRE**

Notes:

- **Some numerical differences may occur due to rounding.**
- **RPEEE is defined by optimised pit shells based on a gold price of USD2,000/oz.**
- **Reported at a gold grade cut-off of 0.5 g/t Au.**
- **Includes drill holes up to and including 25 July 2022.**
- **Includes Mineral Reserves.**

Table 14.20.2 Doropo Updated Inferred Mineral Resource Estimate (CIM Definition Standards), ** 25 October 2022

Inferred Mineral Resources			
Prospect	**Mt**	**Au g/t**	**Au Moz**
Attire	0.60	1.96	0.04
Chegue Main	0.44	1.24	0.02
Chegue South	0.04	0.83	0.001
Enioda	1.95	1.19	0.07
Han	0.32	1.51	0.02
Hinda*	0.55	1.01	0.02
Kekeda	0.18	1.10	0.01
Kilosegui	5.75	1.09	0.20
Nare*	0.09	1.13	0.003
Nokpa	0.11	0.74	0.003
Souwa	0.04	0.92	0.001
Tchouahinan*	0.97	1.36	0.04
Vako*	2.63	0.95	0.08
TOTAL	**13.67**	**1.14**	**0.50**

*** - prospect models not updated in this MRE; models as per the 2021 MRE**

Notes:

- **Some numerical differences may occur due to rounding.**
- **RPEEE is defined by optimised pit shells based on a gold price of USD2,000/oz.**
- **Reported at a gold grade cut-off of 0.5 g/t Au.**
- **Includes drill holes up to and including 25 July 2022.**
- **No Mineral Reserves included.**

Table 14.20.3 Breakdown of the ATI Mineral Resource by Oxidation State Reported within a USD2,000 Optimised Pit Shell at a Gold Grade Cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	-	-	-
	Transitional	-	-	-
	Fresh	-	-	-
	Total Indicated	**-**	**-**	**-**
Inferred	Oxide	0.04	2.20	2.8
	Transitional	0.41	1.78	23.5
	Fresh	0.15	2.39	11.9
	Total Inferred	**0.60**	**1.96**	**38.1**

Table 14.20.4 Breakdown of the CHG Main Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.56	1.04	18.8
	Transitional	1.44	1.12	51.8
	Fresh	2.89	1.31	121.2
	Total Indicated	**4.89**	**1.22**	**191.8**
Inferred	Oxide	0.05	1.01	1.6
	Transitional	0.15	1.10	5.5
	Fresh	0.23	1.37	10.3
	Total Inferred	**0.44**	**1.24**	**17.4**

Table 14.20.5 Breakdown of the CHG South Mineral Resource by Oxidation State Reported within a USD2,000 Optimised Pit Shell at a Gold Grade Cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.09	1.18	3.5
	Transitional	0.62	1.26	24.9
	Fresh	0.96	1.51	46.5
	Total Indicated	**1.67**	**1.40**	**74.9**
Inferred	Oxide	0.03	0.85	0.7
	Transitional	0.01	0.77	0.3
	Fresh	-	-	-
	Total Inferred	**0.04**	**0.83**	**1.0**

Table 14.20.6 Breakdown of the ENI Mineral Resource by Oxidation State. Reported within a USD2,000 Optimised Pit Shell at a Gold Grade Cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.72	1.33	31.0
	Transitional	0.97	1.40	43.9
	Fresh	0.37	1.89	22.1
	Total Indicated	**2.06**	**1.46**	**97.0**
Inferred	Oxide	0.19	1.02	6.1
	Transitional	0.72	1.18	27.2
	Fresh	1.05	1.22	41.2
	Total Inferred	**1.95**	**1.19**	**74.4**

Table 14.20.7 Breakdown of the HAN Mineral Resource by Oxidation State Reported within a USD2,000 Optimised Pit Shell at a Gold Grade Cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.01	1.48	0.4
	Transitional	0.38	2.34	29.0
	Fresh	3.18	2.07	211.1
	Total Indicated	**3.57**	**2.09**	**240.5**
Inferred	Oxide	0.01	1.38	0.5
	Transitional	0.10	2.04	6.5
	Fresh	0.21	1.27	8.7
	Total Inferred	**0.32**	**1.51**	**15.7**

Table 14.20.8 Breakdown of the HND Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	-	-	-
	Transitional	-	-	-
	Fresh	-	-	-
	Total Indicated	**-**	**-**	**-**
Inferred	Oxide	0.49	1.03	16.2
	Transitional	0.05	0.85	1.3
	Fresh	0.01	1.02	0.3
	Total Inferred	**0.55**	**1.01**	**17.9**

Table 14.20.9 Breakdown of the KEK Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.18	1.24	7.0
	Transitional	1.38	1.36	60.4
	Fresh	1.79	1.44	82.7
	Total Indicated	**3.34**	**1.40**	**150.1**
Inferred	Oxide	0.06	0.81	1.6
	Transitional	0.10	1.18	3.8
	Fresh	0.02	1.67	0.9
	Total Inferred	**0.18**	**1.10**	**6.3**

Table 14.20.10 Breakdown of the KILO Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.10	1.10	3.7
	Transitional	3.10	1.15	114.2
	Fresh	15.17	1.32	645.6
	Total Indicated	**18.37**	**1.29**	**763.4**
Inferred	Oxide	0.39	1.02	12.6
	Transitional	2.03	1.07	69.9
	Fresh	3.34	1.10	118.2
	Total Inferred	**5.75**	**1.09**	**200.7**

Table 14.20.11 Breakdown of the NAR Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	-	-	-
	Transitional	-	-	-
	Fresh	-	-	-
	Total Indicated	**-**	**-**	**-**
Inferred	Oxide	0.09	1.13	3.1
	Transitional	-	-	-
	Fresh	-	-	-
	Total Inferred	**0.09**	**1.13**	**3.1**

Table 14.20.12 Breakdown of the NOK Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	0.06	1.12	2.2
	Transitional	0.59	1.88	35.9
	Fresh	3.56	1.95	223.7
	Total Indicated	**4.21**	**1.93**	**261.7**
Inferred	Oxide	0.03	0.66	0.6
	Transitional	0.01	0.71	0.3
	Fresh	0.07	0.78	1.7
	Total Inferred	**0.11**	**0.74**	**2.6**

Table 14.20.13 Breakdown of the SWA Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	2.51	1.50	121.4
	Transitional	3.28	1.81	190.1
	Fresh	7.60	1.77	432.2
	Total Indicated	**13.39**	**1.73**	**743.8**
Inferred	Oxide	0.02	0.84	0.6
	Transitional	0.02	1.02	0.6
	Fresh	-	-	-
	Total Inferred	**0.04**	**0.92**	**1.2**

Table 14.20.14 Breakdown of the THN Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	-	-	-
	Transitional	-	-	-
	Fresh	-	-	-
	Total Indicated	**-**	**-**	**-**
Inferred	Oxide	0.54	1.08	18.9
	Transitional	0.24	1.38	10.6
	Fresh	0.19	2.15	13.0
	Total Inferred	**0.97**	**1.36**	**42.5**

Table 14.20.15 Breakdown of the VAKO Mineral Resource by Oxidation State Reported within a USD2,000 optimised pit shell at a gold grade cut-off of 0.5 g/t Au.

Classification	Oxidation	Mt	Au g/t	Au koz
Indicated	Oxide	-	-	-
	Transitional	-	-	-
	Fresh	-	-	-
	Total Indicated	**-**	**-**	**-**
Inferred	Oxide	0.48	0.91	14.1
	Transitional	1.40	0.98	43.8
	Fresh	0.76	0.92	22.4
	Total Inferred	**2.63**	**0.95**	**80.3**

Figure 14.20.1 Grade and Tonnage Curves for In-pit Classified Material - ATI

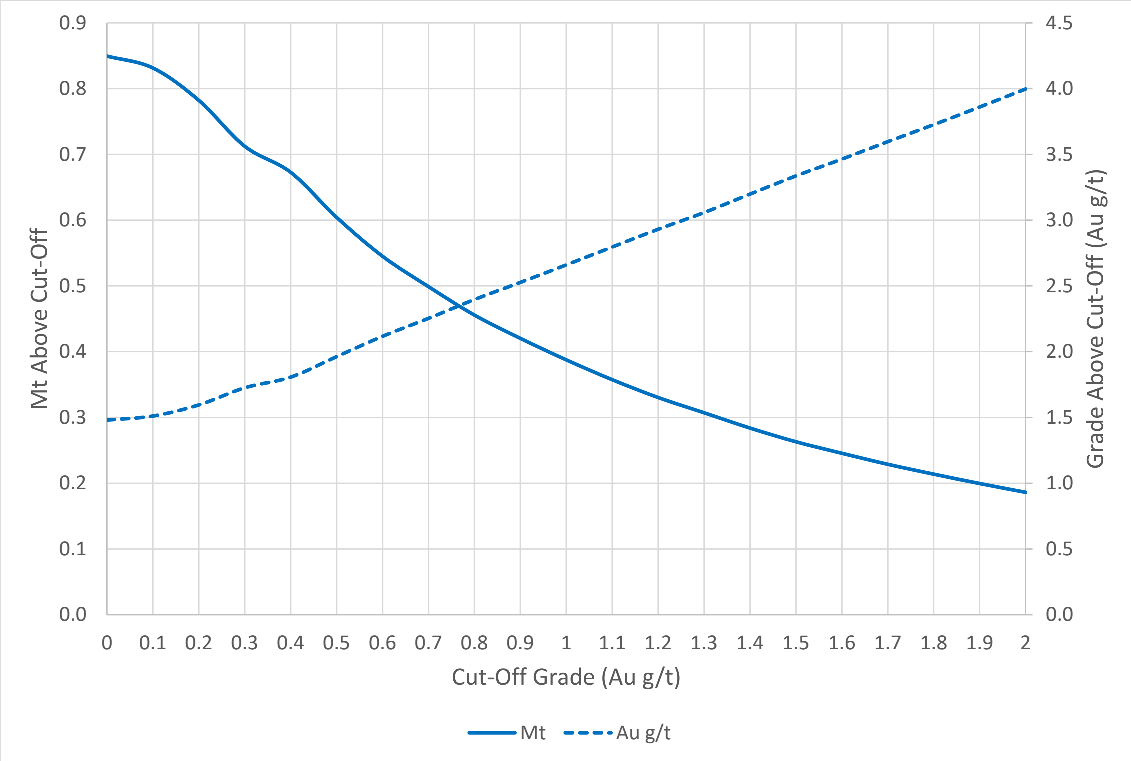


Figure 14.20.2 Grade and Tonnage Curves for In-pit Classified Material – CHG Main

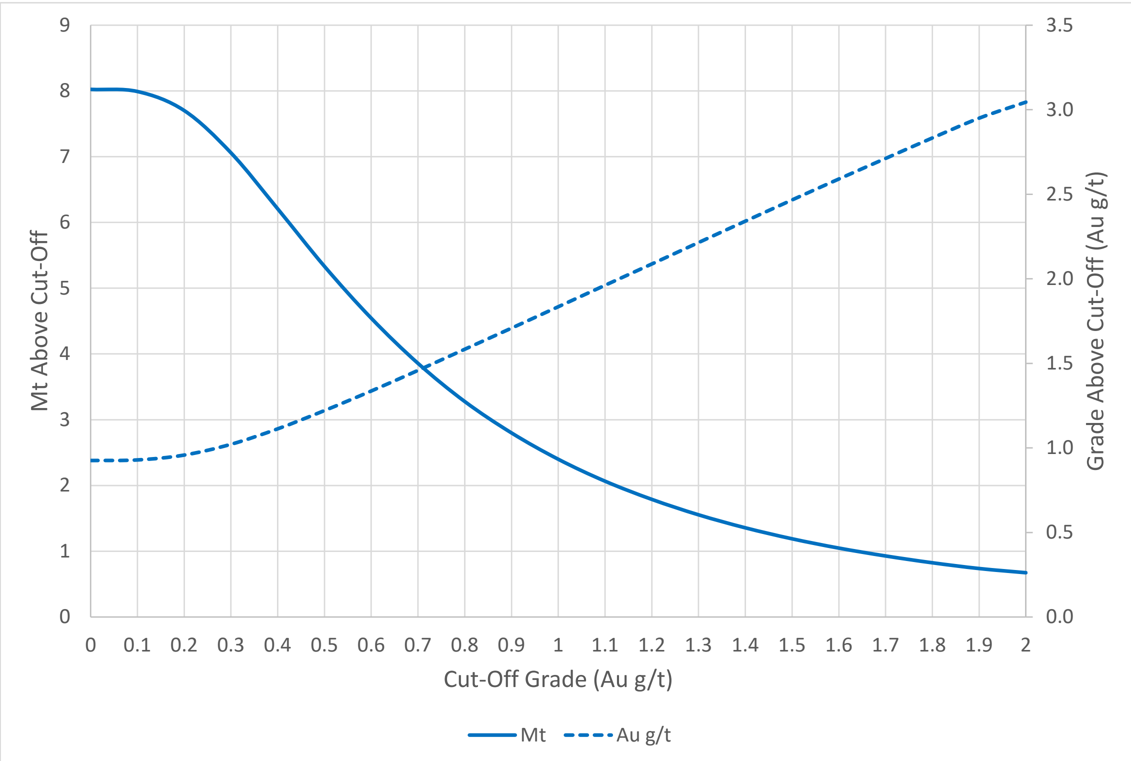


Figure 14.20.3 Grade and Tonnage Curves for In-pit Classified Material – CHG South

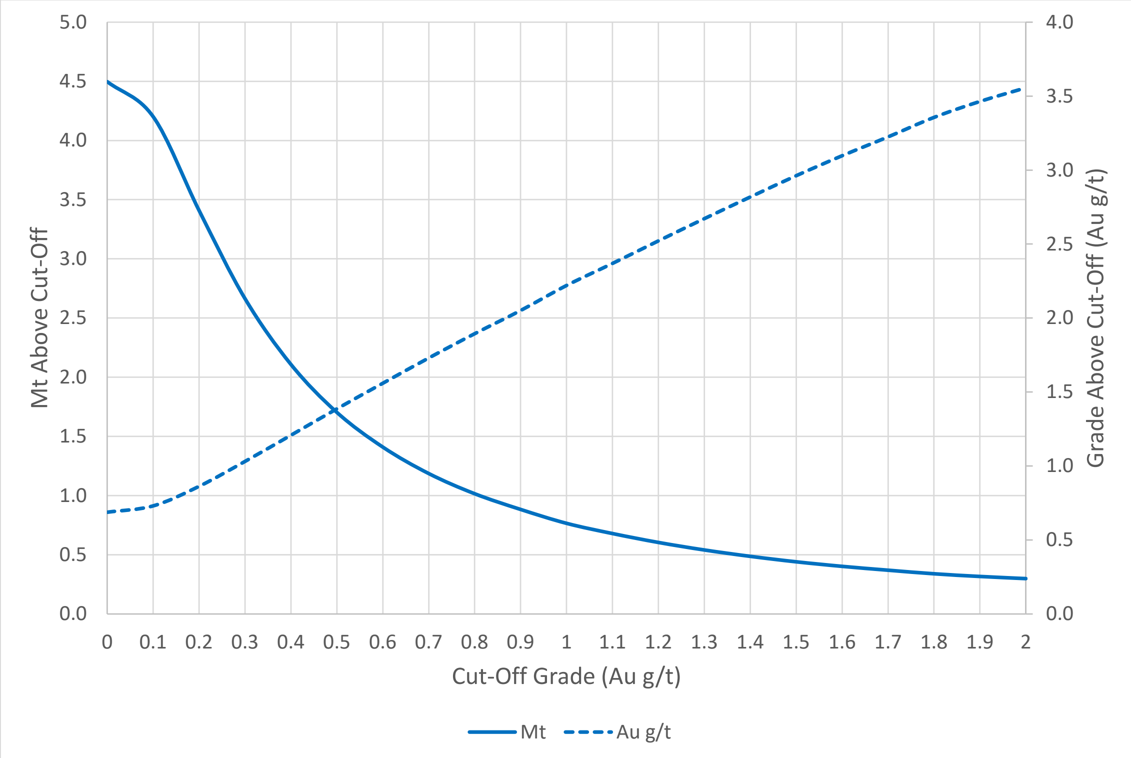


Figure 14.20.4 GRADE and Tonnage Curves for In-pit Classified Material – ENI

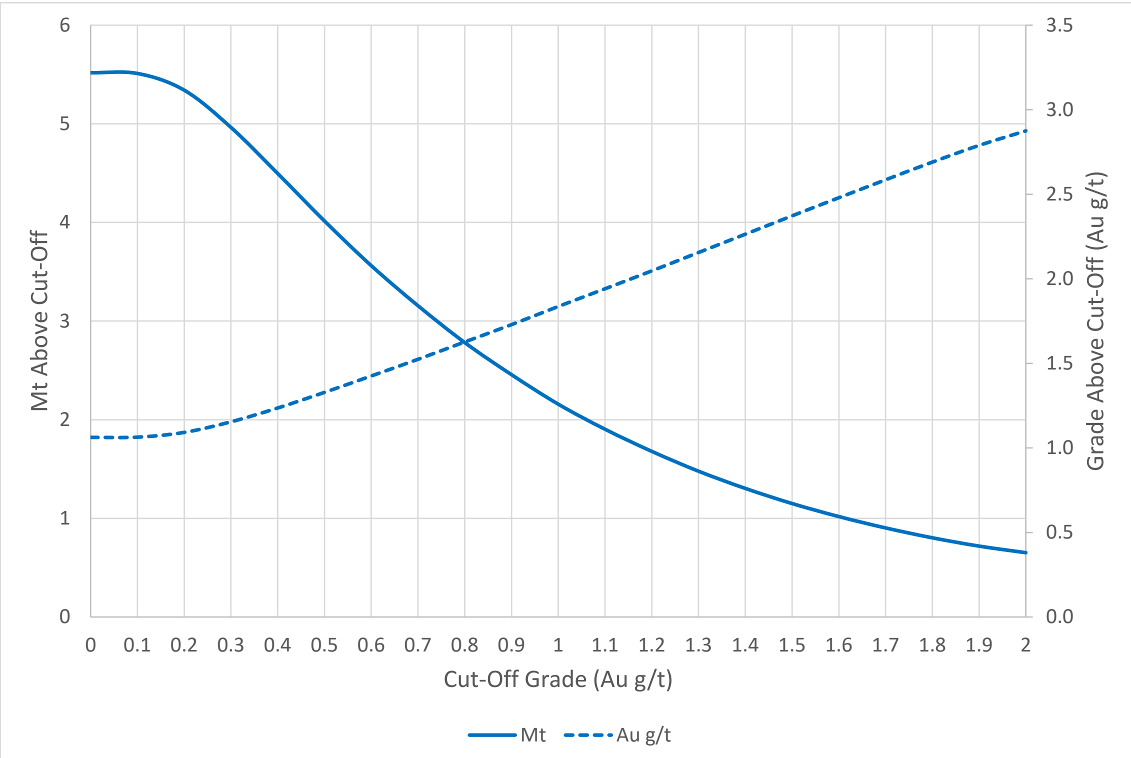


Figure 14.20.5 Grade and Tonnage Curves for In-pit Classified Material – HAN

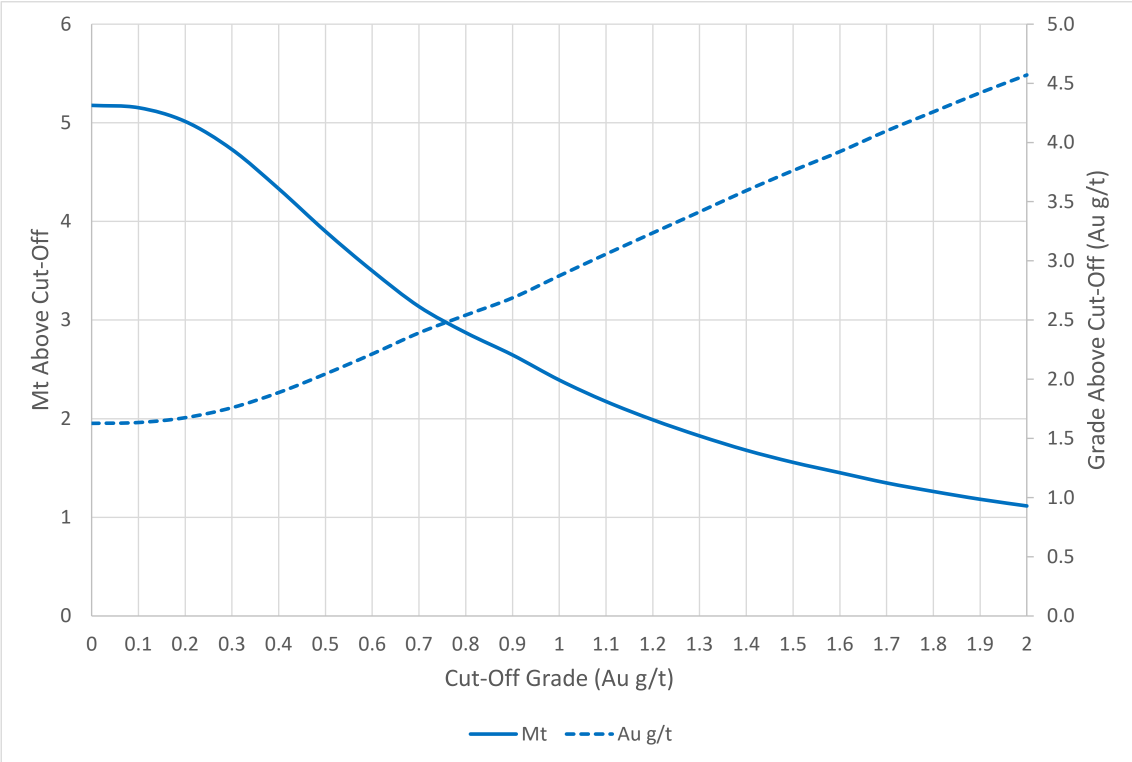


Figure 14.20.6 Grade and Tonnage Curves for In-pit Classified Material – KEK

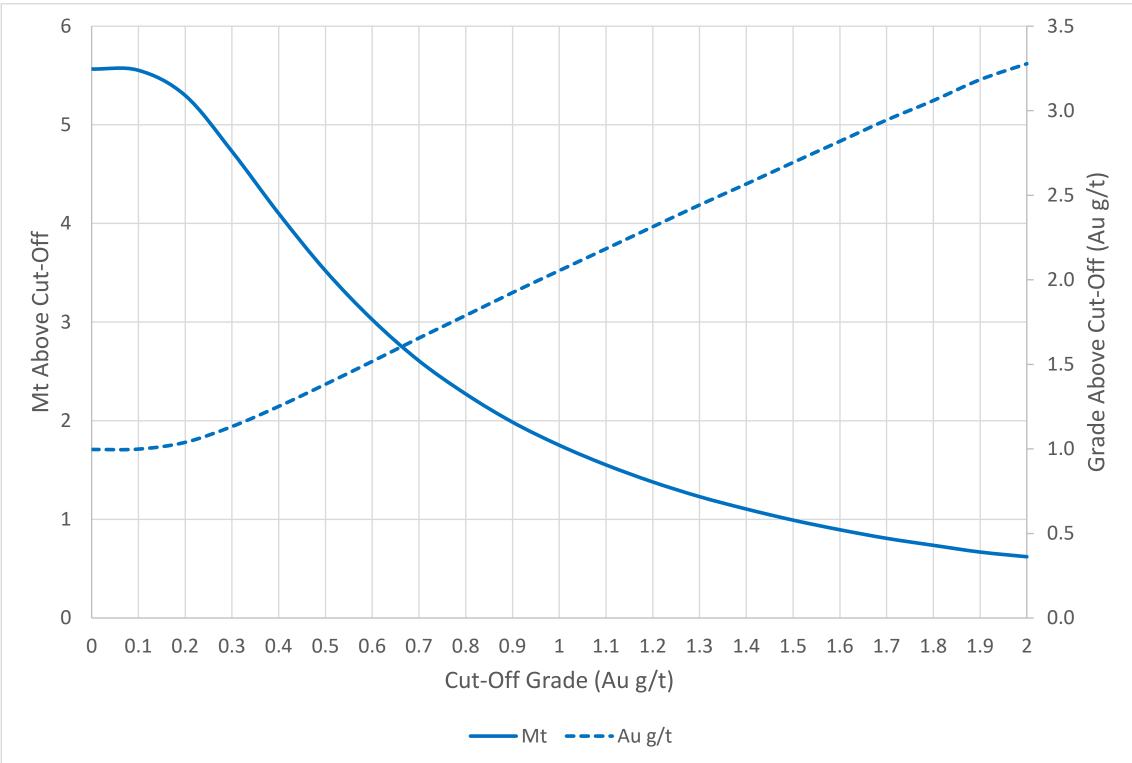


Figure 14.20.7 GRADE and Tonnage Curves for In-pit Classified Material – KILO

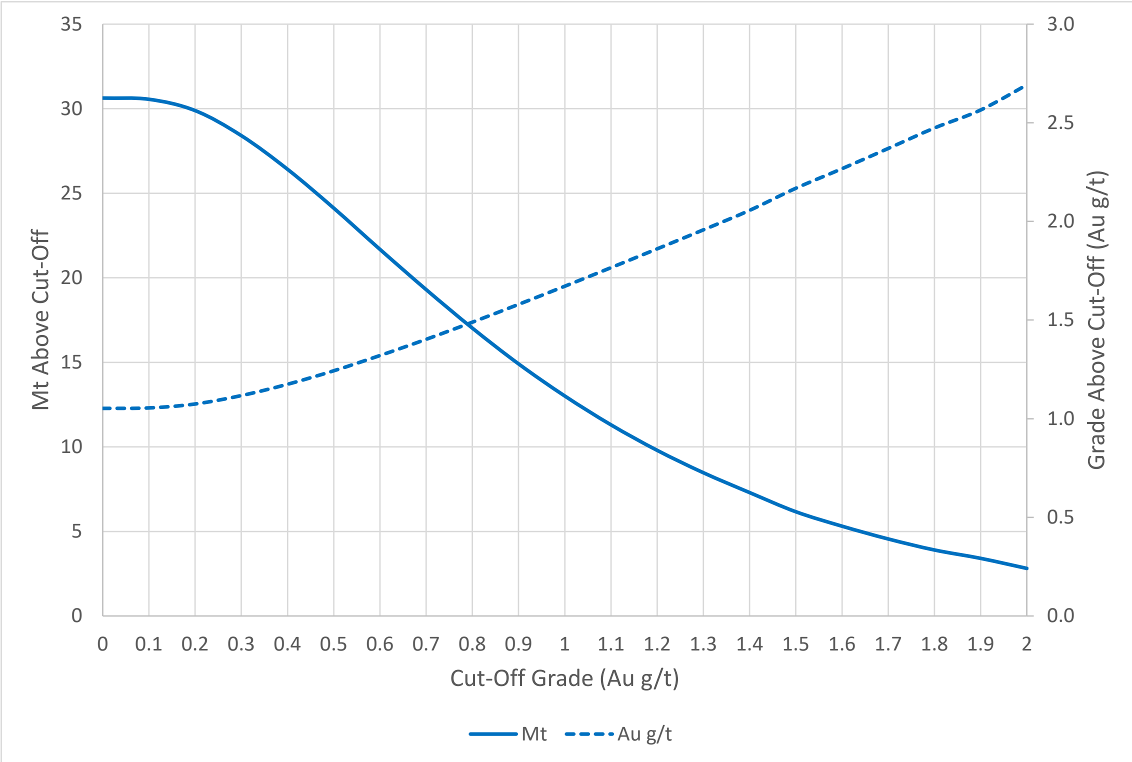


Figure 14.20.8 Grade and Tonnage Curves for In-pit Classified Material – NOK

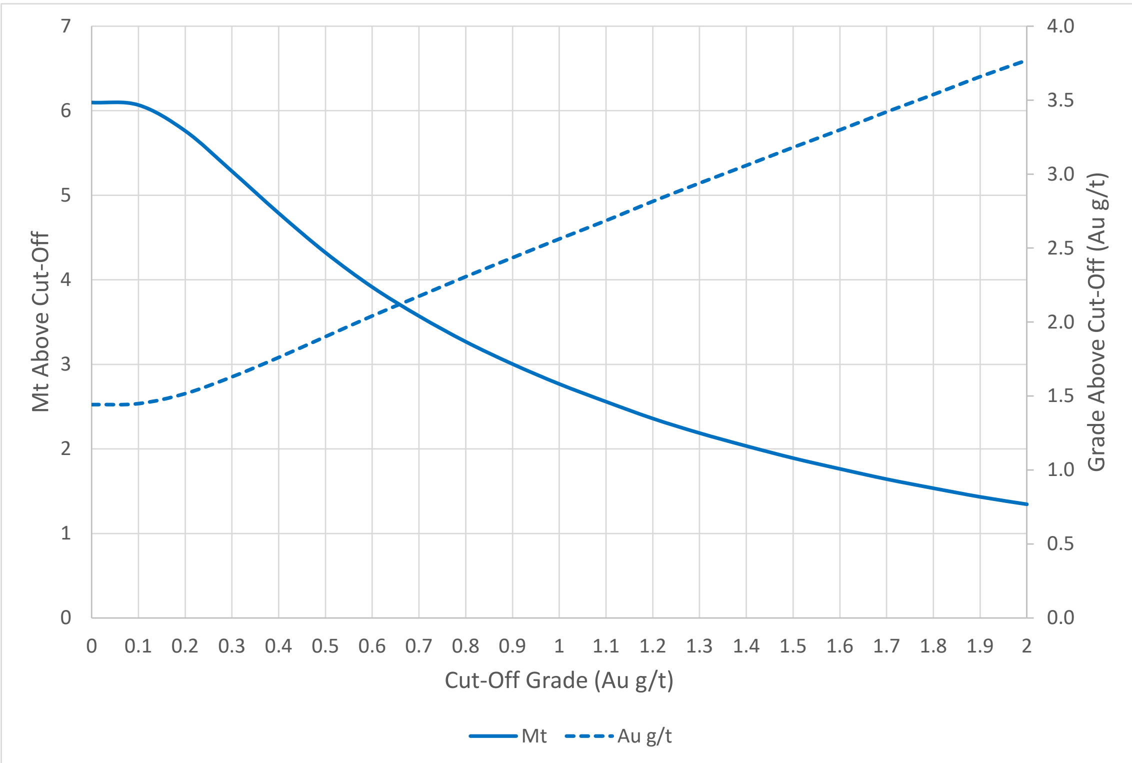
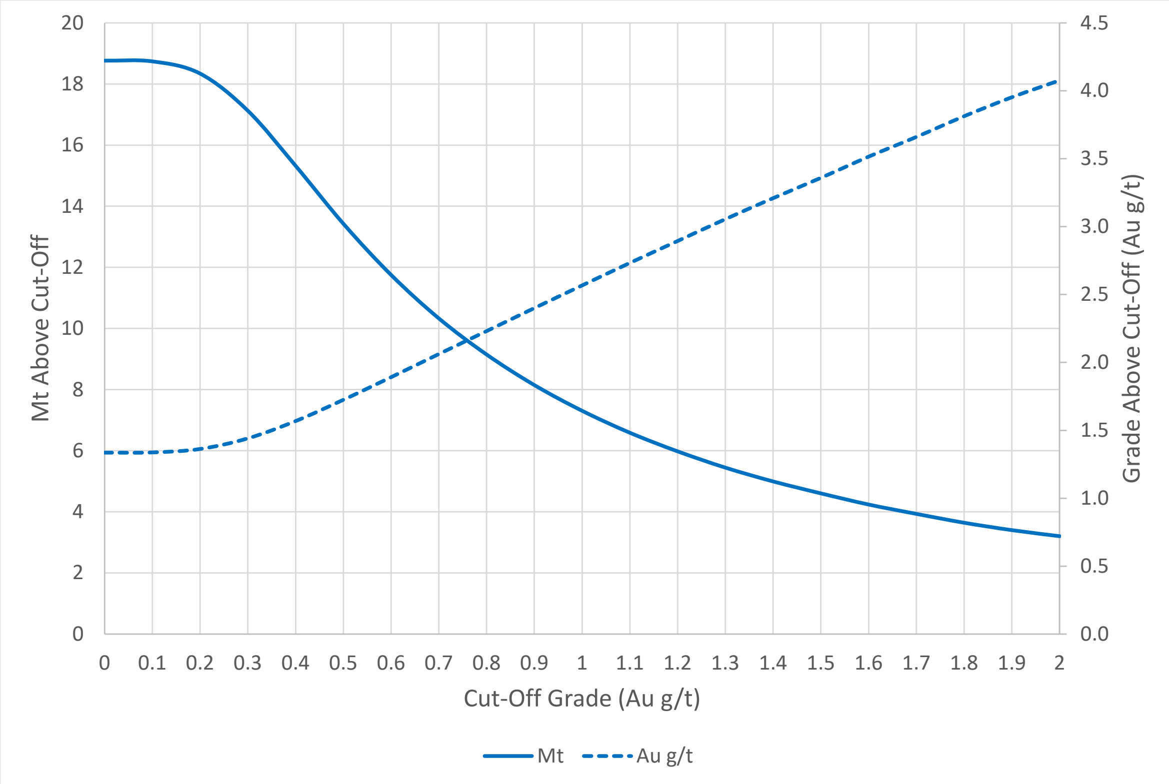


Figure 14.20.9 Grade and Tonnage Curves for in-pit Classified Material – SWA



14.21 Factors that May Affect the Mineral Resource

The drilling, sampling and analytical methods utilised by Centamin are considered appropriate for Mineral Resource modelling and the input data have been found to be of sufficient quality.

Most of the Doropo prospects remains open, predominantly at depth. Additional drilling would be required to fully delineate the mineralisation extents.

The estimation method employed is considered to be appropriate for open pit mining studies.

There are no current known environmental, permitting, legal, title, taxation, socio-economic, marketing and political factors that could materially impact the MRE.

14.22 Comparison to Previous Mineral Resource

Reported Mineral Resources for this 2022 update MRE and the 2021 MRE are compared in Table 14.22.1 and Table 14.22.2.

The following points are pertinent:

- The large reduction in overall Mineral Resource tonnage from 2021 to 2022 is due predominantly to the introduction of pit shells for reporting purposes. This has materially constrained the reporting volume for Mineral Resources, and represents the application of a more rigorous RPEEE condition. Since the models for HND, NAR, THN and VAKO have not been updated since 2021, the change in reported Mineral Resources for these four prospects is due entirely to the application of the constraining pit shells.

- The amount of Indicated Mineral Resource has increased materially due to the PFS infill drilling program, which has nominally reduced the drill spacing from 50 m x 50 m to 25 m x 50 m.

Table 14.22.1 Reported Indicated Mineral Resources – 2022 MRE Update versus 2021 MRE

Prospect	Indicated Mineral Resources - 2022			Indicated Mineral Resources - 2021		
	Mt	Au g/t	Au Moz	Mt	Au g/t	Au Moz
Attire	-	-	-	-	-	-
Chegue Main	4.89	1.22	0.19	-	-	-
Chegue South	1.67	1.40	0.07	-	-	-
Enioda	2.06	1.46	0.10	-	-	-
Han	3.57	2.09	0.24	-	-	-
Hinda*	-	-	-	-	-	-
Kekeda	3.34	1.40	0.15	-	-	-
Kilosegui	18.37	1.29	0.76	-	-	-
Nare*	-	-	-	-	-	-
Nokpa	4.21	1.93	0.26	2.34	2.13	0.16
Souwa	13.39	1.73	0.74	-	-	-
Tchouahinan*	-	-	-	-	-	-
Vako*	-	-	-	-	-	-
TOTAL	**51.51**	**1.52**	**2.52**	**2.34**	**2.13**	**0.16**

Table 14.22.2 Reported Inferred Mineral Resources – 2022 MRE Update versus 2021 MRE

Prospect	Inferred Mineral Resources - 2022			Inferred Mineral Resources - 2021		
	Mt	Au g/t	Au Moz	Mt	Au g/t	Au Moz
Attire	0.60	1.96	0.04	3.58	1.56	0.18
Chegue Main	0.44	1.24	0.02	10.52	1.05	0.36
Chegue South	0.04	0.83	0.001	10.48	1.11	0.37
Enioda	1.95	1.19	0.07	10.41	1.09	0.36
Han	0.32	1.51	0.02	7.78	1.33	0.33
Hinda*	0.55	1.01	0.02	1.82	0.92	0.05
Kekeda	0.18	1.10	0.01	6.48	1.14	0.24
Kilosegui	5.75	1.09	0.20	43.89	1.02	1.44
Nare*	0.09	1.13	0.003	0.89	1.12	0.03
Nokpa	0.11	0.74	0.003	8.38	1.52	0.41
Souwa	0.04	0.92	0.001	23.65	1.31	1.00
Tchouahinan*	0.97	1.36	0.04	4.64	0.99	0.15
Vako*	2.63	0.95	0.08	10.30	0.88	0.29
TOTAL	**13.67**	**1.14**	**0.50**	**142.82**	**1.13**	**5.21**

14.23 Audits and Reviews

No independent audit has been completed on the updated Doropo MRE.

Cube undertook regular internal peer reviews during the course of the MRE work.

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15.0 MINERAL RESERVE ESTIMATES

15.1 Introduction

15.1.1 Basis of Report

This section of the report was prepared by Orelogy Mine Consulting ('Orelogy') at the request of Centamin plc ('Centamin'). The purpose of this section of the report is to provide Centamin with an Independent Technical Report based on the Pre-feasibility Study completed for the Doropo Gold Project ('the Project') in Cote d'Ivoire, Africa. This section of the report has been compiled based on the requirements of NI 43-101.

The overall financial evaluation carried out as part of the Doropo Gold Project Preliminary Feasibility Study ('Doropo PFS'), which utilised the mining schedule and mining cost estimation developed by Orelogy, has defined the range of criteria under which the Doropo Gold Project in Cote d'Ivoire may be considered potentially economic so that further development of the Project can be planned.

This section of the report was produced for Public Reporting under NI 43-101. It was prepared in accordance with the requirements of:

- Disclosure and reporting requirements of the Toronto Stock Exchange ('TSX') as stipulated in TSX (2010).
- NI 43-101, Form 43-101F1 and Companion Policy 43-101CP (NI 43-101, 2014).
- Canadian Institute of Mining, Metallurgy and Petroleum Definition Standards (CIM, 2014).

The results of the Doropo PFS exclude Inferred Mineral Resources. Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorised as a Mineral Reserve, so any Inferred Resources within the pit shell are considered 'waste' material in this PFS.

Orelogy estimated the Mineral Reserve stated within the Doropo PFS in accordance with the JORC Code (2012). The term 'Ore Reserve' within JORC 2012 is considered equivalent to the term 'Mineral Reserve' as used by Canadian National Instrument 43-101 'Standards of Disclosure for Mineral Projects' (NI 43-101, 2014). The JORC Code (2012) is defined as an 'acceptable foreign code' under NI 43-101.

It should be noted that this PFS is preliminary in nature and there is no certainty that the conclusions of this PFS will be realised.

15.1.2 Statement of Independence

Orelogy is an independent consulting company contracted by Centamin to carry out the mining component of the Doropo PFS. Neither Orelogy, nor the authors of this section of the report, currently have or previously have had, any material interest in Cardinal or the mineral properties in which Centamin has an interest. Orelogy's relationship with Centamin is solely one of professional association between client and independent consultant.

This section of the report was prepared in return for professional fees based upon agreed commercial rates and the payment of these fees is not contingent on the results of this section of the report. No member or employee of Orelogy is, or is intended to be, a director, officer or other direct employee of Centamin.

In the preparation of this Independent Technical Report Orelogy has used information provided by Centamin and other third-party experts appointed by Centamin. Orelogy has verified this information, making due enquiry of all material issues that are required in order to comply with NI 43-101 requirements.

15.1.3 Risks and Forward-looking Statements

Mining and mineral exploration, development and production is, by its nature, a business with significant risk. Profitability and asset values can be affected by unforeseen operating and technical issues, the majority of which are, and will be, beyond the control of Centamin or any other operating entity.

This Independent Technical Report contains forward-looking statements. These forward-looking statements are based on the opinions and estimates of Centamin, Orelogy and other specialist consultants at the date the statements were made. Readers are cautioned not to place undue reliance on forward-looking information or statements. By their nature, forward-looking statements involve numerous assumptions, inherent risks and uncertainties, both general and specific, which contribute to the possibility that actual results may differ materially from those anticipated in the forward-looking statements. Events or circumstances beyond Centamin's control could also cause actual results to differ materially from those estimated or projected and expressed in, or implied by, these forward-looking statements.

Orelogy considers the basis, and associated outcomes, of the forward-looking assumptions applied to their component of work to be reasonable. However, Orelogy does not guarantee future results, levels of activity, performance or achievements of the Project outlined as outlined in the Preliminary Feasibility Study.

15.1.4 Use of the Term 'Ore' in this PFS

The Canadian National Instrument Companion Policy 43-101 (Section 2.3) indicates that, in the context of Mineral Resource estimates, the term 'ore' implies technical feasibility and economic viability that should only be attributed to 'Mineral Reserves'. In compliance with Section 2.3 of the Companion Policy, the term ore is not used in the Mineral Resource context of this PFS.

The term ore is used in the mining and processing sections of this PFS in a generic way to describe the 'mineable' part of the resource estimate that will be extracted from the mine and fed to the process plant. Where appropriate this is referred to as the 'Mineral Reserve' after investigation and application of all relevant Modifying Factors as discussed in Section 15.0, in conformance with the definitions in CIM (2014).

Orelogy has estimated an 'Ore Reserve' for the Project in accordance with the Australian JORC Code (2012). The term 'Ore Reserve' is synonymous with the term 'Mineral Reserve' as used NI 43-101. The JORC Code (2012) is defined as an 'acceptable foreign code' under NI 43-101.

15.2 Reliance on Other Experts

This section of the report was prepared by Orelogy for Centamin as a component of the Doropo PFS for the purposes of Public Reporting. The information, conclusions, opinions, and estimates contained herein are based on:

- Information available to Orelogy at the time of preparation of this section of the report.
- Assumptions, conditions, and qualifications discussed in this section of the report.
- Data, reports, and other information supplied by Centamin and other third parties, as documented and referenced in this PFS Report.

For the purpose of this section of the report Orelogy has relied on ownership information and other local knowledge provided by Centamin. Orelogy has no independent information regarding property title or mineral rights for the Doropo Gold Project and expresses no opinion as to the ownership status of the property.

Except for the purposes legislated under Canadian or other securities laws, any use of this section of the report by any third party is at that party's sole risk.

The major components of this PFS comprise of:

- Resource modelling based on available data.
- Preliminary mine design and production scheduling.
- Mining cost estimation; metallurgical testwork.
- Preliminary process design and process plant cost estimation.
- Environmental assessment.
- Preliminary financial analysis and other supporting studies on geology.
- Hydrogeology.

- Hydrology.
- Rock mechanics for pit slope design and geotechnical engineering.

15.3 Mineral Reserve Estimate

15.3.1 Introduction

No Mineral Reserve has previously been defined for the Doropo Gold Project. Centamin engaged Orelogy to estimate a Mineral Reserve for the Project based on the latest available resource model as part of the Doropo PFS.

The Mineral Reserve developed by Orelogy as part of the Doropo PFS was announced by Centamin on 27 June 2023. Centamin and Orelogy confirm that they are not aware of any new information or data that materially affects the information included in the corresponding market announcement, and that all material assumptions and technical parameters underpinning the Mineral Reserve estimates in the market announcement continue to apply and have not materially changed. This is the maiden release of the Mineral Reserve for the Doropo Gold Project.

The Mineral Reserve was estimated from the Mineral Resource after consideration of the level of confidence in the Mineral Resource and taking account of material and relevant modifying factors including mining, processing, infrastructure, environmental, legal, social and commercial factors available at the time. The Probable Mineral Reserve estimate is based on Indicated Mineral Resources. No Inferred Mineral Resource was included in the Ore Reserve. The Mineral Reserve represents the economically mineable part of the Indicated Mineral Resources. There is no Proven Mineral Reserve since no Measured Mineral Resource has yet been defined.

At this time, there are no known environmental, legal, socio-economic, marketing or other relevant conditions, that would materially affect the estimated Mineral Reserve of the Doropo Gold Project.

The proposed mine plan is technically achievable. All technical proposals made for the operational phase involve the application of conventional technology that is widely utilised in the gold industry in West Africa. Financial modelling completed as part of the PFS shows that the Project is economically viable under current assumptions. Material Modifying Factors (mining, processing, infrastructure, environmental, legal, social and commercial) were considered during the Mineral Reserve estimation process.

15.3.2 Mining Approach

The Mineral Resource Models (MRM's) produced by Cube (2022), as discussed in Section 13 of the Technical Report, were used to develop a Mining Block Model (MBM) for each deposit.

A total of seven deposits were evaluated:

- Souwa (SWA).
- Nokpa (NOK).
- Chegue Main and Chegue South (CHG-MAIN and CHG-STH).
- Enioda (ENI).
- Han (HAN).
- Kekeda (KEK).
- Kilosegui (KLG).

The MRM's have a consistent minimum block size (sub-cell size) of 5 m x 5 m x 2.5 m (X, Y, Z), with a parent size ranging from 20 m x 20 m x 5 m (X, Y, Z) to 20 m x 40 m x 10 m (X, Y, Z). The MBM's were based on the MRM but were regularised to a consistent block model size of 10 m x 10 m x 5 m (X, Y, Z), maintaining the granularity of the MRM sub-cells by retaining an ore parcel and a waste parcel within the regularised block. An Orelogy proprietary routine was then run across the MBM that applies dilution on a block-by-block basis, by transferring a proportion of the waste parcel in any given block into the ore parcel. In this way a location 'edge effect' type dilution is generated whereby blocks at the ore / waste get more heavily diluted than blocks in the middle of orebody. As a result, the global dilution and ore loss across all the deposits approximated 14% and 8 % respectively but varied from deposit to deposit by 8%-18% and 2%-12% respectively. These levels of dilution and ore loss are considered appropriate for:

- The proposed 2.5 m ore mining bench height.
- The proposed equipment size (150 tonne excavator for selective mining).
- The orebody geometry of each deposit.

Open pit optimisations were run in Whittle 4X using a USD1,500/oz gold price to define the geometry of the economic open pit shapes. Mining costs were derived from submissions from mining contractors to a Request for Budget Pricing. Other modifying factors such as processing operating costs and performance, general and administrative overheads, project capital and royalties were provided by Centamin.

Optimisation shells were selected and pit designs were then completed based on these shells, along with associated waste storage landforms, mine haul roads and other mining infrastructure. Some internal mining stages were developed for Souwa.

Mining of the Doropo project will be undertaken utilising medium-scale using open pit mining equipment (90 t haul trucks, 150 t to 300 t hydraulic excavators) typical for West Africa. The mining process will be based on a conventional drill, blast, load and haul operation, with an allowance for 50% of the oxide material to be free-dig (i.e., not require drilling and blasting) utilising the large excavator. Mining areas of disturbance (i.e., pits, dumps, roads etc.) will be cleared of vegetation and topsoil which will be stockpiled for subsequent rehabilitation purposes. Centamin will have a management and technical team which will supervise the mining contract and undertake all technical activities such as grade control, survey and mine planning.

A Life of Mine (LOM) mining schedule was generated detailing the movement of ore and waste on 5 m mining benches for a mine life of approximately 10 years. This includes haulage of the ore from the satellite pits (Han, Kekeda, Enioda and Kilosegui) to the process plant located at Souwa. The schedule indicates that the design process feed rate can be met for the entire mine life.

Approximately 40.5 Mt of ore is processed, of which approximately 80% is direct fed to the plant and 20% is stockpiled as low-grade material.

The PFS is based on mining using a 5 m blast height and excavating in 2.5 m flitches. Waste will be excavated at the 5 m blast height where the larger production excavator is used.

For the purposes of the mining study, it was assumed that a ‘dry pit’ will be operated and that sufficient dewatering will be undertaken to comply with the geotechnical design criteria.

15.3.3 Cut-Off Grade

The estimated breakeven cut-off grade for the Doropo PFS Mineral Reserve was based on the calculation detailed below:

$$COG = \frac{(Ore\ Related\ Mining\ Cost + Processing\ Cost)\ \times (1 + Dilution)}{(Net\ Price\ \times Process\ Recovery)}$$

The modifying parameters used to develop the cut-off grade were those available at the time of the LOM production scheduling and are detailed in Table 15.3.1 below.

Table 15.3.1 Breakeven Cut-off Grade – Modifying Factors

<table>
<tr><th colspan="2">Item</th><th>Unit</th><th>Value</th></tr>
<tr><td rowspan="4">Ore Related Mining Costs</td><td>ROM Rehandle</td><td>USD/dmt</td><td>USD0.82</td></tr>
<tr><td>Grade Control</td><td>USD/dmt</td><td>USD0.50</td></tr>
<tr><td rowspan="2">Owners Team</td><td>USD/dmt weathered</td><td>USD0.30</td></tr>
<tr><td>USD/dmt fresh</td><td>USD0.36</td></tr>
<tr><td colspan="2" rowspan="2">Processing Cost</td><td>USD/dmt weathered</td><td>USD10.32</td></tr>
<tr><td>USD/dmt fresh</td><td>USD11.61</td></tr>
<tr><td colspan="2" rowspan="2">G & A Cost</td><td>USD/dmt weathered</td><td>USD2.35</td></tr>
<tr><td>USD/dmt fresh</td><td>USD2.65</td></tr>
<tr><td rowspan="4">Ore Haulage</td><td>Enioda</td><td>USD/dmt</td><td>USD2.52</td></tr>
<tr><td>Han</td><td>USD/dmt</td><td>USD1.72</td></tr>
<tr><td>Kekeda</td><td>USD/dmt</td><td>USD1.37</td></tr>
<tr><td>Kilosegui</td><td>USD/dmt</td><td>USD5.11</td></tr>
<tr><td rowspan="2">Process Recovery</td><td>Weathered</td><td>%</td><td>Max (-0.1845 x Au^4 + 0.9700 x Au^3 - 1.85331 x Au^2 + 1.5646 x Au + 0.4177 or 95%)</td></tr>
<tr><td>Fresh</td><td>%</td><td>Max (-0.2667 x Au^4 + 1.3936 x Au^3 - 2.6401 x Au^2 + 2.1995 x Au + 0.1772 or 90%)</td></tr>
<tr><td rowspan="6">Gold Price</td><td>Base Gold Price</td><td>USD/oz</td><td>USD1,500.00</td></tr>
<tr><td>Govt. Royalty</td><td>%</td><td>4.00%</td></tr>
<tr><td>Tenement Royalty</td><td>%</td><td>0.50%</td></tr>
<tr><td>Gold Loss</td><td>%</td><td>0.10%</td></tr>
<tr><td>Charge</td><td>USD/oz</td><td>USD3.91</td></tr>
<tr><td>Net Gold Price</td><td>USD/oz</td><td>USD45.88</td></tr>
</table>

As costs and process recovery vary by weathering and/or location, the calculated cut-off grade also varies as detailed in Table 15.3.2 below.

Table 15.3.2 Breakeven Cut-off Grade

Mining Area	Unit	Weathered	Fresh
Souwa / Nokpa / Chegue	g/t	0.39	0.60
Enioda	g/t	0.44	0.66
Han	g/t	0.43	0.64
Kekeda	g/t	0.42	0.63
Kilosegui	g/t	0.50	0.71

15.3.4 Mineral Reserve Estimate

The Mineral Reserves were estimated for the Doropo Gold Project as part of this PFS by Orelogy Mine Consulting. The total Probable Mineral Reserve is estimated at 40.6 Mt at 1.44 g/t Au with a contained gold content of 1,872 koz.

The Mineral Reserve for the Project is reported according to the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012) and CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM, 2014). The Mineral Resource was converted by applying Modifying Factors. The Probable Mineral Reserve estimate is based on the Mineral Resource classified as Indicated. Table 15.3.3 below presents a summary of the Mineral Reserves on a 100% Project basis at a USD1,500/oz gold price.

Table 15.3.3 Doropo Gold Project Mineral Reserve Estimate

Classification	Weathering	Tonnes	Grade	Contained Gold
Probable	Weathered	15.0	1.30	626
	Fresh	25.5	1.52	1,246
	Total	**40.6**	**1.44**	**1,872**

Notes:

The Ore Reserve conforms with and uses the JORC Code (2012) and CIM (2014) definitions.

The Ore Reserve was evaluated using a gold price of USD1,500 per ounce.

The Ore Reserve was evaluated using variable cut-off grades as described in Section 15.3.3.

Ore block grade and tonnage dilution was incorporated into the model.

All figures are rounded to reflect appropriate levels of confidence.

Apparent differences may occur due to rounding.

The Effective Date of the Mineral Reserve is June 27,2023.

All figures are rounded to reflect appropriate levels of confidence. Apparent differences may occur as a result of rounding. Based on the information presented in this PFS, the Mineral Reserve estimation process has converted almost 80% of the Indicated Mineral Resources to Probable Mineral Reserves.

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16.0 MINING METHODS

16.1 Scope of Work

The mining component of the Doropo PFS as undertaken by Orelogy involved the following key activities:

- Distribution of a mining contract Request for Budget Pricing (RBP) for the Doropo Gold Project to a range of suitably qualified mining contractors in West Africa, and evaluation of the submissions received. The RBP was based on first pass mine plans developed utilising the outcomes from the previous Preliminary Economic Assessment (PEA) for the Project.

- Pit optimisations were completed for the seven deposits of the project utilising the most up-to-date Mineral Resource Models for each deposit inclusive of allowances for dilution and ore loss. Appropriate Modifying Factors were applied including mining costs based on the RBP submissions and the most up-to-date parameters provided by Centamin (i.e., processing costs and recoveries, G&A costs, gold price, royalties etc.).

- Optimisation shells were selected from the optimisation results for each deposits, and pit designs were completed along with associated designs for waste rock dumps, mine roads, ore haulage roads etc.

- A Life of Mine (LOM) Production Schedule was developed utilising the pit designs across quarters for the first five years of production and the annually thereafter. There was also one quarter of preproduction mining.

- A detailed mining cost estimate was then developed utilising the various physicals derived from the LOM schedule and the rates from a selected RBP submission. This did not include the Centamin's mining team and related costs which was developed by Centamin.

The outcomes of the mining component of the PFS were then provided through to Centamin and the other contributing third party consultants to be utilised in the development of the final Doropo PFS financial model and subsequent economic evaluation of the Project.

16.2 Operating Strategy

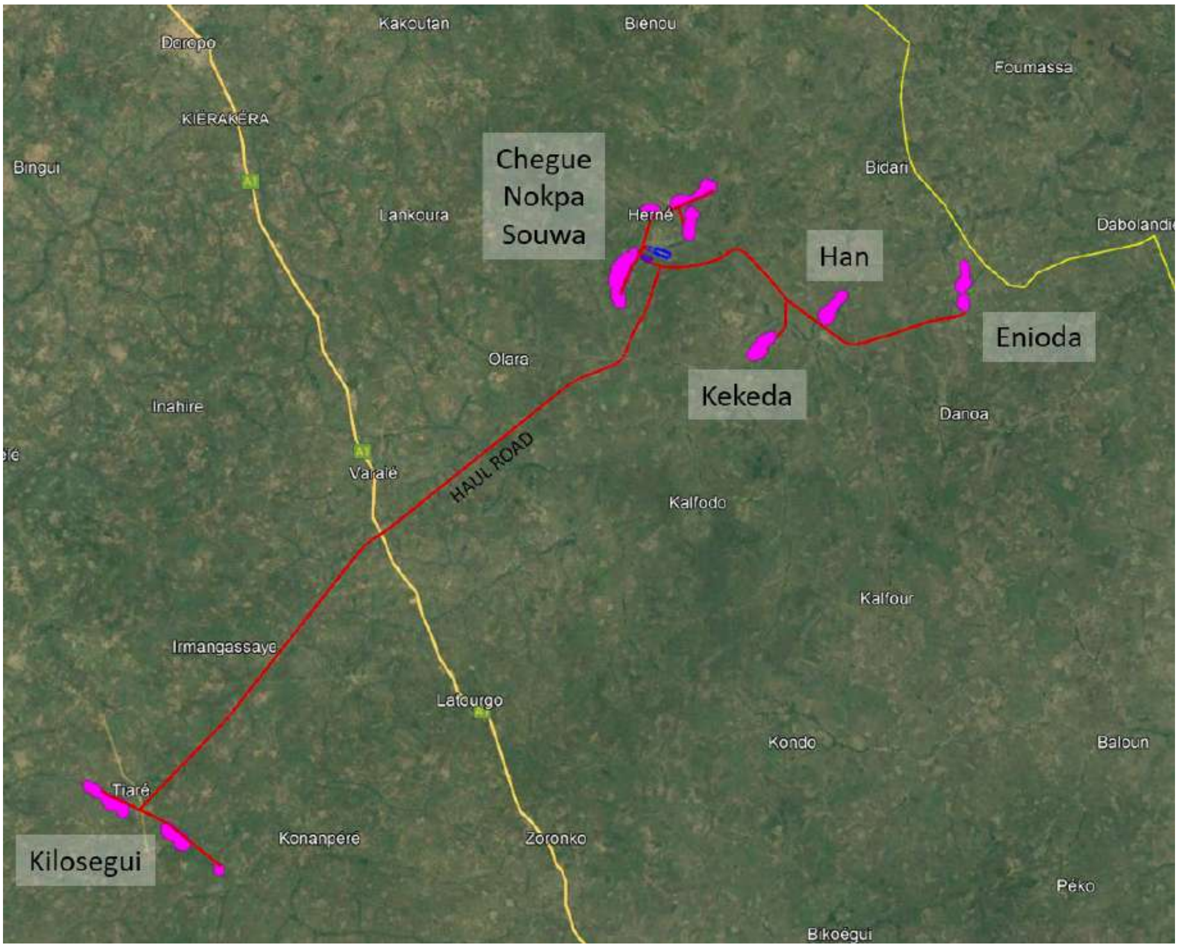
The Doropo Gold Project is a multi-pit project that consists of seven deposits as shown in Figure 16.2.1 below.

They can be considered as:

- A hub of three deposits adjacent to the proposed processing facility comprising Souwa, Nokpa, Chegue Main / Chegue South. These are referred to as the 'hub deposits' in this section of the report.

- Four satellite pits, being Kekeda, Han, Enioda and Kilosegui, being respectively 6 km SE, 7 km E, 11.5 km E and 28 km SW of the processing facility. These are referred to as the 'satellite deposits' in this section of the report.

Figure 16.2.1 Location of Mining Areas



All open pits will be mined utilising a conventional truck and excavator approach undertaking a typical drill, blast, load and haul production cycle. Mining is based on all production related activities being undertaken by a suitably qualified and experienced mining contractor. These activities include, but are not limited to:

- Construction of all mining infrastructure required for undertaking mining operations such as workshops, warehousing, fuel and lube area, washdown facilities, administration building, crib rooms and ablutions etc.

- Construction of all mine haul roads and of the of ore haulage roads from the satellite pits to the processing plant.

- Site preparation for pits, waste rock dumps (WRDs), roads etc. (i.e., clearing and grubbing of vegetation, removal and stockpiling of topsoil material).

- Primary production drilling and blasting.
- Primary production loading and hauling.
- Support of the primary production activities with a suitable sized fleet of support equipment (i.e., bulldozers, graders, water trucks etc.).
- Pit -dewatering via in pit sump pumps.
- Establishment and maintenance of suitable surface water management infrastructure.
- Site rehabilitation and closure works such as re-profiling WRDs to final landform, rehandling and spreading stockpiled topsoil material etc.

Centamin will provide oversight and management of the mining contractors and undertake all technical requirements for the mining operation such as grade control, mine planning, mine survey etc.

Mining of both ore and waste will be undertaken using an excavator (backhoe configuration) to load rigid-body dump trucks. Drill and blast will be carried out on 5 metre bench heights. It has been assumed that 50% of the highly weathered oxide material will be free-dig (i.e., not require blasting) with a small amount of dozer ripping. The ore will be excavated in 2.5 m flitches to minimise dilution and ore loss. Waste will be in mined either 2.5 metre flitches or at the 5-metre blast height depending on the size of the excavator. The configuration for the mining fleet for the contractor submission on which the PFS is based consists of:

- 2 x 150 tonne class excavators.
- 1 x 300 tonne class excavator.
- 90 tonne payload rigid bodied dump trucks.
- 30-45 tonne articulated dump trucks (satellite pit haulage).

Waste will be placed in designated WRDs adjacent to the open pits. Ore mined at the hub deposits will be transported directly to the central processing plant with the mining dump trucks. In the case of the satellite deposits, ore will be dumped to a Run-of-Mine (ROM) stockpile area immediately adjacent to the pit ramp exit for each satellite pit. From here it will be rehandled by a front end-loader to road type tipper trucks for transport through to the process plant.

Ore arriving at the process plant from both the hub and satellite deposits will be either:

- Directly dumped to the primary crusher bin.
- Placed on stockpile fingers on top of the primary crusher ROM pad.

- Dumped to a low-grade stockpile on natural ground level adjacent to the primary crusher ROM pad.

Mining be scheduled such that only two mining areas will be in production concurrently, other than periods where there is overlap as one area is ceasing and another area is commencing.

It has been assumed that the construction of other infrastructure such as the process plant ROM stockpile pad, Tailings Storage Facility (TSF) embankments etc. is carried out by others. However, an allowance has been made for a 'borrow' pit within the Souwa pit design for sourcing the quantity of bulk fill material required for this construction. This borrow pits has then been depleted from the Souwa mining inventory on the assumption it is excavated to completion prior top mining commending.

Rehabilitation works will be carried out on an ongoing basis as areas of WRDs are finalised or infrastructure such as haul roads are no longer required.

No consideration has been made for underground extensions of the operation in this PFS.

16.3 Mining Contractor Request for Budget Pricing

A Request for Budget Pricing (RBP) was developed in Q3 2022 based around the outcomes from the 2021 Preliminary Economic Assessment (PEA) of the Doropo Gold Project. Orelogy replicated the optimisation outcomes from the PEA and developed a mining schedule on which to base the RBP documentation.

The RBP was distributed to eight reputable mining contacting groups with capability to undertake a project of this scale in Cote d'Ivoire.

The scope of services for the mining contractor as detailed in the RBP was as follows:

- Site Establishment and supply of mining infrastructure required to undertake the scope of services, including:
  - Workshops for all mining and ancillary equipment and the Contractor light vehicle fleet.
  - Facilities for maintenance stores, offices, lubrication station, training facilities and ablutions including vehicle go-line area.
  - HV / LV wash-bay.
  - Bulk fuel storage facilities which will include the high flow (heavy vehicles) and low flow (light vehicles) refuelling bowsers.
  - Drainage and sumps for maintenance workshop, fuel storage and washdown facility.

- Explosives magazine complying to relevant Cote d'Ivoire regulations.

- Bulk explosives ANFO and emulsion facility (either fixed or mobile) complying with Cote d'Ivoire regulations.

- Oil and waste oil separator / storage.

- Any bulk earthworks required for the site establishment and construction of the mining areas.

- Turkey's nests.

- Mobilisation and demobilisation of all plant, equipment and personnel.

- Clearing of vegetation and topsoil stripping of all mining areas of disturbance and storage of material in suitable stockpiles for later reclamation purposes.

- Construction of all ex-pit haul roads as follow:

  - Souwa / Nokpa / Chegue – roads for mine haul trucks to the process plant ROM pad and adjacent waste dumps.

  - Han / Kekeda / Enioda / Kilosegui – roads for mine haul trucks to adjacent ROM stockpile and waste dumps. Road from local ROM stockpile to the process plant Rom Pad.

- Construction of the process plant ROM Pad.

- Construction of the local ROM stockpiles where required.

- Sheeting of ore stockpile bases with suitable mineralised low-grade material.

- Drilling and blasting operations.

- Excavation of waste from open pits and hauling to designated waste locations.

- Excavation of ore from open pits and hauling to the either the process plant ROM pad/crusher or the relevant local designated stockpiles.

- Rock breaking of oversize ore to a size suitable for loading to mine trucks and road haulage trucks.

- Rehandling by front end loader from the process plant ROM Pad stockpile fingers to the primary crusher.

- Reclaim by loader / road truck from the local ROM stockpiles to the process plant ROM Pad stockpile.

- Reclaim by loader / mine truck from the Low Grade (LG) stockpiles adjacent to the process plant ROM Pad stockpile direct to the crusher.
- Ongoing pit dewatering as required.
- Progressive mine closure:
  - Shaping and rehabilitation of WRDs.
  - Removal and rehabilitation mine roads and stockpile pads.
  - Demobilisation and site disestablishment of all infrastructure, equipment and personnel at mine closure.
  - Cote d'Ivoire registration requirements.
  - Relevant insurances (i.e., public liability, mining equipment, mining vehicles etc.).

The following items were either excluded from the scope or to be provided by Centamin.

- Centamin will supply all fuel required for the purposes of fulfilling the mining scope.
- Centamin will provide a demarcated area for the construction of the mining contractors facilities adjacent to the process plant. Centamin will provide off-take point for power and potable water at a specified location. These utilities will be provided at no cost to the contractor.
- Accommodation for the Contractor personnel (including OEM personnel) will be provided by Centamin in the mine camp.
- The Contractor's submission should be based on Centamin providing on-site catering for the Contractors employees within Centamin's mine mess facility.
- Submission to exclude allowances for all relevant taxes and duties (i.e., WHT, VAT, importation costs etc.)

The RBP requested rates for the items detailed in Table 16.3.1 below.

Table 16.3.1 Request for Budget Pricing Items

Activity		Rate
Site establishment and infrastructure		USD (lump sum)
Mobilisation and demobilisation of equipment and plant		USD per unit
Management Fee		USD/month
Fixed Costs and Overheads		USD/month
Site Preparation	Clear & Grub	USD/Ha
	Topsoil Stripping	USD/bcm
	Topsoil Haulage	USD/bcm/km
Rehabilitation	Topsoil placement	USD/bcm
	Reprofiling	USD/Ha
	Contouring / ripping & topsoil spreading (includes pads roads)	USD/Ha
Haulroad Construction	Mine Truck	USD/km
	Road Truck	USD/km
ROM Crusher Feeding	FEL only, assume average 75 m from stockpile finger to crusher bin	USD/t
Low Grade Stockpile Reclaim	FEL and Mine Truck assume 300 m horz. and 10 m vert. to crusher bin	USD/t
Satellite ROM Stockpile Reclaim	Loading (FEL)	USD/t
	Hauling (assumes tipper truck)	USD/t/km
Drill and Blast	Oxide	USD/bcm
	Transition	USD/bcm
	Fresh	USD/bcm
	Pre-splitting	USD/lineal wall metre
Load and Haul	Ore by pit by bench to crusher or local ROM stockpile as appropriate	USD/bcm
	Waste by pit by bench to local WRD	USD/bcm

All groups approached provided submissions with the exception of one contractor. This afforded Centamin a useful dataset of costs to assess and determine suitable rates for the PFS. The overall costs and associated USD/t rates are not directly comparable to final costs for the PFS as the RBP schedule was on a larger inventory with a longer mine life.

Figure 16.3.1 below shows the spread of the total mining costs received on a USD/t mined basis. The average of the costs received was USD4.09/t mined with a standard deviation of USD0.69/t mined, or +/-17%.

Most of the cost items were relatively consistent between submissions, with the exception of the ore haulage cost from the satellite pits, which some contractors significantly under-called. This was due to a misinterpretation of the data provided by Orelogy by some of the contractors. Figure 16.3.2 below shows the same comparison with a normalised ore haulage rate applied. As can be seen the distribution flattened somewhat except for the two extremities.

How the submission rates were utilised as part of the PFS study process are detailed in the relevant sections below.

Figure 16.3.1 Comparison of RBP Submissions (USD/t Mined Basis)

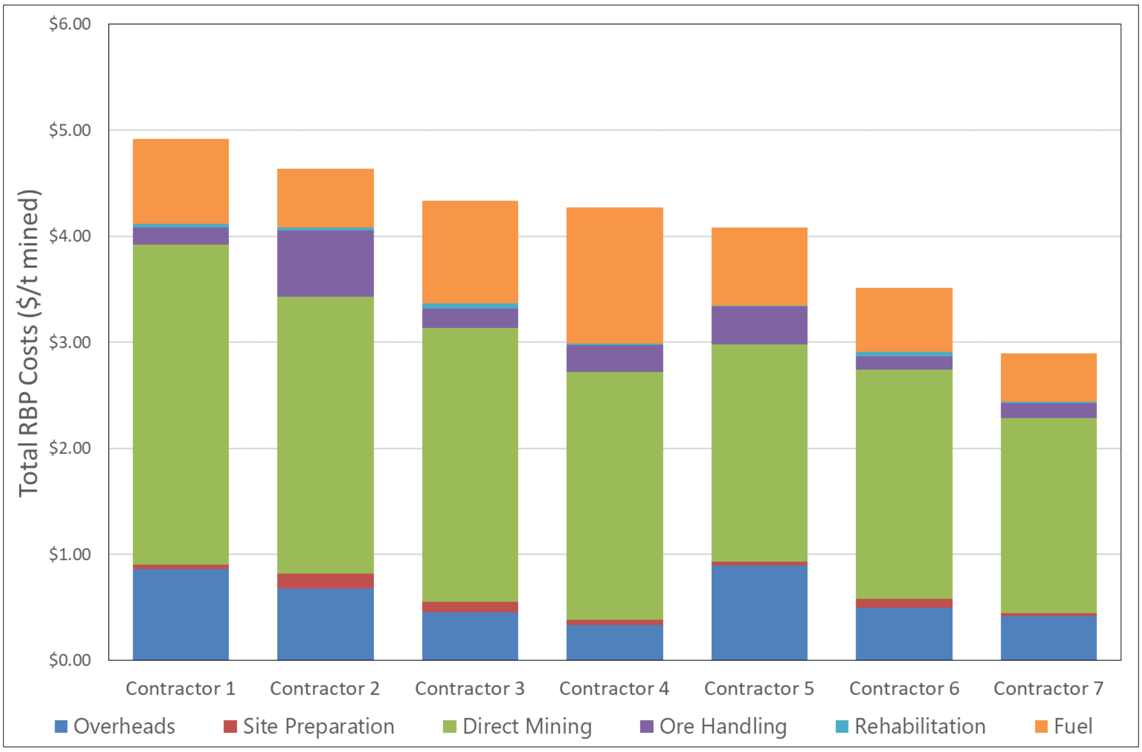
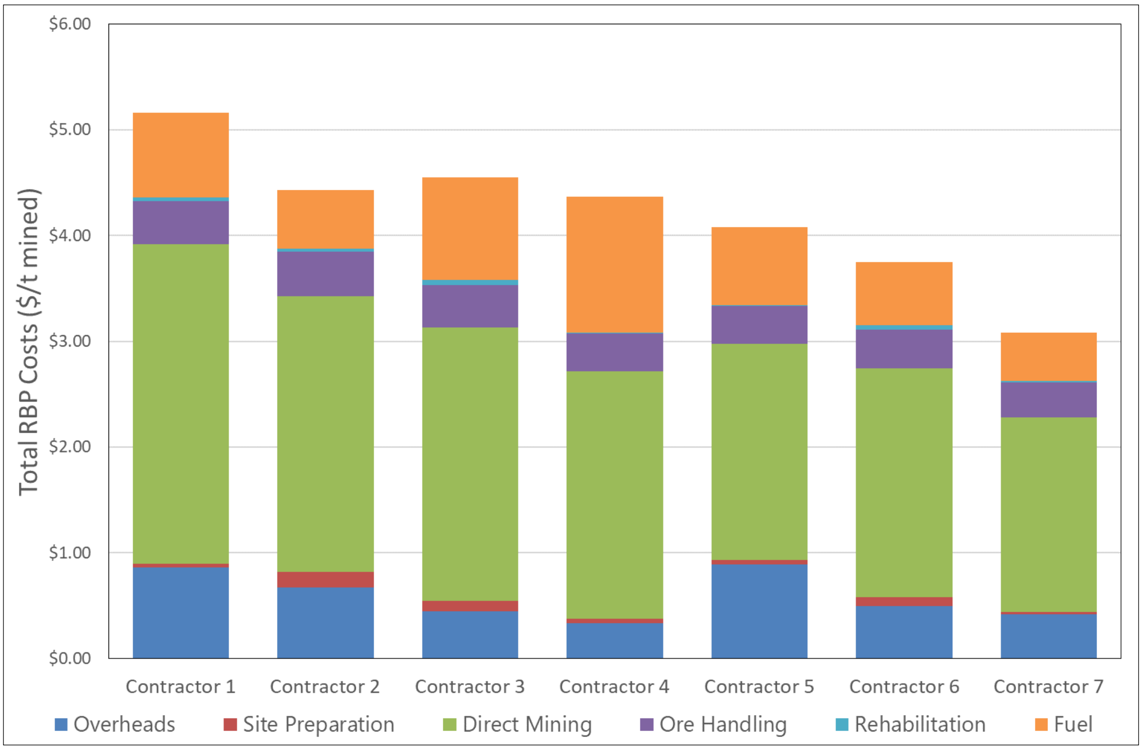


Figure 16.3.2 Comparison of RBP Submissions with Normalised Ore Haulage (USD/t Mined Basis)



16.4 Open Pit Optimisation

16.4.1 Mining Block Model

The mine design and Mineral Reserve estimate for this PFS was based on mineral resource models (MRM's) developed by Cube Consulting Pty Ltd (Cube) for their Doropo Mineral Resource Estimate (MRE) with an effective date of 25 October 2022. A total of six (6) models were provided in 2022, all in Surpac™ (.mdl) format. The Chegue (Main and South) and Nokpa deposits were provided in one model. Key block model parameters are outlined in Table 16.4.1 below.

As can be seen most of the MRM's are rotated to align the grid of the block model with the direction of strike of the orebody. While this is a commonly accepted approach to give better resolution of the boundary of the orebody, it should be noted that:

- In these cases, the X direction does not relate to East / West or the Y direction to North / South.
- The model that combined both the Nokpa and Chegue models means that neither of these deposits are aligned with the to block model orientation.

Table 16.4.1 Resource Block Model Parameters

Orebody	Range	Easting	Northing	Elevation	X size	Y size	Z size	Rotation
Enioda	Min	491,250	1,074,000	-50	5	5	2.5	0
bm_eni_smu_202206	Max	492,510	1,076,600	400	20	40	10	
Han	Min	485,550	1,073,780	-50	5	5	2.5	35
bm_han_smu_20220628	Max	486,820	1,076,080	400	20	20	5	
Kekeda	Min	483,000	1,072,030	-50	5	5	2.5	35
bm_kek_smu_20220601	Max	484,120	1,074,080	400	20	20	5	
Kilosegui	Min	464,260	1,050,710	0	5	5	2.5	-60
bm_klg_smu_202207	Max	466,850	1,060,000	450	20	20	5	
Nokpa	Min	478,370	1,077,200	-200	5	5	2.5	35
bm_nok_chg_smu_20220601	Max	481,690	1,081,670	450	20	20	5	
Souwa	Min	478,000	1,074,000	-50	5	5	2.5	0
bm*_swa_smu_20220601*	Max	479,550	1,076,700	450	20	40	10	

Orelogy used the following in-house procedures to convert the MRM's to a Mining Block Model (MBM) in a format suitable for Hexagon MineSight™, the general mining package (GMP) used by Orelogy:

- Export MRM to a comma separated value (csv) text file and clean-up by replacing null, non-number, and negative numbers with zero.
- Convert to a regularised block model suitable for mine planning purposes. MineSight™ preserves an ore parcel inside each regularised block to maintain the granularity of the underlying resource model. An approximate economic cut-off grade was used for each deposit to define which resource blocks were considered as ore parcels. The regular block size selected was 10 m (X) by 10 m (Y) by 5 m (Z) with a single ore parcel. This was considered an appropriate Selective Mining Unit (SMU) size for the mining model.
- Code classification and weathering flags on a majority volume basis. This can result in a degree of averaging or 'smearing' of these items. Therefore, the classification and weathering fields of the re-blocked model were over-coded with the original classification where required to reconcile the proportional model to the original MRM's and eliminate this effect.
- Accumulate contained metal to ensure exact reconciliation with the original MRM's.
- Intersect RBM with the topography surface to assign a topo%. Only the proportion of the block below the surface was reported.

The MBM's reconciled back to the original resource models with a variance of less than 0.1% in tonnes and ounces after the re-blocking and reclassification process, with the exception being Kekeda with an increase of 0.5% in ore tonnes. The Nokpa, Chegue and Chegue South areas were individually coded in the combined block model to allow for optimisation and reporting of results on a per deposit basis.

16.4.2 Dilution and Ore Loss

Orebody dilution is the result of waste or sub-grade material being excavated with ore during the process of mining, increasing the tonnes but lowering the grade of the ore delivered as process feed.

Ore loss may result from a combination of:

- Inaccuracy in locating the ore / waste boundary from grade control.
- Errors in ore block set-out.
- Errors in ore control (ore spotting).
- Poor accuracy of excavation along the identified boundary.
- Ore being misdirected to the wrong destination.
- Material being diluted to below cut-off grade.

The Mining Block Model resulting from the process described in Section 16.4.1 above does not include any allowance for either dilution or mining recovery with the exception of internal dilution added during the sample compositing process used for resource estimation. As part of the development of a credible and robust mine plan, dilution and mining recovery must be considered.

Of the many methods that can be used to estimate mining dilution and recovery, the application of edge dilution is considered most suitable to these deposits, given the selective mining method proposed. Orelogy assessed this effect by applying a dilution / ore loss allowance along the 'edge blocks' in the resource model, based upon an initial ore / waste cut-off assumption. Orelogy have in-house routines that can apply the edge effect in three possible ways:

- Dilution Only – assumes ore blocks are preferentially over-excavated and dilution is accepted to minimise ore loss.
- Ore Loss Only – assumes ore blocks are preferentially under-excavated and ore loss is accepted to minimise dilution.
- Mixed Ore Loss / Dilution (equal transfer of material in and out of ore parcel).

The dilution only option was selected as the preferred option for these deposits. This is due to the high negative impact of any ore loss in narrow structurally controlled deposits.

A 1.0 m skin width was selected to represent the selectivity that should be achievable by the excavator. The dilution skin was applied to identified edge blocks assuming a zero-diluent grade (i.e., diluent material contributed no metal content).

The dilution script applied to the regularised Mining Block Models (MBMs) and undertook the following steps:

- The code runs across the block model strike from both directions and identifies the edge blocks (i.e. blocks with an ore percent and an adjacent block that is 100% waste). It also separately identifies isolated blocks that have 100% waste blocks on both sides.
- On a section-by-section basis the script added diluent material to the ore percent in any identified edge block or isolated block up to a maximum ore percent of 100 with a consequent reduction in waste percent. The contained metal remains unchanged and therefore the grade was reduced. The percentage of diluent applied was dependent on the apparent skin width [e.g. For a 10 m x 10 m block the assumed 1.0 m of dilution 'skin' equates to 10% additional diluent material to be added to the ore percent, i.e. (1.0 x 10) / (10 x 10)].
- The MBMs were then re-reported at an appropriate cut-off grade which resulted in ore loss due to material being diluted below cut-off grade.

Table 16.4.2 below summarises the parameters used in the dilution script for each MBM.

Table 16.4.2 Dilution Parameters by Orebody

Area	Orebody dip	Skin width	Dilution Axis	Ore Definition
	(°)	(m)		(g/t)
Enioda	30-35	1.0	E-W	0.4
Han	30	1.0	E-W	0.4
Kekeda	15-30	1.0	E-W	0.4
Kilosegui	30	1.0	E-W	0.5
Chegue / Nokpa	15-35	1.0	E-W	0.35
Souwa	25	1.0	E-W	0.35

The dilution and ore loss from RBM and MBM are shown by area in Table 16.4.3 below, where it can be seen that dilution and ore loss vary widely between the deposits with an overall average of 14% dilution and 8% ore loss.

Table 16.4.3 Dilution and Ore Loss by Orebody

Orebody	Undiluted			Diluted			Dilution	Oreloss
	Mass (kt)	Grade (g/t)	Cont. Au (kozs)	Mass (kt)	Grade (g/t)	Cont. Au (kozs)		
Enioda	15,421	0.85	420.7	16,663	0.77	412.2	16%	7%
Han	9,680	1.26	391.9	10,212	1.19	390.1	8%	2%
Kekeda	10,438	0.88	294.6	10,948	0.81	285.9	16%	11%
Kilosegui	72,722	0.87	2,030.8	77,378	0.80	1,995.7	13%	6%
Chegue/Nokpa	44,710	0.97	1,399.2	47,166	0.90	1,359.6	18%	12%
Souwa	31,437	1.19	1,201.6	33,693	1.10	1,187.1	13%	6%
Total	**184,407**	**0.97**	**5,738.9**	**196,061**	**0.89**	**5,630.6**	**14%**	**8%**

16.4.3 Open Pit Optimisation Approach

The first stage of the conversion of a Mineral Resource into a mineable open pit Mineral Reserve is the open pit optimisation process. It is at this stage that all the latest physical, technical, and economic parameters are applied to the orebody to determine the 'ideal' open pit excavation geometry.

If the economics of this 'ideal' pit geometry (shell) are favourable, the shell can then be used as a guide in the subsequent pit design process.

The WHITTLE™ open pit optimisation software tool was used by Orelogy to undertake this component of the study. WHITTLE™ is an industry recognised pit optimisation package.

As discussed in Section 15, the term 'ore' is used in the following sections describing the optimisation process. It is used to describe mineralised material that the optimisation considered potentially economic. It should not be confused with the stricter definition of economically extractable material as denoted by ore in a 'Mineral Reserve'.

In broad terms, the process that WHITTLE™ undertakes is to vary the base input price by a range of factors (referred to as the Revenue Factors), up and down from a base value of 1. For any given Revenue Factor WHITTLE™ then produces a three-dimensional shape, or 'shell', that generates the maximum possible value for all the input parameters and the associated factored price.

Lower Revenue Factors (i.e., lower price) will produce smaller shells; the higher Revenue Factor, the larger the shell. This results in a set of 'nested' shells, with each shell lying inside the shell of the next largest Revenue Factor.

The value of each shell is then reported at the original input price of the optimisation. The effect of this is:

- Shells with a Revenue Factor <1 are smaller and have less ore than the shell with Revenue Factor 1. This reduces the revenue generated and therefore they will have a lower value.

- Shells with a Revenue Factor >1 are bigger and have relatively more waste (i.e., higher strip ratio). This increases the costs and therefore they will have a lower value.

- The result is the classic WHITTLE™ cash flow curve that peaks at the base price (i.e., Revenue Factor 1). The robustness of this shell is reflected in how quickly the value falls away either side of this peak.

These nested shells are important for a number of reasons:

- The smaller shells indicate the areas of highest value in the ore body and therefore give a guide as to where mining should commence.

- The larger shells provide an indication of how much additional mineralisation may become economic, or alternatively what current ore may become unviable, should input parameters (assumptions) change in the future.

- They permit WHITTLE™ to develop a theoretical 'schedule' for mining the deposit over time and therefore allow a Discounted Cash Flow (DCF) to be generated.

As part of the initial assessments an optimisation scenario was run using the WHITTLE™ function 'Multi-Mine' which allows all of the models to be combined into one global optimisation. The advantage of this approach is that it allows the WHITTLE™ algorithm to holistically assess all of the mining areas together and identify the highest value areas that should be targeted earlier in the mine life. The Multi-Mine optimisation outcome confirmed that Souwa contained the majority of the project value and therefore should be the focus of initial mining.

A drawback with the Multi-Mine approach is the complexity of applying differing slope parameters across the different mining areas. This requires a significant amount of detailed coding within all the models and there was insufficient time available to undertake this component of work. Therefore, average pits slopes were applied across all the mining areas. As a result, the slopes of the optimisation shells generated by the Multi-Mine were not considered accurate enough to be utilised as the basis for the Mineral Reserve pit design.

The following sections detail the parameters used for the final shell selection optimisation on which subsequent pit designs were based.

16.4.4 Optimisation Modifying Factors

Wall Slope

Wall slope parameters were derived from the parameters provided by SRK Consulting (SRK) in the document '31455 – Doropo Pit Design_20221013'. (SRK Consulting (UK) Limited, 2023). Table 16.4.4 and Table 16.4.5 below provide the geotechnical design criteria from the SRK report for weathered and fresh material respectively.

Table 16.4.4 Wall Slope Design Criteria for Weathered Domains

Material Description		Max Depth	Bench Height	Berm Width	Face Angle	IRA[1]	Geotechnical Berm Description
Geotechnical	Model	(m)	(m)	(m)	(°)	(°)	
Completely Weathered / Highly Weathered	Oxide	20	5	5	60	32.4	Geotech berm of 10 m at base of saprolite for drainage and spill cleanup.
		40	5	6	60	29.4	Geotech berm of 10 m every 20 m and at base of saprolite.
Moderately weathered / Slightly weathered	Transition	20	10	8	60	36.0	Geotech berm of 10 m at base of saprock.
		60	10	8	60	36.0	Geotech berm of 15 m at top and base of saprock.

[1] Inter-ramp Angle

Table 16.4.5 Wall Slope Design Criteria for Fresh Domains

Material Description		Bench Height	Berm Width	Face Angle	IRA[1]	Geotechnical Berm Description
Geotechnical	Model	(m)	(m)	(°)	(°)	
Fresh	Fresh	20	10	75	52.5	15 m required every 100 m.
Fresh/Faulted	Fresh (Nokpa / Kilosegui HW[2] only)	20	12	75	49.0	

[1] Inter-ramp Angle
[2] Hanging wall

The SRK slopes included a flatter slope in fresh for areas defined as ‘fresh / faulted’, being the Nokpa pit and the hanging wall of the Kilosegui deposit.

Orelogy made allowances in the slope angles for ramps access. The oxide zone was complex to model in Whittle due to the varying criteria based on depth of horizon. Therefore, as the difference in IRA was relatively small (29.4° to 32.4°), Orelogy utilised the average of the two. The resulting overall slope angles are detailed by mining area in Table 16.4.6 below. It should be noted that the differential between footwall and hanging wall in the Souwa area is a function of ramp location, not geotechnical criteria.

Table 16.4.6 Overall Slope Angles

Mining Area	Orientation	Slope Angle (°)		
		Oxide	**Trans**	**Fresh**
Enioda	All	25.7	28.0	50.5
Han	Hanging wall (NW)	21.2	28.0	54.3
	Footwall (SE)	19.8	26.8	46.5
Kekeda	All	25.7	28.0	51.9
Kilosegui	All	23.8	26.8	50.0
Nokpa	All	19.1	22.8	51.9
Chegue South	All	23.7	28.0	51.9
Chegue Main	All	19.1	22.8	51.9
Souwa	Hangingwall (W)	19.1	22.8	54.3
	Footwall (E)			48.1

Mining Costs

The LG algorithm in Whittle determines whether a block is ore or waste at the pit crest based on the potential cash flow that can be generated from the block at that point. For this reason, the mining cost applied to a block is on the assumption that each block is waste.

Mining costs used in the optimisation were derived from the mining contractor submissions to the Request for Budget Pricing discussed in Section 16.3. The waste mining costs that were variable by locations (i.e., load and haul rates by bench by pit) and by material type (i.e., drill and blast costs by material type) were combined and coded into the individual block models for each mining area by bench and / or by material type as appropriate.

Other mining costs generated as part of the RBP submissions were applied as a global USD/bcm cost.

The above costs are detailed in Table16.4.7.

Process Recoveries

Figure 16.4.1 and Figure 16.4.2 below outline the estimated recovery curves based on the metallurgical sampling test results available at the time of optimisation. The estimated recoveries were converted into a formula provided by Centamin which could be used in WHITTLE™ for calculating the recovery of each block (this equation is shown in the graphs below). Maximum recovery percentages were capped at 95.8% recovery for oxide and transition material above 1.7g/t and 93.2% for fresh material above 1.7g/t.

Figure 16.4.1 Oxide / Transition Grade / Recovery Curve

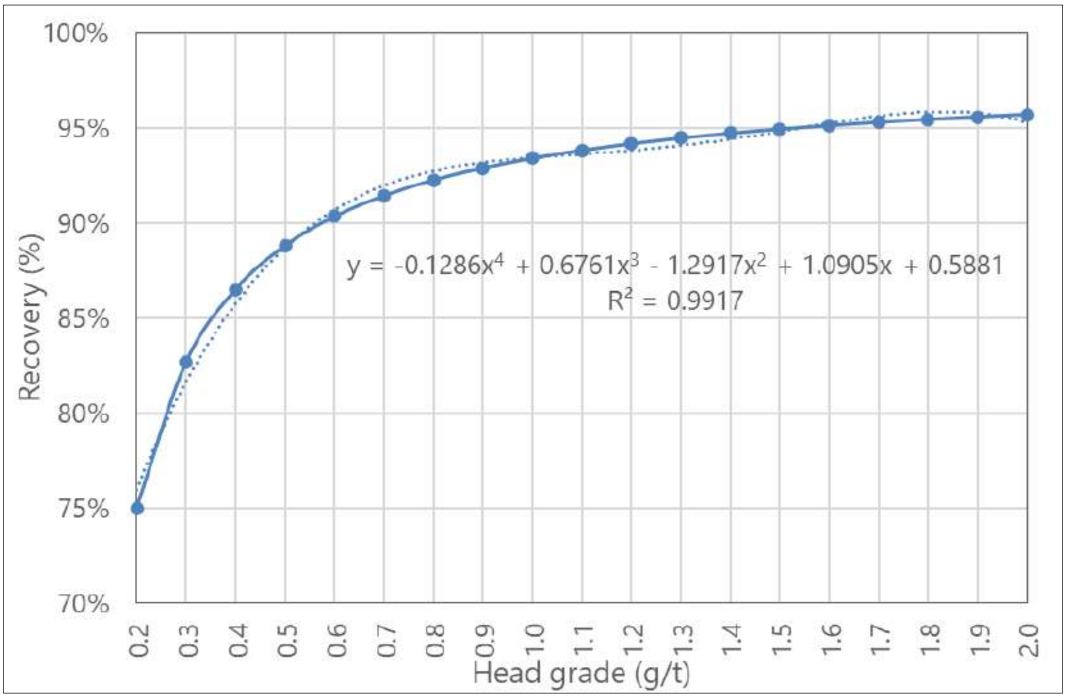
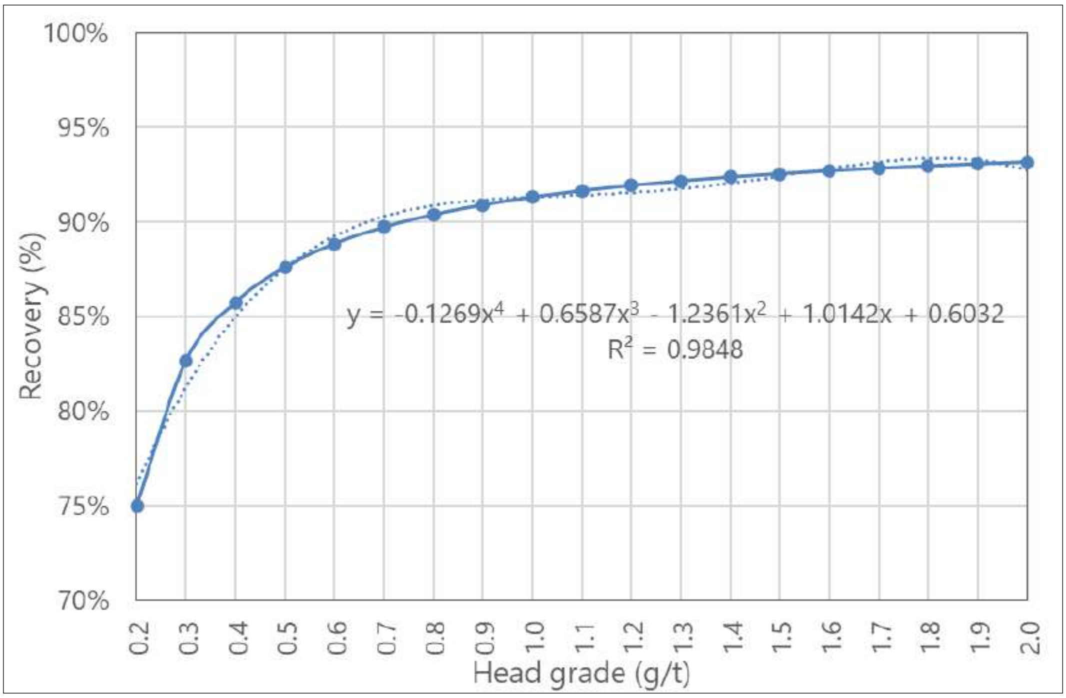


Figure 16.4.2 Fresh Grade / Recovery Curve



Oxide material was excluded as potential ore from the final optimisations for Han, Kekeda, Kilosegui, Nokpa, and Chegue South due to insufficient metallurgical testing results at the time of running the optimisations.

Process Costs

Processing costs applied in Whittle are a combination of processing costs, fixed G&A costs and any ore related mining costs. Processing throughput rates and costs were based on the Doropo PEA, as the PFS finalised throughput rates and operating costs were not available at the time of this report. As such it can be considered an all-in Ore Cost as opposed to purely a processing cost. The fixed costs used in the optimisation are detailed in Table 16.4.7 below.

Table 16.4.7 Fixed Ore Cost

Parameter		Unit	Value
Production Rates	Oxide	Mtpa	4.5
	Trans	Mtpa	4.5
	Fresh	Mtpa	4.0
Ore Related Mining Costs	ROM Rehandle	USD / dmt	USD0.82
	Grade Control	USD / dmt	USD0.50
	Owners Team	M USD / year	USD1.35
		USD / dmt Oxide	USD0.30
		USD / dmt Trans	USD0.30
		USD / dmt Fresh	USD0.34
Processing Cost		USD / dmt Oxide	USD10.32
		USD / dmt Trans	USD10.32
		USD / dmt Fresh	USD11.61
G&A Costs		USD / dmt Oxide	USD2.35
		USD / dmt Trans	USD2.35
		USD / dmt Fresh	USD2.65
Total Processing Cost		**USD / dmt Oxide**	**USD14.30**
		USD / dmt Trans	**USD14.30**
		USD / dmt Fresh	**USD15.92**

In addition, the difference between mining ore and mining waste was coded into the block model on a mining area and bench basis. This is referred to as the Ore Mining Premium (OMP) and was then also added to the Whittle 'processing cost'.

Ore Haulage Cost

Ore from the satellite pits will be placed on ROM stockpiles adjacent to the pits, and then rehandled through to the process plant using road type tipper trucks. Therefore, the cost for this rehandle component was also applied in Whittle as an additional ore cost for these mining areas. These costs were based on an average loading cost of USD0.66/t and a haulage cost of USD0.16/t/km.

Table 16.4.8 Satellite Ore Haulage Costs

Mining Area	Haulage Distance (km)	Cost (USD/t)
Enioda	11.65	USD2.52
Han	6.65	USD1.72
Kekeda	4.45	USD1.37
Kilosegui	27.95	USD5.11

Capital Costs

Capital costs were not applied in Whittle. All of the deposits were optimised separately and as there was no definitive scheduling sequence at this point in time the capital could not be correctly distributed across the different mining areas.

The capital component in Whittle is applied as an upfront cost with no discounting. Therefore, it does not affect the basis for shell selection, as the shell that makes the most money, or the best margin, is still the same shell with or without capital, it just makes less money with the capital allowance.

Revenue and Financial

Revenue inputs are outlined in Table 16.4.9 below. Gold price was assumed at USD1,500 USD/oz. Selling costs include government and tenement royalties of 4% and 0.5%, respectively. Transport and refining charges were USD3.91 USD/oz with a 0.1% ore loss. A 5% discount rate was used for NPV calculations.

Table 16.4.9 Product Revenue Parameters

Parameter		Basis	Value
Revenue	Gold price	USD/oz.	1,500
Selling Cost	Govt. Royalty	4% of sales	60.00
	Tenement Royalty	0.5% of sales	7.50
	Gold Loss	0.1% of sales	1.50
	Dore Transport Cost	USD/oz	3.91
Net Price		**USD/oz**	**1,427.09**
		USD/gram	**45.88**

A discount rate of 5% was used as directed by Centamin.

16.4.5 Optimisation Results and Shell Selection

Optimisation scenarios were run on Indicated material only.

The shells used for pit design purposes were selected on the basis of the maximum Worst Case DCF (refer to Section 16.4.3) and these shells are summarised in Table 16.4.10 below.

For most of the mining areas, the shells are relatively small and provide less than one years of plant feed. As this feed rate is the basis of the schedule used for calculation of the Whittle DCF, there is effectively no discounting and therefore no difference between Best Case and Worst Case DCF's for these areas. The exceptions to this are Souwa and Kilosegui and therefore some further analysis of these results was undertaken.

The graphs presented in Figure 16.4.3 and Figure 16.4.4 below provide a useful assessment of the optimisation results for Souwa. Figure 16.4.3 is referred to as the tonnage / value curves, and plots the tonnes of ore and waste, and the associated Best Case DCF and Worst Case DCF for a range of revenue factors. The average of Best Case and Worst Case is also shown, along with the revenue factors for the maximum of Best Case (Max. Best) and Worst Case (Max. Worst) DCF's. There appears to be a relatively linear increase in both ore tonnes and waste tonnes between the Max. Worst and Max. Best shells.

Table 16.4.10 Selected Whittle Optimisation Shells

Description	Revenue Factor	Total Ore			Waste	Total	Financials (Undiscounted) Total Costs	Revenue	Cashflow	DCF Worst Case	Mine Life	Strip Ratio	Cost per oz.
		kt	g/t	oz.	kt	kt	(USDM)	(USDM)	(USDM)	(USDM)	Years		(USD/Oz)
Enioda	0.98	1,508	1.46	70,767	7,628	9,136	-64.7	100.0	35.3	34.7	0.34	5.06	970
Han	0.96	3,628	1.94	226,666	14,172	17,800	-150.0	315.7	165.8	158.7	0.90	3.91	712
Kekeda	1.00	3,468	1.22	136,073	9,991	13,459	-118.6	189.5	70.9	68.1	0.82	2.88	939
Kilosegui	0.94	13,451	1.28	553,913	44,237	57,687	-535.0	768.1	233.1	203.6	3.28	3.29	1,045
Souwa	0.90	12,294	1.61	636,774	48,662	60,956	-477.6	891.5	413.9	372.3	2.90	3.96	804
Nokpa	0.96	3,812	1.75	214,580	24,195	28,006	-193.4	299.0	105.6	100.9	0.93	6.35	970
Chegue South	1.00	1,480	1.30	61,765	7,703	9,183	-3.1	85.8	22.7	22.3	0.35	5.21	1,103
Chegue Main	1.00	1,854	1.23	73,582	9,149	11,003	-75.5	102.5	27.1	26.5	0.43	4.93	1,104
Total	**N/A**	**41,494**	**1.48**	**1,974,119**	**165,736**	**207,230**	**-USD1,677.9**	**USD2,752.2**	**USD1,074.3**	**N/A**	**9.95**	**3.99**	**850**

Figure 16.4.3 Souwa Tonnage / Value Curves

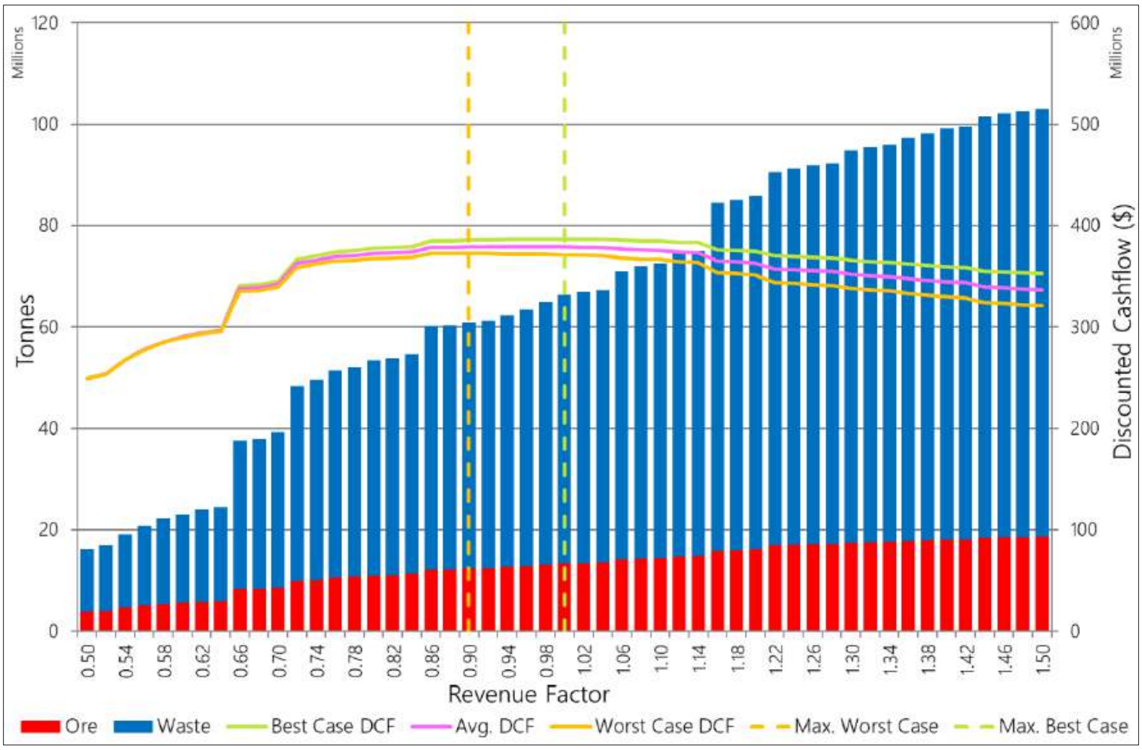
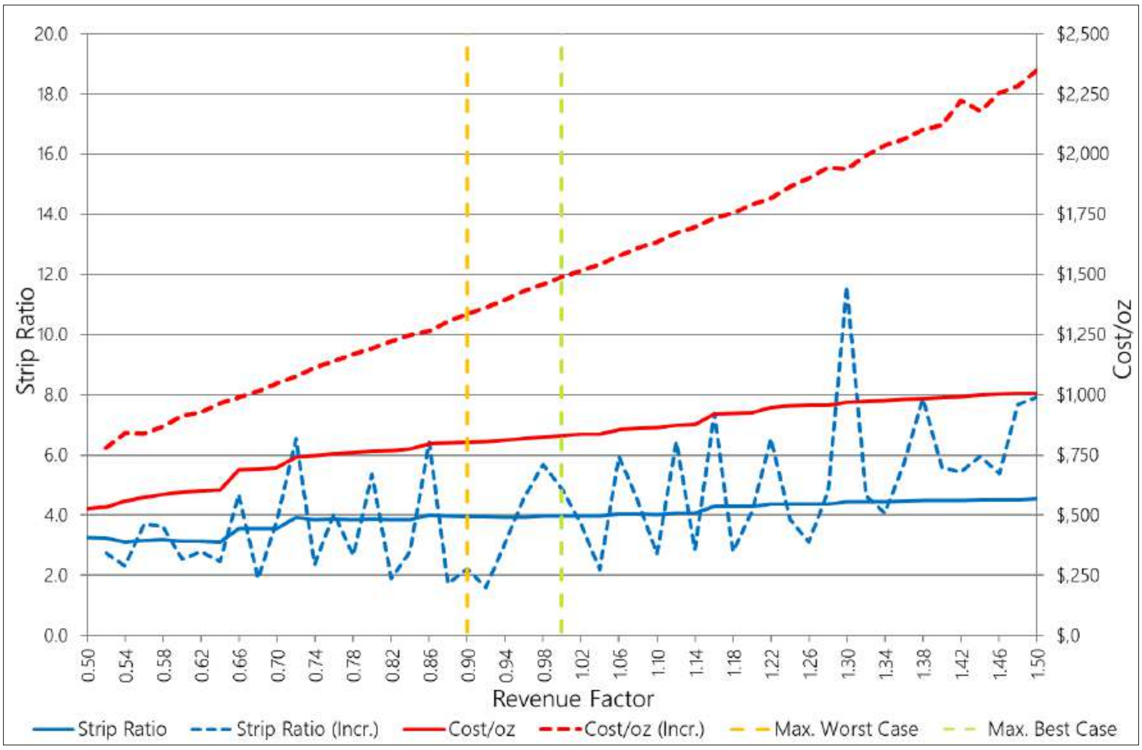


Figure 16.4.4 Souwa Strip Ratio and Cost/oz



The DCF curves are all relatively flat between the Max. Worst (Revenue Factor 0.90) and Max. Best (Revenue Factor 1) shells. This indicates the additional ore being generated is marginal and adding very little to project value.

Figure 16.4.4 displays strip ratio and cost / oz by shell revenue factor. The value for each shell, and the incremental change from the previous shell are shown. As expected, it indicates very little change in strip ratio from Max. Worst to Max. Best, but a linear increase in cost per oz.

On this basis, the Souwa shell was selected on a Max. Worst basis as this was considered a robust, low risk approach given higher shells added minimal additional value. The tonnage/value curve for Kilosegui is very different to that of Souwa. As can be seen in Figure 16.4.5 below, both the tonnage and value curves are much steeper, with the value curve falling away rapidly either side of the Max. Worst to Max. Best bandwidth. This indicates the shell is much more sensitive to changes in revenue, and to costs by inference. The average of Best Case and Worst Case is effectively decreasing from the Max. Worst to Max. Best, therefore giving support to selecting the Max. Worst for Kilosegui also.

Figure 16.4.6 below shows the strip ratio and cost per oz curves for Kilosegui. While the gradients (i.e., degree of change) of the curves are similar to the Souwa results:

- The costs are overall higher due to the constant additional ore haulage component.
- The strip ratios are lower to counter the increased cost.

Consequently, Orelogy also selected the Kilosegui shell on a Max. Worst Case basis. It was considered a lower risk selection and also meant the selection criteria was consistent across all the mining areas.

Figure 16.4.5 Kilosegui Tonnage / Value Curves

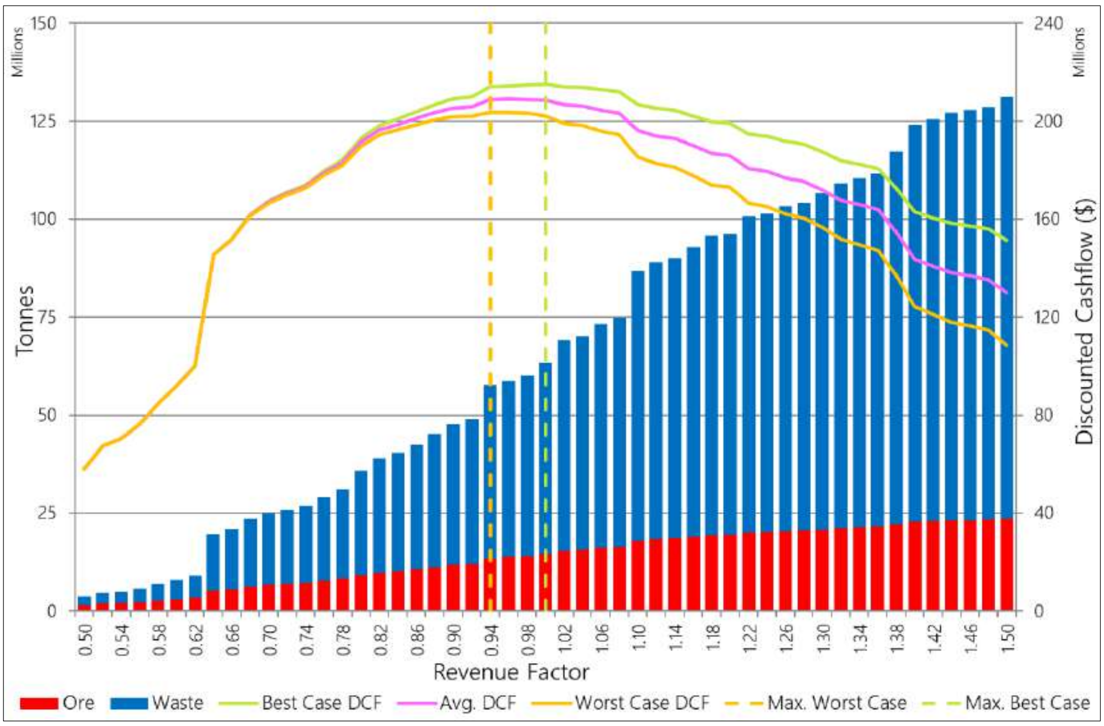
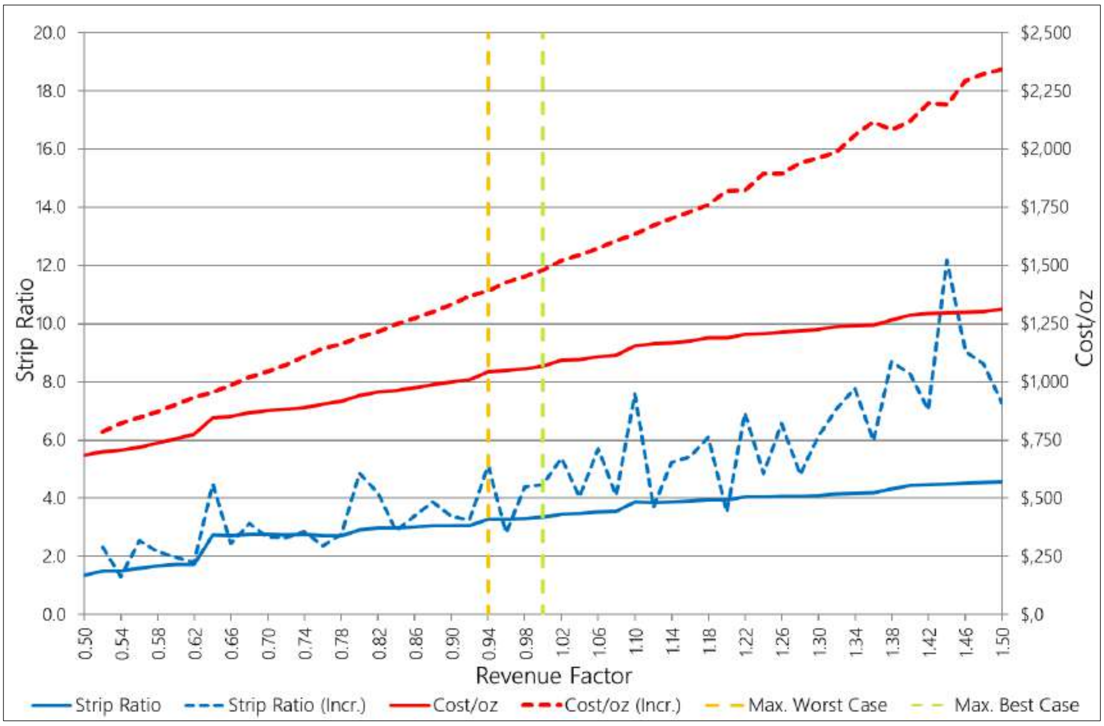


Figure 16.4.6 Kilosegui Strip Ratio and Cost/oz



16.5 Mine Design

16.5.1 Mine Design Criteria

Slope Design Criteria

Slope design criteria (i.e., berm widths, bench face height and bench face angles) were taken from the SRK provided parameters in the document '31455 – Doropo Pit Design_20221013' (SRK Consulting (UK) Limited, 2023). These parameters are described in detail in the Wall Slopes subsection of Section 16.4.4 above (refer to Table 16.4.4 and Table 16.4.5 above for weathered and fresh respectively)

These parameters were coded into a re-blocked 'slope code' model with much larger block sizes in the X and Y directions to smooth out the variations in the weathered zone boundaries which required a specified catch berm width. In this way a smoother, more practical pit design could be generated that still honoured the overall slopes requirement of the SRK recommendations. The pit design tool in MineSight reads these parameters as the designer steps through the design by 5 m bench increments.

Ramp Design Widths

The ramp widths based on the selected Caterpillar 777 dump truck were 16 metres and 24 metres for one-way and two-way ramps respectively. These layouts were provided by Centamin based on their operating experience in Africa and their geometry is shown in Figure 16.5.1 and Figure 16.5.2 respectively.

Figure 16.5.1 One-way Ramp Layout

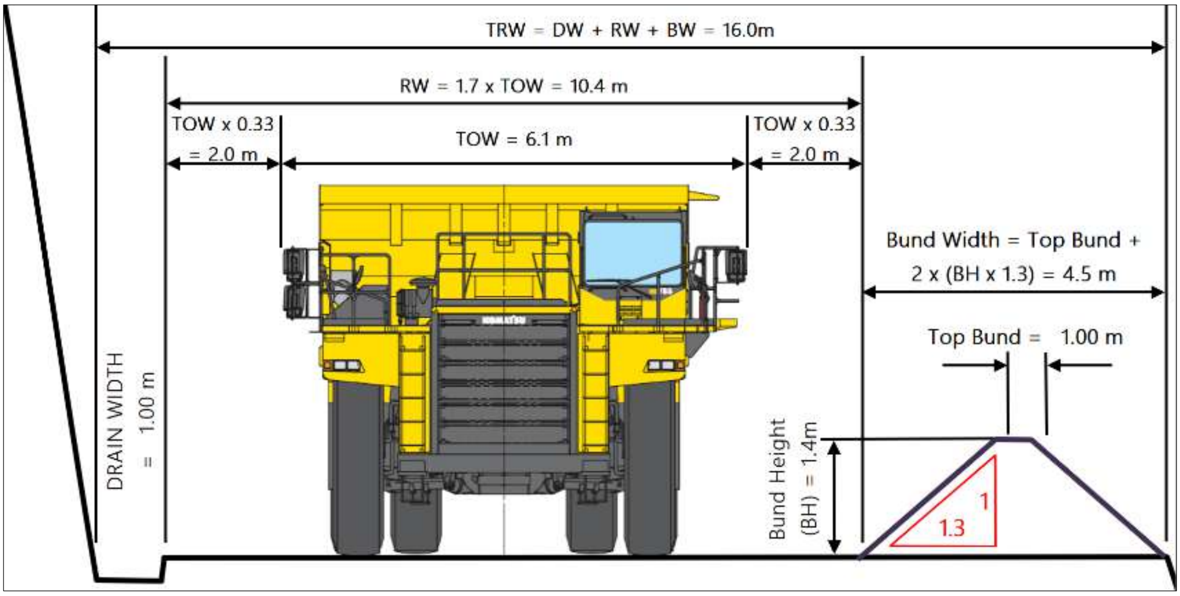
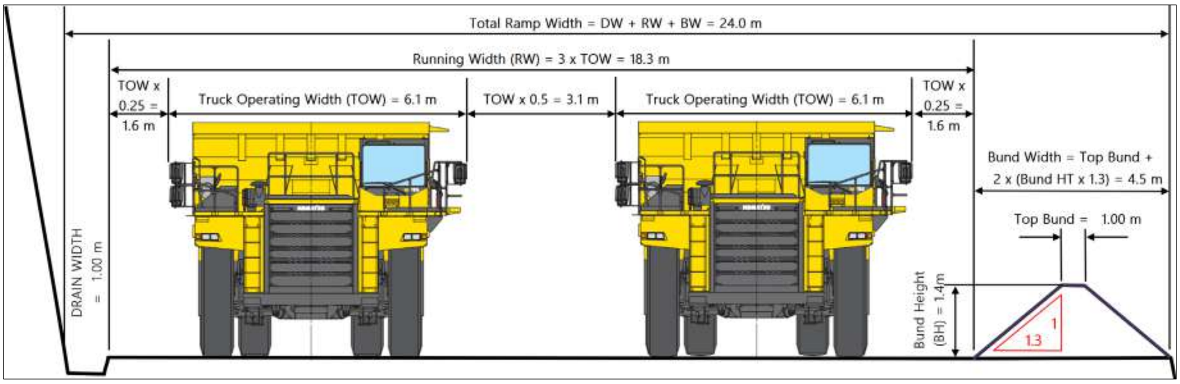


Figure 16.5.2 Two-way Ramp Layout



Single lane ramp access is generally used for the benches at the base of the pits on the basis of the lower traffic intensity in these areas of the pits. The small nature of some of the satellite pits has required relatively aggressive use of single lane ramps to minimise excess waste stripping.

Minimum Mining Width

Pit design objectives were the safe, efficient, and practical extraction of ore and waste. This meant a minimum mining width was applied at all stages to ensure that adequate space is available for equipment to access mining areas and avoid congestion. Based on a 150 t-class excavator and a 90 t-class trucks, the following mining width constraints were applied:

- **Pit wall pushback** – a minimum safe mining width of 50 m was used between any successive pit wall pushbacks for interim stages. This only applies to the Souwa mining area as this was the only pit where internal pit stage designs were developed.

- **Base of pit** – a mining width of 25 m was applied to the bottom benches of the pit designs to allow space for machine clearance and excavator slew. Final bench 'goodbye' cuts to a depth of up to 10 m were designed if there was sufficient length to allow temporary access to be developed with the excavator.

16.5.2 Final Pit Designs

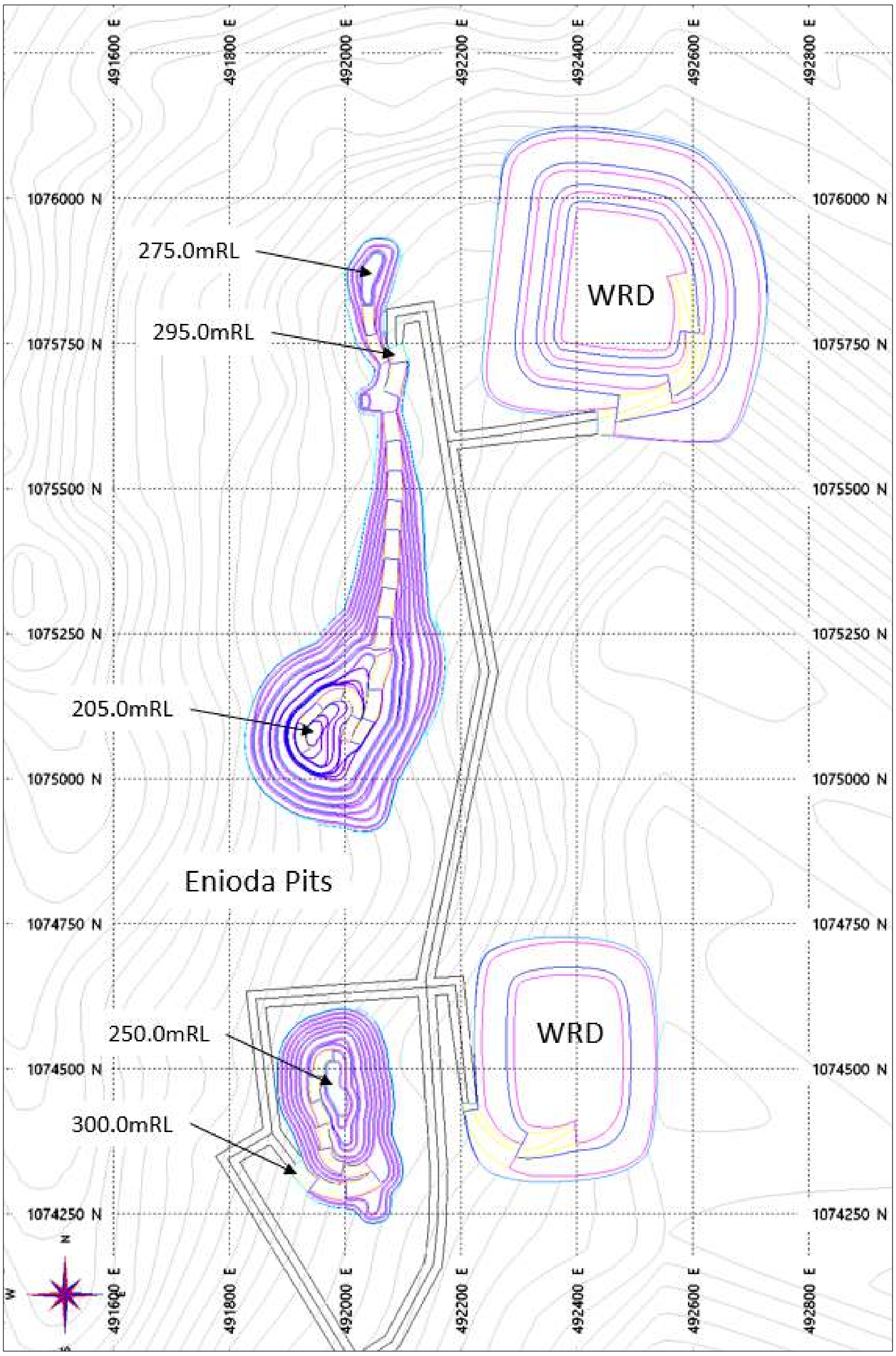
The optimisation shells detailed above were used as a guide for final pit designs. Souwa is the only deposit where internal stages were designed, targeting the high value areas indicated from shells of lower revenue factor. The designs were cognisant of design criteria and mining practicalities detailed in Section 16.5.1. The objective of the designs was to produce practical designs that maximise ore tonnes. Every effort was made to minimise waste but not to the detriment of ore recovery.

The following figures also show the layout of the associated waste rock dumps (WRD's) and mine haul roads.

Enioda

The Enioda pits sit approximately 11.5 kms from the process plant ROM pad. As such, Enioda ore requires stockpiling and rehandle by road train. The primary pit at Enioda is approximately 90 m deep as shown in Figure 16.5.3. Both spiral ramps and slot ramps were assessed, with a slot ramp to the north from the main pit the preferred option. This was chosen as it captures a significant tonnage potential Inferred material between the pits with little additional waste material generated versus a spiral.

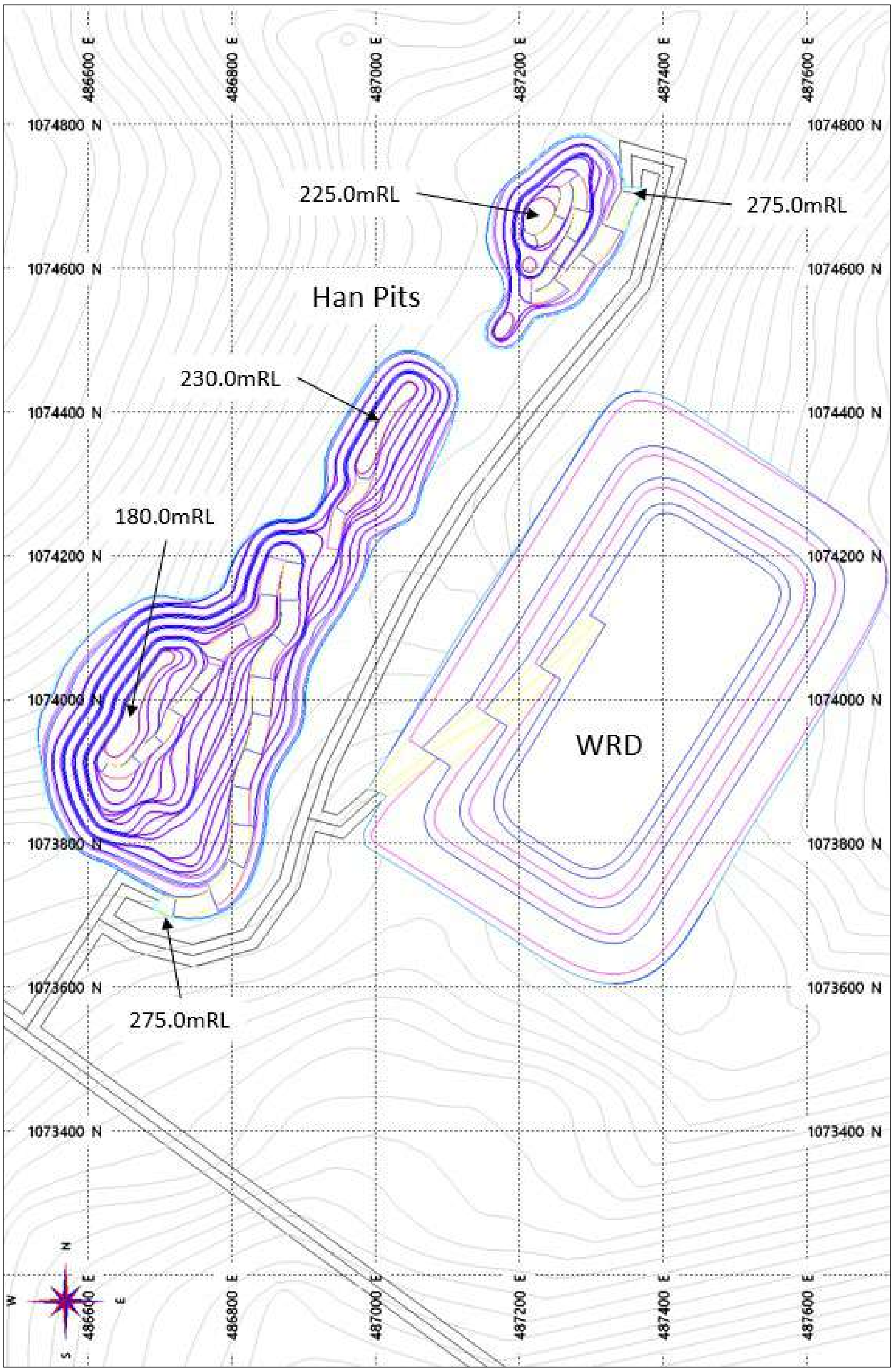
Figure 16.5.3 Enioda Pit Design



Han

Two pits make up the Han deposit as shown in Figure 16.5.4. The larger pit is to the south and is approximately 95 m deep. A smaller pit to the north is approximately 50 m deep. The pit is approximately 6.5 km from the process plant ROM pad and will require ore to be stockpiled and hauled via road truck.

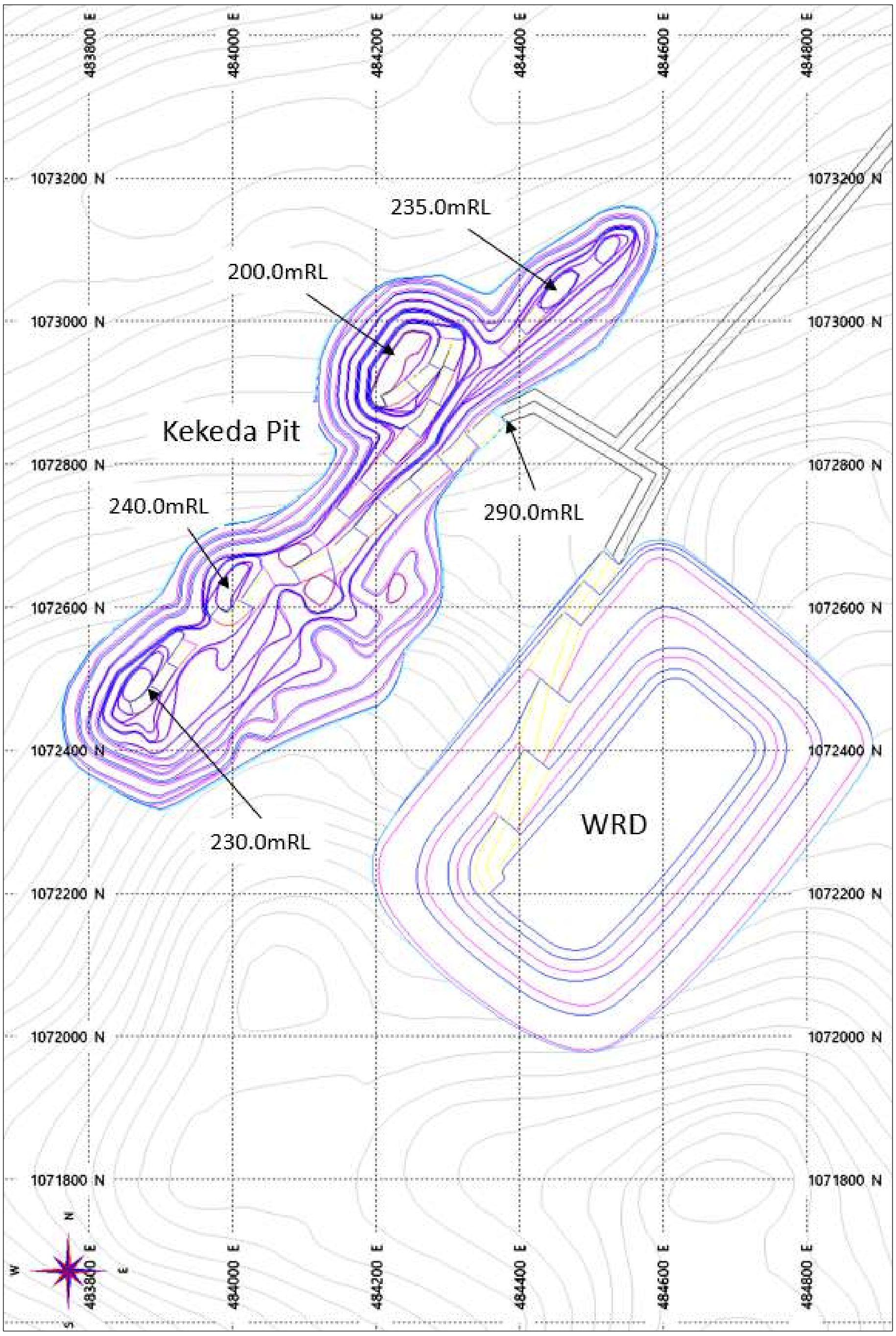
Figure 16.5.4 Han Pit Design



Kekeda

The Kekeda pit has an unusual geometry due to some shallow parallel deposits that WHITTLE targeted in the optimisation. The result is a very flat footwall, with a steep hanging-wall as shown in Figure 16.5.5 below. The maximum pit depth is 90 m. The pit is approximately 4.5 km from the process plant ROM pad and will require ore to be stockpiled and hauled via road truck.

Figure 16.5.5 Kekeda Pit Design



Kilosegui

The Kilosegui pits are spread across a considerable strike of more than 6 km. It consists of three primary pits and two small pits.

The Kilosegui Pits (West) pits are shown in Figure 16.5.6 below, which comprises two of the primary pits and one of the small pits, the deepest pit being the eastern primary at 125 m. The Kilosegui Pits (East) pits are shown in Figure 16.5.7 below. This area comprises the third primary pit which sits approximately in the middle of the mining area, and the second small pit to the very eastern extent. The primary pit has the deepest point in Kilosegui at 130 m.

The Kilosegui pits are located approximately 28 km from the process plant ROM pad and ore will require ore to be stockpiled and hauled via road truck.

Figure 16.5.6 Kilosegui Pit Design (West)

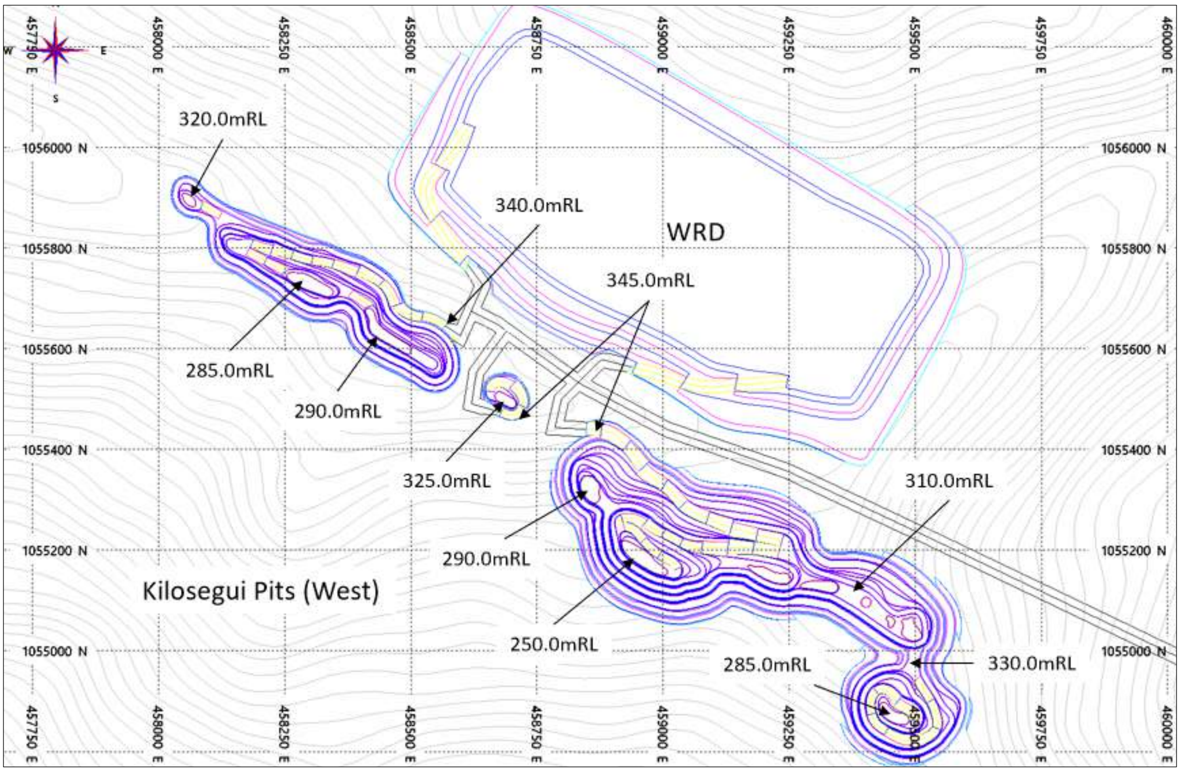
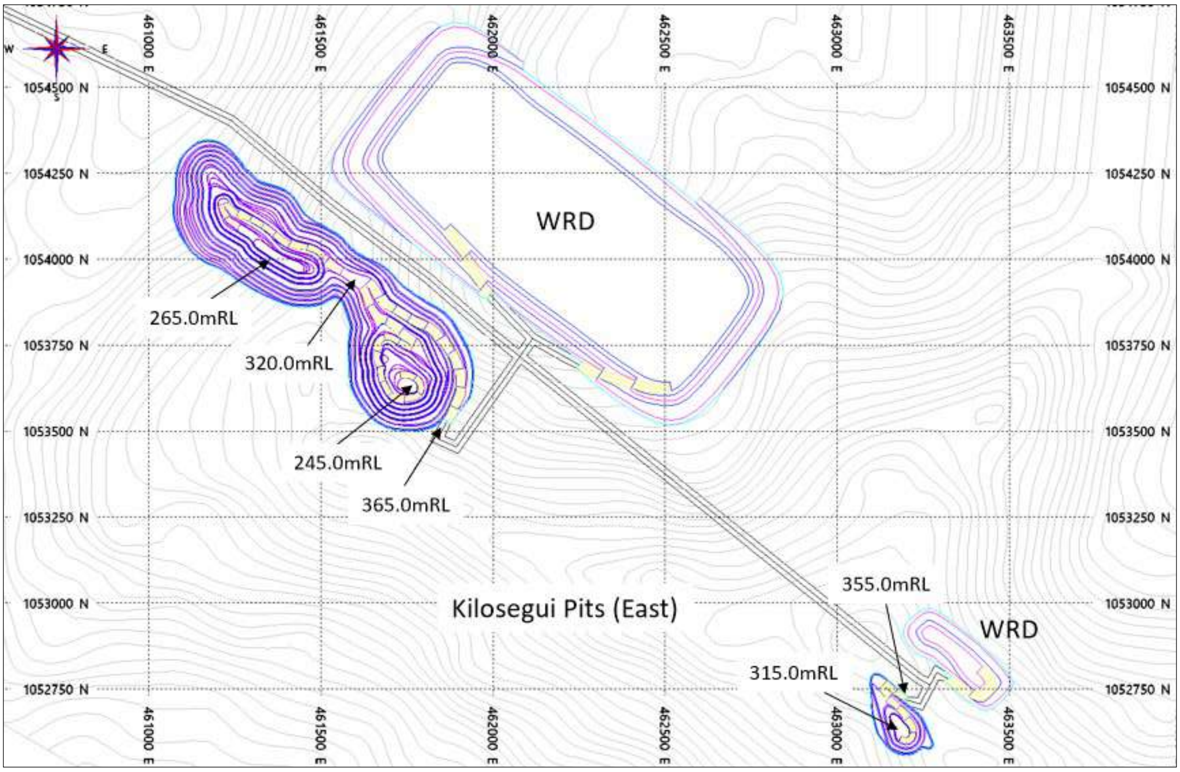


Figure 16.5.7 Kilosegui Pit Design (East)



Nokpa / Chegue

The Nokpa pit is 115 m deep with a single ramp for access. Its proximity to the ROM pad means that ore can be hauled directly to the ROM. It is shown in Figure 16.5.8.

Chegue Main consists of two primary pits with three minor pits as shown in Figure 16.5.9. Maximum pit depth is 70 m.

Chegue South is essentially two pits with the north pit extending to a depth of 75 m and the south pit depth of 80 m as shown in Figure 16.5.10.

Figure 16.5.8 Nokpa Pit Design

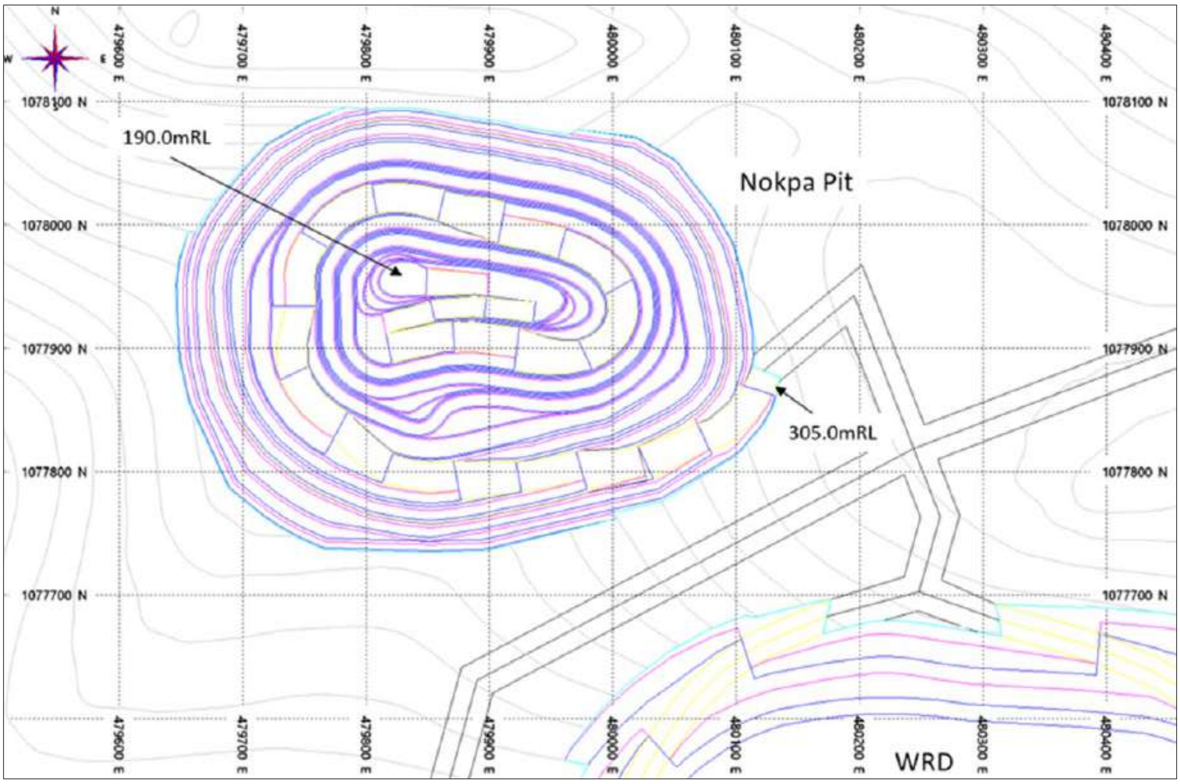
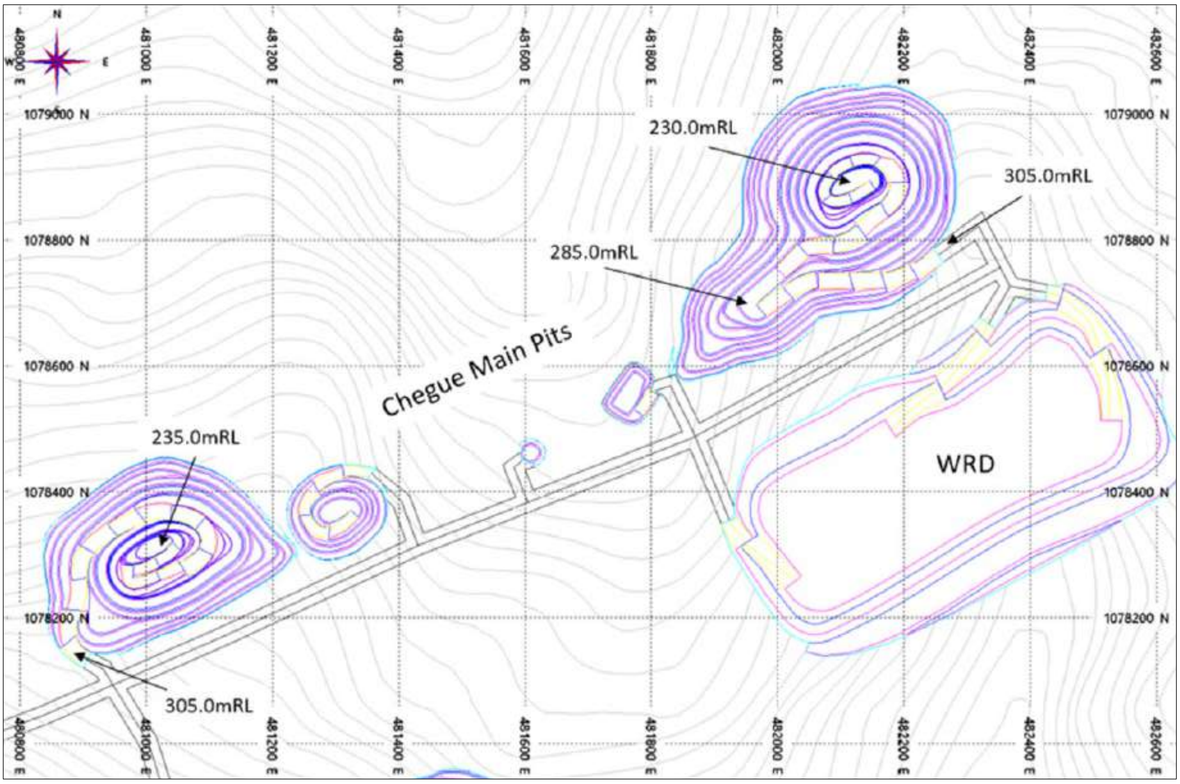


Figure 16.5.9 Chegue Main Pit Design



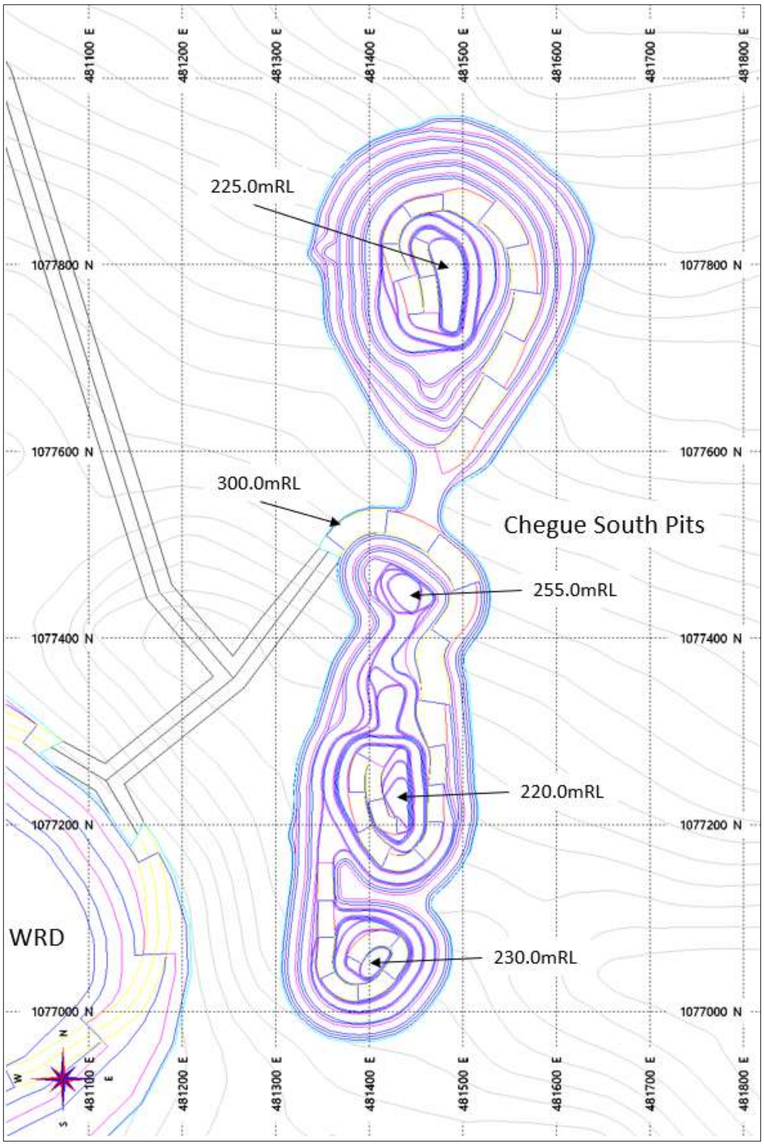
Souwa

Souwa is the largest pit and primary driver of value for the Project. Consequently, it has been divided into five (5) stages to reduce initial strip ratio and bring forward access to the better grade material, thereby unlocking value earlier. The stages have been designed utilising optimisation shells at lower revenue factors which target higher margin areas.

The Souwa stages consist of:

- A small borrow pit (Figure 16.5.11 below) designed to provide bulk fill material for the first lift of the tailings storage facility (630 kbcm) and the ROM Pad construction (390 kbcm). This pit is assumed to be removed at the project construction phase by others and was depleted from the mining inventory for scheduling purposes.

Figure 16.5.10 Chegue South Pit Design



- A starter pit was developed to access near surface oxide and transitional ore in the north of the as shown in Figure 16.5.12. Consequently, it is relatively shallow at 20 m below surface. Weathered ore has a considerably higher throughput rate than fresh ore (5.4 Mtpa vs 4.0 Mtpa for fresh) and a higher recovery, particularly at lower grades. Therefore, weathered material can generate value far quicker than fresh material and for a lower processing cost.

- Stage 1 is shown in Figure 16.5.13 below. It extends the Starter Pit to a deeper section in the south (95 m from surface).

- Stage 2 is shown in Figure 16.5.14 below. It comprises a pushback to the northwest of Stage 2 to a depth of 120 m. Waste from the top 10 m of Stage 2 (i.e., to the 330 m RL) will be mined utilising temporary in-pit ramps. From 330 m RL to the 320 m RL, material will be hauled via the western hanging wall ramp of Stage 1 down into Stage 1 and then out via the Stage 1 eastern footwall ramps. From the 320 m RL the eastern footwall ramps can be extended to depth as shown in Figure 16.5.14. Figure 16.5.14 also indicates the location of Stage 3 and Stage 4.

- Stage 3 is a southern pod of the main Souwa Pit that has been designed with its own access ramp to a depth of 70 m.

Figure 16.5.11 Souwa Borrow Pit Design

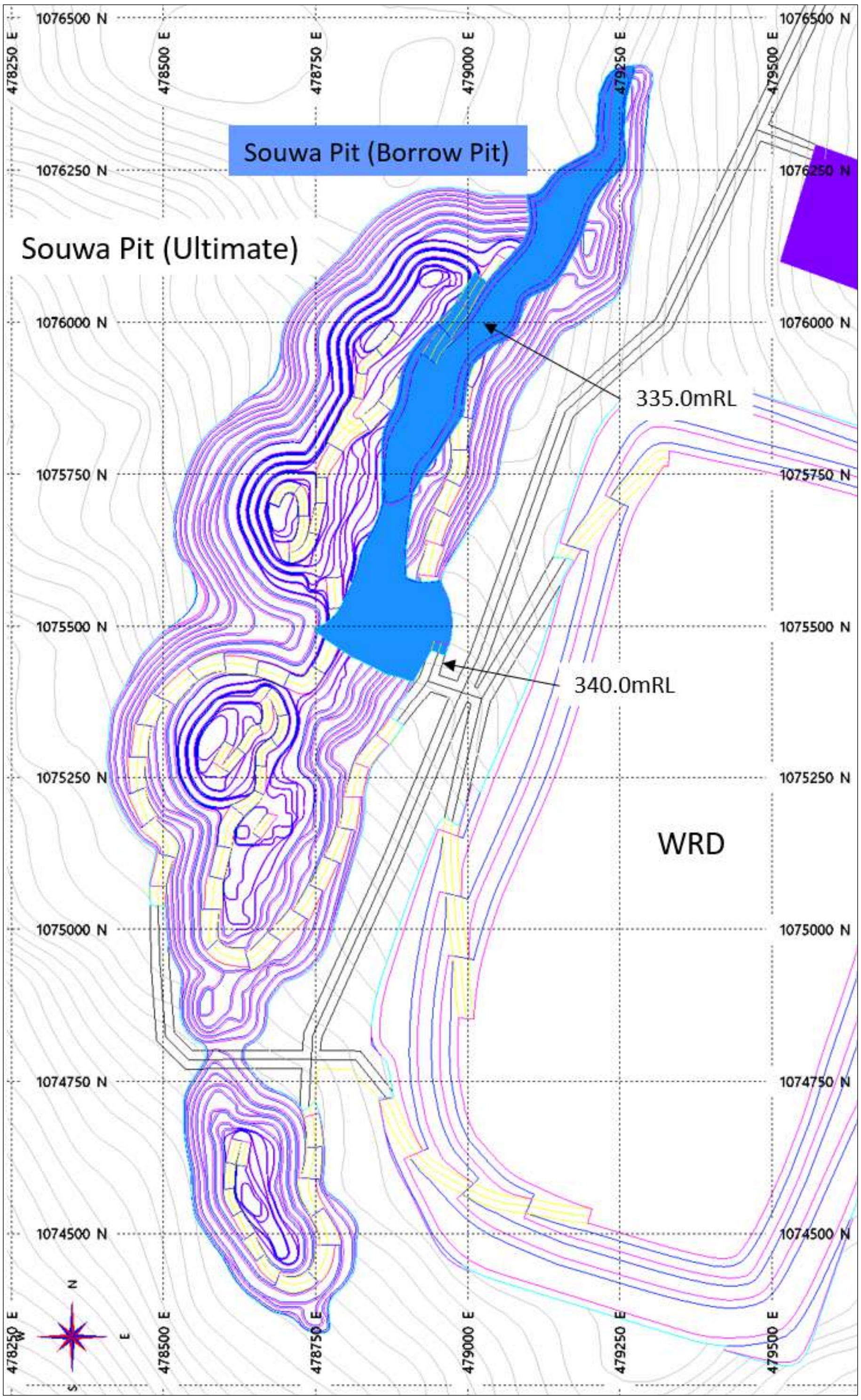


Figure 16.5.12 Souwa Starter Pit Design

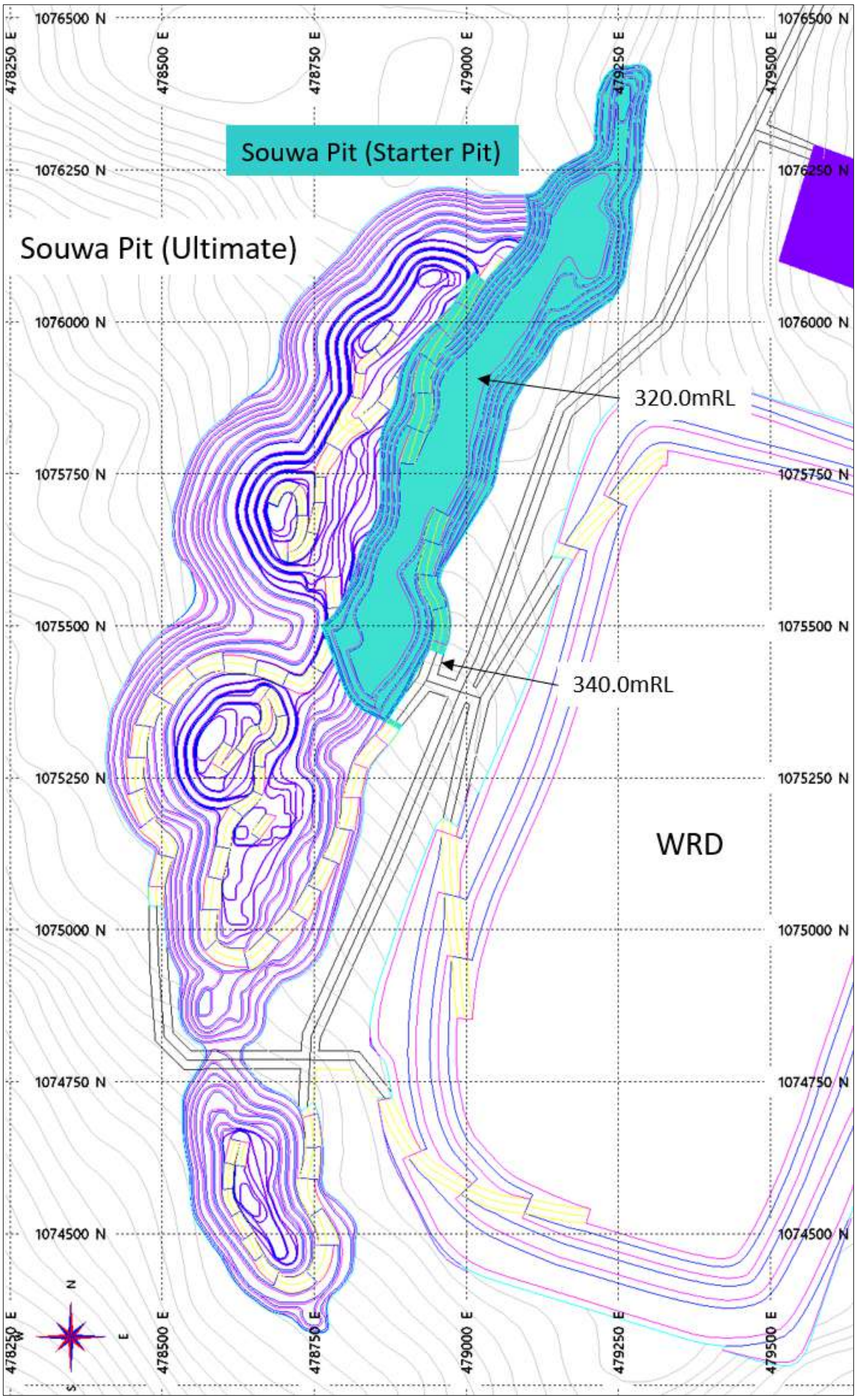


Figure 16.5.13 Souwa Stage 1 Pit Design

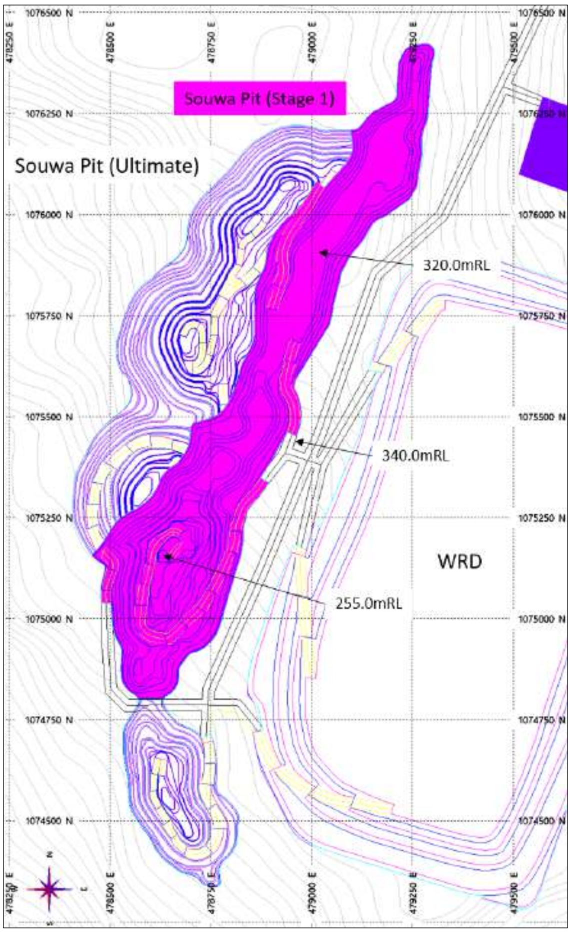
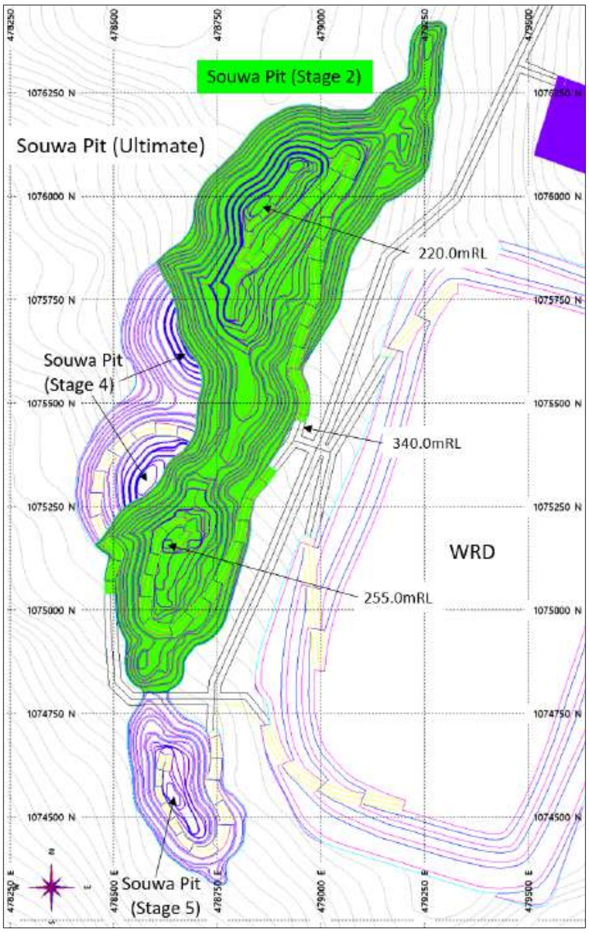


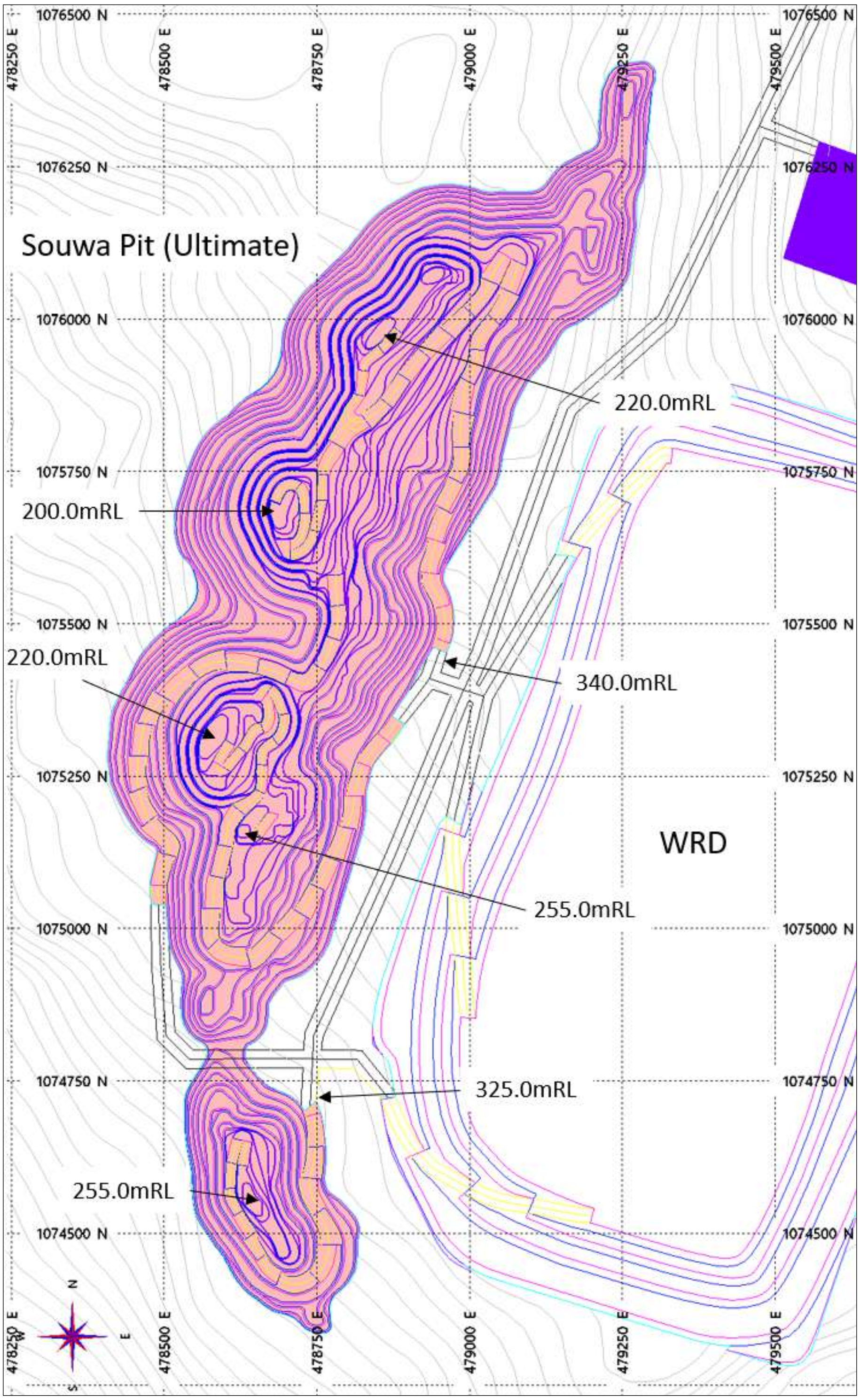
Figure 16.5.14 Souwa Stage 2 Pit Design



- Stage 4, which is the final western pushback of the Souwa Pit and mines out the two deepest sections of the pit down to a depth of 140 m. It also utilises its own (hangingwall) ramp which wraps around the southern pod to the 275 m RL. At this point access can be re-established from the Stage ½ southern ramp into the southern pod of Stage 4. From there the Stage 4 ramps continued north along the hangingwall to the 255 m RL. From this point access to the Stage 4 northern pod can be re-established from the Stage 2 ramp.

- The Souwa ultimate pit design is shown in Figure 16.5.15. The shared ramp approach described above is more apparent in this figure.

Figure 16.5.15 Souwa Ultimate Pit Design



16.5.3 Pit Design Reconciliation to Whittle

Comparison of the WHITTLE optimised pit shells against the pit designs reveal that matching the design to the WHITTLE pit shell was challenging, particularly for the smaller pits. Also, the varying stack berm width in fully and partially weathered material was difficult to model due to the highly variable thickness of these zones. This was less of an issue with the larger pits, such as Souwa. Nokpa saw the greatest change in value and tonnes as the optimisation was chasing a relatively low-grade zone at depth and therefore even a marginal flattening of the wall resulted in the optimisation pulling up from this zone to a shallower, more profitable shell.

Souwa and Kilosegui showed good reconciliation to the optimisation shells. However almost all the other pits, with the exception of Nokpa, generated similar ore tonnes but significant increases in waste. This extra waste was offset globally by Nokpa, which showed a relatively small ore tonnage reduction for a significant reduction in waste. As a result, while overall ore and waste tonnes are relatively close to the combined Whittle shells, undiscounted cashflow was reduced by approximately 10%. Any subsequent design studies should assess the trade-off between additional waste vs reduced ounces for each pit.

Table 16.5.1 Pit Design Inventory and % Difference from Optimisation Shells

Mining Area	Total Ore		Cont. Au	Waste	Total	Cashflow
	kt	Au	Oz.	kt	kt	(USDM)
Enioda	1,460	1.45	68,059	9,211	10,670	USD24.0
Han	3,538	1.92	217,973	15,710	19,249	USD150.5
Kekeda	3,732	1.16	139,165	12,533	16,265	USD59.8
Kilosegui	12,974	1.27	529,805	46,730	59,703	USD208.0
Souwa	13,001	1.56	651,144	48,705	61,706	USD417.8
Nokpa	2,286	1.74	127,926	11,698	13,984	USD76.4
Chegue South	1,627	1.21	63,320	10,333	11,961	USD9.1
Chegue Main	1,936	1.19	74,310	10,806	12,742	USD17.3
Total	40,554	1.44	1,871,701	165,725	206,279	USD963.0
% Difference from Optimisation Shell1						
Enioda	-3%	-1%	-4%	21%	17%	-32%
Han	-2%	-1%	-4%	11%	8%	-9%
Kekeda	8%	-5%	2%	25%	21%	-16%
Kilosegui	-4%	-1%	-4%	6%	3%	-11%
Souwa	6%	-3%	2%	0%	1%	1%
Nokpa	-40%	-1%	-40%	-52%	-50%	-28%
Chegue South	10%	-7%	3%	34%	30%	-60%
Chegue Main	4%	-3%	1%	18%	16%	-36%
Total	-2%	-3%	-5%	0%	0%	-10%

16.5.4 Waste Rock Dump Design

The WRD designs have been developed with based on the as-mined waste volumes and the following assumed swell factors:

- Oxide = 10%
- Transitional = 15%
- Fresh = 25%

WRD slopes design criteria assumed a concave final rehabilitation surface and a maximum dump height of 40m above ground level. The slope design assumptions are detailed in Table 16.5.2 below.

Table 16.5.2 Waste Rock Dump Slope Design Criteria

Height		Face Height	Face Slope	Bern Width	Overall Slope
From (m)	To (m)	(m)	(°)	(m)	(°)
0	10	10	37	43.4	10
10	20	10	37	24.1	15
23	30	10	37	17.5	18
30	40	10	37	N/A	N/A

Some contingency capacity was included with each design to account for changes to material mixes and assumed swell factors. Each deposit has individual WRD(s) positioned and designed to minimise haulage wherever possible. Run-of-mine waste will also be used to construct for the satellite stockpile pads to a form a level base.

The designs of the WRDs are shown on the figures in the following Section 16.5.5 General Site Layout.

16.5.5 General Site Layout

Most of the mine infrastructure will be centred around the Nokpa / Souwa pits (Figure 16.5.16). Han and Kekeda (Figure 16.5.17) are nearby satellite pits (approximately 6 km and 7 km from the processing facility respectively), with Enioda being further to the east (Approx. 11.5 km). These pits will be connected via haul roads to the processing facility stockpiling areas. Kilosegui (Figure 16.5.18) is 28 km to the south-west and a major haul road will be constructed to allow haulage of ore to the processing facilities. This haul road will cross a major highway and this intersection will need to be managed with a flyover or similar crossing.

The main ROM pad and processing facility is located between the Souwa and Nokpa pits on the footwall side. This sits in the arc of the Souwa / Nokpa / Chegue mining area and adjacent to Souwa, the primary mining area for the first few years of mine life. Offices and workshops will also be located in this area.

Figure 16.5.16 Site Layout – Souwa, Nokpa and Chegue

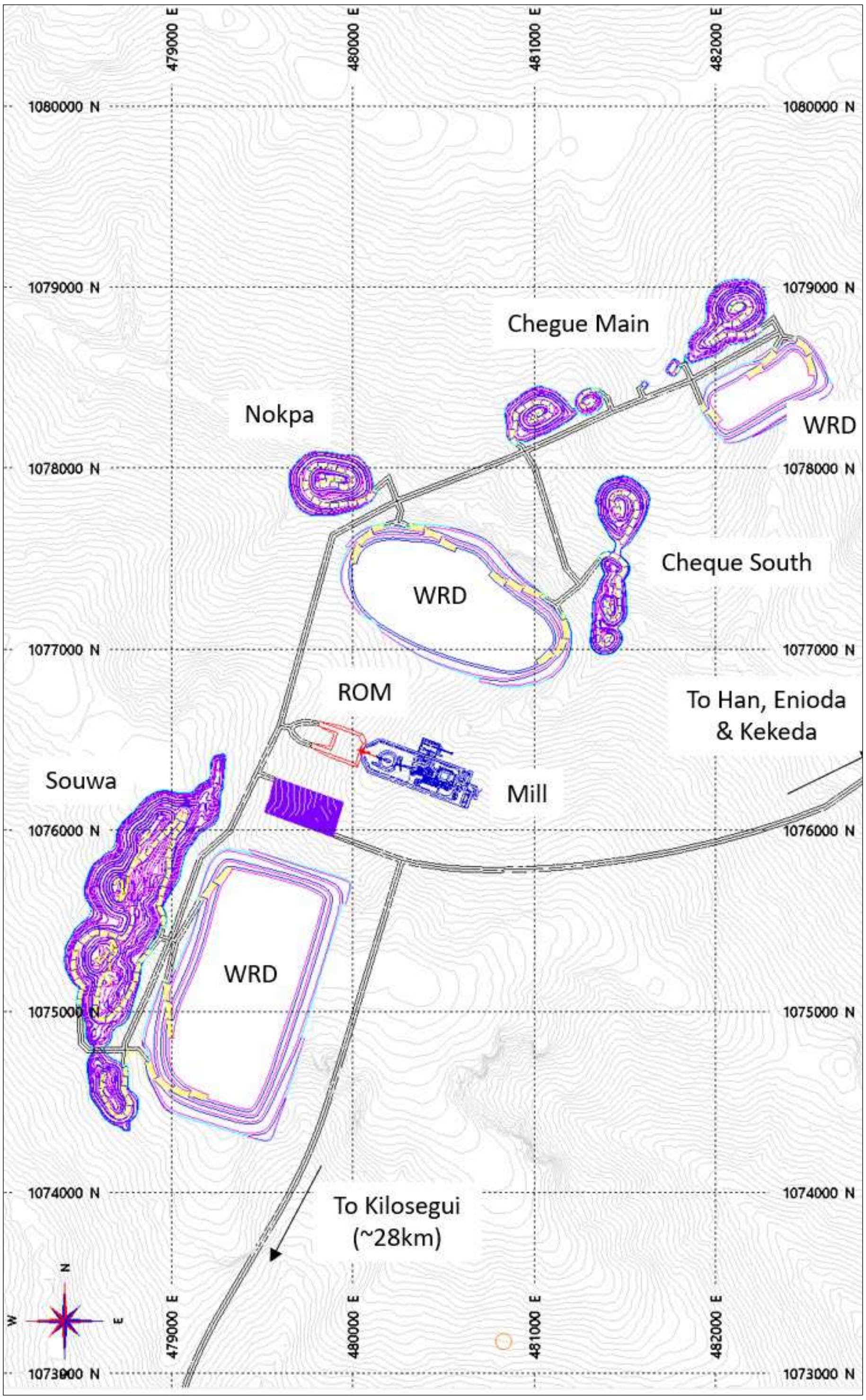


Figure 16.5.17 Site Layout - Enioda, Han, Kekeda

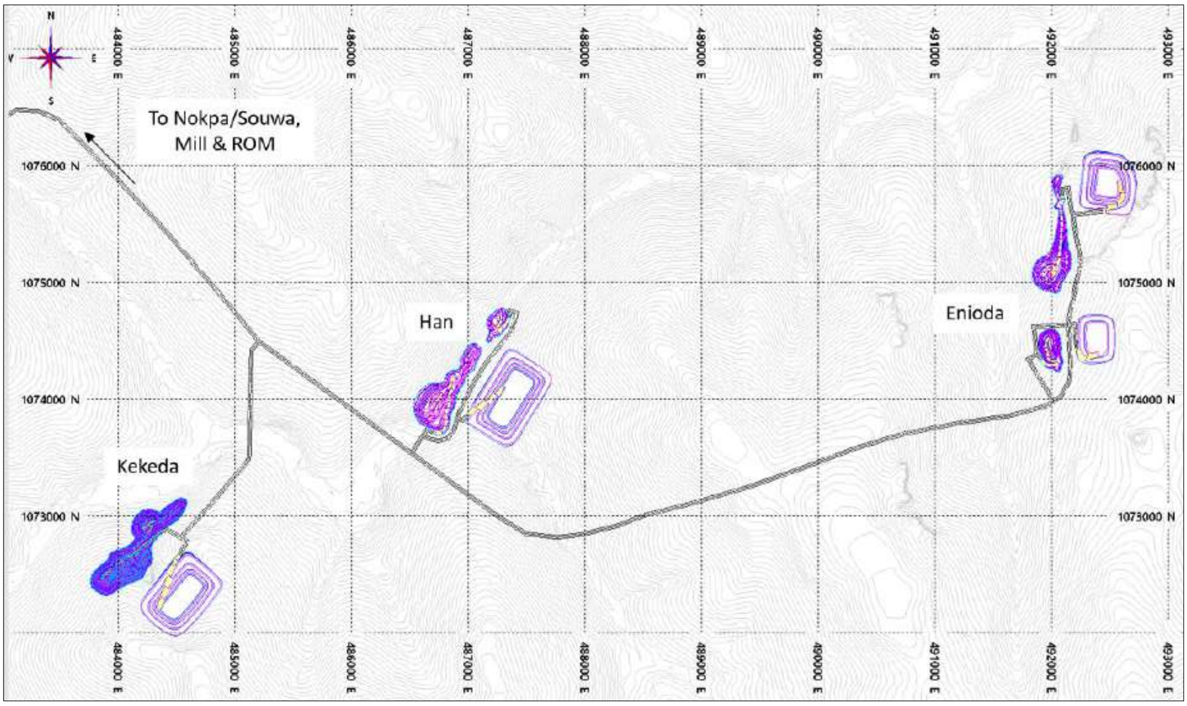
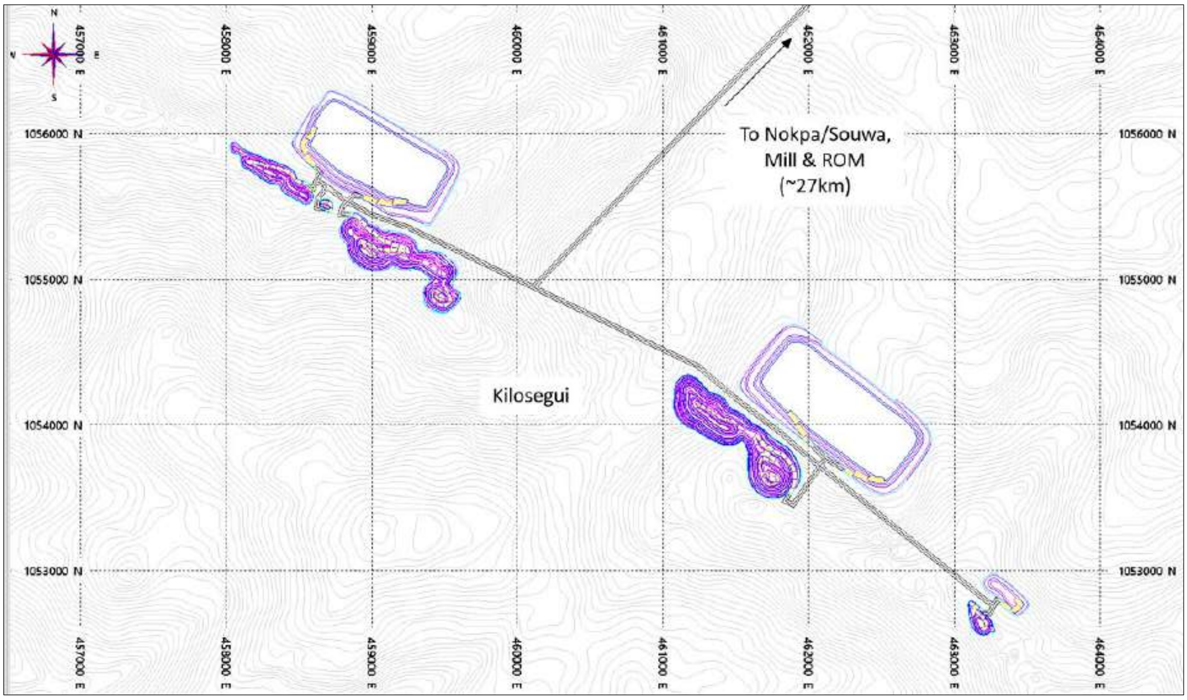


Figure 16.5.18 Site Layout - Kilosegui



16.6 Life of Mine Production Schedule

The mine schedule was developed using Maptek Evolution™ software. The scheduling software has two main modules:

- Evolution Strategy (Strat) which optimises Net Present Value (NPV) using optimised cut-off grade policies and strategic stage release to deliver high-value practical schedules.
- Evolution Origin (Origin) which develops schedules on a block-by-block basis using the mining model described in Section 16.4.1 and guided by the outcomes of any Strat scheduling undertaken. Origin uses multi-objective evolutionary algorithms to produce multiple iterations of practical, achievable schedules within the required objectives and constraints of the mine plan, allowing the scheduler to converge on the best option for the project.

16.6.1 Initial Strategic Scheduling

Some early Strat scheduling was undertaken prior to pit designs being finalised. This process therefore utilised optimisation shells which, while providing a guide to mining sequence and associated sensitivities, does not provide definitive project value or sequencing. The broad outcomes of the Strat schedule optioneering undertaken was:

- The plant feed rate of 4.5 Mtpa for weathered material and 4.0 Mtpa for fresh material could be maintained with mining rates of 20 Mtpa to 25 Mtpa.
- Ensuring satellite pits were mined to completion once started (i.e., areas not paused and then restarted) did not adversely affect value.
- Plant feed could be maintained with a maximum bench turnover constraint of 12 per year. Bench turnover is defined as starting, mining and completing a bench, including initial drop-cut of ramp and final wall cleanup.

In all cases Souwa was developed first, closely followed by Kilosegui, as these pits provide the majority of the value and plant feed (65%).

16.6.2 LOM Production Schedule Objectives and Constraints

Mine scheduling is inherently a trade-off between conflicting objectives and constraints. For the Doropo Project, the primary objective was to maximise NPV. An additional objective was to maintain a high and consistent gold ounce production profile, on a recovered basis, for as long as possible.

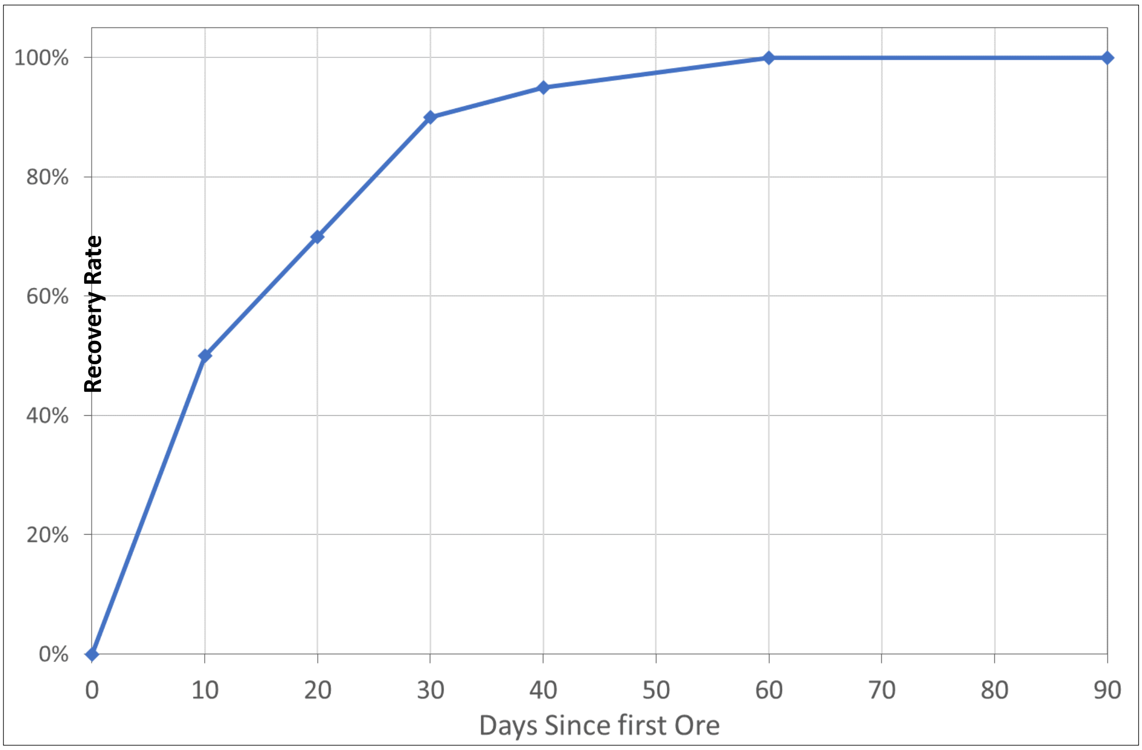
The following constraints and objectives were applied as part of the LOM Production Schedule:

- Scheduling periods
  - Pre-strip of one quarter (Y-1 Q1)

- Five years of production in quarters (Y1 Q1 to Y5 Q4)
- Remainder of mine life in years.

- Maximum mining rate of 25 Mtpa.
- Maximum bench turnover rate of 12 per annum.
- Maximum of two mining areas operating.
- A three month process plant ramp up as shown in Figure 16.6.1.

Figure 16.6.1 Processing Ramp-Up – Throughput and Recovery



- The LOM Production Schedule was undertaken as a Total Material Movement (TMM) schedule, which assumes the loading unit utilisation is the constraint and that a sufficient trucking fleet is available to 'service' the loader. Good management of equipment will be necessary to ensure that the truck fleet size is maintained at a reasonable level. A mining capacity limit of 25 Mtpa was applied on the basis that the fleet proposed by the mining contractor had this capacity, as the RBP schedule peaked at this quantity. Orelogy undertook an independent evaluation of this capacity based on:

  - the assumed equipment types
  - reasonable availability and utilisation

- a 50-minute working hour efficiency factor
- the LOM split of material types.

The results are detailed in Table 16.6.1 below:

Table 16.6.1 Mining Productivity Validation

		Oxide	Trans	Fresh	Mtpa per Unit	# Units	Total
Material Proportion		23%	36%	41%			
Mtpa (dry)	**Cat 6030**	15.5	13.0	13.3	13.8	1	13.8
	Cat 6015	5.4	5.5	5.6	5.5	2	11.1
	Total						**24.8**

- A cut-over grade (i.e., maximum grade) for defining stockpiled material was applied on a period-by-period basis, using the strategic outcomes as a guide. In general, all material below the cut-over will be sent to stockpile. However, in some periods small amounts of low-grade may be fed to the plant to ensure plant feed is at 100% of capacity, or alternatively small amounts of material above the cut-over sent to stockpile when there is excess production. The cut-over grades used are provided in Table 16.6.2 below.

Table 16.6.2 LOM Production Schedule Low Grade Cut-Over

Y-1	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3	Y2 Q4	Y3 Q1	Y3 Q2	Y3 Q3	Y3 Q4
N/A	N/A	N/A	N/A	0.6	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.9
Y4 Q1	**Y4 Q2**	**Y4 Q3**	**Y4 Q4**	**Y5 Q1**	**Y5 Q2**	**Y5 Q3**	**Y5 Q4**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
0.9	0.9	0.9	0.9	1.1	1.1	0.9	0.9	0.9	0.76	0.76	0.76	0.76

- Stage availability (stage lag / precedence) using the stage release from the annual strategic schedule as a guide.
- Mining width of 60 m across strike between benches (i.e., must have mined at least 3 x 10 m blocks either side before opening up new bench).
- Equipment moves per period between pits / stages limited to once per fortnight (i.e., must mine at least 600 adjacent blocks before moving).

16.6.3 Schedule Results

The resulting physicals of the LOM schedule are provided in the following Figure 16.6.2 to Figure 16.6.5 and Table 16.6.3 to Table 16.6.4 below. They are presented in an annualised form in the figures for clearer presentation.

Figure 16.6.2 TMM by Deposit

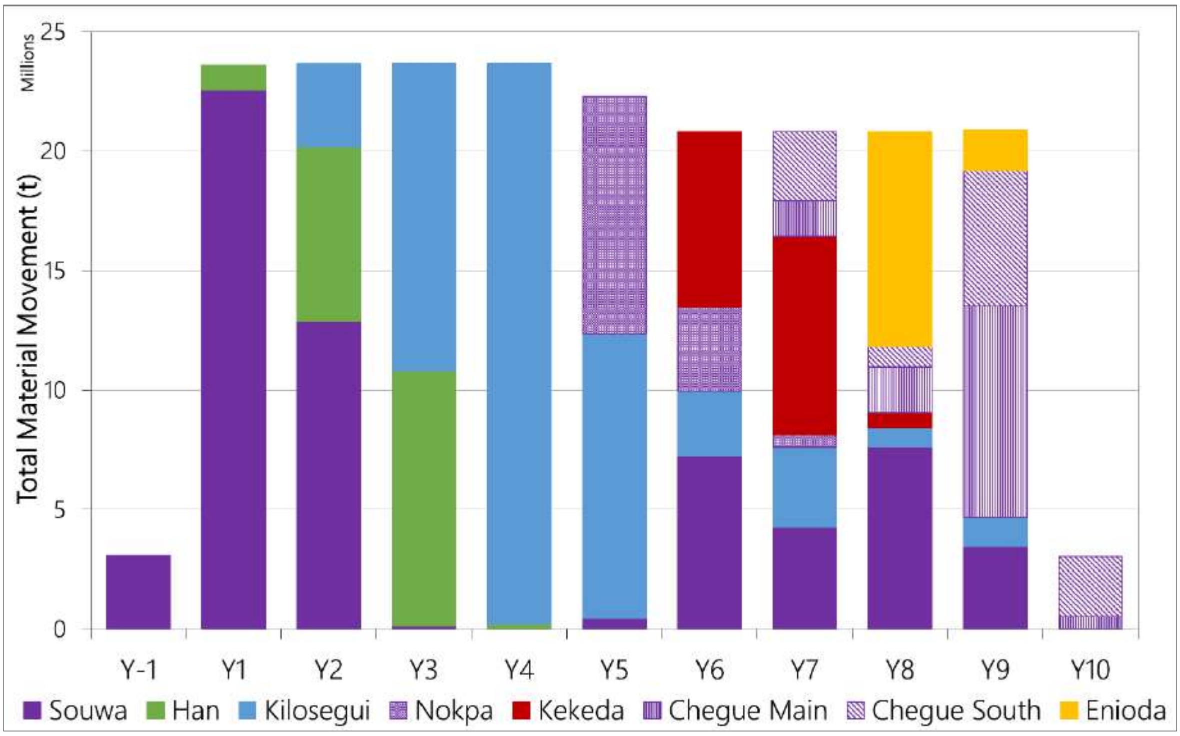


Figure 16.6.3 Process Plant Feed

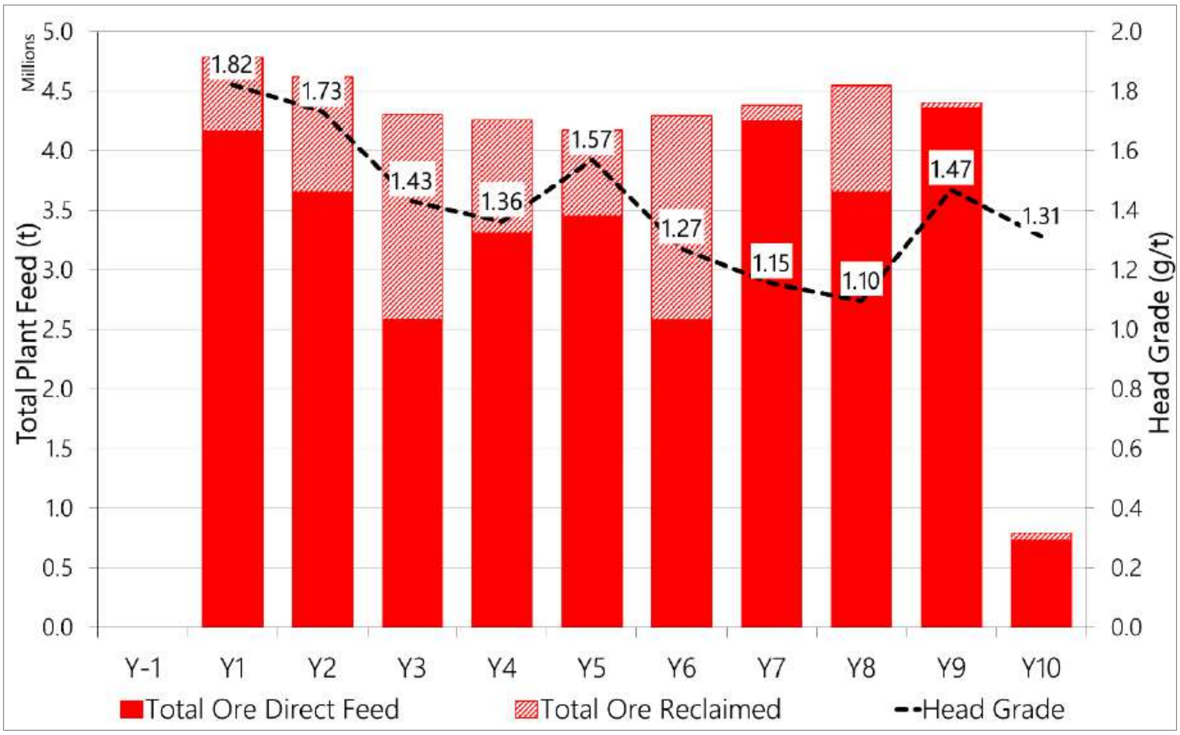


Figure 16.6.4 Closing Stockpile Balance

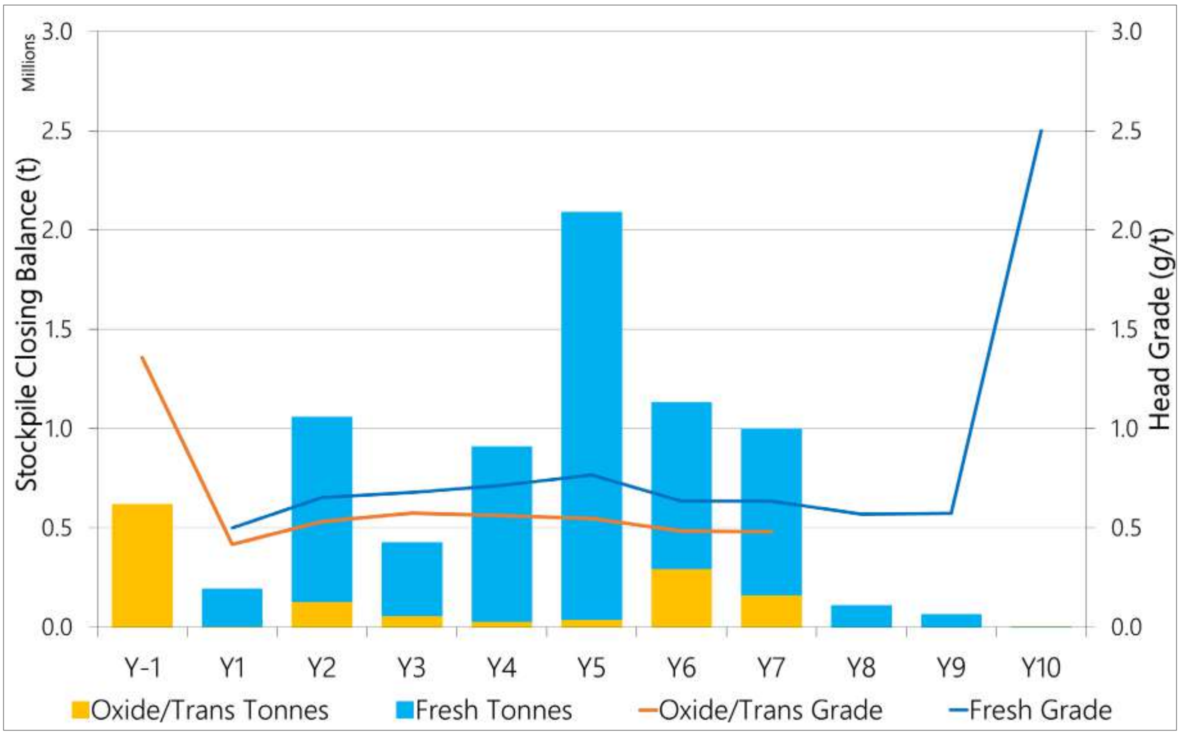


Figure 16.6.5 Gold Production

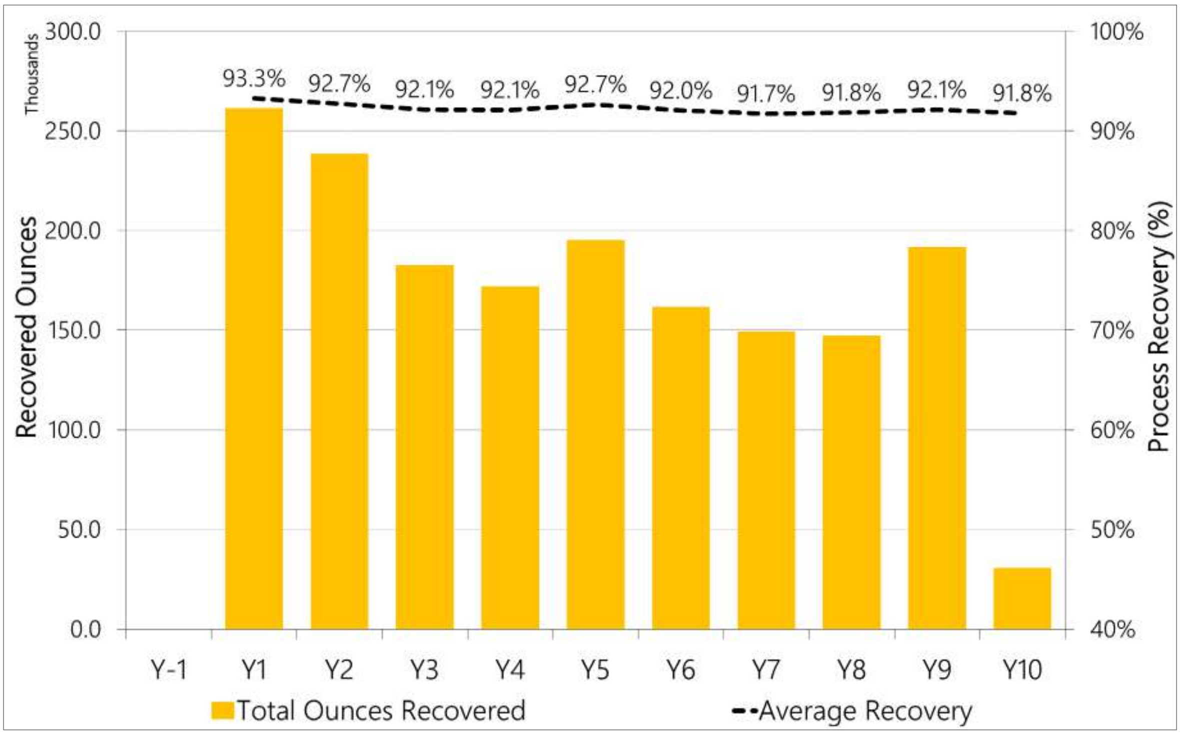


Table 16.6.3 LOM Production Schedule Physicals by Period (Year -1 to Year 3)

Items		Units	Total	Y-1 Q4	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3	Y2 Q4	Y3 Q1	Y3 Q2	Y3 Q3	Y3 Q4
Total Material Mined (TMM)		Mt	206.3	3.1	5.9	5.9	6.0	5.8	5.8	5.9	6.0	6.0	5.8	5.9	6.0	6.0
Total Material Moved (Incl. Reclaim)		Mt	214.1	3.1	6.2	6.1	6.0	5.8	6.0	6.0	6.1	6.6	6.3	6.4	6.5	6.2
Ore Mined		Mt	40.6	0.617	0.8	1.1	1.2	1.2	1.3	1.6	1.6	1.0	0.9	0.8	0.8	1.2
		g/t	1.44	1.36	1.64	1.65	2.27	1.71	1.63	1.55	1.57	1.48	1.52	1.85	1.44	1.50
Waste Mined		Mt	165.7	2.5	5.0	4.8	4.8	4.6	4.5	4.3	4.4	5.0	5.0	5.1	5.2	4.7
Strip Ratio		W:O	4.1	4.0	5.9	4.4	4.1	3.7	3.4	2.7	2.7	5.2	5.8	6.3	6.5	3.9
Direct Feed Ore		Mt	32.7		0.8	1.1	1.2	1.0	0.9	1.0	1.1	0.6	0.7	0.6	0.5	0.8
		g/t	1.61		1.64	1.65	2.27	1.93	2.16	2.04	1.97	2.05	1.77	2.32	1.85	1.92
Stockpiled Ore		Mt	7.8	0.6				0.2	0.5	0.5	0.5	0.4	0.2	0.2	0.3	0.4
		g/t	0.71	1.36				0.50	0.60	0.62	0.59	0.58	0.61	0.67	0.65	0.66
Reclaimed Ore Feed		Mt	7.8		0.3	0.2	0.0		0.2	0.1	0.1	0.6	0.5	0.5	0.5	0.3
		g/t	0.71		1.34	1.42	1.05		0.50	0.51	0.52	0.55	0.61	0.67	0.63	0.65
Total Processed		Mt	40.6		1.2	1.3	1.2	1.0	1.1	1.1	1.2	1.2	1.1	1.1	1.1	1.1
		g/t	1.44		1.55	1.61	2.24	1.93	1.89	1.95	1.84	1.29	1.30	1.58	1.23	1.60
		koz	1,871.7		59.2	69.5	86.5	64.9	63.9	69.1	73.7	50.4	47.3	53.6	41.9	55.2
TMM	Enioda	Mt	10.7													
	Han	Mt	19.2					1.0	1.5	1.8	2.0	2.0	2.0	4.6	2.7	1.4
	Kekeda	Mt	16.3													
	Kilosegui	Mt	59.7								0.7	2.8	3.7	1.3	3.2	4.6
	Nokpa	Mt	14.0													
	Chegue Main	Mt	12.7													
	Chegue South	Mt	12.0													
	Souwa	Mt	61.7	3.1	5.9	5.9	6.0	4.8	4.3	4.1	3.3	1.2	0.1			

Table 16.6.4 LOM Production Schedule Physicals by Period (Year 4 to Year 10)

Items		Units	Y4 Q1	Y4 Q2	Y4 Q3	Y4 Q4	Y5 Q1	Y5 Q2	Y5 Q3	Y5 Q4	Y6	Y7	Y8	Y9	Y10
Total Material Mined (TMM)		Mt	5.8	5.9	6.0	6.0	5.9	5.9	5.2	5.2	20.8	20.8	20.8	20.9	3.0
Total Material Moved (Incl. Reclaim)		Mt	6.2	6.2	6.1	6.1	6.2	6.0	5.4	5.4	22.5	20.9	21.7	20.9	3.1
Ore Mined		Mt	1.0	1.2	1.3	1.2	1.2	1.5	1.3	1.3	3.3	4.3	3.7	4.4	0.7
		g/t	1.36	1.24	1.37	1.24	1.31	1.47	1.37	1.44	1.36	1.17	1.21	1.48	1.38
Waste Mined		Mt	4.8	4.7	4.7	4.7	4.7	4.4	3.9	3.9	17.5	16.6	17.2	16.5	2.3
Strip Ratio		W:O	4.9	3.9	3.6	3.8	3.8	3.0	3.0	2.9	5.2	3.9	4.7	3.8	3.2
Direct Feed Ore		Mt	0.7	0.8	0.9	0.9	0.7	0.9	0.9	0.9	2.6	4.3	3.7	4.4	0.7
		g/t	1.69	1.48	1.63	1.47	1.69	1.84	1.65	1.83	1.60	1.17	1.21	1.48	1.38
Stockpiled Ore		Mt	0.3	0.4	0.4	0.4	0.5	0.5	0.4	0.5	0.8				
		g/t	0.67	0.68	0.70	0.71	0.80	0.81	0.70	0.68	0.55				
Reclaimed Ore Feed		Mt	0.4	0.3	0.1	0.2	0.3	0.1	0.2	0.2	1.7	0.1	0.9	0.0	0.1
		g/t	0.66	0.67	0.62	0.69	0.69	0.69	0.68	0.64	0.78	0.49	0.61	0.56	0.57
Total Processed		Mt	1.1	1.1	1.1	1.0	1.0	1.0	1.1	1.1	4.3	4.4	4.5	4.4	0.8
		g/t	1.32	1.29	1.50	1.34	1.39	1.74	1.51	1.64	1.27	1.15	1.10	1.47	1.31
		koz	44.6	45.1	51.9	44.8	45.0	57.3	52.3	56.1	175.4	162.6	160.1	207.9	33.4
TMM	Enioda	Mt											9.0	1.7	
	Han	Mt	0.2												
	Kekeda	Mt									7.3	8.3	0.6		
	Kilosegui	Mt	5.6	5.9	6.0	6.0	3.6	3.7	2.8	1.8	2.7	3.4	0.8	1.2	
	Nokpa	Mt					2.3	2.2	2.5	3.0	3.5	0.5			
	Chegue Main	Mt										1.5	1.9	8.8	0.5
	Chegue South	Mt										2.9	0.9	5.7	2.5
	Souwa	Mt								0.4	7.3	4.3	7.6	3.5	

The primary objective of the LOM Production Schedule is to increase value by increasing upfront profitability. The key levers that were utilised to achieve this were:

- Generating higher head grade by either utilising mining stages that target high grade material or applying an elevated cut-off grade and stockpiling lower grade material.
- Increasing process plant through put by prioritising weathered ore types.
- Reducing mining costs by minimising waste mining.

16.6.4 Physicals for Cost Estimation

The LOM Production Schedule was utilised to determine the timing of other mining activities along with the primary production. These were then used as part of the mining cost estimation process. The scheduled activities are detailed in Table 16.6.5 and Table 16.6.6 below.

Any clearing and/or construction of pits, WRDs, roads and stockpiles is assumed to occur in the quarter prior to the item being required. Once the schedule reaches annual periods they are assumed to be cleared/constructed in the same year as use.

Rehabilitation is assumed to occur on a relatively ongoing basis, occurring as areas are completed and become available.

Table 16.6.5 Total Mining Physicals for Cost Estimation (Year -1 to Year 3)

Description		Unit	Total	Y-1 Q3	Y-1 Q4	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3	Y2 Q4	Y3 Q1	Y3 Q2	Y3 Q3	Y3 Q4
Ex-Pit Material Movement	Ore	Mt	**40.55**		0.62	0.85	1.10	1.17	1.24	1.34	1.58	1.60	0.97	0.86	0.81	0.80	1.21
		Mbcm	**16.50**		0.33	0.46	0.56	0.49	0.47	0.56	0.66	0.70	0.39	0.35	0.31	0.30	0.46
	Waste	Mt	**165.73**		2.47	5.05	4.80	4.79	4.60	4.50	4.31	4.36	4.99	4.98	5.09	5.17	4.75
		Mbcm	**72.76**		1.28	2.74	2.48	2.10	1.80	2.01	2.00	2.01	2.31	2.15	1.99	2.09	1.92
	Total	Mt	**206.28**		3.08	5.90	5.90	5.96	5.83	5.83	5.90	5.96	5.96	5.83	5.90	5.96	5.96
		Mbcm	**89.26**		1.62	3.20	3.05	2.59	2.27	2.57	2.66	2.71	2.70	2.50	2.30	2.39	2.37
Plant Feed	ROM Pad	Mt	**32.74**			0.85	1.10	1.17	1.05	0.88	1.04	1.14	0.60	0.67	0.58	0.52	0.80
	Stockpile	Mt	**7.81**			0.34	0.24	0.03		0.17	0.06	0.11	0.62	0.45	0.47	0.53	0.27
	Total	Mt	**40.55**			**1.19**	**1.35**	**1.20**	**1.05**	**1.05**	**1.10**	**1.25**	**1.22**	**1.13**	**1.05**	**1.06**	**1.07**
Satellite Ore Mined	Kilosegui	Mt	**12.97**									0.02	0.06	0.44	0.15	0.22	0.51
	Kekeda	Mt	**3.73**														
	Enioda	Mt	**1.46**														
	Han	Mt	**3.54**						0.13	0.22	0.29	0.21	0.24	0.33	0.66	0.57	0.71
Mining Activities	Clearing Area	Ha	**959.0**		80.5			82.0	54.2		247.9						60.2
	Mine Haul Road	km	**21.5**		2.4			1.9			3.2						1.6
	Ore Haulage Roads	km	**46.9**					8.1			30.2						
	Rehab Area	Ha	**607.5**														

Table 16.6.6 Total Mining Physicals for Cost Estimation (Year 4 to Year 10)

Description		Unit	Y4 Q1	Y4 Q2	Y4 Q3	Y4 Q4	Y5 Q1	Y5 Q2	Y5 Q3	Y5 Q4	Y6	Y7	Y8	Y9	Y10
Ex-Pit Material Movement	Ore	Mt	1.00	1.19	1.30	1.25	1.24	1.47	1.30	1.34	3.34	4.25	3.65	4.36	0.73
		Mbcm	0.38	0.46	0.49	0.47	0.47	0.56	0.51	0.51	1.34	1.68	1.57	1.74	0.28
	Waste	Mt	4.84	4.71	4.66	4.71	4.66	4.43	3.94	3.90	17.48	16.56	17.16	16.51	2.31
		Mbcm	1.92	1.86	1.83	1.81	1.99	1.86	1.61	1.53	8.22	7.10	7.87	7.30	0.97
	Total	Mt	5.83	5.90	5.96	5.96	5.90	5.90	5.25	5.25	20.81	20.81	20.81	20.87	3.04
		Mbcm	2.30	2.32	2.32	2.28	2.46	2.42	2.12	2.04	9.56	8.78	9.45	9.03	1.25
Plant Feed	ROM Pad	Mt	0.67	0.83	0.94	0.87	0.70	0.94	0.92	0.89	2.58	4.25	3.65	4.36	0.73
	Stockpile	Mt	0.38	0.26	0.13	0.17	0.31	0.09	0.16	0.17	1.71	0.13	0.89	0.04	0.06
	Total	Mt	**1.05**	**1.09**	**1.08**	**1.04**	**1.01**	**1.02**	**1.08**	**1.06**	**4.29**	**4.38**	**4.55**	**4.40**	**0.79**
Satellite Ore Mined	Kilosegui	Mt	0.83	1.19	1.30	1.25	1.21	1.35	1.01	0.80	0.87	0.87	0.57	0.31	
	Kekeda	Mt									1.28	2.23	0.22		
	Enioda	Mt											1.13	0.33	
	Han	Mt	0.17												
Mining Activities	Clearing Area	Ha				58.4			10.0		103.4	149.2	78.1	35.0	
	Mine Haul Road	km				2.0			0.5		0.9	3.9	2.0	3.3	
	Ore Haulage Roads	km									2.0		6.6		
	Rehab Area	Ha		181.6						77.1				89.3	259.6

16.7 Mining Cost Rates and Assumptions

16.7.1 Estimation Approach and Accuracy

The mining costs have been developed on the basis of a mining contractor operation. A preferred contractor was selected from the submissions received for the Request for Budget Pricing (RFB) as described in Section 16.3. This was Contractor 6 of the assessed submissions which was the second lowest bid (refer to Figure 16.3.2 in Section 16.3 above). This submission was within 10% of the average and was from a reputable contractor with considerable experience and track record in West Africa. It was therefore not considered an unduly risky selection. The following sections detail the assumptions and rates derived from the selected submission.

Owner's mining costs developed by Centamin related to management and technical personnel, grade control etc.

The costs estimate was developed in three steps:

- Determining the physicals for each activity by period.
- Determining the unit rates for those activities.
- Calculation of the cost by period by:

– Multiplying the scheduled quantity by the appropriate rate.

– Apply any fixed costs on a time based pro-rata basis.

The estimates assumed a fuel price of 1.00 USD/l.

The costs estimate has been developed to an accuracy of ±25%, in line with the requirements of a study to prefeasibility level.

16.7.2 Site Establishment and Mobilisation / Demobilisation

The mobilisation / demobilisation for the selected submission fleet is shown in Table 16.7.1 below.

Site establishment and associated infrastructure are detailed in Table 16.7.2 below.

Table 16.7.1 Selected RBP Submission – Mobilisation and Demobilisation

Description		Make	Model	# units
Mining Equipment	Excavator	Cat	6030	1
		Cat	6015B	2
	Mine Truck	Cat	777E	20
	Road Truck	MAN	30t	10
	Front End Loader	Cat	992	2
		Cat	950	2
	Drill Type	Sandvik	DP1500i	7
	Excavator (Clean-up)	Cat	390F	1
	Track Dozer	Cat	D9T	4
	Grader	Cat	16M	2
	Water Truck	Cat	777	2
	Rockbreaker	Cat	336E	1
	Subtotal			54
Ancillary Equipment & Personnel	Tool carrier	Cat	IT28	1
	Fuel truck			2
	Service Truck	Iveco		1
	Lighting Plant	Allight		13
	Light Vehicle	Toyota		17
	Town Bus	Toyota		4
	Mine Bus (4x4)	Iveco		3
	Tyre Handler			1
	Miscellaneous Items[1]			1
	Personnel			1
	Project Startup Management			1
	Subtotal			45

Table 16.7.2 Selected RBP Submission – Site Establishment and Infrastructure

Description
Mining Contactor Office
Staff Training Facility
Kitchen Diner
Junior Staff Change House
Ablutions Facility
HME Workshop & Stores
LV & Drill Rig Workshop
Service / Lube Bay
Wash Bay
Tyre Bay
Hose Repair Facility
Security Guard House x 2
Mine Services Area Prep Works
Site Services connections etc
Total

16.7.3 Primary Production Rates

The contractor elected to utilise emulsion product across all material types. There was a consistent pattern for oxide and transitional material, with fresh material split 50/50 between two pattern sizes.

Load and haul rates were provided by deposit by bench for the three weathering zones.

16.7.4 Other Mining Activities and Fixed Costs

Other mining costs were generated as part of the RBP submissions on a rates basis.

16.7.5 Ore handling

Ore rehandle rates were provided for reclaim from short term stockpiles on top of the process plant ROM pad, and FEL/truck rehandle from longer term low grade stockpiles adjacent to the ROM pad. Ore haulage from the satellite pits were costed on the basis of a normalised loading rate (USD/t) and hauling rate (USD/t/km).

16.7.6 Dayworks

A dayworks rates of 5% was applied on top of the combined costs for drilling, blasting, loading, hauling and ore rehandle.

16.8 Risks and Opportunities

Given the comprehensive mining study undertaken for the Doropo Prefeasibility Study and considering the conditions provided in this report, Orelogy consider the Doropo Gold Project to be technically and economically viable. The QP does however provide the following opportunities and risks with respect to the Mining Methods and associated Mineral Reserves.

16.8.1 Risks

The Doropo Project has the usual risks associated with any mining operation. Detailed below are the key mining related risks to the project along with any inherent or planned mitigation measures to reduce the either the likelihood and / or impact of the risks.

- Inadequate ore definition and / or mining selectivity and associated increases in ore loss and / or dilution. This will be mitigated through the use of industry standard ore control techniques such as:

– in-advance RC grade control drilling and detailed grade control modelling

– digital ore mark-out combined with ore spotting where required

– the use of smaller excavators for highly selective zones.

- Geotechnical risk of:

– wall failure and associated safety risks and / or production interruptions

– wall slopes needing to be flatter than originally designed.

- The geotechnical wall slope criteria has been developed to a high level of detail based on the modelled weathering surfaces. These surfaces are based on relatively limited information and show considerable variability in depth and thickness. It is likely that during operations these surfaces will change and therefore the resulting wall slopes will vary, particularly through the weathered zones.

- This will be mitigated by the additional resource drilling to be undertaken from the end of the current PFS through to the eventual project execution which will provide considerable further definition to the weathering surface. In addition, a more detailed review of the geotechnical criteria will be part of the scope of the any subsequent DFS, and this work also will continue through to project execution.

- Inability of the mining contractor to meet production targets due to operational issues. This will be mitigated by a robust mining contractor selection process that will ensure the eventual selection has the capacity, capability and experience to undertake the work to the required quality.

- The large number of satellite pits that require ore transported to the processing facility mean there is a potential risk to ore continuity. This may require some ore being mined in advance and stockpiled to ensure the ore is available for processing. If this ore is stockpiled at the pits, it then presents a potential ore security risk. Therefore, the ore should be transported and stockpiled at the central stockpiling area adjacent to the processing plant. This mitigates the security risk, all be it at the cost of incurring the ore transport costs in advance of the ore being required for feed.

- The assumption of 50% free-dig through the highly weathered zone needs to be validated as part of the next phase of study. This will be included as part of the scope for any subsequent geotechnical assessments.

- Additional risks at Doropo are related to impacts on the local community, as a large number of the open pits have either villages, dwellings or farmland in proximity to the working areas. The impacts can include noise, dust, local water, traffic etc. The interaction of both mining activities and the ore haulage activities from the satellite pits will need to be carefully and systematically managed to minimise any negative impacts on these communities. These impacts and proposed mitigations are covered in detail in Section 20.

16.8.2 Opportunities

The key opportunities for the Doropo Gold project include, but are not limited to:

- Extension to the resource model primarily in strike, but also to depth. The Kilosegui mining area probably demonstrates the most potential in this aspect.

- There may be the possibility to blast some of the broader areas of waste rock at higher bench height to reduce cost in these areas. It would need to be ensured that the mining contractor has suitable equipment for both blasting and loading operations for this to be opportunity to be realised.

Doropo Gold Project

Pre-feasibility Study

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17.0 RECOVERY METHODS

17.1 Process Design

17.1.1 Design Philosophy

The proposed process plant design for the Doropo Gold Project is based on a robust metallurgical flowsheet designed for optimum recovery with minimum operating costs. The flowsheet is based upon unit operations that are well proven in industry.

The key criteria for equipment selection are the suitability for duty and the projected mine life of the operation without unnecessarily compromising reliability and ease of maintenance. The plant layout provides ease of access to all equipment for operating and maintenance requirements while maintaining a compact footprint to minimise construction costs.

The Doropo gold plant will process a range of material types from the nine Doropo pits included in the current LOM (oxide, transition and primary ore) of variable material characteristics and head grades.

The grades per resource per lithology are presented in the Mineral Resource Estimate in Section 14 as of 25 October 2022, which formed the fundamental basis of the plant design. The selected comminution circuit has been sized to accommodate the 85th percentile in terms of competence of the ores to be treated. It is intended that the process plant will operate with a SABC comminution circuit configuration. All ore types contain significant quantities of gravity recoverable ('free') gold.

The key project and ore specific design criteria that the plant design must meet are as follows:

- 4,000,000 t/y of primary ore.
- Crushing plant mechanical availability of 80% (7,008 h/y).
- Mechanical availability for the remainder of the plant of 91.3% (8,000 h/y) supported by crushed ore storage and standby equipment in critical areas.
- Sufficient automated plant control to minimise the need for continuous operator interface and allow manual override and control if and when required.

A process design criteria (2234-FPDC-001) document has been prepared incorporating the engineering and key metallurgical design criteria derived from the results of PFS metallurgical testwork, as discussed in Section 13, and comminution circuit modelling. The design document forms the basis for the design of the processing plant and required site services.

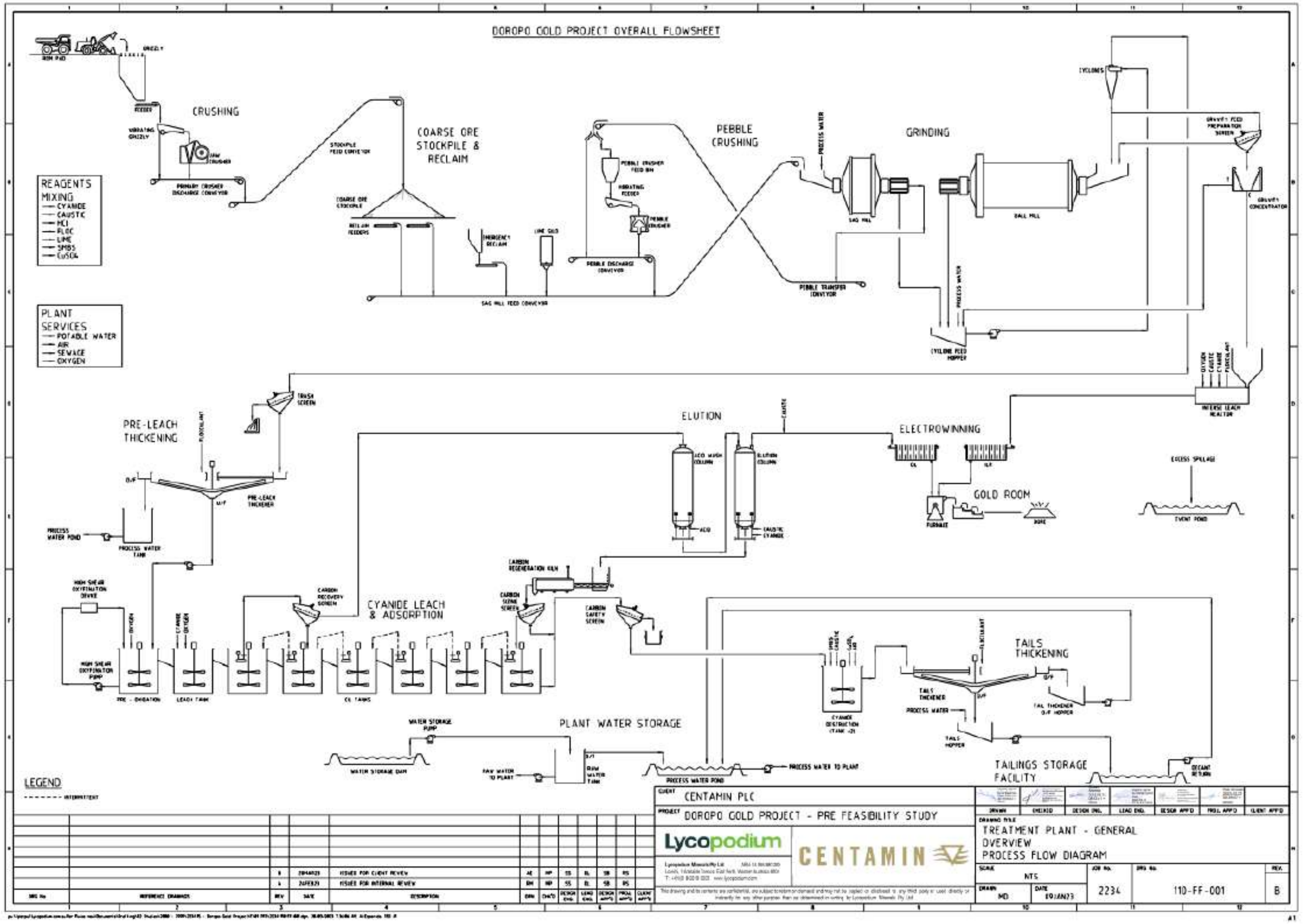
17.1.2 Selected Process Flowsheet

The treatment plant design incorporates the following unit process operations:

- Primary crushing with a jaw crusher to produce a coarse crushed product.
- A live stockpile.
- A SABC comminution circuit comprising a SAG mill in closed circuit with a pebble crusher and a ball mill in closed circuit with hydrocyclones to produce an 80% passing (P_{80}) 75 µm grind size (primary ore) and 106 µm oxide and transition ores.
- The cyclone overflow slurry will gravitate via trash screening to a pre-leach thickener.
- Trash screen to remove any trash before the pre-leach thickener.
- Pre-leach thickening of the milled slurry will increase the slurry density feeding the carbon in leach (CIL) circuit to minimise slurry tank volume requirements and reduce overall reagent consumption.
- Pre-oxidation and Carbon in Leach (CIL) circuit consisting of a pre-oxidation tank, followed by a leach tank and six CIL tanks to provide 36 hours of leaching residence time when processing primary ore at design plant throughput. Sodium cyanide solution will be added to the first leach tank slurry to start the gold leaching process in the presence of the elevated dissolved oxygen levels. An acid wash column to remove inorganic contaminants from the carbon with hydrochloric acid.
- A split AARL elution circuit, electrowinning and gold smelting to recover gold from the loaded carbon to produce doré.
- Two electrowinning cells for gold recovery on to cathodes and sludge smelting to doré.
- Carbon reactivation kiln to remove organic contaminants from the carbon with heat.
- Tailings treatment incorporating cyanide destruction using the INCO SO_2 / air process (sodium metabisulphite / oxygen).
- Tails thickening of the leached slurry will increase the slurry density and minimise the volume of tailings to be handled.
- Tailings pumping to the tailings storage facility (TSF).
- Reagent mixing, storage and distribution facilities.

A simplified flow diagram depicting the unit operations incorporated in the selected process flowsheet is shown in Drawing 110-FF-001 shown in Figure 17.1.1.

Figure 17.1.1 Flowsheet Schematic



17.1.3 Plant Design Basis

The key issues considered in the process and equipment selection are outlined in this section.

Process Plant

The plant design has been based on a nominal capacity of 4.0 Mtpa of primary mineralised material. Over the life of mine the plant will be fed with approximately 13% oxide, 33% transition and 54% primary. The ore will come from nine pits with the two main being Souwa (28% of LOM Feed) and Kilosegui (30% of LOM Feed). The most abundant ore lithology is granodiorite. When processing predominantly oxide ore in the early years of the mine life, it is anticipated that the plant throughput will be significantly greater than the nominal 4.0 Mtpa.

ROM Pad and Ore Delivery (by Mining Contractor)

The ROM pad and stockpiles will be an important part of the mine operation with mineralised material feed stocks being blended to ensure a consistent feed rate and grade to the plant, while the ROM bin will be designed to accommodate both direct tipping from mine trucks and blended feed addition by FEL. A mobile rock breaker, included as part of the mining fleet, will be used to break any oversize rocks on the ROM bin static grizzly.

Comminution Circuit Selection

The comminution circuit design has been based on the 85th percentile results of the PFS comminution testwork for the primary material. Details of the comminution testwork are included in Section 13. The comminution data was provided to Orway Mineral Consultants (OMC) for comminution circuit modelling and mill sizing. A grind size P_{80} of 75 µm was selected as the optimum grind size based on the PFS grind optimisation testwork. The comminution circuit is detailed in the comminution design report compiled by OMC and attached in Appendix X.

The conclusions from the report are as follows:

- OMC recommended a primary jaw crusher / SABC (SAG mill, Ball mill and recycle Crusher) circuit.
- A primary jaw crusher (Metso C150 or equivalent) is recommended.
- Treatment of the less competent oxide or transitional material enables the comminution circuit to operate at a throughput equivalent to 5.4 Mtpa when processing exclusively oxide or transitional ore and will lead to the predicted P_{80} grind size increasing from the fresh ore 75 µm target to 106 µm.

The design criteria used in modelling the comminution circuit and the equipment selection are summarised in Table 17.1.1 and Table 17.1.2. The comminution average power and consumables requirements for primary and oxide mineralised materials are summarised in Table 17.1.3 and are used in the estimation of the process plant operating cost.

Table 17.1.1 Comminution Design Criteria and Circuit Parameters

Parameters	Units	Oxide / Transitional Ore	Primary Ore
CWi	kWh/t	7.6	13.0
RWi, 85th Percentile	kWh/t	12.7	18.5
BWi, 85th Percentile	kWh/t	19.7	18.4
Axb, Derived from 85th Percentile [1]	-	84.2	37.2
Ai, Average	-	0.162	0.200
SG	t/m^3	2.52	2.67
Plant Throughput	t/y dry	5,400,000	4,000,000
Crushing Circuit Availability	%	80	80
Crushing Circuit Throughput	t/h dry	775	571
Crushing Feed F_{100}	mm	800	800
Crushing Feed F_{80}	mm	332	423
Grinding Circuit Availability	%	91.3	91.3
Grinding Circuit Throughput	t/h dry	679	500
Milling Feed F_{80}	mm	119	153
Milling Product P_{80}	µm	106	75
SAG Mill Specific Energy	kWh/t	6.1	10.1
Ball Mill Specific Energy	kWh/t	11.5	15.6
Pebble Crusher Specific Energy	kWh/t	-	0.1
Total Specific Energy	kWh/t	17.6	25.8

Notes:

1. **BWi figures are from the met testwork**

Table 17.1.2 Summary of Selected Comminution Circuit

Description	Units	Parameter	
Comminution Circuit		Primary Crush SABC	
Design Blend		100% Primary	
Primary Crushing			
Type		Jaw Crusher	
Model		Metso C150 or equivalent	
Open Side Setting	mm	150	
Machine Load	%	55	
Milling			
Type		**SAG Mill**	**Ball Mill**
Mill Diameter x Length (EGL)	m x m	8.53 x 5.05	6.71 x 11.12
Discharge Configuration	-	Grate	Overflow
Speed	% Nc	75	75
Drive	type	Variable	Fixed
Top Ball Size	mm	125	50
Milling Density	% Solids	75	75
Ball Charge, Duty	% vol	10	30
Total Load, Duty	% vol	25.0	N/A
Pinion Power, Max	kW	6,578	8,580
Installed Power	kW	6,900	9,000
Pebble Crushing			
Type		Cone Crusher	
Model		Metso HP200 or equivalent	
Closed Side Setting	mm	11	
Machine Load	%	82	

The comminution average power and consumables requirements are summarised in Table 17.1.3 and are used in the estimation of the processing operating cost, as detailed in Section 12.

Table 17.1.3 Comminution Consumables by Ore Type

Parameters	Units	Primary Ore	Oxide / Transitional Ore
Bond Abrasion Index – Average	g	0.200	0.162
Primary Crusher			
Liner Consumption – Fixed Jaw	hours/unit	2,500	2,000
Liner Consumption – Moving Jaw	hours/unit	3,333	3,333
Gross Power Consumption	kWh/t	0.09	0.14
SAG Mill			
Media Consumption	kg/t milled	0.347	0.243
Liner Consumption	kg/t milled	0.072	0.041
Gross Power Consumption	kWh/t milled	11.2	6.8
Ball Mill			
Media Consumption	kg/t milled	0.839	0.569
Liner Consumption	kg/t milled	0.111	0.076
Gross Power Consumption	kWh/t milled	16.9	12.4
Pebble Crusher			
Liner Consumption	hours/set	1,111	-
Gross Power Consumption	kWh/t milled	0.1	-

Crushing and Crushed Material Storage

The crushing circuit has been sized on the basis of achieving 80% utilisation at a feed rate 14% above that of the nominal milling throughput.

A jaw crusher has been selected as being most suitable to cater to the variations in material characteristics and tonnage throughput requirements.

Crushed ore will feed a live stockpile from which the ore will be reclaimed by two variable speed apron feeders controlled by weightometer to maintain the desired SAG mill feed rate. The stockpile will provide approximately 24 hours of nominal plant throughput when processing oxide or transitional material. This decouples the lower utilisation primary crushing circuit from the higher utilisation downstream plant.

Milling and Classification

The milling circuit has been selected to reduce the primary crushed product to the nominal circuit P_{80} size of 75 µm. The SAG mill will be equipped with a variable speed drive and will be capable of operating between 60% and 80% of critical speed. The variability in ore hardness between the softer oxide ore and the harder primary ore can, therefore, be accommodated by varying the speed of the SAG mill – the softer ore will require the mill to operate at a slower speed, while processing of the more competent primary ore will require a higher mill speed. The ball mill will have a fixed speed drive.

A cluster of cyclones with standby units has been selected for the classification duty. The provision of standby cyclones will facilitate maintenance on individual units without compromising operability. Cyclone overflow slurry will have a solids concentration of between 34% and 30% for oxide and fresh ores respectively to achieve the required cut size. Cyclone overflow will report to a single trash screen, while cyclone underflow will be returned to the ball mill for further grinding.

Gravity Concentration

Gravity testwork has indicated that up to 80% of the gold in the plant feed may be recovered by gravity gold methods. A gravity recovery circuit with intensive cyanidation of the concentrates will allow the feed grade to the CIL circuit to be smoothed, enabling the CIL operation to be optimised by removing spikes of high grade material from the feed stream. A dedicated electrowinning circuit will be provided for the intensive cyanidation solution to assist with metallurgical accounting and eliminate any potential impact on the operation of the carbon elution and electrowinning circuit.

Pre-leach

As well as allowing the grinding circuit to operate at optimum classification densities, inclusion of a pre-leach thickener ahead of the CIL circuit achieves a higher and more constant leach feed density and optimises the tank sizes and residence times and reagent concentrations for leaching. Flocculant will be added to assist with settling and the overflow will be pumped to the process water pond for re-use within the plant.

One pre-leach tank will be provided. Oxygen will also be added into the tank.

Design parameters and flocculant consumption rates for the pre-leach thickening circuit have been assumed and are based on similar gold plant parameters and rates.

Leach and Adsorption Circuit

The PFS metallurgical testwork indicated that:

- 'Preg-robbing' is unlikely to be an issue at Doropo.

- Initial leach kinetics for all lithologies are mostly rapid following gravity gold recovery. However, several of the gravity tails samples, particularly associated with primary ore, displayed slower leach kinetics and benefitted from additional leaching time through to 36 hours. Provision for the longer residence time is allowed in the design to ensure that maximum gold extraction is achieved for all ores.

- Cyanide, lime, and oxygen consumptions vary depending on ore type but are generally low.

On the above basis, a circuit configuration comprising one leach tank and six stages of CIL tanks has been selected in order to achieve acceptable stage efficiency and minimise soluble solution losses, whilst maintaining a moderate inventory of carbon in circuit. All CIL tanks will be identical in size with the circuit designed for a total residence time of 36 hours when treating exclusively primary ore (500 t/h, 45% w/w solids).

Elution and Goldroom

The average daily movement of carbon has been calculated based on the design feed grade and maximum CIL gold extraction (assuming no gravity gold recovery). On this basis, an 18 tonne capacity split AARL elution circuit has been selected requiring six strips per week. The split AARL circuit has been selected in preference to a Zadra stripping circuit as it offers the flexibility to run more than one elution per day. The split AARL is more water efficient than a straight AARL.

Based on the design gold head grades and recoveries, the loaded carbon grade will be ~1,700 g/t of gold. The goldroom will require two electrowinning cells to recover the expected precious metals load from CIL, with a third cell dedicated to the pregnant solution from the gravity circuit. This arrangement will facilitate metallurgical accounting.

The sludge from the electrowinning cells will be filtered, dried and smelted to doré bars in a diesel fired furnace.

The presence of mercury within the Doropo ores has not been identified, and thus no specific mercury mitigation measures have been included within the proposed elution circuit and goldroom designs.

Plant Tailings Treatment

The air / SO_2 cyanide destruction method will be used to reduce cyanide in the plant tailings to below a CN_{WAD} level of 50 ppm.

Design parameters and reagent consumption rates for the cyanide destruction circuit have been assumed and are based on similar gold plant parameters and rates.

Copper sulphate will be added as required to catalyse the cyanide destruction reaction. The presence of arsenic within the Doropo ores has not been identified, and thus no requirement for arsenic stabilisation measures have been included within the proposed tailings treatment circuit.

Raw and Potable Water

Raw water for the Project will be sourced from the water harvest dam retaining surface runoff from the catchment. This water will be pumped regularly to the water storage dam, which will be the main water supply for the operations. Surplus water from the open pit mine will also be pumped to the water storage dam. The raw water from the dam will be used as raw water in the plant, mine and camp and as the feed stream for the potable water treatment plants.

The pre-leach and tailings thickeners overflowing to the process water pond will allow direct recycle of the majority of process water required for the milling circuit with make-up water overflowing from the raw water tank as required. The TSF decant return water will also be pumped to the process water pond.

17.1.4 Key Process Design Criteria

The key process design criteria summarised in Table 17.1.4 form the basis of the detailed process design criteria and mechanical equipment list.

Table 17.1.4 Summary of Key Process Design Criteria

Description	Units	Oxide	Primary	Source
Plant Throughput	t/y	5,400,000	4,000,000	Centamin
Design Gold Head Grade	g Au/t	2.0	2.0	Assumed
Gravity Gold Recovery	%	45	35	Testwork
Design Overall Gold Recovery	%	92	85	Testwork
Crushing Plant Utilisation	%	80	80	Lyco / OMC
Milling / CIL Plant Utilisation	%	91.3	91.3	Lyco / OMC
ROM Ore Top Size	mm	800	800	OMC
Ore SG	-	2.47	2.67	Testwork / OMC
Comminution Circuit	type	Primary Crush / SABC		Centamin / OMC
Crush Size, P_{80}	mm	119	153	OMC
Target Grind Size, P_{80}	µm	106	75	Testwork
Cyclone O/F Density	%w/w solids	34	30	Lyco / OMC
Pre-leach Thickener Solids Loading	$t.m^{-2}.h^{-1}$	1.0	1.0	Assumed
Pre-leach Thickener Flocculant	g/t	30	20	Assumed
Leach Feed Slurry Density	%w/w solids	45	45	Lyco
CIL Residence Time	hours	24	36	Testwork
Number of Pre-leach Tanks	#	2	2	Lyco
Number of CIL Tanks	#	6	6	Lyco
Average Cyanide Consumption[6]	kg/t	0.21	0.16	Testwork
Average Quicklime Consumption[7]	kg/t	1.38	0.58	Testwork
Elution Circuit Type	-	Split AARL	Split AARL	Lyco
Elution Circuit Capacity	t	18	18	Lyco
Frequency of Elution	strips / week	6	6	Lyco
Cyanide Destruction Method	-	INCO Air/SO_2	INCO Air/SO_2	Lyco

Notes:

1 **'Testwork' refers to comminution and metallurgical testwork conducted.**
2 **'Centamin' refers to advice / agreement from Centamin.**
3 **'Lyco' refers to Lycopodium experience or generally accepted practice.**
4 **'OMC' refers to advice from Orway Mineral Consultants.**
5 **Cyanide consumption makes allowance for 100 ppm residual cyanide in the CIL tail solution.**
6 **Lime consumption based on 90% CaO.**

17.2 Process and Plant Description

The process and plant description should be read in conjunction with the process plant flowsheet.

17.2.1 ROM Pad

Mining haul trucks will deliver ROM material to the ROM pad where it will be directly tipped into the ROM bin or dumped in blending 'finger' stockpiles arranged by material gold grade and lithology. A FEL will be used to reclaim and tram the material from the various stockpiles to the ROM pocket.

Ore will be blended under the guidance of mine geologists and process personnel to maintain a relatively constant feed grade and hardness to the process plant. Spotters on the ROM pad and within the mine pit will be used to identify and remove excess steel and timber that may eventuate from the original underground workings.

The ROM bin will be provided with a dust suppression system comprising a water tank, pump, and manifold to deliver raw water to the ROM bin during ore tipping.

17.2.2 Crushing Circuit

ROM material will generally be direct tipped into the ROM bin. A mobile rock breaker operated by the mining contractor will be used to break any oversize material accumulating on the ROM bin static grizzly. Mineralised material will be withdrawn from the ROM bin by a variable speed apron feeder and delivered to a vibrating grizzly feeder. Oversize material from the feeder with gravitate to a jaw crusher and the crushed product will combine with the feeder undersize on the primary crusher discharge conveyor. A self-cleaning belt magnet suspended above the primary crusher discharge conveyor head chute will collect and discharge tramp metal into a dedicated bunker for subsequent disposal. Crushed ore from the primary crusher discharge conveyor will transfer onto the stockpile feed conveyor. A weightometer beneath the stockpile feed conveyor will indicate the instantaneous and totalised primary crushing tonnage.

A reverse pulse bag filter will be installed on the discharge conveyor to capture dust from beneath the primary crusher and discharge points. The captured particulates will be periodically discharged from the filter bags and back onto the conveyor.

The crushing circuit will be monitored and controlled from the crusher control room. Two-way radio communication between the crusher control room operator and the ROM pad FEL driver will ensure that a minimum inventory is maintained within the ROM bin.

17.2.3 Plant Feed Storage and Reclaim

The stockpile feed conveyor will discharge onto the crushed ore stockpile. A spray water manifold will be installed at the head end of the stockpile feed conveyor dust suppression as required.

Crushed ore will be withdrawn from the crushed ore stockpile at a controlled rate by two variable speed apron feeders and delivered to the milling circuit via the mill feed conveyor. A weightometer beneath the mill feed conveyor will indicate the instantaneous and totalised mill feed tonnage and will be used to control the speed of the reclaim feeder.

A FEL will be used to load SAG mill grinding media from the SAG media storage bunker directly into the SAG mill charging feeder for subsequent discharge onto the mill feed conveyor. The same FEL will typically be used to reclaim crushed ore from the stockpile for delivery to the mill feed conveyor via the emergency reclaim feed bin if the primary crushing circuit is off-line.

Quicklime, used for pH control in the leach circuit, will be delivered to site in bulk tankers and pneumatically off-loaded into a lime silo. The silo will be fitted with a dust collector and bin activator to prevent compaction and blockages. Quicklime will be metered from the silo directly onto the mill feed conveyor using a variable speed rotary valve feeder. The speed of the valve will be varied according to the mill feed tonnage. The silo will be fitted with a dust collector.

A pulsed jet dust scrubber will reduce airborne dust generation at the loading points of the apron feeder and at the lime discharge point(s).

The reclaim circuit will be controlled from the main control room.

17.2.4 Grinding and Classification Circuit

Crushed ore will be milled to achieve the required grind size for effective gold recovery. The grinding circuit will consist of a SAG mill in closed circuit with a pebble crusher and a ball mill in closed circuit with a cluster of hydrocyclones.

Crushed ore will be fed directly to the SAG mill and process water added to achieve the correct milling density. The SAG mill will be equipped with a variable speed drive to enable operation at between 60% and 80% of critical speed. The SAG mill will typically operate at minimum speed and with a low ball charge to meet the requirements for treating high proportions of lower competency oxidised material. As the amount of competent primary material in the mill feed increases, the mill speed will be increased and the ball charge increased. When treating predominantly oxide ore, it is unlikely that there will be any significant generation of pebbles.

The SAG mill will discharge to a trommel screen with oversize pebbles and worn steel grinding media discharging onto the pebble transfer conveyor. Trommel oversize may also be diverted to the milling area drive in sump, if required. A self-cleaning belt magnet mounted above the pebble transfer conveyor will be used to remove mill balls and any other magnetic steel debris discharged from the SAG mill. Tramp metal that is not removed by the magnet will be detected by a metal detector located above the pebble transfer conveyor prior to the pebble crusher. If any tramp metal is detected, an automated flop-gate will be activated to temporarily divert tramp steel and pebbles away from the crusher and back onto the mill feed conveyor. This diverter gate will also allow maintenance to be carried out on the pebble crusher without having to shut down the milling circuit. A weightometer on the pebble transfer conveyor will indicate the mass of pebbles being recycled.

Pebbles will report to the pebble bin and will be fed to the pebble crusher at a controlled rate from the vibrating feeder. The pebbles will be crushed and will discharge onto the pebble discharge conveyor and then onto the SAG mill feed conveyor.

Undersize material from the mill trommel will gravitate to the cyclone feed hopper (along with the ball mill discharge slurry) and will be diluted with process water prior to pumping to the hydrocyclone (cyclone) cluster for classification. The cyclone cluster will be fed from duty / standby variable speed cyclone feed pumps. The cyclone underflow (coarse material) will be collected in the underflow launder and gravitate to the feed chute of the ball mill for further grinding. Provision will be made to divert a portion of the cyclone underflow to the SAG mill to balance milling power draws if required.

The ball mill will typically operate at ~30% volumetric ball loading and at a fixed 75% of critical speed. The ball mill will discharge via a trommel with the trommel oversize (scats) reporting to the scats bunker and trommel undersize gravitating to the cyclone feed hopper where it will combine with the SAG mill product and be pumped to the hydrocyclone cluster for subsequent classification.

Steel grinding media will be added to the ball mill feed hopper using a hoist and a kibble arrangement. The kibble will be charged with grinding media, hoisted to the ball charging level, and discharged into the ball mill.

The cyclone overflow (grinding circuit product) will gravitate to a single vibrating trash screen via a distribution box, where it will be screened to remove any misreporting coarse ore particles, wood fragments, organic material and plastics that may adversely affect the performance of the carbon circuit and 'peg' the intertank screens. Screen oversize trash material will report to the trash bunker while the screen undersize will gravitate to the pre-leach thickener via the pre-leach thickener feed box.

17.2.5 Gravity Circuit

The gravity circuit will be fed by a stream taken from the cyclone underflow splitter box and feeding the horizontal vibrating scalping screen to prevent coarse material from reporting to the gravity concentrator. Screen oversize will return to the ball mill feed hopper for further processing.

Undersize slurry from the scalping screen will feed a centrifugal gravity concentrator to remove coarse gold from the milling circuit recirculating stream. The coarse, high specific gravity material (gravity concentrate) will be periodically discharged to the concentrate storage hopper, while the centrifugal concentrator tails will gravitate to the cyclone feed hopper for further processing.

Gravity Concentrate Treatment

Gravity concentrate will be processed in batches through an intensive leach reactor (ILR) circuit located within a secure enclosure in the milling area.

The ILR will process the gravity concentrate once per day in a rotating drum leach vessel. A strong solution of sodium cyanide and caustic will be introduced into the slurry, and the drum will be rotated for up to 20 hours to leach the coarse gold while sparging with oxygen. The resulting leach solution (pregnant liquor) will be separated from the barren solids and pumped to the dedicated pregnant liquor tank adjacent to the gold room. Flocculant may be added to assist in settling of the solids. ILR tails will be pumped to the mill discharge hopper for additional milling and recovery of any remaining entrained gold.

17.2.6 Pre-Leach Thickening

The pre-leach thickener (32 m diameter) will increase the density of the cyclone overflow to around 45% solids to optimise the use of reagents, tank size and residence time. The thickener feed slurry will be mixed with flocculant to facilitate effective settling. Process water recovered from the pre-leach thickener will overflow to the pre-leach thickener overflow tank and then pumped to the process water pond. Thickened underflow slurry will be pumped by dedicated duty / standby underflow pumps to the to the leach feed distribution box, from where it will flow to the pre-oxidation tank and then to the leach tank.

The pre-leach thickener area will be bunded and a sump pump installed within the bunded area. Spillage and wash down will be collected by the sump pump and will be returned to the thickener feed box.

17.2.7 Pre-oxidation and CIL Circuit

Pre-leach thickener underflow slurry will be pumped to the pre-oxidation tank and then flow on through one leach and six CIL tanks.

In the pre-oxidation tank, leach feed slurry will be introduced to oxygen gas to assist in oxidation of sulphide minerals. Oxygen generated by vacuum or pressure swing adsorption type plants on site will be injected into the slurry in the pre-oxidation tank.

Gold will be leached from the milled ore using sodium cyanide and oxygen. The dissolved gold leached from the ore will be recovered from the leach solution by adsorption onto activated carbon. The carbon will be periodically removed from the slurry and further processed to recover the gold.

The leach and adsorption circuit will consist of one leach and six CIL adsorption tanks operating in series which, together with the pre-leach tank, will be sized to provide the required leaching residence time. All tanks will be identically sized (4,000 m^3 each) to provide the required leaching residence time.

The tanks will be interconnected with launders and slurry will flow by gravity through the tank train. Each CIL tank will be equipped with two inter-tank screens per tank and a recessed impeller carbon transfer pump to facilitate carbon transfer between adjacent tanks. Each inter-tank screen will be a stainless steel wedge wire cylinder equipped with an internal agitator and external rotating wiper blade mechanism to prevent screen blinding and effectively pump the slurry to the next tank whilst retaining carbon within the tank. The launder arrangement will allow any tank to be bypassed for maintenance, if required.

Quicklime (added to the mill feed conveyor) will ensure that the slurry pH is sufficiently elevated for cyanidation. Sodium cyanide solution will be metered into the CIL circuit from the cyanide ring main. Oxygen gas will be sparged down the shaft of the individual tank agitators to maintain the required dissolved oxygen concentration within the slurry.

Regenerated barren carbon will be added to the final tank (CIL Tank 6) of the CIL circuit and will be advanced counter-current to the slurry flow, allowing leached gold to adsorb onto the carbon and be recovered from the CIL slurry. The carbon will be advanced by pumping slurry and carbon from the downstream to the adjacent upstream tank. Any carbon will be retained in the upstream tank by the intertank screen whilst the slurry will flow by gravity back to the downstream tank. This counter-current process will be repeated until the carbon eventually reaches the first CIL tank (CIL Tank 1).

Carbon loaded with gold (loaded carbon) will be removed from the circuit by pumping CIL Tank 1 slurry and carbon to the loaded carbon recovery screen. The loaded carbon will be washed on the screen to remove fine ore particles and will report as screen oversize to the elution circuit. The screen undersize slurry will gravitate back to CIL Tank 1.

Barren slurry from CIL Tank 6 (CIL tails) will gravitate to the carbon safety screen to recover any fugitive carbon which may have passed through worn screens or overflowed from tanks. Screen undersize slurry will gravitate to the cyanide destruction circuit and the screen oversize (recovered carbon) will be collected in the carbon bin for subsequent return to the circuit.

Recycle barren carbon transferred from the carbon regeneration kiln will be screened on the carbon sizing screen to remove fine carbon and quench / transfer water. The regenerated and screened carbon will discharge from the sizing screen directly to CIL Tank 6.

A gantry crane mounted on rails on top of the CIL tanks will provide easy access for intertank screen and carbon transfer pump maintenance.

17.2.8 Elution and Goldroom Operations

The following operations will be carried out in the elution and goldroom areas:

- Acid washing of carbon.
- Stripping of gold from loaded carbon back into solution using a split AARL method.
- Electrowinning of gold from solution.
- Filtration, drying, and smelting of electrowinning sludge.
- Regeneration of barren carbon.

The split AARL stripping circuit will be automated and will contain separate acid wash and elution columns. The total daily carbon movement around the elution circuit, assuming one elution per day, will be eighteen tonnes.

Acid Wash

Loaded carbon will be received into the acid wash column from the loaded carbon screen. During acid washing, a dilute solution of hydrochloric acid will be pumped into the bottom of the column to remove contaminants, predominantly carbonates, from the carbon. Upon completion of acid soak, a rinse step will commence with addition of filtered water to remove residual acid before pressure transferring the acid washed loaded carbon to the adjacent elution column. Dilute acid and rinse water from the acid wash column will report directly to the tailings hopper.

The acid wash area will be bunded and the area serviced by a sump pump. The sump pumps will deliver acidic effluent or spillage to the tails hopper.

Elution

Acid washed carbon will be hydraulically transferred into the elution column and the excess transfer water will be drained from the column through the strainer manifold.

The split AARL elution process will be used to recover gold adsorbed onto the carbon recovered from the CIL circuit. Prior to elution of gold from a batch of acid wash carbon, lean eluate from the previous batch in the lean eluate tank will be heated to approximately 95°C and pumped into the base of the elution column using the strip solution pump. Sodium hydroxide (NaOH) and sodium cyanide (NaCN) solutions will be pumped from the respective storage tanks and injected into the suction line of the strip solution pump. The loaded carbon will be pre-soaked in the cyanide and caustic solution for 30 minutes to elute the gold.

The pregnant eluate will then be rinsed from the carbon by up to ten bed volumes of solution heated to ~135°C. The first five bed volumes of the elution will be drawn from the lean eluate tank and directed to the pregnant solution tank for recovery of gold by electrowinning. The last five bed volumes of the elution will be drawn from the treated water tank and will be directed to the lean eluate tank for re-use in the subsequent elution cycle. Two pregnant solution tanks will be installed to allow an elution batch to be initiated if the prior batch electrowinning is still underway.

Once elution is complete, the eluted carbon will be cooled with water prior to being transferred to the hopper above the carbon regeneration kiln.

Strip solutions will be heated indirectly by a diesel fired oil heater and a heat exchanger. Heat recovered from solution exiting the elution column will be used to pre-heat the strip solution.

Solution samplers will be provided to collect pregnant and stripped eluent for assay.

Strainers will be installed on the elution column outlet.

A sump pump will be installed in the elution area.

Electrowinning and Goldroom

Once the elution cycle is completed, recovery of gold by electrowinning will proceed. Pregnant solution will be pumped from the pregnant solution tank through two electrowinning cells arranged in parallel. Direct current will be passed through stainless steel anodes to stainless steel wool mesh cathodes to deposit precious metal as a 'sludge' on the cathodes.

Barren electrolyte will be pumped to the CIL feed to recover residual gold values and utilise residual cyanide.

Rectifiers, one per cell, will be located in a position accessible from outside the goldroom high security area to enable maintenance access without breaching goldroom security. Rectifier remote indication and controls will be located adjacent to the electrowinning cells. In normal operations, an electrowinning batch will be completed in less than a single 12 hour shift.

Pregnant liquor from the gravity circuit will be pumped from the ILR pregnant liquor tank through a dedicated electrowinning cell in the goldroom. Gold will be recovered onto the stainless steel mesh cathodes and the solution recycled to the ILR pregnant liquor tank. Recirculation of the solution through the electrowinning cell will continue until the solution precious metal tenor is sufficiently depleted. The barren liquor will then be returned to the CIL circuit. Once electrowinning is complete, the cathodes from the gravity electrowinning cell will be processed separately from the CIL electrowinning cathodes in order to determine the gravity gold recovery and to assist in metallurgical accounting.

An overhead crane within the goldroom will be provided to assist with cathode and anode handling. The cathodes will be washed with high pressure spray water and the gold sludge will be recovered in a vacuum pan filter. The filtered sludge will be placed in trays and dried in an oven, before being mixed with fluxes and smelted in a diesel fired furnace to produce doré bars.

Fume hoods, ducting, and extraction systems will be provided to remove fume and off-gas from the electrowinning cells, drying oven, and barring furnace. In addition, a number of air fans will be installed to provide adequate ventilation inside the goldroom.

Carbon Regeneration

After completion of the elution process, eluted (barren) carbon will be hydraulically transferred from the elution column to the dewatering screen in the carbon regeneration circuit. The screen will remove the majority of contained water prior to the carbon discharging into the feed hopper of the diesel-fired carbon regeneration kiln. In the feed hopper, most of the residual and interstitial water will be drained from the carbon before it enters the kiln.

During the regeneration process, the carbon will be heated to between 650°C and 750°C and maintained within this temperature range for ~20 minutes to allow effective carbon regeneration to occur. Regenerated carbon from the kiln will discharge to the quench tank where it will be quenched with raw water before being pumped on a batch basis to the carbon sizing screen located above the final CIL tank. Carbon screen undersize (raw water and fine carbon) will gravitate back to the quench tank for recycle as quench water with provision to periodically divert this stream to the CIL tails launder to prevent accumulation of carbon fines within the quenching circuit.

17.2.9 Tailings Treatment

Cyanide Destruction

A SO_2 / oxygen cyanide destruction circuit will be utilised to meet the ICMC tailings discharge requirements of less than 50 mg/L of weak acid dissociable cyanide (CN_{WAD}) in the tailings slurry.

Screened CIL tails will gravitate to the cyanide destruction circuit comprising two mechanically agitated tanks interconnected with launders to allow the circuit to be run in parallel or series. Copper sulphate and sodium metabisulphite (SMBS) solutions will be added to provide the required copper and sulphur dioxide for the cyanide destruction process. Gaseous oxygen gas will be sparged into the tanks through externally mounted spargers to achieve the target dissolved oxygen concentration. The ability to add caustic solution to the cyanide destruction circuit to maintain slurry pH between 8.0 and 9.0 will also be provided.

Cyanide destruction discharge will gravitate to the tailings thickener.

17.2.10 Tailings Disposal

Plant tailings and other miscellaneous waste streams from the process plant will be combined in the tails thickener and thickened to between 55% (oxide ores) and 65% (primary ores) solids before being pumped to the TSF by the single stage duty / standby pumps. Process water recovered from the tailings thickener will overflow to the tailings thickener overflow hopped and then pumped to the process water pond for re-use in the process plant.

The tailings hopper area will be bunded and a floor sump pump installed within the bunded area. Spillage and wash down collected by the sump pump will be returned to the hopper.

Tailings will be deposited into the TSF using established discharge and decant methods, as described in Section 18. The supernatant water (decant return) will be pumped to the plant process water circuit for re-use.

Any plant spillage that may contain cyanide will report to plant bunding which will overflow to the event drainage channel and will gravitate to the event pond.

17.2.11 Reagents

Reagents Storage

Reagents will be received on site either in bulk (grinding media) or in shipping containers, with a minimum of 30 days capacity stored on site, to ensure that supply interruptions due to port, transport or weather delays do not restrict production. Reagent containers will be offloaded from the delivery truck by the site crane and stacked in a lay-down area until required. Empty containers will be returned with the next delivery.

The reagents utilised within the process plant will include:

- Lime for pH control in leaching and cyanide destruction.
- Sodium cyanide for gold dissolution in leaching and elution.
- Caustic soda for carbon acid washing neutralisation, elution and electrowinning.
- Hydrochloric acid for carbon acid washing.
- Flocculant for pre-leach and tailings thickening.
- Copper sulphate for cyanide destruction.
- Sodium metabisulphite for cyanide destruction.
- Anti-scalant to minimise scaling in the water systems and elution circuit.

- Fluxes for smelting.
- Diesel fuel for elution circuit heaters, reactivation kiln and smelting furnace.

Quicklime

Quicklime will be delivered to site in bulk tankers and pneumatically transferred to the 285 tonne capacity lime silo. The silo will be equipped with a reverse pulse bag filter to minimise dust emissions during loading, and a bin activator to prevent compaction and blockages. Quicklime will be metered from the silo via a variable speed rotary valve directly onto the mill feed conveyor for circuit pH control.

Sodium Cyanide

Sodium cyanide will be delivered as dry briquettes in bulk bags in boxes. The cyanide bags will be removed from the crates and the contents of the bags added to a mixing tank via a bag breaker and dissolved in process water to achieve the required solution concentration (20%w/v NaCN).

The cyanide solution will be transferred to the storage tank for use in the process. Cyanide will be reticulated to the CIL circuit via a ring main and dosed to the CIL tanks as required. A dedicated pump will provide cyanide solution for the elution circuit and intensive cyanidation reactor as required.

Sodium Hydroxide

Caustic soda (sodium hydroxide) will be delivered to site as dry 'pearl' pellets in bulk bags. Sodium hydroxide flakes will be released from the bulk bag by the bag splitter into filtered water that will have been added to the mixing and storage tank to achieve a solution of the desired caustic concentration. The mixing tank will be mechanically agitated to assist with dissolution.

Following completion of the mixing cycle, sodium hydroxide solution will be dosed by dedicated metering pumps which will deliver caustic solution to the elution circuit, intensive cyanidation reactor, cyanide destruction facilities and cyanide mixing tank.

Hydrochloric Acid

Concentrated hydrochloric acid will be delivered to site in intermediate bulk containers (IBCs). The concentrated hydrochloric acid will be pumped into the acid mixing and storage tank where the correct quantity of filtered water will have already been added to achieve the target concentration (3%w/v HCl) for acid washing. The dilute acid will be pumped to the elution circuit as required.

Activated Carbon

Activated carbon will be delivered in bulk bags. Fresh carbon will be added to the CIL circuit via the carbon quench tank as required for carbon make-up to the CIL inventory. The carbon will then be transferred from the hopper to the carbon sizing screen to remove fine carbon particles. The screened oversize carbon will discharge to the final CIL tank.

Grinding Media

Grinding balls (125 mm diameter for the SAG mill, 50 mm diameter for the ball mill) will be delivered to site and will be charged to the SAG and ball mills, as required, to achieve the target power draws. The SAG mill media bulk bags will be delivered from the storage area by forklift and discharged into a ball bunker adjacent to the reclaim hopper. A FEL will then load the media into the reclaim hopper, as required, for subsequent discharge onto the mill feed conveyor. Ball mill media will be delivered from the storage area by forklift and discharged into a kibble. The mill charging hoist will then hoist the kibble into position above the ball mill charge chute for subsequent discharge into the ball mill feed box.

Flocculant

Flocculant powder will be delivered to site in bulk bags and subsequently added to the flocculant plant storage hopper. The vendor supplied package flocculant mixing plant will automatically mix batches of flocculant with raw water and transfer the mixed flocculant to a separate storage tank after each mixing cycle is complete.

Flocculant solution will be metered from the storage tank to the pre-leach and tailings thickeners using duty / standby flocculant dosing pumps. A dedicated flocculant dosing pump will enable flocculant to be added to the intensive leach reactor.

Sodium Metabisulphite

Sodium metabisulphite (SMBS) will be delivered to site in bulk bags as a dry powder. SMBS will be added to the agitated mixing tank using a hoist and bag breaker. The powder will be dissolved in filtered water to achieve the target solution concentration (20%w/v $Na_2S_2O_5$).

After mixing, the SMBS solution will be transferred to the storage tank and then metered to the cyanide destruction circuit using duty / standby dosing pumps. Both the mixing and storage tanks will be vented to atmosphere via an extraction fan to prevent accumulation of SO_2 in the SMBS make-up and storage area.

Copper Sulphate

Copper sulphate will be delivered to site in bulk bags as a dry powder. Copper sulphate bags will be added to the mixing tank via a bag breaker on the receiving hopper and then dissolved in filtered water to the target solution concentration (20% w/v $CuSO_4$).

The copper sulphate buffer tank will be used as the dosing tank during copper sulphate mixing. Once mixing is complete and the mixing tank is full, the buffer tank will be refilled. Copper sulphate solution dosing into the cyanide destruction circuit will be from a dosing pump, either from the mixing tank or buffer tank, as required.

Fluxes

Sodium borate (borax), silica flour, sodium nitrate (nitre), and sodium carbonate (soda ash) will be used as fluxes for gold smelting. The fluxes will be delivered in 25 kg bags and mixed in small quantities with the dried gold sludge prior to smelting.

Diesel

Diesel will be delivered to site by road tanker and transferred into a bulk storage tank. The diesel will be used in the mine, the process plant, for emergency generators, and to refuel site vehicles.

Diesel will be pumped from the storage tank to the plant diesel header tank for use in the elution heater and carbon regeneration kiln and for refuelling plant mobile equipment.

Diesel reservoirs for the incinerator, firewater, and pit dewatering pumps will be filled from a site service tanker.

17.2.12 Water Services

Raw Water

Raw water for the process plant will be sourced from the water harvest dam collecting rainfall runoff and pumped to the water storage dam. Duty/standby pumps extract water from the dam and pump into the booster pump feed tank. Raw water is pumped using duty/standby raw water booster pumps from this tank to the raw water tank located at the process plant. The tank will be kept full and the overflow used for make up to the process water pond. The raw water tank will have sufficient capacity to minimise the impact of short term supply interruptions. Dewatering water from the mine pit will also be pumped, to the water storage dam.

Raw water will be used to feed the potable and filtered water treatment plants for reagent mixing, gland water and cooling water make up.

Duty and standby raw water pumps will distribute raw water to the plant, mine, and camp areas, while a dedicated gravity fluidisation pump will draw from the raw water suction manifold and deliver fluidising water to the gravity concentrator.

Fluidising Water

A dedicated gravity fluidisation water pump will draw from the raw water tank suction manifold and deliver fluidising water to the gravity concentrator, thereby ensuring consistency of supply flow and pressure.

Firewater

Firewater for the process plant will be drawn from the reserve in the lower section of the raw water tank. The firewater pumping system will comprise:

- An electric jockey pump to maintain fire ring main pressure.
- An electric firewater delivery pump to supply firewater at the required pressure and flowrate.
- A diesel driven firewater pump that will automatically start if power is not available for the electric firewater pump or that the electric pump fails to maintain pressure in the firewater system.

Fire hydrants and hose reels will be located throughout the process plant, fuel storage and plant offices at intervals that ensure complete coverage in areas where flammable materials are present.

A separate firewater system will be provided for the accommodation camp, depending on the camps final location, again comprising a jockey pump and electric and diesel-driven firewater pumps. The firewater will be reticulated throughout the accommodation camp via a pressurised main to a series of fire hydrants and hose reels. The campfire water pumps will draw suction from the camp raw water tanks, which in turn will be supplied from the camp bore water pumps.

Process Water

Overflow from the pre-leach and tailings thickeners will report to the process water pond, as well as decant water returned from the TSF. Overflow from the raw water tank will also gravitate to the process water pond and provide any make-up necessary for the process water circuit. The process water pond will also receive reclaimed water from the event pond and backwash from the water treatment plant. Duty / standby process water pumps will be provided for the plant process water supply.

Antiscalant will be added as required to condition the water and reduce fouling of pipelines, spray nozzles and screen decks.

Filtered and Potable Water

Filtered water for the process plant will be produced by treating raw water in the filtered water treatment plant. The treatment plant will consist of clarification through flocculant addition, sand filtration, carbon filtration and biocide dosing. Filtered water will report to the filtered water tank and will be distributed, using duty / standby filtered water pumps, to the elution circuit and for a number of reagent mixing duties.

Raw water will be supplied to a water filtration plant in the process plant. Water will be filtered and sent to the filtered water tank and a potable water treatment plant for sterilisation. The resulting potable water will report to the plant potable water tank. Duty / standby plant potable water pumps will reticulate potable water to the plant ablutions, safety showers as well as the nearby administration offices and Mining Services Area (MSA). Additional ultraviolet sterilisation units will be installed on outgoing potable water distribution headers if required. A camp potable water treatment plant, fed with raw water from the camp raw water tanks will generate potable water for the accommodation camp. Potable water will report to the camp potable water tank and duty / standby potable water pumps will reticulate the water throughout the accommodation camp. Additional ultra-violet sterilisation will be provided on the outgoing potable water distribution header.

Filtered water will be used in the plant for some reagent mixing, cooling system make up, acid wash and eluant solution make up, high pressure cathode wash sprays and elution heat exchanger de-scalant make up gland water.

Water from the filtered water storage tank will be distributed as gland service water using duty / standby gland water pumps.

Cooling Water

Cooling water for the SAG and ball mills will be circulated through an evaporative water cooling tower and heat exchanger. Filtered water will be added to the cooling tower sump to supplement the water loss from evaporation and blowdown. Antiscalant and biocide will be dosed into the cooling water system to maintain water quality.

17.2.13 Plant Services

Sewage Collection and Treatment

Raw sewage from the plant site will be collected and pumped to the plant sewage treatment plant using a network of forwarding pumps. The sewage treatment plant will comprise an aerated equalisation tank, a moving bed bioreactor (MBBR), sand filtration, and chlorine disinfection post treatment using a 12% w/w solution of sodium hypochlorite. Grey water from the treated sewage will report to the plant treated sewage tank for subsequent use as irrigation water for the mine site. The waste sludge will report to the sludge collection tank and will be removed on a demand basis (nominally once per month) using a vacuum truck and despatched for disposal off-site.

Event Pond

Any spillage within the process plant which over-tops the various bunded areas will gravitate to the polyethylene lined event pond located at a low point in the overall process plant layout. The solids reporting to the event pond will be allowed to settle before recovering the supernatant solution to the process water pond using the submersible event pond pump. When the majority of the supernatant has been recovered, the solids will be repulped using a monitor cannon supplied with process water before pumping the resulting slurry to the cyanide destruction feed box using the same submersible pump.

17.2.14 Air Services

Plant and Instrument Air Supply

High pressure air at nominally 700 kPag will be provided by two high pressure air compressors, operating in a lead lag configuration. The entire high pressure air supply will be dried and can be used to satisfy both plant air and instrument air demand.

Dried air will be stored in one primary air receiver before being distributed throughout the plant, including the assay laboratory. Additional secondary air receivers will be located throughout the plant as required including at the grinding area for the mills auxiliary equipment.

Oxygen

A pressure swing adsorption (PSA) oxygen plant will be installed which will generate an oxygen rich (~90% O_2) gas stream. Gaseous oxygen will be reticulated under pressure from the oxygen receiver to the intensive leach reactor, CIL and cyanide destruction circuits.

LP Blower Air

A series of low pressure air blowers will be installed to provide LP air (@300 kPa(g)) for the CIL, cyanide destruction circuits.

17.3 Plant Layout and Design Considerations

The plant layout drawings have been developed based on an appropriate level of engineering effort required for a PFS and to support the current level of capital cost estimation. In order to accomplish this, the drawings include typical details for a plant of this flowsheet, capacity and scale.

The plant has been located to suit the available usable area, while providing appropriate access for all supporting infrastructure including mining, power supply, tailings storage, and accommodation camp. Due consideration for the interaction of these activities is critical for the effective operation of the processing plant and is captured in the overall plant layout.

The design approach adopted reflects industry accepted ‘good practice’. This principle will be continued and further developed during the subsequent DFS and detailed engineering of the project. The preliminary design incorporates Lycopodium’s extensive experience in gold plant design and project implementation in West Africa.

As elements of previous Lycopodium designs have been used to develop cost estimates, the estimates inherently represent the cost of designs compliant with local regulatory requirements and Australian standards.

Where practical, general project facilities will be located around the process plant site to maintain a single centre of operations. Other facilities provided are divided into the following categories:

- Mine services area (refer Section 16).
- Administrative and general support services (refer Section 18).
- TSF (refer Section 18).

The main exception to this is the accommodation camp which is considered somewhat remote from the process plant (refer Section 18).

17.3.1 Site Location and Layout

The plant site is located north east of the Souwa pit and adjacent to the haul road connecting Doropo and the Nokpa / Chegue pits. The existing mine access road that will run through Doropo pit will be decommissioned and a new bypass road will be constructed that provides road access to the plant and Doropo town site. The new accommodation camp will also be accessed from the new bypass road and will be located approximately 2 km from the process plant. The TSF is located to the west of the process plant and the natural ground level slopes towards this location. There are very few practicable alternative locations for the plant site due to the topography, mine pit locations, blast exclusion zones, location of the TSF, and mining lease boundaries. The final location of the plant site may be optimised further when detailed geotechnical assessments are completed during the DFS phase.

The layout of the plant roads and equipment takes into account the need for ease of access to perform maintenance activities. Utilisation of mobile cranes for maintenance activities has been maximised.

The weather data for this general area indicates that the prevailing wind is from the north and of low velocity, with a typical maximum of 14 m/s therefore the plant is not expected to be affected by dust from the main pits or waste dumps.

17.3.2 Earthworks and Drainage

The plant site will be cleared, cut back and prepared, as required, to provide the necessary level areas and to accommodate drainage falls across the site.

Rainfall run-off from outside the bunded process areas within the main processing plant will be captured in the plant surface drainage channels and diverted to sediment control dams on the outskirts of the plant and infrastructure facilities.

Wherever possible, run-off from areas not subject to potential contamination will be diverted around the plant and re-join the natural watercourses.

17.3.3 Water Supply

The raw water supply to the processing plant will the water harvest dam as described in Section 18.3.

Raw water will be distributed throughout the processing plant for process use from a raw water tank and will be used as feedstock for potable and filtered water treatment plants. The water supply lines to external facilities including mine services and camp areas will be buried, thus minimising the opportunity for unsolicited access.

17.3.4 Plant Area Buildings and Infrastructure

The plant area will be surrounded by a double security fence provided with perimeter lighting and camera monitoring. The secure process plant area will contain the following support facilities:

- Plant offices of prefabricated modular construction incorporating meeting room, ablutions and lunchroom.
- Plant workshop / warehouse of clad steel frame construction with external hardstand and prefabricated offices and ablutions.
- A plant meals facility for serving meals to plant operations and maintenance personnel.
- Appropriate reagent storage sheds with concrete floors, sumps and facilities to isolate, separate and handle hazardous goods.
- Assay laboratory of prefabricated modular construction with sample preparation and fire assay facilities to process grade control and plant process control samples.
- A security gatehouse at the entrance to the plant gate incorporating security facilities, changerooms and ablution facilities.
- HV switchyard.
- A plant control room mounted on top of the CIL tanks.
- Fuel depot including an unloading bay and 2 x 900 m^3 diesel storage tanks, bulk lubricant storage and distribution. Transfer pumps supplying day tanks in the plant and MSA are also included. The facility is appropriately bunded. The distribution of fuel will be securely managed.
- Substations servicing the crushing, reclaim, milling, CIL, and plant services within the main plant area.

17.4 Electrical Design

The Project, including all mining and processing facilities, accommodation and infrastructure is estimated to have a maximum demand of approximately 30 MW, and an average load of 20 MW. The largest single loads will be the SAG mill and ball mill, each with an installed motor power of 6.9 and 9.0 MW respectively. The SAG mill will be provided with a VVVF drive which will minimise the impact on the power system during starting, while the ball mill will have a liquid resistance starter.

17.5 Control System

17.5.1 General

The general approach to automation and control for the plant will be one with a moderate level of complexity offering the option of local control and remote monitoring or control from a central control room. Instrumentation will be provided within the plant to measure and control key process parameters to minimise operator intervention in standard start-up functions and to provide key monitoring and control to minimise process excursions and maintain steady operation.

The main control room will house two PC based operator interface terminals (OIT). Two additional servers will also be located here to act as the control system supervisory control and data acquisition (SCADA) servers in a redundant configuration. The control room is intended to provide a central area from where the plant is operated and monitored and from which the regulatory control loops can be monitored and adjusted. All key process and maintenance parameters will be available for trending and alarming on the process control system (PCS).

The PCS that will be used for the plant will be a programmable logic controller (PLC) and SCADA based system. The PCS will control the process interlocks and PID control loops for non-packaged equipment.

Vendor supplied packages will use vendor standard control systems throughout the project. Vendor packages will generally have limited interfaces with the PCS such that control and set-point changes may have to be adjusted locally. General equipment fault alarms from each vendor package will be monitored by the PCS and displayed on the OIT. Fault diagnostics and troubleshooting of vendor packages will be performed locally.

17.5.2 Field Input / Output

All instrumentation and field controls will be captured by the PCS via remote I/O modules, generally located at each process module of the plant, primarily to minimise the extended cable run lengths back to switchrooms. These remote I/O modules are electrical field enclosures housing power supplies, network equipment, marshalling terminals and PLC remote I/O nodes. All remote I/O nodes will be linked to the PLC via a PCS Ethernet network, supported over the site fibre optic cabling between switchrooms, remote I/O modules and key infrastructure buildings.

17.5.3 Drive Control

In general, the plant process drives will report their ready, run and start pushbutton status to the PCS and will be displayed on the OIT. Local control stations will be in the field in proximity to the relevant drives. These will, as a minimum, contain start and latch-off-stop (LOS) pushbuttons which will be hard-wired to the drive starter. Plant drives will predominantly be started by the control system in automatic operation.

The OITs will allow drives to be selected to Auto, Local, Remote or Out-of-Service modes via the drive control popup. Statutory interlocks, such as emergency stops and thermal protection, will be hardwired and will apply in all modes of operation. All PLC generated process interlocks will apply in Auto and Remote modes. Process interlocks will be disabled or bypassed in Local mode except for critical interlocks such as lubrication systems on the mills.

Local selection will allow each drive to be operated by the operator in the field via the local start pushbutton. Remote selection will allow the equipment to be started from the control room via the drive control popup. Status indication of process interlocks, as well as the selected mode of operation, will be displayed on the OIT.

17.5.4 Control Loops

Regulatory control loops will be provided for all key process circuits to provide optimal functionality without regular operator intervention.

There will be two modes for loop controlled setpoints available in the OIT. These are 'Loop Auto Mode' and 'Loop Manual Mode'. In Loop Auto Mode (analogous to cascade control), the setpoint will be predominantly controlled by the applicable 'master' PID loop (e.g. for thickener underflow pumping control the bed pressure PID controller output will supply a setpoint for the thickener underflow flow control loop which ultimately controls the speed of the thickener underflow pump). In Loop Manual Mode, a setpoint may be entered manually from the loop setpoint pop up in the OIT.

Where required, analogue setpoints from the PCS to vendor supplied control panels can be adjusted either via the OIT or via vendor control panels.

17.6 Communications

17.6.1 Network Topology

The onsite communications network is designed around a site-wide fibre optic backbone which will be shared by all services. This will minimise cabling and related communications equipment and be installed in underground conduits, cable tray and via the overhead powerline. The services that will use the common fibre optic backbone include:

- Corporate LAN including telephony (Voice over Internet Protocol – VoIP).
- Plant Control System.

- CCTV / Security Services.

17.6.2 External Connectivity

A microwave internet link will provide external network connectivity to the site. Camp entertainment services will be provided via satellite TV with dishes located on each senior accommodation building.

17.6.3 Private Mobile Radio (PMR)

Cost allowances have been made to provide a site-wide PRM system typically supported above ground by a 30 m high communications tower. Heavy and light vehicles will be equipped with radios and allowance has been made for hand-held radios to be used for intra-plant communications.

17.6.4 Server / Computer Infrastructure

Corporate servers, network switches and a firewall will be installed onsite to support the users locally with the expectation the proponent will implement a VPN link to any remote central office as required. An allowance for staff workstations / laptops has been made along with required software and office equipment such as docking stations, monitors, photo-copiers and cabling.

17.6.5 CCTV / Security

CCTV cost allowances have been made to incorporate general plant coverage, 'no-man's land' perimeter monitoring, access gates coverage and detailed coverage of the concentrator and gold room. Security cost allowances include automated access boom gates to the site and swipe card access control to the gold room, switch rooms, control room and server room.

17.7 Metallurgical Accounting

Provision will be made for monitoring instrumentation and field measurement totalisation to assist with metallurgical accounting for the operation. Automatic stream samplers will be provided for the leach feed and adsorption tails streams to provide shift composite samples for leach head grade and tails solution and residue grades.

Weightometers will be located on the following conveyors throughout the plant:

- Stockpile feed conveyor will measure the tonnage of primary crushed ore.
- SAG Mill feed conveyor will measure mill feed tonnes.
- Pebble transfer conveyor will measure the mill pebble discharge being recirculated to the SAG mill feed.

Automated stream samplers on the leach feed and adsorption tails streams will ensure reliable composite shift samples for leach head grade and tails solution and residue grades.

Density and flow meters on the leach feed and plant tailings lines will allow the dry tonnage of solids pumped to the leach circuit and TSF to be determined as a cross check of the mill feed tonnage determined from the mill feed weightometer. In conjunction with the leach feed and plant tails samples, the mass flow measurements will allow the gold recovered in the leach / CIL to be calculated.

A dedicated electrowinning cell will be provided for recovery of the gold leached by intensive cyanidation of gravity concentrate and the recovered gravity gold sludge can be smelted separately. The plant head grade can be back-calculated from the gravity and leach head grade.

Regular gold in circuit (GIC) surveys will allow reconciliation of precious metals in feed compared to doré production.

Water supplied and used in the various areas will be continuously monitored.

Reconciliation of the amount of reagents used over relatively long periods will be achieved by delivery receipts and stock takes. On an instantaneous basis, reagent usage rates to unit operations will be measured (L/h) and accumulated (m^3) using flow meters.

Doropo Gold Project

Pre-feasibility Study

National Instrument 43-101 Technical Report

2234-GREP-001

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18.0 PROJECT INFRASTRUCTURE

18.1 Site Development

Knight Piésold Pty Ltd (KP) was commissioned by Centamin to undertake a Prefeasibility Study (PFS) of the following site infrastructure for the Doropo Gold Project:

- Tailings Storage Facility (TSF).
- Water Storage Dam (WSD).
- Water Harvest Dam (WHD).
- Sediment Control Structures (SCS).
- Haul Access Road (HAR).
- Site Access Road (SAR).
- Site Airstrip.

The project comprises open pit mining operations, waste dumps, TSF, WSD, WHD and a process plant. The processing plant has been designed to treat ore at a rate of 4 Mtpa.

18.2 Tailings Storage Facility (TSF)

18.2.1 Design Objectives

The design objectives for the TSF are as follows:

- Permanent and secure containment of all solid waste materials (tailings) generated by the process plant.
- Maximisation of tailings densities using subaerial deposition.
- Removal and reuse of free water as much as practicable.
- Reduction and control of seepage.
- Excess storage capacity to retain ANCOLD prescribed design storms and annual rainfall sequence, including containment of runoff from upstream catchments.
- Rapid and effective rehabilitation.
- Ease of operation.

- Monitoring network comprising embankment piezometers, survey pins and groundwater bores.

18.2.2 Design Criteria

The TSF has been designed to ANCOLD guidelines. Design criteria for the TSF are summarised in Table 18.2.1.

An ANCOLD consequence category of 'High B' was determined on the basis of a potential Persons at Risk (PAR) in the range of '≥10 to <100' and a Severity Level of 'Major'. An ANCOLD environmental spill consequence category of 'Significant' was determined on the basis of a potential PAR in the range of '<1' and a Severity Level of 'Major'.

Table 18.2.1 TSF Design Standards

Design Standards	
TSF Consequence Category	High B
Dam Spill Consequence Category	Significant
Design Storage Allowance Parameters: • Design storage allowance • Extreme storm storage	 1% AEP notional wet season runoff (1 in 100) 1:100 AEP 72-hour storm
Contingency Freeboard: • Wave Run-up • Additional Freeboard	 1:10 AEP wind 0.5 m
Emergency Spillway Design Parameters: • Design Flood • Wave Freeboard Allowance	 Probable Maximum Flood (PMF) None
Earthquake Loading: • Operating • Final	 Operating Basis Earthquake (OBE) Safety Evaluation Earthquake (SEE)
Operations	
Capacity: • Final • Starter	 41 Mt of dry tails 6 Mt of dry tails (15 months initial capacity)
Production Rate	4.0 – 5.4 Mtpa.
Slurry Characteristics: • Density: Stage 1 Final	 0.73 – 1.25 t/m^3 (assumed, to be confirmed after density modelling). 1.40 t/m^3 (assumed, to be confirmed after density modelling).

Notes: AEP – Annual Exceedance Probability

18.2.3 Design Summary

The TSF will comprise a cross valley storage formed by multi-zoned earth fill embankments, comprising a total footprint area (including the basin area) of approximately 166 ha for Stage 1 increasing to 346 ha for the final stage facility.

The TSF is designed to accommodate a total of 41 Mt of tailings. The Stage 1 TSF is designed for 18 months storage capacity. Subsequently, the TSF will be constructed in annual raises to suit storage requirements. This may be adjusted to biennial raises to suit mine scheduling during the operation. Downstream raise construction methods will be utilised for all TSF embankment raises. Staged embankment crest elevations and heights are presented in Table 18.2.2.

Table 18.2.2 TSF Staged Embankment Levels

Stage	Tailings Storage (Cumulative) (Mt)	TSF Embankment Elevation (m RL)
1	6.0	325.7
2	10.0	327.7
3	14.0	329.9
4	18.0	331.9
5	22.0	333.5
6	26.0	334.6
7	30.0	335.7
8	34.0	337.0
9	38.0	338.3
10	41.0	339.6

The TSF embankment will have an upstream slope of 3H:1V (to facilitate HDPE geomembrane liner installation), an operating downstream slope of 3H:1V and a minimum crest width of 10 m. The final downstream embankment profile will consist of an overall slope of approximately 3.5H:1V, comprising a 3H:1V slope with benches at 10 m vertical intervals. The embankment upstream face will be lined with textured HDPE geomembrane liner, to allow safe egress from the TSF. A downstream seepage collection system will be installed within and downstream of the TSF embankment, to capture and return seepage from the TSF.

The TSF embankment will comprise an upstream low permeability zone (Zone A), and downstream structural fill zone (Zone C). Typical specifications for material types are summarised as follows:

- Zone A material will be won from borrow to form the low permeability zone of the embankments.

- Zone C material will be delivered to the embankment by the mining operation, levelled with a dozer and traffic compacted by loaded haul trucks on an ongoing basis during the operation. When material from the open pits is not available, Zone C material will be won from borrow.

- Zone F will be clean sand / gravel drainage material supplied to a stockpile adjacent to the works.

A cut off trench will be located beneath the upstream low permeability zone (Zone A) of the embankments. The cut-off trench will be excavated to extend through to competent low permeability foundation material and backfilled with low permeability fill (Zone A).

The TSF basin area will be cleared, grubbed and topsoil stripped, and a 200 mm thick compacted soil liner will be constructed over the entire basin, comprising either reworked in-situ material or imported low permeability material. The area within the TSF basin will be lined with 1.5 mm HDPE geomembrane liner, overlying the compacted soil liner.

The TSF design will incorporate an underdrainage system to reduce pressure head acting on the basin liner system, reduce seepage, increase tailings densities, and improve the geotechnical stability of the embankments. The underdrainage system will comprise a network of collector and finger drains. The underdrainage system will drain by gravity to a collection sump located at the lowest point in the TSF basin.

A leakage collection and recovery system (LCRS) will be installed beneath the basin composite liner to reduce water pressure build-up on the HDPE liner. Solution recovered from the underdrainage system and LCRS will be released to the top of the tailings mass via submersible pump, reporting to the supernatant pond.

Supernatant water will be removed from the TSF via submersible pumps located within a series of decant towers located within the north-eastern valley of the TSF basin. The decant pumps will be moved between towers as the supernatant pond migrates up the valley during the course of operation. Solution recovered from the decant system will be pumped back to the plant for re-use in the process circuit.

An operational emergency spillway will be available during TSF operation in order to protect the integrity of the constructed embankments in the event of emergency overflow. The spillway location will be excavated initially to form the spillway invert completely in cut into the eastern abutment of the TSF embankment. The spillway will be relocated in subsequent raises to higher ground as the embankments are raised.

Tailings will be discharged into the TSF by sub-aerial deposition methods, using a combination of spigots at regularly spaced intervals from the TSF embankment. A pipeline containment trench will be constructed during Stage 1 to contain both the tailings delivery pipeline and decant return pipeline between the TSF and Plant Site, to reduce environmental impact if the pipeline bursts.

18.2.4 Monitoring

Groundwater monitoring stations will be installed downstream of the TSF to facilitate early detection of changes in groundwater level and/or quality, both during the operating life and following decommissioning. Standpipe piezometers will be installed in the TSF embankment to monitor pore water pressures at several locations within the embankments to assess embankment stability. Survey pins will be installed at regular intervals along the TSF embankment crest in order to monitor embankment movements and assess the impact.

18.2.5 Closure Summary

At the end of the TSF operation, the downstream faces of the embankment will have a slope of 3H:1V, with 5 m benches located at 10 m height intervals, for an overall slope profile of approximately 3.5H:1V. The profile will be inherently stable under both normal and seismic loading conditions and will provide a stable surface water drainage system and will allow for revegetation.

Rehabilitation of the tailings surface will commence upon termination of deposition into the TSF. The closure spillway will be constructed in such a manner as to allow rainfall runoff from the surface of the rehabilitated TSF to discharge via the closure spillway.

The TSF closure spillway will be excavated after the remaining supernatant water is proven to be suitable for release and during rehabilitation of the tailings surface subsequent to decommissioning. The closure spillway will discharge into the existing drainage course downstream of the TSF. The TSF will be a fully water-shedding structure on closure. The closure spillway will allow conveyance of PMP storm events without any attenuation in the TSF.

The final soil cover for the tailings surface subsequent to decommissioning will be confirmed during operation based on on-going operational tailings geochemistry testing results. The following cover design for the tailings beach has been adopted at this stage but is subject to ongoing testing and review:

- Mine waste capillary break (500 mm).
- Low permeability fill layer (300 mm).
- Topsoil growth medium layer (200 mm).
- The finished surface will be shallow ripped and seeded with shrubs and grasses.

18.3 Water Management

18.3.1 Site Water Balance

The management of water is a critical aspect of the design of the Doropo Project. A water balance model was developed based on the following primary objectives:

- Establish the filling rate for tailings solids within the TSF and estimate the in-situ tailings density within the TSF taking into consideration the TSF basin storage parameters and assumptions based on similar projects in the region.
- Determine supernatant pond volumes within the TSF under average climatic conditions throughout operation.
- Determine supernatant pond volumes within the TSF for design wet rainfall sequences and storm events, check TSF storm water storage capacity and confirm the suitability of the current TSF design philosophy.
- Determine staged embankment crest elevations, to ensure containment of tailings and design supernatant pond volumes.
- Determine the likelihood of recycle water shortfalls during average conditions and design dry rainfall sequences.
- Determine the required WSD capacity to store make-up water for these shortfalls.
- Determine the required WHD capacity and abstraction rate (from WHD to WSD) to provide supplemental make-up water for shortfalls.
- Assess risk factors for water balance modelling.

The water balance modelling included the TSF, WHD, WSD and process plant, with a view to determining site water storage requirements. Design wet conditions were modelled to ensure that the TSF is designed with sufficient storage capacities to comply with design criteria. Key findings from the water balance modelling are as follows:

- The TSF is designed to hold the tailings plus the design rainfall conditions and thus has sufficient stormwater storage capacity for all design storm events and rainfall sequences.
- The supernatant pond volume peaks in September each year (at the end of the wet season).
- Decant return / process water shortfall is expected to occur under average and design dry climatic conditions.

- All make-up water requirements can be provided by the WSD reservoir, supplemented by the WHD for design dry conditions. It is necessary that the WSD is completed early to allow a full wet season of filling prior to commissioning.

- A WSD storage capacity of 2,000,000 m^3 is required to provide sufficient make-up water, supplemented by an abstraction rate of 125 L/s from the WHD.

- A WHD capacity of 500,000 m^3 is required to reduce the risk of shortfalls under design dry conditions.

18.3.2 Water Harvest Dam

The Water Harvesting Dam (WHD) will be the primary water collection structure and be able to store up to 500,000 m^3 of water at the maximum operating level. The design intent of the WHD is that the reservoir is frequently pumped to the WSD during each wet season, with a view to filling the WSD reservoir to its maximum storage level prior to each dry season. The WHD will have a catchment area of 4,742 ha.

The WHD embankment will comprise a central low permeability core (Zone A), with upstream and downstream structural zones (Zone C). The low permeability core will be lined with a non-woven geotextile to act as a filter preventing Zone A from entering Zone C. Typical specifications for material types are summarised as follows:

- Zone A material will be won from borrow to form the low permeability core of the embankment.

- Zone C material will be won from borrow to form the outer structural zones.

- Zone F1 will be clean sand / gravel drainage material supplied to a stockpile adjacent to the works.

As the WHD is expected to fill during each year of operation, it is anticipated that the spillway will flow each wet season and discharged water will report to the existing stream bed downstream of the WHD.

18.3.3 Water Storage Dam

The Water Storage Dam (WSD) will be the primary storage pond for clean process water on site and be able to store up to 2,000,000 m^3 of water during Stage 1. The current design assumes the WSD will be raised along with the TSF for each stage.

The WSD has a catchment area of 1,110 ha. The WSD is intended to be recharged by water abstracted from the Water Harvesting Dam (WHD) and rainfall runoff from its upstream catchment. Pit dewatering will be pumped to the WSD, and it was assumed that dust suppression and wash down water will be sourced from the WSD. The water collected in the WSD will be pumped back to the plant to supply plant raw water requirements and process make-up water requirements. Water will be recovered from the WSD by a floating pump.

The WSD embankment will comprise a central low permeability core (Zone A), downstream structural zone (Zone C) and upstream Zone A and Zone C. Typical specifications for material types are summarised as follows:

- Zone A material will be won from borrow to form the low permeability core of the embankment.
- Zone C material will be won from borrow to form the outer structural zones.
- Zone F1 will be clean sand / gravel drainage material supplied to a stockpile adjacent to the works.

The WSD basin area will be cleared, grubbed and topsoil stripped to ensure that the process water supply remains free of organic material.

Discharge from the WSD will occur in a controlled manner via engineered diversion channels constructed during each raise, in order to protect the integrity of the embankments from overtopping failure. It is expected that a permanent engineered spillway will be constructed at some intermediate stage, subject to detailed analysis and optimisation studies.

18.4 Sediment Management

The main component of the site sediment control system will be Sediment Control Structures (SCSs). SCSs are sediment dams that will be constructed in the downstream reaches of catchments impacted by site infrastructure, to attenuate sediment-laden runoff and facilitate the settling of sediments before discharge. For minor events, and depending on storage within the structure prior to a rainfall event, they may completely contain runoff. A total of two SCSs have been included based on the site layout.

The SCSs were designed to limit the maximum water depth to ~2 m for safety reasons (drowning risk). As such, the maximum embankment height for the SCSs is approximately 3 m. The SCS embankment will be a homogeneous earth fill embankment comprising low permeability fill (Zone A), won from local borrow areas within the SCS basin, where practicable. The upstream face of the SCS embankments will be lined with rip rap (Zone E) for erosion protection, and the downstream face will be revegetated.

Discharge from the SCSs will be to the environment downstream of the project site via an engineered spillway. The spillway will be lined with erosion protection material (Zone E). As the SCS is expected to fill frequently, it is anticipated that the spillway will flow frequently during each wet season. Discharged water will report to the existing stream bed downstream of the SCS.

18.5 Access Roads

The following were proposed as part of the road design:

- Haul roads have been designed to connect the Chegue / Nokpa pit and Souwa pits in the north and the Kiosegui Ore bodies in the south with the proposed process plant (total distance of 30 km). An overpass is proposed where the haul road intersects the existing highway (sealed national road A1). It is expected that the access road connecting the highway with the Kilosegui ore bodies will be developed at a later stage (Year 4 / 5).

- Site access road has been designed to connect the national road A1 with the proposed plant site, with a total distance of 16 km. The site access road runs parallel to the haul access road.

The adopted design speed for the site access road is 60 km/h, with a road width of 7.0 m (comprising 2 lanes of 3.5 m width), with a maximum vertical grade of 8 %. The safety berm proposed is 0.5 m high where fill batters exceed 2 m in height. A 150 mm laterite gravel-wearing course will be placed over the subgrade / general fill. It is expected that routine maintenance and re-surfacing (as required) of the site access road will be completed during the operation.

The adopted design speed for the haul roads is 40 kmph with a single lane width of 12 m, with a maximum vertical grade of 8 %. The safety bund is proposed to be 2 m high, based on the diameter of the tire of the largest mining fleet being less than 3 m. A 200 mm laterite gravel-wearing course will be placed over the subgrade / general fill, with a view to being upgraded during operation by the mining fleet when competent rock is available.

The road alignment was designed as balanced cut to fill as much as practicable over the road length. Culvert crossings were designed at significant stream crossing locations to convey runoff. Culverts typically comprise corrugated metal pipe structures.

Where the proposed haul road meets the national A1 road, a corrugated metal overpass is proposed.

18.6 Airstrip

The airstrip was designed to Civil Aviation Safety Authority (CASA) and International Civil Aviation Organization (ICAO) guidelines. The design aircraft for the project was a Cessna Caravan. Since no site specific wind velocities or prevalent wind directions are currently available, the prevailing wind direction of southwest and south based on Gaoua station (~67 km away) was adopted. The runway surface will be 850 m and 20 m wide, and the surrounding runway strip 80 m wide (including the runway). Cut to fill operations are expected to achieve a design compliant with CASA guidelines. The apron will be 100 m by 50 m and will comfortably park two design aircraft. Surface water on both sides of the airstrip will be diverted and discharged into natural drainage courses. Runoff from the airstrip will be collected via v-drains and discharged via silt traps to a natural river course. Site investigation, suitability of in situ materials and borrow sources and detailed site drainage around the airstrip location will be evaluated during the feasibility design.

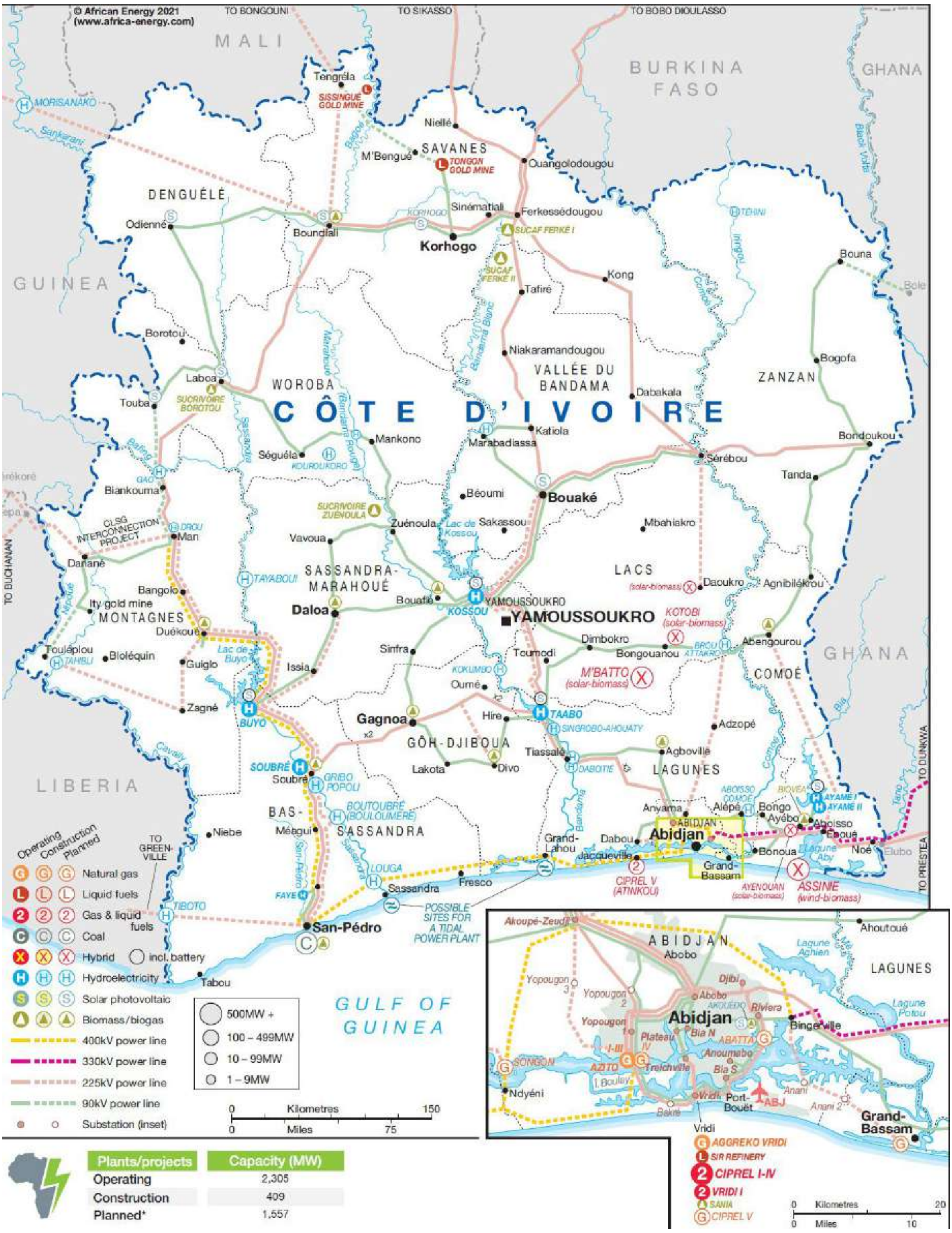
18.7 Power Supply and Distribution

18.7.1 Installed Load and Maximum Demand

Côte d'Ivoire Electricity Grid Connection

The following map shows the CIE electricity network in Côte d'Ivoire.

Figure 18.7.1 Electricity Network in Cote d'Ivoire



As can be seen below, the closest substation within the grid network is the Bouna Substation.

Figure 18.7.2 Séguéla Substation (Black Dot) in Relation to the Site (Red Dot)

The Bouna Substation is fed via a 90kV transmission line from the 225 / 90kV Bondoukou Substation.

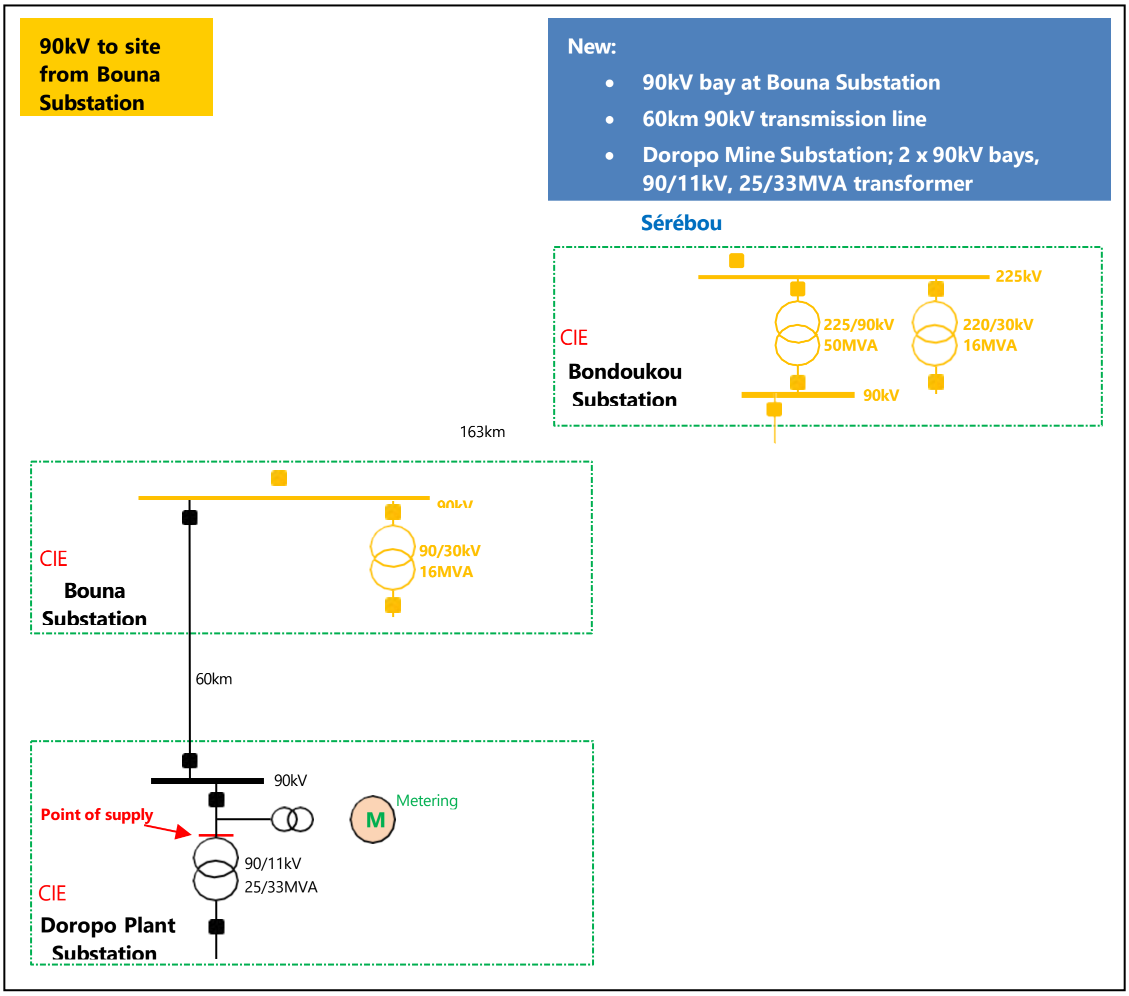
The Power System Master Plan contains a future connection between the Bouna Substation and the Bole Substation in Ghana which is part of a 161 kV ring main system around the country where various sources of generation are connected and being a ring main offers a great deal of redundancy.

This planned interconnection from Bouna to Bole is expected to be completed in 2025. The following map shows a direct connection from Bouna to Doropo being 55 km.

Figure 18.7.3 Location of the Doropo Mine Site and a Direct Connection to Bouna

The following sketch shows the proposed grid connection.

Figure 18.7.4 Grid Connection Sketch



The work involves the extension of the Bouna Substation by extending the existing 90 kV bus, adding a 90 kV transmission line feeder, construction of 60 km of 90 kV single circuit lattice tower transmission line, and constructing a substation at Doropo site. The Doropo Plant Substation would be owned and operated by CIE and Doropo mine would take a 90 kV tariff metered feeder, installing a 90 / 11 kV transformer in their substation and taking an 11 kV feeder to the Plant Main 11 kV Switchboard.

The point of supply and point of change of ownership is the primary 90 kV terminals of the 11 kV transformer. This is the point of the tariff metering.

Selecting the national electricity grid for stationary power is aligned with Centamin's Energy and Climate Change Policy and commitment to integrate climate considerations into strategic decisions and capital allocation. Approximately 39% of the CIE network is sourced from hydro with an increase in the renewable fraction expected following commitments in Cote d'Ivoire's Nationally Determined Contributions. The Doropo Project will help Centamin achieve a material reduction in its group-level GHG emissions intensity. Estimated average annual emissions for the Project are 83,494 tCO_2-e.

18.7.2 Power Supply

The 90 kV supply at Bouna should be of good quality and reliable. The recently constructed 90 kV transmission line from Bondoukou to Bogofa and Bouna is lightly loaded. The supply at Bondoukou is from the 225 kV network and is part of a ring-main system which is very reliable.

Further reinforcement is expected in 2025 when the Bouna to Bole Substation in Ghana is completed. This is a 90 kV interconnection to Ghana and the connection at Bole Substation is part of the Ghana 161 kV interconnected network and is very reliable.

CI-ENERGIES are yet to confirm the acceptance of this connection and will want to complete a load flow study before confirming this.

18.7.3 Electrical Distribution

The electrical system for the Project is based on 11 kV distribution and 415 V working voltage. System frequency is designed at 50 Hz. The largest drives within the process plant are the ball and SAG mill motors (9,000 kW and 6,900 kW respectively). The total installed process power is 30.7MW.

From the 66 / 11 kV switchyard, the 11 kV supply will be reticulated from a tariff metered plant feeder to the process plant 11 kV switchboard. Remote loads such as the camp loads will be fed via 11 kV overhead transmission lines.

The main process plant will have four containerised switchrooms.

Emergency power generators will be supplied at the main plant (2,000 kVA).

18.7.4 Electrical Buildings

All site electrical switchrooms are designed to house the LV Motor Control Centres (MCC) MCC, MV switchboards, Variable Speed Drives (VSD) and Process Control System (PCS) hardware. The switchrooms will be sealed against dust ingress and be supplied with air conditioning, Uninterruptible Power Supplies (UPS) and fire detection system.

The switchrooms will be mounted on 2 m high steel pedestals to facilitate cable installation below the switchroom and bottom entry connection to the internal equipment through gland plates. Entry to the rooms will be via stairs and access platforms constructed at each end.

18.7.5 Transformers and Compounds

All 11 kV / 415 V distribution transformers will be of ONAN (non-fan forced) cooling configuration and vector group Dyn11.

Fire rated concrete walls will be constructed around the pad mounted transformers.

Distribution transformers have been rationalised in the electrical design to minimise spares holding requirements. The standard sizes are:

- 11 / 0.415 kV 500 kVA – 3 off total.
- 11 / 0.415 kV 1,000 kVA – 2 off total.
- 11 / 0.415 kV 2,500 kVA – 3 off total.

18.7.6 11 kV Switchboards

One 11 kV switchboard has been allowed for in the 66 / 11 kV switchyard and one will be supplied for the plant.

The indoor 11 kV switchboards will be a withdraw-able design. All 11 kV switchboards will be supplied with protection, metering and earthing facilities.

The design fault level and circuit breaker ratings adopted are:

- 11 kV switchboard busbar 2,000 A, 25 kA at 1 second.
- 11 kV incomer circuit breakers 2,000 A.
- 11 kV feeder circuit breakers 630 A.

Protection will be provided by microprocessor-based protection relays. Protection relays on the RMU (Ring Main Unit) will be the self-powered type.

18.7.7 415 V Motor Control Centres

The LV MCCs will be single-sided and housed in the LV switchrooms. Construction of all MCCs will have Form 4b segregation, Type 2 coordination. Starters in MCCs will be of demountable design and main incoming circuit breakers will be of withdraw-able design complete with protection. Motor starters up to 90 kW will be equipped with thermal overload protection and electronic protection will be used for all larger drives. The LV MCCs will supply power to the low voltage motors, low voltage variable speed drives and low voltage distribution boards.

18.7.8 Electronic Variable Speed Drives and Soft Starters

Low voltage variable speed drive (VSD) units will be supplied from the LV MCCs. These units will be installed along the internal wall of the relevant LV electrical switchrooms. LV VSDs rated 90 kW or greater will have active front-end converters to improve the power factor and power quality to the power system.

18.7.9 Fire Protection

All switchrooms will be provided with local fire detection systems consisting of Very Early Smoke Detection Apparatus (VESDA) sampling for the switchboard. Signals from the fire detection system will be wired to the respective Fire Indication Panel (FIP) in the switchrooms and all signals will be monitored by a master fire detection panel (MFIP) in the Administration Building. Each FIP will also be wired to a local siren with beacon to warn staff of the fire detection.

18.7.10 Earthing System and Lightning Protection

The earthing system within the plant will be designed in accordance with relevant Australian Standards and equivalent IEC Standards. The following method of system earthing will be implemented at various voltage levels:

- 11 kV Earthed via earthing transformer or NER at 66 / 11 kV Substation.
- 415 V Solidly earthed system / Multiple Earthed Neutral (MEN) / T-N-C-S.

Earth stakes and grading rings will be provided around the switchrooms to mitigate against step and touch potential risks.

Lightning protection will be provided for buildings and structural steel as appropriate. Lightning protection systems will have their own independent earthing electrodes and will be interconnected with the power earthing system.

18.7.11 Electrical Field Installation

Cables up to 25 mm^2 will be PVC insulated and larger cables will be XLPE insulated.

VSD cables will be three phase and three earth cables symmetrically laid out within an overall shielded cable.

In general, cables within the plant area will be installed above ground on cable ladders and follow the pipe racks wherever possible. Cables to equipment in open areas such as process water pumps will be partially installed underground in conduits for ease of access and to minimise clashes with pipework.

Cable ladders will generally be laid horizontally, with vertical ladders only used in areas where regular spillage may occur. Hot dip galvanised cable ladder will be used throughout the plant with stainless steel cable ladder being used in the acid area. Ladder routes will in general follow the mechanical pipe racks.

Cables of different voltage groups will generally be installed on separate ladders. Where they need to be installed together, segregation in the form of barrier strips will be provided.

Sun cover will be provided over the top level of all cable ladders to provide protection against UV damage and plant spillage.

Plant lighting will be designed in a fit for purpose manner to suit the operational requirements of the plant. LED luminaires will be used to maximise light spread and energy efficiency. Enclosed areas and staircases will be fitted with traditional swivel lighting poles. Vibration resistant fittings and auxiliaries will be used where required. Flood lights and high-bay luminaires will be provided for perimeter, general area and workshops lighting.

UPS maintained emergency light fittings will be installed as required throughout the plant to ensure that personnel can safely negotiate obstacles in substations, control rooms, stairways, access ways and safety shower locations. Emergency lighting will comply with AS 2293.

18.8 Potable Water

The potable water demand for the Project has been calculated on a per capita usage basis and is summarised in Table 18.8.1 below.

Table 18.8.1 Potable Water Demand

Area	No. of Personnel	Usage (L/person/day)	Demand (m^3/day)
Accommodation Camp	300	300	90
Plant	146	70	10
Other	448	70	31
Total			**131**

Raw water will be sourced from the water harvest dam and pumped to a raw water storage tank located at the process plant.

A vendor package modular potable water treatment plant including filtration, ultra-violet sterilisation and chlorination will be installed. Potable water will be stored in the plant potable water tank and will be reticulated to the plant buildings, site ablutions, safety showers and other potable water outlets.

Potable water for the accommodation camp will be prepared from raw water pumped from the plant site to a water storage tank at the camp. A separate vendor package modular potable water treatment plant including filtration, ultra-violet sterilisation and chlorination will be installed at the camp. The potable water tank will provide two-day reserve storage in the event of supply or treatment plant disruptions. Water will be delivered into the camp reticulation system using a constant pressure variable flow pump system.

18.9 Sewage

Effluent from all water fixtures in the process plant, mine services area and accommodation camp will drain to gravity sewerage systems. The gravity sewerage system for each area will drain to a sewer pump station from where it will discharge via a pressure main to vendor package sewage treatment plants. Separate plants will be provided for the process plant area and the accommodation camp.

Treated effluent from the accommodation camp will be disposed of by spraying onto a dedicated spray field, while treated effluent from the plant will be discharged into the plant tails hopper. Treatment plant sludge will be suitable for direct landfill burial in unlined pits.

18.10 Fuel and Lubricant Supply

A vendor supplied fuel storage and pumping system will be supplied as part of the fuel supply contract. This will include:

- Two 12,000 m^3 double skinned self-bunded fuel storage tanks and pump skids.
- A transfer pumping system to fuel the heavy vehicles in the mine services fuel bay.
- A transfer pumping system to fuel the light vehicle bowsers.
- A lubricants storage facility.

The fuel farm will include an integrated fire control system.

18.11 Solid and Hydrocarbon Wastes

Wastes will be sorted and reused or recycled as far as the limited access to recycling facilities allows.

Waste lubricating oils will be returned to the supplier for recycling.

General solid wastes will be deposited into a landfill at the toe of the mine waste dump and promptly covered to deter vermin and scavengers.

Materials such as cyanide packaging will be decontaminated and buried, under supervision, on site beneath mine waste to prevent unauthorised use, or burned in an appropriate incinerator.

18.12 Communication System Infrastructure

Internal communications and IT services will be via a site wide fibre optic network.

One of the local mobile phone providers will be contracted to install facilities on site and provide a link into the local, national and international telecommunication network.

A radio network will be established with dedicated operational, security and emergency channels.

A local ground station will be installed to provide a data connection via microwave to the local ISP.

18.13 Explosive Storage and Handling

An emulsion plant for mixing and storage of ANFO (ammonium nitrate / fuel oil) will be established by contract with a reputable supplier. The cost of this facility has been included in the explosive supply cost in the operating cost estimate. The facility will be located south of the mine services area and accessed by an unsealed road. The facility will be fully fenced and will include security.

A high explosive magazine will be built and located separately. This will store high explosives and detonators and will include a blast berm and will be fully fenced.

18.14 Security and Fencing

18.14.1 Perimeter Fencing

Security fencing will be installed around the perimeter of the pit to protect the local residents from entering within the blast zone and potentially interrupting the mining operations.

18.14.2 Accommodation

The accommodation camp will be perimeter fenced and will include a security gatehouse and security guards on 24-hour duty.

18.14.3 Process Plant Security

The process plant area will have two levels of security and fencing:

- A perimeter fence and security gatehouse will regulate entry of personnel to the low security buildings including the main administration building and warehouse.

- A double fence separated by 10 m will surround the high security process plant. A separate gatehouse with turnstile and search facility will regulate personnel entry to the process plant itself.

18.14.4 Goldroom Security

The goldroom area will be fenced off separately. Goldroom security will include magnetic locks with a password entry together with motion sensors, CCTV and proprietary security.

18.15 Workforce Accommodation

18.15.1 Permanent Accommodation Camps

A 300-bed accommodation camp will be located within approximately 3 km of the process plant and will provide accommodation for salaried staff and a separate 80 man security camp will accommodate security staff.

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19.0 MARKET STUDIES AND CONTRACTS

19.1 Introduction

Gold is a readily traded market that operates internationally. Major trading centres are located across all time zones with most global gold trading volumes passing through the London Over The Counter (OTC) market, US futures market and the Shanghai Gold Exchange. In 2022, London Bullion Market Association ("LBMA") gold prices closed broadly flat at USD1,816/oz, starting the year at USD1,800/oz. Similarly, with annualised average prices, 2022 average prices averaged USD1,802/oz versus an average price of USD1,799/oz in 2021. Despite this relative stability on an annual basis there was a wide spread of USD428/oz between the low of USD1,628/oz and the high of USD2,056/oz.

Table 19.1.1 Historical Annual Average LBMA Gold Prices (S&P Capital IQ)

Period	Annual Average USD/oz
2017	1,258
2018	1,269
2019	1,393
2020	1,771
2021	1,799
2022	1,802
2023 Q1	1,889

The study assumes that the Project would generate income from the sale of gold doré. The amount produced from the LOM is 1,871 koz with further upside from ongoing drilling. Metallurgical testing to date has indicated a recovery of 84.9 – 98.9% with 92.4% used in the pit optimisations.

The gold price used to determine the economics of the Project and for this study is USD1,500/oz with sensitivity analysis performed on mining and processing costs of +/-10%.

19.2 Contracts

For the study, the strategy is to utilise the services of a mining contractor(s) for all mining activities on site. Contract terms are as per industry norms particular to the West African region where the Doropo deposit is located.

For the doré produced from the proposed Doropo treatment plant, in the absence of letters of interest or letters of intent from potential smelters or buyers of gold, general smelter terms for similar projects have been applied.

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20.0 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

20.1 Introduction

The Doropo Gold Project currently covers eight discrete mineral resources, located over four of the seven Ampella exploration tenement areas of 1,847 km^2, named Souwa, Nokpa, Chegue Main, Chegue South, Kekeda, Han, Enioda and Kilosegui. Atirre was also considered as a future potential resource in this study.

It is proposed that the development strategy is underpinned by a staged mine development commencing with a 'starter' project with extension to satellite pits in subsequent years.

The preferred development scenario involves the mining of ore via open pits, processing of ore through a gravity separation and carbon in leach (CIL) process plant proximal to the most significant defined resources, and construction of supporting infrastructure including waste rock dumps, a tailings storage facility (TSF), water storage dam (WSD), water harvest dam (WHD), power plant, airstrip and accommodation camp.

20.2 Objectives

The objectives of the PFS environmental and social study were to:

- Describe the physical, ecological and social setting of the proposed Project.
- Provide a preliminary assessment of the potential environmental and social impacts and risks of the Project.
- Discuss the management implications of these potential impacts for the Project design, construction, operation, closure and rehabilitation.
- Describe the approvals and permitting requirements and expected pathway for the Project.
- Identify any uncertainties and remaining areas of investigation to inform the scope of work for an environmental and social impact assessment.

A substantial environmental and social baseline has been developed for the Project with extensive field studies having been undertaken as part of the PFS, including Socio-Economic, Land and Water Use Baseline, Surface and Groundwater Resources Baseline, Ecology and Biodiversity Baseline, and Archaeology and Cultural Heritage Study. This work provides an excellent basis for examining the environmental and social aspects associated with the potential development of the Doropo Project and will allow for more targeted specialist studies to be conducted during the Environmental and Social Impact Assessment (ESIA) phase.

Centamin is required to submit its mine Exploitation Permit application by mid-June 2024, for which the Environment Permit is a requirement. To achieve this milestone, it is proposed that the draft ESIA report is submitted to the environmental regulator (ANDE) by 31 December 2023. This allows H1 2024 to obtain approvals and permits, including: pre-approval by ANDE, public inquiry, validation by the interministerial committee and Ministerial approval.

20.3 Project Setting

Four of the prospects are clustered in the sub-prefecture of Kalamon, which includes the largest prospect of Souwa. This is the proposed location of the processing plant, TSF, water storage infrastructure, airstrip and office facilities. Four of the satellite prospects are located within 7 km of this main cluster, with Kilosegui located approximately 30 km to the southwest, all of which would require haul roads to truck ore to the processing plant.

The area around the mineral deposits is gently undulating with old erosional and weathered surfaces. Small land holding agriculture dominates the area with artisanal mining often found in the mineralised areas.

There is a distinct dry and wet season with surface water flow at the Doropo area consisting of a network of non-perennial streams and smaller tributaries.

A majority of the Project Area is comprised of modified habitats, predominantly agricultural areas such as cashew plantations as well as artisanal mining, settlements, roads and tracks. Four principal natural vegetation types occur within the Project Area, these are wooded savannah, shrub savannah, gallery forest and swampy thicket. All habitats are highly degraded due to agricultural, grazing and artisanal mining activities.

The Project is located in a poor and underserviced part of Côte d’Ivoire. Education, health, transport, water supply, energy and communication services are basic. There are very few job opportunities apart from within agriculture and artisanal mining.

The Bounkani Region is administered by a Regional Prefect who is supported in this role by Department- level Prefects and Sub-Prefects and various governmental technical agencies. The Region is characterized by a customary system of land governance held by the Koulango authorities, according to which land resources are the exclusive property of the King of Bounkani. The King entrusts administrative responsibilities for land management to local-level Canton Chiefs. Within the Project area, legal land title has yet to be implemented and the customary system of land tenure is the only established land management mechanism.

Figure 20.3.1 Doropo Gold Project Administrative Boundaries, Exploration Permit Boundaries and Settlements

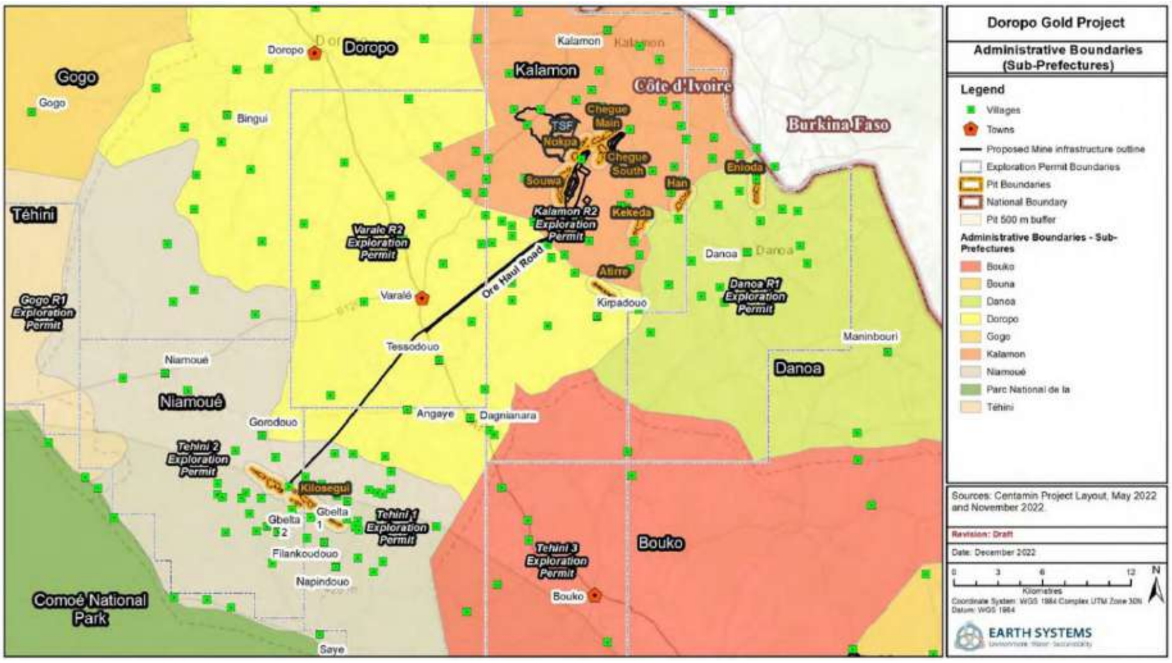


Table 20.3.1 Habitat Type and Land Use in Project Footprint Areas

Vegetation / Habitat Types	Project Components (ha)						Project Footprint	
	Starter Project	Kekeda	Han	Enioda	Atirre	Kilosegui	ha	%
Natural Habitats								
Degraded shrubby savannah	158.6	44.4	24.8	30.6	1.0	7.9	267.3	5.5
Degraded swampy thicket	18.6	11.0	6.8	-	1.1	-	37.5	0.8
Degraded wooded savannah	52.1	-	-	-	79.2	14.2	145.5	3.0
Gallery forest	23.3	8.1	13.5	8.8	16.0	14.4	84.1	1.7
River	-	0.4	3.3	-	0.3	0.3	4.4	0.1
Shrubby savannah	552.2	41.9	30.3	10.9	-	39.0	674.3	13.8
Swampy thicket	214.7	22.6	15.3	28.3	15.8	110.7	407.4	8.3
Wooded savannah	240.0	0.4	1.8	6.5	64.0	32.2	345.0	7.0
Sub-total	1259.6	128.8	95.8	85.2	177.6	218.8	1965.6	40.1
Modified Habitats								
Agriculture	1079.8	98.5	138.9	253.7	111.1	817.6	2499.6	51.0
ASM	180.7	51.4	28.6	15.9	0.6	10.9	288.0	5.9
Road	12.9	10.6	10.8	10.3	10.3	2.7	57.6	1.2
Settlement	44.0	5.7	13.4	12.0	-	14.1	89.2	1.8
Sub-total	1317.5	166.2	191.6	291.9	845.2		2934.4	59.9
Total	2577.0	295.0	287.4	377.1	1063.9		4900.0	100.0

20.4 Project Need and Benefit

The key benefits of the proposed Project for Côte d'Ivoire will be financial, economic and social benefits at the national, regional and local levels. On a local level, the Project can provide a significant injection of income and employment opportunities to the region, providing opportunities for training and skill development. It has the capacity to catalyse economic and social development in the area, improve access to infrastructure, goods and services, and leave a lasting positive legacy. Royalties and taxes from the Project would also provide needed income for the National Government of Cote d’Ivoire.

Mining companies operating in local communities in Cote d’Ivoire are required to pay 0.5% of their turnover to a Local Mining Development Fund, which aims to finance community development projects in mining regions. This Fund is expected to generate approximately USD17M over a 13-year life of the Project with USD1.8M generated each year for the first five years of operation.

20.4.1 Works Conducted for the PFS to Date

A number of Environmental and Social studies have been undertaken as part of the Pre-Feasibility process for the Doropo Gold Project. These studies include:

- Socio-Economic baseline studies (H&B Consulting, 2022a) comprising an initial scoping visit in October 2021; two data collection missions undertaken in February and May of 2022.
- Terrestrial Ecology baseline studies (H&B Consulting, 2022b) comprising a dry season study in February and wet season study in May 2022,
- Aquatic Ecology baseline studies (H&B Consulting, 2022c) comprising an initial site scoping visit in February 2022 and a wet season study in October 2022. The study included Local Knowledge Surveys, aquatic macroinvertebrate surveys, and fish surveys.
- A groundwater and surface water sampling and analysis programme was initiated in August 2022 (H&B Consulting, 2022d).
- Archaeology and cultural heritage baseline studies (H&B Consulting, 2022e) comprising two field missions in February and May 2022. The studies consisted of interviews with traditional leaders, village chiefs, and other authorities on matters of history, cultural traditions, and sites of archaeological/cultural significance. Interviews were followed by field investigations to locate sacred sites and sites of archaeological significance.
- Meteorological and climate review (Earth Systems, 2022).
- Geochemical analysis programme for the characterisation of waste rock (Piteau, 2022), including the results of static and kinetic testing.
- An engineering and geotechnical reconnaissance mission in January 2022 to identify options for infrastructure design, including Tailings Storage Facilities (TSF), water harvesting and storage facilities and the Plant Site (Knight Piésold 2022a, b, c, d, e).

These studies provide a baseline of the existing physical and social environment and have been used to inform the technical parameters such as infrastructure location, aiming to avoid impact on communities where possible.

20.5 ESIA / Permitting

The following outputs are likely to be required by the Government of Côte d'Ivoire and international stakeholders as part of the environmental permitting / assessment process:

- ESIA Terms of Reference.
- ESIA Non-technical Summary.
- ESIA main report and Technical Appendices.

- Environmental and Social Management and Monitoring Plan (ESMMP).
- Livelihood Restoration and Resettlement Plan.
- Rehabilitation and Conceptual Mine Closure Plan.
- Environmental Emergency Response Plan.
- Stakeholder Engagement Plan.

20.6 Potential Social Issues and Risks

The Project area is located in a rural setting dominated by subsistence agricultural, cashew plantations and artisanal gold mining. The Project has potential to impact approximately 10,000 ha of agricultural land and some villages may require resettlement. Early estimates indicate that as many as 2,000 to 3,000 people may be directly affected by Project land acquisition, subject to further design studies.

The key social issues and risks that will need to be closely managed by the Project are:

- Resettlement and livelihood restoration for impacted communities who have a high economic and social vulnerability.
- Implementing strong livelihood restoration in addition to appropriate cash compensation.
- Managing the potential for land conflicts especially those associated with the overlapping rights of Koulango and Lobi communities.
- Ensuring a fair system of employment especially across different ethnic groups.
- The effective removal and deterrence of illegal artisanal mining activities from within Project areas will present a challenge to operations, security and community relations.
- Community health and safety particularly associated with transportation routes including haul routes from satellite mining pits.
- Land and socio-economic fragmentation resulting from the extended Project footprint.

Key social opportunities will arise through the resettlement and livelihood restoration program; the Local Mining Development Fund; employment and training; procurement of goods and services; and investment in infrastructure and services.

20.7 Social Aspects and Management implications

20.7.1 Resettlement and Livelihood Restoration

Numerous small villages and agricultural hamlets are located within the broader Project area. Approximately 7,900 people reside in villages and hamlets that will be affected by Project-related land acquisition. Of this number, approximately 3,000 people reside in villages and hamlets that are at risk of Project-related resettlement. Preliminary estimates indicate that approximately 4,377 ha of productive land and habitation areas are at risk of loss within the Project Development Area.

Ivorian legislation does not stipulate the requirement of a Livelihood Restoration Plan (LRP or Resettlement Action Plan (RAP) for Project development, however, compensation is regulated. Project compensation and resettlement should be managed in a manner that is consistent with national and international best practice, in particular, the IFC Performance Standard 5 (PS5). A LRP/RAP will be prepared and will be guided by these standards.

The development of strategies to avoid, minimise and compensate for potential resettlement impacts will need to be conducted in consultation with affected persons during the ESIA.

As part of the ESIA process, an in-principle agreement will need to be reached with all affected persons on their entitlements and eligibility for resettlement / livelihood restoration.

20.7.2 Assets and Infrastructure

No major infrastructure (e.g., significant road, powerline, irrigation infrastructure etc) is expected to be negatively impacted by the development of the Project.

Access to basic community infrastructure and services within the rural settlements of the Project Area is severely lacking.

The development of the Project is likely to lead to improved accessibility to the region, and contribute positively to local infrastructure development (such as improvements to road, telecommunication, and water infrastructure) and community development through the Local Mining Development Fund.

20.7.3 Artisanal Mining

Despite being an illegal activity, gold extraction by Artisanal Mining (ASM) is an important livelihood activity in the Project area, and many villages are abandoning farming as the main livelihood activity in favour of ASM activities. ASM contributes to community development in the area, however, it is a source of insecurity due to numerous conflicts and the potential for in-migration from other areas and countries. The benefits of ASM in the region often do not advantage local communities and are instead felt across the border in Burkina Faso where the ore is processed.

An important aspect of the ESIA will be to understand the use and significance of the different ASM areas and to develop a consistent approach to livelihood restoration and the protection of human rights in these ASM areas. The effective removal and deterrence of illegal ASM activities from within Project areas will present a challenge to operations, security and community relations. Centamin will assess all forms of loss to local communities impacted by Project-related land acquisition and aim to mitigate this loss as an element of the LRP. However, illegal ASM mining activities will not be compensated.

Potential management implications are likely to include:

- A partnership between government and local communities to stop illegal ASM activities and secure the sustainable management of land and resources.
- Support the government to formalise the ASM sector for the benefit of community development.
- Support the development of alternative livelihoods.
- Ongoing consultation with relevant stakeholders to avoid conflict between Artisanal Miners and AMPELLA.

20.7.4 Archaeology and Cultural Heritage

A broad archaeological and cultural heritage survey of the Doropo Project area identified a number of locally valuable archaeological and cultural heritage sites, some occurring proximal or within the PDA. Most of these are sacred sites respected by both the Lobi and Kuolango traditional owners.

The ESIA should undertake pre-development archaeology and cultural heritage surveys and assessment of the final footprint areas of the initial mining operations to ensure that appropriate management and mitigation measures are employed prior to clearing.

20.8 Community Development Plan

A Community Development Plan will be prepared in collaboration with neighbouring communities and territorial and local administrative authorities, with a specific set of objectives and an investment plan for submission in the ESIA.

The Project has the capacity to catalyse economic and social development, through employment, skill development, in-country procurement, and improved access to infrastructure and services in the local area. At national level, the Project would contribute royalties and taxes to the government of Cote d'Ivoire.

Mining companies are required to pay 0.5% of their turnover to a Local Mining Development Fund, which aims to finance community development projects in mining regions. This Fund is expected to generate approximately USD17M over a 12-year life of the Project with USD1.8M generated each year for the first five years of operation.

Key management measures to maximise the socio-economic benefits of the Project at the local-level are likely to include:

- Training and skill development programmes for national workforce.
- Subject to skill availability, preferential recruitment of local candidates.
- Development and implementation of livelihood improvement programs through the Local Mining Development Fund.
- Actively support local procurement and development of a responsible supply chain.

Access to basic community infrastructure and services within the rural settlements of the Project Area is severely lacking. The development of the Project is likely to lead to improved accessibility to the region, and contribute positively to local infrastructure development (such as improvements to road, telecommunication, and water infrastructure) and community development through the Local Mining Development Fund.

Community and Government consultation will be an ongoing process during the Project permitting, construction and operation phases including documentation and review of stakeholder concerns.

20.9 Potential Environmental Issues and Risks

The deposits are in moderately undulating terrain in a heavily weathered tropical environment with a distinct wet season.

Significant waste rock will need to be mined to gain access to ore. The mineralogy of the waste rock has been tested and the results indicate low sulphide with some carbonate mineralisation; indicating a lower risk of impact to downstream water quality.

The Project will require a TSF that is carefully designed and managed to protect downstream activities through operations and post closure, aligned with the Global Industry Standard for Tailings Management following Centamin's Group commitment The TSF is being designed as a no discharge facility. The Project is also designed to be compliant with International Cyanide Management Code standards, incorporating suitable tailings treatment for cyanide destruction and requiring our cyanide producer and transporter to be signatories to the Cyanide Code.

The Kilosegui satellite deposit is located approximately 10 km from the Comoé National Park, a UNESCO World Heritage Site (WHS), while other Project components are located a further 30 km to the northeast. The Project is being designed to avoid impacts to the Outstanding Universal Value of the site in consultation with the Office Ivoirien des Parcs et Reserves (OIPR). Guidelines of UNESCO's IUCN will also be applied on environmental assessment in proximity to the WHS.

The key environmental issues and risks that will need to be closely managed by the Project are:

- Long term geotechnical and chemical stability of the TSF.

- Water availability and use during the dry season.
- Site water discharge during the wet season.
- The management of cyanide and other hazardous chemicals used by the Project.
- Geotechnical and geochemical stability of waste rock dumps and the tailings storage facility.
- Potential air quality and noise impacts for surrounding communities during construction and operations.
- Erosion and sediment control during construction.
- Water storage, containment and diversion.
- Drought and bushfire risk.
- Potential direct and indirect impacts to the biodiversity values in the Project Area, and the periphery zone of the Comoé National Park (CNP).

20.10 Biological Aspects and Management Implications

20.10.1 Terrestrial Biodiversity

The Project area is largely comprised of modified habitats, predominantly agricultural areas such as cashew plantations as well as artisanal mining, settlements and roads and tracks. The flora surveys revealed five species of global conservation concern to be present in the Project area. No flora species identified are likely to qualify as Critical Habitat based on PS6 criteria.

As the Project does not fall within the boundaries of the Comoé National Park, it will not directly impact the terrestrial component of the Outstanding Universal Value. The IFC PS6 aligned Biodiversity Screening undertaken identified 6 terrestrial species that potentially meet the thresholds for Critical Habitat. No species that likely qualify for Critical Habitat based on PS6 criteria were recorded in the Project area during the field and local knowledge surveys. The degraded nature of habitats and lack of evidence indicates that potentially Critical Habitat qualifying mammal species are unlikely to inhabit the Project area.

20.10.2 Aquatic Fauna and Biodiversity

Much of the Project area has been degraded by agricultural activities. This has resulted in general degradation of the aquatic ecosystems.

One fauna species observed in the Study Area, the dwarf crocodile (Osteolaemus tetraspis), is listed as Vulnerable on the IUCN Red List of Threatened Species and identified as an Outstanding Universal Value (OUV) for the Comoé National Park under Criterion X. This species has been confirmed as present in streams near the proposed Kilosegui and Atirre pits.

The management of water quality from the mining development areas will be important in maintaining the health of aquatic ecosystems and minimising impact to Critical Habitat qualifying species.

20.10.3 Comoe National Park

Comoé National Park (CNP) lies in a transitional zone between forested habitats and savannah habitats meaning that there is a high habitat diversity present within the boundaries of the park. At its closest point, the Kilosegui deposit is located approximately 10 km from the boundary of the Camoe National Park (CNP). The western section of the Kilosegui deposit lies within the Iringou watershed which drains to the Comoé National Park. In the absence of suitable controls, here is a low risk of pollution leading to impacts on downstream water quality and aquatic biodiversity values.

It is understood that AMPELLA will adopt a no net loss for Critical Habitat approach for the Project, through application of the mitigation hierarchy. AMPELLA shall establish an appropriate buffer zone between Project activities and the CNP, in which there will be no land disturbance, in order to safeguard the Outstanding Universal Values of the CNP. This buffer zone will be defined during the ESIA process.

20.11 Project Water Resources

20.11.1 Topography, Catchments and Climate

The topography of the area is gently undulating, with average slopes of the various pit catchments ranging between 0.4% and 4.0%. The main water course, the Pouene River, flows from southeast to northwest through the project footprint. The Han pit catchment is the largest, with the channel of the Pouene River flowing directly through the proposed pit footprint. The Kekeda pit is located on the southern flank of the Pouene River, 2.4 km upstream of the Han pit. The Souwa, Chegue South and Main, and Nokpa pits, lie on the northern flank of the Pouene catchment, approximately 6.5 km west of the Han pit, while the Enioda pit lies on the southern flank of the Pouene River, approximately 4.7 km downstream of the Han pit. The Kilosegui complex lies within two separate catchments: the Kilosegui Southeast (SE) catchment which drains southwards before flowing in a south-easterly direction towards the Black Volta River, and the Kilosegui Northwest (NW) catchment which flows to the west.

The Kilosegui pits are located at the highest elevation (maximum elevation over 400 m), with the lowest elevation of their natural catchment areas at over 340 m. The large catchment area upstream of the Han pit ranges from over 400 m in the southwest to 274 m at the Han pit. The Chegue, Nokpa and Souwa natural catchment areas range between 360 and 295 m.

Climate

The Doropo area is characterised by distinct wet and dry seasons, with the dry season running from November to April, and the wet season being from May to October. The annual average rainfall is 1133 mm, with 90% of the annual regional rainfall occurring during the wet season, with August typically being the wettest month. Mean monthly rainfall can vary from effectively zero in January to approximately 200 mm in August, with the mean number of days with rainfall varying from zero to 22 between the same months.

Evaporation rates are also extremely high with daily rates varying from 4-6 mm in the wet season and between 6-10 mm in the dry season.
The extreme variability in rainfall, coupled with the high evaporation rates, makes development of sustainable water supply options difficult, while also requiring large scale water management infrastructure (diversion channels, pumping capacity) to be implemented to manage potentially short duration storm events during the wet season.

20.11.2 Project Water Demand

The current mine plan is based on a Process Plant input rate of 4.0M tpa (12,328 tpd) of fresh ore and 5.4 Mtpa (14,795 tpd) of oxides, with an associated design process water demand of 568 m^3/hr (13,632 m^3/d). A summary process water balance is shown in Figure 20.10.1 and indicates a TSF Decant return of 307 m^3/h (7,368 m^3/d) requiring a freshwater makeup requirement of 261 m^3/h (6264 m^3/d) once the TSF is established. A more detailed water balance showing year on year raw water demands under a range of climatic scenarios has been developed by Knight Piésold (KP 2023a), and in which the following associated water storage infrastructure is proposed to meet raw water demands under all modelled scenarios:

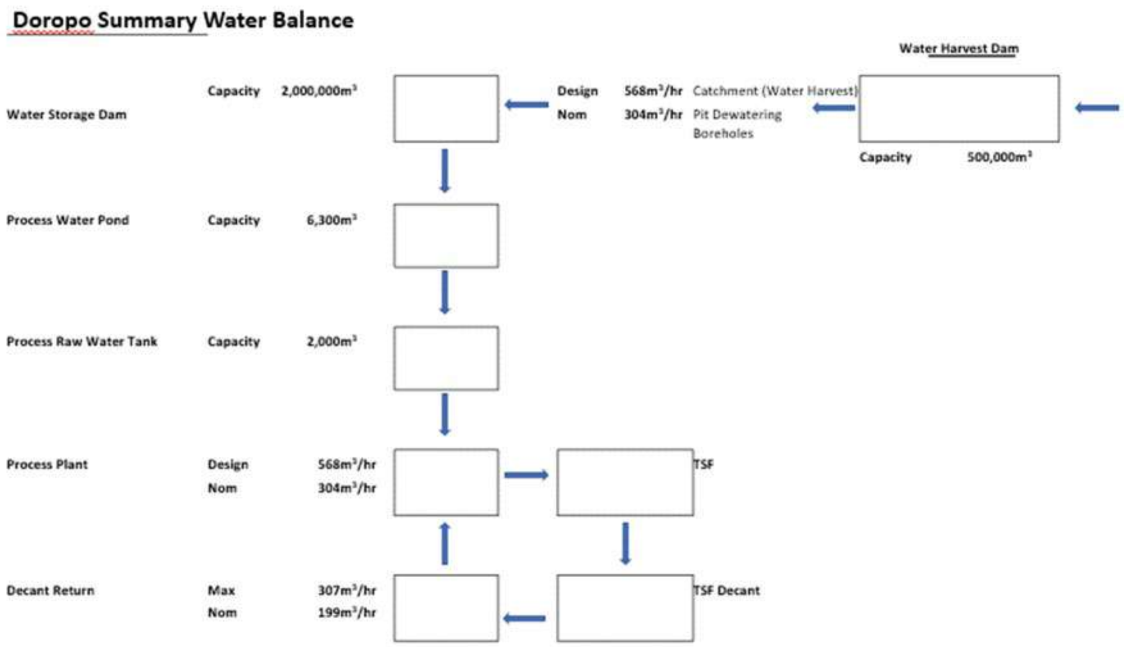
- Water Harvest Dam: 500,000 m^3 for a 3.2 m high dam – equivalent to 37 days of total process demand or 80 days of makeup demand.

- Water Storage Dam: 2,000,000 m^3 for a 10.2 m high dam – equivalent to 146 days of total process demand or 271 days of makeup demand.

- Process Water Pond: 6,300 m^3.

- Process Raw Water Tank: 2,000 m^3.

Figure 20.11.1 Summary Project Water Balance (Knight Piésold 2023)



The operating philosophy for the water storage system is that water will be pumped from the water harvest dam to the water storage dam during the wet season. It is understood that detailed hydrological modelling of the water storage dam will be developed during DFS to determine how much runoff will occur from the upstream catchment upstream to the dam.

20.11.3 Surface Runoff

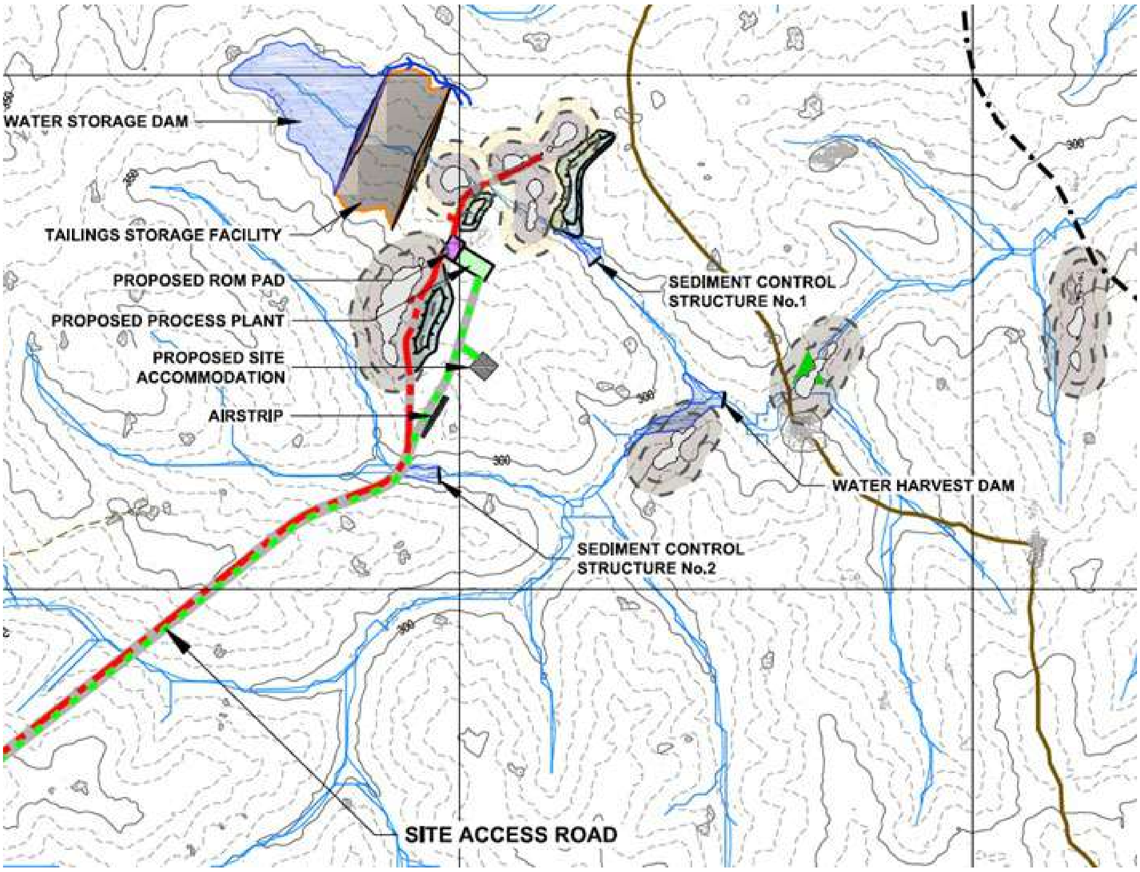
The development of the Doropo Project will affect the natural drainage in the region during the life of the mine. The establishment of the water harvest dam upstream of the Han pit will capture some surface water run-off for use within the process plant, while dewatering of the open pits will discharge groundwater and rainfall which enters the pits. Once the mining operations are complete and the closure plan implemented, the surface water drainage will return to close to pre-operational conditions, except that the mined-out pits will fill with water and the water storage and harvest dams will provide a useful water resource for the local community in a region that can experience prolonged arid conditions.

The surface water drainage network in the area is ephemeral, with surface water flow only occurring in drainage channels in response to storm events during the wet season. Monitoring of flows in this type of environment is extremely difficult, and it is not clear if continuous flow occurs in any sectors of the Pouene River, or its tributaries, for any period of the year. No surface water flow data is currently available for the project area.

20.11.4 Water Storage Facilities

Notwithstanding the generally good quality of the surface water runoff predicted by Piteau, additional sediment control structures will be developed to ensure that turbidity in runoff from the operational areas is reduced by allowing suspended solids to settle out of runoff water before it enters the natural watercourses. A plan of the proposed facilities showing the water storage and harvest dams as well as the locations of proposed sediment control structures is given in Figure 20.11.2.

Figure 20.11.2 General Arrangement for Water Storage Facilities (Knight Piésold 2023)



20.11.5 Water Chemistry

Groundwater and Contact Water

Piteau Associates of Shrewsbury, United Kingdom have undertaken a laboratory geo-environmental testing programme to characterise the potential water chemistry of runoff / seepage which will develop through the interaction of precipitation / runoff with exposed pit walls, and associated waste rock dumps, during operation of the Doropo project. In addition, these data will also inform modelling of the pit lake water chemistry that will develop post-closure in response to groundwater inflow, direct precipitation and surface water runoff into the open pits. For the purposes of this PFS-level water management plan the data provide an indication of what water treatment might be required for either use or discharge of water collected by the dewatering system. Piteau's summary of their investigation is as follows:

Geochemical testing of 80 samples of fresh rock, saprock and saprolite from the Doropo project was carried out to determine the ARD and metal leaching propensity of the waste rock, and to aid in waste management planning. The results of acid base accounting (ABA) analyses indicate that all waste rock materials have low total S contents, and as a result, low acid generation potential (AP). The saprock and saprolite units have total S and AP values below detection limits, and the fresh rock samples have a maximum of 0.71% total S. In the case of fresh rock samples with detectable AP, the neutralisation potential (NP) is higher than the AP in all cases, indicating a net acid-neutralizing capacity in the form of carbonate minerals. Mineralogy data indicate that the fresh rock samples contain up to three times more calcite than pyrite. No trend in ABA properties by alteration type in the fresh rock is apparent.

The mobility of sulphate and metals in the waste rock is indicated by results of shake flask analysis, NAG extract analysis and humidity cell testing (HCT) to be low for all material types. Sulphate concentrations are less than 100 mg/L for all material types in all leach tests. Occasional exceedance of international drinking water standards occurs for Al, Mn and Fe in NAG leachates, and elevated Al is apparent for 2 samples in HCT leachates (1 fresh rock and 1 saprock). The application of drinking water standards to mine contact water is, however, over-conservative.

Sulphide oxidation rates determined from humidity cell tests indicate that there is sufficient available neutralization potential in fresh rock and saprock to buffer any acidity generated through oxidation of the available sulphide-S. The saprolite material is estimated to transition towards net-acid generating behaviour after 20 to 25 years. However, the acid generation capacity of these samples is indicated by the ABA results to be extremely low, and this 20- to 25-year assumption is conservative as it assumes that carbonate NP is the only mechanism of acidity buffering. In probability, the weak acidity produced following the exhaustion of measured NP in static tests would be buffered by other non-carbonate reactions, particularly those involving silicates and Fe-Al oxides.

Based on the above it appears that the waste rock / wall rock at Doropo does not present any substantive ARD risk and no segregation of materials is likely to be required for waste dump design. Further predictive water quality modelling is recommended to assess whether contact waters influenced by the saprolite unit will result in ARD risk or if the net-acid potential can be offset by contact water from the saprock and fresh lithologies. The metal leaching potential of the material is low, although elevated Al concentrations in waste rock contact water are a possibility and may need to be factored into waste rock management planning and assessments of water treatment requirements. Additional testing is recommended to improve the level of certainty around the leachability of Al in the saprolite and fresh rock material, and predictive water quality modelling will be necessary to determine the long-term contact water quality accounting for AP and NP exhaustion rates, particularly with respect to the pit wall runoff that will need to be managed from within the open pits.

Surface Water

Surface water samples were collected at nine locations on the drainage network across the Doropo site from a mix of streams and ponds. The samples provide an indication of the water quality of surface runoff that may be handled by the project, together with the quality of receiving water that may receive discharge from the operations. The data provide an initial indication of whether water treatment, beyond sediment retention, may be required. The potential impact of runoff from facilities including the open pit walls, waste rock dumps and the TSF will be further investigated as part of the DFS.

Exceedance of the ambient guideline concentration for iron occurs at six of the locations.

20.12 Rehabilitation and Closure

For a Project such as Doropo there will be opportunities to undertake rehabilitation during early stages of Project development due to the multiple pit development of the Project. The integration of closure risks and opportunities into the Project design process is essential to ensure long-term geochemical and geotechnical stability of facilities and infrastructure, which is essential for ongoing community health and safety and environmental health. Consideration of closure requirements from an early stage also enables Centamin and other Project stakeholders to more accurately assess the nature and extent of Project-related impacts, mitigation measures and associated implementation costs. Refer to section 22.3.7 for an estimate of the cost of closure.

At closure, the majority of the site is expected to be returned to government and local villages. Key sensitivities for the Project post-closure are expected to include:

- Water quality and water management.
- Stability of land forms and facilities.
- Site contamination.
- Future land uses.

- Beneficial use of the mining footprint post closure.
- Post closure change to income levels and mine infrastructure.
- Community health and safety.
- Economic sustainability and livelihoods.

Closure of the TSF, waste rock dumps and open pits will be key issues. Closure of these facilities will need to be undertaken in a manner that:

- Ensures they are geotechnically and geochemically stable landforms.
- Minimises post-closure risks to community health and safety, land and water resource use, and environmental values.
- Accounts for visual amenity.
- Returns productive land capability, environmental value or other benefits to the government and local community.

Importantly, the Project should be designed to leave a strong Project legacy post closure. Notable opportunity for community development include improved access to water and energy infrastructure and the intensification of agricultural activities.

20.13 Environmental and Social PFS-level Design Criteria

The environmental and social design criteria presented below are intended to provide guidance for the design and development of the Project by outlining key potential environmental and social risks, design criteria / considerations and relevant guidelines and standards.

These design criteria have been identified on consideration of the baseline environmental and social studies and are aimed at protecting the following priority environmental and social values in the Project area:

- Downgradient ground and surface water quality.
- Community settlement, productive land and water use.
- Community safety.
- The integrity of the Comoè National Park and its Outstanding Universal Values.

Table 20.13.1 Design Criteria

Key Issue / Risk	Project Design Criteria / Considerations	Relevant Guidelines / Standards
Water Resources	• Minimise water use of the Project, taking into consideration the water stress on local communities and the region and risks to water resources as a result of climate change. • Design to minimise discharge of contaminated (including sediment laden) water during Project development. • Design to divert non-contact surface water runoff around Project facilities. • Design and install water recycling capacity in process pant and accommodation camp (maximise water recovery from tailings, recycle grey water, water efficient machines, etc.) • Install groundwater monitoring wells upgradient of Project and downgradient used as baselines. • Downgradient surface water and groundwater quality must achieve applicable water quality standards / guidelines. • Assess opportunities for Project development to enhance community water security for domestic use, agriculture, and other productive activities.	National Water Code, Law no. 98-755 of 23 December 1998. IFC General EHS Guidelines (2007). IFC EHS Guidelines for Mining (2007). EU Ambient Water Quality Guidelines World Health. Organisation (WHO) Guidelines for Drinking Water Quality (2011).
Land disturbance	• Engage with government and community as partners to ensure Project development is broadly consistent with long-term strategic land use plans, and to prevent land and water use conflicts. • Undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for key Project components with the aim to select an alternative that minimises risks to people and the environment. • Design to maintain a compact and integrated Project footprint with sensitive location of linear infrastructure (co-alignment where possible) • Minimise requirements for land disturbance, particularly in areas of Natural or Critical Habitat and agricultural land. • Retain topsoil for the rehabilitation of lands disturbed by the Project.	National Rural Land Code, Law no.98-750 of 23 December 1998 modified by Law No. 2004-412 of 14 August 2004. National Forestry Code, Law no. 2019-675 of 23 July 2019. Protection measures for water resources, installations and structures, Decree no. 2013-440 of 13 June 2013. IFC PS5 Land Acquisition and Involuntary Resettlement (2012). IFC PS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012).

Key Issue / Risk	Project Design Criteria / Considerations	Relevant Guidelines / Standards
Hazardous Materials Management	• Maintain secure containment of explosives and a minimum safety distance of 800 meters between the magazine and human settlement and/or built structures. • Develop specific procedures for all activities related to explosives (handling, transport, storage, charging, blasting, and destruction of unused or surplus explosives) in accordance with recognized fire and safety codes. • Hazardous liquid storage (including bulk fuel, oil and reagents) enclosed with bunds designed to a capacity of 110% of the largest tank, or the combined capacity of any tanks that are hydraulically linked. • As a minimum, comply with national regulations for transport of hazardous materials. • Cyanide to be procured and transported by a supplier that is signatory to the International • Cyanide Management Code (ICMC). Design the cyanide circuit, storage facilities and disposal facilities to align with the International Cyanide Management Code, including cyanide detoxification. • Minimise hazardous waste streams and put in place specific procedures for their safe and secure management.	Classified installations for the protection of the environment, Decree no. 98-43 of 28 January 1998. National Code on the Protection of Public Health and the Environment against the effects of toxic and nuclear industrial waste and noxious substances, Law No. 88- 651 of July 7, 1988. National prevention of fraud relating to petroleum products and violation of technical safety requirements, Law no. 92-469 of 30 July 1992. National regulations on weapons, ammunitions and explosive substances, Law no. 98-749 of 23 December 1998. National regulations for explosive substances, Decree no. 2016-111 of 24 February 2016. IFC EHS Guidelines for Mining (2007). International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide In the Production of Gold (2021).
Tailings	• Design tailings management facilities to achieve zero harm to people and the environment. Comply with the Global Industry Standard on Tailings Management (GISTM). • Design and operate tailings management facilities to ANCOLD standards. • Undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for tailings management with the aim to (i) select an alternative that minimises risks to people and the environment; (ii) minimise the volume of tailings and water placed in external tailings facilities. • Develop preliminary designs for the tailings facility with external loading design criteria consistent with both the consequence of failure classification selected based on current conditions and higher Consequence. • Classifications (including 'Extreme').	Classified installations for the protection of the environment, Decree no. 98-43 of 28 January 1998. National Water Code, Law no. 98-755 of 23 December 1998. National Code on the Protection of Public Health and the Environment against the effects of toxic and nuclear industrial waste and noxious substances, Law No. 88-651 of July 7, 1988. Global Industry Standard on Tailings Management (2020). ANCOLD Guidelines. IFC EHS Guidelines (Mining) (2007). International Cyanide Management Code for the

Key Issue / Risk	Project Design Criteria / Considerations	Relevant Guidelines / Standards
	• For tailings facilities with 'Very High' or 'Extreme' Consequence Classifications, conduct an independent review of the planning, siting, design, construction and risk management. • Develop and document a breach analysis for the tailings facility that estimates the physical area impacted by a potential failure. • Design facility with suitable geomembrane liner.	Manufacture, Transport, and Use of Cyanide In the Production of Gold (2021).
Air quality, noise, vibration and light emissions	• Design to maximise the distance between emission sources and human settlement, including fixed and mobile plant. • Minimise possibility of wind-blown dust, noise, vibration and light emissions adversely affecting human settlement. • Design for dust suppression measures along Project roads.	Air Quality, Decree no. 2017-125 of 22 February 2017 WHO Air Quality Guidelines - Global update 2005. IFC EHS Guidelines for Mining (2007). IFC EHS General Guidelines (2007).
Flyrock	• Blasting to be conducted during daylight hours only. • Include an exclusion zone (of at least 500 m)1 from the pit crest line during surface blasting.	National Social Security Code, Law no. 99-477 of 2 August 1999, amended by Ordinance no. 2012-03 of 11 January 2012. IFC EHS Guidelines for Mining (2007).
Community Health and Safety	• Define a safety exclusion zone and accompanying controls for community access around Project facilities. • Maintain safe access for communities to other lands within the Mine Concession, outside of the Project development area. • Apply and enforce a Code of Conduct for all. • Project employees and contractors, to minimise the potential adverse impact of the workforce on the community. • Put in place a community health and safety plan to minimise the potential adverse impact of Project-induced in-migration on the community	National Social Security Code, Law no. 99-477 of 2 August 1999, amended by Ordinance no. 2012-03 of 11 January 2012. National Labour Code, Law no. 2015-532 of 20 July 2015. IFC PS4 Community Health, Safety and Security (2012). IFC General EHS Guidelines (2007).
Transport and Transport Infrastructure	• As far as practicable, avoid / minimise the use of community roads for heavy vehicles. • Limit heavy vehicle movement to day-time hours only. • Minimise night-time use of community roads. • Apply and enforce strict speed limits on all roads. • Install GPS tracking system on all company. • vehicles and encourage contractors to do same.	National regulations for the use of public roadways, Decree no. 64-212 of 26 May 1964 IFC PS4 Community Health, Safety and Security (2012) IFC General EHS Guidelines (2007)

Key Issue / Risk	Project Design Criteria / Considerations	Relevant Guidelines / Standards
Energy and Climate Change	• Assess current and future climate risks / opportunities to the success of the Project. • Identify and evaluate relevant and cost-effective adaptation options to build climate resilience into the Project life-cycle. • Undertake a multi-criteria alternatives analysis of all feasible technologies and strategies for fuel supply and power generation with the aim to minimise greenhouse gas (GHG) emissions during Project construction and operation. • Estimate the GHG emissions arising from Project development.	National Environment Code, Law no. 96-776 of 3 October 1996. National Guidance on Sustainable Development, Law no. 2014-390 of 20 June 2014. Equator Principles (2020). GHG Protocol: a Corporate Accounting and Reporting Standard (2004).
Resettlement and Livelihoods	• As far as possible, design and develop the Project to avoid physical and economic displacement of local communities. • Minimise community land take, loss of land access and barrier effects arising from Project siting. • Design the Project to enhance the opportunity for livelihood restoration and improvement, for example: integrated land use planning, water security, land/market access, energy, telecommunication, technology. • Through the Company's investment program, commence pilot livelihood development projects that demonstrate the opportunity available to enhance the livelihoods of potentially affected communities.	Scale of compensation for the destruction of crops, Interministerial Order no. 453/ MINADER/ MIS / MIRAH / MEF/ MCLU / MEER / MPEER/ SEPMBPE / of 1 August 2018. National Rural Land Code, Law no. 98-750 of 23 December 1998 modified by Law no. 2004-412 of 14 August 2004. Transfer and distribution of powers from the State to the Territorial Authorities, Law no. 2003-208 of 7 July 2003. IFC PS5 Land Acquisition and Involuntary Resettlement (2012). IFC General EHS Guidelines (2007).
Local Economic Development	• Design the Project to enhance the opportunity for benefit sharing with local communities, including access to Project infrastructure and services, vocational employment and training, procurement, investment. • Implement an investment program during the Project design and development process that builds community partnership and demonstrates the opportunity for benefit sharing. • In accordance with national regulations, contribute 0.5% of gross revenue to a local development fund for the benefit of villages identified as affected.	National Guidance on Sustainable Development, Law no. 2014-390 of 20 June 2014 Regulation relating to the application of the National Mining Code (Law 2014-138), Decree no. 2014-397 of 25 June 2014. Royalties and taxes relating to the activities governed by the National Mining Code, Ordinance no. 2014-148 of 26 March 2014. IFC Strategic Community Investment (2010).

Key Issue / Risk	Project Design Criteria / Considerations	Relevant Guidelines / Standards
Artisanal Miners	• In consultation with local communities and public authorities, secure the mineral deposits from encroachment by illegal artisanal miners. • Through the Company's investment program, commence pilot livelihood development projects /that demonstrate the opportunity available to enhance the livelihoods of potentially affected communities.	Institutional framework for small-scale artisanal mining, its responsibilities, organisation and operation, Order No. 139/PM/CAB of 31 March 2014. International Council on Mining & Metals – Working Together: How large scale mining can engage with artisanal miners (2010).
Closure	• Engage with government and community as partners to ensure Project development is broadly consistent with long-term strategic land use plans, and to prevent land and water use conflicts. • Design for geotechnical and geochemical stability of mine facilities post-closure with no significant long-term environmental or social risk. • Design to maximise the post-closure benefit to local communities of Project land, water, infrastructure, and sustainable livelihoods.	National Mining Code, Law no. 2014-138 of 24 March 2014. Regulation relating to the application of the National Mining Code (Law 2014-138), Decree no. 2014-397 of 25 June 2014. IFC General EHS Guidelines (2007) ICMM Integrated Mine Closure (2019)
Permitting	• In consultation with the regulator define a Project permitting strategy to facilitate timely and effective approvals. • Conduct a comprehensive environmental and social impact assessment including an examination of alternatives where appropriate. • Undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for key Project components with the aim to select an alternative that minimises risks to people and the environment. • Provide Project-affected communities and other stakeholders with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures.	National Mining Code, Law no. 2014-138 of 24 March 2014. Regulation relating to the application of the National Mining Code (Law 2014-138), Decree no. 2014-397 of 25 June 2014. National Environment Code, Law no. 96-776 of 3 October 1996 Rules and procedures applicable to Environmental Impact Studies for development projects, Decree no. 96-894 of 8 November 1996. Classified installations for the protection of the environment, Decree no. 98-43 of 28 January 1998. IFC PS1 Assessment and Management of Environmental and Social Risks and Impacts (2012).

20.14 Recommendations

The key environmental and social recommendations for the Project going forward to the detailed Feasibility and environmental and social impact assessment phases are as follows:

- Ensure environmental and social considerations are fully incorporated into the Project design through application of the mitigation hierarchy and defined environmental and social design criteria.
- Liaise with ANDE to finalise the ESIA ToR and permitting strategy.
- Conduct an environmental and social impact assessment in parallel with a detailed Feasibility Study. To meet Government of Côte d'Ivoire requirements, the ESIA outputs should include the following:
  - ESIA Terms of Reference
  - ESIA Non-technical Summary
  - ESIA Main Report
  - ESIA Technical Appendices
  - Environmental and Social Management and Monitoring Plan (ESMMP)
  - Livelihood Restoration and Resettlement Plan
  - Rehabilitation and Conceptual Mine Closure Plan
  - Stakeholder Engagement Plan
  - Community Development Plan
- Adopt Centamin's Sustainability Performance Framework including group policies and commitments and appropriate international standards for the ESIA, in addition to Government of Côte d'Ivoire regulatory requirements for the ESIA.
- Maintain informed consultation and participation with the affected communities, relevant government departments and other stakeholders.
- Obtain the required, additional environmental and social permitting requirements for the Project during the ESIA phase.
- Define a Project Development Area (PDA) in the ESIA that protects community safety and controls the extent of the development footprint, and its associated impacts.

- Through good project design, avoid impact and safeguard the integrity of the World Heritage Comoé National Park and its Outstanding Universal Values.
- Mitigate closure risks through Project design and establish a clear concept of a post closure legacy.

Doropo Gold Project

Pre-feasibility Study

National Instrument 43-101 Technical Report

2234-GREP-001

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TABLES

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21.0 CAPITAL AND OPERATING COSTS

21.1 Capital Costs

21.1.1 Introduction

Capital costs were developed for a 4.0 Mtpa (Fresh material) throughput plant which has been selected as the base case for this study.

21.1.2 Summary

The project Capital Cost Estimate (CCE) was compiled by Lycopodium with input from Knight Piésold on roads, airstrip, water infrastructure and the tailings storage facility. Centamin provided project specific portions of Mining, Owners costs and HV power supply. The CCE reflects the Project scope as described in this study report.

The CCE is summarised in Table 21.1.1

Table 21.1.1 Capital Cost Estimate Summary (USD, Q12023, +20/-10%)

Main Area	Capital (USD'000)
Treatment Plant	98,552
Reagents & Plant Services	18,001
Infrastructure	73,071
Mining	19,408
Contractor and Construction Distributables	25,922
Subtotal	**243,757**
Management Costs (inc. Vendor Reps)	27,168
Owners Project Costs	53,688
Subtotal	**84,186**
Contingency	33,628
Project Total	**349,437**

All costs are expressed in USD dollars unless otherwise stated and based on 1Q2023 pricing. The estimate is deemed to have an accuracy of +20 / -10%.

Where costs used in the estimate were provided in other than USD dollars the following exchange rates were used:

- AUD1 = USD0.6646
- EUR1 = USD1.0830
- PHP1 = USD0.0179
- ZAR1 = USD0.0518

21.1.3 General Estimating Methodology

The process plant was broken down into unit operation areas with quantity take-offs based on similar facilities from previous projects to provide an acceptable level of confidence required for a Pre-feasibility Study (PFS) estimate.

Unit rates have been established for bulk commodities, materials and labour that were drawn from previous studies within the region.

Capital equipment pricing was based on project specific Budget Quotation Requests (BQRs) for major equipment and database pricing for the balance, drawn from similar projects currently under construction.

The rates used in the estimate have been reviewed and deemed to reflect the current market conditions.

21.1.4 Engineering Status

The design status varies depending on the basis of design, from recently completed facility designs, modified construction and as-built drawings of current and past project facilities, to initial concept drawings.

The key process and engineering design criteria used for equipment selection in the development of the capital cost estimate is described in Section 17.

21.1.5 Estimate Basis

The capital cost estimate was prepared in accordance with Lycopodium's standard estimating procedures and practices. The basis and methodology are summarised in Table 21.1.2 and Table 21.1.3.

Table 21.1.2 Capital Cost Estimate Basis

Description	Basis
Site	
Geographical Location	Client advice from Site Plan
Maps and Surveys	Topo provided
Geotechnical Data	Site assessment by Knight Piésold.
Process Definition	
Process Selection	PFS testwork
Design Criteria	PFS level
Plant Capacity	Throughput study result
P&IDs	Not Required
Mass Balances	PFS
Equipment List	PFS
Process Facilities Design	
Equipment Selection	PFS
General Arrangement Drawings	Preliminary
3D model	Reference only
Piping Drawings	Not required
Electrical Drawings	SLD
Specifications / Data Sheets	Used for major equipment only
Infrastructure Definition	
Power	Overhead power line and grid connection cost provided by Centamin PLC
Water	WHD / WSD. Knight Piésold design and quantities – KP rates
Accommodation	Preliminary – 380 man camp
Access road	Allowance of all-weather dirt (Knight Piésold quantities)
TSF	Knight Piésold design and quantities – KP rates
Mine Services	Based on similar projects/ Included by owners
Security/Fencing	Estimated
Design Basis	Preliminary
Layout	Preliminary

Table 21.1.3 Capital Cost Estimate Methodology

Description	Basis
Bulk Earthworks	Preliminary from Topo
TSF	Engineered and MTO provided by Knight Piésold
Raw water Dam	Engineered and MTO provided by Knight Piésold
Site Access Road	Engineered and MTO provided by Knight Piésold
Detailed excavation	Allowance based on footprint, layout drawings and projects of a similar size
Concrete Installation	Quantities estimated from the layout and completed like projects
Structural Steel	Quantities estimated from the layout and completed like projects
Platework & Small Tanks	Platework items as per the mechanical equipment list
Tankage Field Erect	Tanks as per the mechanical equipment list
Mechanical Equipment	Items as per the mechanical equipment list. BQR enquiries used for twelve major items. Costs for all other items taken from the Lycopodium database of current or recently completed projects
Plant Piping General	Estimated based on projects of a similar size
Overland Piping	Sized by engineering including MTO and specification
Electrical Costs	Estimated based on projects of a similar size
Commodity Rates – General	Appropriate rates taken from the Lycopodium database
Installation Rates – General	Appropriate rates taken from the Lycopodium database
Large Cranage	Hire of a 250 t crane
Freight General	Combination of freight tons and percentages
Contractor Mobilisation / Demobilisation	Estimated based on projects of a similar size
EPCM	EPCM based on projects of a similar size – As requested by client
Owner's Costs	Client template used

Pricing Basis

Pricing has been identified by the following cost elements, as applicable, for the development of each estimate item.

- Plant Equipment
    - This component represents prefabricated, pre-assembled, commonly available mechanical equipment.
- Bulk Materials
    - This component covers all other materials, normally purchased in bulk form, for installation on the Project.

- Installation
  - This component represents the cost to install the plant equipment and bulk materials on site or to perform site activities.
- Temporary Construction Facilities
  - Facilities will be capable of servicing the Owners and EPCM teams.
- Heavy Lift Cranage
  - The hire of a heavy lift crane of 250 t capacity has been allowed for in the estimate.
- Contractor Distributables
  - Costs for mobilisation / demobilisation of labour and equipment to / from the Project site were based on projects of a similar size and adjusted to suit the Project location.

21.1.6 Qualifications

The estimate is subject to the following qualifications:

- Mining contractor mobilisation and establishment costs were provided by Centamin.
- Overhead power line and grid connection cost were provided by Centamin.
- Prices of materials and equipment with an imported content have been converted to USD at the rates of exchange stated previously in this document. All pricing received has been entered into the estimate using native currency.
- All materials, equipment supply and labour costs are Q12023. Contingency has been allowed based on the quality of the various estimate inputs, however no allowance for escalation has been included.
- Contractor rates and distributables include for mobilisation / demobilisation, recurring costs, direct and indirect labour, construction equipment, construction cranes up to 250t, materials, materials handling and offloading, temporary storage, construction facilities, off site costs, insurances, flights, construction fuel, tools, consumables, meals and PPE.
- The bulk commodities for earthworks that include for imported material are based on the assumption that suitable construction / fill materials will generally be available from borrow pits within 2 km of the work fronts, other than roads that will likely have longer haulage distances.
- There is no allowance for blasting in the bulk earthworks.

- Concrete imported materials have been included in the concrete installation rates by the contractor.
- The estimate allows for aggregate and sand for concrete batching to be provided by the concrete contractor and are assumed available locally to the project site.
- The estimate allows for all reinforced bar and mesh for construction to be provided by the concrete contractor. Free issue of materials would be a project capital opportunity.
- Contractor accommodation costs per day have been included in the individual contractor's rates.
- Meals and accommodation for the EPCM team, Owners Team and Senior Contractors staff has been included in the estimate.
- The estimate allows for supply of structural steel and minor platework from South East Asia.
- Owner's mobile equipment to be purchased early and made available for construction and operations.
- Project spares are a percentage allowance of the mechanical supply cost based on similar size projects.
- Owner's vehicles and mobile equipment to be purchased early for use by the EPCM team during construction.

21.1.7 Contingency

An amount of contingency has been provided in the estimate to cover anticipated variances between the specific items allowed in the estimate and the final total installed project cost. The contingency does not cover scope changes, design growth, etc., or the listed qualifications and exclusions.

Contingency has been applied to the estimate as a deterministic assessment by assessing the level of confidence in each of the defining inputs to the item cost being engineering, estimate basis and vendor or contractor information. It should be noted that contingency is not a function of the specified estimate accuracy and should be measured against the project total that includes contingency.

A contingency analysis has been applied to the estimate that considers scope definition, materials / equipment pricing and installation costs. Contingency applicable to various Owners inputs have been specified by Centamin.

The resultant contingency for the project is 10.6%.

21.1.8 Escalation and Foreign Exchange

Escalation

Escalation is excluded from the estimate.

Exchange Rates

All items in the capital cost estimate have been expressed in United States Dollars and no allowances for exchange rate variations are included in the estimate.

21.1.9 Preproduction Costs

Preproduction costs that include first fills, opening stocks, preproduction labour and vendor representative costs have been included in the estimate.

21.1.10 Working and Sustaining Capital

No allowance has been made for working capital costs.

21.1.11 Exclusions

The following is excluded from the overall project capital costs:

- Geotechnical drilling, testing, engineering / design services and remediation.
- Working capital. (To be included directly in the financial model).
- Duties / taxes / fees.
- Project sunk costs.
- Exchange rate variations.
- Project escalation.

21.2 Project and Process Plant Operating Cost Estimate

21.2.1 Process Operating Cost Estimate

Introduction

The operating costs have been compiled by Lycopodium based on costs developed by:

- Lycopodium - Processing costs.

- Knight Piésold – TSF and Infrastructure.
- Centamin – Site general and administration costs.
- Centamin – Mining Costs.

Operating costs for Mining are detailed separately in Section 21.4.

The estimate is considered to have an accuracy of +20 / -10%, is presented in USD and is based on information obtained during the first quarter of 2023 (Q12023).

Process Plant Operating Costs

Processing operating costs have been developed by Lycopodium for a life of mine (LOM) blend. It is expected that the plant will operate on a range of mineralised material blends. The LOM processing costs are a weighted average of the various mineralised material type processing costs based on the LOM blend.

Processing operating costs have been developed for a plant with an annual throughput equivalent to 4,000,000 tonnes of fresh mineralised material plant feed at a P_{80} grind size of 75 µm, based on a 24 hour per day operation, 365 days per year. The plant will operate at the following availabilities:

- 80% (7,008 h/y) – primary crushing.
- 91.3% (8,000 h/y) – milling with all subsequent downstream processing plant sections.

The operating costs have been compiled from a variety of sources, including the following:

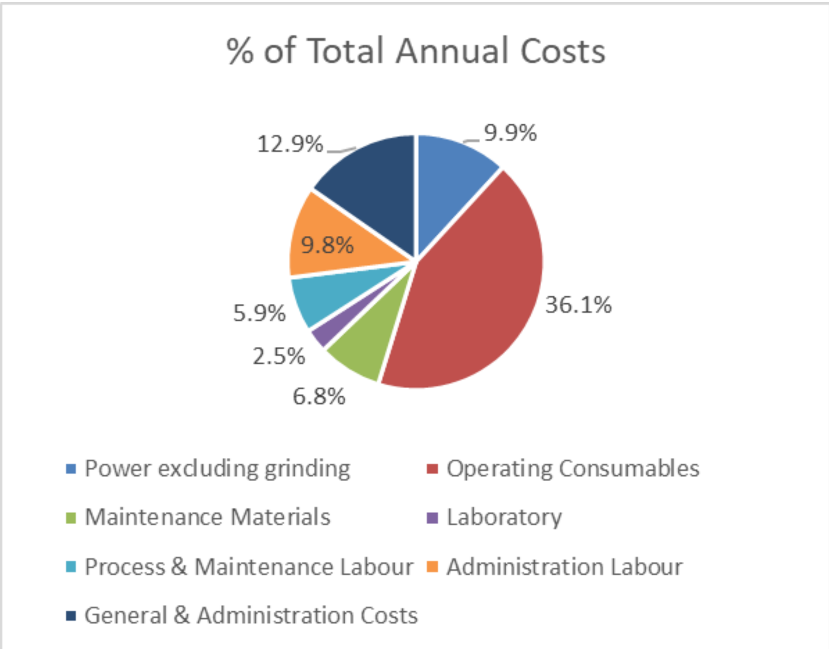
- Labour pay rates and manning as advised by Centamin.
- Power costs as advised by Centamin, at a rate of 0.11 USD/kWh.
- Consumable prices from supplier budget quotations, Centamin advice, and the Lycopodium database. It should be noted that market prices are currently volatile with cognisance given to the cyanide and mill ball costs utilized being from quotes obtained in Q1 2023.
- Modelling by OMC for crushing and grinding energy and consumables, based on physical mineralised material characteristics determined from comminution testwork for the various mineralised material types.
- Reagent consumptions and gold extractions based on the results from a metallurgical testwork programme.
- First principle estimates based on typical operating data / standard industry practice.

The processing operating cost estimate is summarised in Table 21.2.1. The relative proportions of each operating cost centre for the processing and process plant (processing plus G&A) operating costs are shown in Figure 21.2.1.

Table 21.2.1 Operating Cost Summary (USD, Q12023, +20 / -10%)

	LOM Blend	
Proportion of LOM	**100%**	
Plant Feed t/y (LOM Average)	**4,647,242**	
Cost Centre	**USD/y**	**USD/t**
Power excluding grinding	7,540,934	1.62
Grinding Power	12,213,444	2.63
Operating Consumables	26,262,289	5.65
Maintenance Materials	5,161,685	1.11
Laboratory	1,931,568	0.42
Process and Maintenance Labour	4,517,320	0.97
Total Processing	**57,627,240**	**12.40**
Administration Labour	6,312,000	1.36
G&A Costs	8,225,641	1.77
Mining Tech Services Labour	0	0
Total G&A	**14,537,641**	**3.13**
Total OPEX (Excl. Mining)	**72,164,881**	**15.53**

Figure 21.2.1 Operating Cost Breakdown



The process operating costs have been split into fixed and variable components to enable them to be used to derive annual costs for changing plant feed blends and/or throughput over the life of the project. The fixed and variable costs are considered valid for throughput variations within 25% of the design plant feed throughput and are summarised in Table 21.2.2 for the LOM blend.

Table 21.2.2 Fixed and Variable Components (USD, Q12023, +20 / -10%)

COST CENTRE	LOM		
	Fixed USD/y	Variable USD/t	% Fixed
Power	13,760,691	1.29	70%
Operating Consumables	0	5.65	0%
Maintenance	4,218,748	0.20	82%
Laboratory	1,333,368	0.13	69%
Process & Maintenance Labour	4,517,320	0.00	100%
Total Processing	23,830,127	7.27	41%
Administration Labour	6,312,000	0.00	100%
General & Administration Costs	8,225,641	0.00	100%
Total G&A	14,537,641	0.00	100%
TOTAL	**38,367,768**	**7.27**	**53%**

Exclusions:
All Mining Costs, except catering and camp costs.

The operating costs include all direct costs to allow production of gold bullion. The battery limits for the processing operating costs are as follows:

- Mineralised material delivered to the ROM bin.
- Tailings discharged to the tailings storage facility (TSF).
- Gold bullion in plant goldroom safe.

Qualifications

The operating cost estimate presented in this section excludes the following:

- Any impact of foreign exchange rate fluctuations.
- Any escalation from the date of the estimate.
- Future required equipment power and operating costs.
- Any contingency allowance.

- All withholding taxes and other taxes.
- First fill costs are included in the project financial analysis cashflows.
- Gold refining and bullion transport and in-transit security of gold from site (but insurance of the bullion is included in the G&A Insurance costs).
- Tailings storage facility future lifts and site rehabilitation.

The operating cost estimate includes the following:

- Import duties on consumable unit costs (in the consumables cost).
- Costs for Mine Service Area (MSA) power and raw, fire and potable water supply (in the power and consumables costs).
- Costs for the preparation and assaying of 263 mine grade control samples per day (8,000 per month) and routine laboratory tests on the site water samples (in the laboratory cost).
- Selected G&A costs (travel to site for international and regional expats, international expat recruiting / relocation and camp, catering, and cleaning) for mine (as well as administration and process plant) personnel (in the G&A costs).

21.2.2 Power

The power cost estimate has been based on a life of mine (LOM) average power supply of 175.2 GWh at a unit cost of USD0.11/kWh. The average continuous power draw and power cost for the LOM blend by plant area are summarised in Table 21.2.3.

The power cost for the accommodation camp is included in the G&A operating cost.

Table 21.2.3 LOM Blend – Power Cost Summary (USD, Q12023, +20 / -10%)

Plant Area	Installed Power (kW)	LOM Blend Average Continuous Power Draw (kW)	LOM Blend Power Cost (USD/y)
Primary Crushing and Reclaim	848	498	491,162
Milling, Classification and Gravity Conc	18,956	13,675	13,500,211
CIL Feed & Thickening	124	81	79,504
CIL Leaching	2,387	1,702	1,679,869
Elution, Gold room and Cyanide Destruction	721	343	338,236
Tailings Handling	1,572	592	584,428
Reagents	127	25	24,844
Water Services	1,754	807	796,941
Air Services	1,358	704	694,940
Water Supply and Treatment incl Camp	1,498	610	602,085
Plant Buildings and Workshops	1,009	791	780,852
Mining Facilities	337	184	181,305
Total	**30,691**	**20,009**	**19,754,378**

The power consumption for the crushers and ball mills has been calculated by OMC based on the physical mineralised material properties determined from comminution testing. The power consumption for the remainder of the individual plant mechanical equipment items has been calculated from the installed power and typical drive efficiency and utilisation factors.

21.2.3 Operating Consumables

Costs for processing operating consumables, including reagents, liners, fuels, and process supplies have been estimated and are summarised for the various generic mineralised material types and LOM blend by plant area in Table 21.2.4.

Table 21.2.4 Consumables Cost Summary (USD, Q12023, +20 / -10%)

Plant Area	**LOM Blend**	
Throughput (LOM Average)	**4,647,242 t/y**	
% of LOM	**100%**	
	USD/yr	**USD/t**
Crushing	130,548	0.03
Milling	10,119,294	2.18
Pre-Leach and CIL	6,280,604	1.35
Cyanide Destruction	4,647,869	1.00
Thickening	603,980	0.13
ADR and Gold Room	2,339,232	0.50
Miscellaneous	2,140,762	0.46
Total	**26,262,289**	**5.65**

The consumables cost for mining is included in the mining operating cost.

The consumption of reagents and other consumables has been calculated from laboratory testwork and comminution circuit modelling at average mineralised material properties, calculated from first principles, or has been assumed based on experience with other operations. No additional allowance for process upset conditions and wastage of reagents has been made.

Reagent costs have been sourced from a combination of budget quotations, Client supplied costs, and in-house data relating to similar projects in the region. Transport and freight to site and import duties and taxes have been added based on vendor information.

Cyanide destruction cost has been based on the Air / SO_2 method, with the treatment of CIL tailings containing 150 g CNWAD/m^3 down to 50 g CNWAD/m^3 after cyanide destruction. The cost of reagents for cyanide destruction has been derived from metallurgical testwork data. Future arsenic precipitation process cost has been excluded as it is a future option for the process facility.

A diesel price, delivered to site, of USD1.00 per litre has been used, as provided by the Client. Diesel will be used in plant mobile equipment, for the carbon elution heater circuit, the carbon regeneration kiln, and furnace. The diesel consumption for plant mobile equipment is based on industry standard vehicle consumption rates and estimated equipment utilisation, while the diesel usage for carbon treatment has been calculated from equipment anticipated running times and vendor data.

Allowances have been made for water treatment reagents and operator supplies. Lubricants are excluded from the consumables costs and have been included under the maintenance cost centre.

21.2.4 Maintenance

The plant maintenance cost allowance has been factored from the capital supply cost using factors from the Lycopodium database and is summarised for variable costs by ore type and fixed costs in Table 21.2.5.

Table 21.2.5 Maintenance Cost Summary (USD, Q12023, +20 / -10%)

Area	Variable Maintenance Cost			Fixed Cost
	USD/t ore (Fresh)	USD/t ore (Oxide)	USD/t ore (Trans)	USD/y
Treatment Plant	0.82	0.61	0.61	2,634,480
Reagents and Services	0.13	0.10	0.10	427,200
Raw Water Supply and Decant Return	0.05	0.03	0.03	146,800
Buildings	0.05	0.03	0.03	145,200
Mobile Equipment	0.13	0.10	0.10	418,068
Sub-Total - Plant Maintenance	1.18	0.87	0.87	3,771,748
General Maintenance	0.11	0.08	0.08	447,000
Total Annual Maintenance	**1.29**	**0.96**	**0.96**	**4,218,748**

The allowance covers mechanical spares and wear parts, but excludes crushing and grinding wear components, grinding media and general consumables which are allowed for in the consumables cost.

The maintenance cost excludes payroll maintenance labour which is included in the labour cost. Contract labour has been allowed for primary crusher and mill liner changes and plant shutdowns in the General Maintenance category, along with specialist maintenance software, maintenance manuals, training costs, vendor visits, and control system maintenance and licence fees.

The mobile equipment allowance is based on unit costs for maintenance of the light vehicles, portable generators, and other mobile equipment for the process plant.

21.2.5 Labour

The labour rates, manning levels and rosters used to determine the labour operating cost estimate have been agreed with Centamin and are based on benchmarking with other west African gold operations.

The plant labour cost includes all labour costs associated with site-based administration, plant operations and maintenance personnel. The plant labour cost excludes all mining personnel (included in the Mining cost category) and all head office (included in the General & Administrative Overheads costs). The labour costs are summarised in Table 21.2.6.

Table 21.2.6 Labour Cost Summary (USD, Q12023, +20 / -10%)

	People	Cost USD/y
Administration	237	6,312,000
Plant Operations and Metallurgy	82	2,695,000
Plant Maintenance	64	1,822,000
Mining Tech Services	166	0*
Total Plant + Administration + Mining Tech Services	**549**	**10,829,000**

*Mining Tech Services are included in Centamin's Financial Model (Section 22.0)

The site laboratory will be operated on a contract basis with the personnel included in the process labour count, but the labour costs included in the contract laboratory cost. Camp management / catering / cleaning, site security and the medical clinic will be operated on a contract basis with the personnel included in the administration labour count, but the respective labour costs included in the camp contract cost, the security contract cost, and the medical services contract cost.

The estimate of the labour contingent has been based on a three shift operation (two shifts working 12 hours per day, one rotation shift), to provide continuous coverage for the plant operation with allowance for leave and absenteeism coverage. Provision has been made in the manning numbers to accommodate annual and sick leave requirements.

The roster is based on all expatriate personnel working six weeks on site and three weeks off site with all other personnel working 10 days on site and four days off site with four weeks annual leave and two weeks sick leave per year.

Unit rates for labour have been based on Client advice and include the base salary and an overheads allowance. The overhead cost includes allowances for housing, travel, overtime and shift work, medical health insurance, life and disability cover, leave provisions and production bonuses. Camp and transportation costs for the workforce are excluded from the labour cost category and are included in the G&A costs.

21.2.6 Laboratory Costs

A contract laboratory will provide sample preparation and assay services for mine grade control and exploration samples and plant and environmental samples. A total of 110,543 samples per year have been allowed.

Laboratory costs have been based on contract laboratories operating at other similar West African gold operations. The laboratory cost allows for the supply of the laboratory equipment, mobilization, and all ongoing costs (laboratory labour, equipment and consumables) comprising a fixed monthly cost and a variable cost related to the number of samples being processed. The laboratory building has been included as a separate item in the capital cost estimate.

21.2.7 Services and Utilities

Mobile Equipment

Plant mobile equipment requirements have been agreed with the Client. Mobile equipment costs provide for the fuel and maintenance of the mobile equipment fleet (excluding the mining fleet and mining light vehicles). The purchase cost of this equipment has been included in the capital cost estimate.

The fuel and maintenance costs for the mobile equipment are included in the consumables and maintenance cost centre, respectively.

An allowance has been made for a Front End Loader (FEL) to be routinely used in the plant to feed stockpiled mineralised material into the mill feed bin when the primary crushing circuit is off-line, as required.

Water Supply

Water supply costs are included in the power and maintenance costs, with no requirement for any abstraction or harvesting fees.

21.2.8 Site General and Administration

The general and administration costs is based on information and costs provided by the Client and are summarised in Table 21.2.7.

Table 21.2.7 General and Administration Cost Summary (USD, Q12023, +20 / -10%)

Item	Cost, USD/y
Abidjan Office	568,400
Doropo Site Office	1,108,400
Insurances	1,925,000
Financial	246,000
Government Charges	140,000
Personnel	526,332
Contracts	626,000
Community Relations	168,000
Transport	600,000
Other	336,000
Camp, Catering & Cleaning Contract	1,981,509
TOTAL	**8,225,641**

The general and administration expenses include the following ongoing operating expenses:

- Abidjan and site office expenses including communications and communication maintenance, office equipment and supplies, computer supplies and software licenses.
- Insurance expenses covering industrial special risks, third party liability, motor vehicle and bullion transport. Labour associated insurances (medical, death and disability and workers liability insurances) are included in the labour costs.
- Financial expenses including banking charges, legal fees, auditing costs and accounting consultants and bullion selling. Bullion refining and royalties are excluded as they are deducted directly from revenue in a separate cost category.
- Government charges including permits and environmental inspection fees.
- Personnel expenses such as first aid and medical costs, safety supplies, travel and accommodation, expatriate travel, international expat recruiting / relocation costs, training, recreational and local facilities costs, professional memberships and subscriptions, and entertainment allowances. The allowances for expatriate travel (international and regional) and international expat recruiting / relocation include all personnel (mining as well as administration and process plant).
- Contract costs for personnel transport (in country charter flights and on site bussing), camp catering and cleaning (shown separately), environmental compliance testing, OH&S and other consultants. The camp catering and cleaning contract cost includes all personnel (mining as well as administration and process plant).
- Community relations expenses including general expenses, community projects and scholarships.

21.2.9 Process Plant Pre-Production and Working Capital Costs

The costs incurred by operations during the latter stages of construction and commissioning are included in the capital cost estimate but are derived in this estimate. Pre-production costs associated with mining are excluded.

Pre-Production Labour

Pre-production site administration and processing labour costs reflect the need to recruit key operating personnel in time for them to set up and establish operating procedures and undergo training as required. It is envisaged that manning will commence to build-up eight months preceding plant start-up.

Pre-Production Site Administration Expenses

The pre-production site administration expenses cost covers the establishment of operations during the twelve months preceding start-up and includes provision for power consumption, mobile equipment, and other expenses during this period.

First Fill Reagents and Opening Stocks

Costs have been allowed in the project financial model cash flow estimates to purchase the mill balls and cyanide needed to commission the plant. Other consumables and reagents required for the process plant first fill and opening stocks are expected to be paid for in the commissioning and ramp up period, from the operating cost budget.

Sufficient first fill reagents and consumables have been estimated for the initial ball mill steel ball load, to fill the reagent tanks, fill the CIL circuit with cyanide and carbon, and for other plant consumable requirements. Opening stocks refer to the purchase of the reagents and consumables required to sustain the operations for 30 days, which is the minimum on-site start-up storage quantity nominated by the Client.

Quantities allowed have been based on either consumption over the minimum period or minimum shipping quantities, considering package size.

Diesel costs are excluded as the supply contract will be based on a consignment arrangement with fuel usage charged as it is drawn.

Vendor Representatives

This cost allows for specialist vendor representatives to oversee commissioning of their processing equipment and include allowances for labour, airfares, and expenses.

Training

The training allowance covers the cost of providing pre-production training for process plant operations and maintenance staff, but not their salaries as these are covered in the pre-production labour costs.

Working Capital

Working capital covers the cost of operating the process plant before the first receipt of revenue from bullion sales. The working capital calculation is based on treating 100% ROM feed for the initial four weeks of operation at 85% of the design throughput rate. Working capital calculations are included in Centamin's project cashflow analysis but are not included in either the capital or operating costs estimates.

21.3 Mining Cost Rates and Assumptions

21.3.1 Estimation Approach and Accuracy

The mining costs have been developed on the basis of a mining contractor operation. A preferred contractor was selected from the submissions received for the Request for Budget Pricing (RFB) as described in Section 16.3. This was Contractor 6 of the assessed submissions which was the second lowest bid (refer to Figure 16.3.2 in Section 16.3 above). This submission was within 10% of the average and was from a reputable contractor with considerable experience and track record in West Africa. It was therefore not considered an unduly risky selection. The following sections detail the assumptions and rates derived from the selected submission.

Owner’s mining costs developed by Centamin related to management and technical personnel, grade control etc.

The costs estimate was developed in three steps:

- Determining the physicals for each activity by period.
- Determining the unit rates for those activities.
- Calculation of the cost by period by:
  - Multiplying the scheduled quantity by the appropriate rate.
  - Apply any fixed costs on a time based pro-rata basis.

The estimates assumed a fuel price of 1.00 USD/l.

The costs estimate has been developed to an accuracy of ±25%, in line with the requirements of a study to prefeasibility level.

21.3.2 Site Establishment and Mobilisation / Demobilisation

The mobilisation / demobilisation for the selected submission fleet is shown in Table 21.3.1 below.

Site establishment and associated infrastructure are detailed in Table 21.3.2 below.

Table 21.3.1 Selected RBP Submission – Mobilisation and Demobilisation

Description		Make	Model	# units
Mining Equipment	Excavator	Cat	6030	1
		Cat	6015B	2
	Mine Truck	Cat	777E	20
	Road Truck	MAN	30t	10
	Front End Loader	Cat	992	2
		Cat	950	2
	Drill Type	Sandvik	DP1500i	7
	Excavator (Clean-up)	Cat	390F	1
	Track Dozer	Cat	D9T	4
	Grader	Cat	16M	2
	Water Truck	Cat	777	2
	Rockbreaker	Cat	336E	1
	Subtotal			54
Ancillary Equipment & Personnel	Tool carrier	Cat	IT28	1
	Fuel truck			2
	Service Truck	Iveco		1
	Lighting Plant	Allight		13
	Light Vehicle	Toyota		17
	Town Bus	Toyota		4
	Mine Bus (4x4)	Iveco		3
	Tyre Handler			1
	Miscellaneous Items[1]			1
	Personnel			1
	Project Startup Management			1
	Subtotal			45

Table 21.3.2 Selected RBP Submission – Site Establishment and Infrastructure

Description
Mining Contactor Office
Staff Training Facility
Kitchen Diner
Junior Staff Change House
Ablutions Facility
HME Workshop & Stores
LV & Drill Rig Workshop
Service / Lube Bay
Wash Bay
Tyre Bay
Hose Repair Facility
Security Guard House x 2
Mine Services Area Prep Works
Site Services connections etc
Total

21.3.3 Primary Production Rates

The contractor elected to utilise emulsion product across all material types. There was a consistent pattern for oxide and transitional material, with fresh material split 50/50 between two pattern sizes.

Load and haul rates were provided by deposit by bench for the three weathering zones.

21.3.4 Other Mining Activities and Fixed Costs

Other mining costs were generated as part of the RBP submissions on a rates basis.

21.3.5 Ore handling

Ore rehandle rates were provided for reclaim from short term stockpiles on top of the process plant ROM pad, and FEL/truck rehandle from longer term low grade stockpiles adjacent to the ROM pad.

Ore haulage from the satellite pits were costed on the basis of a normalised loading rate (USD/t) and hauling rate (USD/t/km).

21.3.6 Dayworks

A dayworks rates of 5% was applied on top of the combined costs for drilling, blasting, loading, hauling and ore rehandle.

21.4 LOM Mining Contractor Cost Estimate

The Life of Mine contractor mining costs are summarised annually in Figure 21.4.1 below.

The total mining cost for the LOM is estimated at USD823.8M which equates to USD3.99/t mined or USD20.31/t ore mined.

- The costs on a USD/t mined basis are slightly higher over the first half of the mine life (i.e., Y-1 to Y5) at USD4.07 compared to the second half at USD3.89.

- However, they are slightly lower on a USD/t ore basis (USD20.15 vs USD20.55) and considerably lower on a USD/rec. oz basis (USD465 vs USD494).

This indicates the lower cost ozs have been targeted as part of the project value maximisation process.

Figure 21.4.1 Mining Contractor Cost Estimate (Annualised)

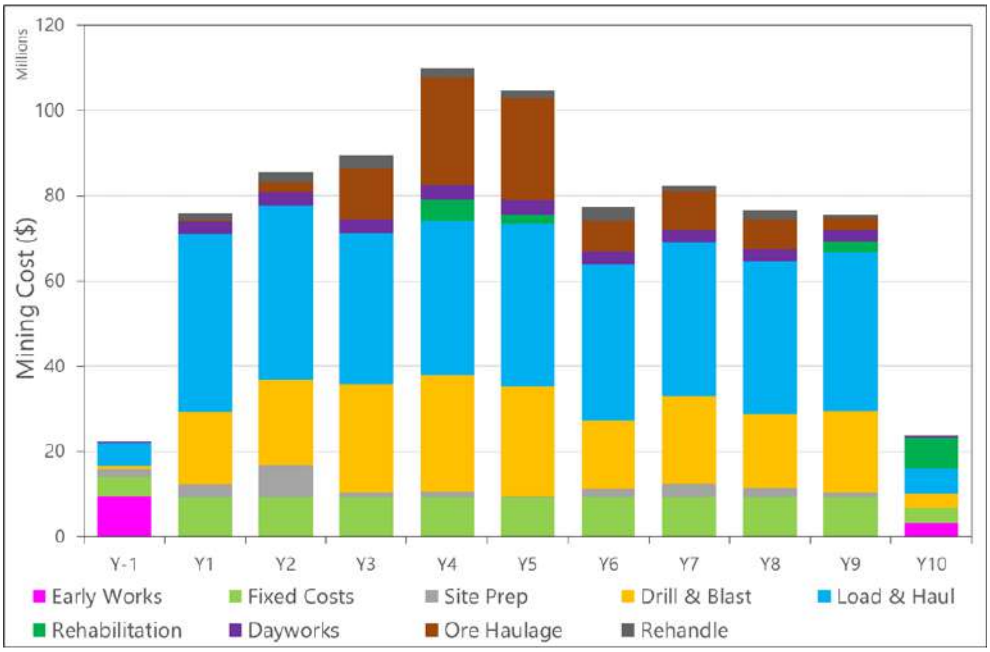
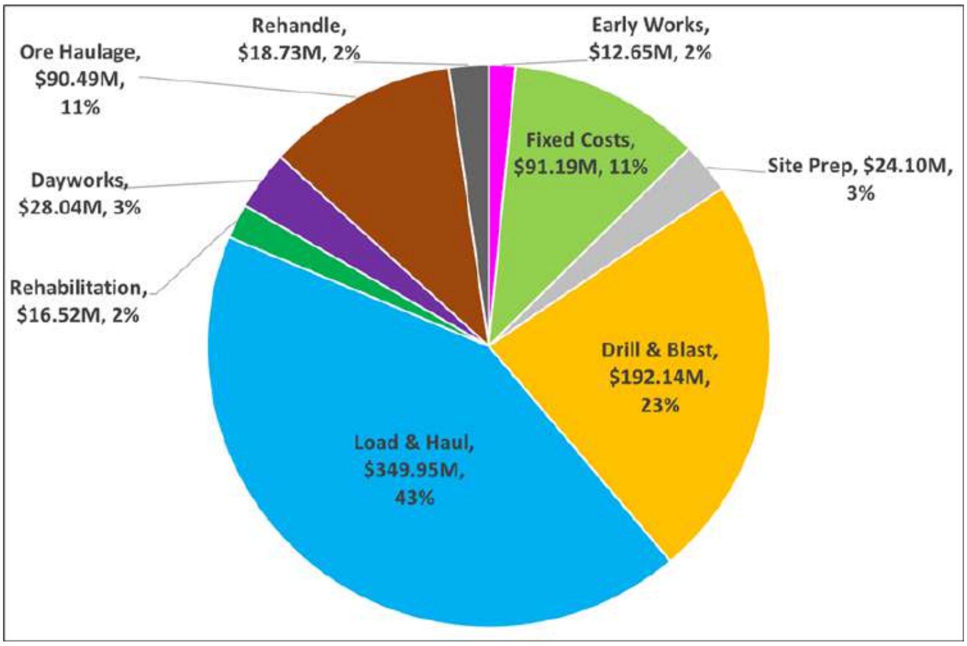


Figure 21.4.2 Mining Contractor Cost Estimate Breakdown



Doropo Gold Project

Pre-feasibility Study

National Instrument 43-101 Technical Report

2234-GREP-001

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22.0 ECONOMIC ANALYSIS

22.1 Introduction

An economic analysis has been undertaken by Centamin and incorporates Study outputs including, milled tonnages and grades for the ore and the associated recoveries, gold price (revenue), operating costs, bullion transport and refining charges, government royalties and capital expenditures (both initial and sustaining). The purpose is to provide an estimate of project cashflows and overall economics for evaluation.

The evaluation method considers the Project has been evaluated on a 100% ownership basis, with no debt financing. The outputs are a Project Cashflow, Net Present Value ("NPV") at a 5% discount rate ("NPV5%") and the Internal Rate of Return ("IRR"). The basis of the estimate utilises inputs from Orelogy (Project physicals namely mining and processing, and mining operating costs), Lycopodium (Process infrastructure, processing operating costs and site G&A costs), Knight Piésold (Infrastructure) and Centamin (Site G&A and economic analysis).

Centamin will continue to review their tax position regarding, corporate income tax, withholding taxes and VAT to ensure that the DFS accurately reflects the most suitable and relevant taxation for the asset.

22.2 Summary

The results of the economic model show potential within the asset. The model applies a long-term gold price of USD1,600/oz, below consensus forecasts, on a flat line basis from commencement of production. The Project is estimated to produce 173 koz per annum over its 10 year mine life, at an average cash cost of USD869/oz gold produced and an average all-in sustaining cost (ASIC) of USD1,017/oz gold sold. The initial capital is expected to be USD349M.

The project economics are a Pre-tax NPV5% of USD418M and an IRR of 31% and a Post-tax NPV5% of USD330M and an IRR of 26%

Table 22.1 shows a summary of the physical, financial and economics of the project.

Table 22.1 Economic Summary

Economic Summary	Units	Value
Mine life	Years	10
LOM ore processed	kt	40,554
LOM strip ratio	w:o	4:1
LOM feed grade processed	Au g/t	1.44
LOM gold recovery	%	92.4%
LOM gold production	koz	1,729
Upfront capital cost	USDM	349
Life of Mine Average:		
Gold, average annual production	oz	173
Cash costs per ounce	USD/oz	869
AISC per ounce	USD/oz	1,017
Project years 1 to 5		
Gold, average annual production	oz	210
Cash costs per ounce	USD/oz	813
AISC per ounce	USD/oz	963
Pre-Tax Economics		
Net present value - 5%	USDM	418
Internal Rate of Return	%	31%
Post-Tax Economics		
Net present value - 5%	USDM	330
Internal rate of return	%	26%
Payback period	Years	2.3

22.2.2 Sensitivity Tables

The after tax NPV sensitivity (in USDM) comparing varying discount rate percents and gold price in USD/oz is indicated in Table 22.2. The Doropo Gold Project after tax economic reported result is in bold.

Table 22.2 NPV Sensitivity in USDM of Discount Rate vs Gold Price in USD/oz

Discount Rate	1,500	1,600	1,700	1,800	1,900	2,000
5%	248	**330**	428	526	624	701
6%	222	300	393	486	579	652
7%	198	272	360	448	536	606
8%	176	247	330	414	497	563
9%	156	223	302	382	461	524
10%	137	201	276	352	428	487

The after tax NPV sensitivity (in USDM) comparing operating expenditure fluctuations with varying gold prices in USD/oz is indicated in Table 22.3. The Doropo Gold Project after tax economic reported result is in bold.

Table 22.3 Operating Expenditure % Change vs Gold Price USD/oz, $NPV_{5\%}$ in USDM

% Change	1,500	1,600	1,700	1,800	1,900	2,000
-20%	423	506	604	701	799	877
-10%	336	418	516	614	712	789
0%	248	**330**	428	526	624	701
10%	160	243	341	439	537	614
20%	72	155	253	351	449	526

The after tax NPV sensitivity (in USDM) comparing up-front capital expenditure fluctuations with varying gold prices in USD/oz is indicated in Table 22.4. The Doropo Gold Project after tax economic reported result is in bold.

Table 22.4 Up-front Capital Cost % Change vs Gold Price USD/oz, $NPV_{5\%}$ in USDM

% Change	1,500	1,600	1,700	1,800	1,900	2,000
-20%	304	387	485	583	681	758
-10%	276	359	457	554	652	730
0%	248	**330**	428	526	624	701
10%	220	302	400	498	596	673
20%	192	274	372	470	568	645

22.3 Principal Assumptions and Inputs

The economic evaluation for the project was based upon:

- Capital cost estimates prepared by Lycopodium, ECG, Knight Piésold and Centamin.
- Mine schedule and mining operating cost estimates based on contract mining prepared by Orelogy with inputs from Centamin.
- Mining technical services labour and grade control were estimated by Centamin
- Process operating cost estimates prepared by Lycopodium.
- General and administration (G&A) cost estimates prepared by Lycopodium based on Centamin input.

- Metallurgical performance characterised by testwork conducted on representative composite samples from the Doropo deposits.
- Typical sustaining capital cost estimates for the infrastructure, relocation and closure as estimated by Knight Piésold and Centamin.
- Côte d'Ivoire government royalties. The cash flow analysis excludes any effects due to inflation.
- A gold price of USD1,600/oz.
- Construction completed over a 24 month period shown in the 'Pre-production' period.
- The financial assessment has been undertaken in United States Dollars (USD).

22.3.1 Depreciation

Provision has been made for depreciation using a straight-line method for all capital.

22.3.2 Company Tax

Corporate tax rate of 25% of taxable profit has been used.

22.3.3 Refining Costs

A typical refinery gold payable rate of 99.95% and an additional USD4.00/oz freight plus insurance charge has been used based on recent comparable studies.

22.3.4 Silver Credits

No silver production or revenue has been factored into the model.

22.3.5 Royalties

The Côte d'Ivoire royalty rate for gold is as defined below:

- 3.0% if gold price is ≤ USD1,000/oz.
- 3.5% if gold price is >USD1,000 and ≤USD1,300/oz.
- 4.0% if gold price is > USD1,300 and ≤ USD1,600/oz.
- 5.0% if gold price is > USD1,600 and ≤ USD2,000)/oz.
- 6.0% if gold price is USD (>2,000)/oz.

In addition to this there is an additional royalty of 0.5% of revenue paid to a community development fund.

22.3.6 Working Capital

Allowance for working capital has been included in the Owners cost estimate.

22.3.7 Closure Costs

In the economic model, rehabilitation is ongoing during the operation with an additional final allowance for demolition and closure activities occur after mining and processing once activities have ceased, the total allowance for rehabilitation and closure in the model is USD30M.

22.3.8 Other

- The cash flow model is based on 100% project ownership, i.e. no allowance for minority shareholders and government free carry.
- No provision has been made for interest or cost of capital.
- No provision has been made for escalation or inflation.
- No provision has been made for salvage value of the remaining assets upon cessation of mining and processing activities.

Table 22.5 Summary Annual Economic Model

	Unit	LOM	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11
Mining schedule															
Total material moved	kt	**206,279**	-	3,084	23,591	23,653	23,655	23,656	22,287	20,814	20,814	20,815	20,871	3,039	-
Total waste moved	kt	**165,725**	-	2,467	19,235	18,168	19,979	18,918	16,932	17,478	16,564	17,161	16,513	2,310	-
Total ore mined	kt	**40,554**	-	617	4,356	5,486	3,676	4,737	5,355	3,336	4,250	3,654	4,358	729	-
Stripping ratio	w:o	**4.1**	0.0	4.0	4.4	3.3	5.4	4.0	3.2	5.2	3.9	4.7	3.8	3.2	0.0
Au grade - ore mined	g/t	**1.44**	0.00	1.36	1.83	1.56	1.57	1.30	1.40	1.36	1.17	1.21	1.48	1.38	0.00
Contained gold - ore mined	oz	**1,872**	-	27	256	276	185	198	241	146	161	142	207	32	-
Processing schedule															
Total ore processed	kt	**40,554**	-	-	4,782	4,618	4,307	4,257	4,173	4,294	4,381	4,548	4,402	791	-
Au grade - processed	g/t	**1.4**	0.00	0.00	1.82	1.73	1.43	1.36	1.57	1.27	1.15	1.10	1.47	1.31	0.00
Contained gold - processed	oz	**1,872**	-	-	280	257	198	186	211	175	163	160	208	33	-
Au recovery	%	**92.4%**	--	--	93.3%	92.7%	92.1%	92.1%	92.7%	92.0%	91.7%	91.8%	92.1%	91.8%	--
Recovered gold	oz	**1,729**	-	-	261	238	182	172	195	161	149	147	192	31	-
Cash flow summary															
Gross revenue	USDM	**2,765**	-	-	418	381	292	274	312	258	238	235	306	49	-
Less: Royalties	USDM	**152**	-	-	23	21	16	15	17	14	13	13	17	3	-
Less: Refining & transport	USDM	**7**	-	-	1	1	1	1	1	1	1	1	1	0	-
Net revenue	**USDM**	**2,606**	**-**	**-**	**394**	**360**	**275**	**259**	**294**	**243**	**225**	**222**	**289**	**46**	**-**
Operating costs															
Mining	USDM	**836**	-	-	85	92	95	111	109	82	88	82	79	14	-
Processing	USDM	**523**	-	-	57	58	57	57	57	57	57	57	57	10	-
Site G&A	USDM	**143**	-	-	15	16	16	16	16	16	16	16	16	4	-
Total operating costs	USDM	**1,502**	**-**	**-**	**157**	**165**	**167**	**183**	**181**	**155**	**160**	**155**	**152**	**28**	**-**
Operating margin	**USDM**	**1,104**	**-**	**-**	**237**	**195**	**108**	**76**	**113**	**89**	**64**	**67**	**137**	**18**	**-**
Construction capital	USDM	**349**	122	227	-	-	-	-	-	-	-	-	-	-	-

	Unit	LOM	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11
Sustaining capital	USDM	**110**	-	-	17	20	6	10	8	4	9	6	9	7	14
Change in Working capital	USDM	**-0**	-	-	-37	-0	2	-2	-1	6	-0	1	-1	27	6
Net project cash flow Pre- tax	**USDM**	**644**	**-122**	**-227**	**183**	**175**	**104**	**63**	**105**	**90**	**55**	**62**	**127**	**38**	**-8**
Income Tax	USDM	**118**	-	-	13	19	17	9	18	11	5	5	21	-	-
Net after-tax cash flow	**USDM**	**526**	**-122**	**-227**	**171**	**155**	**87**	**55**	**87**	**79**	**51**	**57**	**105**	**38**	**-8**
Cumulative after-tax cash flow	USDM		-122	-349	-179	-23	63	118	205	284	334	392	497	534	-
Cash operating cost per ounce*	USD/oz Prod	**869**	-	-	600	691	916	1,067	927	958	1,075	1,052	791	930	-
All-in sustaining cost per ounce	USD/oz Sold	**1,017**	-	-	758	866	1,040	1,218	1,061	1,078	1,226	1,183	932	1,253	-

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23.0 ADJACENT PROPERTIES

The Doropo Gold Project site is located approximately 30 km south-west of Batie West in Burkina Faso. No operating mines or active exploration is occurring adjacent to the Doropo Gold Project.

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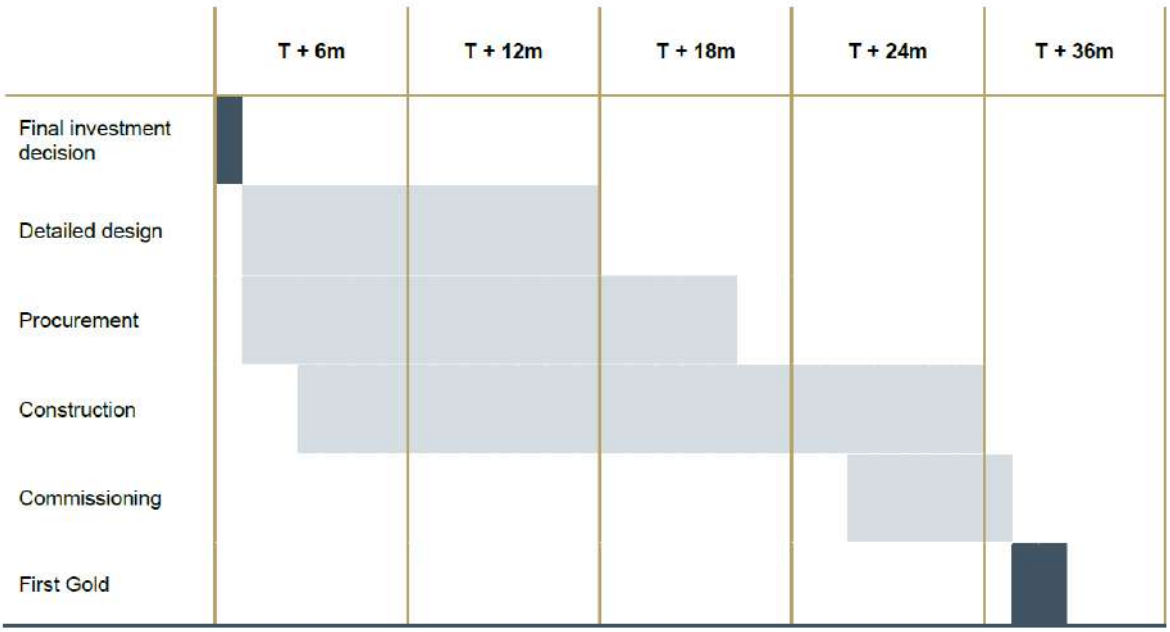
24.0 OTHER RELEVANT DATA AND INFORMATION

The approach to project implementation outlined in this study was used as the basis for the preliminary implementation schedule and the build-up of the capital cost estimate. The proposed approach is to engage a suitable Engineering, Procurement and Construction Management (EPCM) contactor for design and construction management of the process plant and infrastructure, which will then be handed over to the Owner's operating team. The construction of the mining operations, tailings dam, water storage and harvest dams, power supply / 90 kV switchyard and the camps / non process infrastructure blockwork buildings.

The Doropo summary schedule is shown below in Figure 24.1.1.

Figure 24.1.1 Project Summary Schedule



24.1 Owner's Team and Organisational Structure

The Centamin Owner's team will be progressively expanded to widen its skills and knowledge base to meet the needs of the Project, at a point in time when offshore based engineering, design and procurement activity is high and site works are also underway.

A Centamin project team will manage both the onshore and offshore activities of the principal EPCM contractor and specialist subcontractors as well as providing specialist technical input into the Project design.

Key onshore mine operations roles will be filled early to contribute to mine design and manage the early mine development works on site.

A Centamin on site management, administration and services department will manage environment and community issues and prepare the site for the coming influx of operating personnel.

24.2 Logistics

West Africa has a well-developed mining industry serviced by a network of air, sea and road routes. The logistics needs of a project the size of Doropo, however, are relatively modest on a regional mining scale and the port facilities at Abidjan have the capacity and facilities to act as the main gateway for importation of both construction equipment and materials, and ongoing operating consumables.

Road links within the country are generally good with significant investment in roads in Cote D'Ivoire in the past decade. Road conditions from Abidjan to the Doropo site are sealed the whole way and are generally in a good condition.

24.3 Mine Development

The mine planning study is based on a Mining Contractor being engaged by the Owner for the mining operation. The mining activities will be performed by the Mining Contractor under the management of the Owner's mine management team. It is unlikely that the mining fleet will be used to undertake early-stage bulk earthworks for the Project given a later commencement of mining activities.

A mining services area (MSA) has been located east of the process plant with good access to the mine pit, waste dumps and ROM pad from mine haul roads. The MSA will consist of mine support facilities and infrastructure such as offices, workshop, wash bay, fuel facility and workforce facilities.

24.4 Process Plant and Surface Infrastructure

For the process plant and surface infrastructure, the implementation strategy is an EPCM approach where an EPCM Contractor (an internationally accredited EPCM company) will be responsible for managing all aspects of the design and procurement, field engineering, quality assurance and control, safety and commissioning under the broad direction of the Owner's team. The EPCM Contractor will also provide key supervisory roles for construction activities under the direction of an Owner's Construction Manager.

A comprehensive Project Execution Plan (PEP) incorporating a schedule and control budget will be developed for the Project detailing the overall management methodology for the delivery of the Project, including engineering, procurement, construction, commissioning and handover.

The PEP will include strategies for all aspects of project management and control across all the Project functions and phases.

Overall responsibility for health and safety, scope, schedule, budget, and quality within the boundaries of the EPCM contract will rest with the EPCM Project Manager. The EPCM Project Manager will be supported at corporate level by the EPCM Project Sponsor and peer review team who will act as coordinators and advisors regarding the EPCM Contractor's corporate quality requirements.

The EPCM Contractor's offshore design, procurement and commissioning team will all report to the EPCM Project Manager. The EPCM management team including Design Manager, Lead Project Engineer, Contracts Engineer, Lead Procurement Officer and Health and Safety Manager will all report to the EPCM Project Manager. The EPCM Contractor's onshore construction team will report to the EPCM Construction Manager who will report directly to the EPCM Project Manager and indirectly to the Owner's Construction Manager.

24.5 HV Power Supply

24.5.1 General

An engineering consultant will be appointed to project manage the implementation of the power supply. The components of the power supply will be divided into Engineering, Procurement and Construction (EPC) packages and competitively tendered.

24.5.2 Site Supply

The HV power will be supplied from the electricity grid in Cote D'Ivoire and involves installation of a 66 kV transmission line. The power supply will be operational prior to the commencement of dry commissioning of the processing plant to enable commissioning to proceed.

24.6 Health and Safety

All aspects of the Project will be required to comply with relevant local legislation and current international industrial practice.

24.6.1 Health and Safety Principles

The Project's HSEC objective is to develop a culture and install processes to ensure the safety and health of all employees, contractors and stakeholders. In striving for this objective, the following principles will apply:

- All contractors shall demonstrate commitment to high HSEC standards to be eligible to work on the site.
- No business objective will take priority over health and safety.
- At all times, the safety of all personnel is to be ensured.
- The Project will target zero harm.

- All incidents and injuries shall be reported, investigated, and actions taken to prevent reoccurrence.
- Accountability for providing a safe work environment rests with every employee.
- All individuals have the responsibility and accountability to identify and eliminate or manage hazards / risks associated with their workplace.
- Legal obligations are the minimum requirements for safety and health standards.
- All employees (including those of contractors) are to be trained and equipped to have the skills and facilities to enable an injury free workplace.
- All employees (including those of contractors) are to undergo Project specific inductions prepared by the EPCM Contractor and Centamin, as appropriate to their site work requirements.

Ensuring health and safety is the responsibility of each Project participant. Consistent with this position, each individual will be expected to actively contribute to the promotion of constructive health and safety behaviours and in the implementation of HSEC management plans.

24.6.2 HSE Management Plan

In consultation with Centamin, the EPCM Contractor will prepare a HSE Management Plan for the Project.

The HSE Management Plan will be issued to all contractors tendering for site work as part of the enquiry document. Each contractor will be required to demonstrate a satisfactory prior commitment to safety and present a site-specific plan for their proposed involvement in the Project.

24.7 Design Management

A Project Engineering Plan will define the principles and execution guidelines to be adopted by the EPCM's design team during the design phase of the Project. It will also describe the handover of various engineering deliverables at procurement, tender, construction, commissioning, project close-out and handover stages.

To achieve as short as possible timeline for the overall project development without commitment to full expenditure the schedule has allowed for a period of early works immediately post completion of the DFS. This period will concentrate on finalising the layout / process design criteria and the development of engineering deliverables relating to the tendering and award of early contracts including bulk earthworks and the camp facilities and related infrastructure including the construction and permanent facilities. This period will also allow for completion of the long lead procurement packages commenced in the DFS phase to allow a recommendation for award to be issued prior to funding approval.

The Engineering Plan is the principal document detailing the EPCM's major design activities and outlines the philosophy of how key activities will be implemented, the key aspects of each activity and the associated procedures that will be followed to ensure successful outcomes.

The objectives of the Engineering Plan are to:

- Define the engineering organisational structure.
- Nominate key engineering personnel.
- Define project roles and responsibilities.
- Outline key work processes required to complete the design and identify procedures and documentation.
- Incorporate the intent of applicable Centamin specifications into the Engineering Plan and associated procedures.
- Identify the performance measures used to monitor the completion of all tasks and activities to gauge the success of the design.

The majority of design outputs are produced during the early works and detailed design process. These take the form of equipment specifications, datasheets, drawings and purchase requisitions. Support documentation includes lists, material take-offs, calculations, check prints, vendor data and field installation checklists for construction and commissioning.

The Engineering Plan details the specific design, design review, verification and checking procedures to ensure successful outcomes.

24.8 Project Controls

Effective project controls are critical to the successful completion of a project providing relevant and consistent budget, costs and schedule reporting to the Project team. This provides the tools to efficiently manage the Project at the level of detail necessary to meet project cost and schedule objectives.

The Project Controls requirements will be outlined in the PEP addressing cost control, planning, progress measurement, project reporting, asset capitalisation and close-out. The scope of Project Controls is to provide a framework of the work processes, workflows and information relating to the standard project controls and accounting interface tools, systems and procedures that will be utilised during the execution of the Project.

24.8.1 Project Schedule and Implementation

The implementation strategy is structured into four broad stages:

- Detailed design of the process plant and infrastructure.
- Procurement.
- Construction.
- Commissioning and handover.

The estimated durations of key project activities are provided in Table 24.8.1.

Table 24.8.1 Key Project Dates

Milestones	Months from Award
FEED / Early works Milestones	
Early works Award	-4.0
Project Schedule Baseline IFR	-2.1
Preliminary Bulk Earthworks Design & MTO IFT	-1.8
Mill RFA Issued	-0.7
Pioneer Camp RFA Issued	-0.5
Owners Project Milestones	
Board Approval & FID	-1.2
Site Access & Initial Accommodation Required (By Owner)	2.7
Accommodation Available for Concrete Contractor Establish & Critical Activities (By Owner)	6.8
Water Supply Available	14.6
EPCM Milestones	
EPCM Award	0.0
EPCM Kick off	0.2
Bulk Earthworks RFA Issued	0.5
Award Mill Supply Contract	0.5
Award Bulk Earthworks	1.4
Commence Process Plant Concrete Works	8.2
Pioneer Camp Available - Required to Ramp Up Concrete Contractor	9.1
First Village Rooms Available	10.6
Permanent Camp Completion	10.7
Commence Commissioning	19.5
First Ore into Plant	23.5
First Gold Pour	24.5

24.8.2 Cost Control

The capital cost estimate developed during the DFS will be updated at key design milestones and used as the control budget for the Project.

Costs will be measured and reported by activity in accordance with the Project Work Breakdown Structure (WBS) developed during the DFS and contract award phases. This will serve to keep the Project informed on a timely basis regarding the status and risks associated with cost and time.

Monthly cost reports will be prepared to show original budget, approved changes, revised budget and current forecast costs. Committed and incurred costs and paid expenditures will also be included in the report.

24.9 Quality

The Project Quality Plan (PQP) will cover all work to be undertaken and all services provided by the EPCM Contractor and its subconsultants including the provision of EPCM services, subconsultants and other suppliers contracted to undertake work on the Project.

The PQP sets out the quality objectives for the Project and provides the framework for effective quality management during execution of the Project. The document also sets out the measures by which the achievements of the Project can be assessed against project KPIs.

24.10 Procurement and Contracting

The PEP will address the major procurement and contracting activities, and detail the strategies, methodology, procedures and controls that will be adopted during the delivery of the Project.

Packages will be competitively tendered to achieve competitive pricing and an effective negotiating position to provide value for money to Centamin. Packages to be sole sourced will be duly justified and first agreed with Centamin.

Equipment suppliers will be selected on the basis of cost, technical compliance, previous performance and availability to supply relevant equipment within the Project timeline. Contractors for site works will be selected on the basis of their safety record, their IR record, previous experience with similar type projects, cost, schedule, availability and capability to perform the work.

A logistic services provider will be engaged to consolidate all project freight, provide sea passage to Abidjan, arrange port and customs clearance, and arrange road transport to site. With existing mines in operation in the region, no insurmountable logistical issues are anticipated.

Local contractors and suppliers will be encouraged to tender for all project works and contracts for which they are qualified to undertake and will be assessed based on their ability to meet the required conditions. It is planned that direct negotiations will be undertaken with smaller local business groups with specific contract packages to encourage local sourcing of project requirements.

Construction contracts will generally be tendered as horizontal packages, that is, by discipline of construction work (e.g., concrete, SMP erection) although in some cases, a vertical design / supply / install contract may be considered.

24.11 Construction Plan

The construction management requirements will be outlined in the PEP and details the strategies and resources required to construct the works. This includes defining the responsibilities of all parties during construction activities to ensure they are undertaken in a safe and organised manner.

As previously identified, the construction strategy will be largely governed by the Owner's team with the EPCM Contractor providing key supervisory roles within the Owner's onshore structure.

Bulk earthworks for the process plant will be undertaken by an earthwork's contractor. The contractor will initially focus on areas required for temporary facilities and priority buildings to allow these facilities to be established prior to the major plant packages commencing. Temporary facilities include the EPCM's construction offices and project laydown areas.

Concrete works will commence in areas identified to provide earliest access to install major structural steel and site erected tanks.

Structural, mechanical and piping (SMP) and electrical and instrumentation (E&I) installation packages will be structured to provide maximum overlap of activities with preceding disciplines, but without causing excessive interface issues.

Construction activities will be prioritised and managed to facilitate an orderly handover for pre-commissioning activities which will then lead into dry commissioning as operable sections of the plant and infrastructure become available.

Handover to operations for wet commissioning will be on an area by area basis to facilitate the early commencement of operational activities and transition to the operations phase.

24.12 Project Commissioning

A commissioning execution plan will be prepared for the Project.

This document will outline the plan for pre-commissioning and wet commissioning of the process plant and infrastructure. It will also outline the plan for process (or load) commissioning of the plant followed by ramp up to design capacity and execution of performance tests.

The EPCM Contractor will provide commissioning services and facilities to ensure the proper execution of the various commissioning phases, as well as bringing the Project into service in a controlled and timely manner to the satisfaction of Centamin.

Assistance will be provided to Centamin, if required, for developing and implementing its operational readiness plan.

The EPCM Contractor will assist with initial commissioning runs to ensure that plant performance is in accordance with the specified design / performance criteria and to provide such additional supervision and expertise as is required to identify and rectify defects and thereby enable the plant to operate at its specified parameters.

Formal performance trials will be carried out to confirm the completed plant meets its key performance criteria.

24.13 Project Closeout

At the completion of all construction and commissioning activities, the EPCM Contractor will provide the following close out information to Centamin:

- As built drawings covering P&IDs, electrical, and others as agreed.
- Testing and commissioning data and records including instrument calibration sheets.
- Documentation for the discharge of vendor and contractor bank guarantees and warranties.
- Project close out report.
- Quality records.

24.14 Basis of Schedule

24.14.1 Calendars

The following calendars have been setup and assigned in the preparation of this schedule:

- Engineering – 5 Day 8 hours per day including public holidays and Christmas break.
- Procurement – 5 Day 8 hours per day including public holidays and Christmas break.
- Fabrication – 5 Day 8 hours per day including public holidays and Christmas break.
- Delivery – 7 Day 10 hrs per day excluding public holidays and Christmas.
- Mobilisation and Site Establishment – 5 Day 8 hours per day including public holidays and Christmas break.
- Construction – 6 Day 10 hrs per day (allowance had been made for an 11-12 day Christmas break).
- Dry and Wet Commissioning – 6 Day 10 hrs per day.

- Ore Commissioning - 7 Day 10 hrs per day excluding public holidays and including Christmas.

24.14.2 Resources

Construction resources covering all disciplines have been created in the P6 schedule and all direct manhours for construction have been assigned / loaded into the master schedule as soon as they have been captured in the estimate to ensure full alignment between the latest control budget estimate and project master schedule.

24.14.3 Engineering / Design

Design activities had been planned to a combined area and discipline level for the main areas of work.

24.14.4 Procurement

The procurement phase has been planned with two focus areas. Firstly, placing orders for the long lead and critical items to ensure the earliest completion possible. Secondly, focusing on expediting and tracking the fabrication and delivery of the critical equipment while at the same time procuring the remaining equipment and expediting the vendor information to ensure timely completion of design so as not to delay fabrication of steelwork and piping required for completion of construction.

The long lead items have been identified in the schedule and lead times used have been taken straight from the vendor budget quotations received. In most cases 12 weeks have been allowed from preparing the enquiry through to placement of order.

24.14.5 Fabrication and Delivery

Fabricated items are being tracked in the schedule at a combined facility level to align with the estimate. Commencement of fabrication is determined by design completion. General delivery duration of 1 to 2 weeks has been allowed for items procured within the borders of the country.

24.14.6 Contracts

The major construction and fabrication contracts required have been detailed in the schedule. The time of issue of contracts has been typically determined by the availability of sufficient design detail.

24.14.7 Construction

Construction works are detailed to Level 3 (discipline level). As far as possible works have been planned taking into account the following:

- Clear uninterrupted access to cranes and support equipment.
- Minimising double handling of materials and equipment.

- Taking into account resource limitations around confined spaces and confined working areas (where applicable).
- Allowing for continuation of work to prevent standing time.

The construction sequence and methodology is as follows:

- Concrete construction sequence was planned using two contractors and focusing on the bigger areas first. The first contractor also focuses on the main areas with the second contractor doing the minor areas as well as infrastructure.
- SMP installation will follow the same construction sequence as the concrete but will also start erection from the centre outwards and conveyors happening only once the main areas are well advanced so as not restrict crane and vehicle access around the major areas like the mill, thickeners and stockpile / reclaim.

24.14.8 Construction Facilities

The initial construction will be supported by the existing offices and accommodation camp at the existing plant site. The new administration building and accommodation camp will be constructed prior to demolition of the existing infrastructure.

24.14.9 Commissioning

Commissioning have been detailed in three phases:

- Dry commissioning at an area / facility level.
- Wet commissioning at an area / facility level.
- Ore commissioning at a plant level.

24.14.10 Schedule Build

Constraints

The schedule contains limited constraints used only where suitable relationship logic could not be applied or special circumstances applied.

Relationship Lag

As a general rule lag has been kept to a minimum.

Lag has been used to achieve the following goals:

- To reflect a period of time where a vendor is required to submit data.

- To reflect a period of time where a discipline is reliant on another progress.

Relationship lag in the schedule will be mostly applied to Finish-Finish (FF) and Start-Start (SS) relationships. Finish-Start (FS) with negative lag will be used only when there are no other relationship options.

Procurement Logic

The interaction of procurement and design on the availability of vendor data has been represented by a standard timeframe, with vendor data planned for receipt 2-4 weeks post award. Standard logic and timeframe for tendering is shown below.

Table 24.14.1 Timeframe for Tendering

Activity	Duration	Successor
Finalise and issue tender	2 weeks	Tender period
Tender period	4 weeks	Review proposals and award
Review proposals and award	6 weeks	Receipt of initial vendor data
Receipt of initial vendor data	2-4 weeks post award	Vendor data review and return. Mechanical design commencement.

24.14.11 Critical Path

Primary Critical Path

The primary critical path runs through the supply and installation of the SAG mill:

- Development, tender and award of the SAG mill supply package.
- Manufacture of the SAG mill (estimated lead time of 60 weeks) and delivery to site.
- Installation of the mills.
- Completion of associated mechanical equipment, piping, electrical and instrumentation and services.

Note: See Appendix 15.2 for the detailed critical path print.

24.14.12 Schedule Opportunities

Due to the long lead time required for the mill there is the opportunity to potentially save a month on the critical path by ordering the mill as soon as possible prior to full funding by making funds available earlier for this purchase.

24.14.13 Durations / Metrics

The following metrics are assumed for the inclusion of activity durations for achievability:

- Design – Determined via process plant requirements and equipment lists, durations of design activities (in the absence of man hours) have been determined from recent design history.
- Procurement and fabrication lead times – taken from budget quotes received during the study.
- Civil works – Determined via estimated quantities and recent construction history.
- Steelwork installation - Determined via estimated quantities and recent construction history.
- Mechanical Installation - Determined via estimated quantities and recent construction history.
- Electrical and Instrumentation work - Determined via estimated quantities and recent construction history.

24.14.14 Schedule Assumptions

20 days have been allowed for inductions and preparation of onsite mobilisation to site.

Abbreviations

BoS	Basis of Schedule
CIL	Carbon in Leach
DFS	Definitive Feasibility Study
E/I	Electrical and Instrumentation
EPC	Engineering, Procurement and Construction
EPCM	Engineering, Procurement Construction Management
MCC	Motor Control Centre
SAG	Semi-Autogenous Grinding
SMP	Structural, Mechanical and Platework

24.15 Interpretations / Conclusions / Risks

This is a standard gold plant in Cote D'Ivoire which has a stable well defined gold mining industry. There are limited risks within the project implementation schedule.

24.16 Data Verification

All delivery dates used in the schedule came from supplier's quotations and are in line with current industry norms.

24.17 Recommendations and Future Work Plan

A sufficient level of design has been completed to provide confidence in the project implementation schedule and therefore no future work is required at this time.

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25.0 INTERPRETATION AND CONCLUSIONS

25.1 Mineral Resources

Cube has produced a MRE update for the Doropo Gold Project in line with the scope of its engagement by Centamin. The Mineral Resource has been reported in accordance with CIM Definition Standards – For Mineral Resources and Mineral Reserves (CIM Council, 2014) and is effective 25 October 2022.

The Mineral Resource is reported within pit shells using a metal price assumption of USD2,000/oz Au, and is reported above 0.5 g/t Au in-pit. The qualified person believes this is a reasonable approach, considering the potential mine life and considerations for reporting Mineral Resources in accordance with the CIM Definition Standards (CIM Council, 2014).

The Mineral Resource is furthermore considered to have RPEEE on the following basis:

- The Project is located in a mining jurisdiction with multiple operating gold mines, with no known impediments to land access or tenure status.
- The volume, orientation and grade of the Mineral Resource is amenable to mining extraction via traditional open pit methods.
- Current metallurgical recovery based on available preliminary metallurgical test work was used in a pit optimisation to generate the resource pit shells.

The Mineral Resource Qualified Person is of the opinion that the data used in the preparation of the MRE were collected in a manner consistent with industry good practice and are therefore fit-for-purpose. The MRE was undertaken using a range of appropriate statistical, geostatistical and 3D visual analysis tools and methods, using reliable and proven software. The Doropo mineralisation is still open, especially at depth; the potential therefore exists to further extend it.

25.2 Mineral Reserves

Given the comprehensive mining study undertaken for the Doropo Pre-feasibility Study and considering the conditions provided in this report, Orelogy's Qualified Person considers the Doropo Gold Project to be technically and economically viable.

- Mining selectivity and ore definition will be important to the success of the mining operation to ensure ore loss and dilution is minimised.
- The geotechnical wall slope criteria has been developed to a high level of detail based on the modelled weathering surfaces. These surfaces are based on relatively limited information and show considerable variability in depth and thickness. It is likely that during operations these surfaces will change and therefore the resulting wall slopes will vary, particularly through the weathered zones.

- Due to the multiple pit mining operation, careful selection of a reliable mining contractor will need to be made to ensure strong management of the multiple working faces and fleets. The Owners mining team will need to adequately staffed to manage the multiple working areas and contractors.

- The multiple pit scheduling may require some ore being mined in advance and stockpiled to ensure the ore is available for processing. If this ore is stockpiled at the pits, it may present a potential ore security risk. Therefore, the ore should be transported and stockpiled at the central stockpiling area adjacent to the processing plant. Although this mitigates the security risk of the ore, it will be at the cost of incurring the ore transport costs in advance of the ore being required for feed.

- A fifty percent (50%) free-dig has been assumed for the highly weathered zones which needs to be validated as part of the next phase of study.

- The interaction of both mining extraction activities and the ore haulage activities from the satellite pits will need to be carefully and systematically managed to minimise any negative impacts on regional communities.

- The large number of satellite pits that require ore transported to the processing facility mean there is a potential risk to ore continuity.

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26.0 RECOMMENDATIONS

The following recommendations should be considered for the Doropo Gold Project if it progresses into a feasibility study.

26.1 Metallurgy

Metallurgical testwork is to continue for the Doropo project as part of the next study phase. It is recommended the definitive feasibility study level programme includes the following testwork.

26.1.1 Ore Type Composite Testwork

Testwork should be conducted on the ore type composites to provide detailed information on each of the main ore types. Testwork should include:

- Oxygen uptake rate tests.
- Pre-oxidation assessment.
- Air / oxygen assessment.
- Cyanide optimisation.
- Slurry density optimisation.
- Slurry rheology.
- Cyanide detoxification.
- Demonstration tests (repeatability).
- Mineralogy and diagnostic leach tests as required.

26.1.2 Master Composite Testwork

Master composites will be made up from the ore type composites to represent the LOM blend or another 'design' blend as specified by the client. Master Composite testwork should include:

- Head assay.
- Grind establishment.
- The financial benefits a finer grind for oxide and transitional ores should be investigated immediately after the PFS in order to improve definition of the next phase of the Project.
- Demonstration leach (optimised conditions).
- Sequential CIP tests.
- Carbon loading capacity (Freundlich’s Isotherm).

- All tailings should be retained for possible further metallurgical investigations.

26.1.3 Engineering Composite Testwork

- Tailings sample preparation for additional tailings testwork.
- Pre-leach and tailings thickening.

26.1.4 Variability Testwork

Samples will be selected which will allow an assessment of how gold recovery is impacted by the expected mineralised material types (lithology and oxidation level), depth and location within the deposit and head grade. Testwork will be conducted using the optimised conditions determined from the ore type composite testwork.

- Head assay.
- Grind establishment (optimum grind size).
- Duplicate extraction tests.

All tailings will be retained for possible further metallurgical investigations.

26.2 Mineral Resources

Cube recommends the following with respect to the Doropo Gold Project to be completed in the feasibility study:

- For the Doropo feasibility study, undertake additional metallurgical test work, primarily to inform processing recovery estimates, but also possibly to enhance the understanding of the mineralisation model.
- As a follow-on from the previous recommendation, Centamin should give consideration to constructing a geo-metallurgical model to support future studies as part of the feasibility study.
- Once studies identify a preferred mining process, consideration should be given to pre-production work, such as the drilling of close-spaced grade control patterns in key areas to deliver short-range information. Consideration could then be given to how to best set up a fit-for-purpose mine geology system.

26.3 Mineral Reserves

Orelogy recommends the following with respect to the Doropo Gold Project in the feasibility study:

- Mining selectivity and ore definition will need be mitigated through the use of industry standard ore control techniques such as.
- In-advance and detailed RC grade control drilling and modelling.

- Digital ore mark-out combined with ore spotting where required.
- The use of smaller excavators and blast balls are recommended for highly selective zones.
- A robust mining contractor tender process is required in the next phase to ensure the eventual contractor selection has the capacity, capability and experience to undertake the work to the required complexity and quality.
- The free-dig assumption for the highly weathered zones will need to be validated as part of the next phase of study. This will need to be included as part of the scope for the subsequent geotechnical assessments.

26.4 Budget

The budget for the feasibility study including explorational, extensional, infill and grade control drilling is estimated in Table 26.1 below.

Table 26.1 Feasibility Study Estimate

Activity Description	Estimated Cost (USD)
Drilling and associated costs	10,000,000
Metallurgical Testwork	800,000
Hydrology / Hydrogeology	400,000
Mine Design Study	500,000
Process Design Study	1,000,000
Infrastructure Design (TSF, WSD, Power, Airstrip, Roads)	500,000
Environmental and Social Study	500,000
TOTAL	**13,700,000**

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27.0 REFERENCES

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28.0 CERTIFICATES

Certificate of Qualified Person – Michael Millad

As a Qualified Person and a co-author of the technical report titled: "National Instrument 43-101 Technical Report for the Doropo Gold Project, Northeastern Cote d'Ivoire" for Centamin plc, with Effective Date of June 27, 2023 (the "Technical Report"), I, Michael Millad do hereby certify that:

1) I am a Director and Principal Geologist/Geostatistician with Cube Consulting Pty Ltd at its office located at Level 4, 1111 Hay Street, West Perth, Western Australia, Australia.
2) I am a professional geologist having graduated with a BSc (Hons) in Geology from Rhodes University (1993), MSc (Economic Geology) from Rhodes University (2004) and CFSG from École des Mines de Paris (2007).
3) I am a Member of the Australian Institute of Geoscientists (member #5799).
4) I have practised my profession as a geologist for the past 28 years in the mineral resources sector and engaged in the mining geology and resource estimation of mineral projects both within Australia and internationally.
5) I have read the definition of "Qualified Person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined by NI 43-101) and past relevant work experience, I fulfil the requirements to be a "Qualified Person" for the purposes of NI 43-101.
6) I have authored and take responsibility for Items 1.9, 1.11, 2 to 5, 10 to 12, 14 and 25.1 of the Technical Report.
7) I have conducted a recent and current site inspection.
8) I am independent of the Issuer as described in Section 1.5 of NI 43-101.
9) I have had no prior involvement with the property that is the subject of the Technical Report.
10) I have read NI 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that Instrument and Form.
11) As of the Effective Date of the Technical Report, to the best of my knowledge, information, and belief, contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated August 10, 2023 at West Perth, Western Australia, Australia

Mike Millad, BSc (Hons), MSc, CFSG, MAIG

Director and Principal Geologist/Geostatistician

Cube Consulting Pty Ltd

Certificate of Qualified Person – Craig Barker

I, Craig Lawrence Barker, BSc., Post Grad. Dip. (Geology), FAIG do hereby certify that:

1. I am the Group Mineral Resource Manager for Centamin plc with a business address at 2 Mulcaster Street, ST HELIER JERSEY JE2 3NJ, JERSEY.

2. This certificate applies to the NI43-101 Technical Report entitled 'National Instrument 43-101 Technical Report for the Doropo Gold Project, Northeastern Cote d'Ivoire' with an effective date of June 27, 2023 (the Technical Report').

3. I graduated with a Bachelor of Science in Geology from the University of Adelaide (1994) and a Post Graduate Diploma in Geology from the University of Western Australia (1998). I am a Fellow of the Australian Institute of Geoscientists. My membership number is 3141.

5. I have worked as a Geologist for a total of 25 years since graduating from university with mining companies in Australia, Africa, Laos, Bulgaria, Armenia, Cambodia and Mongolia in exploration, project development, production and management roles.

6. I have read the definition of 'qualified person' as set out in National Instrument 43-101 ('NI 43-101') and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a 'qualified person' for the purposes of NI 43-101.

7. I personally inspected the Doropo Project on 29 and 30 August 2021.

8. I am responsible for the Items 1, 6 to 9 , 19, 20 and 22 to 27 of the Technical Report.

9. I am not independent of the issuer applying the test set out in Section 1.5 of NI 43-101 since I am a full-time employee at Centamin plc.

10. I have read NI 43-101, Form 43-101F1 and the items of the Technical Report for which I am responsible and such items have been prepared in compliance with that instrument and form.

11. As of the 'effective date' stated in the Technical Report, to the best of my knowledge, information and belief, the Items of the Technical Report that I am responsible for, contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

12. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated: August 10, 2023

Craig Barker
FAIG,
Group Mineral Resource Manager – Centamin plc

10 August 2023 Ref: 0908-COR-0001

Centamin plc.
Company registration number: 109180
2 Mulcaster Street, St Helier,
JERSEY JE2 3NJ.

RE: The report prepared for Centamin plc (Centamin) titled "National Instrument 43-101 Technical Report for the Doropo Gold Project, Northeastern Cote d'Ivoire" (the Technical Report)

CERTIFICATE OF QUALIFIED PERSON – ROSS CHEYNE

I, Ross Cheyne, Bachelor of Engineering Hons (Mining) do hereby certify that:

1. I am a Principal Mining Consultant with :

   Orelogy Consulting Pty Ltd,
   Unit 19/ 162 Colin Street,
   West Perth,
   WA 6005,
   AUSTRALIA.

2. I graduated with a degree from the University of Auckland, New Zealand, with a Bachelor of Engineering Degree (Hons) in Mining.

3. I am a Fellow of the Australasian Institute of Mining and Metallurgy (Member No. 109345).

4. I have worked as a Mining Engineer for a total of 33 years since 1990. I have worked on gold mining operations for a period of 3 ½ years. I have worked in West Africa for 1 year. I have been a consultant for 23 years and have worked on multiple PEA's, PFS's and FS's for gold project in West and Sub-Saharan Africa. I have acted as QP signing off on Mineral Reserves and Ore Reserves under NI-43101 and JORC reporting guidelines.

5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a "qualified person" for the purposes of NI 43-101.

6. For this Technical Report, I am responsible for the preparation of Items: 1.12, 1.13, 15, 16, 21.3, 21.4 and 25.2.

7. I have not visited the Site.

8. I have not had prior involvement with the property that is the subject of this Technical Report.

9. I am independent of the issuer applying all of the tests in Section 1.5 of National Instrument 43-101.

10. I have read National Instrument 43-101, Form 43-101F1 and the items of the Technical Report for which I am responsible and such items have been prepared in compliance with that instrument and form.

11. As of the 'effective date' stated in the Technical Report, to the best of my knowledge, information and belief, the Items of the Technical Report that I am responsible for, contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

12. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

13. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated: August 10, 2023

Ross Cheyne (FAusIMM)
Principal Consultant
Orelogy Consulting Pty Ltd

CERTIFICATE OF QUALIFIED PERSON

I Abraham Buys, NHD. (Extraction Metallurgy) do hereby certify that:

1. I am Group Manager - Process at Lycopodium Minerals Pty Ltd, Level 5/1 Adelaide Terrace, East Perth, 6004 Western Australia, Australia.
2. I am a co-author of the Technical Report titled National Instrument 43-101 Technical Report for the Doropo Gold Project, Northeastern Cote d'Ivoire', effective date of 27 June 2023.
3. I graduated with a diploma from Technikon Witwatersrand, South Africa, with an HND (Higher National Diploma) in Extraction Metallurgy (1992).
4. I am a fellow of the Australasian Institute of Mining and Metallurgy (FAusIMM). My membership number is 227721.
5. I have worked as a metallurgist, operations manager, and process engineer/manager for a total of thirty-one years since my graduation, over 17 years of which have been as a Process Engineer/Manager. Relevant experience includes:
   - Managed, interpreted, and reported the results from numerous testwork programs on gold ores.
   - Involved in the process design of treatment plants for over 17 years.
6. I have read the definition of 'qualified person' as set out in National Instrument 43-101 ('NI 43-101') and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be a 'qualified person' for the purposes of NI 43-101.
7. For this Technical Report, I am responsible for the preparation of Sections/Subsections: 13, 17, 21.2.
8. I have not visited the Site.
9. I have not had prior involvement with the property that is the subject of this Technical Report.
10. I am independent of the issuer applying all of the tests in Section 1.5 of National Instrument 43-101.
11. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.
12. As of the 'effective date' stated in the Technical Report, to the best of my knowledge, information and belief, the Sections of the Technical Report that I am responsible for, contain all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
13. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated: 10 August 2023

Abraham Buys

FAusIMM,

Group Manager - Process, Lycopodium Minerals Pty Ltd

Knight Piésold
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Email perth@knightpiesold.com

CERTIFICATE OF QUALIFIED PERSON

I, David John Toomey Morgan, of Knight Piésold Pty Ltd, do hereby certify that:

a) I am a Civil Engineer with Knight Piésold with a business address at Level 1, 184 Adelaide Terrace, East Perth, WA 6004.

b) This certificate applies to the Technical Report titled 'National Instrument 43-101 Technical Report for the Doropo Gold Project, Northeastern Cote d'Ivoire' (the Technical Report) dated August 10, 2023 prepared for Centamin plc.

c) I am a graduate of University of Manchester, (BSc, Civil Engineering, 1980), and University of Southampton (MSc, Irrigation Engineering, 1981). I am a member in good standing of the Australasian Institute of Mining and Metallurgy (Australasia, 202216) and a chartered Professional Engineer and member of the Institution of Engineers Australia (Australia 974219). My relevant experience includes Project Director – Geita Gold Mine, Project Director – Ahafo Gold Project, Project Director – Akyem Gold Project.

d) By reason of my education, affiliation with a professional association and past relevant work experience, I am a 'qualified person' for the purposes of National Instrument 43-101-'Standards of Disclosure for Mineral Projects' ('NI 43-101').

e) I personally inspected the Doropo Project on 29th January to 1st February 2022 and Professional Engineers under my control have conducted site investigations on my behalf.

f) I am responsible for Items 1.15 and 18 of the Technical Report.

g) I am independent of Centamin plc as described by Section 1.5 of the Technical Report.

h) I have had no prior involvement with the property that is the subject of the Technical Report.

i) I have read NI 43-101 and the items of the Technical Report that I am responsible for, and such items have been prepared in compliance with NI 43-101 and Form NI 43-101F1.

j) At the effective date of the Technical Report, to the best of my knowledge, information and belief, parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Signed and dated this August 10, 2023 at Perth, Western Australia, Australia.

David J T Morgan

David J T Morgan
MIEAust CPEng
Chartered Professional Engineer
Membership No. 974219
The Institution of Engineers, Australia