BILBOES GOLD PROJECT FEASIBILITY STUDY

NATIONAL INSTRUMENT 43-101 TECHNICAL REPORT - PREPARED BY DRA PROJECTS (PTY) LIMITED FOR THE BILBOES GOLD PROJECT FEASIBILITY STUDY

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This notice is an integral component of the Bilboes Gold Project Feasibility Study ("BGP 2021 FS") Technical Report and should be read in its entirety and must accompany every copy made of the BGP 2021 FS. The BGP 2021 FS has been prepared using the Canadian National Instrument 43-101 Standards of Disclosure for Mineral Projects ("NI 43-101").

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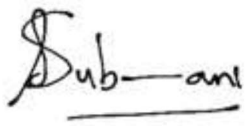
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DATE AND SIGNATURE PAGE

This report titled "Bilboes Gold Project Feasibility Study", National Instrument 43-101 Technical Report with an effective date of 15 day of December 2021 was prepared on behalf of Bilboes Gold (Pvt) Ltd. ("BG") by Desmond Subramani, Joel Mungoshi, Johan Waldemar Olivier, Dave Thompson, and signed:



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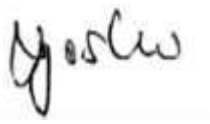
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BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 1 SUMMARY

Document Number: JZWEBR6013-STU-REP-001

DRA

ABREVIATIONS

Abbreviation	Description
AACE	American Association of Cost Engineers
AARL	Anglo American Research Laboratory
ANCOLD	Australian National Committee on Large Dams
BFS	Basic Ferric Sulphate
BoQ	BoQ
BIOX	Biological Oxidation
BVAR	Block Variance
BMA	Bulk Modal Analysis
CIM	Canadian Institute of Mining
CCE	Capital Cost Estimate
CCIC MinRes	Caracle Creek International Consulting Minres
CO2	Carbon Dioxide
CIL	Carbon in Leach
CO	Carbon Monoxide
CCL	Compacted Clay Liner
QC	Control Requirements
CEMA USA	Conveyor Equipment Manufacturers Association
CBE	Cost Baseline Estimate
CCD	Counter Current Decantation
COS	Crushed Ore Stockpile
m^3	Cubic Meter
°C	Degrees
DDA	Design Development Allowance
DEM	Digital Elevation Model
DCF	Discounted Cash Flow
DRA	Dra Africa Holdings (Pty) Ltd
EIS	Ecological Importance and Sensitivity
EC&I	Electrical, Control and Instrumentation
AuAg	Electrum
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EMA	Environmental Management Agency
EHS	Environmental, Health and Safety
ESSMS	Environmental, Social and Safety Management System
EMC	Eurus Mineral Consultants

Abbreviation	Description
EPO	Exclusive Prospecting Orders
FoS	Factor of Safety
FS	Feasibility Study
Fidelity	Fidelity Printers and Refiners (Private) Limited
FEED	Front End Engineering Design
g/t	Gram per tonne
GriynOva	GriynOva Environmental Consultancy
IMTT	Intermediated Money Transfer Tax
IRR	Internal Rate of Return
ICOLD	International Commission on Large Dams
IFC	International Finance Commission
ILO	International Labour Organisation
ktpm	Kilo tonne per Annum
kg	Kilogram
km	Kilometre
KEF	Kriging Efficiency
KVAR	Kriging Variance
LCR	Lab Coarse Duplicates
LPR	Lab Pulp Duplicates
LARF	Land Acquisition and Resettlement Framework
LC	Leachable Concentration
LG	Lerchs-Grossman
LRP	Livelihoods Restoration Plan
LAN	Local Area Network System
LoM	Life of Mine
LBMA	London Bullion Market Association
mbgl	Metres Below Ground Level
MAP	Mean Annual Precipitation
MEL	Mechanical Equipment List
MSD-Z	Meteorological Services Department of Zimbabwe
m	Meter
mamsl	Meter above mean sea level
mm	Millimetre
Mtpa	Million Tonne Per Annum
Mt	Million Tonnes
MREs	Mineral Resource Estimates

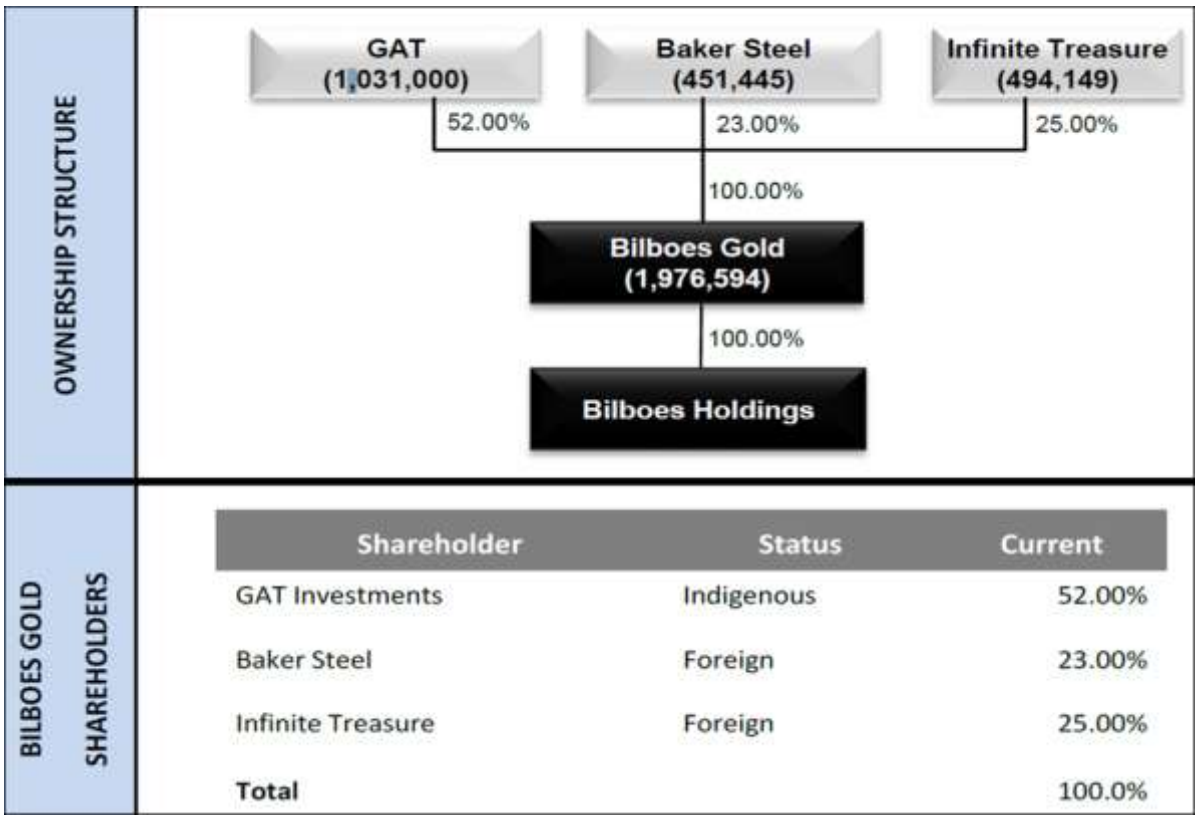
Abbreviation	Description
MCC	Motor Control Centre
NEMWA	National Environmental Management: Waste Act
NI43 101	National Instruments 43 101
Au	Native Gold
NPV	Net Present Value
NOX	Nitrogen Oxides
NUMSAM	Number of Samples Used
OBE	Operating Basis Earthquake
OIT	Operator Interface Terminal
PSD	Particle Size Distribution
PGA	Peak Ground Acceleration
PBS	People Based Safety
PCNEGWTH	Percentage of Samples with Negative Kriging Weights
PLZ	Performance Laboratories Zimbabwe Limited
P&ID's	Piping and Instrument Diagrams
PGM's	Platinum Group Metals
PAG	Potentially Acid Generating
PFC	Power Factor Correction
P&G	Preliminary and General
PEA	Preliminary Economic Estimate
POX	Pressure Oxidation
PDC	Process Design Criteria
PFD	Process Flow Diagram
POP	Procurement Operating Plan
PLC	Programmable Logic Controller
PEP	Project Execution Plan
QP	Qualified Persons
QS	Quality Assurance
QCPs	Quality Control Plans
QKNA	Quantified Krige Neighbourhood Analysis
RoR	Rate of Rise
RT	Retention Time
RMR	Rock Mass Rating
RoM	Run of Mine
SHE	Safety, Health and Environment
SLOR	Slope of Regression

Abbreviation	Description
SRL	SLR Consulting (Africa) (Pty) Ltd
SEX	Sodium Ethyl Xanthate
SMBS	Sodium Meta Bi Sulphite
SCS	Soil Conservation Services
km²	Square Kilometre
m²	Square meter
SIB	Stay in Business
SMPP	Structural, Mechanical, Platework and Piping
SCADA	Supervisory Control and Data Acquisition
TSF	Tailings Storage Facility
t	Tonne
tconc	Tonne Concentrate
$	United States Dollar
VAT	Value Added Tax
VSD	Variable Frequency Invertor
VOC	Volatile Organic Compounds
WCMR	Waste Classification and Management Regulations
WRD	Waste Rock Dumps
WAD	Weak Acid Dissociable Cyanide
WGC	World Gold Council
ZETDC	Zimbabwe Electricity Transmission and Distribution Company
ZINWA	Zimbabwe National Water Authority
ZOI	Zone of Influence

1 SUMMARY

1.1 Introduction

Bilboes Holdings (Pvt) Limited ("Bilboes" or the Company") is a private gold-focussed mining and exploration company registered and incorporated in Zimbabwe. The Bilboes Properties are wholly owned by Bilboes Holdings (Pvt) Ltd, which is 100% owned by Bilboes Gold Limited (Bilboes Gold). Bilboes comprises three shareholders i.e., Gat Investments (Private) Limited ("Gat Investments"), Baker Steel Resources Limited ("Baker Steel"), and Infinite Treasure Limited ("Infinite Treasure"). Gat Investments owns 52% of the shareholdings and is based in Harare, Zimbabwe. Baker Steel and Infinite Treasure own 23% and 25%, respectively. Baker Steel is a foreign-listed capital investment company based in London, while Infinite Treasure is a foreign investment company based in Hong Kong.



Shareholder	Status	Current
GAT Investments	Indigenous	52.00%
Baker Steel	Foreign	23.00%
Infinite Treasure	Foreign	25.00%
Total		100.0%

Figure 1-1: Bilboes Corporate Structure (Taken from Ngilazi and Martin, 2017)

Bilboes has mandated DRA Africa Holdings (Pty) Ltd ("DRA") to complete this Technical Report on the Feasibility Study ("FS"), following National Instrument 43 101 ("NI 43 101") rules and guidelines, regarding the extraction of sulphide ore from four of their existing open pits.

1.2 Property Description and Location

Bilboes owns three groups of claims that consist of four open-pit mining properties in Matabeleland North Province of Zimbabwe. These open pits are referred to as Isabela North;

Isabela South; McCays and Bubi ("Isabella McCays-Bubi"), as shown in the location map of Figure 1-2 below. The first three are situated 80 km due north of Bulawayo whilst Bubi is 100 km due northeast of Bulawayo and about 32 km northeast of Isabella. The Isabella McCays-Bubi properties comprise 128 claim blocks covering an area of 2,664.4 ha. A summary for each of the three groups of claims is contained in Table 1-1 below. Additional ground is held at When, Sandy, Eastnor and Ferroro (3,935 ha).and did not form part of the study.

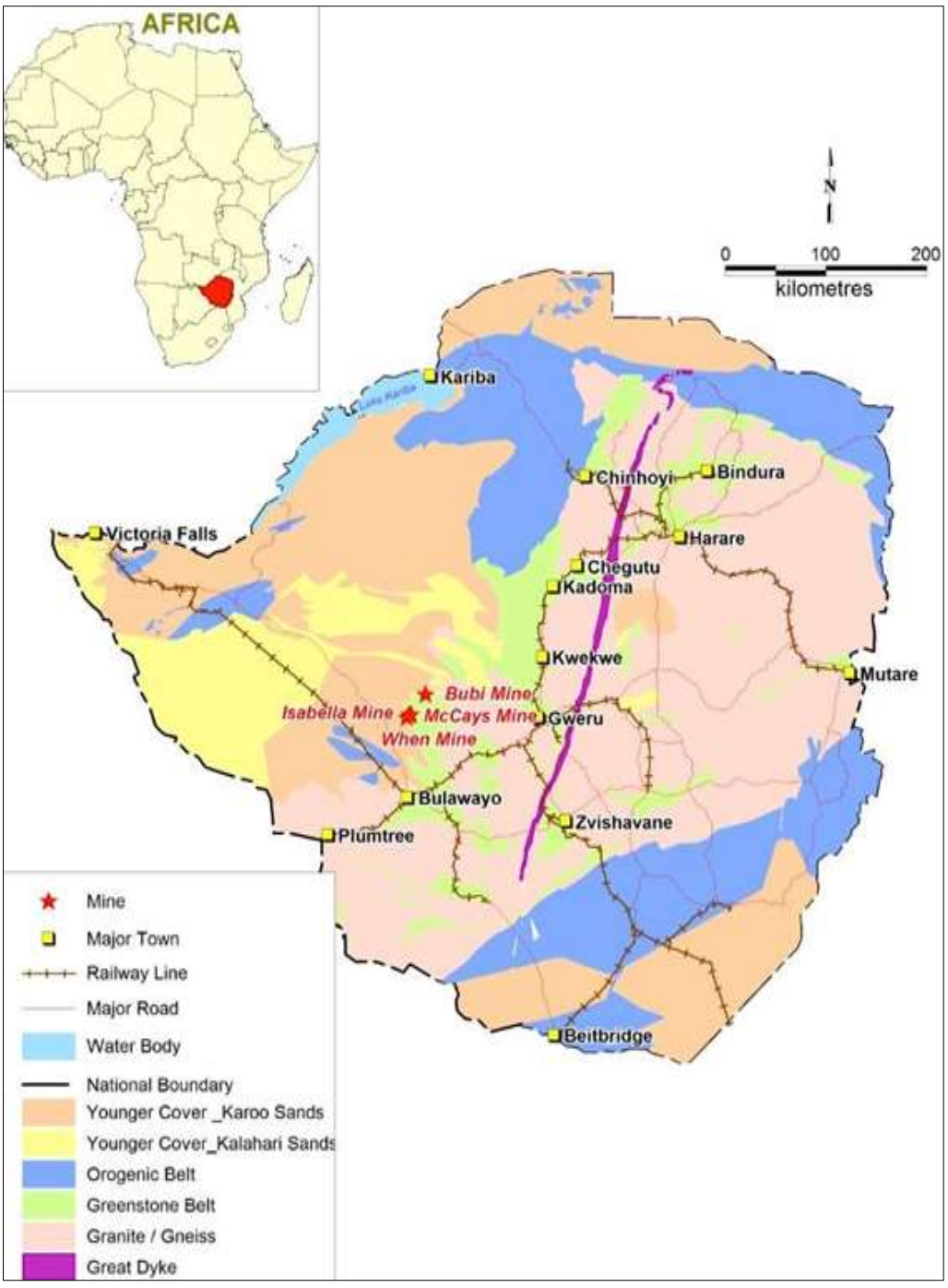


Figure 1-2: Location Map of Bilboes Properties

Table 1-1: Bilboes Claims

Group of Claims	Mining District	Province	No. of Blocks	Area (ha)	Coordinate X1	Coordinate Y1
Calcite and Kerry (Isabella Mine)	Bulawayo	Matabeleland North	48	1,864.4	662,106	7,846,712
Ruswayi (McCays Mine)	Bulawayo	Matabeleland North	33	330	666,339	7,849,975
Chikosi (Bubi Mine)	Bulawayo	Matabeleland North	47	470	684,838	7,865,515
Total			**128**	**2,664.4**		

1.3 Accessibility, Climate, Infrastructure and Physiography

Isabella McCays and Bubi are approximately 80 km and 100 km directly north and northeast of Bulawayo, the second largest city of Zimbabwe with an approximate population of 655,675 (2013. All the mines are accessed via public roads and although these are of variable quality, they are accessible by all types of vehicles. Isabella is 110 km (1.5 hours) whilst Bubi is 140 km (2 hours) by road from Bulawayo. Bubi can also be accessed by road from Isabella (70 km in 1 hour).

Average daily temperatures range from 24°C in June, to 32° in October and apart from the occasional heavy downpour in the rainy season, there are no climatic conditions that prevent all year-round exploration and mining.

The properties lie between 1,150 m and 1,200 m above sea level and are covered by red and grey soils of the greenstone rocks in the area. The area is generally flat and covered by woodland interspersed scrubby vegetation. Agricultural activities are mainly small-scale ranching.

1.4 History

Anglo American Corporation of Zimbabwe Ltd (“AMZIM”), a company that formed Bilboes Holdings (Pvt) Ltd and which was later taken over by GAT investments (Pvt) Ltd in 2003 held the Isabella, McCays and Bubi claims. AMZIM acquired the Isabella claims in 1982.

Initial exploration allowed the estimation of a small oxide Resource and an open-pit; heap-leach mine was commissioned in 1989. Subsequent exploration extended the Isabella and new discoveries were made at Bubi and McCays, which has yielded 8,954 kg of gold (287,883 oz) to December 2020. 90,048 oz of this being produced since the takeover of the company in 2003. All mining has been from open pit oxide ore utilising the heap leach extraction processing method.

Exploration for sulphide Mineral Resources began in 1994/95, with a sum of 17,650 m of exploratory drilling being completed by 1999, covering a strike length of 3,440 m. A maiden mineral Resource estimate for the sulphide Mineral Resources was completed by SRK in 2009, containing 4.75 Mt of Inferred Mineral Resources grading 3.49 g/t. This estimate used a 2.0 g/t cut-off for delineation of the mineral Resource estimation domains.

1.5 Geology and Resource Estimate

1.5.1 Geological Setting and Mineralisation

The Bubi Greenstone Belt (Archean) covering the Bilboes Properties consists of volcanic rocks of the Upper Bulawayan Group and capped by sedimentary sequences of the Shamvaian Group, all of which have been metamorphosed into felsic and mafic schists. Gold deposits are concentrated at the interface between these two groups, where major structural breaks and splays provide pathways for hydrothermal vein mineralisation.

Gold is associated with sulphides that are commonly found in hydrothermal systems. These include pyrite and arsenopyrite as major components, but copper, lead, zinc, antimony, are also present in some deposits. Common alteration associated with gold mineralisation is silicification, with lesser sericite and chlorite alteration.

1.6 Deposit Types

Mineralisation is hydrothermal and consists of silicified stockworks that host pyrite and arsenopyrite. The stockworks are characterised by a series of subparallel echelon zones. The gold is very finely dispersed within the sulphides and is refractory.

All the deposits are oxidised with the sulphide interface occurring between 6 m and 50 m below surface.

1.7 Exploration

Soil sampling, trenching and geological mapping have been progressively carried out since exploration and oxide mining commenced in 1982. Soil sampling was used to identify areas for trenching and mapping. Trenches were sampled at 1 m to 2 m intervals and analysed using the bottle roll method. These assays were used to guide the interpretation and projection of oxide mineralisation along strike and at depth. The assays from trench sampling were however not used in grade estimation.

Ground Magnetics and Induced Polarisation geophysical surveys have been conducted at Isabella, as part of the oxide ore exploration since 1996.

1.8 Drilling

Drilling of the sulphides to provide data for the Resource estimate was done in three phases totalling 93,400 m. The first phase by Anglo American Corporation was between 1994 and 1999 and the second phase by Bilboes from 2011 to 2013. The latest drilling which was from December 2017 to November 2018. The third campaign focussed on upgrading of the Mineral Resources from the Inferred and Indicated to Indicated and Measured categories, as required for this FS.

1.9 Sample Preparation, Analysis and Security

During the drilling campaigns, all geological logging and sampling was carried out in accordance with Bilboes standard operating procedures which were adopted from AMZIM and enhanced over time to keep up with industry best practices.

Independent SANAS accredited laboratories were used in the analyses of samples. Performance Laboratories Zimbabwe Limited (“PLZ”) in Harare was selected as the primary laboratory. ZIMLABS and Antech Laboratories (“Antech”) in Zimbabwe were used for check analyses.

Certified Reference Materials (CRMs), blanks, field duplicates, coarse and pulp repeats were used for QA / QC purposes.

Excess cores and RC samples have been stored at the mine in sample containers and the core shed and have been retained for future use.

The QPs have assessed the standard operating procedures together with the results of the QA / QC program and are of the view that these are adequate for the purposes of reporting the Mineral Resources contained herein.

1.10 Data Verification

Before commencement of the 2017 / 2018 drilling campaign in addition to the Datamine™ software already in place Bilboes acquired Fusion database software for the capture: storage and management of drill hole information. This software has built in data verification tools to minimise transcription errors. Bilboes standard operating procedure involves a thorough audit by a senior geologist of each drillholes’ geology and sampling logs, from data logging through to capturing into the database and QA / QC checks.

Each hardcopy log is audited and signed-off by a senior geologist prior to being used in modelling and estimation.

1.11 Metallurgical Test Work

1.11.1 Preliminary and Flotation Test Work

1.11.1.1 Test work Programme Overview

The feasibility metallurgical test work was concluded in different phases over a period extending from September 2013 to March 2019 and involved various laboratories and consultants as outlined in Table 1-2.

Table 1-2: Test work Program Outline

Phase	Test work Description	Done By	Supervision and Oversight	Date
1A	Sample characterisation detailing mineralogical and chemical analysis	Mintek, South Africa	Bilboes, MMC and MDM Engineering	Sept 13 to Dec 13
1B	Comminution test work done on the two composites namely Composite 1 (Bubi ore) and Composite 2 (combination of Diana, Calcite, Castile, Maria and McCays ores)	Mintek, South Africa	Bilboes, MMC and MDM Engineering	Jan 14 to Apr 14
2	Selection of a process route covering gravity amenability tests, flotation optimisation and treatment of the sulphide flotation concentrates via POX, Bio-Oxidation and Ultra-fine grinding followed by cyanidation	Mintek and Suntech, South Africa	Bilboes and MMC	May 14 to Sept 14
3	Variability flotation tests and bulk flotation concentrate production for additional BIOX® and gold leach tests	Suntech and SGS, South Africa	Bilboes, Minxcon and MMC	Oct 15 to Aug 16
4A	Laboratory and Pilot plant test work campaigns on the different ore types to generate additional flotation kinetics and grind data, bulk concentrates for BIOX® pilot plants, flotation design parameters and validate flowsheet	MMC at the client's project site in Zimbabwe	Bilboes and DRA	Apr 18 to Sept 18
4B	Review, modelling and simulation of laboratory and pilot plant test results	EMC, South Africa	Bilboes, MMC and DRA	Oct 18 to Mar 19

1.11.1.2 Discussion of the Feasibility Results

1.11.1.2.1 *Chemical Analyses*

The mineralogical and chemical analyses of the ores conducted on the individual and composite samples is summarised as follows:

- Gold content in the samples varied from 1.8 mg/kg to 6.8 mg/kg

- All samples contained high concentrations of Si, Al, Ca, Fe and As. Total sulphur concentrations in the samples varied from 1.2% to 5.3% and significant amounts of it was sulphide specie
- Total carbon in the ores was detected at 1.3-5.3% and was mainly present as carbonate. Organic carbon was low for all samples tested, indicating low potential for preg-robbing. Carbon (as carbonate) content was high, especially for Bubi and McCays pits (double amount in comparison to other composite samples. Carbonate concentrations of between 7.4% and 18.4% were detected in the samples
- The Total sulphur content in the samples was found to be mainly in the sulphide form with the lowest content of 0.69% in the McCays ore and the highest content of 2.65% in the Bubi ore. Concentration of elemental sulphur and sulphate was very low. High As content was detected in all samples which highlighted the importance of investigating as behaviour during the processing steps and to consider possible environmental issues in deciding on process route and economics. The As content in the McCays ore was disproportionately higher than the other pits

1.11.1.2.2 *Mineralogical Characterisation*

- Diagnostic leach results showed that gold recovery via direct cyanidation was low, varying from 25% to 50% and Au locked in sulphides and carbonate minerals varied from 46% to 72%
- Bulk modal analysis (BMA) showed that Quartz, feldspar, and mica were present in major to intermediate amounts in all the samples, followed by major to minor amounts of carbonates. Sulphide minerals, pyrite and arsenopyrite, were present in minor to trace amounts throughout all samples. All other mineral phases are present in in trace amounts in all samples
- The Au bearing minerals identified in this study were electrum (AuAg) and native gold (Au). Native gold and electrum are variably distributed throughout all samples
- Most Au-bearing grains reported to the 0-10 µm size class fraction and a smaller quantity in the 10-15 µm size class fraction
- Pyrite was the dominant BMS mineral present as majority of the samples followed by arsenopyrite (from 5 to 58%) and trace amounts of other sulphides (sphalerite, pentlandite, chalcopyrite, chalcostibnite, ullmannite, gersdorfiite and galena)
- The majority of all BMS mineral grains (>50 mass%) in all samples reported to the finer, 0-21 µm size classes, with lesser amounts reporting to the coarser size classes

- The majority (>80 mass%) of pyrite, arsenopyrite and other sulphides had free surface with lesser amounts being associated with other mineral phases in all the samples examined

1.11.1.2.3 *Comminution*

Comminution test work showed that Isabella and McCays samples with Bond Ball Work Index (BBWi) values ranging from 15.70 to 17.81 kWh/t and A*b values ranging 27.50 to 32.80 could be classified as being hard, while Bubi ore with a BBWi value of 21.45 kWh/t and A*b value of 19.0 was very hard. All samples were characterised as being moderately abrasive with Ai indices ranging from 0.22 to 0.42.

1.11.1.2.4 *Process Route Identification*

1.11.1.2.4.1 Gravity Tests

Gravity amenability tests indicated poor gold recoveries and varied from 14% to 22% at 0.5% mass pull. Gravity separation at higher mass pull provided higher gold recovery but still was not a feasible option.

1.11.1.2.4.2 Preliminary Flotation

Initial milling and flotation results indicated high gold recoveries of 89 - 97% with high mass pulls ranging 10 -15%, low concentrate grades of 12-20 g/t Au and unacceptable high levels of carbonates in the range of 7-13% which were bound to negatively affect the down-stream gold recovery process. The test work established that the ores can be easily floated with good recoveries at grinds ranging from 80% of 106 - 75 µm and that flotation optimisation with respect to mass pulls, concentrate grade and other concentrate quality metrics was required.

1.11.1.2.4.3 Flotation Optimisation

Subsequent flotation optimisation tests involving the addition of depressant and 1 and 2 cleaning stages improved the overall flotation performance with recoveries ranging from 88 - 94%, mass pulls ranging 4 - 12%, concentrate grades of 50 – 120 g/t Au and acceptable carbonates levels in the range of 4 - 10%.

The optimum flotation conditions were determined to be as follows:

Table 1-3: Optimum Flotation Conditions

Description	Value
Grind	80% - 75 µm
Reagents Dosages – g/t	
Copper Sulphate	80

Description	Value
Sodium Ethyl Xanthate	100
Sodium Carbonate	200 - 350
Starch	70 - 125
XP200 Frother	35 - 60

1.11.1.2.4.4 Gold Dissolution from Flotation Concentrates

- Direct cyanidation of the flotation concentrate resulted in a 27% gold dissolution.
- Ultra-fine grinding (80% - 20 µm) followed by cyanidation and oxygenation resulted in a marginal improvement in gold dissolution from 27 to 30%.
- A single POX test was done on concentrate with the main objective to oxidise 100% of the sulphide which then resulted in a further 98% gold dissolution by cyanidation of the POX leach residue. Formation of Basic Ferric Sulphate (BFS) resulting in high lime and cyanide consumption in the downstream processing (cyanidation) was observed. Significant amount of or arsenic was also detected in the POX filtrate.
- BIOX® of the concentrate provided 99% sulphide decomposition with 97% gold dissolution by cyanidation of the bio-residue. Formation of iron and cyanide complexes was observed. The solid residue after cyanidation was of the bioleach product was stable with respect to arsenic.

Based on the above results, historical test work and consideration of environmental impacts and risk minimisation by adopting commercially established and proven processes, the process route identified for additional evaluation was flotation, pre-treatment of the concentrate by Bio-oxidation followed by cyanidation.

1.11.1.3 Variability Testing

Variability flotation test work on the ores indicated an average recovery of 89.2%, a recovery range of 83.4 - 95.9% and recovery standard deviation of 3.4% for Isabella McCays ore and average recovery of 86.6%, a recovery range of 80.5 - 94.2% and recovery standard deviation of 4.4% for Bubi ore.

1.11.1.4 Pilot Plant Test Work

1.11.1.4.1 *Objectives*

The pilot plant test work was conducted over a period of three months from July 2018 to September 2018, with the follow up laboratory test work being conducted between September

2018 and January 2019.The pilot plant utilised a total of 20 t of the Isabella McCays ores and 15 t of Bubi ore

The objectives of the pilot plant were as follows:

- Demonstration of the capability of the plant to achieve the flotation performance attained from laboratory tests during PFS test work with reference to gold recoveries, concentrate gold grades and other quality specifications
- Generate enough bulk concentrates within specifications for processing in the onsite BIOX® pilot plants as part of the feasibility study
- Generate process design criteria information for the proposed commercial plant
- Provide training in the operation of flotation plant to the Bilboes employees

1.11.1.4.2 *Pilot Plant Operation and Flowsheets*

The flowsheets evaluated during the pilot plant campaigns are shown Figure 1-3.

Flowsheet 2 was ultimately adopted as the preferred flowsheet based on better recoveries and concentrate grades.

Reagent addition was as per optimum flotation conditions outlined above.

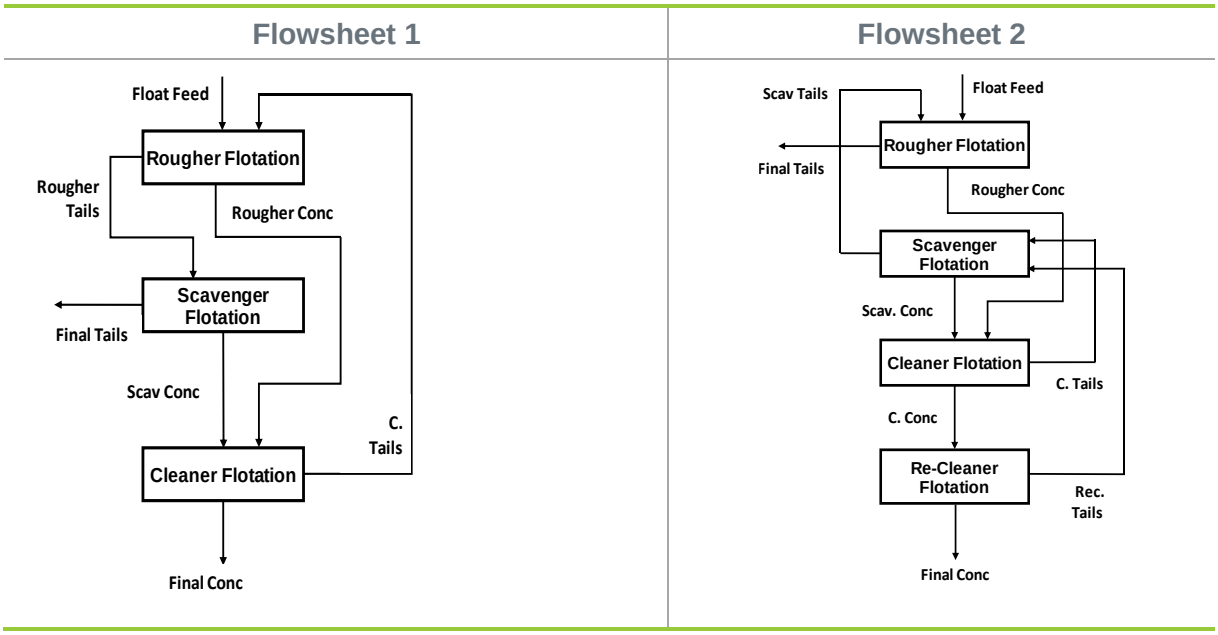


Figure 1-3: Pilot Plant Campaign Flowsheets

1.11.1.5 Pilot Plant Results

1.11.1.5.1 Recoveries and Mass Pulls

The Isabella McCays ores gold recoveries ranged from 85.9% to 91.0% and the mass pulls ranged from 3.8% to 6.0% with a weighted average of 88.4% recovery and 5.0% mass pull. The Bubi ore recoveries ranged from 85.9% to 88.8% and mass pulls ranged from 7.8% to 15.2% with averages of 87.5% recovery and 10.0% mass pull.

1.11.1.5.1.1 Chemical Analyses of Bulk Concentrates

The analyses of the individual and blended concentrates produced from the pilot plant operation for the BIOX® process piloting was within the limits of the BIOX® process requirements.

1.11.1.5.2 Additional Laboratory Test Work and Simulation

Due to constraints on the classification circuit, the grind on the flotation feed ranged from 63 to 68% - 75 µm against a targeted grind of 80% - 75 µm. This outcome was addressed by conducting additional comparative laboratory flotation tests at these grinds to validate the effect of grind with modelling and simulation applied to the actual pilot plant recoveries to derive expected recoveries at the target grind as explained in the latter section

1.11.1.5.3 Flotation Rate and Comparative Grind Tests

To determine the expected pilot plant recoveries at the target grind of 80% - 75 µm, comparative flotation rate tests were conducted on the individual ores at the pilot plant grind of 65% - 75 µm and the target grind. The results showed that the target finer grind of 80% - 75 µm consistently resulted in higher recoveries in comparison to the pilot plant grind of 65% - 75 µm with recovery increments ranging from 0.2% - 4.7% on all ore types.

1.11.1.5.4 Modelling and Simulation

1.11.1.5.4.1 Grind and Recoveries

Eurus Mineral Consultants (EMC) were engaged to review and conduct modelling and simulation on the laboratory and pilot plant test work results on the Bilboes ore and the rate and grind test results which indicated improvement in recovery with a finer grind.

The comparative results of the simulated pilot plant recoveries at 80% - 75 µm and the actual recoveries at 65% - 75 µm are presented in Table 1-4. The results indicate an expected recovery improvement of 3.1% and 4.2% on the Isabella McCays and Bubi ores with grind improvement from 65% - 75 µm to 80% - 75 µm respectively.

Table 1-4: Comparative Pilot Plant Simulated Recoveries

Ore Source	Head g/t	65% - 75 µm (Pilot Plant)			80% - 75 µm (Simulation)			Var:(80% - 75 µm) -(65% - 75 µm)		
		% Mass Pull	Conc g/t	% Rec	% Mass Pull	Conc g/t	% Rec	% Mass Pull	Conc g/t	% Rec
Isabella North	2,00	4,2	41,3	86,1	4,4	40,5	89,2	0,2	-0,8	3,1
Isabella South	2,54	5,1	45,4	90,3	5,2	44,6	92,0	0,2	-0,8	1,7
McCays	2,20	5,5	33,7	83,7	5,9	33,3	88,8	0,4	-0,4	5,1
Isabella McCays Total*	2,20	4,7	41,0	86,9	4,9	40,3	90,0	0,3	-0,7	3,1
Bubi	2,59	8,7	26,0	86,9	9,2	25,6	91,1	0,6	-0,4	4,2

*Based on ISBN-50%, ISBS-30%, McCays-20%

1.11.1.5.4.2 Flotation Residence Times

The modelling and simulation were also applied to derive requisite flotation residence times for the proposed Flowsheet 2 which as follows:

Table 1-5: Flotation Residence Times

Flotation Stage	Residence Time-Mins
Rougher	84
Cleaner	68
Re-Cleaner	46
Cleaner and Re-Cleaner Scavenger	55

1.11.1.5.5 *Projected Operational Gold Recovery*

The following observations from the test work programme results provide evidence of expected higher operational recoveries than the average expected 90.0% and 91.1% derived for the Isabella McCays and Bubi ores respectively.

- Both Isabella McCays and Bubi ores indicated a positive correlation of head grade and recoveries. With pilot plant head grades being slightly lower than the planned LoM grades, actual plant recoveries can be expected to be better than pilot and simulated recoveries at the same grind
- Laboratory test work and plant simulation results showed marginal improvement in recoveries ranging from 0.3% to 0.9% with finer grinding from 80% - 75 µm to 90% - 75 µm. Although marginal and subject to further validation and analysis of economic benefits, the trend provides a basis for additional optimisation prior to implementation or continuous improvement during the operational phase

- Comparative simulation of the proposed flotation circuit comprised of a Rougher, Cleaner Scavenger and a common 2-stage cleaning and a flowsheet comprising a Rougher, Cleaner Scavenger and separate 2 -stage showed marginal recovery improvement of 0.5 to 0.8% with the latter indicating potential to improve recoveries with flowsheet reconfiguration subject to validation and analysis of economic benefits
- Statistical analysis of results from all laboratory and pilot plant test work results showed expected recoveries of 90.2% and 92.1% and recovery ranges of 85.4% - 95.1% and 89.2% - 95.0% at one standard deviation for the Isabella McCays and Bubi ores respectively

1.11.1.5.6 *Improvements in Flotation Gold Recovery*

It is anticipated that with better knowledge of the recovery relationships, optimal milling and flotation design, steady state operation, higher head grades with continuous improvement and the benefits of the economies of operating experience, the downside recoveries can be avoided and that the operational recoveries ranging from a minimum of the expected values of 90.0% and 91.1% for Isabella McCays and Bubi respectively to a maximum of 95.0% for both ores may be realised.

1.11.2 BIOX®

1.11.2.1 Feasibility Study Testwork

Feasibility test work was conducted on Ore samples from Isabella McCays and Bubi deposits to develop test work data to design a gold processing plant. The feasibility metallurgical test work was concluded during 2019 under the supervision of DRA by the following consultants and laboratories:

- Outotec BIOMIN RSA - BIOX® test work both on-site and off-site
- SGS South Africa - BIOX® BAT Program, Thickening, CIL
- Outotec Test Work Facility - Dynamic settling tests BIOX® and Tailings Slurries

1.11.2.2 Feasibility Test Work Results

Summary of the test work results is shown in Table 1-6.

1.11.2.3 Feasibility Test Work Results

Table 1-6: Summary of the Test Work Feasibility Results

BIOX® Testwork on Sulphide Concentrate			
		Isabella McCays	Bubi
Sulphide oxidation	%	89.6	90.0
Gold recovery	%	88.8	95.7
NaCN consumption	kg/t_{conc}	16 - 18	18 - 20
Lime consumption	kg/t_{conc}	5 - 15	5 - 15

BIOX® pilot plant test work programs were completed on composite Isabella McCays and Bubi concentrates produced during the on-site flotation test work programs. The pilot plant programs have provided details of sulphide oxidation performance under various operating conditions for each concentrate, as well as the relationship between gold dissolution and sulphide oxidation. This data has been used to specify certain design criteria for a full-scale BIOX® plant treating both concentrates. Associated metallurgical test work programs focussing on unit processes such as liquid – solids separation, neutralisation and BIOX® product CIL were also completed on slurries generated during each pilot plant campaign.

The Isabella McCays bulk concentrate sample had a gold grade of 49.9 g/t and a sulphide sulphur grade of 18%. The mineralogical assemblage comprised of 28.5% pyrite, 22.2% arsenopyrite and 0.02% stibnite. The continuous BIOX® pilot plant operated on this sample for a period of 103 days and the run included detailed sampling phases at 6.5 and 6-day retention times.

The BIOX® test work indicated the following:

- An average BIOX® sulphide oxidation of 89.6% was achieved at a 6-day retention time and a feed slurry solids concentration of 20%,
- This resulted in an average CIL gold dissolution of 88.8% on the BIOX® product solids,
- The lower-than-expected sulphide sulphur oxidation levels in the pilot plant overflow product slurry are believed to be due to short-circuiting of unoxidized / partially oxidised solids between the reactors,
- The BAT BIOX® tests completed on the various Isabella McCays concentrate samples achieved sulphide oxidation levels in the range 86.4 to 99.3% and yielded gold dissolutions in the range 92.3 to 97.9%.

The continuous neutralisation pilot run conducted on an Isabella McCays BIOX® liquor sample produced a suitable effluent since the As(T) concentration in the neutralised solution was at

0.5 ppm and the TCLP testing of the residue showed a final As(T) leachate of <3 ppm, below the stipulated 5 ppm requirement. Continuous neutralisation tests are recommended to optimise the use of the Isabella McCays float tails for stage 1 pH control with respect to high Fe concentration in TCLP extract for the batch neutralisation tests.

The settling behaviour and flocculent requirement for the various Isabella McCays process slurries were found to be comparable to projects with a similar concentrate mineralogy previously evaluation during BIOX® test work programs.

The Bubi bulk concentrate sample had a gold grade of 28 g/t and a sulphide sulphur grade of 27.1%. The mineralogical assemblage comprised of 57.2% pyrite and 9.00% arsenopyrite. The continuous BIOX® pilot plant operated on this sample for a period of 235 days and the run included detailed sampling phases at 6.5 and 6-day retention times.

The BIOX® test work indicated the following:

- An average BIOX® sulphide oxidation of 90% was achieved at a 6.5-day retention time and a feed slurry solids concentration of 20%,
- This resulted in an average CIL gold dissolution of 95.7% on the BIOX® product solids,
- The BAT tests completed on the Bubi concentrate sample achieved sulphide oxidation levels in the range 97 – 98% and yielded gold dissolutions in the range 92.3 to 96.8%.

The continuous neutralisation pilot run conducted on a Bubi McCays BIOX® liquor sample produced a suitable effluent since the As(T) concentration in the neutralised solution was at 0.5 ppm and the TCLP testing of the residue showed a final As(T) leachate of < 0.4 ppm, below the stipulated 5 ppm requirement. Continuous neutralisation tests are recommended to optimise the use of Bubi / Isabella McCays float tails for stage 1 pH with respect to high Fe concentration in TCLP extract for the batch neutralisation test.

The settling behaviour and flocculent requirement for the for the various Bubi process slurries were found to be comparable to that achieved on the Isabella McCays process slurries. The test work indicated higher settling area requirement of 4,00 m²/t/h for the Bubi BIOX® product compared the 2,90 m²/t/h for the Isabella McCays BIOX® product.

1.12 Mineral Resource Estimates

The Mineral Resource Estimates (MREs) were compiled by Desmond Subramani, Principal Consultant at Caracle Creek International Consulting MINRES (Pty) Ltd (“CCIC MinRes”) and are compliant with the definitions and guidelines for the reporting of Exploration Information, Mineral Resources and Mineral Reserves in Canada, “the CIM Standards on Mineral

Resources and Reserves - Definitions and Guidelines" (2014). These MREs also adhere to the Rules and Policies of the National Instrument 43 101 Standards of Disclosure for Mineral Projects, Form 43 101F1 and Companion Policy 43 101CP.

Compared to the April 2019 MRE for the Measured and Indicated categories, there is a 6 % increase in tonnage and 1 % decrease in grade. Significant change is the tonnage of the Inferred category which has increased by 78 %, from 5.3 Mt grading at 1.99 g/t Au, to 9.47 Mt grading at 1.89 g/t Au.

The Resource classification follows the Canadian Institute of Mining, Metallurgy, and Petroleum's ("CIM") definition for classification of Inferred, Indicated and Measured Mineral Resources. Classification of the Estimated Resources used a "Checklist" approach where various criteria were assessed to determine the confidence and continuity of geology and grades. The base case classified Mineral Resource Estimate is summarized in the following table using a cut-off grade of 0.9 g/t Au and constrained inside a Lerchs-Grossman (LG) optimized pit shell using $ 2,400 per ounce gold price.

Table 1-7: Mineral Resource Tabulation for the Properties using a Base Case Block Cut-Off Grade

Base Case Mineral Resources (0.9 g/t Au)

Property	Classification	Tonnes	Au (g/t)	Metal (g)	Ounces
ISBS	Measured	1,325,112	2.34	3,103,953	99,796
	Indicated	6,105,092	2.08	12,705,457	408,496
	Total Measured and Indicated	**7,430,204**	**2.13**	**15,809,410**	**508,292**
	Inferred	1,583,437	1.75	2,767,872	88,991
ISBN	Measured	2,589,257	2.68	6,939,262	223,106
	Indicated	4,865,729	2.27	11,068,764	355,874
	Total Measured and Indicated	**7,454,987**	**2.42**	**18,008,026**	**578,980**
	Inferred	1,704,219	2.15	3,666,721	117,890
Bubi	Measured	1,288,169	1.95	2,517,625	80,945
	Indicated	14,006,154	2.19	30,707,737	987,292
	Total Measured and Indicated	**15,294,323**	**2.17**	**33,225,363**	**1,068,237**
	Inferred	5,116,389	1.80	9,208,472	296,064
McCays	Measured	925,105	3.05	2,821,343	90,710
	Indicated	4,075,342	2.36	9,610,395	308,986
	Total Measured and Indicated	**5,000,446**	**2.49**	**12,431,738**	**399,696**
	Inferred	1,071,163	2.14	2,295,974	73,818
	Total Measured	6,127,643	2.51	15,382,184	494,556
	Total Indicated	29,052,317	2.21	64,092,352	2,060,649

Base Case Mineral Resources (0.9 g/t Au)					
Totals (ISBS +ISBN+ Bubi + McCays)	**Total Measured and Indicated**	**35,179,960**	**2.26**	**79,474,537**	**2,555,205**
	Total Inferred	9, 475,209	1.89	17,939,038	576,762

1 CIM definitions (May 10, 2014) observed for classification of mineral resources.

2 Block bulk density interpolated from specific gravity measurements taken from core samples.

3 Resources are constrained by a Lerchs-Grossman (LG) optimized pit shell using Whittle software.

4 Mineral resources are not mineral reserves and have no demonstrated economic viability. The estimate of mineral resources may be materially affected by mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social, and governmental factors ("Modifying Factors").

5 Numbers may not add due to rounding.

6 Effective Date of Resource Estimate is 25th of October 2021.

1.13 Open Pit Mineral Reserves

The process to develop the Mineral Reserve estimate was as follows:

- Open pit optimisation was undertaken on the measured and indicated resources only.
- The grades and tonnes of the mineral resource model have been modified by a mining / geological recovery and a mining dilution based on ore body geometry and mining methodology. The Mining Model contains undiluted ore tonnes and ore grade. 95% ore recovery and fixed dilution parameters of 20 cm of hanging wall and 20 cm of footwall (4% in Whittle) were applied in the optimisations
- The Whittle optimisation software was used to perform the pit optimisations. Whittle is an accepted industry optimisation tool. A range of operating costs and production parameters were applied. The source of the parameters and these are summarised below, along with the source of the information:
  - A base gold price of $1,500/oz (PMI). A government royalty of 5.0% of revenue and a Refining/Selling Cost of 1.5% of revenue were then applied. This resulted in a Net Gold Price of ~$ 1,402.50/oz.
  - Pit slopes inter-ramp angles ranging from 30 to 55 degrees. Resulting overall pit slopes account for access ramps where applicable.
  - Gold recovery ranging from 70% to 88.9% dependent on mining area and ore type being processed.
  - Processing throughput of 2.88 Mtpa for phase 1 and 2.16 Mtpa for phase 2.
  - Mining contractor costs based on budget submissions from Southern African based mining contractors.

An average annual processing cost per tonne of ore, inclusive of general / administration costs and overland haulage. These costs ranged from $2.00 for oxide heap leaching to $13.57/t to $22.54/t for transitional and fresh ores depending on processing parameters.

A sensitivity assessment was done on gold prices of $1,600/oz and $1,700/oz. A gold price of $2,400/oz scenario assessment was also done to determine surface infrastructure boundaries only to ensure that no potential future resource is sterilised. This indicated the optimal shell inventory (i.e., the size and shape of the optimal shell and therefore the ore and waste generated) was relatively robust for all mining areas.

Optimal shells (maximum profit) were selected for each deposit area base on a $1,500/oz gold price that were then used as the basis for pit designs. These shell selection criteria are relatively conservative, based on a gold price of $1,500/oz.

A cut-off grade of 0.9 g/t based on project specific projected revenue and cost was applied to all Project resources to ensure tonnes milled generate enough revenue to cover costs.

Table 1-8 summarises the Mineral Reserve Statement based on the work detailed above, undertaken as part of the Bilboes Project.

Table 1-8: Bilboes Gold Project In-situ Mineral Reserve Statement

Deposit	Classification	Tonnage (Mt)	Au Grade (g/t)	K oz
McCays	Proven	0.8	3.00	81
	Probable	2.8	2.44	223
Isabella South	Proven	1.3	2.24	93
	Probable	5.1	1.98	323
Isabella North	Proven	2.5	2.57	207
	Probable	3.1	2.17	216
Bubi	Proven	1.2	1.90	75
	Probable	9.8	2.38	747
Total	Proven	5.9	2.42	456
	Probable	20.8	2.26	1,509
Grand Total	**Probable + Proven**	**26.6**	**2.29**	**1,964**

Note: All tonnes quoted are dry tonnes. Differences in the addition of deposit tonnes to the total displayed is due to rounding to one decimal place.

The Mineral Reserve estimate has been classified and reported in accordance with the Canadian National Instrument 43-101.

The estimate of Mineral Reserves of the Bilboes is not at this stage materially affected by any known environmental, permitting, legal, title, taxation, socioeconomic, marketing, political, or

other relevant issue. Furthermore, the estimate of Mineral Reserves is not materially affected by any known mining, metallurgical, infrastructure, or other relevant factors.

- DRA Comments

  DRA is confident that enough geological work has been undertaken, and sufficient geological understanding gained, to enable the construction of an ore body model suitable for the derivation of Mineral Resource and Mineral Reserve Estimates. DRA considers that both the modelling and the grade interpolation have been carried out in an unbiased manner and that the resulting grade and tonnage estimates should be reliable within the context of the classification applied. In addition, DRA is not aware of any metallurgical, infrastructural, environmental, legal, title, taxation, socio-economic, or marketing issues that would impact on the mineral Resource, or reserve statements as presented.

1.13.1 Pit Designs

The Bilboes Project area consists of four mining areas containing between one to three pits each. These areas are McCays, Isabella South, Isabella North and Bubi as shown in Figure 1-4.

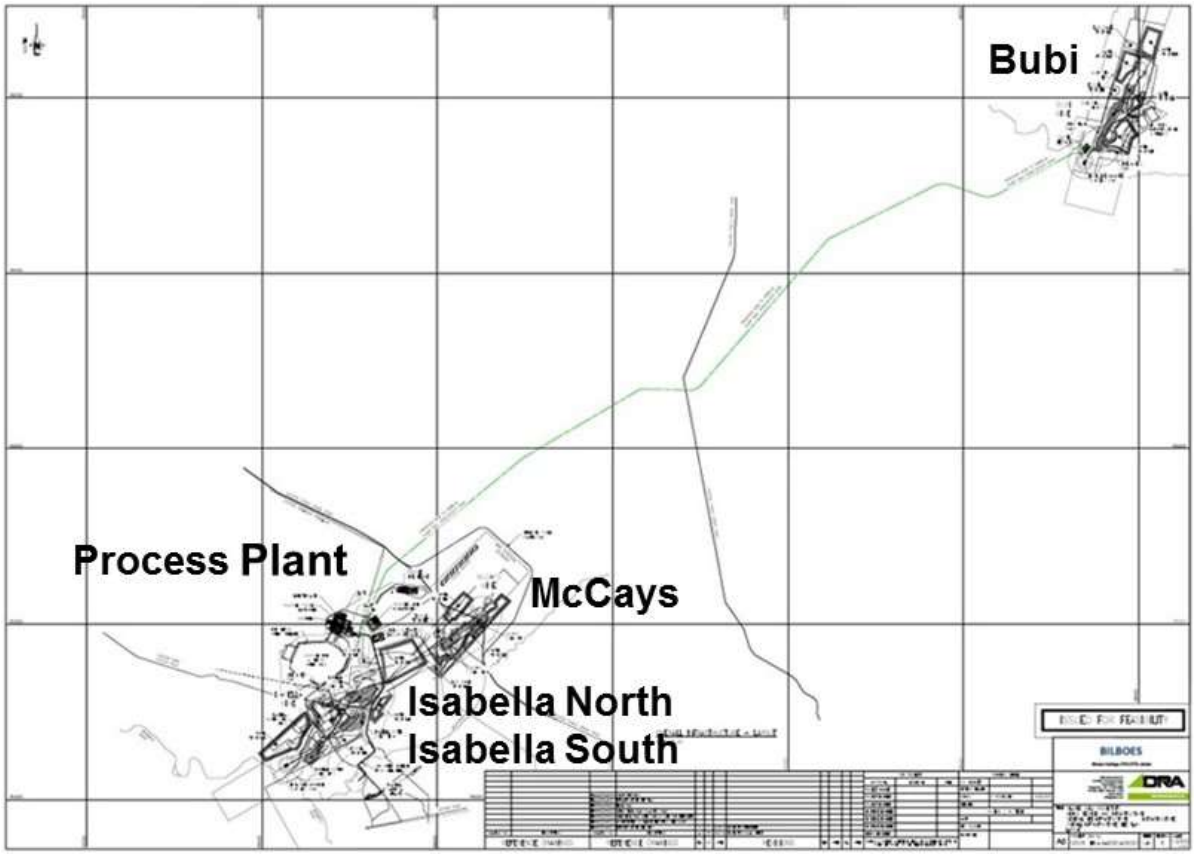


Figure 1-4: Block Plan Showing Bilboes Pits and Process Plant Location

1.13.1.1 McCays Pits Design with Waste Dumps

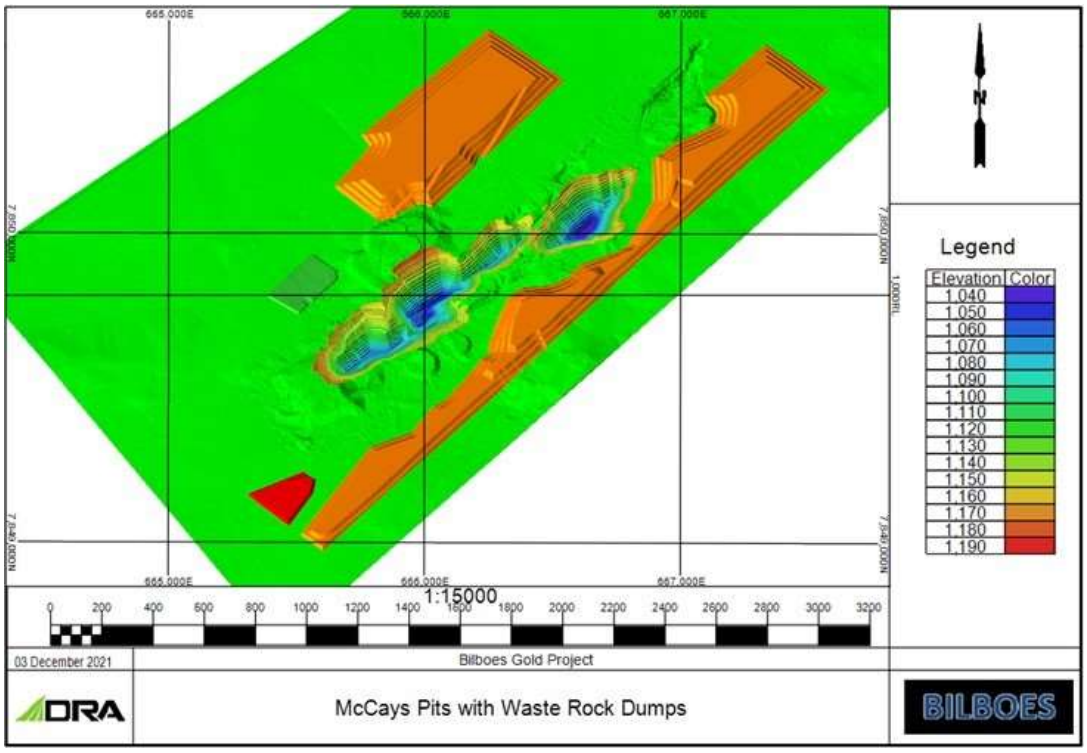


Figure 1-5: McCays Pits and WRD Designs

1.13.1.2 Isabella South Pits and Waste Dumps

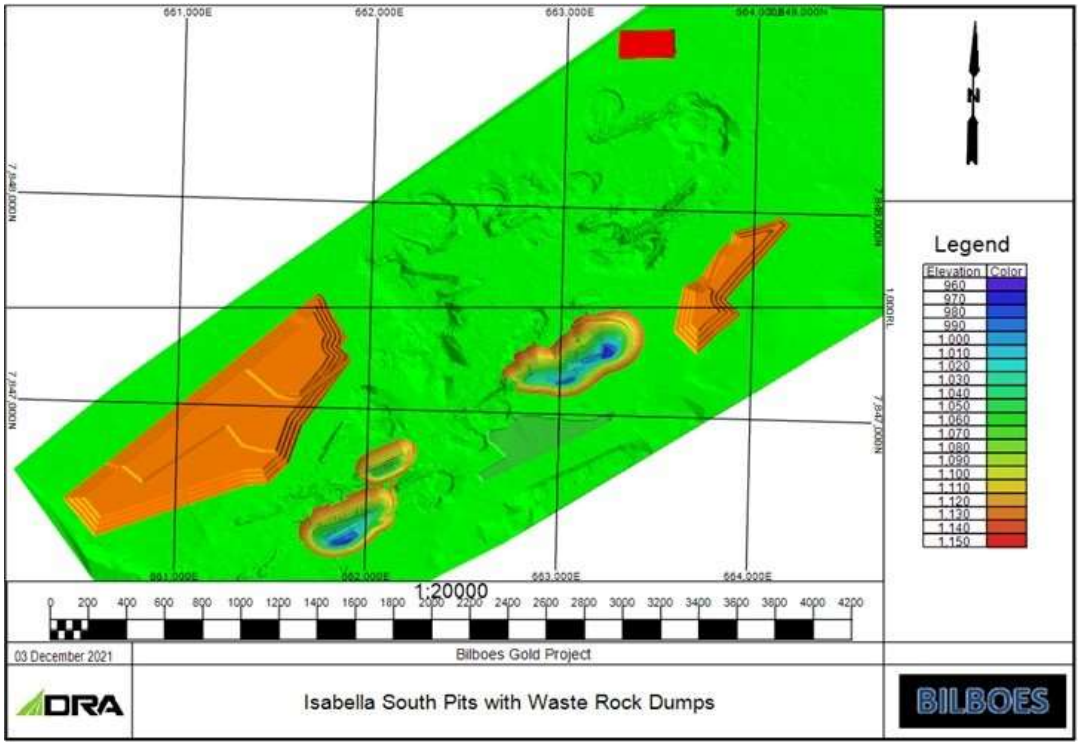


Figure 1-6: Isabella South Pits and Dumps

1.13.1.3 Isabella North Pits with Waste Dumps

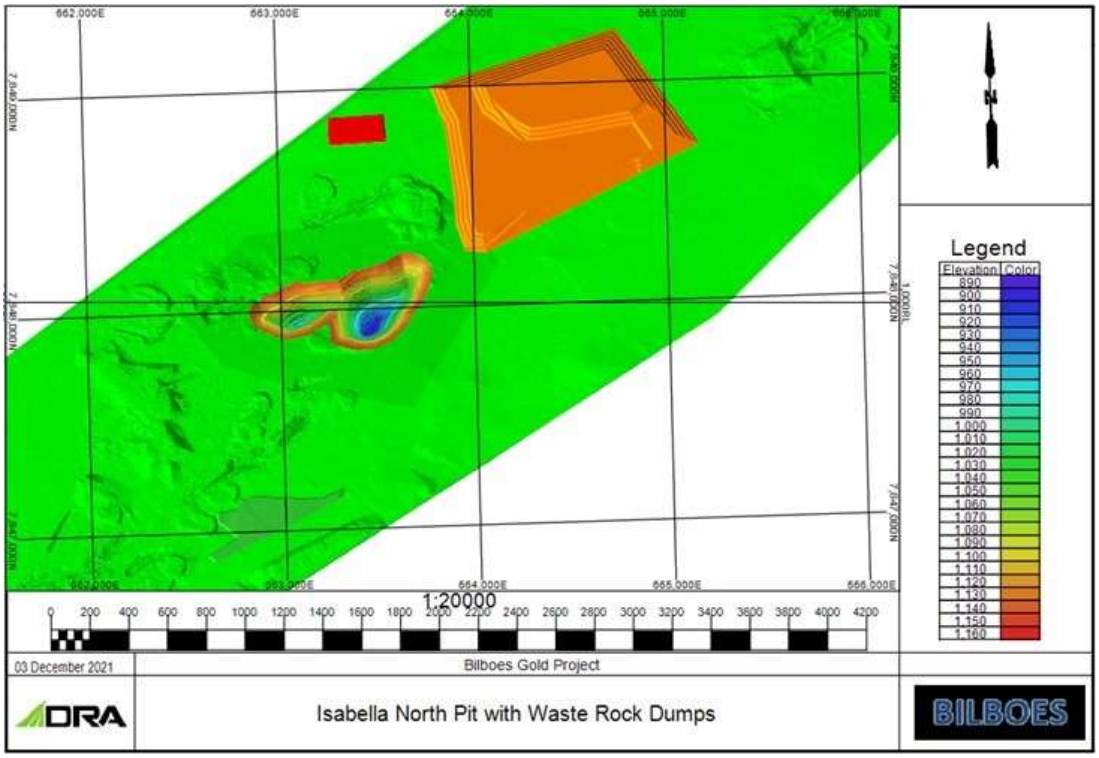


Figure 1-7: Isabella North Pit Design

1.13.1.4 Bubi Pits with Waste Dumps

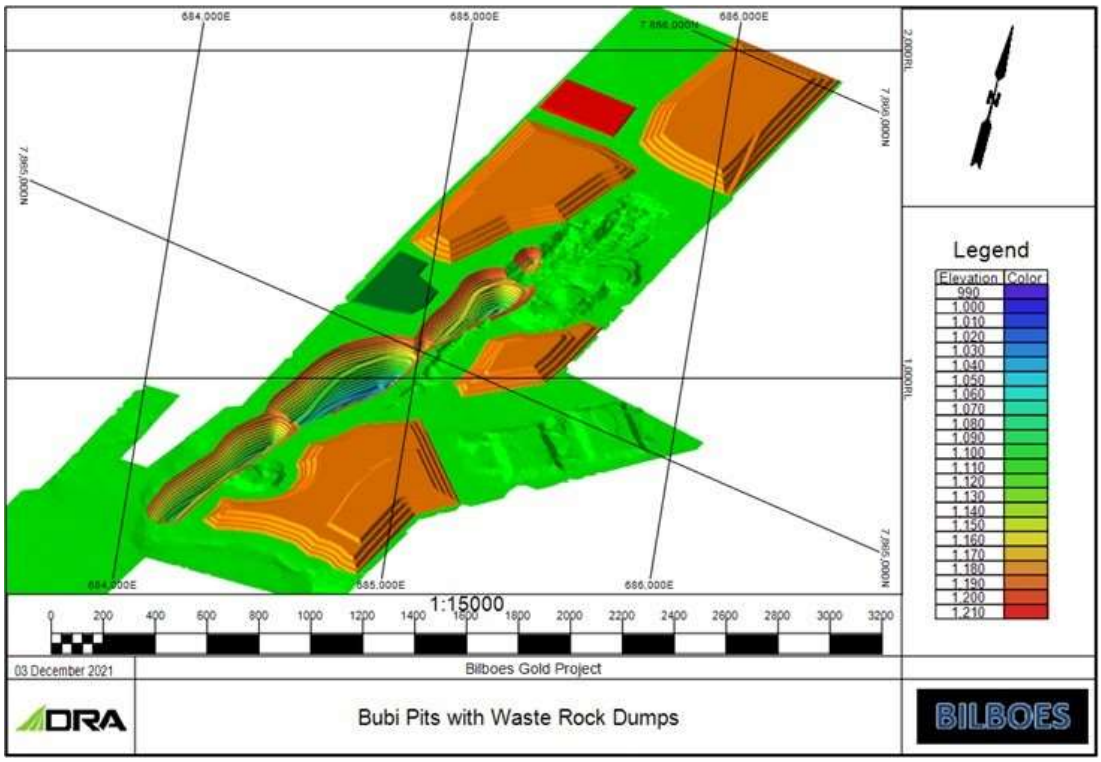


Figure 1-8: Bubi Pits and Dumps

1.14 Mining Strategy

A LoM schedule has been developed to supply two processing phases. These consist of phase 1 at a processing capacity of 2.88 Mtpa (Isabella and McCays) and phase 2 at a processing capacity of 2.16 Mtpa (Bubi). The LoM schedule considers the blending requirement that a maximum of 50% of feed to plant be sourced from Isabella North and the remainder from Isabella South (preferred blend) or McCays for phase 1.

A mining contractor will be used for all open pit mining related earthmoving activities.

All deposits will be mined utilising conventional truck and shovel method.

Transitional and fresh ore and waste will be drilled and blasted.

Free dig and blasted waste will be loaded, hauled with 60 t haul trucks, and dumped to designated waste dump locations which will be systematically dozed and levelled to allow dump to be raised to design heights.

Free dig and blasted ore will be loaded and hauled with 40 or 60 t haul trucks and will either be direct tipped into the crushing facility, heap leach pads or placed on the RoM pad stockpile areas.

The Bubi ore will be dumped on the pit rim stockpiles before being loaded and hauled with a fleet of road trucks to the central processing facility at Isabella. There it will either be direct tipped into the crushing facility or placed on the RoM pad stockpile areas.

McCays will commence production first. This will assist in delivering higher mill feed grades early in the project life.

Approximately eleven months of waste stripping will be required to expose sufficient ore to maintain a constant ore feed rate during phase 1 once the processing plant has been commissioned.

The mining of all four deposits will run for a period of approximately 10.8 years based on the current production schedule. The peak production requirements are 28.1 Mtpa (total material movement).

1.15 Mine Production Schedules

The scheduling undertaken for the Study is based on the ore and waste inventories for each of the pit designs. The aim of the scheduling component was to ensure that the mining process allowed for:

- Pre-stripping and stockpiling of sufficient ore in time for commissioning of the processing plant and then reaching the annual processing plant feed rate
- A practical and realistically achievable schedule in terms of fleet deployment, equipment productivities and bench turnover rates

The mining schedule aims to maximise value by:

- Reducing waste mining during the early years as much as possible
- Mining high grade material during early years of mine life
- Delaying mining of deposits with higher ore mining cost
- Limiting the waste excavator fleet to four excavators

Further requirements for the mining schedule were:

- McCays to be mined first due to highest average grade
- Isabella North ore must be blended with that of Isabella South (or McCays) with maximum of 50% of the feed to plant coming from Isabella North
- Bubi mined last due to long transport distance to plant

The mining schedule aims to meet the following processing plant feed criteria, during each scheduling period:

- Phase 1 production ramp up to 2.88 Mtpa of ore from McCays / Isabella South and North combined
- Phase 2 feed to plant rate of 2.16 Mtpa of ore from Bubi

Due to the relatively short life of each of the mining areas the entire production schedule was done in months. For reporting purposes, the monthly production schedule was also aggregated into calendar years.

All mining schedules were generated in XPAC, RPM's propriety scheduling software.

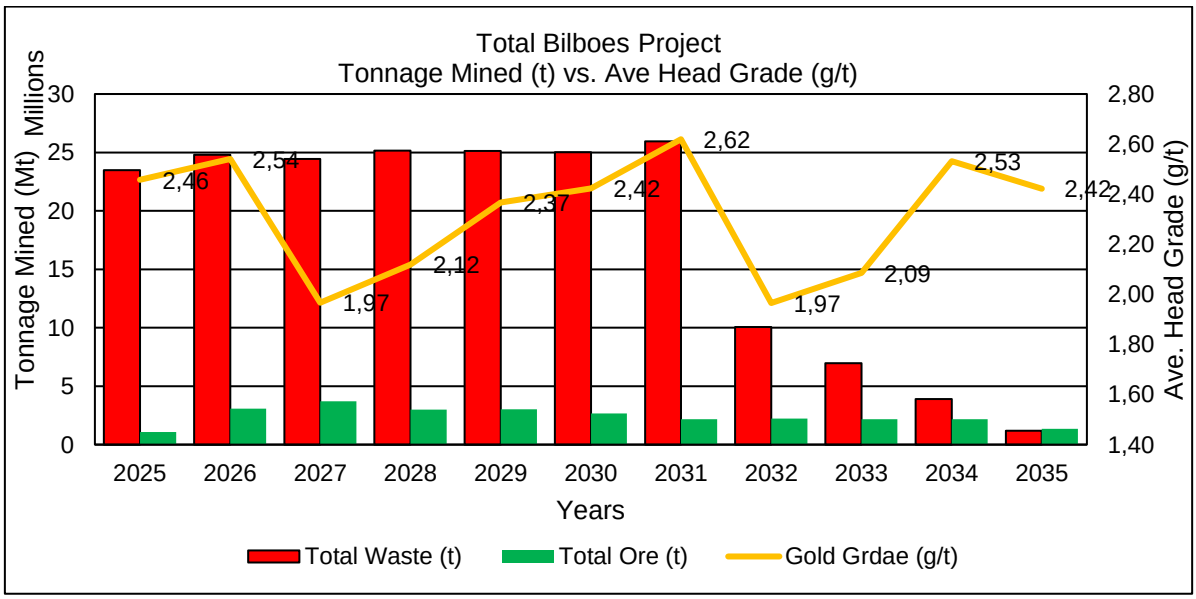
1.15.1 Operating Assumptions

The operation is planned to utilise three crews on a two 10-hour shift roster for 353 days (365 / year less 12 public holidays) of the year based on mining being carried out by a mining contractor.

1.15.2 Scheduling Results

The scheduling results are summarised in Graph 1-1. The results show that the schedule is a practical solution that targets value and meets all mining and processing goals monthly. The key features of the final Base Case schedule include:

- The need for 13 Mt of pre-strip material movement over seven months of pre stripping in the McCays and Isabella mining area will allow the process plant to commence its throughput ramp up.
- Both Isabella South and North need to be pre-stripped while producing ore from McCays. The pre-strip requirements for these areas are 3.6 Mt and 8.1 Mt for Isabella South and North respectively
- A maximum annual materials movement of 28.1 Mtpa in 2027
- The initial production ramp up needs four waste excavators and two ore excavators during the production ramp up for McCays, Isabella South and North. This remains constant during the LoM at Bubi except at stages all the excavators are not fully utilised.
- The ore excavators are never fully utilised mining ore only and are used to mine the waste partings between the various reefs

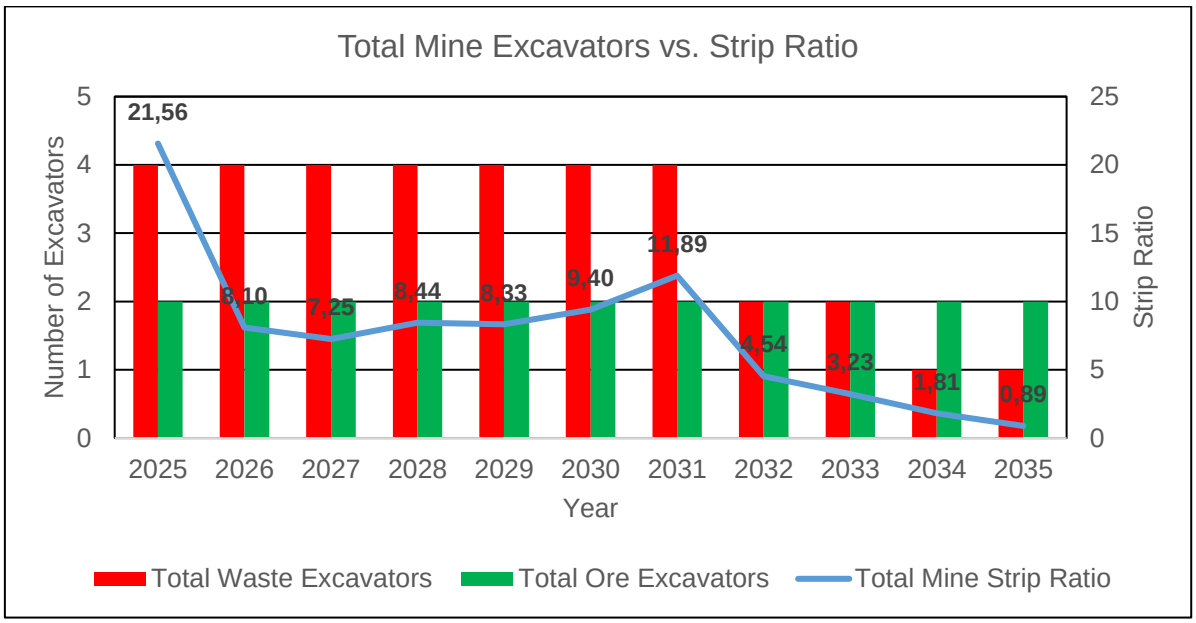


Graph 1-1: Total Mine Material Movements for LOM

1.15.3 Production Fleets Required

The scheduling in XPAC is driven by the excavating capability during each period (i.e., the product of the number of excavators and their productivity).

For scheduling purposes, it was assumed that 100 t excavators with 6 m³ bucket will be deployed on waste and 75 t excavators (4 m³ bucket) on ore. These excavators will be loading trucks with a payload capacity of 60 t and 40 t respectively. The first principal productivity calculations for determining period by period material movement were based on Caterpillar 390, Caterpillar 374 excavators and Caterpillar 773 dump trucks and Caterpillar 740 articulated dump trucks respectively. The envisioned excavator fleet deployment is shown in Graph 1-2.



Graph 1-2: LoM Excavator Fleet

1.15.4 Waste Rock Dumps

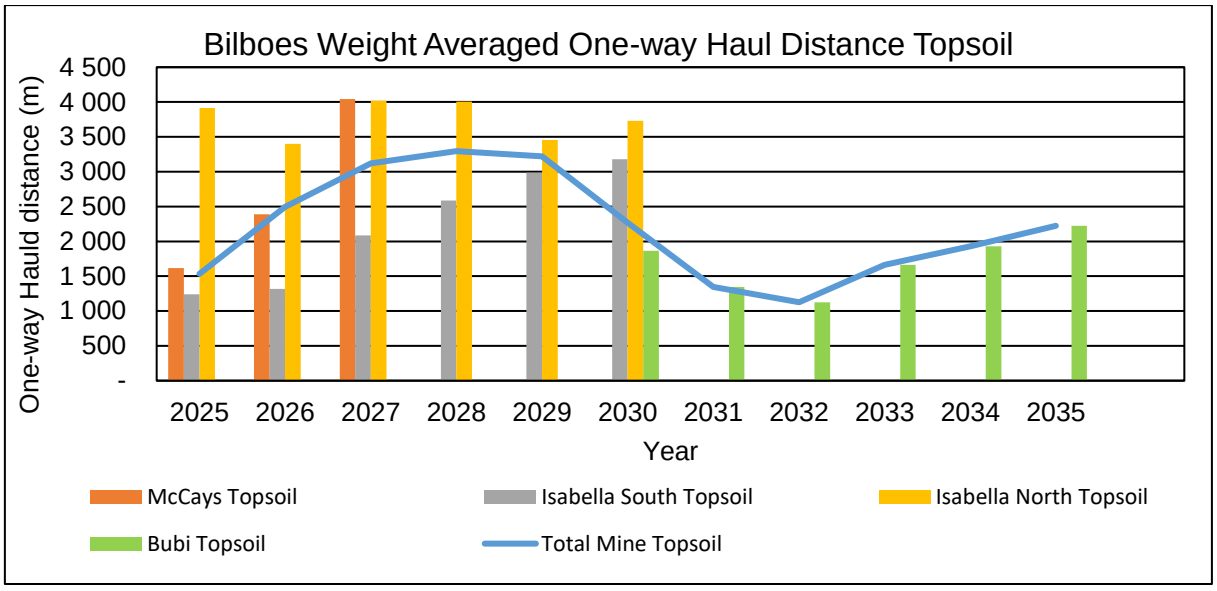
The waste dumps were staged appropriately to minimise haul distances throughout the LoM.

The waste dump construction and final landform are based on the following criteria:

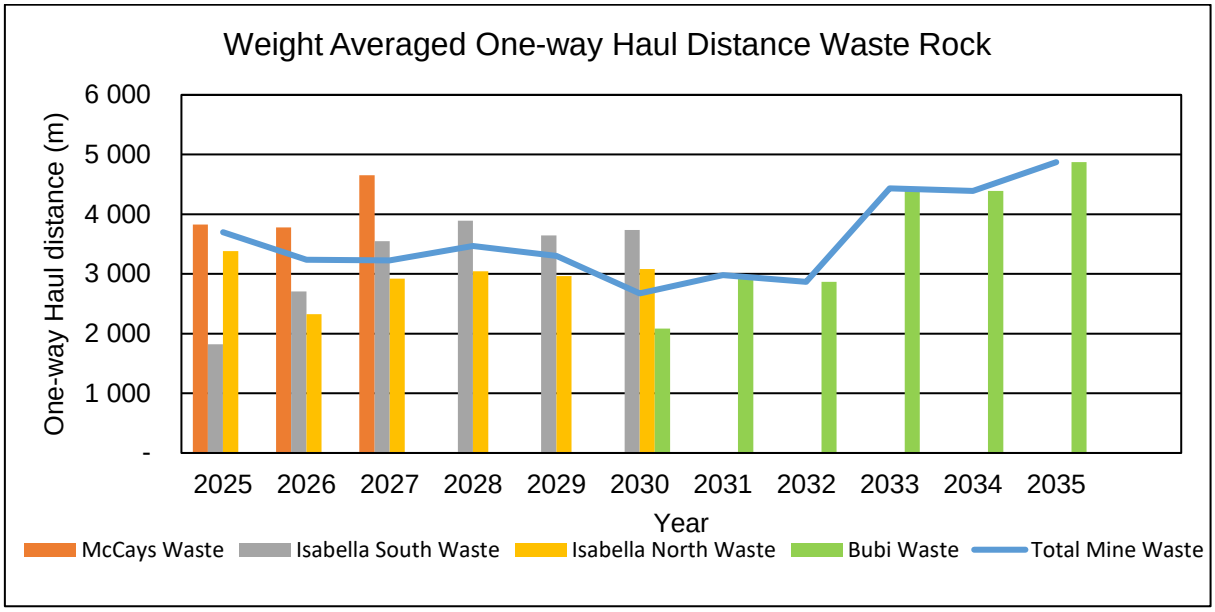
- The maximum height of waste dumps is currently set at 40 m above ground level
- A swell and re-compaction factor of 50% was utilised to calculate a material placement density of waste on the waste dumps
- Dump bench face angle is designed at 30 degrees during construction, with 10 m berms separating benches. During the rehabilitation phase, the WRD slopes will be progressively dozed down into continuous slopes without benches, as required for agricultural use. After rehabilitation, the final landform slope will not exceed 19 degrees overall slope angle
- The waste dumps will be built with a minimum 1:100 gradient on the top surface to ensure effective water shedding

- All dump locations were selected outside the boundaries as indicated by the Whittle gold price scenario of $ 2,000/oz. Future prospecting zones were also considered so as not to sterilise any potential Resource
- The minimum operating width on the waste dump is 40 m
- All the waste dumps were designed with ramps of 10% gradient
- It has been assumed that all waste is benign and does not require any neutralising treatment, or containment

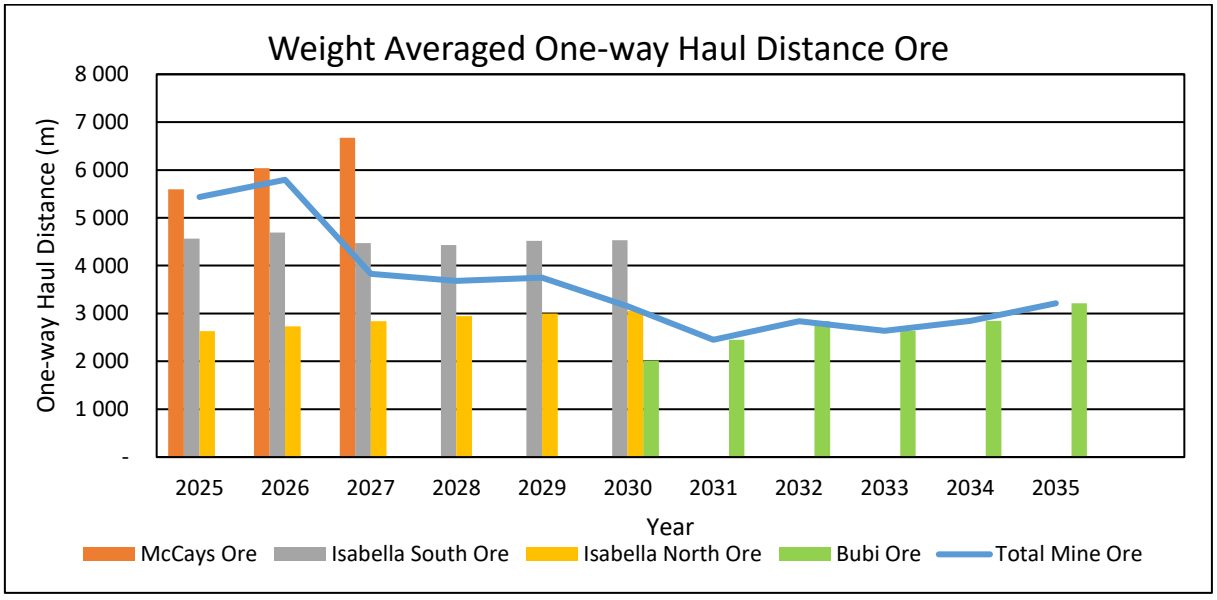
The placement of the waste rock dumps was used to determine the expected hauling distances over LoM. These are shown in Graph 1-3 to Graph 1-4 below for topsoil, waste rock and ore. The haul distances for ore for McCays, Isabella South and Isabella North is the direct haul to the processing plant. The ore haul distances for Bubi only reflect the distance to the Bubi RoM pad where the ore will be re-handled onto on-road trucks for transport to the processing plant.



Graph 1-3: Weight Averaged One-way Haul Distances for Topsoil



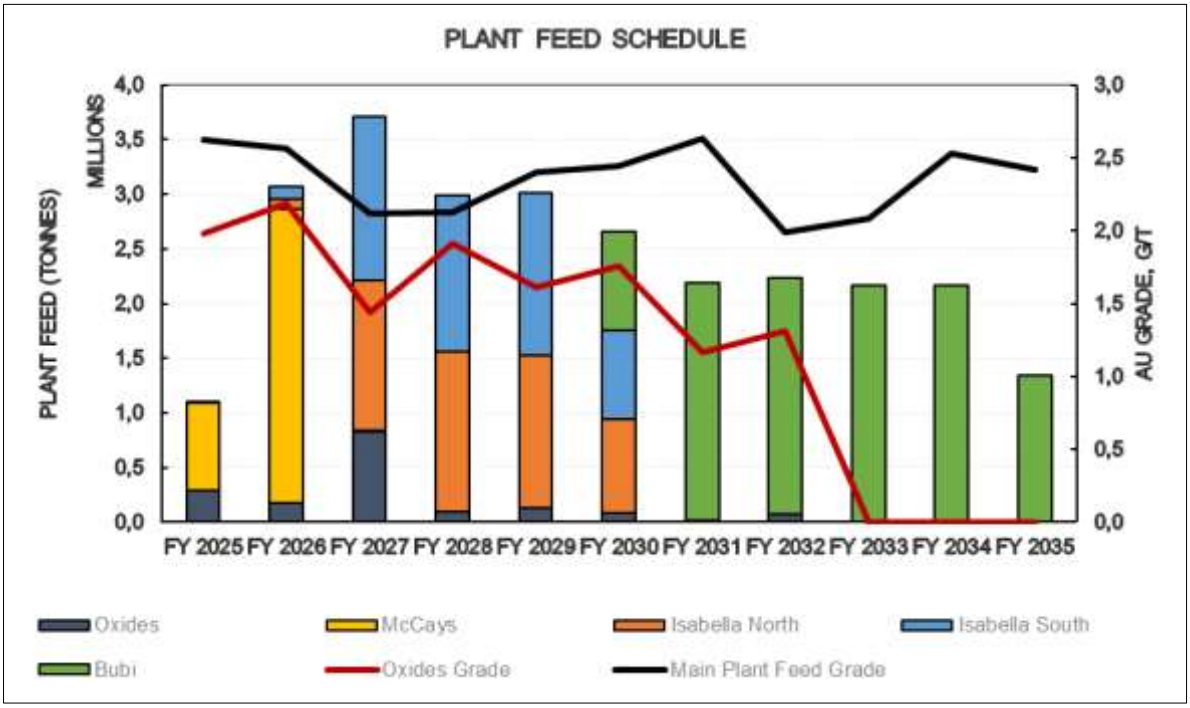
Graph 1-4: Weight Averaged One-way Haul Distances for Waste Rock



Graph 1-5: Weight Averaged One-way Haul Distances for Ore

1.16 Plant Feed Schedules

The production profile is reported as ore fed to the plant from four mineralisation properties which are McCays, Isabella North, Isabella South and Bubi. A total of 24.9 million tonnes of mineralized material is delivered to the processing facility, with 196 million tonnes of waste removed over the same period. Oxides which amount to 1.7 million tonnes are fed to the existing heap leach circuit. The average grade over life of mine is estimated at 2.34 g/t Au (excl. oxides fed to heap leach). below on an annual basis.



Graph 1-6: Plant Feed Schedule

1.17 Tailings Storage Facility

DRA appointed SLR Consulting (Africa) (Pty) Ltd (SLR) to undertake portions of the Bilboes FS involving a new TSF and the associated sundry infrastructure which include return water dams, silt traps, pollution control system, access roads and perimeter fencing.

The pertinent aspects of the TSF feasibility design are as follows:

1.17.1 Design Standards

- There are no specific Zimbabwean regulations or standards that are applicable to TSF design, and as such the Bilboes TSF was designed to comply with the following regulations, standards, and guidelines: IFC Environmental, Health, and Safety Guidelines for Mining, 2007.
- The applicable specifications of the International Commission on Large Dams (ICOLD) and the Australian National Committee on Large Dams (ANCOLD) (as required by the above IFC guidelines, or any other internationally recognised standards based on a risk assessment strategy), specifically the ANCOLD 2012 guidelines on the planning, design, construction, and closure of tailings dams.
- South African regulations regarding the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation, Regulation R632, promulgated under the National Environmental Management, Waste

Act, 2008 (Act No. 59 of 2008) published on 24 July 2015 in Government Gazette No. 39020.

1.17.2 Design Criteria

Two streams of tailings were envisaged: the flotation circuit (which produces flotation tailings), and the BIOX® circuit (which produces BIOX® CIL tailings and the neutralised BIOX® product that is mixed back with flotation tailings). The flotation and BIOX® tailings will be stored separately in two compartments due to variations in chemistry and rheology.

The TSF compartments were sized for the following tailings production profile:

Table 1-9: Tailings Production Profile

Phase	Year	Deposition Rate (tpm)		Cumulative Tonnage (t)	
		Flotation tailings	BIOX® tailings	Flotation tailings	BIOX® tailings
1	1 to 6	240,000	12,000	13,951,000	749,000
23	6 to 10	180,000	18,000	8,748,000	972,000
Total				**22,699,000**	**1,721,000**

The criteria used for the TSF design is outlined below:

- Site selection – general area for the TSF was preselected by Bilboes. SLR conducted a trade-off study that compared various TSF construction, development, and deposition techniques over several TSF layout configurations on the pre-selected site area from which the best option was selected.
- Tailing's development – a hybrid TSF development system that incorporated full containment of tailings during the initial high RoR deposition phases, followed by upstream development in the latter phases of development when the RoR reduces to the permissible 2 m/year.
- Embankment Construction:
  - Full Containment Wall – downstream construction using waste rock material
  - Above containment wall – upstream construction using compacted tailings
- Method of tailings deposition – conventional spigotting of slurry tailings.
- LoM – 11 years
- Allowable RoR – 2 m/year.
- Flotation compartment capacity – 22.70 Mt.
- BIOX® compartment capacity – 1.72 Mt.

- TSF overall slope:
  - Downstream constructed waste rock wall – 1v:3h
  - Upstream constructed tailings wall – 1v:4h

1.17.2.1 Site Geotechnical Investigations

1.17.2.1.1 Test Pits

The site geotechnical investigation was carried out by SLR and included mechanically excavated trial pits as follows:

- A total of 33 test pits were excavated over the TSF area to depths between 0.2 m and 2.6 m
- Nine test pits were excavated over the RWD areas to depths between 1.2 m to 1.9 m
- Three boreholes were drilled at the proposed TSF site
- Two boreholes were drilled at the proposed flotation RWD site
- A total of six rotary core boreholes were drilled (to depths between 27 m and 30 m) at the proposed process plant site, adjacent to the TSF site

1.17.2.1.2 Site Soil Profile

The site soil profile was found to generally consist of firm vegetative alluvial topsoil (about 400 mm thickness) underlain by a layer (400 mm thick) of transported colluvium soils in some sections of the site. The soils can be described as medium dense to dense clayey sand with gravel. The colluvium soils overlie residual arkose at depths between 1.4 m and 2.3 m, which in turn is underlain by moderate to highly weathered arkose bedrock.

On other sections of the site, the transported topsoil is underlain by residual fine grained sandy lean clay andesite soils derived from the weathering of the parent andesite rock. Competent andesite rock underlies the residual andesite soils in these areas of the site.

1.17.2.1.3 Ground water

No groundwater was encountered in any of the test pits and boreholes, and as such groundwater is not expected to affect construction.

1.17.2.1.4 In-situ Permeability

In-situ permeability tests carried out at the TSF site indicated moderate to slow seepage potential for the site founding material.

1.17.2.1.5 *Construction Material*

Good to fair quality material suitable for embankment construction and as a liner to the waste rock can be sourced from the TSF and RWD sites.

The residual arkose and andesite silt materials available on site are clayey and will require the lower Standard Proctor compactive effort rather than the Modified AASHTO compactive effort. In addition, wet compaction would be required to lower the permeability of compacted clayey materials that would render these materials suitable for use in lining systems.

Mine waste rock materials available from previous mining and from the planned mining will be used to form the containment wall.

1.17.2.1.6 *Soil Physical Parameters*

The following material physical properties were derived from the geotechnical site investigation and were used for stability analysis and TSF foundation design:

- Selected embankment fill material friction angle (Φ') :25 degrees
- Selected embankment fill material cohesion (c') :20 KPa
- Selected embankment fill material unit weight :1,600 kg/m³
- Waste Rock friction angle (Φ') :35 degrees
- Waste Rock cohesion (c') :5 KPa
- Waste Rock unit weight :2,100 kg/m³
- Foundation material (residual arkose / andesite) friction angle (Φ') :30 degrees
- Foundation material (residual arkose / andesite) cohesion (c') :12.5 KPa
- Foundation material (residual arkose / andesite) unit weight :1,700 kg/m³
- Bedrock friction angle (Φ) :50 degrees
- Bedrock cohesion (c') :50 KPa
- Bedrock unit weight :2,600 kg/m³

1.17.2.2 Tailings Physical Characterisation

A full suite of geotechnical laboratory tests including foundation indicator tests, consolidated undrained triaxial tests, slurry settling tests, volumetric shrinkage tests, dispersiveness tests, evaporation / air-drying tests were conducted on representative samples obtained from the on-site pilot plant.

The following tailings physical properties were derived from the geotechnical site investigation and were used in the design of the Bilboes TSF:

- In-situ dry density of deposited tailings for capacity calculations :1.35 t/ m³
- Flotation tailings solids concentration in slurry (by mass) :40%
- BIOX® tailings solids concentration in slurry (by mass) :20%
- Flotation tailings specific gravity :2.70
- BIOX® tailings specific gravity :2.75
- Flotation tailings slurry density :1.337 t/ m³
- BIOX® tailings slurry density :1.144 t/ m³
- Flotation and BIOX® tailings effective friction angle (Φ') :31 degrees
- Flotation and BIOX® tailings cohesion (c') :0 KPa
- Flotation and BIOX® tailings unit weight :1,500 kg/m³

1.17.2.3 Tailings Geochemical Assessment and Liner Selection

Tailings geochemical assessment was undertaken on representative flotation, neutralised BIOX® product and the BIOX® CIL tailings samples obtained from the on-site pilot plant. The pilot plant testing was conducted on ore samples collected from Isabella, McCays and Bubi.

The tailings were then classified in accordance with both the Zimbabwe Effluent Discharge Classification, and the South African Waste Classification for reference purposes.

1.17.2.3.1 Zimbabwe Effluent Discharge Classification

Tailings leach test results were compared to the Zimbabwe Environmental Management (Hazardous Waste Management) Regulations, 2006 classification using effluent standards for discharge which classifies samples based on leachable concentrations as either Blue, Green, Yellow or Red with Blue being a safe condition and Red being a high hazard.

Six samples (Bubi, Isabella McCays composite) from the BIOX® and Isabella North and South, McCays, and Isabella McCays composite) for the flotation product were classified as high hazard (Red).

The Bubi flotation samples were classified as low / safe hazard (Green / Blue) level.

1.17.2.3.2 South African Waste Classification

The Bilboes tailings samples were assessed in terms of The South African Waste Classification

and Management Regulations (WCMR) (GN R.634) and the associated National Norms and Standards (GN R.635 and GN R.636).

The waste assessment indicated that the flotation samples require disposal to a facility with a composite liner per GN R.636. The BIOX® tailings, on the other hand, would require pre-treatment / polishing prior to disposal and then re-assessed to determine an applicable liner system. It is understood that such pre-treatment will be incorporated within the Bilboes process plant.

1.17.2.3.3 *Liner Selection*

The following liner system was selected based on the geochemical assessments.

Table 1-10: Liner System

Layer Description	Flotation Tailings		BIOX Tailings	
	TSF	RWD	TSF	RWD
HDPE geomembrane thickness	1.5 mm	2 mm	2 mm	2 mm
Base layers	300 mm selected clayey material (compacted in 2x150 mm thick layers)	300 mm compacted clay liner (compacted in 2x150 mm thick layers)	600 mm compacted clay liner (compacted in 4x150 mm thick layers)	600 mm compacted clay liner (compacted in 4x150 mm thick layers)
In-situ base preparation	Rip and re-compact 150 mm in-situ layer	Rip and re-compact 150 mm in-situ layer	Rip and re-compact 150 mm in-situ layer	Rip and re-compact 150 mm in-situ layer
For the flotation compartment, the above only applies up to 200 m into the basin. The central portion of the flotation compartment will be lined with CCL as described below:		N/A		
Flotation Compartment Central Portion of Basin Liner				
1	600 mm CCL			
2	150 mm Base preparation			

1.17.2.4 Seepage / Leakage Quality

Solution from flotation tailings indicated the following constituents exceeding the WHO drinking water guidelines and IFC guidelines for mining effluent: Arsenic (As), Fluorine (F), Mercury (Hg), Nitrate (NO3), Nickel (Ni), Antimony (Sb), Selenium (Se) and Total Cyanide (CN).

For the BIOX® tailings solution, the following constituents exceeded the WHO drinking water guidelines and IFC guidelines for mining effluent: Arsenic (As), Nickel (Ni), Antimony (Sb), Selenium (Se) and Total Cyanide (CN).

The geochemical assessment indicated the BIOX® CIL tailings are likely to be Potentially Acid Generating (PAG). The flotation tailings are non-PAG.

1.17.2.5 Contaminant Plume Modelling

The contaminant plume modelling undertaken compared the expected maximum extent of plume migration under different pollution control scenarios as follows:

- Scenario 1: “Do-Nothing” i.e., no lining under any of the two TSF compartments
- Scenario 2: Compacted clay liner (CCL) only over the basin of both TSF compartments
- Scenario 3: Composite liner incorporating a geomembrane overlying compacted clay (equivalent to a South African Class C liner)

The modelling results demonstrated that the “Do-Nothing” scenario would not be environmentally acceptable.

The CCL would also not be sufficient to avoid contaminants reaching the drainage line to the north-west of the site even though it provides for a large reduction in contaminant plume migration.

The composite liner option proved sufficient to contain contaminant plume migration within the TSF area.

A partial lining option (a composite geomembrane liner installed up to the top of the full containment starter embankment and extending up to 200 m into the flotation compartment basin; with the central basin portion lined with a compacted clay liner) was considered.

1.17.2.6 TSF Stability Analysis

Stability analysis was conducted on the flotation tailings and the BIOX® tailings compartments. Analyses were conducted for the normal operating conditions (drained condition) and for the worst-case conditions (undrained condition and pool 50 m from the perimeter wall).

The lowest flotation tailings compartment Factor of Safety (FoS) for the worst-case scenario involving the pool located 50 m from the crests and the non-operational drains is 2.2 and that for the BIOX® tailings compartment is 1.9, both of which are greater than the ANCOLD (2012) recommended FoS of 1.5.

1.17.2.7 Pseudo Static Analysis

The Pseudo Static Analysis considered the following Peak Ground Acceleration (PGA) values recommended for this project:

- Operating Basis Earthquake (OBE) (1 in 1,000-year recurrence interval): 0.135 g (1.35 m/s²)
- Maximum Credible Earthquake (MCE) (1 in 10,000-year recurrence interval): 0.250g (2.50 m/s²).

The lowest FoS values yielded by the Pseudo Static Slope Stability Assessment considered for the worst-case scenario involving the pool located 50 m from the crests and the non-operational drains are as follows:

- Flotation tailings compartment :1.5
- BIOX® tailings compartment :1.2

ANCOLD (2012) recommends a FoS of 1.1 for Pseudo Static Loading stability (under OBE).

1.17.2.8 TSF Infrastructure

The TSF was designed with toe drains along the upstream toe of the starter wall, together with a reticulation of finger drains located further into the dam basin to collect seepage and help control the phreatic surface.

Adequately sized permanent and temporary penstocks will be used to decant supernatant operations and storm water off the TSF beach. The temporary penstock intakes will be decommissioned and sealed once the tailings level reaches the intake elevation of the next tower.

Full wall containment during the initial stages of deposition allows for storage of water on top of the TSF for as long as freeboard is maintained and seepage through surrounding embankments is prevented. Storage of water on the dam further allows for the deferment of the construction of the flotation RWD (together with associated return water infrastructure) to that time when upstream construction commences. A floating barge, or an on-shore skid-mounted appropriately sized pump can then be used during that time. The return water flows have been provided accordingly.

The BIOX® RWD was designed assuming return to the plant or elsewhere for treatment. The BIOX® return water flows have also been provided accordingly.

1.17.2.9 Design for Capital Cost Minimisation

The TSF was designed for minimum capital cost on the following design areas:

- Construction method – A hybrid method of construction was chosen based on a trade-off study that considered various TSF layout configurations and different construction methods to determine the most cost-effective option
- An optimal TSF embankment slope was selected as informed by stability analysis and a trade-off study conducted
- Liner system specified and costed comprised the flotation TSF compartment partially lined with a composite geomembrane liner up to 200 m into the basin and up to the top of the containment embankment wall and with a CCL used for the remaining TSF basin interior
- Return Water System – The design gives flexibility to store water on top of the TSF for the period Year 1 to Year 7, and to provide a floating barge or an on-shore skid-mounted pump system for return water pumping. In so doing, RWD and penstock system construction costs can be deferred until such time when needed for the upstream TSF construction phase

  However, a high-level consideration of initial capital investments required for a RWD together with conventional penstock intakes and outfall pipeline systems contrasted against the total establishment and operational costs of a pump system (floating barge or on-shore skid-mounted pump) indicated that apart from the advantage of deferring costs, the costs of the two options are in a relatively similar range. As such, the costing was done on a conventional RWD and penstock system to reflect a reasonable cost estimate.
- Fencing was only considered for the RWDs

1.17.2.10 TSF Hazard Classification

The Bilboes TSF hazard classification was carried out in accordance with both SANS 10286:1998 and ANCOLD (2012).

The Bilboes TSF can be classified as follows:

- A “High” hazard facility per the SANS 10286:1998 safety classification criteria
- A “High B” consequence category per ANCOLD (2012).

1.17.2.11 TSF Operation and Monitoring

The TSF operational aspects considered for this design to ensure an environmentally sustainable operation are as follows:

- Method of deposition
- On-dam pipework

- Decant management
- Operation of on-site pump stations
- General maintenance
- Concurrent rehabilitation
- Monitoring

Monitoring elements include:

- TSF engineering parameters
- Groundwater monitoring programme
- Dust monitoring programme
- Checks for seepage around the TSF toe and slope embankments, heaving at the TSF toe, slip / wedge failures; general condition of solution trench, erosion gullies on slopes, safety around penstock intakes and catwalk, safe access to all other areas of the TSF, and condition of the perimeter fence and warning signs.

1.17.2.12 TSF Closure Concept

The closure concept is envisaged to include a covering of mine waste with a low hydraulic conductivity layer such as a clay or geosynthetic membrane, typically used as a composite system incorporating several other layers to achieve the following:

- Limit erosion to acceptable levels
- Ensure sustainable plant growth
- Limit seepage flux through the cover

1.18 Infrastructure and Site Layout

The overall site plan is shown in Figure 1-9 and includes major facilities of the Project including the Isabella North and South, McCays and Bubi open pit mines, gold processing plan, Tailings Storage Facility, Waste Stockpiles, demarcated areas for mine buildings and accommodation facilities, main power line internal mine roads and access public roads.

Grid power will be supplied from the Zimbabwe National Grid by constructing a 70 km 132 kV Lynx line from Shangani Substation. To feed the line, a line bay will be constructed at Shangani. A mine substation will be constructed at Isabella. The estimate received is for a 132- kV substation, equipped with a 50 MVA 132 / 33 kV step-down transformer.

Raw water will be provided from open pit dewatering and the wellfield boreholes located across the mine license area.

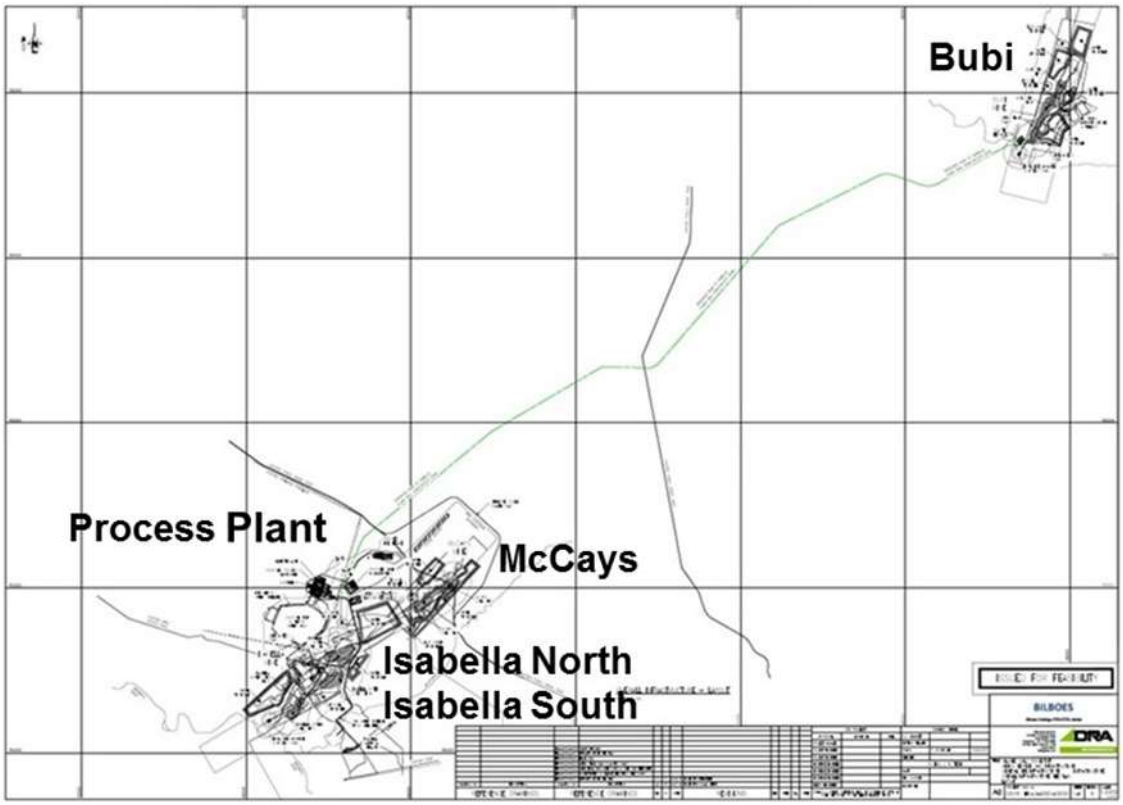


Figure 1-9: Overall Site Plan

1.19 Environmental and Social

Key points with regards to the environmental and social aspects of the proposed Bilboes are outlined in the sections below.

1.19.1 Environmental Studies and Potential Impacts

This section summarises the outcomes of the environmental assessment and potential environmental aspects that could materially impact and/or impair Bilboes ability to extract and process the mineral reserves.

1.19.1.1 Summary of Environmental Studies

Bilboes commissioned SLR in collaboration with GriynOva to undertake an Environmental and Social Impact Assessment (ESIA) in 2018 for exploiting and processing additional gold-bearing sulphide ores beneath the oxide zones within the existing open pits at the Isabella, McCays and Bubi Mines. SLR was the lead consultant for the ESIA, while GriynOva, as the in-country partner, provided input and support at all stages of the process.

The ESIA and accompanying specialist studies were conducted in conformance with the relevant International Finance Corporation (IFC) Performance Standards and associated guidelines and in compliance with the legal framework of Zimbabwe. The ESIA covers project-specific activities and includes a description of the Project, the legal and administrative framework, the environmental and social setting, an assessment of the environmental and social impacts, proposed mitigation and management measures within an environmental management plan and a conceptual closure and decommissioning plan.

The baseline environmental conditions, as described in the ESIA, are summarised below (SLR, 2019).

Geologically, the Bilboes operations are located within the Bubi Greenstone Belt, within the Zimbabwe Craton. The sulphide within the orebody tends to weather readily and all the deposits are covered by oxide caps to a depth of 15 m to 50 m which are readily amenable to heap-leach extraction. It is these oxide caps that have been mined by Bilboes to date. The topography of the area is gently undulating and generally flat except for raised areas created by old waste rock dumps and heap leach pads, as well as the excavated open pits and related mine infrastructure associated with the existing mines.

Generally, the soils are susceptible to surface crusting and sealing following rainfall events, slow water infiltration, compaction and soil and water erosion. The associated land capability of the soil, with the assistance of modern technology (including ripping, ridging, microjet and drip water application), varies between “moderately suitable for well-managed irrigation” and “marginally not suitable” or “displaying moderately severe limiting conditions”. Land uses are predominantly cattle ranching (predominately due to the dry climate of the district), subsistence agriculture (mainly maize) and mining (formal and artisanal mining methods). Subsistence farming is supported by irrigation schemes.

The area is characterised by heavy rainfall (a Mean Annual Precipitation (MAP) is 657 mm) with drier months between May and September. The prevailing wind direction is westerly. There is limited variation in the annual temperature profile and evaporation and as a result precipitation is considered a driving factor in controlling levels of dust.

The Bembezi River, a regionally significant perennial watercourse, and the Mdutshane River, a non-perennial watercourse, drain the southern part of Bilboes’ Isabella and McCays. An unnamed tributary of the Bembezi River is located west and downstream of the proposed TSF. The Bubi River, a large non-perennial river, and its tributary drain the Bubi. Tributaries of the Bubi River cross through the proposed haul road route. The Bembezi and Bubi Rivers meet downstream of the mine and ultimately flow into the Zambezi River. A large dam (Bafana Dam)

is located downstream of Bilboes on the confluence of the Bembezi River and the unnamed tributary of the Bembezi River.

Groundwater occurs within the higher conductive fractures, generally located above the 100 m depth. As depth increases, the fractures become less conductive with lower hydraulic properties. The general flow is in a north-east and south-west direction. Estimated water levels are in the region of 35 to 55 m at Isabella and 5 to 30 m at McCays. For the Bubi, the water levels are estimated to be 5 to 15 m and flow is in an east to west direction. The depth of weathering around the open pits is approximately 20 to 25 m. The weathered zone can be very conductive when the water levels occur above 20 to 25 m.

Surface water is the main water source to the communities, however Bilboes has facilitated the drilling of boreholes from some neighbouring communities. The Bafana Dam was used to supply the Nkosikazi Irrigation Scheme, although this is not operational currently. Groundwater use appears to be limited to groundwater abstraction by Bilboes for domestic water supply. Given the scarcity of water in the area, water within the flooded pits is used by wildlife and local farmers to water livestock (cattle). In addition to livestock watering, several people fish in the flooded pits, and may also bathe in the pit water. Water within the Bubi pit is used to support a community irrigation scheme.

Surface water quality sampling was undertaken in the Isabella, McCays and Bubi open pits as well as the Bembezi, Mdutshane and Bubi Rivers. All surface water samples show elevated levels of suspended solids exceeding the IFC EHS Mining guidelines (2007) and Zimbabwe Effluent Standards (SI 6, 2006) - High Hazard / Red Class. Elevated levels of Arsenic exceeding effluent standards were recorded at some of the pits at the Isabella. Elevated levels of Cadmium and Iron exceeding the maximum permissible levels in terms of the Zimbabwe Drinking Water Standards and the Zimbabwe Effluent Standards (SI 6, 2006) – High Hazard / Red Class, respectively, were recorded from some of the river samples. Exceedances of other elements (Magnesium, Sodium, Dissolved Solids, Electrical Conductivity and Nitrate) above the maximum permissible levels in terms of the Zimbabwe Drinking Water Standards (Magnesium and Nitrate) and the Zimbabwe Effluent Standards (SI 6, 2006) – High Hazard / Red Class (Sodium, Dissolved Solids, Electrical Conductivity and Nitrate) were recorded in samples from the Isabella and McCays pits. Water has been accumulating in the Bilboes pits since the mine went into care and maintenance in 2016. Given the extended dry period experienced at the mine it is possible that concentration of elements has occurred to a degree because of evapotranspiration. However, this would depend on the level of pit inflows which could also have taken place during this period.

The area is largely rural in nature although mining and community developments have influenced the visual landscape to some degree. There are no industrial noise sources, i.e., mechanised processes or diesel-powered equipment other than those used by Bilboes. The ambient daytime noise levels fall below the international guideline thresholds for residential areas (i.e., below 55 dBA). Existing activities within the area that contribute significantly towards air emissions such as dust fallout and particulate matter smaller than 2.5 µm (PM 2.5) include fugitive dust from de-vegetated areas, seasonal burning of vegetation, household combustion of solid fuel, vehicle exhaust emissions and various activities from the existing mine. However, the baseline sampling data shows PM 2.5 dust fallout concentrations generally fall below the local and international guideline limits.

The project area falls between the interface of the South African Bushveld ecoregions and Zambezian Baikiaea woodlands. Apart from Freshwater Resources (discussed further below) and Transformed Habitat areas (areas that have undergone transformation due to agricultural, rural, and mining activities), three habitat units were identified during field assessments. These include the Acacia Woodland Habitat Unit, associated with the South African Bushveld ecoregion, at Isabella and McCays and the Baikiaea Woodland and Brachystegia boehmii Habitat Units, associated with Zambezian Baikiaea Woodlands ecoregion, at the Bubi Mine. These habitat units are considered to have moderately high sensitivity, due to the unique landscape of the vegetation contributing to floral species diversity and the presence of floral species of Conservation Concern. The habitat units are largely intact with most of the area still in good condition.

Several freshwater Resources were identified either within the claims' boundaries or within proximity thereof. These include the Bubi, Bembezi and Mdutshane Rivers and related tributaries. The Bubi River and its tributaries are deemed to be in a moderately modified state and of moderate to moderately high Ecological Importance and Sensitivity (EIS) with a high diversity of tree species and very limited alien invasive plant proliferation evident. The unnamed tributary of the Bembezi River, located west of the proposed TSF, is of moderate EIS due to its contribution to the functioning of the downstream system (i.e., the Bembezi River) as well as its connectivity to surrounding natural areas, providing a faunal migratory corridor, and contributing to the overall biodiversity maintenance of the area.

The Bilboes operations are located within the Bubi District, one of nine districts within the Matabeleland North Province. The Bubi District is the seventh most populous district in the province with only 1.9% of the population located within urban areas. The Isabella McCays area is the most populated of the four wards within which the proposed project will take place with a population of 5,190 people. The ward in which the Bubi project area is located has a

population of 1,374 people. From the available census data, it is evident that there are more males than females in the district. This is likely due to an influx of male jobseekers looking for mining-related work opportunities.

Most of the local communities that surround the Bilboes operations are in Resettlement Areas. The specific villages identified to date that are deemed most likely to be affected by the proposed project are Dabengwa Village (located close to Isabella), Swati Village 2 (located close to the haul road route) and Rhino Village (located close to Bubi). A section of the proposed haul road would pass through communal fields associated with Rhino village. Other villages do occur within the vicinity of the project area. In areas where people were resettled under the Government's land reform programme, there is a lack of school and health facilities as well as insufficient basic services such as water and power supply.

The predominant economic and livelihood strategy employed by the local communities is cattle ranching. The Bilboes operations are located within large parcels of land that have been set aside as grazing areas for these communities. The proposed haul road also passes through two parcels of Commercial Land (held by private farmers) used for ranching.

Subsistence agriculture (mainly maize) and mining (formal and artisanal mining methods) are the other two main economic and livelihood activities. The level of agricultural activity is largely dependent on household labour availability and access to farming implements. To support agricultural activities, irrigation schemes have been developed within some of the communities in the project area. These schemes reduce the likelihood of crop failure due to poor rainfall and where an excess has been produced, members of the local communities sell some of their maize to the Grain Marketing Board as an additional source of income.

Mining has been a major employer of the local population in the past, however over time several mines in the area have been closed. For the Bilboes operations the number of people currently employed is far lower than when the mine was operating at full capacity. Artisanal small-scale mining is now a leading source of income for households in the area, with most families now dependent on gold panning (especially outside of the rainy season). The increase in artisanal mining activities has also led to social conflicts, with many of the artisanal miners entering the district from other areas of Zimbabwe.

Potential vulnerable groups associated with the project area include the land users located within the footprint of the proposed haul road, communities reliant on water from the open pits for domestic and agricultural purposes, as well as woman, children and the sick or elderly.

No cultural heritage Resources have been identified within the proposed project footprint, apart from potential grave sites located in proximity to the proposed TSF footprint. The layout of the proposed TSF has since been revised to avoid this area.

1.19.1.2 Environmental Issues

The natural environment within the project site has been significantly transformed by existing mining operations. The surrounding environment is more natural with disturbances from communities and subsistence farming activities. Other mining operations do occur in the region however over time several mines in the area have been closed. The EIA (SLR, 2019) identified the following potential environmental impacts:

- Potential loss of soils and related grazing land capability within the proposed project footprint. The new TSF, expansion of open pits and WRDs would remain after closure. In the mitigated scenario, the soils can be conserved and reused during rehabilitation which reduces the significance of this impact.

  Significance after mitigation = Low

- Potential contamination of soils, surface water and/or groundwater features within the project site through the addition of contamination sources. Mitigation focussed on the design of potentially contaminating facilities and managing the storage and handling of polluting substances and related clean-up of spills reduces the intensity of these potential impacts.

  Significance after mitigation = Medium to High

- Alternation of drainage patterns and related downstream functionality of aquatic habitat due to encroachment of the Bubi open pit into the non-perennial Bubi River. In addition, the establishment of stream crossings associated with the proposed haul road would potentially contribute to a cumulative loss / disturbance. In the mitigated scenario, where the Bubi River is diverted to ensure that that the hydraulic connectivity of the river is retained and pollution, sedimentation and erosion impacts are generally avoided, the significance of this impact reduces.

  Significance after mitigation = Medium

- Potential contamination of surface and groundwater Resources from various operational activities (short-term point-sources) and contamination from the new TSF and WRDs (long-term diffuse pollution source in the closure phase). Through the implementation of

industry-aligned surface water management measures and a composite lining for the floatation compartment and full HDPE liner for the BIOX® compartment of TSF, as well as the differential handling of the sulphur from the of waste rock associated with the WRDs, the overall significance of these impacts is reduced.

Significance after mitigation for surface water = Medium.
Significance after mitigation for groundwater = High

- Lowering of groundwater levels potentially affecting third party water supply should third party boreholes be located within the dewatering cone of depression. The predicted cone of depression extends to areas outside of the Bilboes claims areas may impact on groundwater inflows into the Mbembesi and Bubi Rivers. While the extent and depth of drawdown reduces over time after mining activities stop, a degree of drawdown would persist in proximity to the open pits after 100 years. In the mitigated scenario, any third-party water sources that have a proven decrease in yield or dry up because of the proposed operations would be compensated with an alternative water supply of equivalent quality and quantity thus, reducing the significance of this impact.

Significance after mitigation = Medium

- Potential reduction in ambient air quality due to particulate emissions (from the open pit workings, WRDs and TSF, as well as gaseous emissions, namely nitrogen oxides (NOX), carbon dioxide (CO2), carbon monoxide (CO) and volatile organic compounds (VOC). The implementation of an air quality and dust management plan during the implementation and operation of the proposed project lowers the intensity, and probability of such impacts occurring, thus reducing the overall significance of the impact.

Significance after mitigation = Medium (operational phase) to
Very Low (construction and decommissioning phases)

- Elevation in ambient noise levels creating a potential disturbance to nearby receptors. During the construction and decommissioning phases, these would be of short-term duration and localised to the areas of construction. During the operational phase, it is anticipated that noise emissions would be more constant (noise disturbance) and have a lower impact than loud irregular noise (nuisance noise). Incorporating mitigation into the site design, as well as adopting sound management practices (e.g., maintaining machinery and equipment in good working order) reduces the overall significance of the impact.

Significance after mitigation = Medium (operational phase) to Low (construction and decommissioning phases)

- Visual disturbance to nearby local communities. Considered to be generally limited when considered cumulatively with the existing mine infrastructure. Local communities located in closest proximity to the proposed TSF, WRDs and sulphide processing plant would have the greatest visual exposure to the proposed project. However, the sensitivity of these receptors is likely to be moderate as they would generally be desensitised to the presence of mining activities and associated infrastructure. By undertaking rehabilitation throughout the course of the proposed operations, the significance of visual impacts is reduced.

Significance after mitigation = Low

- Physical destruction and general disturbance of terrestrial and/or aquatic biodiversity. By ensuring that the project footprint for planned clearing and infrastructure establishment is clearly demarcated and all areas of increased ecological sensitivity, outside of the mining footprint are designated as No-Go areas would limit the associated significance of these impacts.

Significance after mitigation = Medium

The EIA (SLR, 2019) concluded that the proposed project presents several potential positive and negative impacts associated with the unmitigated scenario. With mitigation (in the residual impact scenario) some of the identified potential impacts can be prevented and the remainder can be managed and mitigated to remain within acceptable environmental limits so long as the mitigation set out in the Environmental and Social Management Plan (ESMP) is implemented and Bilboes develops, implements, and annually reviews the Environmental, Social and Safety Management System (ESSMS). Positive impacts can be enhanced by developing and implementing a Community Development Plan as set out in the ESMP.

Bilboes is committed to implementing the mitigation measures within the ESMP together with the ESSMS which will be implemented as part of Bilboes' on-going efforts of continuous environmental improvement. The management system will contain plans and procedures to help manage environmental aspects and impacts and help ensure legal compliance.

1.19.2 Waste, Tailings, Monitoring and Water Management

This Section provides the requirements and plans for waste and tailings management, site monitoring, and water management both during operations and post mine closure.

1.19.2.1 Tailings Management and Disposal

Gold recovery at Bilboes would entail a two-stage process that would result in the generation of two different tailings streams - Flotation and BIOX® tailings. The TSF would be developed with two separate compartments to accommodate each tailings stream.

The proposed liner system for each comportment would incorporate (from top down):

- Flotation Compartment – A 1.5 mm HDPE geomembrane, a base layer of 300 mm selected clayey material (compacted in 2 x 150 mm thick layers)
- BIOX® Compartment – A 2 mm HDPE geomembrane, a base layer of 600 mm selected compacted clay liner (compacted in 4 x 150 mm thick layers).

Both compartments would have a ripped and re-compacted 150 mm in-situ base layer.

The TSF would incorporate a filter drainage system comprising an 8.5 m wide, 500 mm deep toe drain located immediately adjacent to the upstream toe of the starter wall for the Flotation compartment and a 7.5 m wide, 500 mm deep toe drain located immediately adjacent to the upstream toe of the starter wall for the BIOX® compartment.

Both compartments would have a reticulation of above-liner finger drains consisting of a configuration of 160 mm and 110 mm diameter slotted seepage collector pipes in the basin discharging to the solution trench independently of the toe drains to allow monitoring. The proposed decant systems consist of temporary intake structures (designated FT) and permanent intakes (designated FP). The intake structures have both top and side inlets.

There would be on-going rehabilitation of tailings through the application of the rising green wall. The TSF design slopes adopted (1V:4H) are considered environmentally stable to allow for indigenous vegetation growth with minimal ongoing maintenance. To assist with the vegetation establishment, the vegetation will be manually planted and irrigated during the initial stages. A cover involving topsoil and subsoil (in combination with the rocky waste rock material placed during construction protruding) will be progressively placed onto the side slopes of the TSF as the same is developed. These protrusions are advantageous as the mimic natural slopes and dissipate the kinetic energy of rain drops as they strike the surface.

The tops surface will be covered with topsoil mixed into tailings. The top surface will then be paddocked into smaller catchments to reduce water flow lengths.

The Bilboes TSF is classified as a Medium Hazard to High Hazard facility due to the number of residents in zone of influence estimated to be between 8 and 16 (determined in accordance with the South African Code of Practice for Mine Residue Deposits (SABS 0286:1998) and the

requirements of Mineral Regulation 527 of 23 April 2004). The classification considered the two compartments as one facility.

1.19.2.2 Waste Rock Management and Disposal

The planned WRD construction method would entail the following:

- A nominal wall of waste material would initially be constructed to confine the extent of the dumping area within the planned WRD footprint
- Waste material will be delivered to WRD by truck and tipped from the leading edge of the WRD towards the inside of the WRD footprint. The waste will then be spread and shaped as necessary by earthmoving equipment
- The WRD would then be developed in successive lifts of up to 10 m in height, with each lift being completed before commencement of the subsequent lift
- The WRD will be constructed at an angle of repose slopes of approximately 35 degrees

In principle, the WRD lift heights shall be limited to 10 m with a minimum of a 10 m berm, with an overall height of 40 m. Seepage from the toe of the WRD, as well as runoff from the slopes, would be controlled by the construction of an outer containment wall. The containment wall will be the boundary between the clean and potentially contaminated water systems for the purposes of stormwater management.

Some compactions of the waste are expected to take place during placement as trucks pass repeatedly over previously placed material on their way to and from the advancing faces of the WRDs. While compaction of wastes is desirable to maximise density and storage capacity, it is not a requirement for structural stability. Compaction will assist in reducing differential settlements with time, which will assist in ensuring the longer-term integrity of surface water management measures.

1.19.2.3 Non-Mineralised Waste Management

Non-mineralised waste (including general industrial waste, medical clinic waste, hazardous industrial waste, and domestic waste) would be temporarily handled and stored on site before being removed for recycling by suppliers, reuse by scrap dealers or final disposal at the existing waste disposal area located at Isabella. Bilboes has a designated burning site for all waste materials associated with cyanide packaging and hazardous waste on the heap leach pad where all leachate goes into the heap leach cyanide circulation stream as recommended by the cyanide suppliers. An internal waste management procedure will be developed for waste generated by the project.

With respect to sewage, it is proposed that the existing sewage treatment facility located at Isabella would handle the sewage generated. It is proposed that a sewage treatment plant would be established at Bubi.

1.19.2.4 Site Environmental Monitoring

The proposed monitoring programme is detailed in the ESMP for the proposed project. The aspects for which monitoring is proposed includes:

- Annual monitoring (physical observation) for erosion, as well as slope / TSF failure
- Monthly surface and groundwater monitoring (of parameters including water quality, volumes, levels, spillages, and management infrastructure)
- Monthly updating of the site-wide water balance (including biennial updates of the water balance model)
- Air and noise monitoring to establish baseline constituent concentrations / ambient noise levels, as well as regular monitoring during construction and operations, as applicable

Requirements for post-closure monitoring to determine whether the mitigation and rehabilitation measures are effective would be incorporated into a final Closure Plan to be compiled for the operations prior to the commencement of decommissioning.

1.19.2.5 Water Management

1.19.2.5.1 Surface Water

As noted above, there is evidence that the Bembezi, Mdutshane and Bubi Rivers have been impacted open by various anthropogenic activities in the broader area. Furthermore, the planned widening of the open pits at the Bubi would encroach directly on the Bubi River and the tributary located within the Bubi claims area. This would have a material impact on this feature and may have an impact on downstream water users. It is thus recommended that the Bubi River be diverted around the proposed expansion of the southern open pit to: (i) ensure that the hydraulic connectivity of the river is retained, and that pollution, sedimentation and erosion impacts are avoided; and (ii) limit the risk of flooding the southern open pit during a high flow event in the Bubi River.

- The measures to be implemented by Bilboes to address potential adverse water quality effects and to ensure that the planned infrastructure is constructed, operated, and maintained to comply with the provisions of the IFC guidelines, include:
    - Separating clean water systems from dirty water systems

- Minimising the size of dirty areas and divert clean run-off and rainfall water around dirty areas and back into its normal flow in the environment
- Locating all activities and infrastructure outside of the specified zones and/or flood lines of watercourses, as far as possible. Where this is not possible, the affected area should be remediated / rehabilitated to restore the original ecological function post-closure.
- Maintaining specified zones around surface water features in instances where flood lines are unknown or un-surveyed
- Incorporating suitable erosion protection measures at all discharge points, should any discharge be required. Furthermore, all discharges from the mine into the environment will comply with the IFC Effluent discharge standards.

1.19.3 Project Permitting

An approved EIA is required in terms of the Environmental Management Act (Chapter 20:27) No. 13 of 2002 and the Mines and Minerals Act (Chapter 21:05) of 1996. The ESIA was undertaken for the project to satisfy the requirement and an ESIA Report completed for submission to Environmental Management Agency (EMA) within the first quarter of 2020. Thereafter, SLR held public feedback meetings to disclose the findings of the ESIA Report to the identified stakeholders. A record of this disclosure process was compiled and submitted to the EMA. An Environmental Impact Assessment (EIA) certificate was issued to Bilboes for the project in February 2021. The EIA certificate is valid for 2 years and will be renewed in February 2023 subject to conditions which include project update reports, compliance to Environmental Management Plans (EMP) outlined in the ESIA Report and notification to EMA for any changes in the project likely to alter the project as stipulated in the ESIA Report. In addition, there are other permits associated with the processing plant, i.e., the regeneration kiln stacks, laboratory baghouse, electrowinning, gold room baghouse and clinic incinerator as required under section 14 of the Environment Management Act (Atmospheric Pollution Control) Regulations (SI 72 of 2009).

1.19.3.1 Social and Community Related Requirements and Plans

As part of the EIA, an Environmental and Social Management Plan (ESMP) has been developed (SLR, 2019). The ESMP contains the environmental, social and safety management and monitoring commitments that Bilboes will implement to manage the negative impacts and enhance the positive impacts identified in the EIA.

The ESMP is intended as a living document that will be regularly reviewed and updated by

Bilboes in response to any changes to the operations, to address any findings and recommendations emanating from monitoring programmes, changes in the Bilboes organisational structure and/or changes in the relevant national legislation, as applicable. The key measures included in the ESMP relating to social / community requirements are listed below.

1.19.3.1.1 *Livelihoods Restoration Plan*

To mitigate against the loss of, or reduced access to, land for livelihood activities, an LRP will be compiled and implemented prior to the commencement of construction in accordance with international standards. In broad terms the LRP will include the following:

- The project, land uses and socio-economic context
- Summary of the project description
- Summary of affected land, assets, and persons
- Legal and policy framework for land access and acquisition
- Eligibility, entitlements, and possible compensation options of affected parties
- Consultation and disclosure requirements including a grievance mechanism
- Monitoring, evaluation, and reporting
- Implementation, responsibilities, timeline, and funding requirements

1.19.3.2 Community Development Plan

As part of the existing operations Bilboes have undertaken several Corporate Social Responsibility (CSR) programmes. These include the supply of various community boreholes at communities and local schools, building and repairs of school blocks, the repair of various local roads, excavation and scooping of dams and provision of various other services including access to health facilities at the mines and transport in cases of emergency.

The EIA (SLR, 2019) identified the requirement to formalise the provision of community development initiatives through the development of a Community Development Plan which sets out its planned contributions to the development needs of the local communities impacted upon by the proposed project. The aims of the Community Development Plan include:

- Providing appropriate development support to communities impacted upon by the project
- Building capacity in local communities to sustain development initiatives
- Linking community development to business benefits

- Providing additional support to the mitigation of negative impacts and the enhancement of positive impacts of the proposed project

1.19.3.3 Labour, Working Condition and Recruitment Policy

To address potential issues related to employment, Bilboes will develop a fair and transparent labour, working condition and recruitment policy. The policy will comply with local law, IFC Performance Standard 2: Labour and Working Conditions, and International Labour Organisation (ILO) conventions including the following:

- ILO convention 87 on Freedom of Association and protection of the right to organise
- ILO convention 98 on the right to organise and collective bargaining
- ILO convention 29 on forced labour
- ILO convention 105 on the abolition of forced labour
- ILO convention 138 on the minimum age of employment
- ILO convention 182 on child labour
- ILO convention 100 on equal remuneration
- ILO convention 111 on discrimination

The labour and recruitment policy will be advertised widely and appropriately, and an employment committee will be set up and maintained to ensure that the policy is implemented. Contractors will be required to abide by the labour and recruitment policy and will be audited on compliance. The policy will ensure that opportunities for meaningful employment and promotion for women and vulnerable groups are provided for and that a capacity-building programme to increase the local pool of skilled labour is developed and implemented.

1.19.3.4 Skills and Small Business Development

To optimise local small business development, a local procurement policy will be developed and implemented and communicated to all local stakeholders. Amongst other measures, a skills audit in terms of local business / technical–artisanal skills will be undertaken, and a register of existing small enterprises will be maintained to optimise skills and knowledge transfer to the community.

1.19.3.5 Stakeholder Engagement Plan and External Grievance Mechanism

The Stakeholder Engagement Plan developed for the project will be maintained and updated to provide a formal procedure for communications with the regulatory authorities and

communities. Furthermore, an External Grievance Mechanism will be developed and implemented to enable community members and other stakeholders to raise issues of concern. The External Grievance Mechanism serves to receive and facilitate resolution of affected communities' concerns and grievances. The Grievance Mechanism shall also include detailed procedures around recording, tracking, and closing out of grievances received. All sub-contractors would be responsible for adhering to and implementing the Bilboes external grievance mechanism. Bilboes will inform the affected communities about the mechanism during the stakeholder engagement process.

1.19.3.6 Social / Community Issues

Based on the EIA undertaken for the proposed project, social or community impacts that were identified and assessed include the following:

- Positive economic impact because of the direct construction and operational project expenditure, direct and indirect business opportunities, CSR contributions and macro-economic benefits and the recovery of Mineral Resources.

  Significance after mitigation = Very High Positive

- Potential reduction of access to land for livelihood activities (e.g., cattle ranching and subsistence agriculture) undertaken within the mine claims area. A key recommendation to ensure that these land users are appropriately identified, engaged, and compensated is the compilation of a Land Acquisition and Resettlement Framework (LARF). The LARF will provide the framework for developing a plan to address any economic displacement caused by the project and such, reducing the significance of this impact in the mitigated scenario.

  Significance after mitigation = Medium

- Inward migration due to the expectation of employment. This in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around health, safety, and security. The related mitigation measures focus on the implementation of appropriate and effective communication on the number of new employment and procurement opportunities and undertaking recruitment at designated locations outside of the mine footprint. In addition, Bilboes must aim to source most employees from the surrounding local communities, as far as possible.

  Significance after mitigation = High to Medium

- Various health and safety risks for third parties are associated with the proposed project. While the likelihood of incidents is deemed to be low (with mitigation) any injuries or fatalities of third parties would be of high intensity. Recommended mitigation measures aim to further reduce the intensity of such impacts, thereby lowering their significance.

Significance after mitigation = Medium

- No cultural-heritage Resources were found to be located within the proposed project footprint. However, any possible impacts on undiscovered cultural heritage would be most likely to occur, if at all, during the construction phase when most of the clearing and earthworks will occur. The implementation of a Chance Finds Procedure has been recommended should any cultural-heritage material be discovered during project-related activities.

Significance after mitigation = Very Low

Key issues that may have a risk of impacting Bilboes' operations (e.g., resulting in disruption for minor or short periods of time) relate to the loss of grazing land available to the local communities, disagreements regarding the number of employment opportunities being made available to the closest neighbouring communities, disputes on the nature or implementation of planned CSR programme initiatives, or conflicts arising from in-migration of jobseekers into the proposed project area.

1.19.3.7 Mine Closure

A conceptual closure plan and LoM closure liability estimate, based on the environmental, social, and economic risks identified in the EIA, is included in the EIA. Furthermore, the closure issues and concerns raised by stakeholders were also incorporated, where applicable.

Generally accepted "good international practise" mine closure methods were used as the basis for the conceptual closure plan, as well as, for determining the unit rates for the various closure components used in the LoM liability calculation. The mine closure methods also conform to the statutory requirements of Zimbabwe Environmental Management Agency (EMA) who are the regulatory body.

Mine closure planning is a dynamic process that is integrated with LoM planning to ensure a seamless transition from the operational to the decommissioning phases in the mine life cycle. The environmental objective for closure is to minimise the impacts associated with the decommissioning and closure of the mine and to achieve a post closure land use as outlined below.

The conceptual closure plan objectives include the following:

- Environmental damage is minimised to the extent that they are acceptable to all parties involved
- The land is rehabilitated to achieve a condition approximating its natural state (as far as practicable), or so that the envisaged post closure land use / land capability is achieved
- Some of the smaller open pits shall be completely backfilled with material from the overburden / WRDs. Inert building rubble from the decommissioning activities can also be buried in the pit voids. The remaining open pits would not be backfilled and remain open. The pit side-walls and end-walls will only be 'made safe
- All surface infrastructure, excluding the TSF and any other surface infrastructure that will support the envisaged post-closure end use, will be removed from site after rehabilitation
- Contamination beyond the mine site by wind, surface run-off or groundwater movement will be prevented through appropriate erosion resistant covers, containment facilities (i.e., stormwater ponds) and drainage controls
- Mine closure is achieved efficiently, cost effectively and in compliance with the law
- The social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised

Based on the above, the closure outcomes for the mine site are assumed to be as follows:

- To achieve chemical, physical, and biological stability for an indefinite, extended period over all disturbed landscapes and residual mining infrastructure
- To protect surrounding surface water, groundwater, soils, and other natural Resources from loss of utility value or environmental functioning
- To limit the rate of emissions to the atmosphere of particulate matter and salts to the extent that degradation of the surrounding properties' land value and land capability does not occur
- To create a final land use that has economic, environmental, and social benefits for future generations that outweigh the long-term aftercare costs associated with the facility

These broad closure objectives and outcomes will be continually refined as operations continue.

1.19.3.8 Estimated Environmental Costs for Closure

The quantities used in the closure liability calculations were derived from the layout plans and general arrangements for the project; the project infrastructure details within the FS report; and the proposed mining and deposition schedule. The closure liability calculation has been determined for the LoM and is calculated to be $ 28.34M. The closure liability calculations will be regularly reviewed and updated during the operational period of the project until the commencement of closure activities (i.e., final closure plan).

1.19.3.9 Schedule for obtaining the Operating License

The ESIA Report was completed for submission to EMA within the first quarter of 2020. Thereafter, SLR held public feedback meetings to disclose the findings of the ESIA Report to the identified stakeholders. A record of this disclosure process was compiled and submitted to EMA. An Environmental Impact Assessment (EIA) certificate was issued to Bilboes for the project in February 2021. The EIA certificate is valid for 2 years and will be renewed in February 2023 subject to conditions which include project update reports, compliance to Environmental Management Plans (EMP) outlined in the ESIA Report and notification to EMA for any changes in the project likely to alter the project as stipulated in the ESIA Report.

1.20 Process Plant

Extensive testwork was undertaken during the preliminary economic estimate (PEA) and feasibility study (FS) phase. The ore (fresh sulphide) is refractory to normal free milling processing due to the ultrafine gold particles being largely encapsulated (and generally appearing in solid solution) within the sulphide minerals. As a result, the selected process encompasses a biological sulphide destruction step (the Outotec proprietary BIOX® process) to liberate the gold particles and allow dissolution by a cyanide solution in the CIL circuit. The testwork results were used to derive the process design criteria (PDC) for the processing plant as depicted in Table 1-11.

Table 1-11: Process Plant Main Design Criteria

Description	Unit	Design	Remarks
Plant Annual RoM Throughput			
Phase 1 Isabella McCays	tpa	2,880,000	Years approx. 1-6
Phase 2 Bubi	tpa	2,160,000	Years approx. 6-10
Plant Monthly RoM Throughput			
Phase 1 Isabella McCays	tpm	240,000	
Phase 2 Bubi	tpm	180,000	
Head Grade Analysis			

Description	Unit	Design	Remarks
Au			
Isabella Mc Cays	g/t	2.51	Average
Bubi	g/t	1.80	
Sulphides			
Isabella McCays	%	1.0	Average
Bubi	%	2.6	
Ore Product Sizes			
Crushed Ore (P80) (80% passing size)	mm	13	
Milled Ore (P80) (80% passing size)	microns	75	
Flotation Mass Pull			
Isabella McCays	%	5	
Bubi	%	10	

Ore will be derived from the two main mining areas (Isabella McCays and Bubi) with production throughput to be phased over the LoM based on tonnage, proximity to the process plant and metallurgical characteristics. Bubi ore, destined to be processed over the latter part of the LoM will be trucked approximately 23 km to the processing plant which will be situated at the Isabella McCays complex. The envisaged phasing is as depicted in Figure 1-10.

Operations in the Process Plant can essentially be divided into five main sections.

- Comminution (ore size reduction by crushing and milling to facilitate liberation of the mineral particles for subsequent downstream concentration)
- Flotation (concentration of sulphides and gold into a small concentrate mass)
- BIOX® (destruction of the sulphides in the concentrate using oxidising bacteria to expose the gold particles for downstream recovery)
- CIL (cyanidation leach of the BIOX® residue and recovery of the solubilised gold onto activated carbon)
- Carbon treatment
- Electrowinning and Smelting

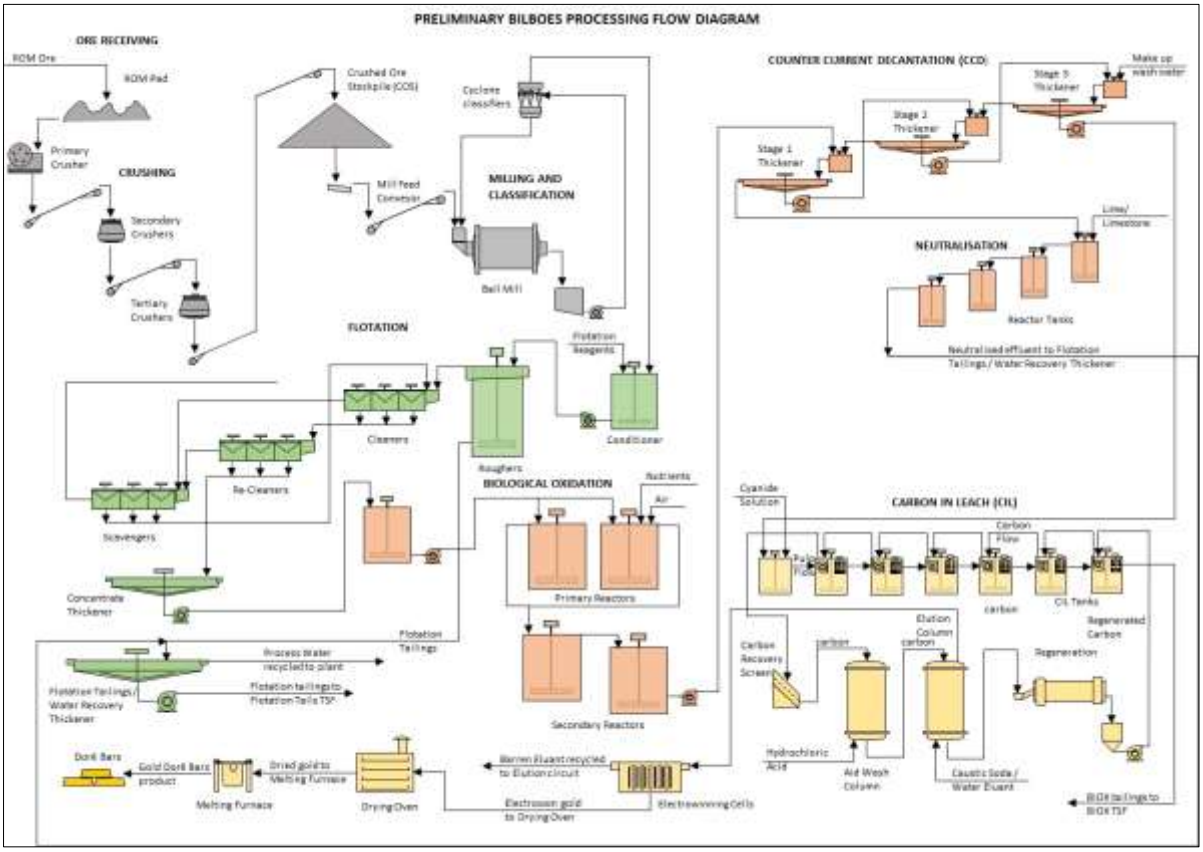


Figure 1-10: Bilboes Simplified Process Flow Diagram

1.21 Capital Costs

1.21.1 Basis of Capital Cost Estimate

1.21.1.1 Estimate Scope

This Basis of the Capital Cost Estimate (CCE) covers the process plant, associated infrastructure, and indirect costs for the 240 ktpm, phased Bilboes FS

The CCE for the process plant and associated infrastructure was prepared by DRA based on the PFD's, equipment lists, GA drawings and layout drawings. These drawings were developed per process plant area.

DRA developed and costed the two phases:

- Phase 1: 240 ktpm milled ore originating from the Isabella McCays mining area (years 1-6)
- Phase 2: 180 ktpm milled ore originating from the Bubi mining area (years 6-10)

The comminution circuit (crushing and milling) is installed for the maximum tonnage requirement in phase 1.

In the BEC all civils are completed in phase 1 with additional relevant flotation cells and BIOX® and CIL tankage installed in phase 2.

1.21.1.2 Estimate Accuracy

The capital cost estimate meets the required accuracy criteria of -10% +15% and generally complies with a Class 3 Feasibility Study as defined by the DRA Estimating Study Class Matrix.

Note that this is equivalent to a Class 2 Estimate as defined by the American Association of Cost Engineers, (AACE).

1.21.1.3 Estimate Base Date

The base date for the CCE is November 2021.

1.21.1.4 Estimate Base Currency

The estimate has been presented in US Dollar ($) currency in present day (November 2021) terms. Prices obtained in other currencies have been converted to $ using the applicable exchange rates stated in the data sheet.

1.21.1.5 General Estimating Methodology

This section covers the estimating methodology adopted by DRA for the process plant and the associated infrastructure.

This estimate is categorised as a FS with a combination of detailed, semi-detailed and limited factored costs. Designs and costings were carried out specific to this project and specific to the locality of this mine.

The general approach to estimating was to measure / quantify each unit cost element from the engineering layout drawings, PFD's, mechanical equipment list, motor lists, cable schedules, and instrument lists where possible, and then to factor the balance of items that were not possible to measure or quantify.

The CCE is based on a project execution strategy whereby major packages of construction work would be let to several specialised construction work contractors. Steelwork, platework and piping thus would, as an example, be supplied by the selected SMPP construction work contractor.

The estimate further assumes that the project would be executed on an EPCM basis.

1.21.1.6 Estimate Compilation

The Estimate was compiled by a Senior Estimator experienced in Process Plants, with the

assistance of the various DRA Discipline Engineers as required.

1.21.1.7 Estimate Reporting

The CCE is split into four main areas, namely:

- Mining
- Process Plant
- Infrastructure, Utilities and Ancillaries
- Indirect Costs

The CCE for the Process Plant and associated infrastructure has been presented as a fully detailed estimate, together with a summary sheet. The estimate considers the Work Breakdown Structure (WBS). The areas and equipment identification coding as utilised in the estimate are thus in accordance with the MEL and PFD's and cover the various WBS areas associated with each area.

1.21.1.8 Estimate Format

The estimate has been prepared in Microsoft Excel format and consists of a summary tab and multiple cost category input tabs.

1.21.1.9 Estimate Data Sheet

The Estimate Data Sheet is the core of the SMP cost estimate and contains the rates necessary to compile the Structural Steel and Platework Estimates. The Data sheet is linked to the Structural Steel and Platework Estimate sheets by means of Indexed Data codes and contains rates for Supply, Corrosion Protection, Shop Detailing, Transport and Erection of commodities required to complete the project. The Datasheet also contains the currency Rates of Exchange for the Project.

1.21.1.10 Estimate Quality Control

Arithmetic formula checks were performed to ensure the accuracy of the costs for the project cost elements while compiling the CCE.

1.21.1.11 Estimate Review

Prior to final submission to the client, the estimate was reviewed by the Project Team comprising of the various DRA Discipline Engineers.

Following the internal reviews by the DRA teams, the CCE would then be reviewed in a joint meeting with the Client representatives. Comments from this review would form the basis of the final CCE.

1.21.1.12 Bulk Earthworks and Infrastructure

The budget was based on the known scope of works and a best estimate was done on quantities based on experience from previous DRA projects. Basic engineering was completed for major cost contributors. Major earthworks cost contributors were modelled to obtain required quantities. The BoQs were then adjudicated, and a contractor was recommended. The recommended contractor's rates were incorporated into the final measured BoQ.

P&Gs have been taken as 16% of the total supply and installation cost, in line with the P&G value quoted from the chosen Earthworks, Mining and Civils contractor.

The following parameters were used for the different areas:

- Terraces

  Terrace size and volumes were ascertained by DRA. All terraces were modelled to the relevant terrain contours to determine bulk earthworks volumes.

  The following terraces were included:

  - Plant Terrace
  - Mine infrastructure Terrace
  - Parking and laydown areas
  - RoM Stockpile Terrace

- Roads

  The following roads were included:

  - Plant Access Road
  - Haul road between Isabella and Bubi

  DRA provided road lengths measured from layout drawings.

1.21.1.13 Civil Works

The civil works were quantified by DRA from the GA and layout drawings by DRA.

A preliminary BoQs was produced for all civil structures relevant to this Project.

Concrete quantities were ascertained using layout drawings based on the assumption that major structures will be constructed either on raft foundations or on large spread foundations, and smaller structures will be constructed on individual bases.

Each Civil structure was measured separately, and the Civil BoQ's was priced by elected tenderers to ascertain a detailed priced BoQ's for civil works. A contractor was selected, and their rates was applied to the quantities per area.

P&G's have been taken as 16% of the total supply and installation cost, in line with the P&G value quoted from the chosen Civil Works contractor.

1.21.1.14 Infrastructure Services

1.21.1.14.1 *Stormwater*

Allowances for stormwater management was made on the Isabella / Bubi haul road only. DRA and QS's generated preliminary BOQ's from layout drawings.

1.21.1.14.2 *Sewage, Potable and RAW water reticulation, and Fire Water*

The length of all pipe reticulation including bends, valves, fittings, etc. has all been measured from layout drawings and provided by DRA. The length for the Water supply line from the existing water storage facility at the Mine site was provided by DRA.

Lengths for potable water reticulation and Fire Water Ring Mains within the Plant and Mine Areas were provided.

DRA provided sewer Reticulation for the Plant and Mine areas up to the Sewer Treatment plant, and a detailed price was obtained

1.21.1.14.3 *Pollution Control Dams*

The HDPE lined Pollution control dam was measured from layout drawings.

1.21.1.14.4 *Fencing*

Fencing quantities was drawn down from layout drawings for the Plant, Mining and Residential Areas.

P&G's have been taken as 16% of the total supply and installation cost, in line with the P&G value quoted from the chosen Civil Works contractor.

1.21.1.14.5 *Building Works*

Architectural layouts for selected building and structures were developed. Building works have been costed on detailed measured BoQ's.

This was completed for all Brick buildings, Prefabricated Panel Wall building structures and sheeted steel portal frame structures.

Tenderers priced detailed bills for all the buildings required on site.

Building P&G's have been taken as 31% of the total supply and installation cost, in accordance with the P&G value quoted from the chosen Building works contractor.

1.21.1.15 Structural Steelwork Supply and Erection

Steelwork quantities for all structures were estimated from GA and layout drawings produced by DRA.

A BOQ was produced by DRA to cover all steelwork and ancillary bought outs including sheeting, grating, stair treads and handrailing, amongst others. This was issued on enquiry to two prominent SMP fabricators / erectors, SA based and Zimbabwean base. Due to the nature and geographical situation of the Bilboes project, it was deemed necessary to obtain current rates and P&G's specific to the area and the project. Rates and P&Gs were received from both contractors. A commercial adjudication was carried out, and the rates and P&Gs were benchmarked against current rates from previous DRA projects. The result was that the rates from SA based were market related and competitive. The estimate was then populated with the final steelwork quantities from DRA and the rates received from SA companies.

These rates are priced per tonne of steel, with separate rates being provided for shop fabrications, shop detailing, corrosion protection, delivery to site and erection on site.

Rates for steel fabrication, delivery and erection are categorised as either light, medium or heavy steelwork.

Structural steel P&G's have been applied at 41% of the total supply and installation cost, in line with the figure quoted by SA contractor.

Note: The SMP value includes for shop detailing, corrosion protection, supply, fabrication, transportation to site, off-loading and erection including all their associated costs with regards to induction, medicals, accommodation and meals, PPE, PPC and travelling to complete the works in full.

1.21.1.16 Platework and Lining

Platework and lining items were quantified by DRA from the equipment list, PFD's, general arrangement, and layout drawings.

A BoQs was produced by DRA to cover all platework and lining requirements. This was issued together with the SMP Enquiry as described in more detail above.

Rates for supply and erect of the platework and the required linings were obtained from the SMP Contractor quotation. The estimate was then populated with the final platework and the linings quantities from DRA and the rates received from SA contractor.

Note: The SMP value includes for platework shop detailing, corrosion protection, supply, fabrication, transportation to site, off-loading and erection including all their associated costs with regards to induction, medicals, accommodation and meals, PPE, PPC and travelling, to complete the works in full.

Platework and lining P&G's have been applied at 41% of the total supply and installation cost, in line with the figure received from SA contractor.

1.21.1.17 Corrosion and Protection

In accordance with the EDC, all fabricated steelwork and platework will be painted in accordance with: Surface Preparation; All surfaces are to be dry abrasive blast cleaned in accordance with SA21/2 of the international standard ISO 8501-1:1988 to obtain a surface profile of 40 to 80 microns, with a Primer Coat; One coat of Carboline 193, DFT of 140 microns, and final coat; One coat of Carboline 134, DFT of 40 microns, colour; to match existing mine requirements.

The rates for surface preparation, galvanising, priming, and painting were quoted by the fabrication contractor, and these have been included in the estimate as part of the ex-works fabrication and supply rate.

An allowance has been provided for the touch-up of steelwork and platework on site after installation.

The cost of galvanizing or painting for piping is included in the piping price.

The Corrosion Protection P&G costs have been included in the steelwork and platework P&G's.

1.21.1.18 Mechanical Equipment

From the MEL and PFD's, DRA issued enquires for all mechanical equipment to vendors for costing, requesting fixed and firm quotations valid for 30 days. All Mechanical Equipment quotations were sourced from selected and preferred vendors.

The erection cost for the mechanical equipment was based on rates received from the steelwork and platework fabrication / erection contractor.

For minor and/or ancillary mechanical equipment items, supply costs were obtained from previous quotations and/or the DRA historical data base.

The mechanical P&Gs were applied at 41% of the erection component only, in line with the P&G value quoted by the chosen SMP contractor.

1.21.1.19 Conveyors

Design of all belt conveyors was carried out by the DRA in accordance with the belt profiles as depicted on the GA drawings and the developed process and EDC. Mechanical equipment components and steelwork requirements were quantified from design outputs. Enquiries were issued to selected vendors for all mechanical equipment costing i.e., for belting, drives, idlers, pulleys, and minor ancillaries. The erection cost for the mechanical equipment and steelwork was based on rates received from the SMP contractor.

Rates for conveyor steelwork and platework were as per the SMP rates received from the chosen SMP contractor as described in the steelwork and platework sections above.

Conveyor P&Gs are as per the percentages described above for mechanical equipment erection only, steelwork supply and erect, and platework supply and erect, in line with the P&G value quoted by the chosen SMP contractor.

1.21.1.20 Piping and Valves

The cost for the process in-plant piping and valves was derived as a factor of the mechanical equipment supply cost. The factors used were derived from the DRA historical data base and are area specific.

Piping P&Gs are inclusive of the factor applied to the mechanical equipment supply cost.

1.21.1.21 Electrical, Control and Instrumentation

This EC&I budget pricing was derived from third party pricing (i.e., tenders / RFQ) and database pricing.

- Technical basis

- The following technical documents and drawings formed the basis of the estimate:
- PCD's
- PID's
- Site Block Plan
- MEL
- Client's input

1.21.1.21.1 *Design / Drawings*

The following documents and drawings were developed as part of EC & I deliverables to inform and define the scope from which estimates were derived.

- Electrical Load List
- MV SLD
- Electrical substation and associated transformers have been placed on the plant block diagram and used to estimate cable lengths and routing.
- Instrument Index /I/O list
- Electrical and Instrumentation Design Criteria.

1.21.1.21.2 *Medium Voltage Reticulation*

SLD were produced to indicate the 11 kV MV reticulation from the new 132/11 kV consumer substation to the main plant. The SLD indicates all major electrical equipment required for the project. This includes reticulation within the process plant area, mine, and plant office infrastructure. Budget prices were taken from recent and currently running projects within the company therefore the prices are based on recent market related pricing.

1.21.1.21.3 *Motor Control Centre*

MCC prices were taken from recent and current running projects A budgetary quotation was received from a reputable equipment supplier. MCC's were sized in accordance with the motor list. Budget pricing was therefore based on recent market related pricing.

1.21.1.21.4 *Power Factor Correction*

Database pricing for Power Factor Correction was utilised. Pricing for PFC yard preparation works is included in the civil works.

1.21.1.21.5 *Transformers and Mini substations*

Database pricing for transformers and mini substations was utilised. Pricing for transformers and mini substations exclude the civil works.

1.21.1.21.6 *Earthing and Lighting Protection*

A typical design was done to estimate quantities. Database rates from recent implementation projects have been used for this equipment to provide market related prices.

1.21.1.21.7 *Lighting and Small Power*

Quantities for plant lighting and small power distribution was calculated based on plant footprint, lux level requirements and comparable projects. Included in estimate is a provision for high mast lighting, for areas such as offices and workshops. Database rates were utilised for high mast structures.

1.21.1.21.8 *Cabling and Racking*

Quantities for cabling and racking were estimated based on the plant block plan, motor list, and the key SLD. Preliminary cable sizes were estimated based on the MEL and estimated average cable length.

1.21.1.21.9 *PLC Equipment*

PLC and remote I/O equipment costing is based on the PID plant IO and control requirements, from which quantities are derived. Database rates from recent implementation projects have been used to provide a cost.

1.21.1.21.10 *Instrumentation*

An instrument list was generated from process design information. and database rates from recent DRA projects were used to provide costs.

1.21.1.21.11 *Electrical, Control and Instrumentation Installation Works*

The BoQ for the EC&I installation was sent to a reputable local installation contractor for pricing.

1.21.1.21.12 *Mechanical Vendor Packages*

Electrical and instrumentation equipment supplied as part of a complete mechanical equipment package were adjudicated to ensure compliance to the EC&I criteria. Pricing for such equipment forms part of the Mechanical CBE.

The EC&I P&Gs were taken as 30% of the total EC&I supply and installation cost; in line with the industry norm for a project of the magnitude and location of the Bilboes mine.

1.21.1.21.13 *Electrical, Control and Instrumentation Inclusions*

The following costs have specifically been included in the cost estimate:

- All MV reticulation, LV reticulation, control, communication networks, instrumentation, lighting, and small power, and earthing and lightning protection for:
  - Process plant
  - Surface infrastructure up to the designated battery limit
  - Diesel emergency power generators, in accordance with the load schedule
  - Critical spares for long lead-time items
  - The 132-kV overhead line. The cost for the bulk power supply was received from the client and incorporated into the budget.

1.21.1.21.14 *Electrical, Control and Instrumentation Exclusions*

The following costs have specifically been excluded from the cost estimate:

- Fire suppression system / detection has been provided for
- CCTV cameras.

1.21.1.22 Preliminary and General Costs

P&G costs include all main Contractors' overheads such as contractual requirements (e.g., safety, sureties, insurance, security during construction i.e., security contractor costs for construction period including their access control and turnstiles as required), the site establishment and the removal thereof including their own company and head office overheads.

The P&G costs also include for site management, site supervision, travel to and from the site, contractor supplied temporary facilities, offices and lay-down areas, cranes, tools, and contractors' equipment including PPE / PPC requirements.

P&G costs have been allowed for as a percentage of the value of the works to be executed and are shown separately in the P&G column against each WBS / sub area in the estimate summary sheet.

Table 1-12: Preliminary and General Percentages

P&Gs	%
Earthwork P&Gs	16%
Civil P&Gs	15%
Infrastructure Buildings P&Gs	31%
SMP P&Gs	41%
Piping P&Gs (incl. installation factor)	0%
EC&I P&Gs (On supply and install)	30%

1.21.1.23 Transportation

Transportation costs for steelwork and platework were quoted in the SMP rates. Other transport costs were based on a tonnage or “per load” basis. Rates from logistic service providers from recent projects in the area were used in the CCE. These rates include for all costs involved in the transportation of goods to site, including the logistics and documentation, as well as the actual transportation of the goods.

1.21.1.24 EPCM and External Services

The EPCM costs cover the project management, detailed engineering, procurement, and construction management costs directly associated with the implementation of the project.

Project Management and EPCM costs relating to the Process Plant and Associated Infrastructure have been based on EPCM manhours calculated by DRA. The rates used are DRA rates and are valid to the end of 2019, after which they are subject to escalation.

The manhours were calculated using the project implementation programme and a proposed project team organogram. The manhour costs are shown in the EPCM manhour schedule, which also includes reimbursable and sundry costs as well as a contractor’s fee.

The External Services costs allow for the utilisation of external consultants, as required.

1.21.1.25 Spares, First Fill and Consumables

Allowances have been made for the first fill of lubrication and grinding media, based on DRA’s calculations.

Spare parts costs have been included in the estimate to cover commissioning, and strategic spares for both mechanical and electrical equipment.

The spares holding costs have been derived from the recommendations of the vendors in their quotations. The spare parts costs have been grouped per item of equipment in a separate tab

within the estimate. Where no spares were quoted by the vendor, and it has been deemed by DRA that there should be a spare holding, a percentage of the supply price has been applied:

- Mechanical Equipment Commissioning Spares : 2.5%
- Mechanical Equipment Strategic Spares : 5%
- EC&I spares : 5%

1.21.1.26 Pre-Production Costs

Allowances have been made for the following as required.

1.21.1.27 Owners Costs

An allowance has been made in the CCE for the Owners Costs.

1.21.2 Mine Capital Costs

Mining costs are based on December 2021 contractor price estimates.

For this document, the capital cost associated with the mining operations was calculated as the cost of the first seven months of pre-development mining. The capital cost is made up of mining contractor site establishment, mining phase 1 capital and the first nine months of pre-development capital and the explosives contractors site establishment cost. The mining capital cost is summarised in Table 1-13.

Table 1-13: Mining Capital Costs

Cost Area	Units	Total
Mining Contractor Site Establishment	US$	2,714,473
Explosives Site Establishment	US$	9,975
Mining Pre-development Capital		
Contractor Fixed Costs	US$	4,004,656
Bush Clearing Cost	US$	44,787
Mining Cost Topsoil	US$	329,766
Mining Cost Softs	US$	13,804,740
Drilling Cost Hard Waste	US$	5,365,678
Blasting Cost Hard Waste	US$	2,315,461
Hard Waste Cost	US$	29,147,067
Drilling Ore Cost	US$	468,530
Ore Blasting Cost	US$	151,351
Bubi Hauling Cost	US$	3,632,925
Ore Load and Haul Cost	US$	-

Cost Area	Units	Total
Ore Re-handle	US$	203,885
Services Cost per Ore tonne	US$	381,359
Mining Cost Capital Cost	US$	62,574,654
	Opex Portion	29,850,206
Bilboes Mining Contractor Capital Cost	**Capex Portion**	**32,724,448**

1.21.3 Process Plant and Infrastructure Capital Costs

Table 1-14: Cost Category Components

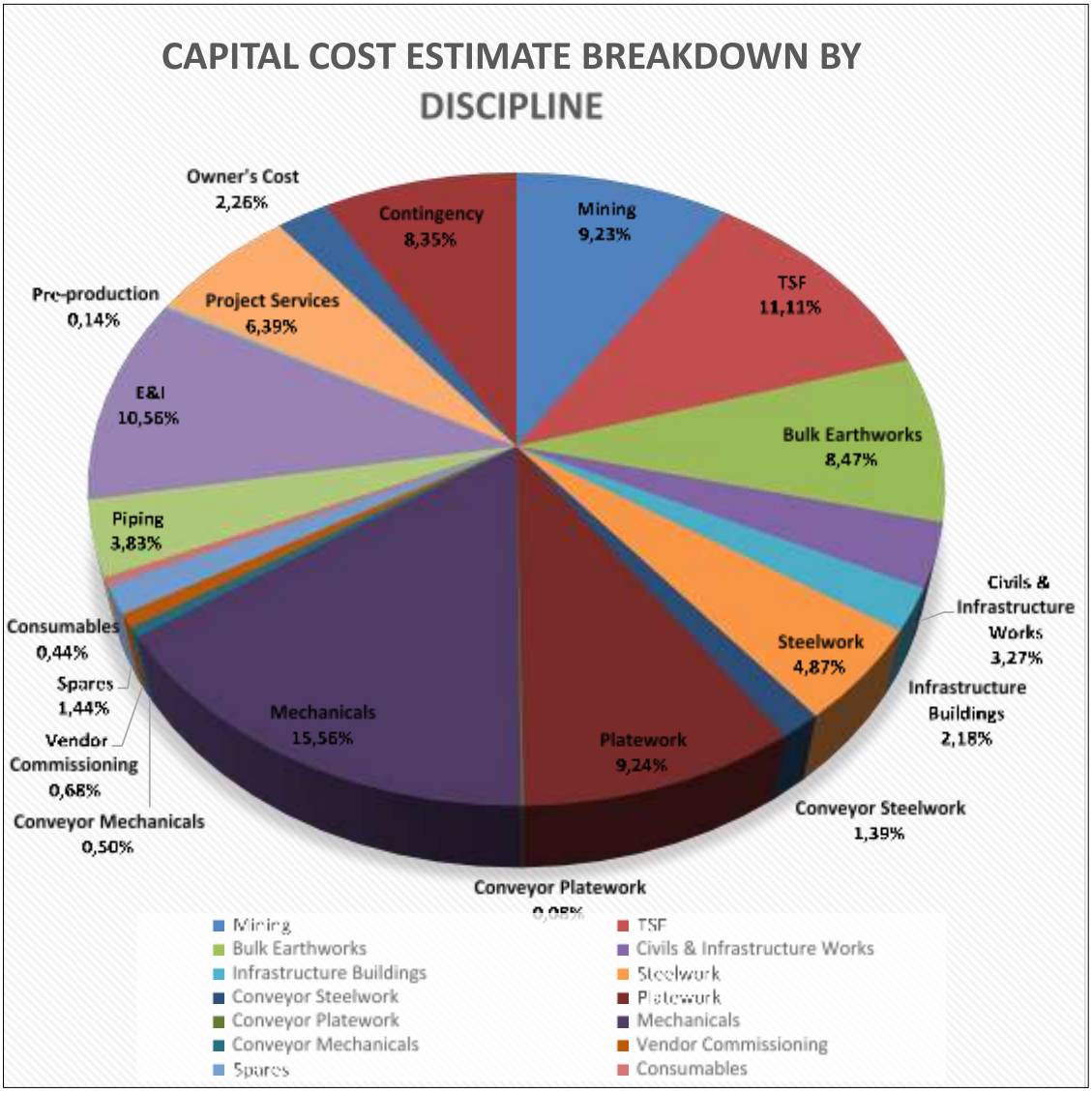
Description	Total USD$
Ore Receiving and Crushing	24,518,732
Milling, Classification & Thickening	15,804,663
Flotation	16,250,891
BIOX®	59,741,050
Carbon in Leach (CIL)	3,667,566
Carbon Treatment	2,649,105
Gold Room	1,184,076
Tailings Handling and Cyanide Detoxification	1,258,855
Reagents	7,133,061
Process Plant Water Services and Reticulation	4,189,324
Process Plant Utility Services	13,295,213
E, C & I Plant	10,385,555
Plant Services	4,551,323
Fire Protection and Detection	254,947
Potable Water and Treatment	883,061
Sewage Treatment	182,431
Storm Water Management	273,779
Fencing	647,854
Pipe and Cable Racks	927,539
Plant Buildings and Workshops	1,616,602
Plant Management Offices Facility	344,407
Security, Changehouse, Crib Room Facility	358,825
Security	107,063
Control Room	187,693
Metallurgical Lab Facility	432,511
Mechanical Workshop	809,892

Description	Total USD$
Plant Electrical Structures	25,881
Overhead Line	14,458,715
MV Substation	281,132
MCCs (Motor Control Centres)	691,348
General Earthworks	3,673,895
Roads and Terraces	17,831,972
Buildings	3,991,944
Flotation TSF	29,140,623
BIOX TSF	10,258,205
Crossings	20,558
Temporary Facilities	410,152
Project Fleet	74,369
EPCM Contractor	21,217,771
First Fill and Commissioning	4,255,194
Spares	5,115,593
Forex	1,190,091
General Administration Costs	8,013,959
Contingency	29,383,006
Total Process and Infrastructure Costs	**321,690,423**

1.21.4 Capital Estimate Summaries

Table 1-15: Capital Summaries per Project Phase

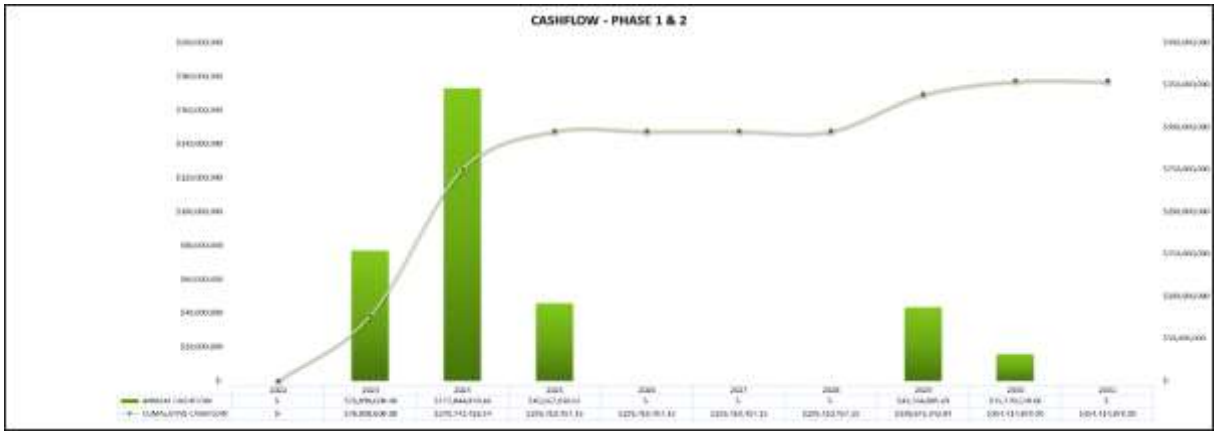
Description	Grand Total $	Sub Total Phase 1 $	Sub Total Phase 2 $
Mining	32,724,448	32,724,448	-
Process	160,078,091	134,213,663	25,864,428
Infrastructure, Utilities and Ancillaries	91,952,197	66,073,752	25,878,446
Indirect Cost	40,277,128	38,046,389	2,230,740
Contingency	29,383,006	24,352,206	5,030,801
Total Project Costs	**354,414,871**	**295,410,457**	**59,004,414**



Graph 1-7: Cost Breakdown by Disciplines

1.21.5 Cash Flow

Shown below is the preliminary cash flow forecast that has been provided for the overall project. These cash flow tables and graphs form part of the detailed estimate and can be found in the cash flow tab within the overall estimate document.



Graph 1-8: Preliminary Cash Flow forecast

1.21.6 Stay in Business Operating Cost Estimate

Stay-in Business Operating Costs are included in the Mining Contractors Costs.

1.21.7 Exclusions and Assumptions

1.21.7.1 Exclusions

The scope of the estimate is restricted to the battery limits as shown on the Block Plan, PFD's, MEL and more specifically as described in the Scope of Study.

The following are items which are not included in the CCE:

- Escalation
- Forex variation allowances
- Forward cover for any foreign content
- Environmental permitting activities
- Hydrological / water supply related costs
- Costs for power supply
- Costs of Socio-Economic development
- Costs for Skills development
- Costs for Enterprise and Supplier development
- Costs for financial modelling and evaluation
- Cost of financing
- Sunk costs

- Legal costs
- All VAT, import duties, surcharges and any other statutory taxation, levies, or government duties
- Acquisition costs including mineral rights and the purchase or use of land
- All royalties, commissions, lease payments, rentals and other payments to landowners, title holders, mineral rights holders, surface right holders, and/or any other third parties
- Any provision for project risks outside of those related to design and estimating confidence levels

1.21.7.2 Assumptions

The following assumptions have been made in the preparation of this estimate:

- The project would proceed on an EPCM basis
- The project would generally be implemented as per the execution programme
- All material and equipment will be purchased from recognised South African vendors

1.21.8 Risks and Opportunities to Capital Estimate

1.21.8.1 Foreign Exchange

A schedule of all the foreign content, together with the relevant exchange rates, has been included as a separate tab within the estimate. The schedule below details the currency used for the base date of the estimate (quoted rates aligned with base date).

Table 1-16: Foreign Exchange

	Value	
USD	$	1.00
ZAR	$	0.06
AUD	$	0.72
EUR	$	1.13
CNY	$	0.16
GBP	$	1.32
CAD	$	0.79
JPY	$	0.01

Fluctuations in the exchange rates from the base date have currently not been allowed for in the estimate.

1.21.8.2 Escalation

Escalation has not been considered past the quoted base date and is therefore excluded from the CCE.

The capital cost estimate escalation risk will be able to be more clearly determined once the project start date is confirmed, and thus costs should be re-evaluated upon project commencement.

1.21.8.3 Contingencies Calculation

The risks applicable to estimate inputs were assessed by the study team and estimating confidence levels have been assigned to the major estimate cost categories. On this basis a contingency of 9.0% was applied and this is considered sufficient for FS requirements.

1.21.8.4 Project Risk / Management Contingency

The following project risk contingencies were not allowed for:

- Strike action
- Adverse weather conditions
- Changes to legislation
- Community disruptions
- Unplanned movement of shutdown dates
- The project / management risk contingency is specifically excluded from this estimate
- Risks associated with COVID-19

1.22 Cash Flow

A preliminary cash flow forecast has been provided for the overall project and can be found in the cash flow tab within the overall estimate.

DRA makes use of a Beta Distribution to model cashflows in instances where the project schedule is not cost loaded. Operating Costs.

1.23 Operating Costs

1.23.1 Mining Operating Costs

1.23.1.1 Basis of Cost Estimate

The operating cost estimate has been completed from a zero base and presented in USD. Costs associated with labour, materials and consumables have been included in this estimate.

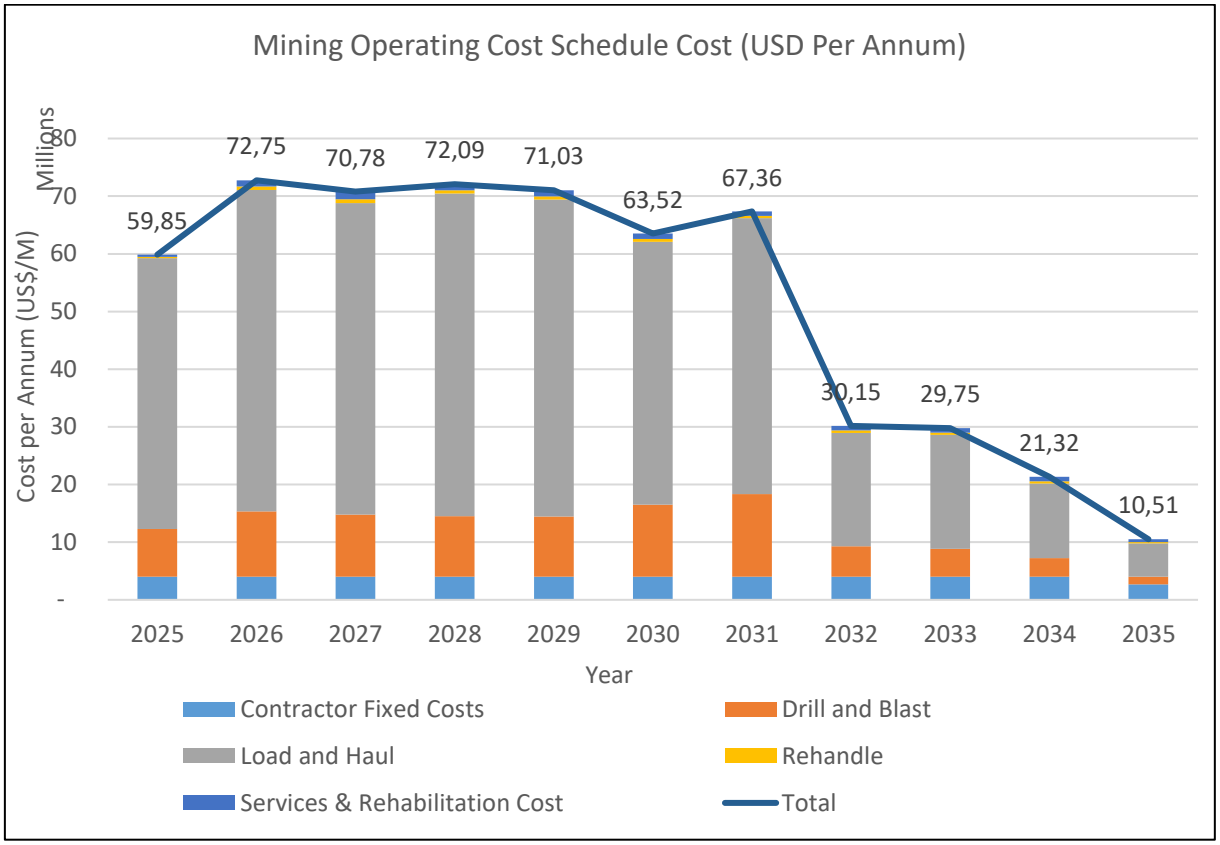
1.23.1.2 Mining Contractor Costing

Open market rates were obtained from several mining contractors, and this formed the basis for the Bilboes Project production schedule / BoQ.

The average mining cost based on pricing received is $ 2.55 / t including the ore transport cost from all mining areas process plant. The cost breakdown is shown in Table 1-17.

Table 1-17: Mining Contractor Costs per Area ($/total tonne)

Area	Cost per Total Tonne Mined (Ore and Waste) (USD)
G & A	0.19
Drill and Blast	0.42
Load and Haul	1.88
Re-handle Ore	0.02
Services Cost	0.04
Total	2.55
Diesel Cost	$1.16 per litre supplied by the Client



Graph 1-9: Mining Cost Breakdown per Annum

1.23.2 Process Plant Operating Cost

1.23.2.1 Basis of Cost Estimate

The operating cost estimate has been completed from a zero base and presented in USD ($). Costs associated with labour, materials and consumables have been included in this estimate with an accuracy range of ±10%.

1.23.2.2 Process Plant Operating Cost Summary

Operating costs have been estimated and based on the production profile over LoM. For illustrative purposes, static costs are presented below for phase 1 and phase 2 in Table 1-18 and Table 1-19 respectively. Main drivers in costs include reagents and power which collectively account for more than 80% of total plant operating costs.

Table 1-18: Phase 1 Plant OPEX (240 ktpm, excl G&A)

Description	Unit	Value	% of Total
Variable	**$/a**	**36,428,267**	**78**
Reagents and Consumables	$/a	19,838,196	42
Power	$/a	9,504,610	20

Description	Unit	Value	% of Total
Maintenance	$/a	7,085,462	15
Fixed	**$/a**	**10,325,329**	**22**
Power	$/a	9,101,573	19
Labour	$/a	911,636	2
Tailing's deposition	$/a	62,424	0
G&A	$/a	0	0
Laboratory	$/a	249,696	1
Overview			
RoM	t/a	2,880,000	
Total variable	$/a	36,428,267	78
Total fixed	$/a	10,325,329	22
Total	$/a	46,753,596	100
Unit cost	$/t ore	16.2	

Table 1-19: Phase 2 Plant OPEX (180 ktpm)

Description	Unit	Value	% of Total
Variable	**$/a**	**40,736,320**	**72**
Reagents and Consumables	$/a	25,472,004	45
Power	$/a	9,950,220	18
Maintenance	$/a	5,314,096	9
Fixed	**$/a**	**15,458,524**	**28**
Power	$/a	14,250,374	25
Labour	$/a	911,636	2
Tailing's deposition	$/a	46,818	0
G&A	$/a	0	0
Laboratory	$/a	249,696	0
Overview	t/a		
RoM	$/a	2,160,000	
Total variable	$/a	40,736,320	72
Total fixed	$/a	15,458,524	28
Total	$/t ore	56,194,844	100
Unit cost	$/a	26.0	

1.23.3 General and Administration Cost

The G&A cost includes administrative personnel, general office supplies, safety and training, travel (both on site and off site), independent contractors, insurance, permits, fuel levies, security, camp power, camp costs, ICT, relocation, and recruitment.

Total G&A costs amount to $6,969,468 per annum in Phases 1 and 2.

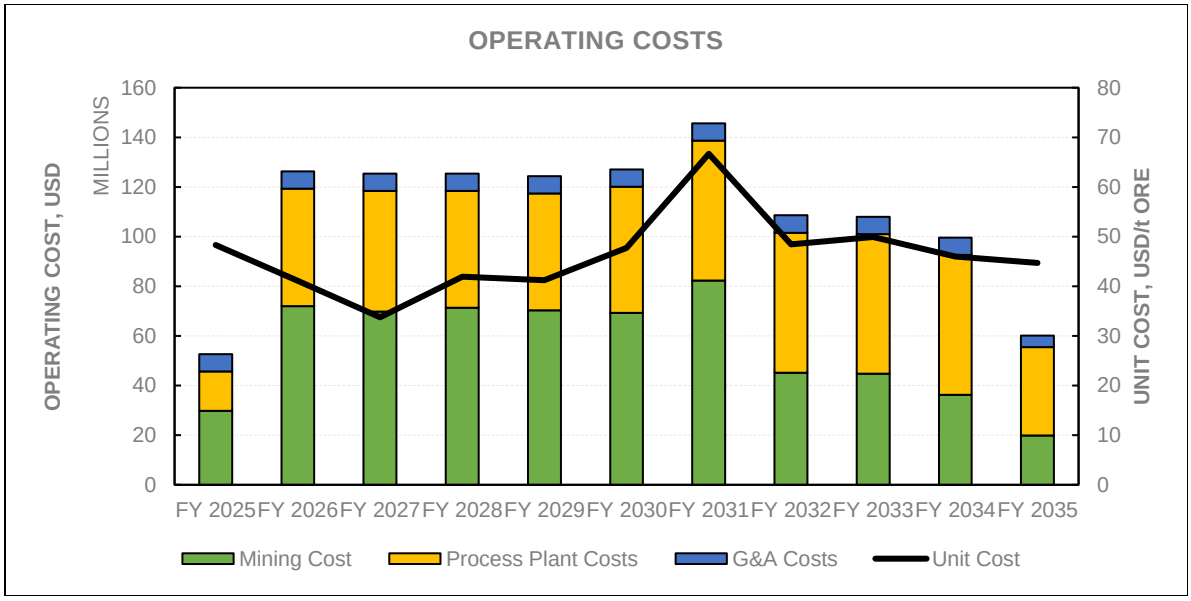
1.23.4 Bilboes Gold Project Total Operating Costs Summary

The Bilboes Projects total operating costs have been estimated and based on the production profile over LoM. A summary of LoM operating costs is shown in Table 1-20 below.

Table 1-20: LoM Operating Cost Summary

Description	Unit	Value	% of Total	Reference
LoM Operating Cost Breakdown				
Total cost	$	1,202,922,518	-	OPEX model
Unit cost				
Mining	$/t ore	22.9	51	OPEX model
Process Plant	$/t ore	19.4	43	OPEX model
G & A	$/t ore	2.8	6	OPEX model
Total	$/t ore	45.2	100	OPEX model

Annual mining, process, and G&A are presented below over the LoM in Graph 1-10.



Graph 1-10: Bilboes Total Operating Costs per Annum

1.24 Economic Outcomes

The financial model has been prepared on a 100% equity project basis and does not consider alternative financing scenarios. A discount rate of 10% has been applied in the analysis. The outcomes are presented in Table 1-21 below on a pre-tax and post-tax basis. A static metal price of $ 1,650 /oz has been applied. All-in sustaining costs have been reported as per the

World Gold Council (WGC) guideline dated November 2018 and is exclusive of project capital, depreciation, and amortisation costs. Key financial outcomes are shown in Table 1-21 below.

Table 1-21: Project Economics Summary

Description	Unit	Pre-Tax	Post-Tax
Project Economics			
NPV @ 10%	USD	439,947,750	323,359,945
IRR	%	38.4	33.4
Peak Cash Funding	USD	249,743,427	249,743,427
AISC*	USD/ozt	826	826
Payback (UNDISCOUNTED)	yrs	1.5	1.5

**As per updated guidance note published by WGC, 2018. Excludes project capital, depreciation, and amortisation costs*.

1.25 Project Development

The key milestones and dates for project development are as follows:

- Full project funding target of October 2022
- Project engineering and design phase from October 2022
- Construction from February 2023
- Plant commissioning from January 2025
- First Plant production from July 2025
- Production ramp up from July 2025 to January 2026

1.26 Recommendations

The following recommendations are meant to provide enhancements, cover the gaps, and mitigate risks identified during the FS study: Geology and Resources

- A regional geological model combining all four resource areas to take a mineral systems approach should be developed. This will enable better interpretation of existing ore bodies and targeting of new deposits in the rest of the Bilboes Claims and EPOs.
- During the operational phase, drilling is required to develop an advanced grade control model prior to mining. A drill spacing study will be required to determine the optimum spacing for “grade control” drilling. The closed space drilling will also enable a more accurate estimation of tonnage and grade as well as a greater definition of oxide, transitional and sulphide ore boundaries.

- The Mineral Resources remain open on strike and at depth. Further exploration is recommended during the operational phase to extend LoM, post 2032.

1.26.1 Mining

- Conduct Whittle optimisation studies at higher gold prices than the base case used in the FS to investigate potential for additional Mineral Reserves.
- On-going geotechnical analysis is recommended during future mining operations to assess pit slope angles to investigate if improvements can be made for less waste stripping, reduced operating costs, and improve overall business economics.

1.26.2 Processing

- If required, further optimisation efforts could be considered during the project execution front-end engineering and design phase, by conducting further testwork focused on flotation optimisation (including variability tests) to establish a grade-recovery relationship and validate recovery upsides.
- Development of the skills base to effectively run the BIOX® operations is crucial for the business and should be prioritised prior and during the operational phase.
- A sufficiently sized water storage dam should be constructed to collect and store water during the wet season and times when the operation is water positive to cater for the dry season.

1.26.3 Economic Analysis

- Updating of the financial model for the next project phase considering the changing parameters such as gold price and gold recoveries after additional test works.

1.26.4 Project

- Environmental and social issues are regarded as integral parts of the business, and it is recommended that the company takes a proactive approach in mitigating the impacts by adhering to regulatory compliance requirements and continually engaging the community and key stakeholders from the onset of operations as recommended in the ESIA study.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 2
INTRODUCTION

Document Number: JZWEBR6013-STU-REP-001

DRA

2 INTRODUCTION

2.1 The Issuer

Bilboes Holdings (Private) Limited (“Bilboes” or the (“Company”) is a private gold-focussed mining and exploration company registered and incorporated in Zimbabwe. The Bilboes Properties are wholly owned by Bilboes Holdings (Pvt) Ltd, which is 100% owned by Bilboes Gold Limited (Bilboes Gold). Bilboes comprises three shareholders i.e., Gat Investments (Private) Limited (“Gat Investments”); Baker Steel Resources Limited (“Baker Steel”) and Infinite Treasure Limited (“Infinite Treasure”). Gat Investments owns 52% of the shareholding and is based in Harare, Zimbabwe. Baker Steel and Infinite Treasure own 23% and 25%, respectively. Baker Steel is a foreign listed capital investment company based in London, United Kingdom, while Infinite Treasure is a foreign investment company based in Hong Kong.

2.2 Technical Team

This Technical Report has been prepared by a team of contributors from the following organisations:

- Caracle Creek International Consulting (“CCIC”) : Mr Desmond Subramani and Mr Obed Nkuna
- Manhize Mineral Consultants (“MMC”) : Joel Mungoshi - Flotation
- Outotec BIOMIN RSA (“Outotec”) : Waldemar (Wallies) Olivier - BIOX®
- DRA South Africa (Pty) Ltd (“DRA”) : Dave Thompson Mining

2.3 Terms of Reference and Purpose

Bilboes has mandated DRA Africa Holdings (Pty) Ltd (“DRA”) to complete this Technical Report on the Feasibility Study (“FS”), following National Instrument 43 101 (“NI 43 101”) rules and guidelines, regarding the extraction of sulphide ore from four of their existing open pits.

This work covered the following key activities:

- Conduct geological work on the properties to upgrade mineral resources into the Measured or Indicated Mineral Resources category
- Conduct on site pilot plant testwork
- Complete a full FS

2.4 Sources of Information

All input drilling data used for the generation of the geological and resource models were supplied by Bilboes who also supplied all historical information including geological data, reports, and maps. The Whittle shells used to define Mineral Resources and Mineral Reserves were produced by DRA, using the latest block models supplied by CCIC MinRes.

All exploration and mining permit information was supplied by Bilboes.

Information on the process was obtained from the pilot plant testwork.

The rest of the technical information was obtained by the various consultants engaged by Bilboes during the FS phase.

2.5 Personal Inspections / Site Visits

The following personal inspections / site visits were done on the properties:

- CCIC Consultants visited the project site on several occasions during the drilling phase of the FS
- MMC, Outotec and SLR Consultants and DRA also visited the project site on several occasions during the FS phase

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 3
RELIANCE ON OTHER EXPERTS

Document Number: JZWEBR6013-STU-REP-001

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3 RELIANCE ON OTHER EXPERTS

DRA has relied on the information provided by Bilboes on past and recent work. Various experts and consultants who have been working with Bilboes have carried out the work.

DRA's responsibility was to assure that this NI 43-101 Technical Report met the stipulated guidelines and standards considering that sections of this Report were contributed by Caracle Creek International Consulting (Pty) Ltd ("CCIC"), Manhize Mineral Consultants ("MMC"), Outotec BIOMIN RSA ("Outotec") and SLR Consulting ("SLR"). DRA are not aware of any information that might have been withheld from them by Bilboes and other experts and it accepts it in good faith. The information, conclusions, opinions, and estimates contained herein are also based on data, reports, and other information supplied by Bilboes and the other party sources throughout the course of its investigations and reflect various technical and economic conditions prevailing at the time of writing. Given the nature of the mining business, these conditions can change over time.

This report was prepared using the reports and documents noted in Section 27 "References".

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 4
PROPERTY DESCRIPTION AND LOCATION

Document Number: JZWEBR6013-STU-REP-001

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4 PROPERTY DESCRIPTION AND LOCATION

4.1 Zimbabwe Overview

Mining in Zimbabwe is dominated by gold, asbestos, PGMs, coal, and base metals.

4.1.1 Country Overview

Zimbabwe, officially called the Republic of Zimbabwe is a landlocked county located in southern Africa. It is bordered by South Africa to the south, by Botswana to the south-west, by Zambia to the north-west, and by Mozambique to the East Figure 4-1.



Figure 4-1: Map of the Republic of Zimbabwe

The country of Zimbabwe covers an area approximately 390,757 in size. It is the 60th largest country (by size) in the world. Of the total area, only 1% is covered by water. With a population of 16,150,362 (as of 2016), Zimbabwe is ranked 73rd in the world. Harare is the capital city and the largest city in Zimbabwe.

There are 16 official languages in Zimbabwe, with English as the language of government and business. It is the main language used in education as well. English is spoken primarily in cities, while other indigenous languages are mostly spoken in rural areas. Shona is spoken by 70% of the population while IsiNdebele is spoken by 20% of the population. Other indigenous languages spoken in Zimbabwe include Venda, Tsonga, Shangaan, Kalanga, Sotho, Ndau, and Nambya.

Zimbabwe has one of the highest adult literacy rates in Africa at 90.70%. The United Nations Development Programme recorded a literacy rate of 92% in 2010 while the 2002 census recorded the rate at 97%.

4.1.2 Government Policy and Outlook Regarding the Mining Industry

The Ministry of Mines and Mining Development of Zimbabwe is the government ministry responsible for mines and mining. It oversees the Zimbabwe Geological Survey, Provincial Mining Directors, various mining departments and the Minerals Marketing Corporation of Zimbabwe. Honourable Winston Chitando is the Minister of Mines and Mining Development. The mining industry contributes approximately 8% towards the country's GDP.

4.2 Project Location

The Bilboes properties are located in the Matabeleland North Province of Zimbabwe. The Isabella-McCays properties are situated approximately 80 km north of Bulawayo while Bubi is situated approximately 100 km north of Bulawayo. Bubi is 32 km due north-east of Isabella.



Figure 4-2: Regional Location of the Bilboes (Taken from Burger et al, 2017)

4.3 Property Area

The Isabella-McCays-Bubi properties comprise 128 claim blocks covering an area of 2,664.4 ha. A summary for each of the three groups of claims are contained in Table 4-1 below.

Table 4-1: Bilboes Claims

Group of Claims	Mining District	Province	No. of Blocks	Area (ha)	Coordinate X1	Coordinate Y1
Calcite and Kerry (Isabella Mine)	Bulawayo	Matabeleland North	48	1,864.4	662,106	7,846,712
Ruswayi (McCays Mine)	Bulawayo	Matabeleland North	33	330	666,339	7,849,975
Chikosi (Bubi Mine)	Bulawayo	Matabeleland North	47	470	684,838	7,865,515
Total			128	2,664.4		

4.4 Mineral Tenure and Title

Bilboes consist of 128 claim blocks wholly owned by Bilboes. Of the 128 blocks, 48 gold and base metal blocks and a Special Mine site belong to the Isabella mining area while McCays comprise of 33 gold blocks and Bubi consisting of 47 gold blocks. The claims are protected annually against forfeiture through gold production and exploration work and the Company has exclusive rights to subsurface areas to produce gold from these properties. DRA has not confirmed the legal tenure of the Bilboes properties but has placed reliance on a legal due diligence conducted by Scanlen and Holderness, a firm of legal practitioners in Harare, Zimbabwe. In DRA's opinion there are no significant risk factors that may affect the legal access to title and the right or ability to perform work on the claims.



Figure 4-3: Bubi Mine Claims Map

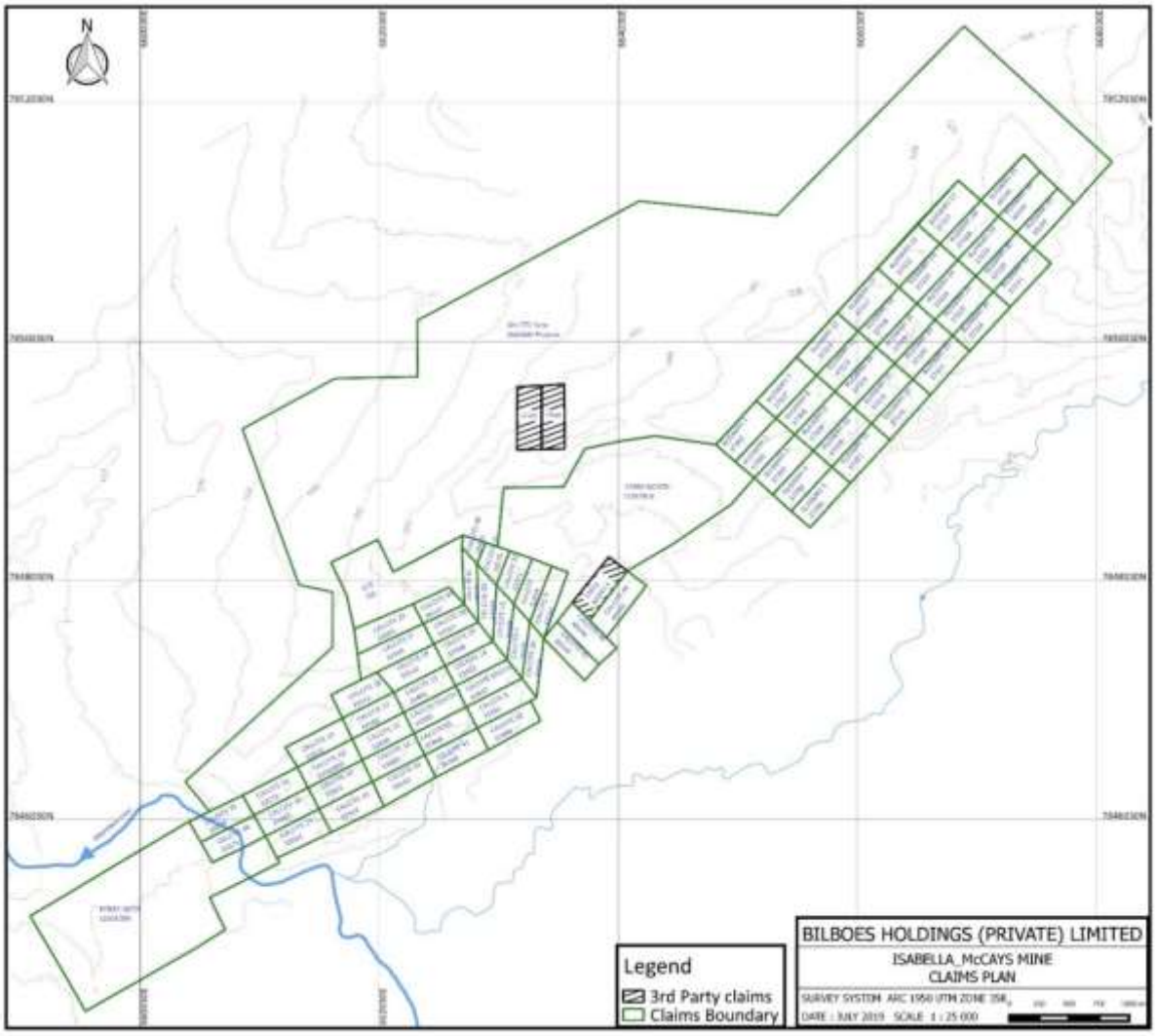


Figure 4-4: Isabella-McCays Mine Claims Map

4.5 Royalties

Royalty in Zimbabwe is levied as 5% on gross gold sales revenue.

4.6 Permits

Bilboes has been operating in Matabeleland since 1989. It holds the necessary mining permits and complies with the terms of the Mines and Minerals Act and allied regulations with respect to all of their claims and in particular that all of the registration certificates are valid, and the protection certificates are up to date. Bilboes thus requires no further permits to explore or produce from the current operational areas, but further permits will be required for the Environmental and Social Impact Assessment ("ESIA"), Tailings Storage Facility (TSF") and proposed haul road between Bubi and Isabella plant.

Further exploration outside the current claims will require approvals by the Environmental

Management Agency (“EMA”) who may request an Environmental Impact Assessment (“EIA”) study.

SLR Consulting based in South Africa in partnership with the local GryinOva Environmental Consultants carried out an ESIA study for the project FS and an EIA certificate of approval was issued by EMA in February 2021 and the certificate is valid for 2 years and is subject to renewal. The conditions of renewal are notification to the agency of any changes in the project, compliance to the approved environmental plan and submission of progress report on the project.

Bilboes also hold 3,485 ha of additional claims and 91,769 ha of exploration licences referred to as Exclusive Prospecting Orders “EPOs” around Isabella-McCays-Bubi and the Gweru area. These claims and EPOs have highly prospective targets which offer Bilboes excellent prospects for organic growth. The company has applied for an extension of the EPOs tenure for a further 3 years after the initial 3-year tenure expired in July 2021.

4.7 Encumbrances and Environmental Liabilities

No encumbrances or environmental liabilities are known, and DRA have placed reliance on a legal due diligence conducted by Scanlen and Holderness, a firm of legal practitioners in Harare, Zimbabwe.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 5
ACCESSIBILITY, CLIMATE, LOCAL RESOURCES INFRASTRUCTURE AND PHYSIOGRAPHY

Document Number: JZWEBR6013-STU-REP-001

DRA

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Access

Isabella McCays is 80 km from Bulawayo by national road whilst Bubi is 100 km. There is a 70 km gravel road that connects Isabella to Bubi. The roads are of variable quality with some tarred sections and some gravel sections.

5.2 Physiography

The area is covered by red and grey soils characteristic of greenstone rocks in Zimbabwe. Vegetation is dominated by scrubby Colophospermum Mopane, Acacia, and Combretum woodlands and minor occurrences of miombo with no extensive grasslands. Agricultural activities are restricted to ranching.

5.3 Climate

Despite lying in the tropics, the climate is subtropical due to its relatively high altitude. The mean annual temperature is 19 °C. Three broad seasons are prevalent: a dry, cool winter season from May to August; a dry, hot early summer from late August to Early November; and a wet, warm summer from early November to April. Rainfall during the wet season averages 594 mm. The climatic conditions allow for a year-round exploration and mining activities.

5.4 Local Resources and Infrastructure

The terms of the claims tenure system in Zimbabwe confer rights to use of the land surface for mining and construction of all related infrastructure such as housing, offices, plant, and tailings / waste disposal facilities subject to adherence to the environmental legislation. Bilboes recently obtained rights for an additional 1,128 hectares for a mine site at Isabella which will be adequate to cater for the additional sulphide mine infrastructure such as the sulphide plant, tailing's storage facility, waste dumps, housing, and additional office infrastructure.

There is sufficient underground water around the mines to run the current heap-leach operations, but additional boreholes and pumping capacity will be required for the proposed sulphide-mining project. This issue was identified in the feasibility stage of the project, along with water-use permits.

There are 33 KV power lines within 5 km and 25 km of the Isabella McCays and Bubi deposits respectively, that form part of the national grid, but new lines will have to be constructed to meet the increased capacity of the proposed exploitation of the sulphides. The plan on power is to tap from the 132 KV power line at Shangani some 70 km away. The line has low load on

it owing to few consumers. An alternative 88 KV power line, which is sufficient for the sulphide project, is located at Turk Mine about 40 km from Isabella McCays and 60 km from Bubi, but this line has recently had an increased consumer load.

Workshops, offices, and housing amenities are available for heap leach extraction, and these will require to be upgraded for the proposed sulphide mining project.

The mines have cell phone and internet connectivity and utilise a two-way radio system.

Generators at all mines allow continued production during load shedding. The capacity will need to be upgraded to cater for the sulphide operation.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 6
HISTORY

Document Number: JZWEBR6013-STU-REP-001

DRA

6 HISTORY

This section has been modified from the report entitled “Independent Technical Report on Bilboes Properties, Matabeleland, Zimbabwe” dated 16 June 2017.

Anglo American Corporation of Zimbabwe Ltd, a company that formed Bilboes, which was subsequently taken over by GAT investments (Pvt) Ltd previously held the Isabella, McCays and Bubi claims.

6.1 Oxide Mineralisation

Exploration at Isabella initially targeted old workings and three existing core holes drilled by a prospecting syndicate. Soil geochemistry, trenching, and open-hole percussion drilling led to the delineation of an open pit Reserve through the exercise of an option agreement with the prospecting syndicate and production commenced in 1989. Regional exploration resulted in further discoveries at Maria, Castile, Calcite, and Diana. Other oxide deposits at When (not subject of this report) and McCays were discovered in the mid-90s during this phase of exploration by Prospecting Ventures Limited “PV”, an exploration entity of Anglo American Corporation. These oxide deposits are situated 5 km southwest and 3 km to the northeast of Isabella respectively.

Soil sampling, mapping, trenching, and drilling of a drainage geochemical anomaly resulted in the discovery of the Bubi gold deposit. The Bubi gold deposit was also discovered by PV in 1995.

The recent exploration for sulphides within the Properties identified further oxide material that is currently being mined at Isabella and McCays.

6.2 Isabella

There are early records of insignificant gold production for the Isabella Mine prior to 1982. In its first year of operation the Isabella open pit operation produced 170 kg of gold from a monthly rate of 15,000 t of ore. At start of production there were three pits with a reserve life of 18 months and as of 31 December 2020, the Mine had treated 6.4 Mt of oxides at 1.16 g/t and recovered 4,565 kg of gold (146,758 oz) inclusive of re-leached gold from the old heap leach pads. The bulk of the production from Isabella was from uncrushed ore with only 1,019 kg (32,771 oz) of gold being recovered from 2.3 Mt of crushed oxide ore after the installation of a crushing plant in 2007. There is some low oxide mining activity at Isabella due to the dwindling oxides.

6.3 Bubi

Bubi was commissioned in 1997 at 25,000 t per month of oxide ore and produced 297 kg of gold in its first year. Mining activities were suspended at Bubi Mine in 2007 after running out of the oxide ore. Gold production from that period to 2013 has been from re-leaching of the old heaps. Progressively inclusive of re-leached gold from the old heap leach pads, the mine has produced 2,611 kg of gold (83,957 oz) as at end of December 2020 from 4.3 Mt of oxide ore at 1.00 g/t. All the ore at Bubi Mine was treated without crushing. There has not been any mining at Bubi from 2005 after the exhaustion of oxides until the commencement of re-leaching activities at the beginning of 2019.

6.4 McCays

As a result of regional exploration by PV, a new gold deposit was discovered at McCays in 1997. In 1998 production from an open pit, heap-leach mine started. Further exploration work within the claims area during the operational phase of the mine added to the Reserves until depletion and temporary closure in 2002. No mining activities took place between 2002 and 2012 at McCays. Gold production was through re-leaching from the year 2004 until 2009. No gold production occurred from 2010 to 2012. Activities commenced after the recapitalisation of Bilboes in 2013. Cumulative gold production from inception at McCays was 1,718 kg (55,245 oz) as of 31 December 2020. This included the re-leached gold from the old heap leach pads from treating 2.1 Mt of oxide ore at 1.16 g/t. Inclusive of this, an estimated 672 kg (21,573 oz) of gold was recovered from 950,001 t of crushed oxide ore after the installation of a crushing plant in 2013. The oxides at McCays are finished and only re-leaching activity is taking place.

6.5 Sulphide Exploration

Sulphide mineralisation underlies all the oxide deposits at variable depths from 15 M to 50 m. Two exploration campaigns account for historical exploration of sulphide gold deposits at Bilboes. Both exploration campaigns were headed by PV. The first drilling campaign occurred in 1994/5. During this campaign 24 holes were drilled. In the second drilling campaign which took place in 1997/9, 99 holes were drilled. A total of 123 holes totalling 17,650 m (12,650 m core and 5,000 m percussion) were drilled at Isabella, McCays and Bubi covering a strike of 3,440 m.

Drill holes depths varied between 70 m and 350 m for the core holes, but the percussion drilling was limited to 50 m. The percussion holes were largely used to estimate oxide Resources and to define the oxide / sulphide interface. Only core holes were included in the sulphide Resource

databases. The drill line spacing varied between 25 m and 100 m with 25 m between holes along these lines.

The initial holes drilled by PV before 1995 targeted the Calcite (5), Castile (9) and McCays (10) deposits. The majority of these were drilled at 45 degrees inclinations and from hanging wall positions of the mineralised zone. The few exceptions resulted from unavailability of a suitable collar position due the open pits. Sampling was limited to the visually recognisable alteration zones resulting in approximately 30% of the total hole length being sampled.

At the Diana pit (Isabella Mine), 14 holes were drilled, two spaced at 10 m and two at 50 m with the rest at approximately 25 m intervals. One hole was drilled on each line all from the hanging wall with one from the footwall. The mineralised intersections occurred at 45 m to 95 m with one intersection at 125 m (DE15-530S). The footwall of the mineralisation intersected was at 169 m to 182 m.

At Maria pit (Isabella) all six holes (1998-9) were drilled from the hanging wall with five holes spaced at 25 m and the rest at 50 m. The average intersection depths occurred at 45 m from surface and geological envelopes were modelled down to 100 m from surface. Two parallel, mineralised zones steeply dip at 70 degrees to SE and the hanging wall ore body stretches along the entire length of the pit, but the footwall zone is restricted to the eastern end of the strike.

A total of 15 holes were drilled along the Calcite strike from the footwall and two from the hanging wall at 50 m to 120 m line spacing. The deepest intersection occurred at 130 m from surface and the intersection depths ranged from 50 m to 120 m. The eastern end of the strike remains open.

The Castile drilling intersected two mineralised zones that were modelled to 110 m from surface, but the mineralisation remains open on all sides. Two holes intersected a significant parallel mineralisation (6.68 g/t over 10.59 m and 4.90 g/t over 9 m) in the footwall of the two main zones. Both holes ended in mineralisation and require further investigation in future. These holes have not been investigated in the 2017/8 drilling campaign because they lie outside of this Feasibility Study reserve pit designs.

The 25 holes at Bubi covered a strike of 900 m on lines 25 m apart except for two holes which were spaced at 50 m and 100 m. All the holes (but one) were drilled from the hanging wall in the same SE direction inclined at 45 degrees. Three distinct, parallel zones were identified but these were discontinuous along strike and the mineralisation remained open ended towards the southern strike of 1,500 m. The oxide cap is at 15 m to 30 m from surface and only 10 m

in the southern strike. Drilled intercepts start at 20 m to 80 m and the deepest occurs at 130 m. The geological models were done to a vertical depth of 170 m from surface.

At McCays 23 holes were drilled in the pit and two mineralised zones were defined along strike but broken up mid-way. Drill spacing was at 50 m to 100 m with a few lines having two holes each. All holes were drilled from the hanging wall but at varying inclinations from 45 to 60 degrees. The geological models were created to 160 m vertical depth with average intersections occurring at 75 m. Two of the holes at McCays had the deep (but low grade) intersections that do not form part of the established pattern of mineralisation.

Table 6-1: History of Sulphide Project Core Drilling 1994 - 1999 (From Ngilazi & Martin, 2017)

Mine	Deposit	Pit	No. of Holes	Total Strike (m)	Drilled Length (m)	Depth Achieved (m)
Isabella	Isabella North	Diana	14	315	2,200	150
		Calcite	17	575	2,600	150
	Isabella South	Castile	37	450	5,100	100
		Maria	7	200	550	70
McCays	McCays	Central / Eastern	23	1,000	4,000	100
Bubi	Bubi	North	25	900	3,200	120
Total			**123**	**3,440**	**17,650**	

6.6 Sulphide Resources

6.6.1 Historical Logging and Sampling Procedure

There are no written accounts of the historic sampling procedures, but Mr Chimedza, who has been employed by Bilboes since 1996, was closely involved with the exploration of the sulphide deposits. He confirms that the sampling of the core followed Anglo American Corporation standard procedures. This was considered to have been sufficiently accurate for the purpose of reporting of Inferred Mineral Resource estimates contained in the 2009 Resource estimate.

The geological logging included descriptions of lithologies, structures, alteration, and visible sulphide mineralisation. The information was entered into core logging sheets and mineralised zones were identified. All geological boundaries were defined with reference to the drill length. On completion of assaying, the gold results for each sample were recorded on the log sheets for easy reference. Core recoveries were recorded, and any depth discrepancies were checked and corrected. Geotechnical logging, including the RQD index and fracture spacing, was also undertaken.

Bilboes has hardcopy and digital datasets of all information except for the geotechnical logs for which only hard copies are available.

Core was fitted together, and a longitudinal line drawn to guide splitting. Within the mineralised zones sample intervals were marked between 0.5 m and 1.0 m, taking cognisance of geological and structural boundaries, and sampling was continued at 1 m intervals to 5 m on either side of the mineralisation.

All the visually recognisable mineralised portions of the drill holes were cut, sampled, and assayed with well over 10,000 samples being assayed for gold.

6.6.2 Historical Sulphide Mineral Resource Estimates

In 2009, SRK undertook a Mineral Resource Estimate for the sulphide Properties based on the drill holes and geological interpretations supplied by Bilboes. SRK did not verify the quality of the data used in the estimation process but did validate the supplied data to identify and correct minor inconsistencies. The data supplied to the Qualified Persons (QPs) consisted of the individual projects from Isabella-Bubi and McCays.

Geological models were created for all these deposits, excluding the oxide portions, to a depth of up to 150 m. Solid models were created from the wireframes generated and assays for gold within these were used for geostatistical modelling and resource estimation. Total Mineral Resources of 5.2 Mt containing 533,000 oz were classified to a vertical depth of 100 m with 3.5 Mt containing 240,000 oz unclassified for an additional depth of 50 m.

The grade estimation for the Sulphide Projects was based on a 2.0 g/t cut-off mineralised envelope. In general, the drill coverage was poor, with drill spacing ranging from 25 m (Bubi) to up to 100 m for McCays. In most cases there was only one hole per drill line.

The grade estimate of each mineralised zone was done by initially determining the spatial continuity of the assay data within the mineralised volumes by variogram analysis of grade values. In the initial study all the mineralised zones were studied using 3-dimensional (“3-D”) variograms with grade values composited to the dominant sample length of 1.0 m.

To compensate for the varying thickness of the mineral envelope wireframe, a 2-dimensional (“2-D”) estimation approach was used. For the 2-D method samples were composited across the thickness of the mineralised zone, resulting in one sample per borehole per mineralised intersection.

Classification of the anomalies was based on the quality of the estimate, which in turn was based on grade continuity and data spacing and was done according to the guidelines contained within the JORC code.

Estimates were validated by visually comparing the borehole grades to the block model grades for each section line in Datamine Studio™ (“Datamine”).

The authors considered the sparse data distribution and grade variability, geological interpretations, the un-availability of QA/QC information, the structure of the Omni-directional variograms and the results of the estimation for the classification as an Inferred Mineral Resource.

Table 6-2: Sulphide Inferred Mineral Resources as of 2009

Deposit	Classification	Cut-Off (g/t)	Tonnes	Au (g/t)	Content (oz)
Bubi	Unclassified	2.00	1,434,557	2.68	123,707
Calcite	Unclassified	2.00	500,199	4.96	79,801
Castile	Unclassified	2.00	902,006	4.32	125,353
Diana	Unclassified	2.00	915,189	3.49	102,706
Maria	Unclassified	2.00	176,641	3.1	17,612
McCays	Unclassified	2.00	821,220	3.2	84,455
Total / Average			**4,749,813**	**3.49**	**533,634**

Subsequent to the 17,650 m core drilling by Anglo of 1994-1999, additional exploration work under Bilboes resumed in 2011 through to 2016 where an additional 20,527 m of core and 20,235 m of RC drilling was completed bringing the total metreage to 58,412 m. The drilling culminated in an interim Mineral Resource update by Mr Arimon Ngilazi and Dr Anthony Martin in 2017.

Mr Ngilazi and Dr Martin also prepared an independent technical report on the sulphide resources of Bilboes. Data verification was carried out by the abovementioned authors. From this study resources were declared on the 31st of March 2017 at a 0.0 g/t block cut-off and at a 0.9 g/t block cut-off. These results are presented in Table 6-1 and Table 6-2, respectively. Resources in the Indicated and Inferred Categories were declared. At a 0.0 g/t block cut-off, 71.58 Mt at an average grade of 2.17 g/t were declared. At a 0.9 g/t block cut-off, 63.57 Mt at 2.35 g/t were declared.

Table 6-3: Sulphide Mineral Resources as of 31 March 2017, 0.0 g/t Au Block Cut-Off Applied

Property	Indicated				Inferred			
	Mass (Mt)	Au Grade (g/t)	Au (kg)	Au (Moz)	Mass (Mt)	Au Grade (g/t)	Au (kg)	Au (Moz)
BUBI	29.96	2.20	65,912	2.12	9.05	1.90	17,195	0.55
ISBN	12.07	2.19	26,433	0.85	1.55	2.01	3,116	0.10
ISBS	7.90	2.43	19,197	0.62	0.51	2.62	1,336	0.04
MCCAYS	3.48	2.44	8,491	0.27	7.07	1.97	13,928	0.45
Total	**53.41**	**2.25**	**120,034**	**3.86**	**18.17**	**1.96**	**35,575**	**1.14**

Table 6-4: Sulphide Mineral Resources as of 31 March 2017, 0.9 g/t Au Block Cut-Off Applied

Property	Indicated				Inferred			
	Mass (Mt)	Au Grade (g/t)	Au (kg)	Au (Moz)	Mass (Mt)	Au Grade (g/t)	Au (kg)	Au (Moz)
BUBI	28.05	2.27	63,674	2.05	8.66	1.93	16,714	0.54
ISBN	9.94	2.53	25,148	0.81	1.29	2.27	2,928	0.09
ISBS	7.05	2.60	18,330	0.59	0.44	2.86	1,258	0.04
MCCAYS	2.55	3.19	8,135	0.26	5.58	2.38	13,280	0.43
Total	**47.60**	**2.42**	**115,286**	**3.71**	**15.97**	**2.14**	**34,181**	**1.10**

6.7 Production

Prior to the open-pit exploitation of the Isabella Resources by Bilboes, the Calcite Mine (underground and now part of the Isabella strike) produced 559 kg of gold at an average recovered grade of 8.2 g/t.

The production from Bilboes mines including When Mine from inception to 31 December 2020 is presented in Table 6-5 below.

Bilboes has produced some 90,048 oz of gold from the four mines since the takeover of the company in 2003 to 31 December 2020

Table 6-5: Production Data from Bilboes Mines to 31 December 2020

	Start-up Date	Ore Treated (t)	Grade (g/t)	Au Recovered (kg)	Au Recovered (oz)
Isabella	1989	6,383,459	1.16	4,565	146,758
Bubi	1997	4,342,035	1.00	2,611	83,957
McCays	1998	2,094,376	1.16	1,718	55,245
When	2005	183,700	0.78	60	1,923
Total		**13,003,570**	**1.10**	**8,753**	**287,883**

N.B. Figures include gold production from When which does not form part of the Feasibility Study.

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 7
GEOLOGICAL SETTING AND MINERALISATION

Document Number: JZWEBR6013-STU-REP-001

7 GEOLOGICAL SETTING AND MINERALISATION

7.1 Regional Geology

Geology in Zimbabwe can be divided into three main areas; the Archean, the Proterozoic, and the Phanerozoic.

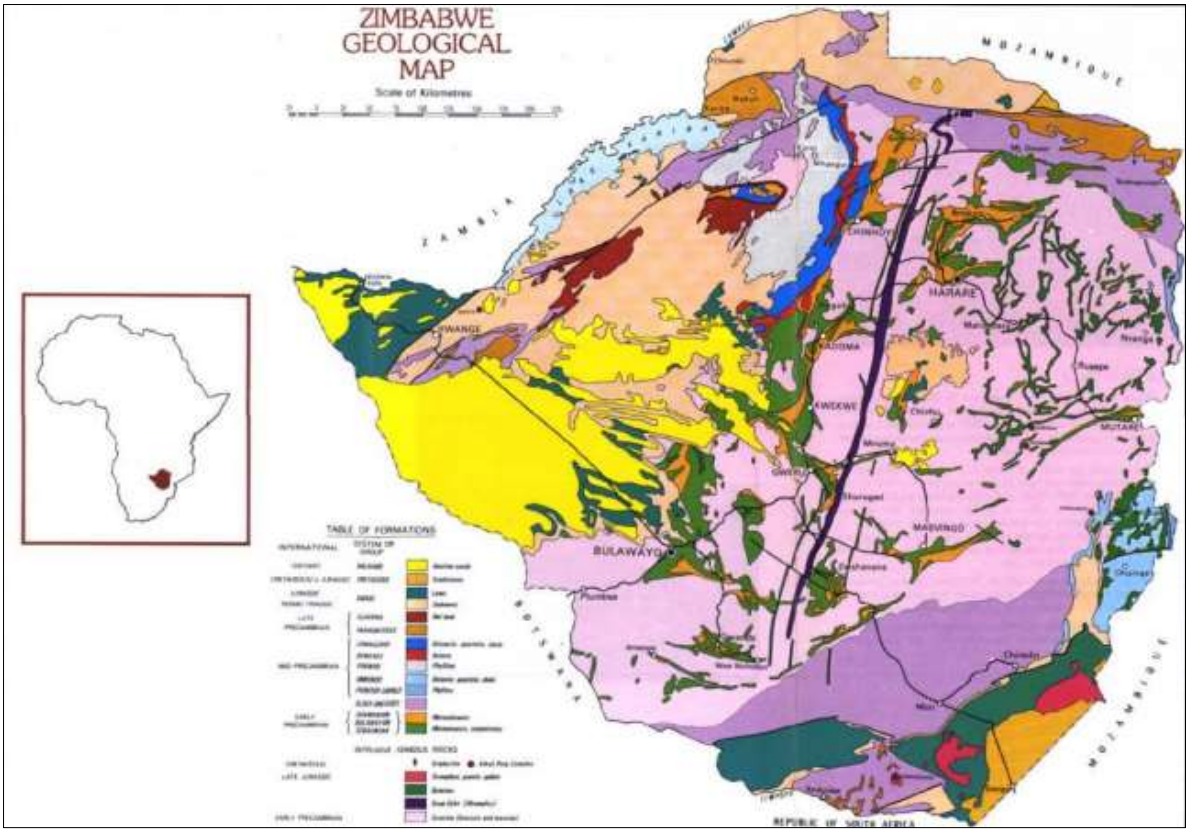


Figure 7-1: Geological Map Zimbabwe (taken from Mugumbate, unknown year)

7.1.1 The Archean

Rocks from the Archean era in Zimbabwe occupy most of the Zimbabwe Craton, an ancient stable continental block. This is the basement and primarily comprises granites and gneisses with remnants of volcano-sedimentary piles known as Greenstone Belts. Greenstone Belts cover approximately 60% of the land surface of Zimbabwe. The Greenstone Belts are renowned for their rich variety of mineral resources as shown in Figure 7-1.

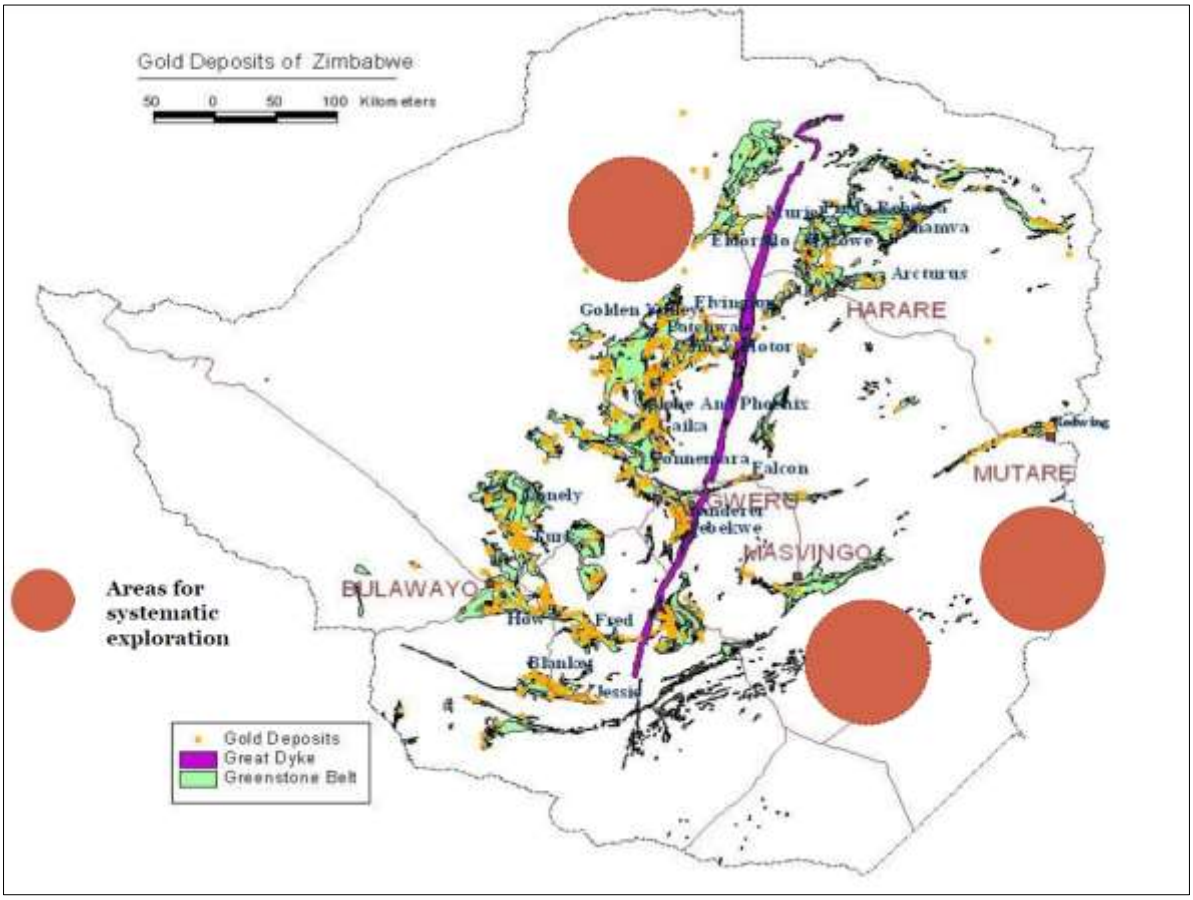


Figure 7-2: Greenstone Belts and known Gold Deposits in Zimbabwe (from Mugandani '17)

7.1.2 The Proterozoic

In Zimbabwe, the Proterozoic era followed immediately after the emplacement of the Great Dyke intrusion at the end of the Archean era. The great dyke is a layered mafic to ultramafic intrusion akin to the Bushveld Complex in South Africa. It was emplaced at the end of the Archaean era at approximately 2,500 mega annum (ma). It has a strike length of 550 km and ranges in width from 4 km to 11 km. It cuts across the entire Zimbabwe Craton in a roughly N-S direction as shown in Figure 7-2. The Great Dyke hosts world-class reserves of platinum group metals (PGMs) and chrome ore.

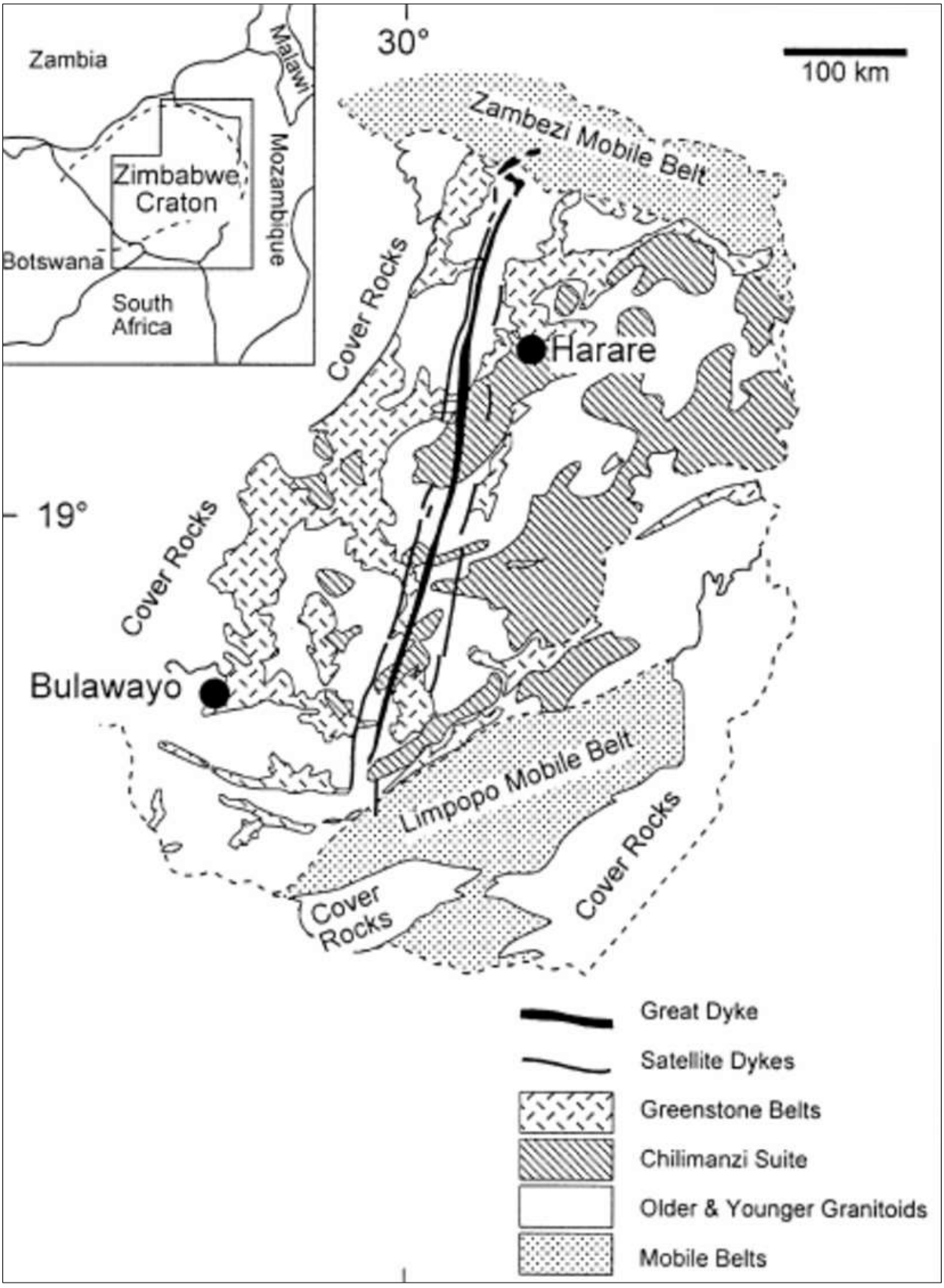


Figure 7-3: NNE Trending Great Dyke cutting across the Zimbabwe Craton (from Mukaka *et al* '98)

There are three metamorphic mobile belts that border the Craton to the north-east, south, and north-west. The neo-Archaean Limpopo mobile belt borders the Craton on the southern boundary. The paleo-Proterozoic Magondi mobile belt borders the Craton to the north-west while the neo-Proterozoic Zambezi mobile belt borders the Craton to the north Figure 7-3. These metamorphic belts are hosts to economic metamorphic minerals. They also host several gemstones, precious, and base metals. To the east are the Umkondo group sediments which were deposited in a large basin and are capped by younger dolerite sills and basaltic flows. The Umkondo sediments host the Chiadzwa placer diamond deposits.

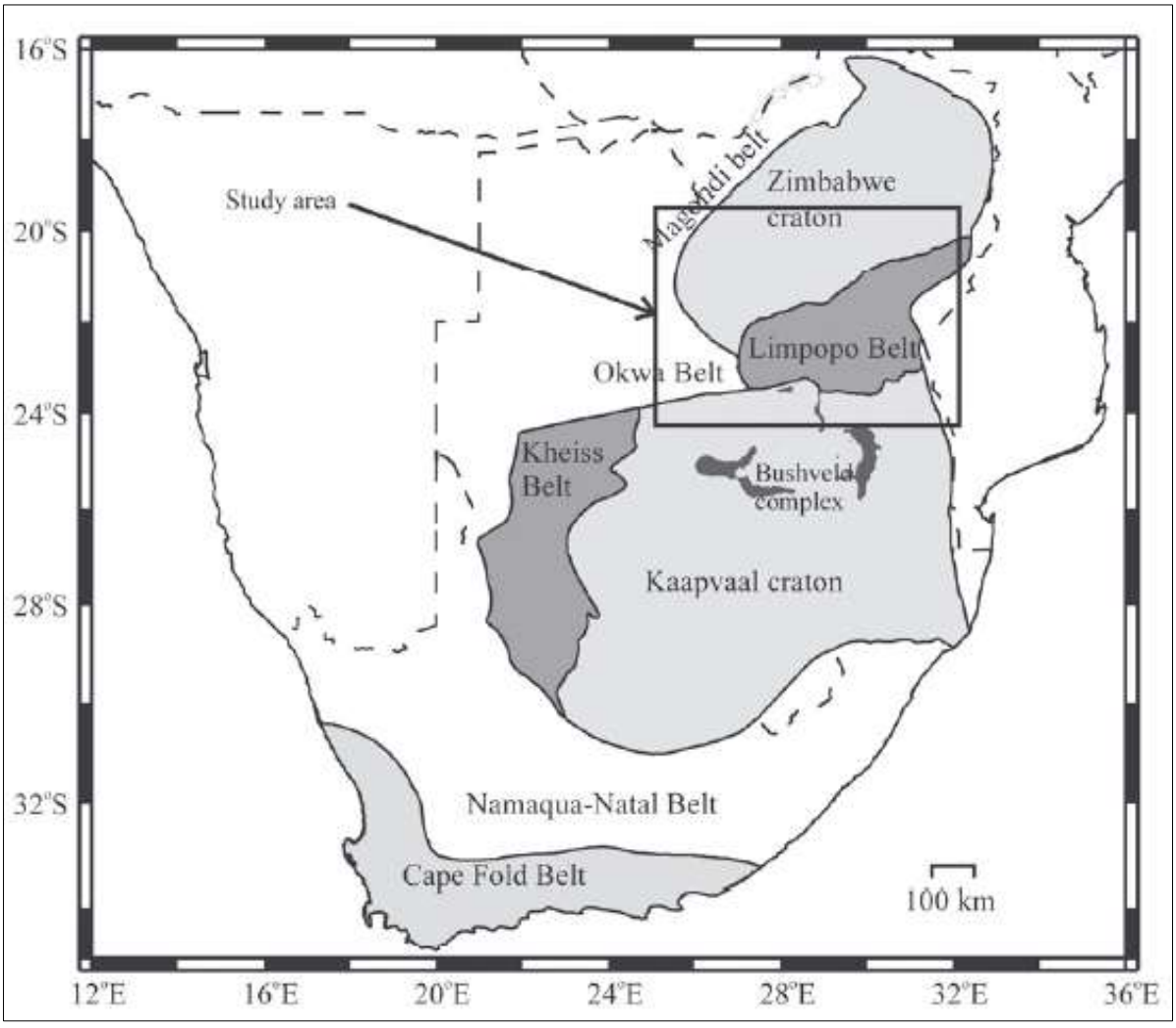


Figure 7-4: Geological Map showing the Zimbabwe Craton and Mobile Belts (taken from Gore et al '09)

7.1.3 The Phanerozoic

The Phanerozoic consists of several sequences of sedimentary rocks covering the peripheries of the Craton. Included in the Phanerozoic are sedimentary basins: the Permian - Triassic

Jurassic Karoo Supergroup, Cretaceous sediments, and Tertiary to recent sand of the Kalahari Figure 7-4.

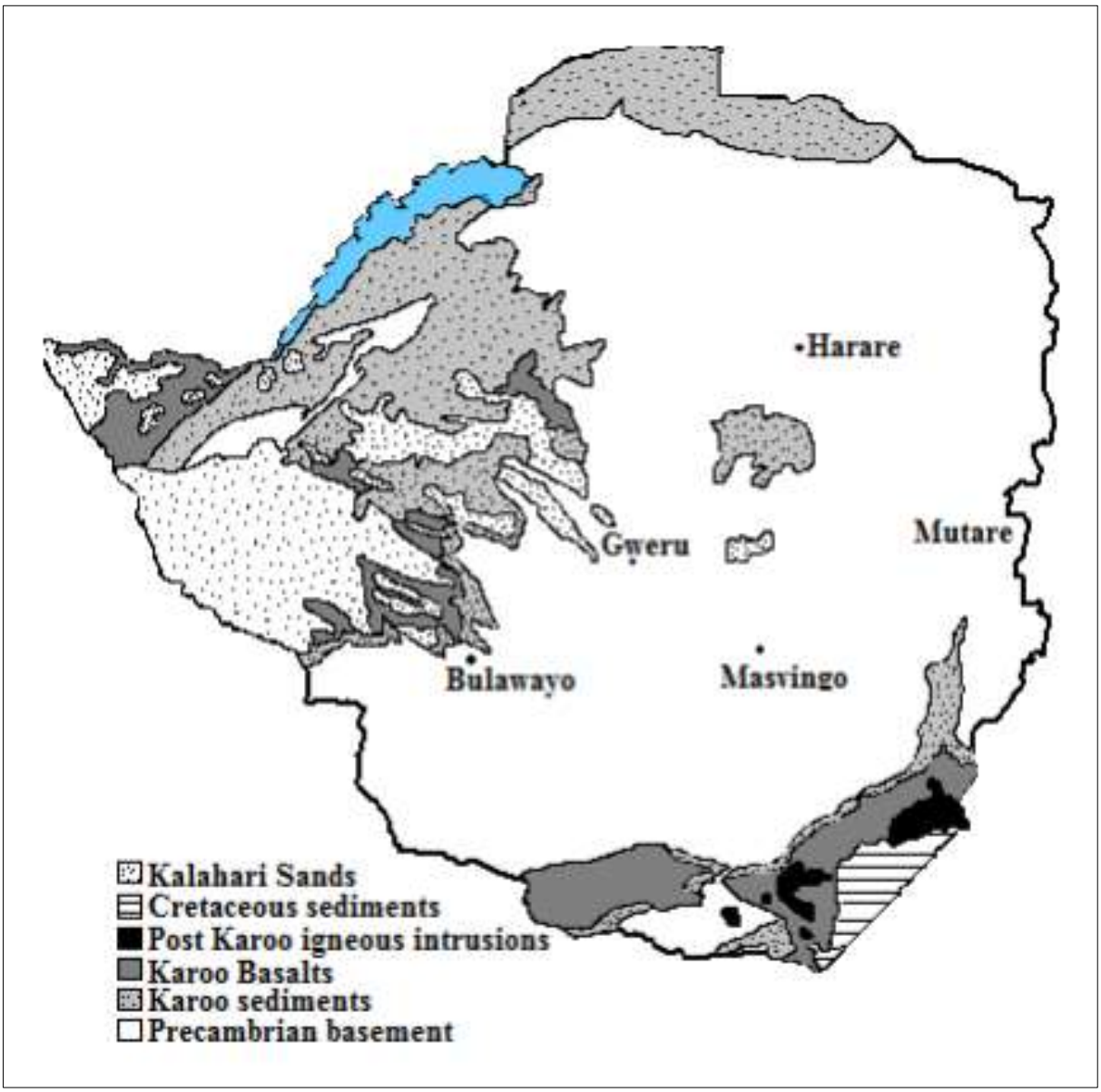


Figure 7-5: Sedimentary Basins of Zimbabwe (taken from Mugumbate, unknown year)

7.2 Regional Geology as it Relates to the Bilboes Properties

The Bubi Greenstone Belt covering the Bilboes Properties consists of volcanic rocks of the Upper Bulawayan Group capped by sedimentary sequences of the Shamvaian Group locally represented by Ndutjana and Dagmar Formations respectively. The deposits occur within the meta-volcanic and meta-sediments close to the contact between these two stratigraphic units.

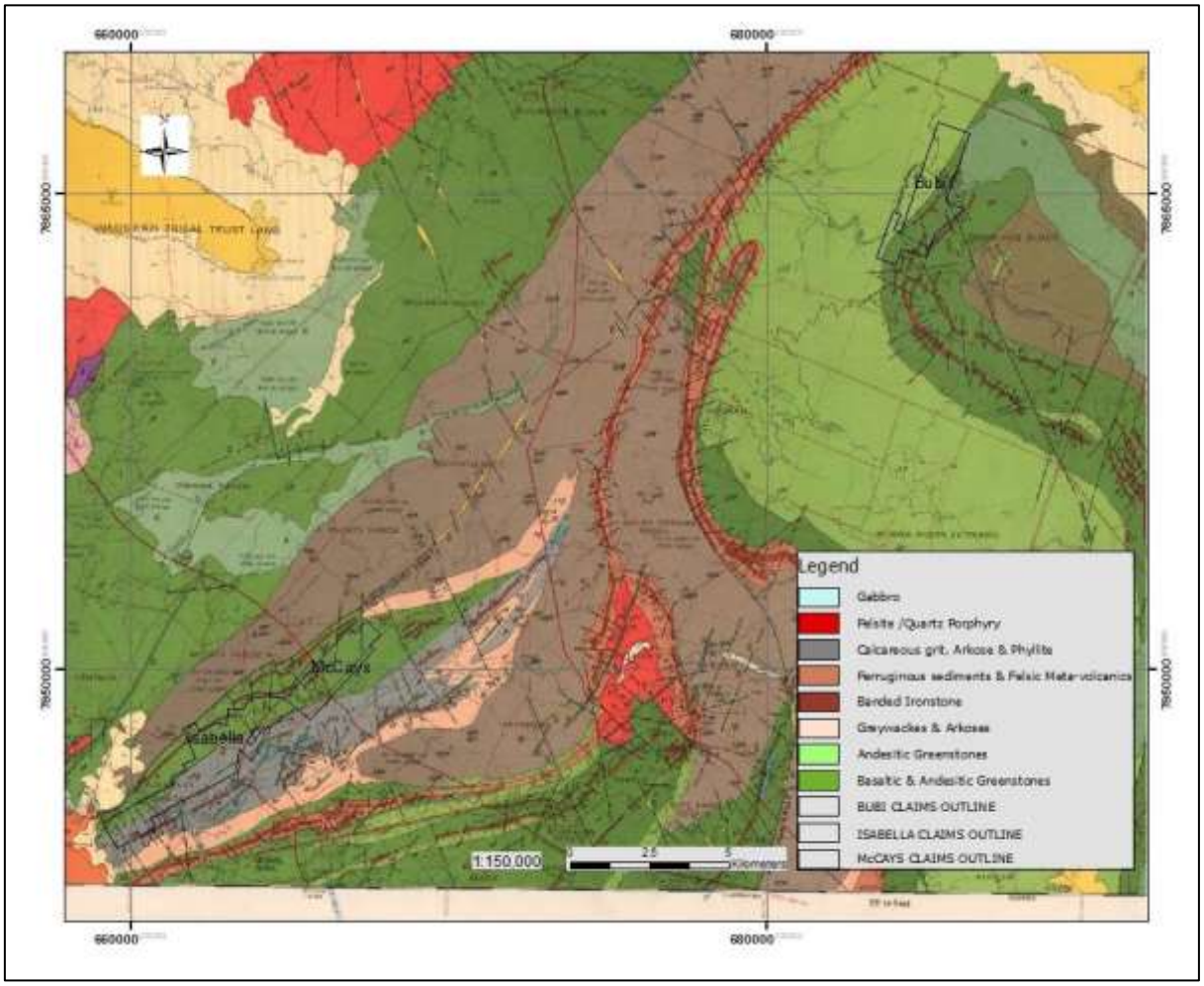


Figure 7-6: Regional Geological Map showing Bilboes Properties (from Ngilazi & Martin '17)

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 8
DEPOSIT TYPES

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8 DEPOSIT TYPES

Mineralisation at Bilboes' four properties is of the hydrothermal variety. It consists of silicified stock-works / veins. The veins comprise pyrite and arsenopyrite. Gold is disseminated within the sulphide mineralisation and is refractory. The mineralised zones are often subparallel to each other and are hosted in a much broader shear zone. The best mineralised zones are associated with brecciation and silicification.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 9
EXPLORATION

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9 EXPLORATION

9.1 Geological Mapping

Mapping has been carried out progressively at the Bilboes mines since commencement of oxide gold operations, with the latest exercise being carried out between January and September 2018. Below are some of the maps produced for Bubi (Figure 9-1) and the Isabella McCays area (Figure 9-2). Mapping was done to decipher surface and in-pit geological and geotechnical information, critical for structural and alteration interpretation of mineralised units and in aiding pit geotechnical slope stability studies.

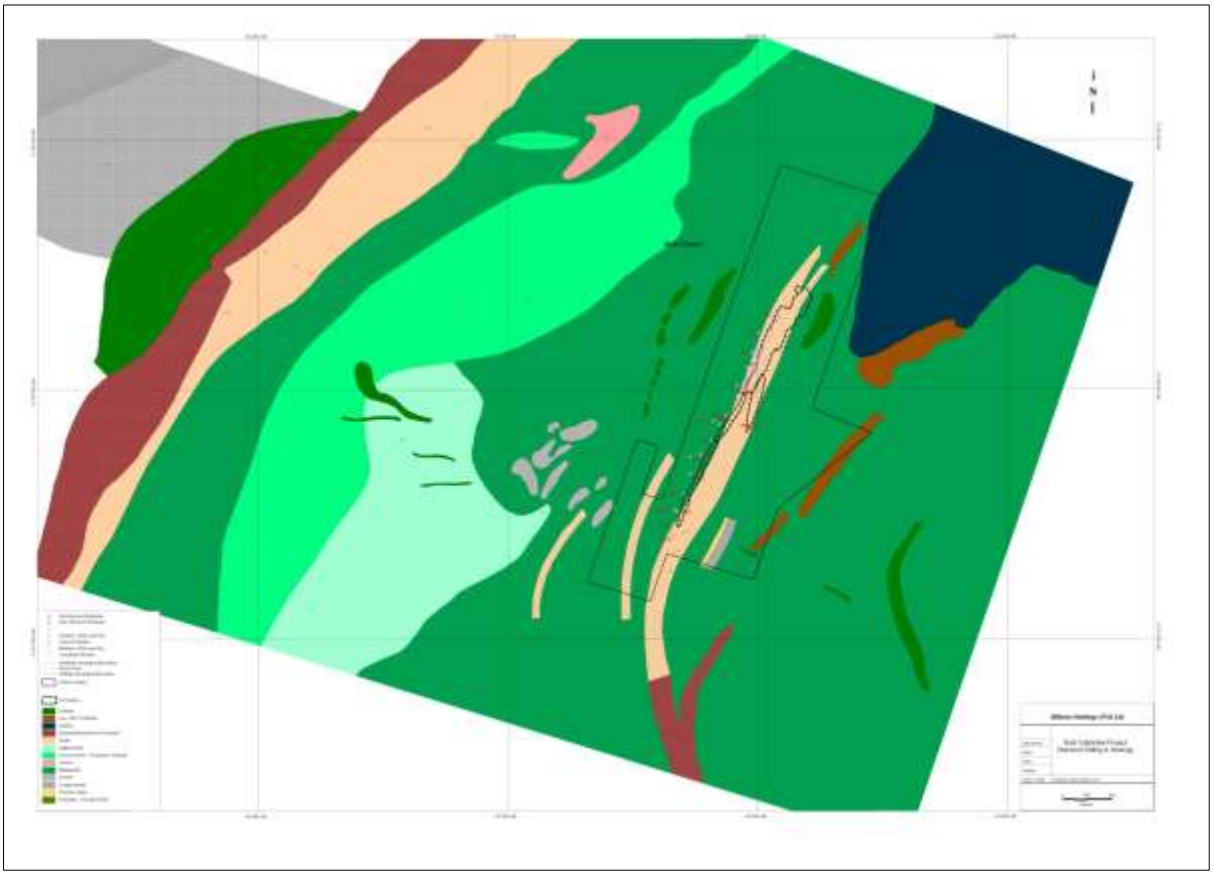


Figure 9-1: Map of the Surface Geology at Bubi

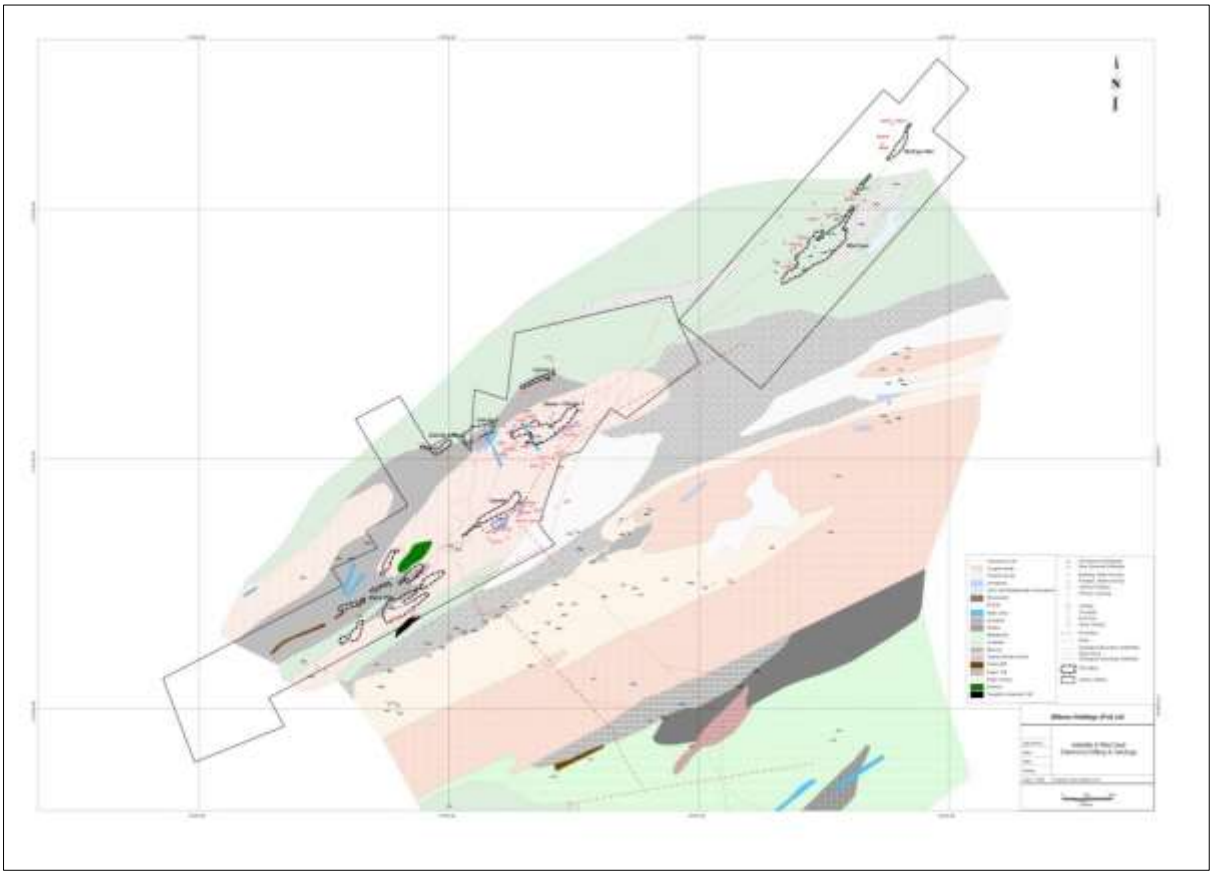


Figure 9-2: Map of the Surface Geology at Isabella McCays

9.2 Trenching

Trenching was carried out across all deposits as part of exploration work for the purposes of defining near surface geology and mineralisation envelopes within the oxide horizons. The trenches were sampled generally on a 1 m to 2 m interval and analysed by the bottle roll method. These assays were used to help in the projection of oxide ore envelopes and excluded from any Mineral Resource Estimation. Channel sampling was also done in all accessible sections of the pits during 2017, which also assisted in the projection of mineralised envelopes in the oxide and transition ore horizons, but the assays were also not used for resource estimation.

9.3 Ground Geophysical Surveying

Ground Magnetics and Induced Polarisation Geophysical surveys were conducted at the Isabella North deposit by Prospecting Ventures as part of the oxide ore exploration in 1996. The anomalies were followed up with oxide trenching and drilling. The oxide drilling data forms part of the depth interpretation of the Bilboes deposits from oxide through transitional and sulphide horizons. Further geophysical surveys were carried out in the Kerry West claims located west of the Isabella South claims and Kerry North claims, between Isabella North and

McCays. Further drilling is outstanding on these targets and these offer potential for oxide and sulphide resources.

9.4 Prospecting and Sampling

Early exploration works targeted oxide mineralisation and includes soil sampling, trenching and drilling. Assays from this work were not used in the sulphide Resource Estimate but were used to guide the interpretation of the ore outlines at depth.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 10
DRILLING

Document Number: JZWEBR6013-STU-REP-001

DRA

10 DRILLING

Drilling of the sulphides to provide data for the resource estimate was done in three phases: the first phase by Anglo American Corporation between 1994 and 1999, and the latter phases by Bilboes between 2011 and 2013, with the latest drilling between December 2017 and November 2018.

Anglo explored the sulphide potential beneath the oxides between 1994 and 1999. The results of widely spaced core drilling of the sulphides were used by Anglo American to estimate a non-compliant resource for this mineralisation and delineated ~533,000 oz of gold over a 3,400 m strike to a vertical depth of 120 m from 17,650 m of core drilling.

Between 2011 and 2012, Bilboes completed further exploration on the sulphides with 16,230 m from 69 core holes and 14,021 m from 101 Reverse Circulation “RC” holes in 2013 and extended the strike to 7,000 m and achieved a vertical depth of 160 m for the mineralisation.

An additional 34,987 m of drilling, split as 17,015 m from 129 core holes and 17,972 m from 178 RC holes was completed between December 2017 and November 2018. This was largely an infill drilling programme for a resource upgrade across all deposits at Isabella, McCays and Bubi and achieved a vertical depth of 200 m. The total project drilling conducted over the three phases is 93,400 m of core and RC holes with an additional 2,500 m of core drilled for geotechnical work for the FS.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 11
SAMPLE PREPARATION, ANALYSES AND SECURITY

Document Number: JZWEBR6013-STU-REP-001

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11 SAMPLE PREPARATION, ASSAY AND ANALYTICAL SECURITY

At all times during sample collection, storage, and shipment to the laboratory facilities, the samples were in the control of Bilboes. The samples were then trucked to Performance Laboratories in Harare for geochemical analysis.

During the 2018 drilling and sampling campaign, all analytical results were emailed by Performance Laboratories to Bilboes. The mailing list comprised Rodrick Chirwa, Douglas Ngwenya, Tawanda Kondo, and Jones Bishi. The above-mentioned personnel were employees of Bilboes. Mr. Nkuna M.O of CCIC MinRes was copied into the mailing list. This ensured that CCIC MinRes received assay results as they were sent to Bilboes. Comparisons were done between the drilling database received from Bilboes and the assay results received from Performance Laboratories to ensure a match.

All the laboratories that carried out the sampling and analytical work were independent of Bilboes. Performance Laboratories in Zimbabwe is an entity of SGS. SGS produces impartial results that are NI 43 101/JORC defendable (**https://www.sgs.co.za**).

11.1 QA / QC

As part of their QA/QC protocols to test for the precision of the analytical process, Bilboes inserted Certified Reference Materials (CRMs), Blanks, and duplicates into their sampling stream. During the 2017 Mineral Resource review of the Bilboes properties, CCIC MinRes did a thorough review of the QA/QC protocols. The findings from that review concluded that protocols employed at Bilboes were adequate and the database was deemed fit for the purposes of geological modeling and resource estimations. Therefore, this review focused on the 2018 drilling and sampling campaign.

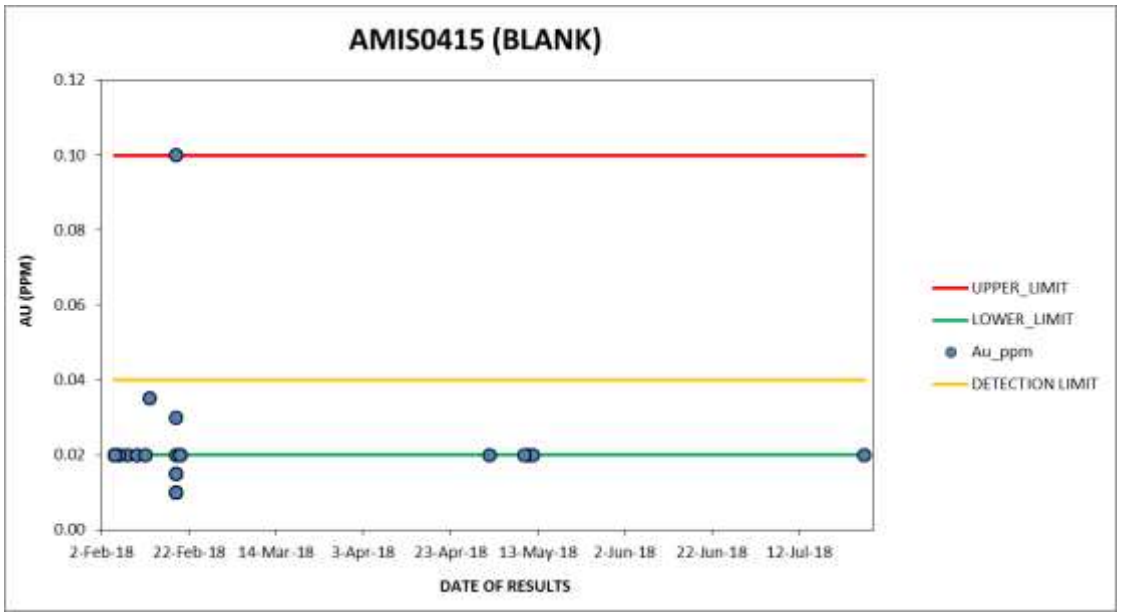
CRMs were sourced from AMIS in South Africa. Silica powder from AMIS and local dolerite were used as blanks. Bilboes utilized two types of duplicate materials, from. a Pulp Duplicate (LPR) and a Coarse Duplicate (LCR). In a batch of twenty samples, at least four out of the twenty samples were control samples. This represents an insertion ratio of at least 20%. If more than 20% of CRM results in a batch returned results that fell outside the allowable deviation of the recommended value; all results from that batch were failed and re-analyzed.

11.1.1 Blanks

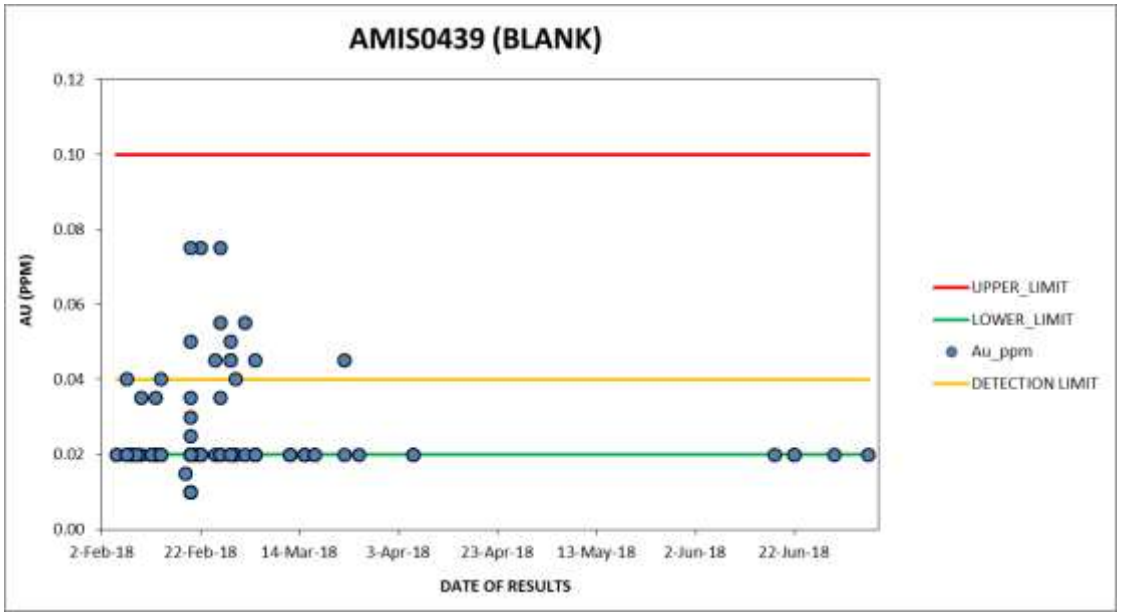
For the 2018 sampling campaign, Silica powder and local dolerite were used as blank material. AMIS0415, AMIS0439, and AMIS0484 were used as silica blanks. During the 2017 review by

CCIC MinRes, 272 blanks were present in the database. An additional 859 blanks were added to the database for the 2018 campaign, taking the total number of blanks to 1,131.

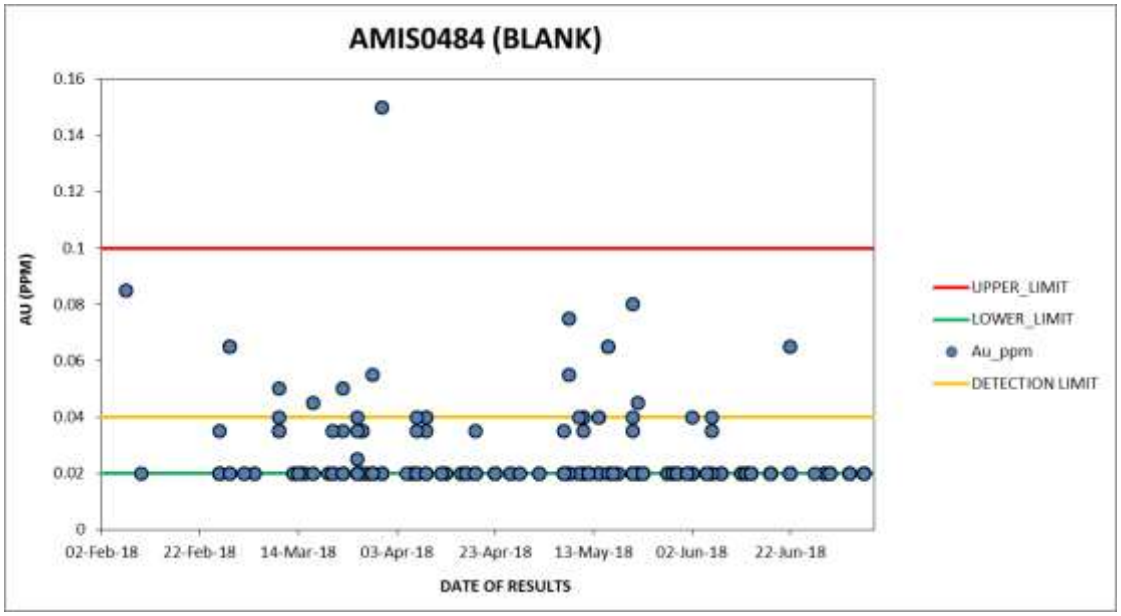
A detection limit of 0.02 g/t was set for the exercise while the upper acceptable limit was set at 0.1 g/t for the silica blanks and 0.15 g/t for the field blank. All samples for AMIS0415 (Graph 11-1) and AMIS0439 (Graph 11-2) plotted below the allowable upper limit of 0.1 g/t. Only one sample returned a gold value more than the 0.1 g/t allowable upper limit for AMIS0484 (Graph 11-3). Similarly, with the field blank, only one sample returned a gold value more than the allowable 0.15 g/t upper limit, shown in Graph 11-4.



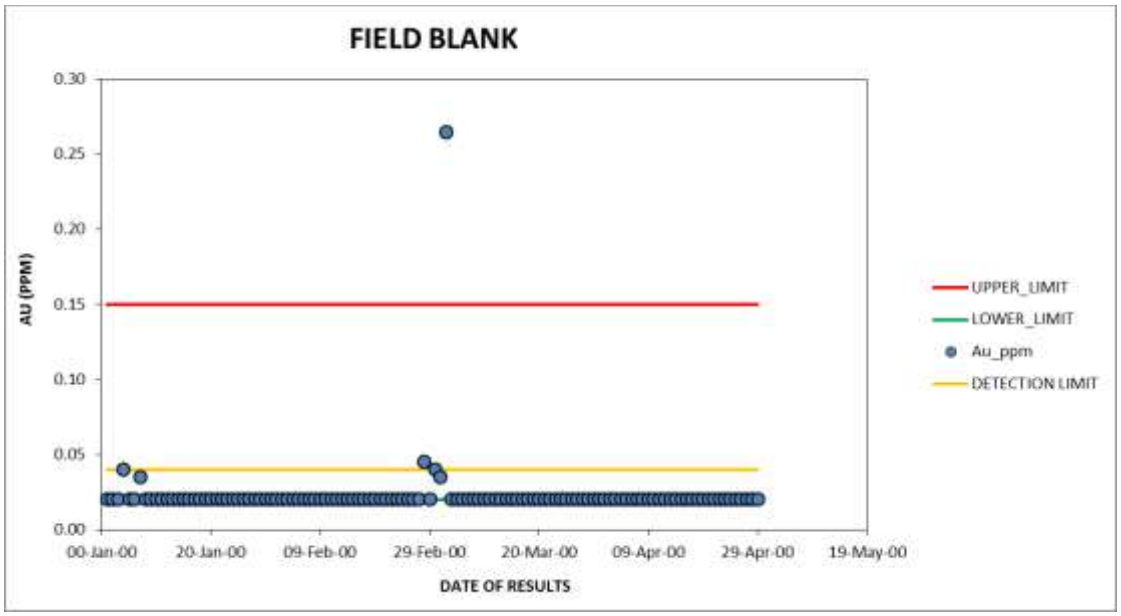
Graph 11-1: Blank Plot for all Four Properties - AMIS0415



Graph 11-2: Blank Plot for all Four Properties - AMIS0439



Graph 11-3: Blank Plot for all Four Properties - AMIS0484

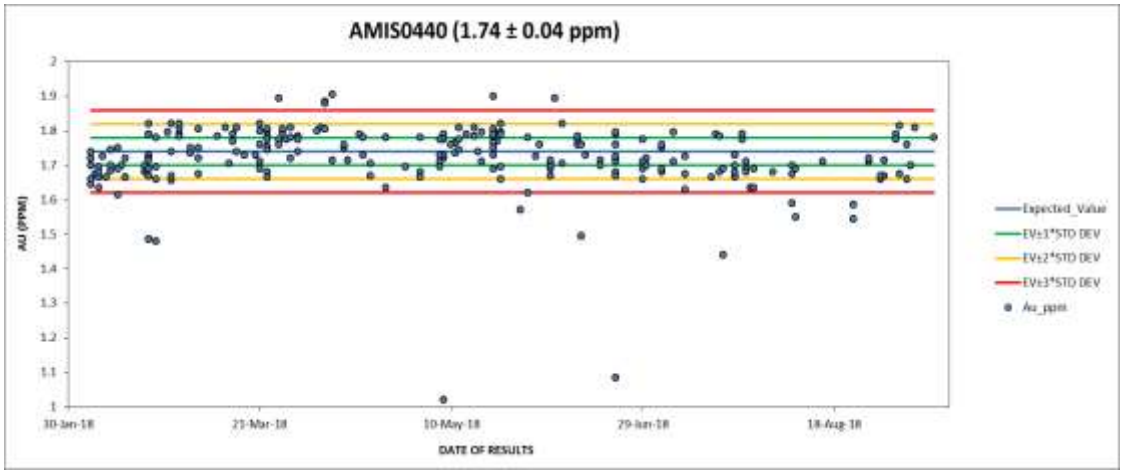


Graph 11-4: Plot for Field Blank (Local Dolerite)

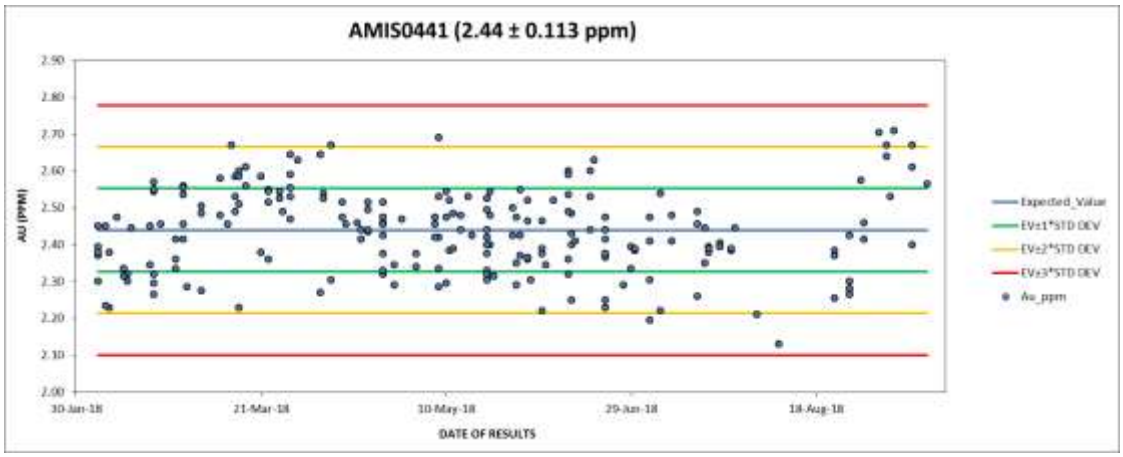
11.1.2 Standards

CRMs were sourced from AMIS in South Africa and Geostats Pty Ltd in Australia for the previous drilling campaign. For the current drilling campaign, CRM was sourced from AMIS. AMIS0440, AMIS0441, AMIS0473, AMIS0525, and AMIS0526 were used during the 2018 drilling and sampling campaign. These represent the grade distribution observed at Bilboes. AMIS0473 has a recommended grade of 0.41 g/t, for AMIS0526 the recommended grade is 1.03 g/t, 1.74 g/t for AMIS0440, 2.44 g/t for AMIS0441, and 8.04 g/t for AMIS0525.

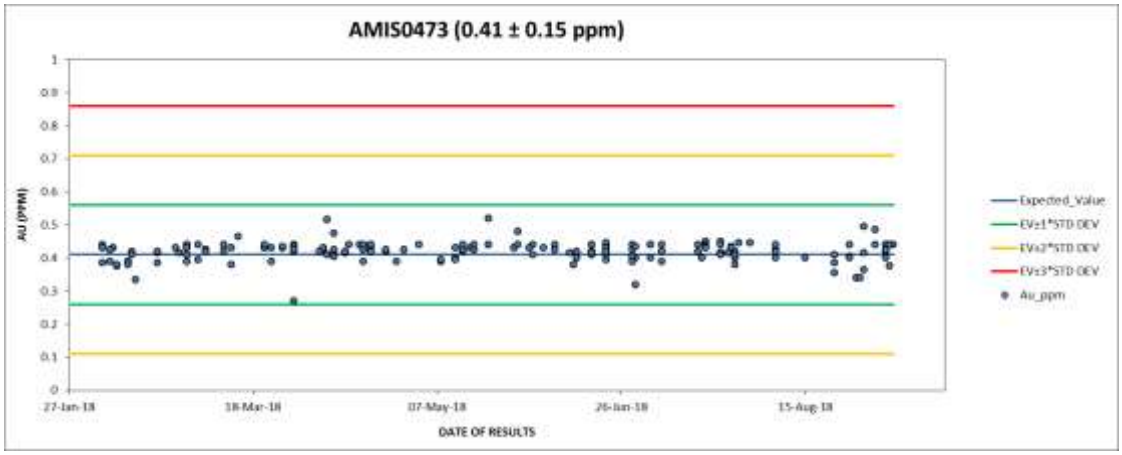
Graph 11-5 below illustrates gold concentrations as observed in the CRM AMIS0440. Most samples plot within three standard deviations of the recommended mean value of 1.74 g/t. some seventeen samples plot outside the allowable three standard deviations limit. This is to be expected of a low / middle grade CRM. All samples representing CRM AMIS0441 (Graph 11-6) plot within three standard deviations of the recommended mean value of 2.44 g/t with most samples lying within two standard deviations. For AMIS0473 (, all samples lie within one standard deviation of the mean of 0.41 g/t. shows gold concentrations as observed in CRM AMIS0525. Here all samples, bar one plot within two standard deviations of the mean value of 8.04 g/t. However, a slight positive bias is observed for AMIS0525 with a majority of the samples lying above the recommended mean value. five samples lie outside three standard deviations of the recommended mean value of 103 g/t for CRM AMIS0526 (Graph 11-9).



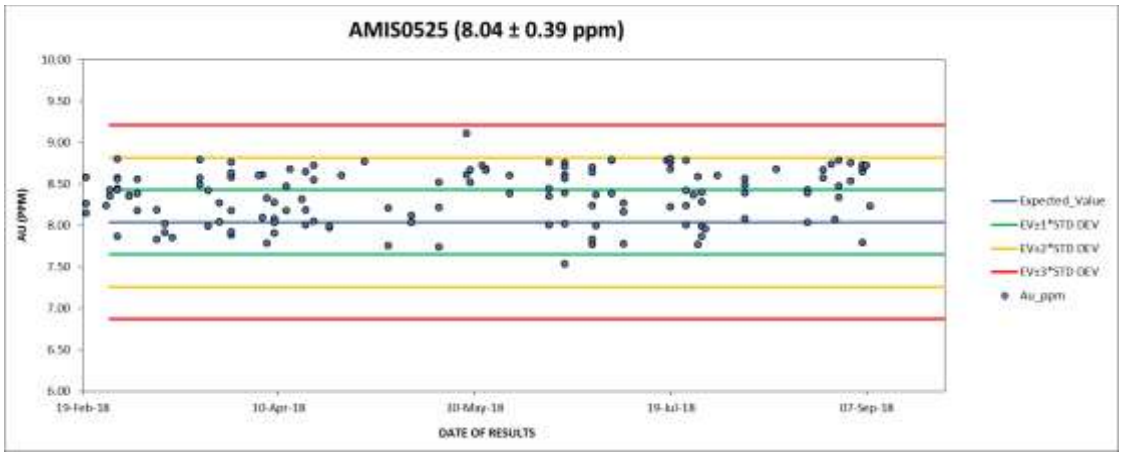
Graph 11-5: Graph Showing Au Concentration as Analysed in AMIS0440



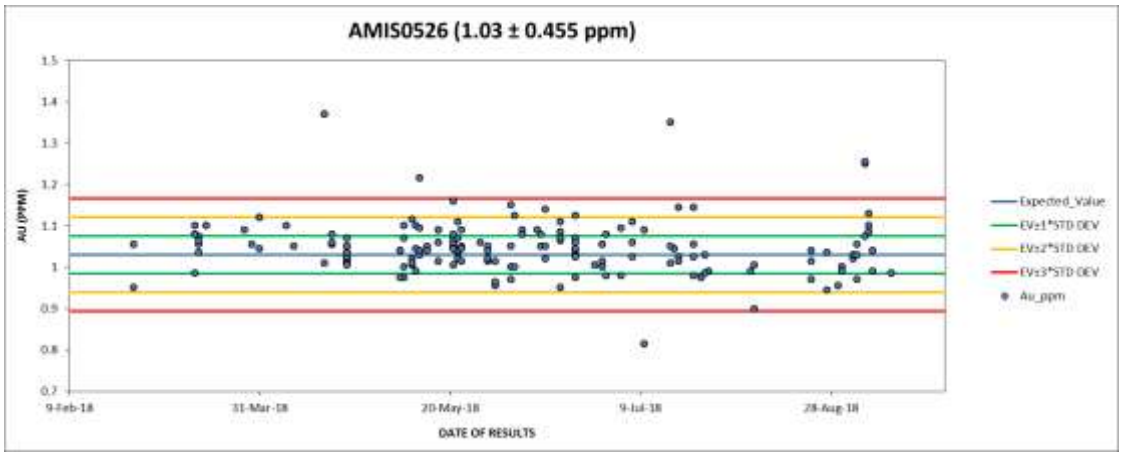
Graph 11-6: Graph Showing Au Concentration as Analysed in AMIS0441



Graph 11-7: Graph Showing Au Concentration as Analysed in AMIS0473



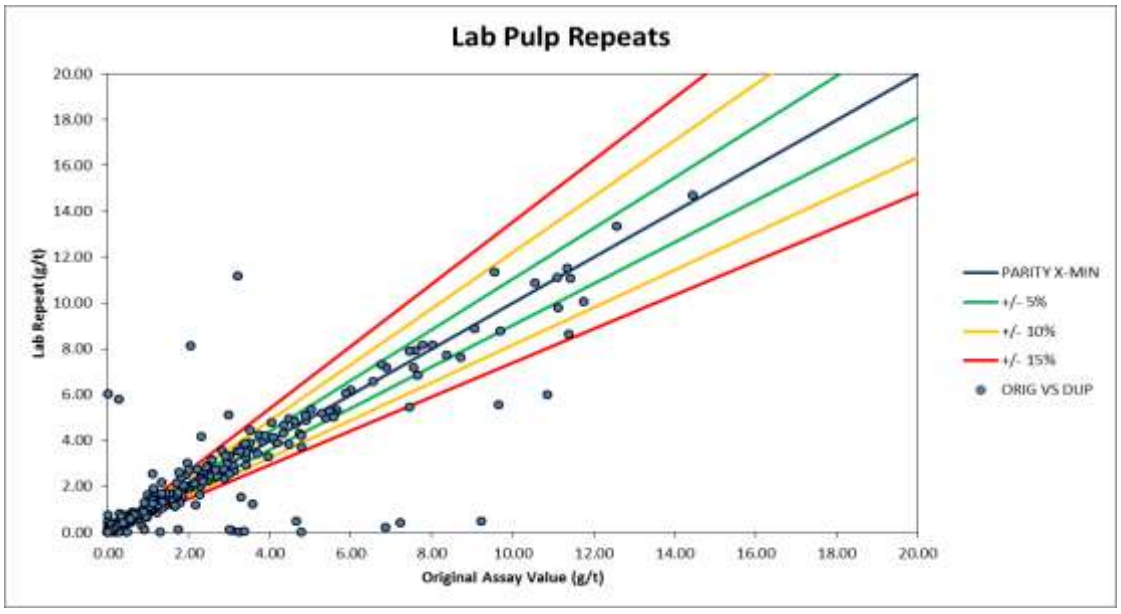
Graph 11-8: Graph Showing Au Concentration as Analysed in AMIS0525



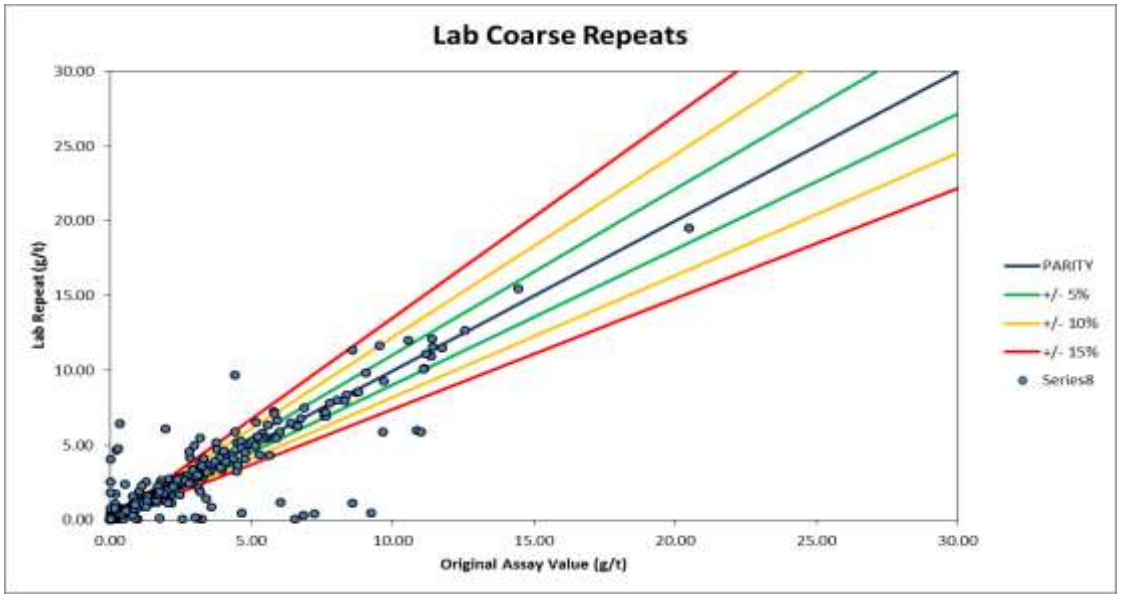
Graph 11-9: Graph Showing Au concentration as analysed in AMIS0526

11.1.3 Duplicates

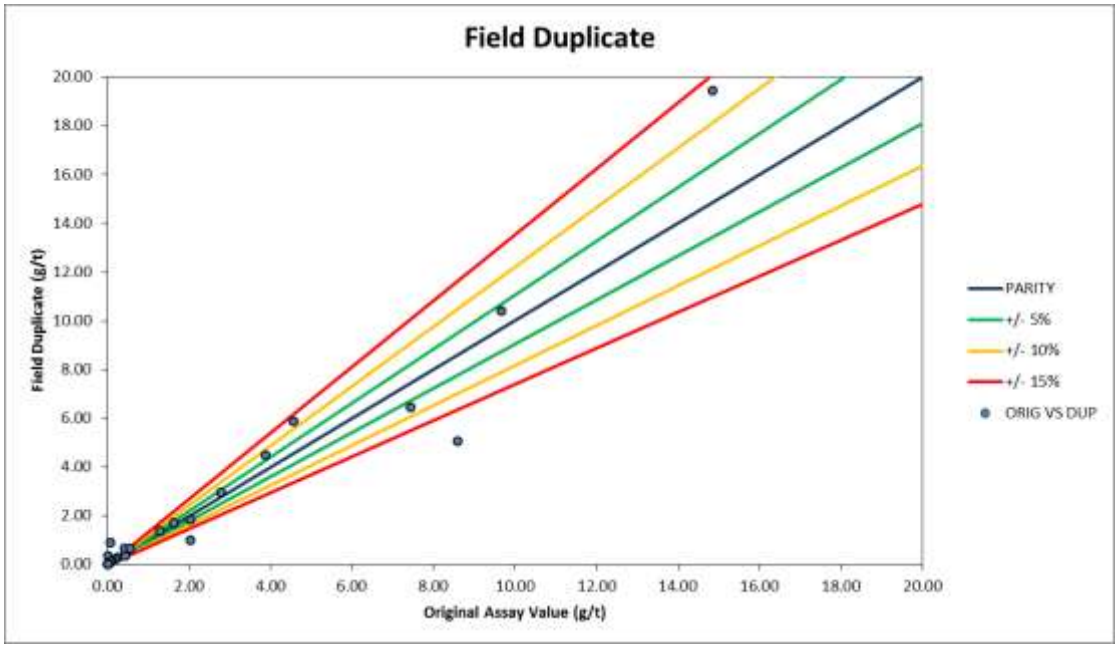
Two types of duplicates were employed in the 2011 to 2018 drilling and sampling campaigns i.e., Lab repeats and field duplicates. The former is made up of Lab Pulp Duplicates (LPR) and Lab Coarse Duplicates (LCR). There were 721 LPRs and 875 LCRs in the database for the 2018 campaign. Graph 11-10, Graph 11-11, and Graph 11-12 compare original and repeats for LPR, LCR, and field duplicates, respectively. The majority of samples were within a 15% margin. Samples that fell outside of the 15% margin could be attributed to the inherent nugget effect of the deposit.



Graph 11-10: Graph Comparing Original Assay Results to Lab Pulp Repeats



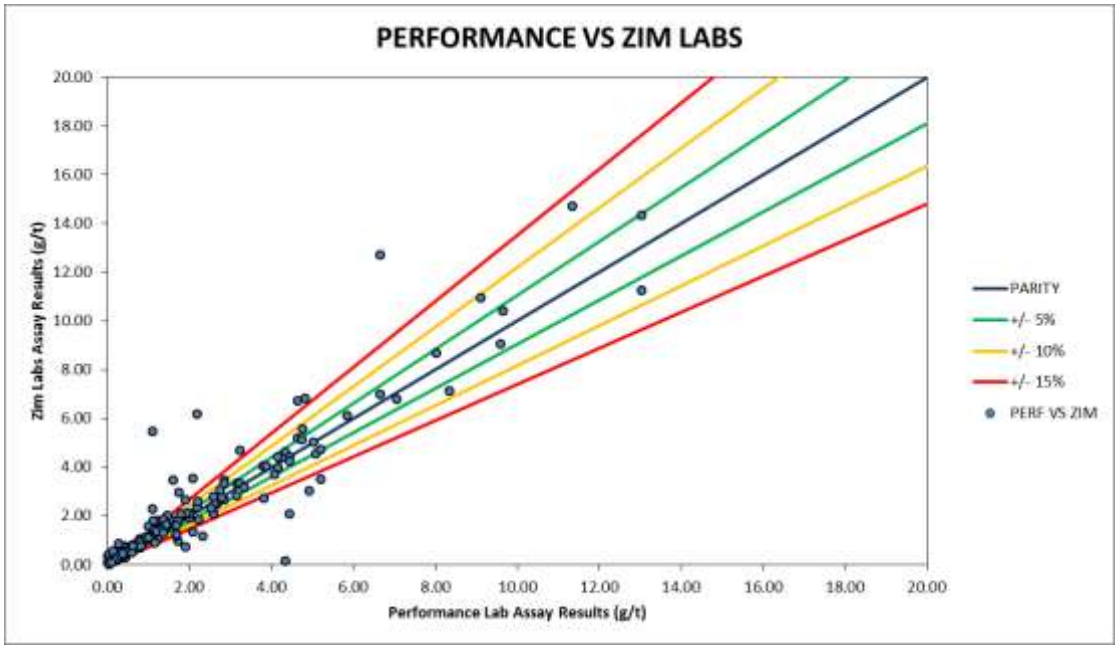
Graph 11-11: Graph Comparing Original Assay Results to Lab Coarse Repeats



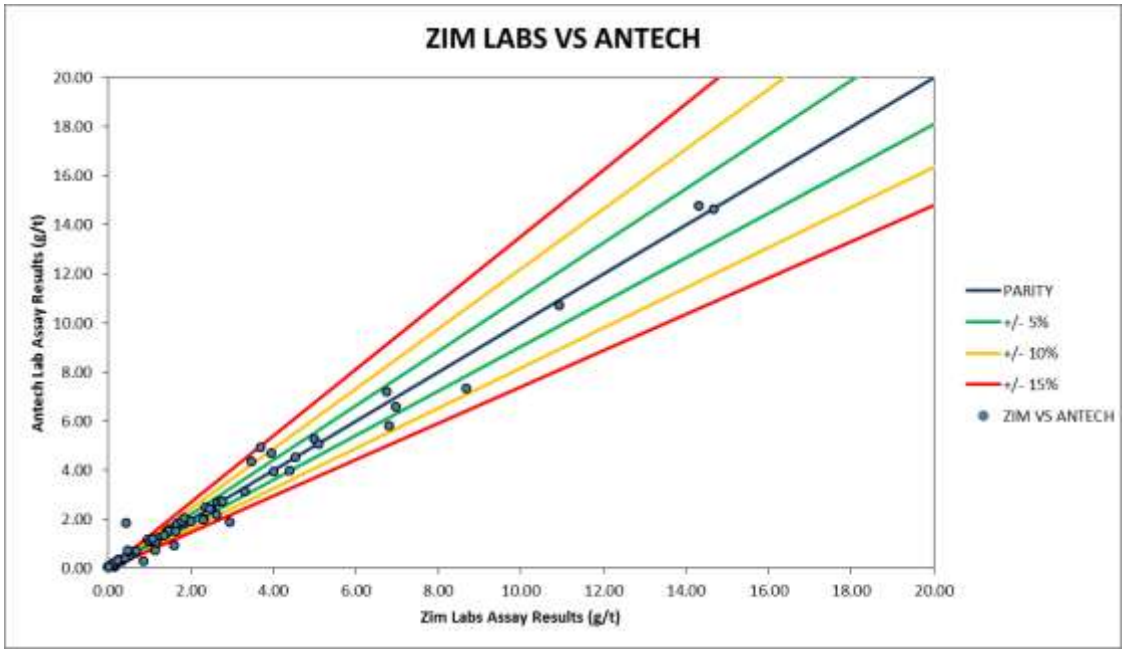
Graph 11-12: Graph Comparing Original Assay Results to Field Duplicates

11.1.4 Umpire Labs

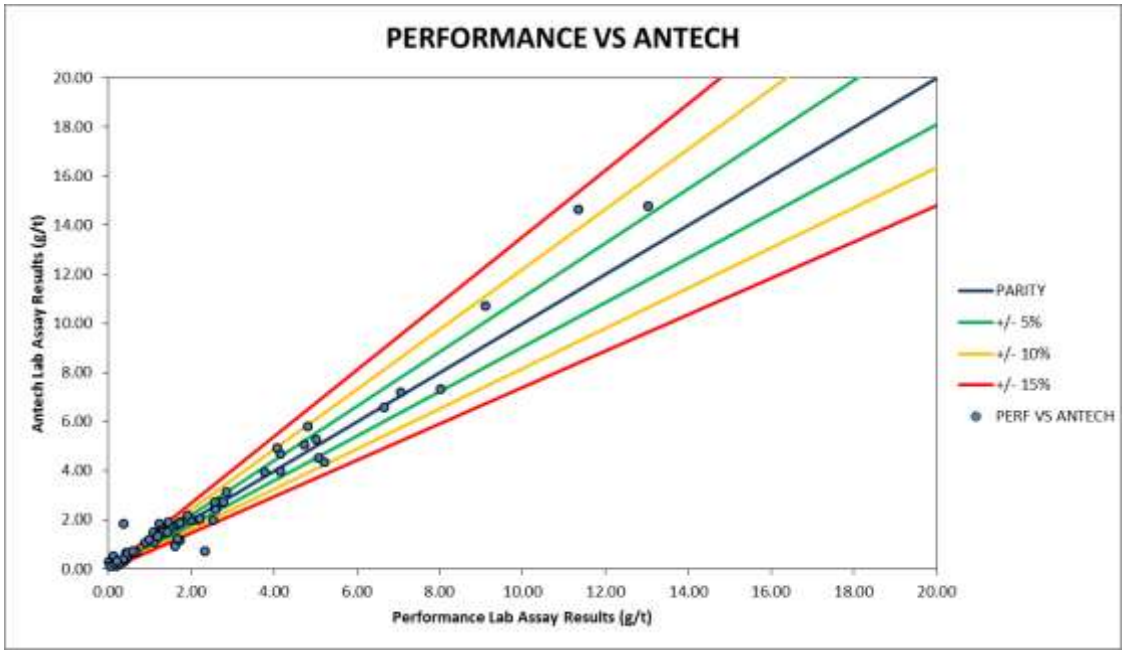
Performance Laboratories was used as the primary laboratory for analysis in the recent drilling campaigns from 2011 to 2018. To check the reliability of the results obtained from Performance Laboratories, ZIMLABS and Antech Lab were used as umpire laboratories. Graph 11-13, Graph 11-14 and Graph 11-15 results from the umpire analysis undertaken by Bilboes. The results show the acceptable correlation between the primary laboratory and the umpire laboratories.



Graph 11-13: Umpire Analysis - Performance Labs vs Zim Labs



Graph 11-14: Umpire Analysis - Zim Labs vs Antech Lab



Graph 11-15: Umpire Analysis - Performance Lab vs Antech Lab

11.2 Security

Recovery of samples from the RC and core drill rigs was done in accordance with laid down procedures adequate for the purposes of reporting of Mineral Resources. Once field measurements, markings and numbering and recording of critical information were completed, the core samples were transported daily from the drill site to the core yard and RC samples to secure metal containers to ensure security and avoid tampering, damage, loss, or

contamination. The core was adequately secured to prevent damage, loss, or mix-up during transportation. Wet RC samples were collected in calico bags to allow water to drain out and minimise sample loss prior to sun drying in metal trays in a securely fenced section of the core shed which free from dust ingress and other forms of contamination. After sampling, excess cores and RC samples have been stored at the mine in secure sample containers and the core shed and have been retained for future use. Transportation of samples to the Assay Laboratories was done utilising Bilboes vehicles accompanied by a senior member of the technical team followed the laid down chain of custody procedure between the company and the Lab to ensure sample security in transit and proper handover-takeover. Transportation of samples to the Lab was done on the same day within working hours with no unnecessary stopovers along the way to reduce risk of loss, contamination, or damage.

CCIC looked at the procedures for sampling, sample preparation protocol, sample handling and storage and are of the view that these are adequate for the purposes of reporting of Mineral Resources contained herein. Bilboes and an Independent SRK Consultant also visited and inspected the laboratories used in the analyses and can confirm that these also followed the correct procedures for sample preparation, analyses, security, and storage.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 12
DATA VERIFICATION

Document Number: JZWFM2576-STU-REP-001

DRA

12 DATA VERIFICATION

CCICs' engagement with Bilboes began with a review of their Mineral Resources as presented in the report by SRK entitled: "Independent Technical Report on Bilboes, Matabeleland, Zimbabwe" dated June 2017 by A. Ngilazi and A. Martin. During the review process, rigorous tests were carried to verify the integrity of the Bilboes database. Several queries as listed in the report by CCIC entitled: "Bilboes Holdings (Pvt) Ltd – Zimbabwe; Mineral Resource Review" dated 5 October 2017 which formed part (and is in the appendix) of the report entitled: "Review and Value Engineering of Bilboes Holdings (Private) Limited Concept Study" by DRA were documented. A recommendation from the review process by CCIC was to implement a commercial data management software, to which Bilboes complied by acquiring Datamine™ Fusion database software for the capture, storage and management of drill hole information. This Fusion database was implemented prior to the start of the 2018 drilling campaign.

The 2018 drilling programme contained 41 RC and 55 DD holes for ISBN, 27 RC and 20 DD holes for ISBS, 76 RC and 55 DD holes for McCays, and 40 RC and 13 DD holes for Bubi. With regards to the 2018 data, CCIC performed various checks to verify the integrity of the collar co-ordinates, logging and sampling procedures, and assay results. CCIC communicated all queries that were identified in the database, with Bilboes. These were resolved, and an updated database was sent to CCIC.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 13
MINERAL PROCESSING AND METALLURGICAL TESTING

Document Number: JZWEBR6013-STU-REP-001

DRA

13 METALLURGICAL TEST WORK

13.1 Introduction

The feasibility metallurgical test work was concluded during 2019 under the supervision of DRA by the following consultants and laboratories:

- Outotec BIOMIN RSA - BIOX® test work both on-site and off-site
- Isabella Metallurgical Testwork Facility - Flotation and BIOX® test work programs
- SGS South Africa - BIOX® BAT Program, Thickening, CIL
- Outotec Test Work Facility - Dynamic settling tests BIOX® and Tailings Slurries

13.2 Metallurgical Testwork and Discussion

13.2.1 Comminution and Flotation Test Work Campaign

The feasibility metallurgical test work was concluded in different phases over a period extending from September 2013 to March 2019 as summarised in Table 13-1: and involved the following laboratories and consultants:

13.2.2 Laboratories

- Mintek (South Africa) - Mineralogical characterisation, comminution test work, preliminary process route identification test work (gravity amenability, ultra-fine grinding, flotation, and oxidation pre-treatment of the concentrate by Pressure and Bio-oxidation followed by cyanidation. Also provided check analytical services for test work conducted in Zimbabwe and other laboratories in South Africa
- Suntech (South Africa) - Flotation optimisation and variability test work and mini-bulk concentrate production for the first BIOX® test work
- SGS (South Africa) - All BIOX® test work conducted in South Africa under the supervision of Outotec, the BIOX® patent holders
- Antech (Zimbabwe) - provision of analytical services for the pilot plant campaigns conducted in Zimbabwe

13.2.3 Consultants

- MDM Engineering (South Africa) - Project Management in the early phases of the study
- Manhize Mineral Consultants (MMC) (South Africa) - Supervision and co-ordination of the test work program and responsibility for the flotation pilot plant

- Minxcon Consultants (South Africa) - Project Management and pre-liminary design and evaluation
- Eurus Mineral Consultants (EMC) (South Africa) - Review, modelling and simulation of laboratory and pilot plant test work results
- DRA (South Africa) - Feasibility study manager with responsibility for reviewing and validation of all test work for process design and the entire design of the process plant

Table 13-1: Test work Program Outline

Phase	Test work Description	Done By	Supervision and Oversight	Date
1A	Sample characterisation detailing mineralogical and chemical analysis	Mintek, South Africa	Bilboes, MMC and MDM Engineering	Sept 13 - Dec 13
1B	Comminution test work done on the two composites namely Composite 1 (Bubi ore) and Composite 2 (combination of Diana, Calcite, Castile, Maria and McCays ores)	Mintek, South Africa	Bilboes, MMC and MDM Engineering	Jan 14 - Apr 14
2	Selection of a process route covering gravity amenability tests, flotation optimisation and treatment of the sulphide flotation concentrates via POX, BIOX®) and Ultra-fine grinding followed by cyanidation	Mintek and Suntech, South Africa	Bilboes and MMC	May 14 - Sept 14
3	Variability flotation tests and bulk flotation concentrate production for additional BIOX®) and gold leach tests	Suntech and SGS, South Africa	Bilboes, Minxcon and MMC	Oct 15 - Aug 16
4A	Laboratory and Pilot plant test work campaigns on the different ore types to generate additional flotation kinetics and grind data, bulk concentrates for BIOX® pilot plants, flotation design parameters and validate flowsheet	MMC at the client's project site in Zimbabwe	Bilboes and DRA	Apr 18 - Sept 18
4B	Review, modelling and simulation of laboratory and pilot plant test results	EMC, South Africa	Bilboes, MMC and DRA	Oct 18 - Mar 19

Phases 1 to 3 constituted preliminary test work and phase 4 (Pilot plant, supplementary laboratory test work, modelling and simulation the definitive test work.

13.2.3.1 *Phase 1a-Chemical Analyses and Mineralogical Characterisation*

This section summarises the mineralogical and chemical analyses of the ores.

13.2.3.1.1 *Metallurgical Test Work Samples*

The initial test work (Phases 1 and Phase 2) was based on a one tonne bulk sample collected from drill cores from the Isabella McCays pits, namely, Diana, Maria, Castile and McCays with Bubi as a standalone mine. While the mineralogical and Communition characterisation was conducted on the individual pit samples, subsequent flotation test work for the Isabella McCays

was conducted on a blend of the four mine pit samples labelled as Composite 2 with the Bubi sample indicated as Composite 1.

In all test work involving blending of the Isabella McCays pit samples, this was done to represent the proportions of the mineable resources from the different pits over the LoM to the extent that was practical subject to availability of sufficient samples.

The naming of the pits was also subsequently changed in the latter tests where Diana was renamed Isabella North (ISBN), with Maria and Castile combined as Isabella South (ISBS) based on their sizes and proximity and similarities. The percentage contributions of the pit samples, the re-constituted naming and composite numbering is shown in Table 13-2 below:

Table 13-2- Preliminary Sample Description and Composition

Composite No.	Mine Cluster	Pit2	Pit1	% Contribution
1	Bubi	Bubi	Bubi	100
2	Isabella McCays	Isabella North (ISBN)	Diana	48
		Isabella South (ISBS)	Castile	21
			Maria	7
		McCays	McCays	24
1 Original pit description				
2 Updated pit descriptions				

13.2.3.1.2 *Chemical Analysis*

Results of sample analyses conducted on twelve individual samples (for variability analyses) and sub-samples of five composites from the different pits are summarised in Table 13-3 and Table 13-4.

13.2.3.1.3 *Variability Samples*

- Gold content in the samples was calculated at an average from 3 - 5 measurements and varied from 3.1 mg/kg to 6.8 mg/kg. Exception was Maria sample with 30 mg/kg Au content which was an anomaly
- All samples contained high concentrations of Si, Al, Ca, Fe and As. Total sulphur concentrations in the samples varied from 1.2% to 5.3% and significant amounts of it was sulphide specie
- Samples from the McCays deposit had 1.5-2.4% elemental sulphur. Sulphate detected in the samples varied from 0% and 6%

- Total carbon in the ores was detected at 1.3 - 5.3% and was mainly present as carbonate. Organic carbon was low for all samples tested, indicating low potential for preg-robbing
- The Bubi ore has a higher content of sulphides and carbonates than the Isabella McCays ores
- High As content was detected in all samples which highlighted the importance of investigating as behaviour during the processing steps and to consider possible environmental issues in deciding on process route and economics. The As content in the McCays ore was disproportionately higher than the other pits

Table 13-3: Chemical Analysis-Variability Samples

Pit	Au	Mg	Al	Si	Ca	Ti	Mn	Fe	Co	Ni	Cu	As	Se	Ag	Sb	Sulphur				Carbon		
																Tot	Element	S2-	SO4	Tot	Org	CO3
	mg/Kg	%							mg/Kg							%						
Bubi	4,19	1,8	6,51	26,1	4,35	0,34	0,1	5,22	<10	27	72	>1000	10,8	0,60	25,7	2,78	<0.1	2,3	1,44	2,13	0,03	10,5
	3,15	3,81	3,15	21	8,09	0,41	0,13	7,21	37	22	133	1907	7,8	2,00	105,0	5,29	<0.1	3,32	5,92	4,51	0,14	21,8
	3,26	3,45	6	17,6	7,45	0,52	0,13	7,21	47	27	67	2544	11,3	0,60	15,5	3,8	<0.1	3,38	1,27	4,13	<0.01	20,6
Diana	6,79	1,22	5,42	27,8	3,31	0,29	0,14	6,02	<10	<10	43	<10	10,0	1,00	6,9	2,08	1,08	1	<0.1	2,44	0,04	8,0
	5,71	0,78	6,53	27,9	2,85	0,3	0,074	6,17	32	<10	37	>1000	10,2	1,20	15,3	3,95	0,17	2,83	2,86	1,57	0,05	7,6
	4,82	0,89	6,97	27,9	3,26	0,27	0,1	6,07	25	<10	<10	>1000	11,4	0,80	19,3	4,13	0,44	3,13	1,67	1,86	0,02	9,2
Maria	29,98	1,01	5,66	31,6	2,78	0,27	<0.05	2,73	<10	<10	<10	6391	10,8	2,50	6,8	1,19	<0.1	0,83	1,09	1,51	<0.01	7,6
McCays	4,7	3,99	5,59	15,4	9,08	0,32	0,17	6,57	<10	47	62	6726	12	0,90	33,0	3,27	2,43	0,84	<0.1	5,33	0,06	9,7
	4,12	2,84	4,77	24,3	5,7	0,32	0,088	4,3	<10	48	52	11374	11,1	1,50	51,5	3,06	2,06	0,94	0,19	3,51	0,08	17,3
	3,11	1,15	7,61	25,5	3,44	0,42	0,088	4,82	<10	<10	39	7167	11,9	0,70	42,8	2,81	1,62	1,19	<0.1	2,03	0,08	17,2
Castile	5,85	0,82	11,2	23,2	2,63	0,91	0,057	4,02	<10	<10	49	1753	9,9	1,10	9,3	4,22	1,51	2,49	0,67	1,29	0,04	26,3
	6,36	0,83	6,69	29,1	2,98	0,35	0,065	3,89	<10	<10	<10	<10	10,1	1,50	9,7	2,43	1,1	1,25	0,24	1,60	<0.01	6,3

13.2.3.1.4 *Pit Composite Samples*

- Gold grades in the composites from various locations were 1.8 - 2.8 mg/kg. It was noted and acknowledged that the Bubi and McCays composite grades at 1.8 mg/kg and 1.6 mg/kg were below the expected LoM grades due to sampling issues which were resolved in subsequent generation of metallurgical test work samples
- All samples contained >20% Si, >5% Al, Ca, Fe. Carbon (as carbonate) content was high, especially for Bubi and McCays pits (double amount in comparison to other composites) which is similar trend observed for variability samples
- Organic carbon level was <0.1 %. The Total sulphur content in the samples was found to be mainly in the sulphide form with the lowest content of 0.69% in the McCays ore and the highest content of 2.65% in the Bubi ore. Concentration of elemental sulphur and sulphate was very low
- The Total Sulphur concentrations varied from 0.69% - 2.7% and mostly present as sulphide. Carbonate concentrations of between 7.4% and 18.4% were detected in the samples. Samples from the McCays deposit had 1.5 - 2.4% elemental sulphur. Sulphate detected in the samples varied from 0% and 0.7%

Table 13-4: Chemical Analysis - Pit Composite Samples

Pit	Au	Mg	Al	Si	Ca	Ti	Mn	Fe	As	Se	Ag	Sb	Sulphur				Carbon		
													Tot	Element	S2-	SO4	Tot	Org	CO3
	mg/Kg	%							mg/Kg				%						
Bubi	1,8	2,01	6,84	20,8	5,13	0,39	0,11	6,2	>1000	17,9	0,74	38,6	2,65	<0.10	2,65	<0.10	2,45	0,08	12,1
Diana	2,8	0,74	5,59	22,4	2,49	0,31	0,074	3,79	>1000	10,0	0,97	9,6	1,13	<0.10	1,13	<0.10	1,50	0,08	7,4
Maria	2,7	0,93	6,75	27,1	2,68	0,32	<0.05	2,59	>1000	15,7	1,70	7,2	1,01	0,42	0,59	<0.10	1,57	0,08	7,8
McCays	1,6	3,62	5,35	20,3	5,07	0,34	0,12	5,67	>1000	17,3	0,88	29,5	0,69	<0.10	0,69	<0.10	3,71	0,08	18,4
Castile	2,3	0,81	6,38	20,3	2,75	0,38	0,066	3,84	>1000	21,4	0,83	9,0	1,51	<0.10	1,28	0,7	1,55	0,07	7,7

13.2.3.1.5 *Mineralogical Characterisation*

- Diagnostic leach results showed that gold recovery via direct cyanidation was low, varying from 25 % - 50 % and Au locked in sulphides and carbonate minerals varied from 46 % - 72 %
- Bulk modal analysis (BMA) showed that Quartz, feldspar and mica were present in major to intermediate amounts in all the samples, followed by major to minor amounts of carbonates. Sulphide minerals, pyrite and arsenopyrite, were present in minor to trace amounts throughout all samples. All other mineral phases are present in in trace amounts in all samples
- The Au bearing minerals identified in this study were electrum (AuAg) and native gold (Au). Native gold and electrum are variably distributed throughout all samples
- Most Au-bearing grains reported to the 0 - 10 µm size class fraction and a smaller quantity in the 10 - 15 µm size class fraction
- Most Au-bearing species were associated with free surface and lesser amounts were associated with sulphide minerals (varying from 0% - 88%); small percentage was associated with silicates, carbonates etc
- Pyrite was the dominant BMS mineral present as majority of the samples followed by arsenopyrite (from 5 - 58%) and trace amounts of other sulphides (sphalerite, pentlandite, chalcopyrite, chalcostibnite, ullmannite, gersdorfiite and galena)
- The majority of all BMS mineral grains (>50 mass%) in all samples reported to the finer, 0 - 21 µm size classes, with lesser amounts reporting to the coarser size classes
- The majority (>80 mass %) of pyrite, arsenopyrite and other sulphides had free surface with lesser amounts being associated with other mineral phases in all the samples examined.
- The assay-by-size results indicated that the gold (and other elements) in the samples was distributed relatively equally between different size fractions. Based on diagnostic leach results, gold recovery via direct cyanidation was low, varying from 25 % - 50%, and gold locked in sulphides and carbonate minerals varied from 46% - 72%.

13.2.3.2 *Phase 1 B: Comminution*

Comminution test work showed that Isabella and McCays samples could be classified as being hard, while Bubi ore was very hard. All samples tested could be characterised as being moderately abrasive.

The Communition results are summarised in Process Route Identification.

13.2.3.2.1 *Gravity Tests*

Gravity amenability tests indicated poor gold recoveries and varied from 14% - 22% at 0.5% mass pull. Gravity separation at higher mass pull provided higher gold recovery but still was not a feasible option.

13.2.3.2.2 *Preliminary Flotation*

Initial milling and flotation results indicated high gold recoveries of 89 - 97% with high mass pulls ranging 10 - 15%, low concentrate grades of 12 - 20 g/t Au and unacceptable high levels of carbonates in the range of 7 - 13% which were bound to negatively affect the down-stream gold recovery process. The test work established that the ores can be easily floated with good recoveries at grinds ranging from 80% of 106 - 75 µm and that flotation optimisation with respect to mass pulls, concentrate grade and other concentrate quality metrics was required.

A follow up flotation evaluation exercise was conducted to determine the optimal composition of the flotation concentrate (gold recovery and grade, mass pull, carbonate grade and therefore optimal flotation conditions) at Mintek and Suntech laboratories in Johannesburg, South Africa.

Initial flotation optimisation test work showed that it was possible to reduce carbonate concentrations in the concentrate by controlling mass pull and applying two stages of cleaning. However, some gold losses were observed (95 - 97% recovery compared to 75% - 86% after cleaner stages) and gold recovered into a flotation concentrate was at a grade of 21 - 65 g/t.

13.2.3.2.3 *Flotation Optimisation*

Subsequent flotation optimisation tests conducted at Suntech Laboratory involving the addition of depressant and 1 and 2 cleaning stages improved the overall flotation performance with recoveries ranging from 88 - 94%, mass pulls ranging 4 - 12%, concentrate grades of 50 – 120 g/t Au and acceptable carbonates levels in the range of 4 - 10%.

The optimum flotation conditions were determined to be as follows in Table 13-6.

Table 13-5: Summary of Comminution Test Results

Parameter	Unit	Value per Ore Type				
		Diana Calcite	Maria	Castile	McCays	Bubi
		Isabella North	Isabella South			
Indices						
Ai	-	0,2225	0,2402	0,2729	0,3093	0,4176
BRWi	kWh/t	15,49	17,22	16,60	17,98	21,67

Parameter	Unit	Value per Ore Type				
		Diana Calcite	Maria	Castile	McCays	Bubi
		Isabella North	Isabella South			
BBWi	kWh/t	15,79	16,95	17,44	17,81	21,45
SMC						
A		61,00	63,90	69,90	63,5	100,00
B		0,53	0,43	0,43	0,47	0,19
A × b		32,80	27,50	30,10	29,80	19,00
Ta		0,31	0,26	0,28	0,28	0,18
DWi	kWh/m³	8,35	9,96	9,29	9,41	14,74
Mia	kWh/t	22,80	25,20	24,50	24,80	34,70
Mih	kWh/t	17,70	21,00	19,40	19,50	30,00
Mic	kWh/t	9,10	10,80	10,00	10,10	15,50
Rank		965,00	441,00	687,00	665,00	37,00
%		21,9%	10,0%	15,6%	15,1%	0,8%
Category		Hard	Hard	Hard	Hard	Very Hard
t10@1 KWh/t						
A × b		25,80	22,30	24,40	23,80	17,30
Rank		944,00	438,00	798,00	686,00	67,00
%		21,5%	10,0%	18,1%	15,6%	1,5%
Category		Hard	Very Hard	Hard	Hard	Very Hard

13.2.3.3 *Process Route Identification*

13.2.3.3.1 *Gravity Tests*

Gravity amenability tests indicated poor gold recoveries and varied from 14% - 22% at 0.5% mass pull. Gravity separation at higher mass pull provided higher gold recovery but still was not a feasible option.

13.2.3.3.2 *Preliminary Flotation*

Initial milling and flotation results indicated high gold recoveries of 89 - 97% with high mass pulls ranging 10 - 15%, low concentrate grades of 12 - 20 g/t Au and unacceptable high levels of carbonates in the range of 7 - 13% which were bound to negatively affect the down-stream gold recovery process. The test work established that the ores can be easily floated with good recoveries at grinds ranging from 80% of 106 - 75 µm and that flotation optimisation with respect to mass pulls, concentrate grade and other concentrate quality metrics was required.

A follow up flotation evaluation exercise was conducted to determine the optimal composition of the flotation concentrate (gold recovery and grade, mass pull, carbonate grade and therefore optimal flotation conditions) at Mintek and Suntech laboratories in Johannesburg, South Africa.

Initial flotation optimisation test work showed that it was possible to reduce carbonate concentrations in the concentrate by controlling mass pull and applying two stages of cleaning. However, some gold losses were observed (95 - 97% recovery compared to 75% - 86% after cleaner stages) and gold recovered into a flotation concentrate was at a grade of 21 - 65 g/t.

13.2.3.3.3 *Flotation Optimisation*

Subsequent flotation optimisation tests conducted at Suntech Laboratory involving the addition of depressant and 1 and 2 cleaning stages improved the overall flotation performance with recoveries ranging from 88 - 94%, mass pulls ranging 4 - 12%, concentrate grades of 50 – 120 g/t Au and acceptable carbonates levels in the range of 4 - 10%.

The optimum flotation conditions were determined to be as follows:

Table 13-6: Summary of Comminution Test Results

Description	Value
Grind	80% - 75 µm
Reagents Dosages – g/t	
Copper Sulphate	80
Sodium Ethyl Xanthate	100
Sodium Carbonate	200 - 350
Starch	70 - 125
XP200 Frother	35 - 60

13.2.3.3.4 *Gold Dissolution from Flotation Concentrates*

Direct cyanidation of the flotation concentrate resulted in a 27% gold dissolution.

Ultra-fine grinding 80% of 20 µm followed by cyanidation and oxygenation resulted in a marginal improvement in gold dissolution from 27 - 30%.

A single Pressure Oxidation (POX) test was done on concentrate with the main objective to oxidise 100% of the sulphide which then resulted in a further 98% gold dissolution by cyanidation of the POX leach residue. Formation of Basic Ferric Sulphate (BFS) resulting in high lime and cyanide consumption in the downstream processing (cyanidation) was observed. Significant amount of or arsenic was also detected in the POX filtrate.

Bio-oxidation of the concentrate provided 99% sulphide decomposition with 97% gold dissolution by cyanidation of the bio-residue. Formation of iron and cyanide complexes was observed. The solid residue after cyanidation of the bioleach product was stable with respect to arsenic.

Based on the above results, historical test work and consideration of environmental impacts and risk minimisation by adopting commercially established and proven processes, the process route identified for additional evaluation was flotation, pre-treatment of the concentrate by Bio-oxidation followed by cyanidation.

13.2.3.3.5 *Concentrate Quality*

The qualities of flotation concentrates used for the above Bio-Oxidation and Pressure Oxidation tests were not optimised for the subsequent oxidation process and it was decided to conduct additional tests with optimised conditions. The concentrate used in the test was a blend of composites 1 and 2 from Bubi and Isabella McCays with the following analyses:

Table 13-7: Phase 2 Laboratory Flotation Concentrate Qualities

Au g/t	Ag g/t	S %	CO_3 %	Fe %	As ppm
12.09	6.93	10.2	8.39	13.3	2.57

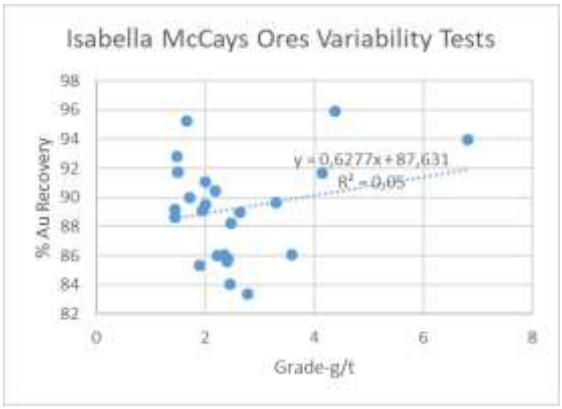
13.2.3.4 *Phase 3 – Bulk Concentrate Production and Variability Testing*

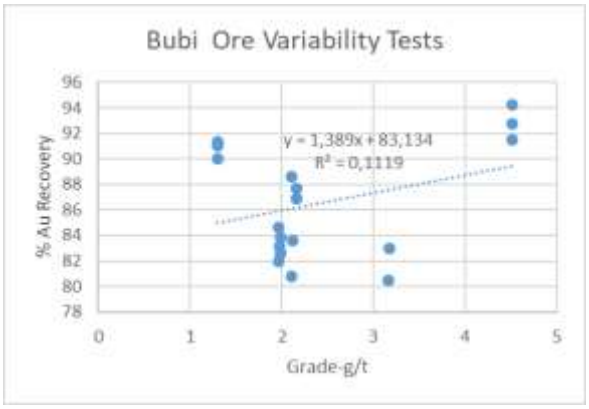
Phase 3 test work was conducted at Suntech on a 2.76 t new bulk sample comprised of approximately equal and separate portions of Bubi and Isabella McCays samples. The grades of the samples were higher that the samples used in the phase 1 test work and closer to the expected RoM grade. The composition of the bulk samples, which in the case of the Isabella McCays ores was based on the ratio of the estimated mineable resources from each pit, is shown in Table 13-8.

Table 13-8: Phase 3 Test work Bulk Sample Composition

Mine	Deposit	Pit	Resource ounces	Composite No.	% Contribution	Bulk Composite No.	Total Mass (Kg)	Grade (Au g/t)	Status
Bubi	Bubi	Bubi	1,564,990	1	100%	1	1,380,00	2,46	Stand Alone
Isabella	Isabella North	Diana-Calcite	1,162,850	2	48%	2	658,19	2,78	Combined as composite 2
	Isabella South	Maria-Castile	670,260	2	28%	2	388,20	2,80	
McCays	McCays	McCays	565,660	2	24%	2	334,00	4,42	
Total			**3,963,760**	**1 and 2**		**1 and 2**	**2,760,39**	**2,82**	

A summary the variability test work results is presented in Figure 13-1: which shows the trend of the recoveries versus grades, the average, standard deviation, variance and range of the grades and recoveries for the Isabella McCays and Bubi ores.





Statistic	Grade-g/t	% Au Rec	Statistic	Grade-g/t	% Au Rec
Average	2,51	89,2	Average	2,46	86,6
Std Dev	1,20	3,4	Std Dev	1,07	4,4
Variance	1,45	11,4	Variance	1,14	19,6
Minimum	1,44	83,4	Minimum	1,30	80,5
Maximum	6,81	95,9	Maximum	4,51	94,2

Figure 13-1: Summary of Variability Tests Results

The test work produced a total of 33 kg and 140 kg of the Isabella McCays and Bubi concentrates respectively from which samples for BIOX® test work was selected. The qualities of the selected concentrates are presented in Table 13-9 which shows comparative chemical analysis from SGS and Mintek laboratories as well the derived critical BIOX® process ratios.

Table 13-9: Phase 3 Bulk Flotation Concentrate Qualities

Assay	Unit	Bubi		Diana Calcite		McCays		Maria Castile	
		SGS	Mintek	SGS	Mintek	SGS	Mintek	SGS	Mintek
Au	g/t	23,20	23,00	67,60	68,40	95,90	96,70	50,80	59,00
Ag	ppm	2,60	2,70	15,10	15,60	12,60	12,50	11,70	12,50
Fe	%	31,40	35,90	30,80	27,90	32,40	36,00	30,80	30,90
As	%	4,70	4,90	17,00	14,20	17,80	17,10	6,90	6,90
CO32-	%	3,40	2,00	0,90	1,20	5,80	8,30	1,40	2,40
S	%	34,40	30,20	26,10	25,50	27,10	32,50	30,40	28,30
Au:S Ratio		0,67	0,76	2,59	2,68	3,54	2,97	1,67	2,09
S:CO32- Ratio		7,29	6,15	1,54	1,79	1,52	1,90	4,43	4,12
Fe:As Ratio		6,65	7,33	1,81	1,97	1,82	2,11	4,49	4,51

13.2.3.5 *Phase 4A – Pilot Plant and Additional Laboratory Test work*

13.2.3.5.1 *Pilot Plant Test work*

13.2.3.5.1.1 *Objectives*

The pilot plant test work was conducted over a period of three months from July 2018 to September 2018, with the follow up laboratory test work being conducted between September 2018 and January 2019

The objectives of the pilot plant were as follows:

- Demonstration of the capability of the plant to achieve the flotation performance attained from laboratory tests during pre-feasibility study test work with reference to gold recoveries, concentrate gold grades and other quality specifications
- Generate enough bulk concentrates within specifications for processing in the onsite BIOX® pilot plants as part of the feasibility study
- Generate process design criteria information for the proposed commercial plant
- Provide training in the operation of flotation plant to the Bilboes employees

13.2.3.5.1.2 *Bulk Sampling*

The bulk samples for the pilot and laboratory test works were co-generated with resources drilling samples as chips through RC drilling.

The quantity of samples generated was based on the planned pilot plant campaigns and feed rate. The total quantity of samples generated, and the criteria is summarised in Table 13-10 which shows a total of 20 and 15 t respectively for the Isabella McCays cluster and Bubi deposits.

Table 13-10: Pilot Plant Campaigns Bulk Samples

Pit	Resource Ratio	No of PP Campaigns	Bulk Sample (t)
McCays	0.17	2	3.4
Isabella South	0.32	2	6.4
Isabella North	0.51	4	10.2
Total Isabella McCays	1.00	8	20.0
Total Bubi		4	15.0
Total		**12**	**35.0**

13.2.3.5.1.3 *Pilot Plant Operation and Flowsheets*

The pilot plant comprised a ball mill in a closed circuit with a classification screen and a flotation circuit and was operated at solids feed rate of 270 kg/hr on average. Each ore type was

processed separately with the number of campaigns to produce concentrates. In the case of the Isabella McCays ores, the concentrates were blended according to the targeted resource ratio to produce a blend for the BIOX® pilot plant and the concentrates from the Bubi ore campaigns were blended into a single bulk concentrate for separate BIOX® piloting test work.

The flowsheets evaluated during the pilot plant campaigns are shown Figure 13-2:.

Flowsheet 2 was ultimately adopted as the preferred flowsheet based on better recoveries and concentrate grades.

The duration for each campaign averaged 10 - 12 hours of continuous operation with sampling being conducted once steady state was attained.

Reagent addition was maintained as per the following optimum conditions established during phase 2 test work:

Table 13-11: Optimum Conditions in Phase 2 Test Work

Description	
Copper Sulphate	80 g/t
Sodium Ethyl Xanthate	100 g/t
Sodium Carbonate	200 – 350 g/t
Starch	70 – 125 g/t
XP200 Frother	35 – 60 g/t

Due to constraints on the classification circuit, the grind on the flotation feed ranged from 63 to 68% passing 75 µm against a targeted grind of 80% - 75 µm. This outcome was addressed by conducting additional comparative laboratory flotation tests at these grinds to validate the effect of grind with modelling and simulation applied to the actual pilot plant recoveries to derive expected recoveries at the target grind as explained in the latter section.

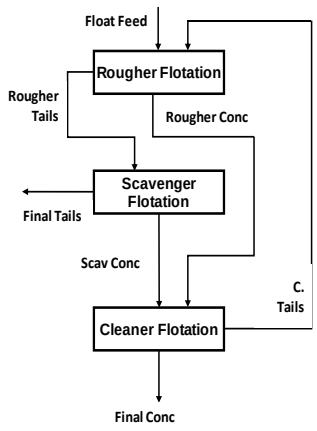
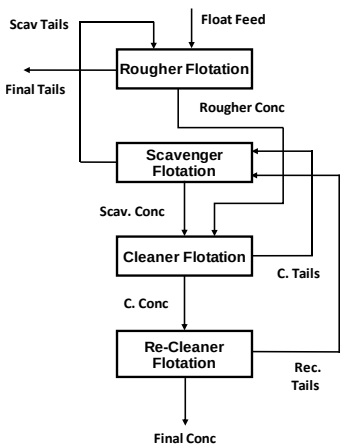
Flowsheet 1	Flowsheet 2
	

Figure 13-2: Pilot Plant Campaign Flowsheets

13.2.3.5.1.4 *Pilot Plant Results*

13.2.3.5.1.4.1 *Recoveries and Mass Pulls*

The pilot plant test work results for the Isabella McCays and Bubi ores are summarised in Table 13-12 and Table 13-13 respectively. The Isabella McCays ores gold recoveries ranged from 85.9% to 91.0% and the mass pulls ranged from 3.8 % to 6.0 % with a weighted average of 88.4% recovery and 4.9% mass pull. The Bubi ore recoveries ranged from 85.9% to 88.8% and mass pulls ranged from 7.8% to 15.2% with averages of 87.5% recovery and 10.2% mass pull.

Table 13-12: Summary of Isabella McCays Ores Pilot Plant Results

Description	Isabella North Campaigns					McCays Campaigns			Isabella South Campaigns			Isabella McCays Total
	1	2	3	4	Average	1	2	Average	1	2	Average	
Float Feed Grade	2,97	2,34	2,00	1,71	2,09	4,04	2,20	2,58	2,54	3,63	3,33	2,51
Final Tails	0,41	0,20	0,29	0,22	0,25	0,32	0,38	0,37	0,21	0,36	0,32	0,31
Measured Bulk Conc Wt-Kgs	46,9	68,0	41,62	70,2	226,7	91,02	214,38	305,40	37,01	106,22	143,23	675,35
Bulk Conc Au Grade g/t	39,90	53,48	47,18	52,34	49,16	43,62	34,80	37,43	44,88	59,19	55,49	45,20
Calculated Feed-Kgs	724	1 692	1 141	2 457	6 013	1 059	4 054	5 114	710	1 911	2 621	13 748
Conc Ratio	15,42	24,90	27,42	34,98	26,52	11,64	18,91	16,74	19,17	17,99	18,30	20,36
Mass Pull	6,5%	4,0%	3,65%	2,9%	3,8%	8,6%	5,3%	6,0%	5,2%	5,6%	5,5%	4,9%
Recovery by Assays	87,1%	91,8%	86,0%	87,5%	88,5%	92,8%	83,6%	85,5%	92,2%	90,6%	91,0%	88,4%

Table 13-13: Summary of Bubi Ore Pilot Plant Results

Description	Bubi Campaigns				Average
	1	2	3	4	
Float Feed Grade	2,48	2,89	2,57	3,92	2,97
Final Tails	0,35	0,37	0,42	0,51	0,41
Measured Bulk Conc Wt-Kgs	221	212	218	149	800
Bulk Conc Au Grade g/t	25,9	32,3	17,8	27,3	25,6
Calculated Feed	2 622	2 731	2 300	982	8 635
Conc Ratio	11,9	12,9	10,5	6,6	10,5
Mass Pull	8,4%	7,8%	9,5%	15,2%	10,2%
Recovery by Assays	87,1%	88,2%	85,9%	88,8%	87,5%

13.2.3.5.1.4.2 *Chemical Analyses of Bulk Concentrates*

The analyses of the individual and blended concentrates produced from the pilot plant operation for the BIOX® process piloting is presented in Table 13-14. The results indicate that the concentrate specifications meet the BIOX® process criteria with respect to most of the element ratios apart from the Isabella North concentrate whose Fe: As molar ratio was marginally below the threshold of three with a value of 2.59. This variance can be managed by blending of the ores to maintain the ratio with the required specification.

Table 13-14: Assays and Chemical Analyses of the Pilot Plant Bulk Concentrates

Gold and Other Elements

Source	Au	Ag	Hg	C - Comb	CO3_DIFF	W_C_ORG	W_C_TOT	S - Comb	Sulphide S
	ppm	ppm	ppm	%	%	%	%	%	%
Isabella South	60,0	12,55	4,33	1,165	3,48	0,47	1,17	25,2	23,15
Isabella North	46,6	7,6	4,2	1,68	5,95	0,49	1,68	17,5	16,30
McCays	42,5	6,6	2,3	2,47	10,4	0,39	2,47	16,0	15,40
Blended Isabella McCays	48,1	8,2	3,3	1,83	6,93	0,44	1,83	19,8	17,30
Bubi	27,7	1,9	2,4	1,08	3,65	0,35	1,08	26,5	26,80

Base Metals

Source	Al	As	Ca	Co	Cr	Cu	Fe	Mg	Mn	Ni	Pb	Si	Ti	V	Zn
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Isabella South	3,95	7,60	1,57	<0.05	0,073	0,070	26,8	0,61	<0.05	<0.05	<0.05	11,833	0,46	<0.05	<0.05
Isabella North	4,74	11,30	2,51	<0.05	0,081	0,084	21,8	0,93	0,055	<0.05	<0.05	14,7	0,44	<0.05	<0.05
McCays	2,59	8,12	5,38	<0.05	0,063	0,110	21,0	3,78	0,087	0,1	<0.05	12,6	0,28	<0.05	<0.05
Blended Isabella McCays	3,85	9,21	3,08	<0.05	0,084	0,094	22,2	1,73	0,057	0,052	<0.05	13,3	0,39	<0.05	<0.05
Bubi	3,14	4,88	2,71	<0.05	<0.05	0,075	29,9	1,08	0,057	<0.05	<0.05	10,3	0,30	<0.05	<0.05

Critical Concentrate Ratios

Source	$Au:S^{2-}$	$S^{2-}/(As+ CO_3^{2-})$	Fe:As Molar Ratio
Isabella South	2,59	2,09	4,72
Isabella North	2,86	0,94	2,59
McCays	2,76	0,83	3,47
Blended Isabella McCays	2,78	1,07	3,23
Bubi	1,03	3,14	8,21

13.2.3.5.1.5 *Additional Laboratory Test work*

13.2.3.5.1.5.1 *Locked Cycle Flotation*

Laboratory locked cycle flotation tests on the Bubi and blended Isabella McCays ores simulating flowsheet 2 achieved similar recoveries, mass pulls and concentrate grades to those obtained on the pilot plant as summarized in Table 13-15. Depending on the applied recovery calculation formula, the recoveries had a wide range which is suspected to be a result of the locked cycle tests not achieving stability.

Table 13-15: Locked Cycle Flotation Test Results

KPI Metric	Ore Type		
	Isabella McCays Blend	Bubi Test 1	Bubi Test 2
Head grade Au (g/t)	2.9	2.2	2.5
Mass Pull (%)	5.6%	6.4%	11.0%
Conc Au Grade (g/t)	45.8	28.6	19.0
Au Recovery (%) - Conc Production	88.2%	83.3%	82.9%
Au Recovery (%) - By Assays	97.5%	87.2%	89.0%
Au Recovery (%) - By Weights and Assays	97.2%	86.6%	88.2%

13.2.3.5.1.5.2 *Flotation Rate and Comparative Grind Tests*

To determine the expected pilot plant recoveries at the target grind of 80% - 75 µm, comparative flotation rate tests were conducted on the individual ores at the pilot plant grind of 65 % - 75 µm and the target grind. The results presented in Table 13-16 show that the target finer grind of 80% - 75 µm consistently resulted in higher recoveries in comparison to the pilot plant grind of 65 % - 75 µm with recovery increments ranging from 0.2 % to 4.7% on all ore types.

Table 13-16: Comparative Grind and Flotation Rate Test Results

KPI	Grind		Var
	80 % - 75 µm	65 % - 75 µm	
McCays			
Mass Pull	7,1%	6,7%	0,4%
Conc Grade	43,4	43,2	0,2
Recovery	94,6%	89,8%	4,7%
Isabella South			
Mass Pull	6,3%	5,7%	0,6%
Conc Grade	43,1	38,7	4,4
Recovery	89,5%	87,0%	2,6%

KPI	Grind		Var
	80 % - 75 µm	65 % - 75 µm	
Isabella North			
Mass Pull	5,4%	3,9%	1,5%
Conc Grade	22,6	20,0	2,6
Recovery	92,1%	91,9%	0,2%
Bubi			
Mass Pull	8,9%	8,3%	0,7%
Conc Grade	30,1	27,8	2,2
Recovery	93,0%	90,1%	2,9%

The rate flotation information from the test work was used to derive kinetic parameters based on Kellsal's equation, which were applied in the simulation outlined in the next section.

13.2.3.6 *Phase 4B – Modelling and Simulation*

13.2.3.6.1 *Grind and Recoveries*

Eurus Mineral Consultants (EMC) were engaged to review the entire metallurgical test work results on the Bilboes ore and the rate and grind test results which indicated improvement in recovery with a finer grind. The specific scope of work for EMC was to kinetically analyse the flotation response of the ore and simulate flotation performance for the pilot plant at the attained grind of 65 % - 75 µm and thereafter simulate the pilot plant performance for the intended finer grind of 80 % - 75 µm to determine what the recovery and concentrate grade would have been if the plant had operated at this grind.

EMC has developed proprietary software SUPASIM® used in flotation simulation and empirical mill sizing and KinCalc® which determines flotation kinetics from laboratory and pilot rate test data. To date the software has been used to simulate and design nine operating float plants from laboratory data only in addition to the simulation and optimization over fifty other plants covering various base and precious metals including gold. EMC also maintains a large database of milling and flotation operations as well as associated laboratory and pilot test data to characterise ores and predict plant performance.

The comparative results of the simulated pilot plant recoveries at 80% - 75 µm and the actual recoveries at 65% - 75 µm are presented in Table 13-17. The results indicate an expected recovery improvement of 3.1% and 4.2% on the Isabella McCays and Bubi ores with grind improvement from 65% - 75 µm to 80% - 75 µm respectively. The expected plant recoveries

at the target grind for the Isabella McCays and Bubi ores are 90.0% and 91.1% respectively as shown in Table 13-17.

Table 13-17: Comparative Pilot Plant Simulated Recoveries

Ore Source	Head g/t	65% - 75 µm (Pilot Plant)			80% - 75 µm (Simulation)			Var:(80% - 75 µm) -(65% - 75 µm)		
		% Mass Pull	Conc g/t	% Rec	% Mass Pull	Conc g/t	% Rec	% Mass Pull	Conc g/t	% Rec
Isabella North	2,00	4,2	41,3	86,1	4,4	40,5	89,2	0,2	-0,8	3,1
Isabella South	2,54	5,1	45,4	90,3	5,2	44,6	92,0	0,2	-0,8	1,7
McCays	2,20	5,5	33,7	83,7	5,9	33,3	88,8	0,4	-0,4	5,1
Isabella McCays Total*	2,20	4,7	41,0	86,9	4,9	40,3	90,0	0,3	-0,7	3,1
Bubi	2,59	8,7	26,0	86,9	9,2	25,6	91,1	0,6	-0,4	4,2

* Based on ISBN-50 %, ISBS-30%, McCays-20%

Table 13-18: Expected Plant Recoveries

Ore Source	Head g/t	% Mass Pull	Conc g/t	% Rec
Isabella North	2,00	4,4	40,5	89,2
Isabella South	2,54	5,2	44,6	92,0
McCays	2,20	5,9	33,3	88,8
Isabella McCays Total*	2,20	4,9	40,3	90,0
Bubi	2,59	9,2	25,6	91,1

*Based on ISBN-50%, ISBS-30%, McCays 20%

13.2.4 Flotation Residence Times

The modelling and simulation were also applied to derive requisite flotation residence times for the proposed flow sheet 2 which as follows:

Table 13-19: Flotation Residence Times

Flotation Stage	Residence Time-Mins
Rougher	84
Cleaner	68
Re-Cleaner	46
Cleaner and Recleaner Scavenger	55

13.2.5 Projected Operational Gold Recovery

The following observations from the pilot plant and modelling and simulation results provide evidence of expected higher operational recoveries than the average expected 90.0% and 91.1% derived for the Isabella McCays and Bubi ores respectively.

13.2.5.1 *Flotation Recovery Variation with Head grade*

The actual pilot plant recoveries (unadjusted for the grind) show trends of recovery increases with head grades as depicted in Figure 13-3 below. Given that the average pilot plant head grades were marginally lower that the expected LoM head grades (2.2 g/t for Isabella McCays vs 2.4 g/t for Isabella McCays and 2.59 g/t vs 2.60 g/t for Bubi) and that the below indicated recoveries are expected to be 2% - 4% higher with improvement in grind from 80% - 65 µm to 80% - 80 µm it is expected that there is an opportunity to improve the operational recoveries beyond the 90.0% and 91.1% with good mining practice that delivers the planned LoM head grades.

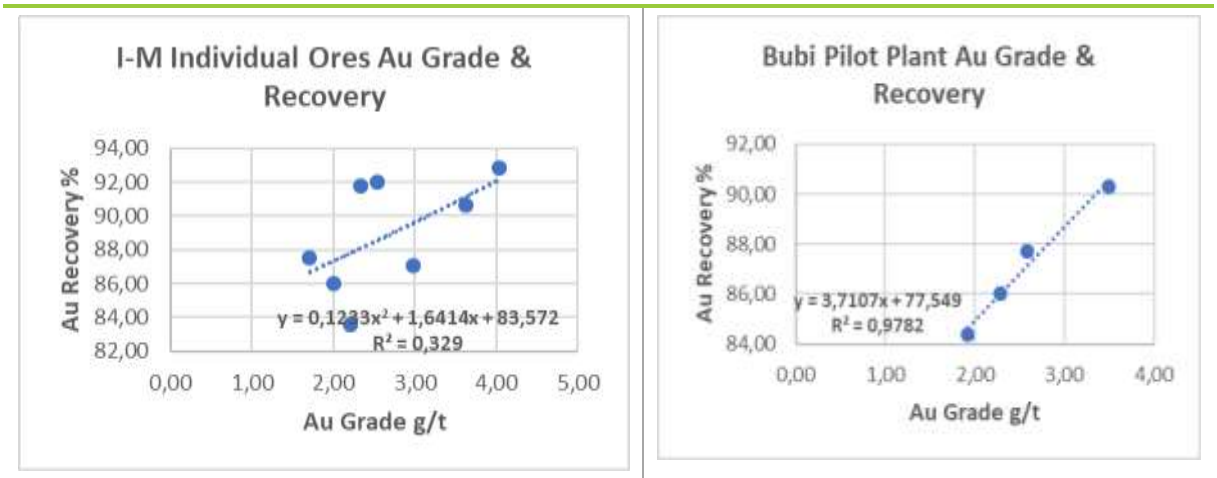


Figure 13-3: Variation of Pilot Plant Recoveries with Head grades

13.2.5.2 *Finer Grinding*

Laboratory test work and plant simulation results showed marginal improvement in recoveries ranging from 0.3% - 0.9% with finer grinding from 80% - 75 µm to 90% - 75 µm. Although marginal and subject to further validation and analysis of economic benefits, the trend provides a basis for additional optimisation prior to implementation or continuous improvement during the operational phase.

13.2.5.3 *Flotation Circuit Configuration*

Simulation of the flotation circuit from a Rougher, Cleaner Scavenger and a common 2-stage cleaning to Rougher, Cleaner Scavenger and separate 2 -stage cleaning as depicted in Figure 13-4 showed marginal recovery improvement of 0.5 - 0.8%. This circuit reconfiguration has potential to improve recoveries subject to validation and analysis of economic benefits.

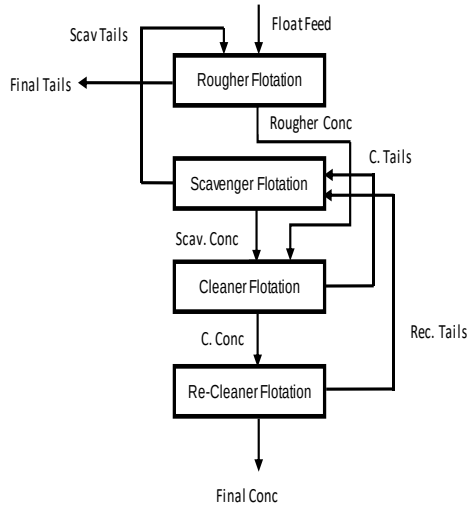
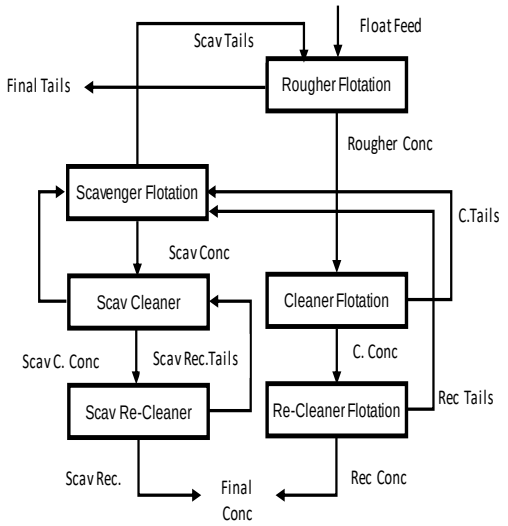
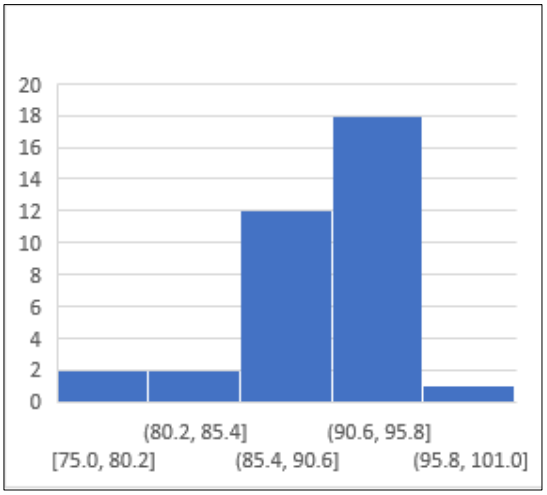
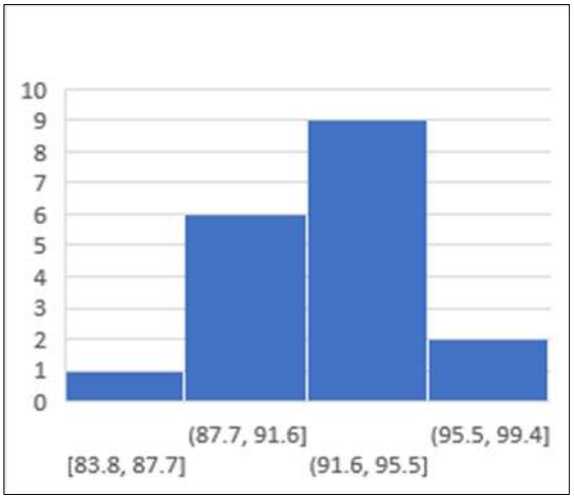
Rougher + Cleaner Scav + 2-Stage Cleaning	Rougher + Cl Scav + 2 X 2-Stage Cleaning
	

Figure 13-4: Flotation Circuit Variation

13.2.5.4 *All Test work results Analysis*

The outcomes of the test work campaign and optimization efforts have produced an average expected recovery for Isabella McCays (90.0%) and Bubi (91.1%). Correlations relating to generating a grade-recovery curve using results from all laboratory and pilot plant test work results were unsuccessful, due to scatter of results. However, it was possible to derive relevant statistical information from analysis of the results which is presented in Figure 13-5. With average expected recoveries of 90.2% and 92.1% and recovery ranges of 85.4% - 95.1% and 89.2% - 95.0% at one standard deviation for the Isabella McCays and Bubi ores respectively, the information provides further validation of the expected recoveries and the downside and upside potential.

ISABELLA MCCAYS RECOVERIES	BUBI RECOVERIES
	

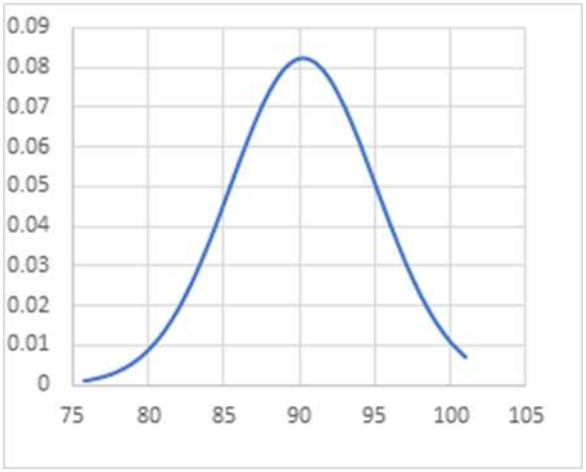
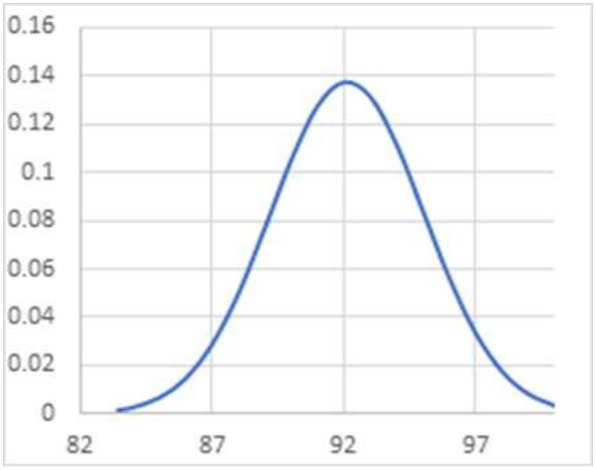
ISABELLA MCCAYS RECOVERIES		BUBI RECOVERIES	
			
Mean	90.2%	Mean	92.1%
Standard Dev	4.8%	Standard Dev	2.9%
Minimum	85.4%	Minimum	89.2%
Maximum	95.1%	Maximum	95.0%
Prob ≥90 % Rec	52.0%	Prob ≥91 % Rec	65.0%
Prob ≥95 % Rec	21.8%	Prob ≥95 % Rec	16.0%

Figure 13-5: Statistical Analysis of All Test work Results

13.2.5.5 *Improvements in Flotation Gold Recovery*

It is anticipated that with better knowledge of the recovery relationships, optimal milling and flotation design, steady state operation, higher head grades with continuous improvement and the benefits of the economies of operating experience, the downside recoveries can be avoided and that the operational recoveries ranging from a minimum of the expected values of 90.0% and 91.1% for Isabella McCays and Bubi respectively to a maximum of 95.0% for both ores may be realised.

13.2.6 BIOX® Testwork Campaign

The Isabella McCays and Bubi deposits are refractory ore deposits located in Zimbabwe. The gold present in these ores is predominantly locked in sulphide minerals making the gold unavailable for recovery via normal cyanidation procedures. The extent of gold dissolution for concentrates produced from these ores is dependent on the extent of sulphide oxidation achieved during the bio-oxidation treatment as well as the characteristics of the BIOX® product.

BIOX® pilot plant test work programs were completed on composite Isabella McCays and Bubi concentrates produced during the on-site flotation test work programs. The pilot plant

programs have provided details of sulphide oxidation performance under various operating conditions for each concentrate, as well as the relationship between gold dissolution and sulphide oxidation. This data has been used to specify certain design criteria for a full-scale BIOX® plant treating both concentrates. Associated metallurgical test work programs focussing on unit processes such as liquid – solids separation, neutralisation and BIOX® product CIL were also completed on slurries generated during each pilot plant campaign.

13.2.6.1 *Objectives*

Confirmation of the amenability of the Isabella McCays and Bubi concentrate samples to bacterial oxidation by:

- Performing a series of laboratory batch BIOX® amenability tests on various Isabella McCays and Bubi concentrate samples
- Performing a continuous BIOX® pilot plant run at different operating parameters to:
  - Determine the rate and extent of sulphide oxidation and the corresponding gold dissolution
  - Determine limestone consumption required for pH adjustment
  - Adapt the bacterial culture to ensure maximum activity under various operating conditions

Other aspects examined during the test work programs, and directed at producing additional design information, were:

- Acid capacity tests on various flotation tailing sources to evaluate the potential for use as neutralisation agent during stage one of the neutralisation circuits
- Batch neutralisation tests of the BIOX® liquor using flotation tailings, limestone and lime (AR grade) to:
  - Produce environmentally acceptable precipitates for land disposal
  - Provide a source of water for re-use in the process
  - Optimise reagent consumption through the use of flotation tailings
- Continuous neutralisation tests of the BIOX® liquor using limestone and lime (AR grade) to confirm results achieved during batch tests
- Determination of the optimum conditions for the cyanidation of BIOX® products
- Determination of thickening characteristics of various process slurries

13.2.6.2 *Summary of Results: IM Concentrate Pilot Run*

13.2.6.2.1 *Sample Characterisation*

The 528 kg Isabella McCays bulk concentrate sample was made up by combining 161 kg of McCays, 249 kg of ISBN and 118 kg of ISBS concentrate as received from the on-site flotation campaign. This was done in accordance with the anticipated commercial scale blend of 30: 47: 22 for the McCays, ISBN and ISBS concentrate feed.

The samples were sun-dried and blended. The chemical composition of the Isabella McCays bulk concentrate was analyses by two laboratories viz: Mintek and SGS, South Africa. The results are presented in Table 13-20 below. The mineral composition of the Isabella McCays concentrate samples are shown in Table 13-21.

Table 13-20: Analyses of Isabella McCays Bulk Concentrate Sample

Description	Units	Mintek	SGS	Variance (1) %
S (T)	(%)	19.6	19.1	-2.55
Au	(g/t)	48.0	49.9	3.96
S^{2-}	(%)	16.6	18.0	8.43
S^{0}	(%)	-	0.37	-
Fe(T)	(%)	21.2	22.7	7.08
CO_3^{2-}	%	6.36	6.09	-4.25
As	(%)	9.58	9,08	-5.22
C(T)	(%)	1.69	1.67	-1.18
C(org)	(%)	0.42	0.41	-2.15
Si	(%)	11.5	13.9	20.9
Hg	ppm	3.30	-	-
Sb	ppm	232	-	-
Cu	ppm	640	<500	-
$Au:S^{2-}$		2.89	2.77	-4.13
$S^{2-}/(As + CO_3^{2-})$		1.04	1.19	13.9
Fe:As		2.97	3.35	13.0

Note: (1) Variance calculated for SGS assays using Mintek assays as basis

A mineralogical investigation was conducted on various Isabella McCays concentrate samples at Mintek. The objective was to provide information on the composition of each sample. The sulphide speciation of the various concentrates can be seen in Table 13-21 below.

Table 13-21: Isabella McCays Concentrates Sulphide Mineral Species

Mineral	Formula	Mass %			
		Isabella North	Isabella South	McCays	Isabella McCays
Pyrite	FeS_2	21.4	42.5	25.1	28.5
Arsenopyrite	FeAsS	26.1	15.7	22.2	22.2
Stibnite	Sb_2S_3	-	-	0.10	0.02
Dolomite	$CaMg(CO_3)_2$	-	-	10.5	2.10
Total Sulphides		**47.5**	**58.2**	**47.4**	**50.7**

The mineralogical analysis has established that the Isabella McCays bulk concentrate sample has a mineralogical assemblage of 50.7% sulphides comprising of 28.5% pyrite: 22.2% arsenopyrite and 0.02% stibnite. The high concentration of pyrite combined with a low concentration of dolomite, will dictate that the concentrate will be acid generating during bio-oxidation treatment thus requiring the addition of limestone for pH control.

13.2.6.2.1.1 *Batch BIOX® Amenability Testing*

Batch BIOX® Amenability Tests (BAT) were performed to establish the relative rate of sulphide oxidation and gold dissolution for the various Bilboes concentrate samples. Also included were the Isabella McCays and Bubi bulk concentrates for comparison with the BIOX® pilot plant results generated for the respective concentrates. Duplicate tests (A and B) were conducted on the various Bilboes concentrates in 5 l vessels on a multi stirrer laboratory bench. Triplicate tests (A, B and C) were conducted on the Isabella McCays bulk concentrate sample.

The sulphide removal, arsenic solubilisation and corresponding gold dissolution during the bio-oxidation treatment of the various Bilboes concentrates are shown in Table 13-22.

Table 13-22: Sulphide Removal, Arsenic Solubilisation and Gold Dissolution Bilboes Concentrate Samples

Description	Duration	Sulphide Oxidation	Arsenic Dissolution	Iron Dissolution	Gold Dissolution
	(days)	(%)	(%)	(%)	(%)
McCays A	21	98.9	73.7	74.4	96.1
McCays B	24	99.1	78.6	85.4	95.9
I-S A	16	99.3	90.8	96.3	97.9
I-S B	20	98.5	83.7	96.1	97.1
I-N A	22	96.3	55.6	37.5	86.7
I-N B	24	96.3	60.5	52.8	86.4
Isabella McCays A	21	99.2	89.0	93.4	96.5

Description	Duration	Sulphide Oxidation	Arsenic Dissolution	Iron Dissolution	Gold Dissolution
	(days)	(%)	(%)	(%)	(%)
Isabella McCays B	22	98.6	81.7	79.2	95.3
Isabella McCays C	16	99.1	91.3	94.5	96.5
Bubi A	28	97.0	78.0	94.7	92.3
Bubi B	18	98.0	79.9	95.1	96.2

The BAT tests completed on the various Isabella McCays and Bubi concentrate samples achieved sulphide oxidation levels in the range 96.3% to 99.3% for batch bio-oxidation treatment times of between 16 and 24 days. Apart from the Isabella McCays BAT BIOX® product samples (A and B), these oxidation levels yielded gold dissolutions in the range 92.3% to 97.9%. An average gold dissolution of 86.5% was achieved on the Isabella McCays BAT BIOX® product samples. Although a high average sulphide sulphur oxidation of 96.3% was achieved on this sample, the iron and arsenic dissolutions were much lower compared to what was achieved on the Isabella McCays bulk concentrate sample. The Isabella McCays BAT test indicated a relatively high mass gain that is likely associated with Paragonite mineral present in the Isabella McCays concentrate at 22.4%. Paragonite is a clay mineral which tends to remove dissolved ions from solution and create precipitation conditions and negatively affected gold dissolution due to occlusion of the gold particles by precipitates.

This was believed to be more related to how pH control was managed towards the end of the BAT tests rather than any inherent properties of the Isabella McCays concentrate.

13.2.6.2.1.2 *Continuous BIOX® Operation*

The main mini plant control parameters were as follows:

- Slurry Feed Density : 20%
- Slurry temperature : 39°C - 41°C
- Slurry pH
  - Primary : 1.40 - 1.60
  - Secondary 1 : 1.40 - 1.30
  - Secondary 2 – 3 : 1.10 - 1.30
- Dissolved oxygen : 3.5 ppm to 4.5 ppm

The various phases of continuous pilot plant operation are summarised in Table 13-23.

Table 13-23: Phases of Isabella McCays BIOX® Pilot Plant Operation

Phase of Operation	Retention Time (d)	Start Date	End Date	Duration (d)	Description
I	20-10	13-Sep-18	17-Sep-18	5	Ramp-up
II	10	18-Sep-18	22-Sep-18	5	Ramp-up
III	8	23-Sep-18	27-Sep-18	5	Ramp-up
IV	7	28-Sep-18	03-Oct-18	6	Ramp-up
V	6	04-Oct-18	27-Oct-18	24	Detailed Sampling
VI	5,5	28-Oct-18	02-Nov-18	6	Transition
VII	5	03-Nov-18	04-Nov-18	2	Transition
VIII	Batch	05-Nov-18	13-Nov-18	9	Recovery
IX	6,5	14-Nov-18	13-Dec-18	30	Detailed Sampling
X	Batch	14-Dec -18	24-Dec-18	11	Extended Oxidation

The average daily sulphide oxidation as well as the corresponding average daily cyanidation gold dissolution for each phase are shown in Table 13-24.

Table 13-24: Isabella McCays BIOX® Pilot Plant Average of Daily SOX and Gold Dissolutions per Phase

Phase	Reagent Addition (kg/t BIOX® product)			Residual Cyanide NaCN (g/L)	Reagent Consumption		Cyanidation		Sulphide Oxidation Si Based (%)	Au Diss. Based on residue (%)
	CaO (kg/t)	NaCN (kg/t)*	Carbon (kg/t)		NaCN (kg/t BIOX® feed)	CaO (kg/t BIOX® feed)	Head Au (g/t)	Residue Au (g/t)		
Direct	1.49	34.8	80	5.22	13.5	0.88	49.9	36.1	-	30.9
II	16.1	20.0	80	1.13	7.99	9.87	86.6	9.00	-	90.5
III	36.4	22.0	80	1.37	17.3	37.3	51.1	10.3	-	81.4
IV	19.8	30.8	80	3.12	18.4	18.8	57.2	9.44	-	84.9
V	9.09	35.0	80	1.74	21.9	6.80	71.7	8.25	89.6	88.8
IX	7.43	35.0	80	1.54	21.9	5.52	62.4	6.92	89.1	89.2
X	3.93	35.2	80	5.41	7.07	0.92	23.2	0.94	99.6	96.2

*Note. Gradually increased to ensure sufficient available CN during the test.

The lower-than-expected sulphide sulphur oxidation levels in the pilot plant overflow product slurry is believed to be due to short-circuiting of unoxidized / partially oxidised solids between the reactors. A higher-grade froth zone was likely created at the slurry surface and around the overflow port of the reactors resulting in higher grade unoxidized particles to be preferentially passed on to the next reactor. This is the result of sulphide particles re-floating due to the presence of residual flotation reagent not removed during the washing stage (concentrate preparation) combined with the highly aerated conditions in the BIOX® mini reactors.

A comparison of gold dissolution vs. sulphide oxidation obtained using excessive cyanide additions for both the overflow and inventory samples, are shown in Figure 13-6.

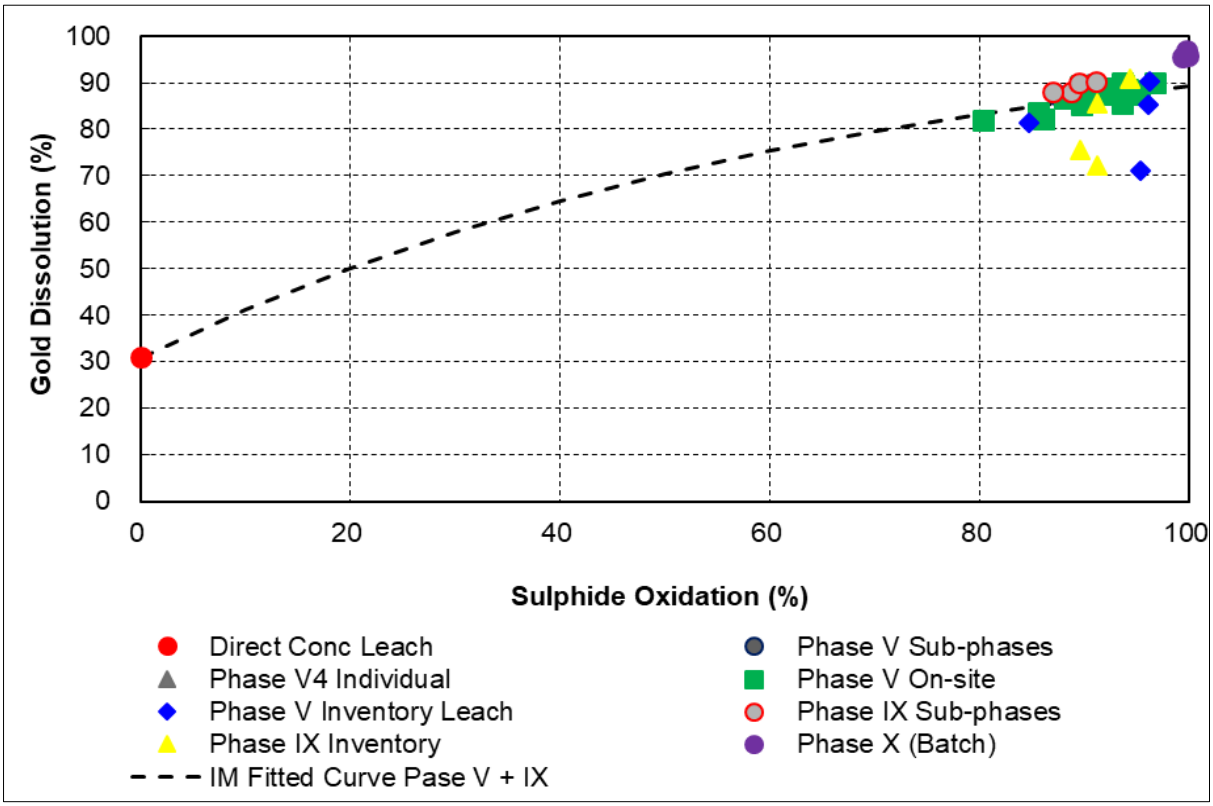


Figure 13-6: Isabella McCays Gold Dissolution vs. Sulphide Oxidation – Batch, Inventory and Overflow Samples

The graph indicated a strong relationship between sulphide oxidation and gold dissolution. The following conclusions can be made from the sulphide sulphur oxidation and gold dissolution results:

- An average gold dissolution of 88.8% was achieved at an average sulphide oxidation of 89.6% for Phase V based on the sub-phase samples
- An average gold dissolution of 89.2% was achieved at an average sulphide oxidation of 89.1for Phase IX
- Gold dissolution of 95.6% to 97.0% were achieved at sulphide sulphur oxidation of 99.3 % to 99.9% when the pilot plant reactors were operated in batch mode for 10 days.

The Au and Si accountabilities (mass out vs mass in) determined for Phases V and IX of the Isabella McCays BIOX® pilot plant run is shown in Table 13-25 below.

Table 13-25: Mass, Au and Si Balance for Detailed Isabella McCays BIOX® Pilot Plant Phases

Description	Accountability (%)		
	Mass	Au	Si
Phase V	63	80	88
Phase IX	72	84	94

As expected, mass accountabilities were outside the acceptable accountability margin due mass loss as the result of Fe and S dissolution during the Isabella McCays BIOX® pilot run. Accountabilities for Au and Si varied between 80 and 94%.

The average limestone consumptions attained during the various phases of the Isabella McCays pilot run are presented in Table 13-26.

Table 13-26: Limestone Consumption During Isabella McCays Pilot Testwork Phases

Phase of Operation	Retention Day	Limestone Consumption (kg/t feed)				
		P1	S1	S2	S3	Total
I	20	0,00	0,00	0,00	0,00	0,00
II	10	0,00	8,90	14,0	11,9	34,8
III	8.0	000	4,03	15,3	14,6	33,9
IV	7.0	4,14	24,1	27,5	22,8	82,7
V	6.0	0,00	7,04	16,5	13,5	37,1
VI	5.5	0,00	4,03	16,4	13,9	34,3
VII	5.0	0,00	0,00	5,87	22,0	27,9
VIII	Batch	0,00	3,56	21,5	22,8	47,9
IX	6.5	1,02	15,5	25,7	16,4	58,6

Inventory samples were taken during stable operation of the BIOX® pilot plant. The average sulphide oxidations representing the main sampling phases are shown in Table 13-27.

Table 13-27: Isabella McCays BIOX® Pilot Plant Sulphide Oxidation (SOX) Profiles

Phase	RT	Sulphide Oxidation, %				
	(days)	P1	S1	S2	S3	Overflow
V	6,0	95.3	84.7	96.1	96.2	89.6
IX	6,5	89.6	91.3	91.3	94.3	89.1
X	Batch	99.3	99.7	99.9	-	-

13.2.6.2.1.3 *Cyanidation Testwork*

The main purpose of the cyanidation test work was to establish the conditions required to produce the maximum gold dissolution from the Isabella McCays bio-oxidation product, while at the same time minimising cyanide consumption and leach time. The gold dissolutions were

achieved at cyanide consumptions of between 19.0and 24.6 kg/t BIOX® feed for the two detailed sampling phases.

The following standard test conditions were used during the routine cyanidation of the BIOX® product samples (both the overflow and inventory samples):

- L/S : 4:1
- Leach period : 48 hours
- NaCN addition : 35 kg/t BIOX® product
- Method of NaCN addition : Bulk at start of test
- Carbon addition : 80 kg/t BIOX® product or 20 g/l slurry
- Slurry pH : 10.6 – 11.5

A series of cyanidation optimisation tests were conducted on a composite Isabella McCays Phase IX BIOX® product solids sample. The following leach parameters were investigated:

- Base case tests (maximum gold dissolution)
- Rate and extent of gold dissolution and reagent consumption
- Varying the solids concentration between 30 and 40% solids
- Varying carbon addition
- Variation in initial cyanide addition and cyanide control levels

The Isabella McCays BIOX® product displayed a very limited preg-robbing effect when leached without carbon (viz. 85.4 vs 87.7% gold dissolution). Any preg-robbing was mitigated when leached in the presence of activated carbon. The optimised leach parameters comprised of a 24-hour leach time performed on slurry with a 40 % solids concentration. An initial bulk NaCN addition of 10 kg/t was made followed by controlling the NaCN at a concentration of 1,500 ppm.

From the cyanidation optimisation test work the following parameters were suggested as being optimum for leaching the Isabella McCays BIOX® product:

- L/S ratio : 1.5: 1 (40 % solids)
- Leach period : 30 hours
- Carbon addition : 60 kg/t CIL feed
- Target free cyanide levels(initial) : 3,000 ppm

- Target free cyanide levels : 1,500 ppm
- Expected cyanide consumption : 16-18 kg/t CIL feed
- Slurry pH : 10.6 – 11.5
- Lime Addition : 5-15 kg/t BIOX® feed

Although a quick leach rate was achieved during test work, a minimum recommended retention time of 30 hrs is suggested that includes a 25% margin added to a minimum retention time of 24 hrs to compensate for high air hold-up and foaming conditions often experienced at commercial scale.

13.2.6.2.1.4 *Liquid / Solid Separation*

Test work was undertaken to determine the settling rate of the following slurries associated with the Isabella McCays concentrate:

- Isabella McCays bulk concentrate
- Isabella McCays concentrates (I-N, I-S, McCays)
- Isabella McCays pilot plant Phase IX BIOX® product
- Neutralised BIOX® liquor product (limestone & lime)
- Bulk Isabella McCays flotation tails

Static settling tests for polymer selection and flocculant dosage optimisation were conducted using measuring cylinders. The results obtained from these tests identified the recommended flocculants and their addition rates, specific thickener areas and the expected solids concentration in the thickener underflows. A laboratory CCD simulation test was performed on the BIOX® product slurry to determine the expected washing efficiencies at a wash ratio of 2:1. Results of the static L/S separation tests are reported in Table 13-28. Dynamic settling tests were carried out at the Outotec Test Facility (Centurion, South Africa). Table 13-29 and Table 13-30 present the results at various solid flux rates for BIOX® product and neutralisation product solids.

Table 13-28: Isabella McCays Liquid / Solid Separation Test Criteria and Results

Process Slurry	Feed Density	Flocculant		Overflow Clarity
	(% Solids)	Selection	Dosage (g/t)	
Isabella McCays bulk concentrate	17.0	M155	60.0	Clear
McCays bulk concentrate	12.0	M155	60.0	Clear

Process Slurry	Feed Density	Flocculant		Overflow Clarity
	(% Solids)	Selection	Dosage (g/t)	
Isabella McCays bulk concentrate	15.0	M155	70.0	Clear
Isabella McCays bulk concentrate	13.0	M155	70.0	Clear
Isabella McCays bulk flotation tails	14.0	M155	60.0	Clear
Isabella McCays BIOX® product – Phase IX	11.3	M333	70.0	Clear
Isabella McCays neutralisation pilot run	11.5	M155	60.0	Clear

Table 13-29: Isabella McCays BIOX® Product Liquid / Solid Separation Test Dynamic Test Results

Run	Feed			Flocculant		Underflow	Overflow	Area
	Flux	Calc. Solids	Liquor RR	Type	Dose	Calc. Solids	TSS	Loading
No.	(t/(m²·h))	(% (w/w))	(m/h)		(g/t)	(% (w/w))	mg/l	m²/t/h
1	0.15	11.3	1.13	M358	70.0	50.7	<100	6.70
2	0.15	11.3	1.13	M333	70.0	50.3	<100	6.70
3	0.25	11.3	1.88	M333	70.0	46.3	<100	4.00
4	0.35	11.3	2.63	M333	70.0	44.5	<250	2.90
5	0.35	11.3	2.63	M333	90.0	45.0	<250	2.90

The test work indicated that a 2.90 m²/t/h settling area would be satisfactory for Isabella McCays BIOX® product at a flocculant dose of 70 g/t. An underflow solid concentration of 44,5% w/w was achieved at this area loading.

Table 13-30: Isabella McCays BIOX® Neutralisation Product and Flotation Tailings Dynamic Settling Test Results

Run	Feed			Flocculant		Underflow	Overflow	Area
	Flux	Calc. Solids	Liquor RR	Type	Dose	Calc. Solids	TSS	Loading
No.	(t/(m²·h))	(% (w/w))	(m/h)		(g/t)	(% (w/w))	mg/l	m²/t/h
1	0.25	11.5	2.02	M155	60.0	55.1	<100	4.00
2	0.30	11.5	2.42	M155	60.0	52.5	<150	3.30
3	0.50	11.5	4.03	M155	60.0	50.2	<250	2.00
4	0.50	11.5	4.03	M155	80.0	50.8	<250	2.00
5	0.25	11.5	2.02	M156	60.0	54.6	<100	4.00

Based on the dynamic settling tests a 2.0 m²/t/h settling area loading would suffice for the Isabella McCays BIOX® neutralised product (flotation tailings/AR lime) at a flocculant dose of 60 g/t. An underflow solid concentration of 50,2% w/w was achieved for this settling area loading.

13.2.6.2.1.5 *Neutralisation*

Acid capacity tests were conducted on all potential neutralising agent sources as listed in Table 13-31 in order to quantify their respective neutralising capacities. The experiments were conducted in a 2-litre agitated beaker with water acidified to pH 1.2.

Table 13-31: Cumulative Acid Capacity of the Isabella McCays Flotation Tails

Sample	Neutralising Capacity ($g\ H_2SO_4$ / kg Reagent)	Average Reactant Utilisation (%)	Final pH
McCays Flotation Tails			
Cumulative to pH 3.0	59.2	18.5	3.36
Cumulative to pH 4.0	59.2	18.5	4.95
Cumulative to pH 5.0	40.2	12.5	5.38
I-N Flotation Tails			
Cumulative to pH 1.5	26.1	23.3	1.40
Cumulative to pH 4.5	21.4	19.1	4.66
Cumulative to pH 5.0	21.4	19.1	5.12
I-S Flotation Tails			
Cumulative to pH 2.0	35.0	22.6	2.13
Cumulative to pH 5.0	35.0	22.6	5.10
Isabella McCays Flotation Tails			
Cumulative to pH 3.0	44.1	25.9	3.15
Cumulative to pH 4.0	34.3	20.2	4.62
Cumulative to pH 5.0	34.3	20.2	5.02

Since the neutralisation capacity is mainly influenced by the carbonate content, the highest capacity of 59.2 kg H2SO4/kg reagent was identified for the McCays tailings at a carbonate content of 19.6%. The highest flotation tails carbonate utilisations per source of between 18.5 and 25.9% were achieved at pH levels of between 1 and 4.

Laboratory-scale batch neutralisation experiments were conducted on BIOX® liquor produced during Phase V of the Isabella McCays BIOX® pilot run. The batch experiments were conducted in 5-litre vessels on the multi stirrer bench with aeration to ensure similar conditions.

The BIOX® liquor was diluted at a ratio of 2:1 with water to simulate the CCD overflow. For the neutralisation test involving BIOX® liquor, the Isabella McCays flotation tails were slurries at 50% w/w in water. Flotation tails and AR limestone were utilised during the first stage reagents of neutralisation process to raise the BIOX® liquor to ~pH 5. The flotation tails were added at predetermined amounts to the test beaker and allowed to react with the BIOX® liquor for 7 hours. AR Lime was used to increase the pH during Stage 2. Sample aliquots were removed at various pH values, immediately filtered and the filtrate submitted for chemical analyses.

The reagent consumptions and neutralised solution compositions for the various tests are present in Table 13-32 and Table 13-33.

Table 13-32: Isabella McCays Batch Neutralisation Test Consumptions

Reagents	Retention Time	Float Tails Addition (kg/kg BIOX® Feed)	$CaCO_3$ Addition (kg/t BIOX® Feed)	CaO Addition (kg/t BIOX® Feed)	Final pH
	(Hours)				
AR Grade [1] Limestone and Lime	6	-	258	24.4	6.99
Isabella McCays Float Tails (100%)	9	19.4	-	-	7.02
Isabella McCays Flotation Tails (80%)	24	15.6	-	-	7.14
Isabella McCays Flotation Tails (60 %)	24	11.7	-	-	6.70
Isabella McCays Flotation Tails (50%) /Lime	12	9.71	-	52.0	7.04

Table 13-33: Isabella McCays Batch Neutralisation Product Analyses

Reagents	Neutralised Solution		Neutralised Solution	
	Fe (ppm)	As (ppm)	Fe (ppm)	As (ppm)
AR Grade [1] Limestone and Lime	<0.02	0.40	<0.05	6.00
Isabella McCays Float Tails (100%)	0.02	0.34	-	-
Isabella McCays Flotation Tails (50%) /Lime	<0.02	<0.34	134 [2]	0.10

The batch neutralisation tests showed a clear benefit of using flotation tailings to reduce the overall neutralisation reagent consumption with flotation tailings additions as low as 9.71 kg per kg BIOX® feed negated the used of limestone for pH control during stage 1 of neutralisation test.

The results of the batch neutralisation tests indicated that the arsenic in the Isabella McCays BIOX® liquor can be successfully removed with concentrations of less than 0.5 ppm and iron concentrations less than 0.02 ppm recorded for the neutralised product solution. The TCLP result reported for the neutralisation product produced from using AR grade limestone and lime as neutralising reagents achieved an as extract of 6 ppm that is higher than the USA environmental legislation setpoint of <5 ppm for the disposal of liquid waste. This was however expected since the Fe: As molar ratios for the Isabella McCays BIOX® liquor tested in the batch neutralisation tests were below the recommended 3:1. The batch neutralisation test carried out with flotation tails and lime also recorded an TCLP extraction high in Fe concentration.

A single continuous neutralisation pilot plant run was conducted using AR grade limestone for Stage 1 pH control and AR grade lime for Stage 2 pH control. The continuous neutralisation campaign was conducted using a recycle ratio of 1:1 (recycle: feed slurry flow) on BIOX® solution collected from Isabella McCays Phase IX. The neutralisation circuit was operated at a 6-hour retention time (for 18 hours i.e., 3 retention times) with limestone added to Tank 2, 3 and 4 to maintain a pH of 3.5, 4.5 and 5 in the respective tanks. Lime was added to Tank 5 and 6 to maintain a pH of 6.8 and 7 respectively to ensure that the iron and arsenic removal from the solution was achieved. The results are presented in Table 13-34 and Table 13-35 below.

Table 13-34: Isabella McCays Continuous Neutralisation Reagent Consumptions

Campaign Neutralising Reagent	Reagent Consumption (kg/t)		Total Ca^{2+} Consumption (kg/t)
	Limestone	Lime	
AR-grade limestone/lime – Run 1	246	46.9	132

Table 13-35 Isabella McCays Continuous Neutralisation Results

SAMPLE	Neutralisation – Run 1	
	Fe (mg/l)	As (mg/l)
	(mg/l) (%)[1]	(mg/l) (%))
Feed	14 200	7 010
Feed Fe:As Ratio	2.71	
Final Solution Profile		
Overflow	<0.02	0.50
Final Product Solids		
Overflow	15,50	6.31
TCLP Extracts – O/F product[2]		

SAMPLE	Neutralisation – Run 1	
	Fe (mg/l)	As (mg/l)
	(mg/l) (%)(1)	(mg/l) (%))
1st Solids Extract	6.40	2.50
2nd Solids Extract	6.40	2.80
Final Solids Extract(4)	6.30	2.50

The continuous neutralisation pilot run was conducted on an Isabella McCays Phase IX BIOX® liquor sample with a Fe:As molar ratios below the recommended minimum ratio of 3:1 to ensure stable concentrate. With regards to US-EPA regulations, a suitable effluent was produced as the As (T) concentration in the neutralised solution was at 0.5 ppm. Contrary to expectation, TCLP testing of the Phase IX residues showed final As (T) leachates of <3 ppm, below the stipulated 5 ppm requirement. Stable products can therefore be produced from Isabella McCays BIOX® solution neutralised using AR grade limestone and lime reagents. Continuous neutralisation tests are recommended to optimise the use of the Isabella McCays float tails on stage 1 of neutralisation with respect to high Fe concentration in TCLP extract.

13.2.6.2.2 *Summary of Results: Bubi Concentrate Pilot Run*

13.2.6.2.2.1 *Sample Characterisation*

A 366 kg Bubi concentrate sample was generated from Bubi ore during the onsite flotation campaign. A 12.2 kg sub-sample was sent to SGS and Mintek South Africa for head analyses, mineralogy and BAT tests. The results are presented in Table 13-36 below. The mineral composition of the Bubi concentrate sample is shown in Table 13-37.

Table 13-36: Analyses of Bubi Concentrate Sample

Description	Units	Mintek	SGS	Variance (1) %
S (T)	(%)	27.5	30.2	-9.82
Au	(g/t)	27.6	28.0	-1.45
S^{2-}	(%)	26.8	27.1	-1.12
S^{0}	(%)	-	0.37	-
Fe(T)	(%)	29.9	28.1	6.02
CO_3^{2-}	%	3.65	3.39	7.12
As	(%)	3.14	4.34	-38.2
C(T)	(%)	1.08	1.01	6.48
C(org)	(%)	0.35	0.46	-31.4
Si	(%)	10.3	10.3	0.00
Hg	ppm	2.4	-	-

Description	Units	Mintek	SGS	Variance (1) %
Sb	ppm	-	-	-
Cu	ppm	<500	-	-
Au:S^{2-}		1.03	1.03	-0.33
S^{2-}/(As + CO_3^{2-})		3.95	3.51	11.2
Fe:As		12.8	8.68	32.0

Note: (1) Variance calculated for SGS assays using Mintek assays as basis

The results for the mineralogical investigation as conducted on the Bubi concentrate sample at Mintek can be seen in Table 13-37 below.

Table 13-37: Bubi Concentrate Sulphide Mineral Species

Mineral	Formula	Bubi
Pyrite	FeS_2	57.2
Arsenopyrite	FeAsS	9.00
Stibnite	Sb_2S_3	-
Dolomite (1)	$CaMg(CO_3)_2$	1.00
Total Sulphides		66.2

Bubi concentrate sample has a mineralogical assemblage of 66.2% sulphides comprising of 57.2% pyrite and 9.00% arsenopyrite. Without high levels of dolomite, the higher pyrite content will dictate that the concentrate will be acid generating and thus will require the addition of limestone for BIOX® pH control.

13.2.6.2.2.2 *Continuous BIOX® Operation*

The main mini plant control parameters during the Bubi continuous BIOX® pilot run was as follows:

- Slurry Feed Density : 15 - 20%
- Slurry temperature : 39°C - 41°C
- Slurry pH
  - Primary : 1.20 - 1.40
  - Secondary 1 : 1.10 - 1.30
  - Secondary 2 – 3 : 1.10 - 1.30
- Dissolved oxygen : 3.5 ppm to 4.5 ppm

The various phases of continuous pilot plant operation are summarized in Table 13-38.

Table 13-38: Phases of Bubi BIOX® Pilot Plant Operation

Phase of Operation	Retention Time (d)	Start Date	End Date	Duration (d)	Description
I	20-10	08-Oct-18	12-Oct-18	5	Ramp-up (20 %)
II	10	13-Oct-18	16-Oct-18	4	Ramp-up (20 %)
III	Batch	17-Oct-18	20-Dec-18	65	Recovery (20-15%)
IV	10-6.5	21-Dec-18	08-Feb-19	50	Ramp-up (15 %)
V	6.5	09-Feb-19	09-Mar-19	29	Detailed Sampling (15 %)
VI	6.5	10-Mar-19	25-Mar-19	16	Ramp up (15-20 %)
VII	6.5	26-Mar-19	15-Apr-19	21	Detailed Sampling (20 %)
VIII	6.5	16-Apr-19	28-Apr-19	13	Detailed Sampling (18 %)
IX	10	29-Apr-19	13-May-19	15	Recovery (18 %)
X	10	14-May-19	30-May-19	17	(Unwashed Concentrate)

The Bubi pilot plant was characterised by bacterial activity inhibition experienced from the onset of Phase III as the feed rate was increased. This was speculated to be the result of a combination of operational factors and inhibition associated with residual flotation reagent still present in the Bubi concentrate post washing. Some efforts were undertaken to mitigate the likely source of inhibition during the recovery ramp up phases (Phase III and IV). When sufficient bacterial activity was ascertained based on BIOX® performance during Phase V, the feed solid concentration was increase to the design targeted of 20 % in the feed.

Over the first 15 days of operation at these conditions the pilot plant showed signs of a decrease in bacterial performance. It was decided to reduce the solids load to the pilot plant by reducing the feed solids concentration to 18 %. Although stable operation was attained during Phase VIII, the phase was cut short as the result an overfeeding incident due to a mechanical failure of the feed splitter. The pilot plant was allowed to recover activity during Phase IX at an extended retention time of 10 day. During Phase X, BIOX® liquor washing was curtailed and the BIOX® pilot plant was fed with unwashed Bubi concentrate. No decrease in pilot plant performance was noticed when the pilot plant operated with unwashed concentrate.

The average daily sulphide oxidation as well as the corresponding average daily cyanidation gold dissolution for the main Bubi sampling phases are shown in Table 13-39.

Table 13-39: BUBI BIOX® Pilot Plant Average of Daily Sulphide Oxidation (SOX) and Gold Dissolutions Per Phase

Phase	Reagent Addition (kg/t BIOX® product)			Residual Cyanide NaCN (g/L)	Reagent Consumption		Cyanidation		Sulphide Oxidation Si Based (%)	Au Diss. Based on residue (%)
	CaO (kg/t)	NaCN (kg/t)*	Carbon (kg/t)		NaCN (kg/t BIOX® feed)	CaO (kg/t BIOX® feed)	Head Au (g/t)	Residue Au (g/t)		
Direct	1.75	35	80	5.73	12.3	1.11	28.0	20.7	0.00	28.4
V	4.89	35	80	3.26	20.0	4.10	39.1	1.34	97.5	96.8
VII	5.78	35	80	2.80	22.7	6.03	38.4	1.74	90.0	95.7

Phase	Reagent Addition (kg/t BIOX® product)			Residual Cyanide NaCN (g/L)	Reagent Consumption		Cyanidation		Sulphide Oxidation Si Based (%)	Au Diss. Based on residue (%)
	CaO (kg/t)	NaCN (kg/t)*	Carbon (kg/t)		NaCN (kg/t BIOX® feed)	CaO (kg/t BIOX® feed)	Head Au (g/t)	Residue Au (g/t)		
VIII	3.97	35	80	3.52	20.9	3.85	38.6	1.50	86.3	96.3

A comparison of gold dissolution vs. sulphide oxidation obtained using excessive cyanide additions for both the overflow and inventory samples, are shown in Figure 13-7.

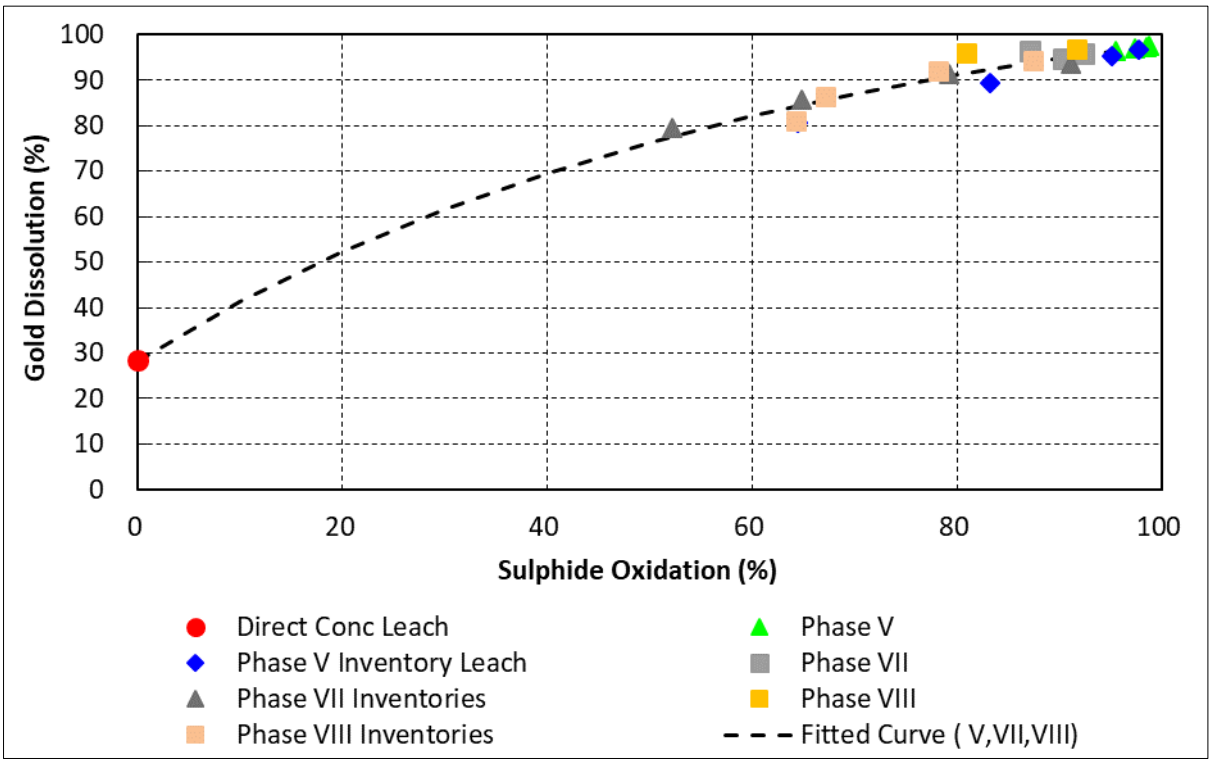


Figure 13-7: Bubi Gold Dissolution vs. Sulphide Oxidation –Inventory an Overflow Samples

The graph indicated a strong relationship between sulphide oxidation and gold dissolution. The following conclusions can be made from the Bubi sulphide sulphur oxidation and gold dissolution results:

- An average gold dissolution of 96.8% was achieved at an average sulphide oxidation of 97.5% for Phase V at 6.5-day RT and a 15% feed solid concentration
- An average gold dissolution of 95.7% was achieved at an average sulphide oxidation of 90% for Phase VII at 6.5-day RT and a 20% feed solid concentration
- An average gold dissolution of 96.3% was achieved at an average sulphide oxidation of 86.3% for Phase VIII

The Au and Si accountabilities (mass out vs mass in) determined for Phases V, VII and VIII of the Bubi BIOX pilot plant run are shown in Table 13-40 below.

Table 13-40: Mass, Au and Si Balance for Detailed Bubi BIOX Pilot Plant Phases

Description	Accountability (%)		
	Mass	Au	Si
Phase V	83%	95%	90%
Phase VII	83%	76%	78%
Phase VIII	93%	103%	89%

As expected, mass accountabilities were outside the acceptable accountability margin as the results of the mass loss due to dissolution of Fe and S during the Bubi BIOX® pilot run. Accountabilities for Au and Si varied between 76 and 103%.

The average limestone consumptions attained during the various phases of the test work are presented in Table 13-41.

Table 13-41: Limestone Consumption During Bubi Pilot Testwork Phases

Phase of Operation	RT	Limestone Consumption (kg/t feed)				
		P1	S1	S2	S3	Total
I	20	36.5	14.5	21.4	9.13	81.5
II	10	42.8	8.99	13.9	12.1	77.7
III	Recovery	105	34.2	30.2	24.5	194
IV	10-6.5	53.0	16.8	17.2	10.6	97.5
V	6.5	183	29.6	24.1	10.3	247
VI	6.5	156	21.3	18.1	5.59	201
VII	6.5	146	31.5	31.8	17.7	227
VIII	6.5	194	38.6	37.6	18.5	289
IX	10	165	27.6	21.0	6.77	221
X	10	205	12.0	9.80	4.82	231

Inventory samples were taken during stable operation of the BIOX® pilot plant. The average sulphide oxidations representing the main sampling phases of the Bubi BIOX® pilot plant operation is shown in Table 13-42.

Table 13-42: BUBI BIOX® Pilot Plant Sulphide Oxidation (SOX) Profiles

Phase	RT	Feed Solids	Sulphide Oxidation, %				
	(days)	Concentration (%)	P1	S1	S2	S3	Overflow
V	6.6	15.0	64.5	83.2	95.1	97.7	97.5

Phase	RT	Feed Solids	Sulphide Oxidation, %				
	(days)	Concentration (%)	P1	S1	S2	S3	Overflow
VII	6.6	20.0	52.2	64.8	79.2	91.1	90.0
VIII	6.5	18.0	64.3	67.2	78.2	87.5	86.3

13.2.6.2.2.3 *Cyanidation Testwork*

The main purpose of the cyanidation test work was to establish the conditions required to produce the maximum gold dissolution from the Bubi bio-oxidation product, while at the same time minimising cyanide consumption and leach time. The gold dissolutions were achieved at cyanide consumptions of between 20.0 and 22.7 kg/t BIOX® feed for the detailed sampling phases. The same standard test conditions as used for the Isabella McCays BIOX® run, were used during the routine cyanidation of the Bubi BIOX® product samples.

A series of cyanidation optimisation tests were conducted on a composite Bubi Phase V BIOX® product solids sample. The optimisation parameters were similar to what was described for the Isabella McCays BIOX® Pilot run.

The base case leach tests yielded an average gold dissolution of 96.2% with bulk additions of cyanide. This gold dissolution was in good agreement with the average gold dissolution of 96.8% achieved for Phase V. Gold dissolution was not negatively affected by an increase in solid concentration to 40% for the bottle role cyanidation test. The carbon addition tests conducted at 60 kg/t and a 40% solids concentration yielded similar gold dissolution to tests conducted with a carbon addition at 80 kg/t. The Bubi BIOX® product displayed no preg-robbing effect when leached without carbon (viz. 96.7 vs 96.2% gold dissolution).

From the cyanidation optimisation test work the following conditions for the Bubi BIOX® product cyanidation is recommended:

- L/S ratio : 1.5: 1 (40 % Solids)
- Leach period : 30 hours
- Carbon Addition : 60 kg/t CIL Feed
- Target free cyanide levels(initial) : 3,000 ppm
- Target free cyanide levels : 2,000 ppm
- Expected cyanide consumption : 18 - 20 kg/t CIL feed
- Slurry pH : 10.6 – 11.5
- Lime Addition : 5-15 kg/t BIOX® feed

Although a although quick leach kinetics was identified during testwork, a minimum recommended retention time of 24 hrs was applied with 25% capacity added for high air hold-up and foaming conditions likely at commercial scale.

13.2.6.2.2.4 *Liquid / Solid Separation*

The liquid-solids separation tests were performed on the following slurries associated with the Bubi concentrate and associated test work, viz:

- Bubi bulk concentrate as was used for BIOX® pilot plant testing
- Bulk Bubi flotation tails
- Bubi pilot plant Phase VIII BIOX® product

Static settling tests for polymer selection and flocculant dosage optimisation were conducted at the Outotec Test Facility using measuring cylinders. The results obtained from these tests indicated the recommended flocculants and their addition rates.

Table 13-43: Bubi Liquid / Solid Separation Test Criteria and Results

Process Slurry	Feed Density	Flocculant		Overflow Clarity
	(% Solids)	Selection	Dosage (g/t)	
Bubi bulk concentrate	8	M155	60.0	Clear
Bubi bulk flotation tails	8	M155	70.0	Clear
Bubi BIOX product	9	M333	60.0	Cloudy

Magnafloc M155 was identified as the most effective flocculant for the Bubi concentrate and flotation tails. Magnafloc M333 was identified as the most effective flocculant for the Bubi BIOX® product.

Dynamic settling tests were carried out at the Outotec Test Facility (Centurion, South Africa). Table 13-44 present the results at various solid flux rates for BIOX® product solids.

Table 13-44: Bubi BIOX® Product Liquid / Solid Separation Test Dynamic Test Results

Run	Feed			Flocculant		Underflow	Overflow	Area
	Flux	Calc. Solids	Liquor RR	Type	Dose	Calc. Solids	TSS	Loading
No.	(t/(m^2·h))	(% (w/w))	(m/h)		(g/t)	(% (w/w))	mg/l	m^2/t/h
1	0.05	8.5	0.51	M358	60	49.8	<50	20.0
2	0.10	8.5	1.02	M333	60	49.2	<100	10.0
3	0.15	8.5	1.52	M333	60	47.9	<100	6.7
4	0.25	8.5	2.54	M333	60	45.3	<100	4.0
5	0.25	8.5	2.54	M333	80	45.8	<250	4.0

The test work indicated that a 4,00 m²/t/h settling area would be satisfactory for the Bubi BIOX® product at a M333 flocculant dose of 60 g/t. An underflow solid concentration of 45,3% w/w was achieved at this setting area. The Bubi settling area requirement is therefor higher than the Isabella McCays BIOX® product area loading requirement of 2,90 m²/t/h.

13.2.6.2.2.5 *Neutralisation*

Laboratory-scale batch neutralisation experiments were conducted on BIOX® liquor produced during Phases VI and VIII of the Bubi BIOX® pilot run. The batch experiment conditions were similar to that previously described for the Isabella McCays BIOX® pilot run. The reagent consumption and neutralised product solution composition per test are shown in Table 13-45 and Table 13-46.

Table 13-45: Bubi Batch Neutralisation Consumption

Reagents	Float Tails Addition (kg/kg BIOX® Feed)	$CaCO_3$ Addition (kg/t BIOX® Feed)	CaO Addition (kg/t BIOX® Feed)
AR Grade (1) Limestone and Lime	-	294	32.8
Isabella McCays Flotation Tails and Lime	11.7	-	79.0
McCays Flotation Tails and Lime	9.04	-	56.0
Isabella McCays Flotation Tails / Limestone / Lime	9.11	57.0	99.0
I-S Flotation Tails / Limestone / Lime	9.11	52.0	139

Table 13-46: Bubi Batch Neutralisation Product Analyses

Reagents	Neutralised Solution		TCLP Extract	
	Fe (ppm)	As (ppm)	Fe (ppm)	As (ppm)
AR Grade (1) Limestone and Lime	0.06	0.06	<0.05	0.24
Isabella McCays Flotation Tails and Lime	1.32	<0.34	173	<0.01

The batch neutralisation tests showed a clear benefit of using flotation tailings to reduce the overall neutralisation reagent consumption. Flotation tailings additions of between 9.04 and 11.7 kg per kg BIOX feed were used. Since not Bubi flotation tailings were available for the neutralisation test work, Isabella McCays flotation tailings was used as a proxy. The additions

of Isabella McCays flotation tailings were however based on the expected mass pull for Bubi flotation concentrates. The use of flotation tailings at the indicated addition rates significantly reduced the limestone addition required for pH control during stage 1 of neutralisation test.

The results of the batch neutralisation tests indicated that the arsenic in the Bubi BIOX® liquor can be successfully removed with concentrations of less than 0.34 ppm Isabella McCays Flotation Tails and Lime. The iron concentration was however higher than the requirement at 1.32 ppm. The TCLP result reported for the neutralisation product produced from using Isabella McCays Flotation Tails and Lime as neutralising reagents achieved and As extract of <0.01 ppm that is well below the USA environmental legislation setpoint of <5 ppm for the disposal of liquid waste. This was however expected as the Fe: As molar ratios for the Bubi BIOX® liquor tested in the batch neutralisation tests was well above the recommended 3:1. The batch neutralisation test carried out with flotation tails and lime also recorded a TCLP extraction high in Fe concentration.

A single continuous neutralisation pilot plants runs was conducted using AR grade limestone for Stage 1 pH control and AR grade lime for Stage 2 pH control. The continuous neutralisation campaign was conducted using a recycle ratio of 1:1 (recycle: feed slurry flow) on BIOX® solution collected from Bubi Phase VI and VIII. The neutralisation circuit was operated at a 6-hour retention time (for 11 hours i.e., 2 retention times) with limestone added to Tank 2, 3 and 4 to maintain a pH of 3.5, 4.5 and 5 in the respective tanks. Lime was added to Tank 5 and 6 to maintain a pH of 6.8 and 7 respectively to ensure that the iron and arsenic removal from the solution was achieved. The results are presented in Table 13-47 and Table 13-48 below.

Table 13-47: Bubi Continuous Neutralisation Reagent Consumptions

Campaign Neutralising Reagent	Reagent Consumption (kg/t)		Total Ca^{2+} Consumption (kg/t)
	Limestone	Lime	
AR-grade limestone/lime – Run 1	243	68.7	146

Table 13-48: Bubi Continuous Neutralisation Results

Sample	Neutralisation – Run 1	
	Fe (mg/l)	As (mg/l)
	(mg/l) (%)[(1)]	(mg/l) (%))
Feed	12,467	2,697
Feed Fe:As Ratio	6.19	
Final Solution Profile		
Overflow	4.2	<0.1

Sample	Neutralisation – Run 1	
	Fe (mg/l)	As (mg/l)
	(mg/l) (%)[1]	(mg/l) (%))
Final Product Solids		
Overflow	18.3	3.42
TCLP Extracts – O/F product [2]		
1st Solids Extract	0.08	0.35
2nd Solids Extract	<0.05	0.30
Final Solids Extract [4]	<0.05	0.30

The continuous neutralisation pilot run conducted on the Bubi BIOX® liquor samples produced during Phases VI and VIII had Fe: As molar ratio of 6.19 that was well above the recommended minimum ratio of 3:1. With regards to US-EPA regulations, suitable effluents were produced as the As(T) concentrations in the neutralised solutions were all lower than 0.5 ppm. TCLP testing of the neutralised product residues also showed final As (T) leachates of <0.4 ppm, below the stipulated 5 ppm requirement. Stable products can therefore be produced from Bubi BIOX® solution neutralised using AR grade limestone and lime reagents. A continuous neutralisation tests is suggested to optimise the use of the Bubi float tails on stage 1 of neutralisation with respect to high Fe concentration in TCLP extract.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 14
MINERAL RESOURCE ESTIMATES

Document Number: JZWEBR6013-STU-REP-001

DRA

14 MINERAL RESOURCE ESTIMATES

The Mineral Resource Estimates (MRE's) were compiled by Qualified Persons and are compliant with the definitions and guidelines for the reporting of Exploration Information, Mineral Resources and Mineral Reserves in Canada, the "CIM Standards on Mineral Resources and Reserves - Definitions and Guidelines" (2014). These MRE's were also prepared in accordance with the Rules and Policies of the National Instrument 43101 Standards of Disclosure for Mineral Projects, Form 43101 F1 and Companion Policy 43101 CP.

Leapfrog Geo™ software was used to construct volumetric solids for the zones of weathering, structural discontinuities, and mineralisation. Three-dimensional (3D) resource modelling, using geostatistical techniques for grade estimation, was done in Datamine Studio RM™.

14.1 Geological Database

The previous MRE was published on 8 April 2019. This MRE was constrained to a Lerchs-Grossmann pit shell using 0.9 g/t Au as the cut-off grade. Since then, there has been no mineral resource exploration. This 25 October 2021 MRE is therefore an update to reflect current metal prices and updated operational (mining and processing) parameters derived from the updated Feasibility Study. The geological and mineral resource block models remain unchanged; the Lerchs-Grossmann pit shell has been updated. The key assumptions and methodologies used for the resource estimates are outlined below. All other sections of the report except the Mineral Resource Tabulation remain unchanged.

14.1.1 Topography

A 3D Digital Elevation Model (DEM) was provided by Bilboes as a points file containing X, Y and Z data. The points were generated from an airborne photogrammetric survey conducted in 2018. Existing rock dumps, heap leach pads, and mining pits were incorporated in the points file provided. For pits that contained water ingress, a bathymetric survey was done to determine pit bottom. In the Isabella-McCays area elevation ranges from 1,090 mamsl in the pit areas to approximately 1,190 mamsl on the mining dumps. At Bubi elevations range from 1,186 to 1,234 mamsl. In general, the topography is gently dipping. No records were available of the original topography before mining activities took place at Bilboes.

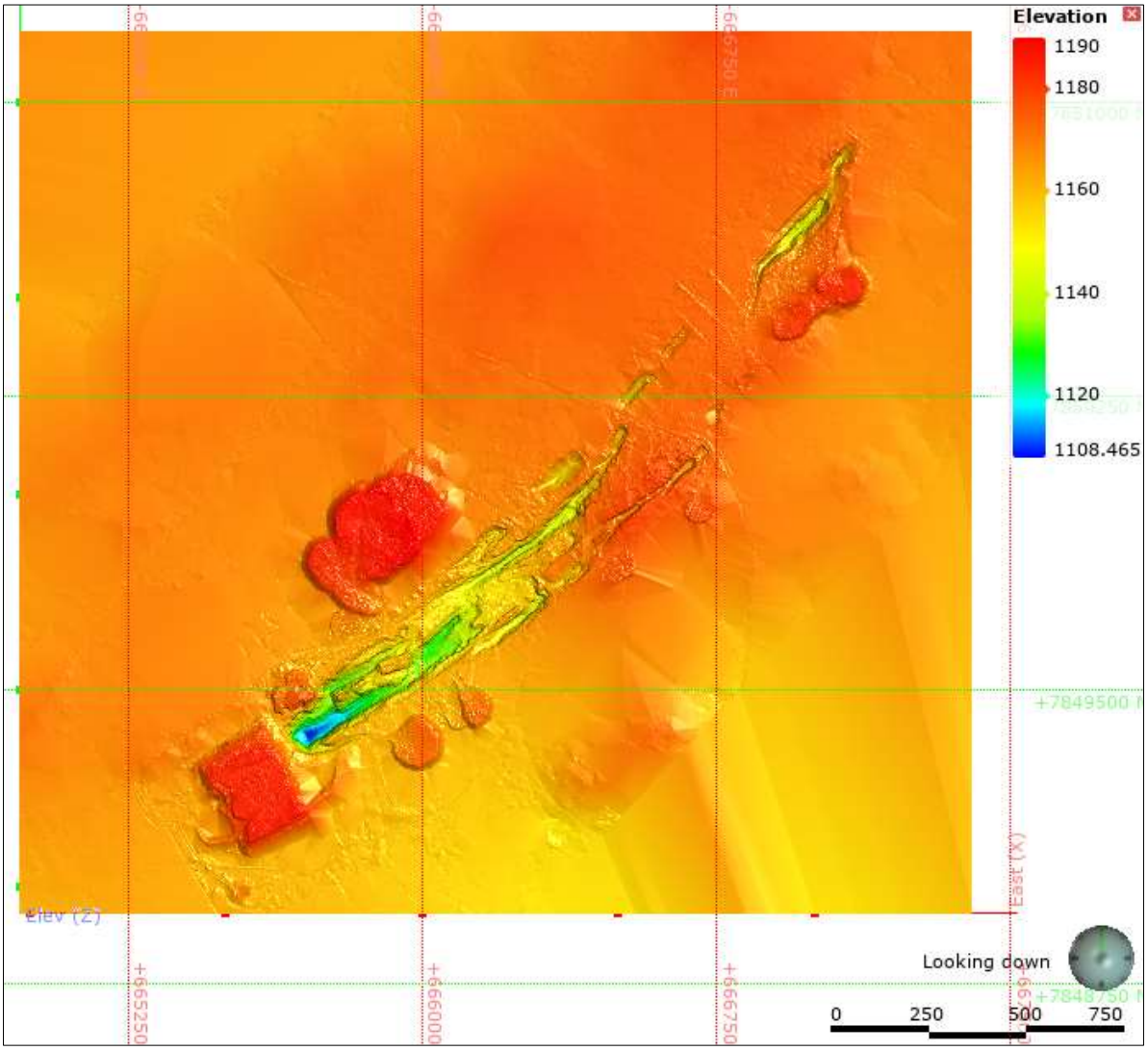


Figure 14-1: Topography of McCays

14.1.2 Drill Holes

The four MRE's were based on a database containing 4,330 drill holes, totalling 246,320.23 m. The database comprised of diamond drilling (DD), reverse circulation (RC) and percussion (PERC) holes, summarised in Table 14-1 below. The ISBS database is made up of 1,097 drill holes totalling 54,182 m ISBN contains 939 drill holes totalling 63,212 m; Bubi contains 1,821 drill holes totalling 87,408 m and McCays contains 475 drill holes totalling 41,551 m.

Figure 14-2, Figure 14-3, Figure 14-4 and Figure 14-5 are plan views showing drilling at ISBS, ISBN, Bubi, and McCays, respectively. Blue, green and red represent diamond, percussion, and reverse circulation drilling holes. Most of the percussion drilling occur within the oxidised zone, the majority of which is mined out.

At ISBS, drill holes dip between 40 degrees and 60 degrees towards the NW. At ISBN, drill holes dip between 45 degrees and 60 degrees towards the NW/SE while at McCays, they dip at 60 degrees towards the SE. At Bubi, the majority of drill holes dip at approximately 60 degrees towards the SE.

Table 14-1: Summary of Drill Holes

Property	DD Holes		RC Holes		Perc Holes		Total	
	No. of Holes	Meters	No. of Holes	Meters	No. of Holes	Meters	No. of Holes	Total Meters
ISBS	68	10,233.74	72	9,636	957	34,312	1,097	54,181.74
ISBN	105	19,574.97	67	9,279	765	34,325.	937	63,179.01
BUBI	68	11,500.02	90	10,376	1,663	65,532	1,821	87,408.02
McCays	89	12,565.49	88	8,931	298	20,055	475	41,551.49

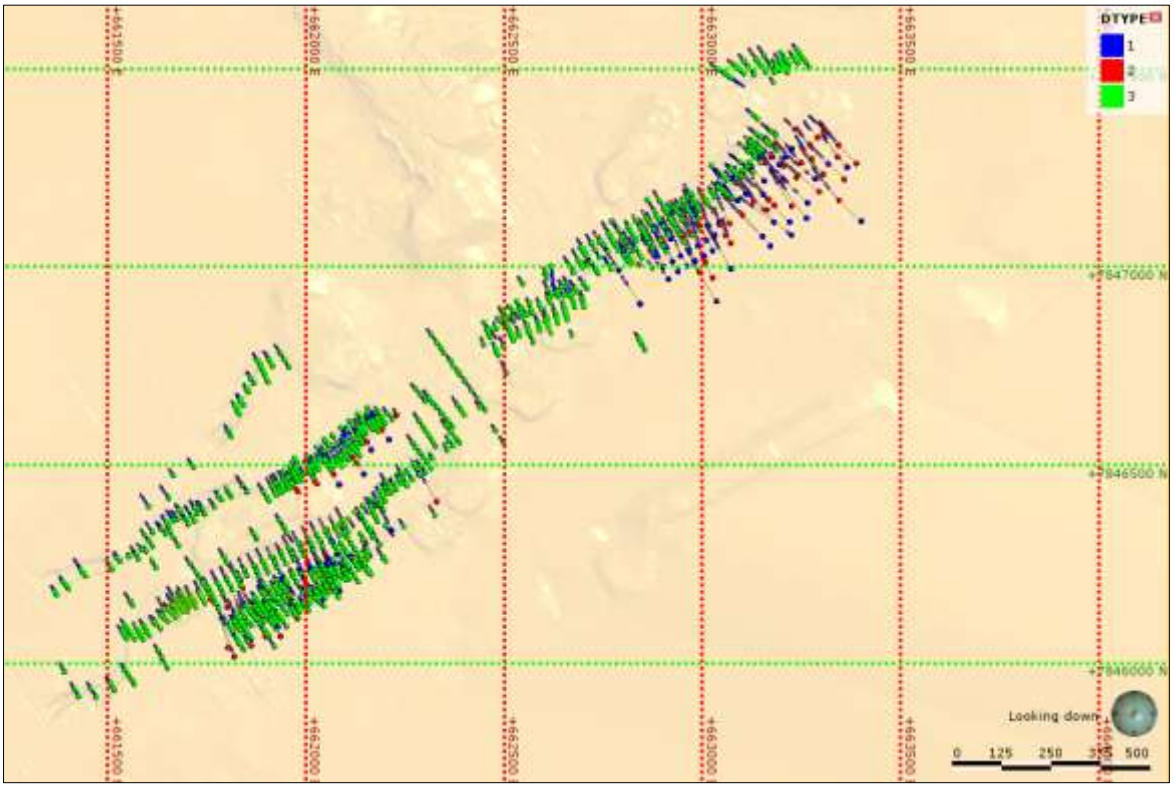


Figure 14-2: Plan View showing Drilling at ISBS (green = perc; blue = DD; red = RC)

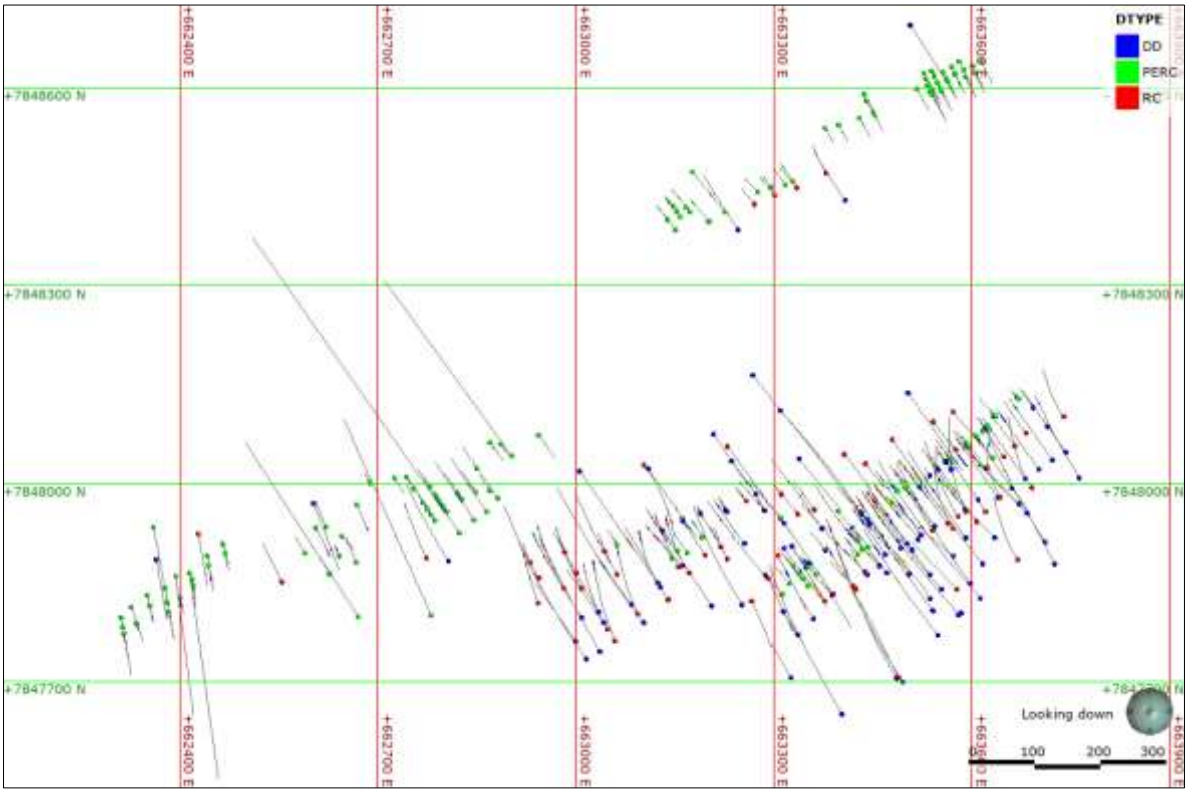


Figure 14-3: Plan View showing Drilling at ISBN (green = perc; blue = DD; red = RC)

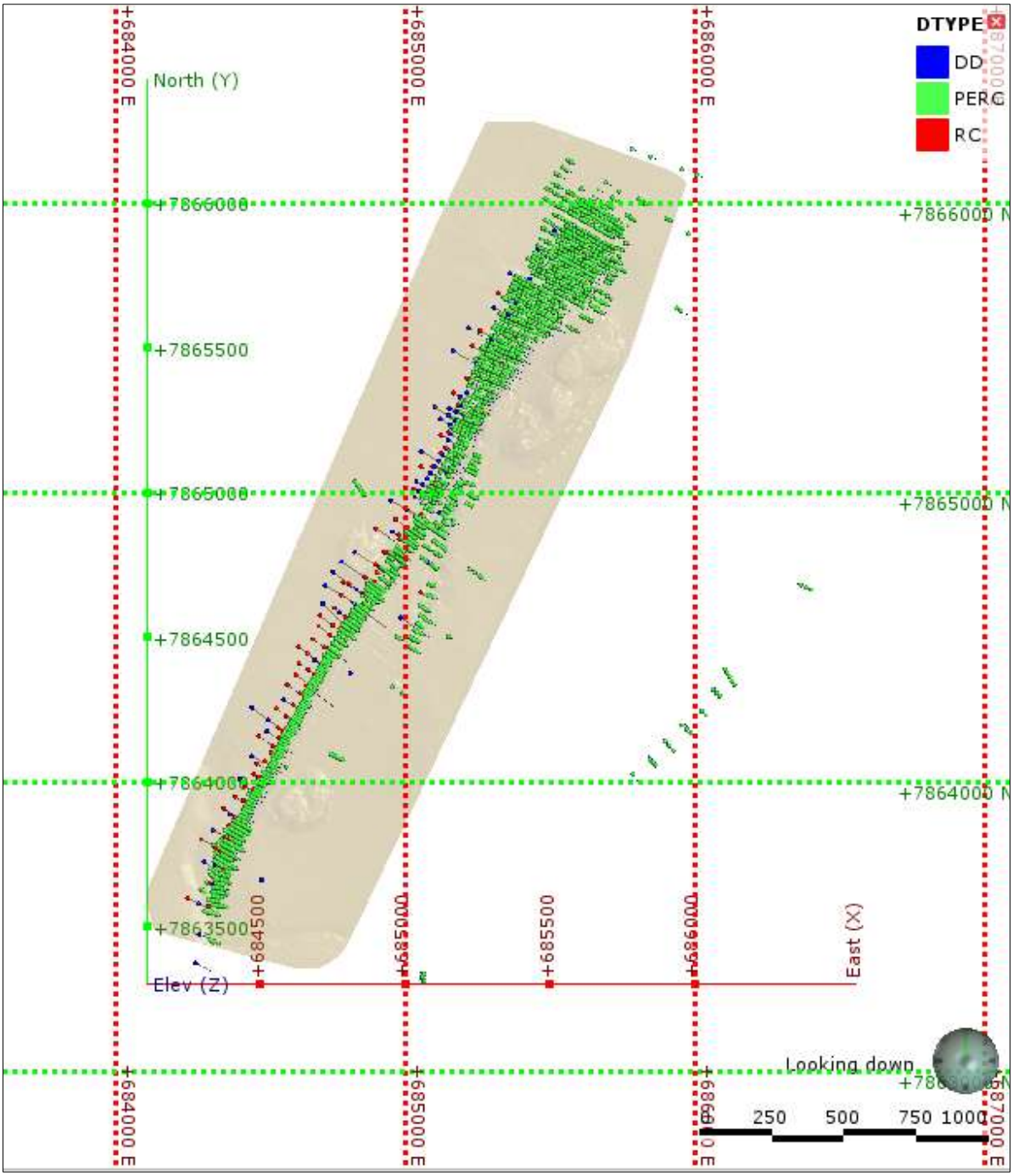


Figure 14-4: Plan View showing Drilling at Bubi (green = perc; blue = DD; red = RC)

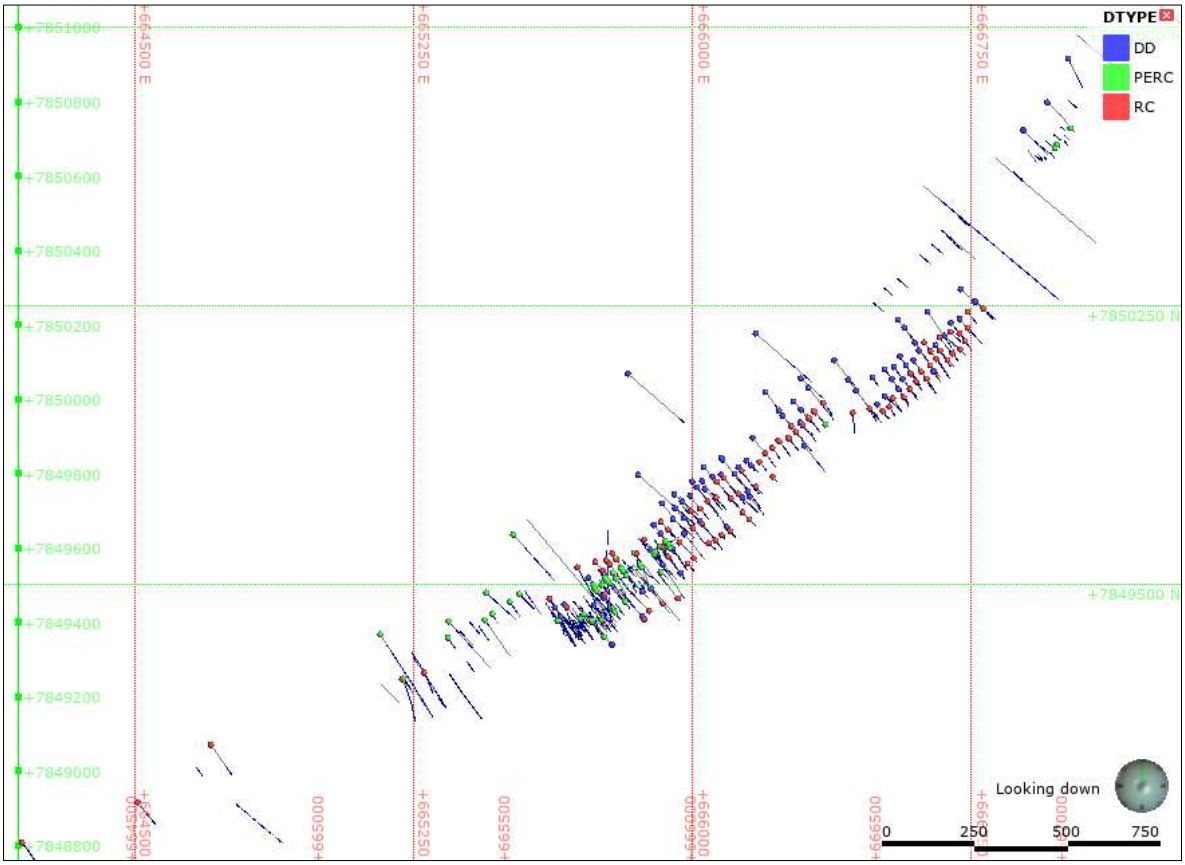


Figure 14-5: Plan View showing Drilling at McCays (green = perc; blue = DD; red = RC)

14.1.3 Density

For drilling campaigns prior to 2011, density measurements were taken at irregular intervals. During the 2011 to 2018 drilling campaigns, every metre of core that was sampled, was submitted for density measurements. The Archimedes method of density measurement was used. A summary of these measurements per project area are presented in Table 14-2 below, with the supporting histograms from Figure 14-6, Figure 14-7, Figure 14-8 and Figure 14-9.

Table 14-2: Summary of Density Measurement per Resource Area

Resource Area	No of Measurements	Minimum (g/cm^3)	Maximum (g/cm^3)	Mean (g/cm^3)
ISBS	2,599	2.01	3.39	2.76
ISBN	3,604	2.00	3.94	2.78
McCays	3,967	2.18	3.93	2.8
Bubi	7,152	2.25	4.65	2.83

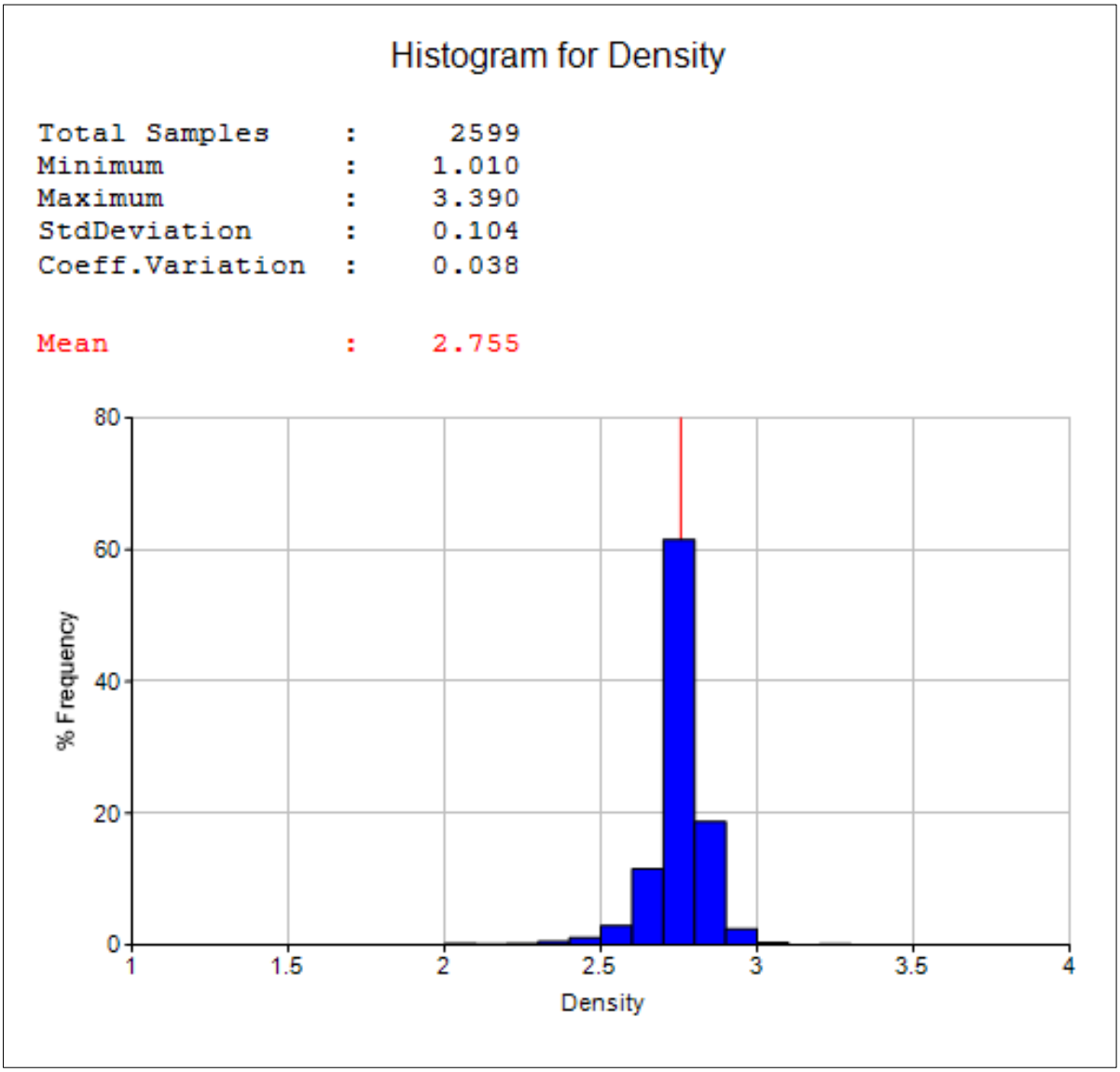


Figure 14-6: Histogram of Density for ISBS

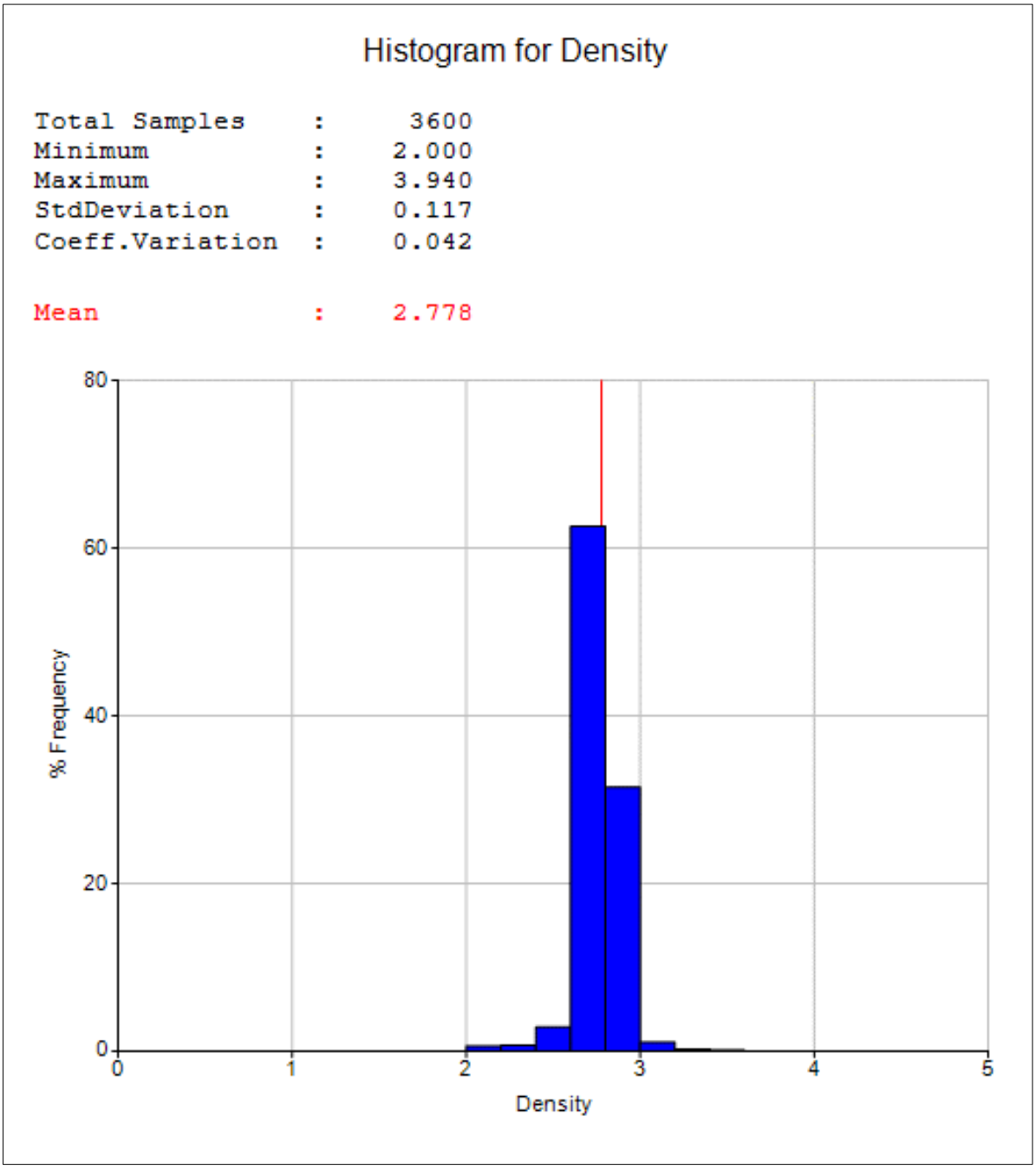


Figure 14-7: Histogram of Density for ISBN

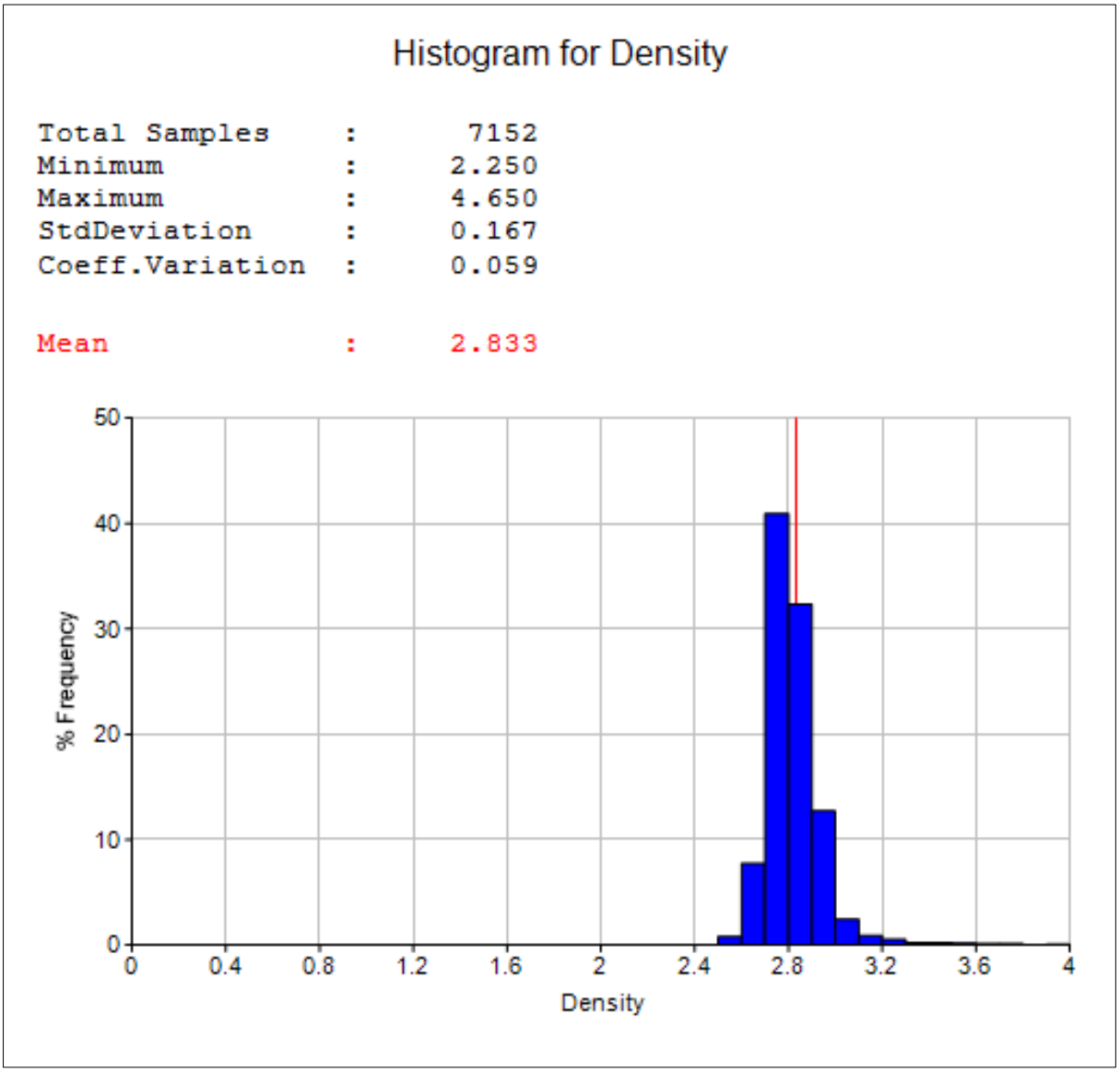


Figure 14-8: Histogram of Density for Bubi

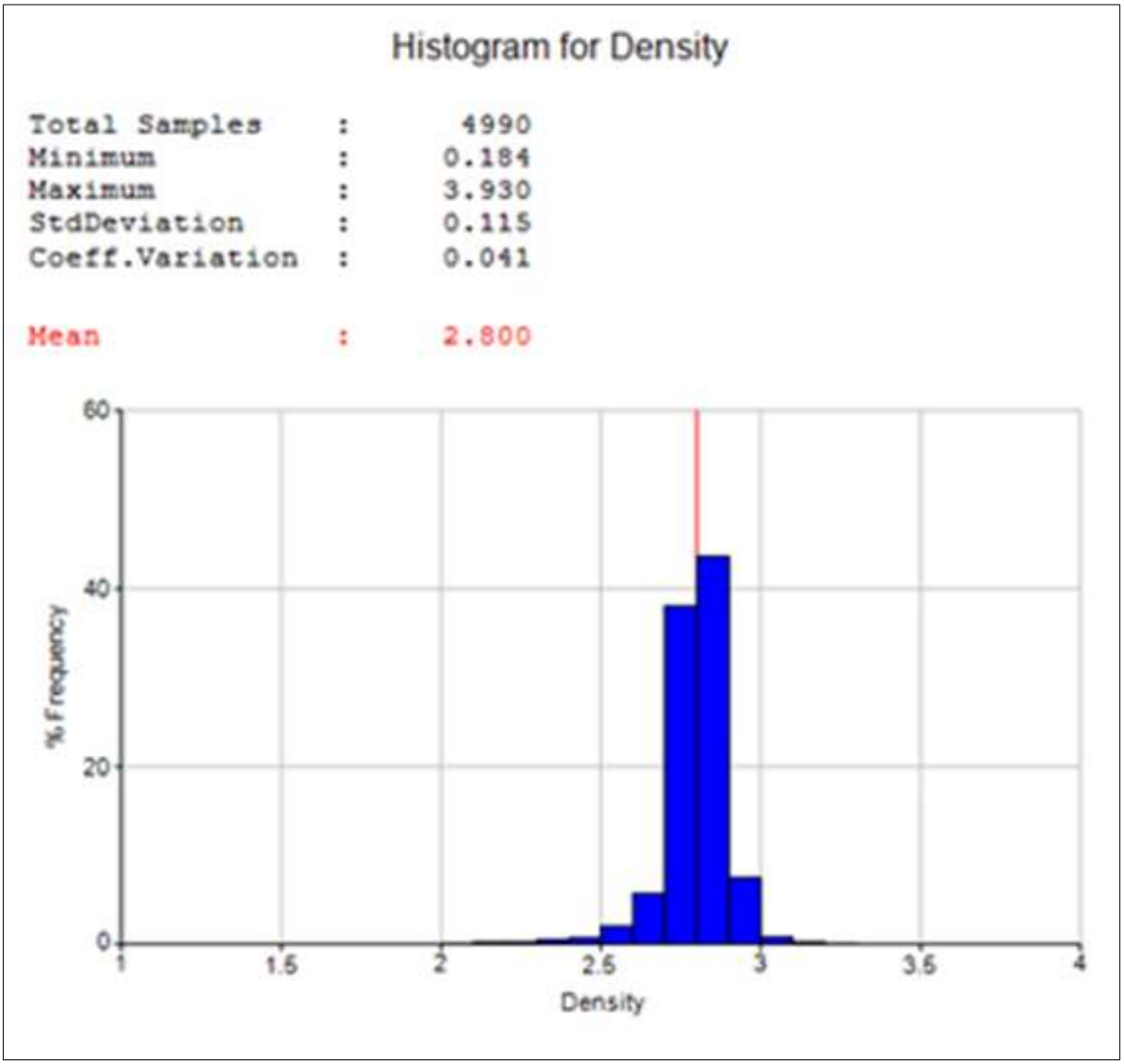


Figure 14-9: Histogram of Density for McCays

To check the reliability of the density measurements that were done in-house, 36 samples from Bubi, 25 from ISBS, 25 from ISBN and 15 from McCays were submitted to an independent third-party laboratory at the Institute of Mining Research, University of Zimbabwe. Comparisons between the 2018 density measurements and check analysis done at the University of Zimbabwe are presented as QQ plots in Figure 14-10, Figure 14-11, Figure 14-12 and Figure 14-13 below. In-house measurements compare well with the check analysis.

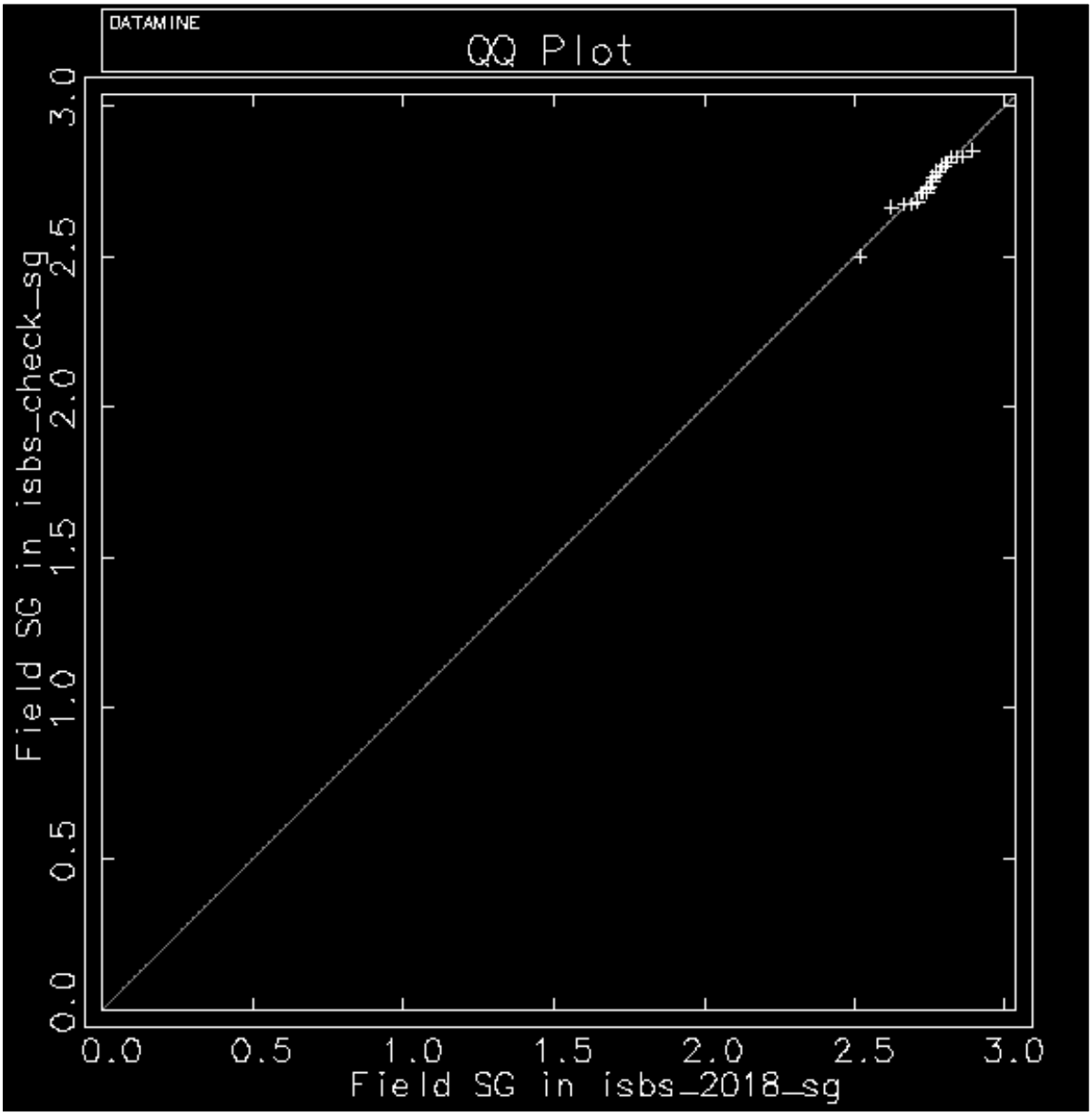


Figure 14-10: QQ Plot Comparing 2018 Density Measurements to University of Zimbabwe Density checks, ISBS

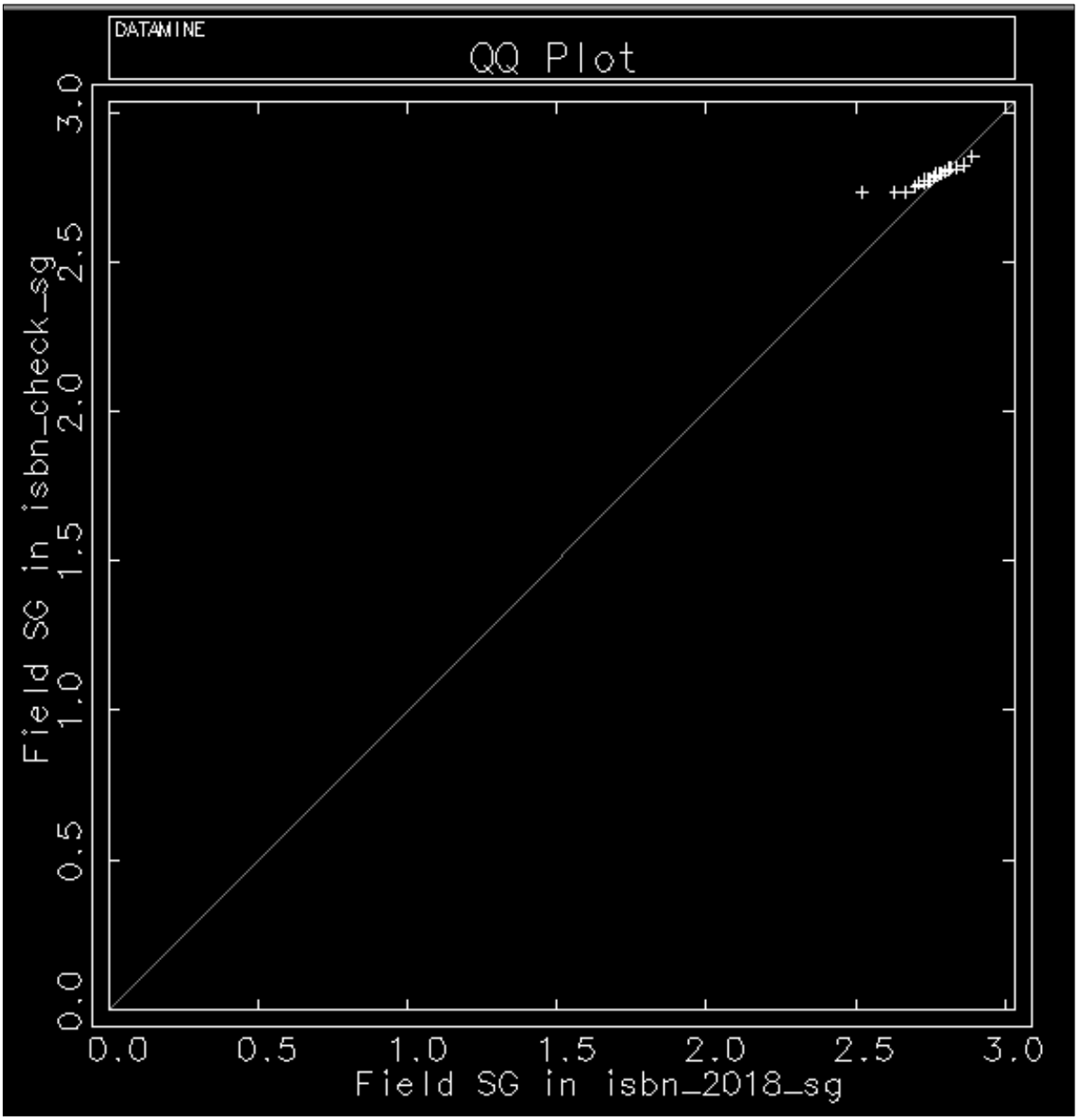


Figure 14-11: QQ Plot Comparing 2018 Density Measurements to University of Zimbabwe Density checks, ISBN

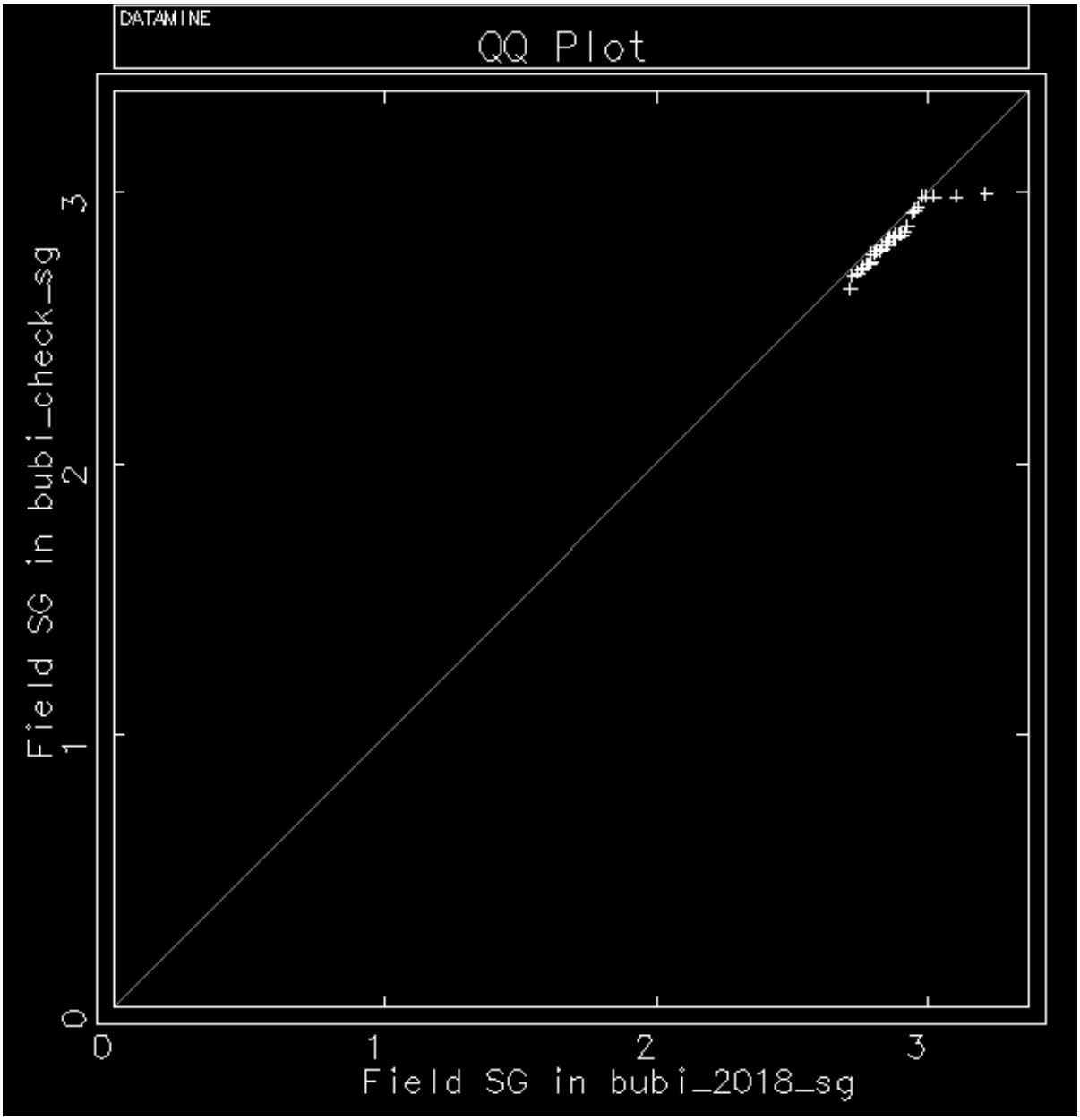


Figure 14-12: QQ Plot Comparing 2018 Density Measurements to University of Zimbabwe Density checks, Bubi

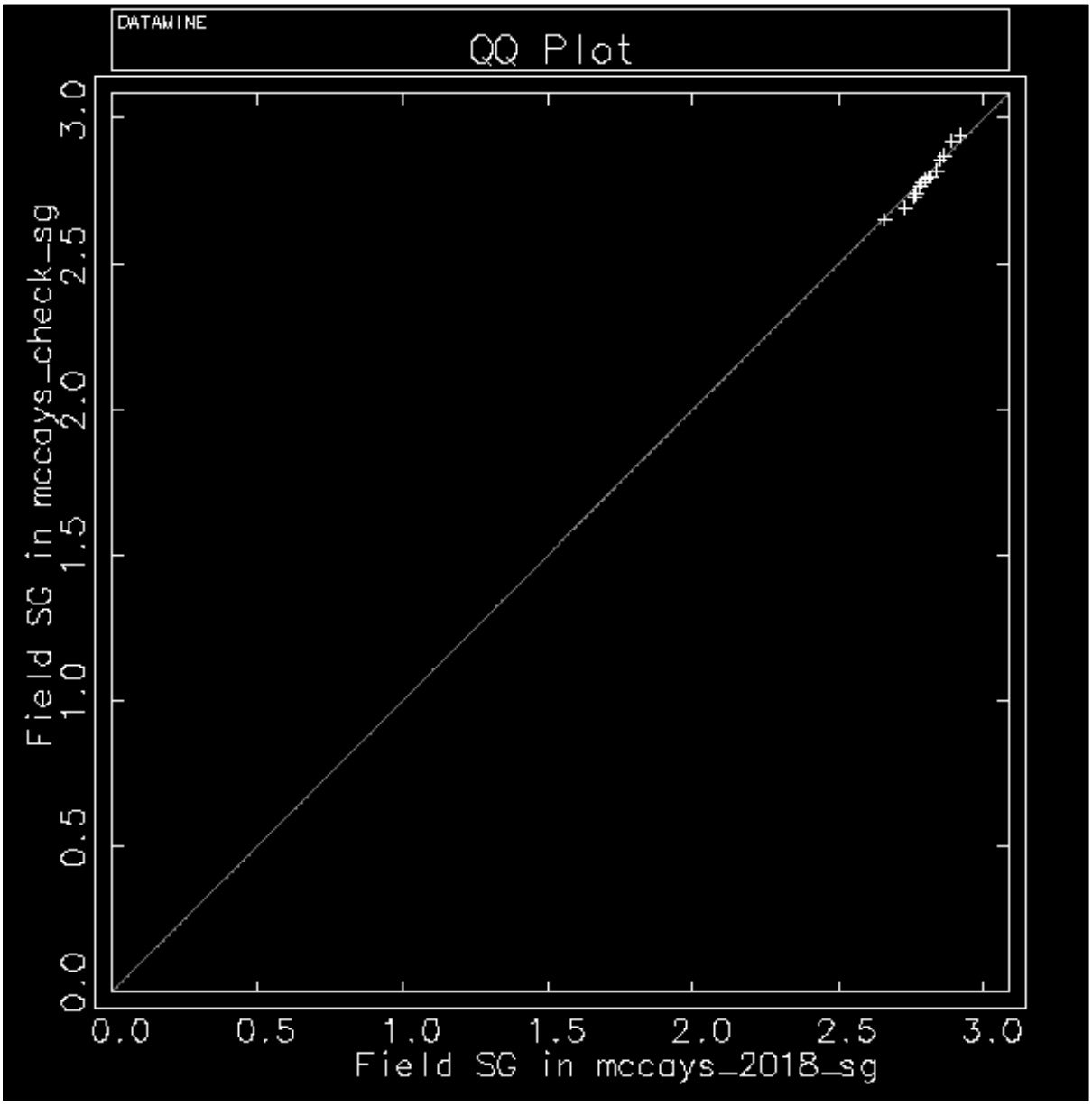


Figure 14-13: QQ Plot Comparing 2018 Density Measurements to University of Zimbabwe Density Checks, McCays

14.2 Geological Model on which the Grade Estimate is based

14.2.1 Geological Interpretation and Ore Zonation

Mineralisation at Bilboes is classified as Archaean hydrothermal alteration within broad shear zones. Discrete mineralised zones have been observed from the oxide open cast mining. Mineralised zones at ISBS strike NE and dip steeply (~65 degree to 75 degree) towards the SE. Mineralisation at ISBN strike NE and dip at 79 degree to 85 degree towards the SE. The strike at Bubi is NE-SW and dips towards the SE at approximately 75 degrees. At McCays, the dip is approximately 73 degrees towards the NW and strikes NE-SW. The strike lengths of the mineralised zones vary from a few hundred meters to over a kilometre. The thickness

of the mineralised zones varies from less than a meter, to approximately 20 m, with few areas greater than 20 m.

A total of 16 mineralised zones were interpreted in ISBS. The 2017 resource estimate had seven interpreted zones. At Bubi, there were six zones in 2017 and ten in the current 2021 study period. For ISBN and McCays, in 2017 there were eight and six, respectively; the 2018 models have sixteen zones for both these properties. One of the reasons for the increase in the number of zones is that some zones were previously interpreted as broad zones that bifurcated. In the 2018 models, these zones have been split up into multiple distinct zones (Figure 14-14). In some areas, the new drilling identified additional zones.

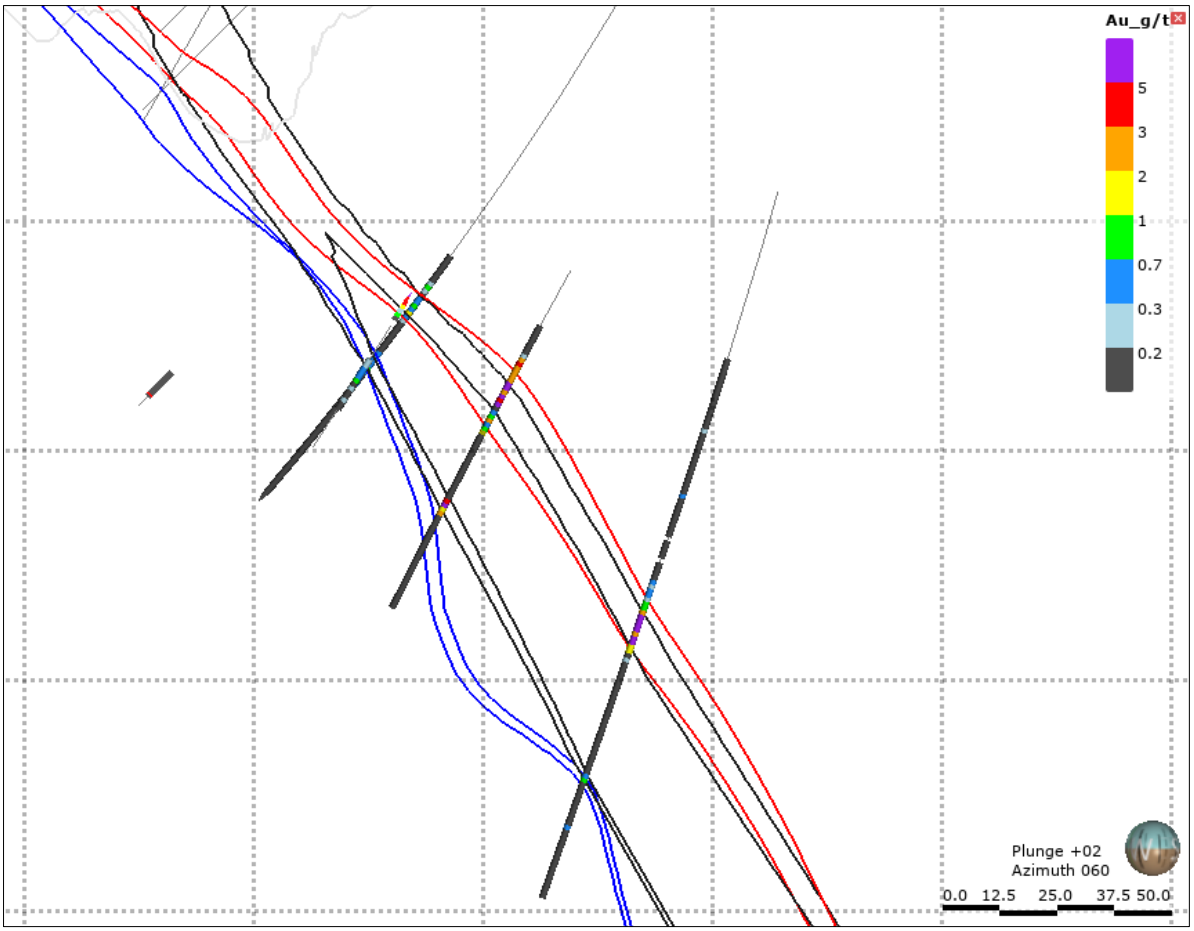


Figure 14-14: Section View showing Re-Interpreted Ore Zone (black = 2017; red and blue = current)

The names of zones from 2017 have been retained and the new zones have been given names using a similar naming convention to that used in 2017. Table 14-3, Table 14-4, Table 14-5 and Table 14-6 shows the names for the different zones for ISBS, ISBN, Bubi and McCays respectively.

Table 14-3: Mineralised Zone Names, ISBS

Ore Zone #	CCIC Name	SRK Name
1	Castile Main	Castile Main
2	Castile Footwall	Castile Footwall
3	Castile Hangingwall	
4	Castile West	
5	Castile West-1	
6	Maria Extension	
7	Maria North Footwall	Maria North Footwall
8	Maria North Hangingwall	
9	Maria South Footwall-1	
10	Maria South Footwall	Maria South Footwall
11	Maria South Hangingwall	Maria South Hangingwall
12	Maria Footwall	Maria Footwall
13	Maria Footwall-1	
14	Maria Footwall-2	
15	Maria Hangingwall	Maria Hangingwall
16	Northern Ore Zone	

Table 14-4: Mineralised Zone Names, ISBN

Ore Zone #	CCIC Name	SRK Name
1080	Calcite 4 1	Castile 4w
2080	Calcite 4 2	Castile 4w
2090	Calcite 4 HW	
3040	Diana FW 6	Diana FW
3060	Diana FW 3	Diana FW 2
3070	Calcite 5	Castile 5
3090	Diana FW 7	
4011	Diana Main 1	Diana Main
4012	Diana Main 2	Diana Main
4020	Diana HW	Diana HW
4030	Diana HW 1	Diana HW1
4040	Diana FW 4	
3050	Diana FW 1	Diana FW1
4050	Diana FW 2	Diana FW1
4060	Diana FW 5	
4070	Diana HW 2	

Table 14-5: Mineralised Zone Names, Bubi

Ore Zone #	CCIC Name	SRK Name
1	Main	Main
2	North Hangingwall	North Hangingwall
3	South Hangingwall	South Hangingwall
4	East Zone	East Zone
5	North Central	North Central
6	West	West
7	North Hangingwall-1	
8	Main 2	
9	Far North Hangingwall	
10	Footwall	

Table 14-6: Mineralised Zone Names, McCays

Ore Zone #	CCIC Name	SRK Name
1	Main -1	Main
2	Main -2	Main
3	Footwall - 1	Footwall
4	Footwall - 2	Footwall
5	Extension	Extension
6	Main Footwall South	
7	Footwall West	Footwall West
8	Hangingwall	Hangingwall
9	Hangingwall North	Hangingwall North
10	Extension North	
11	Main Hangingwall North	
12	Footwall North 1	
13	Footwall South 1	
14	Footwall North 2	
15	Footwall South 2	
16	Hangingwall South	

The previous resource estimate interpreted the mineralised zones to be thinner at depth and widening towards the surface, as was observed in the open cast mining. For the 2018 resource estimates, the widths of the mineralised zones were interpreted from drilling information and supported by the 2018 in-fill drilling campaign.

The boundary between mineralised and un-mineralised zones follows a “natural” break, resembling a hard boundary. This grade drop-off varies between 0.2 g/t Au to 0.7 g/t Au. The

interval selection tool in Leapfrog was used to flag samples as either “MINZ” or “waste”. MINZ samples were then assigned to mineralised zones using mineralised zones utilised in the previous resource estimate as a guide. Interpretations used the previous resource model as a guide and adjusted or re-interpreted to fit the new drilling. In the properties of Bubi, McCays, and ISBN faulting was introduced. Faults were interpreted from regional maps and supported by off-sets in the mineralised zones.

The selected intervals were modelled using the veining tool in Leapfrog. This tool allows the user to create continuity in areas where mineralisation is very thin. It also allows the user to create pinch outs in areas where the mineralisation pinches out. At depth, the geological model is restricted by introducing a maximum depth at which the geological model can extend to. Figure 14-16, Figure 14-17 and Figure 14-18 shows the modelled mineralised zones from ISBS, ISBN, Bubi and McCays respectively.

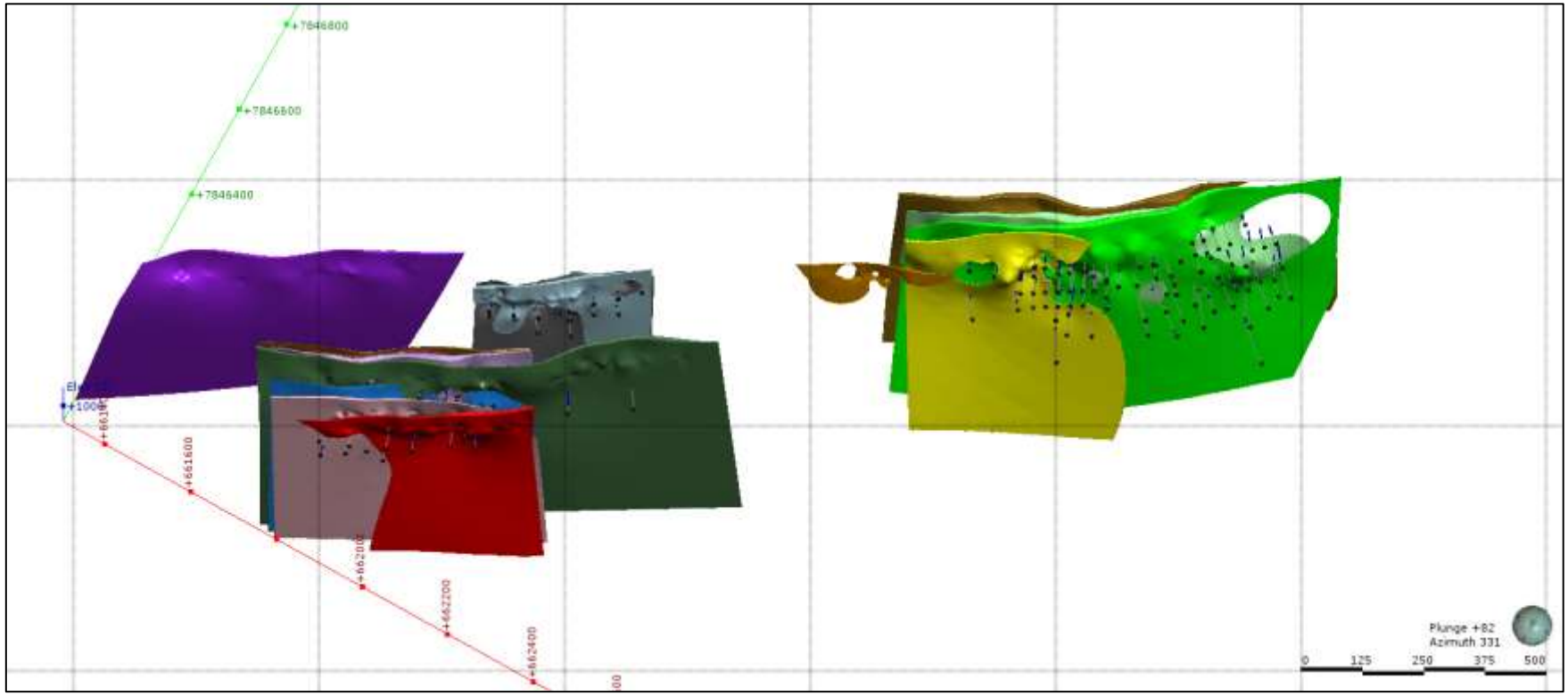


Figure 14-15: ISBS Mineralised Zones

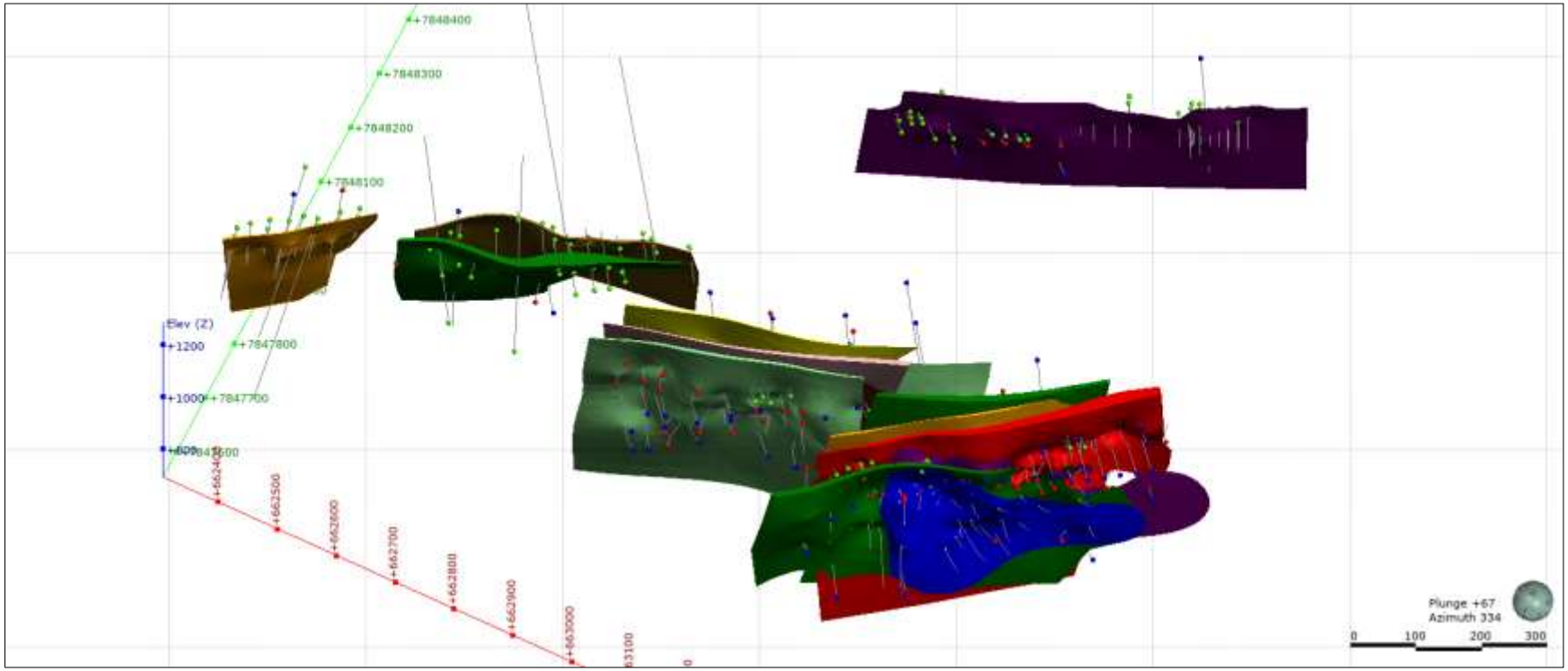


Figure 14-16: ISBN Mineralised Zones

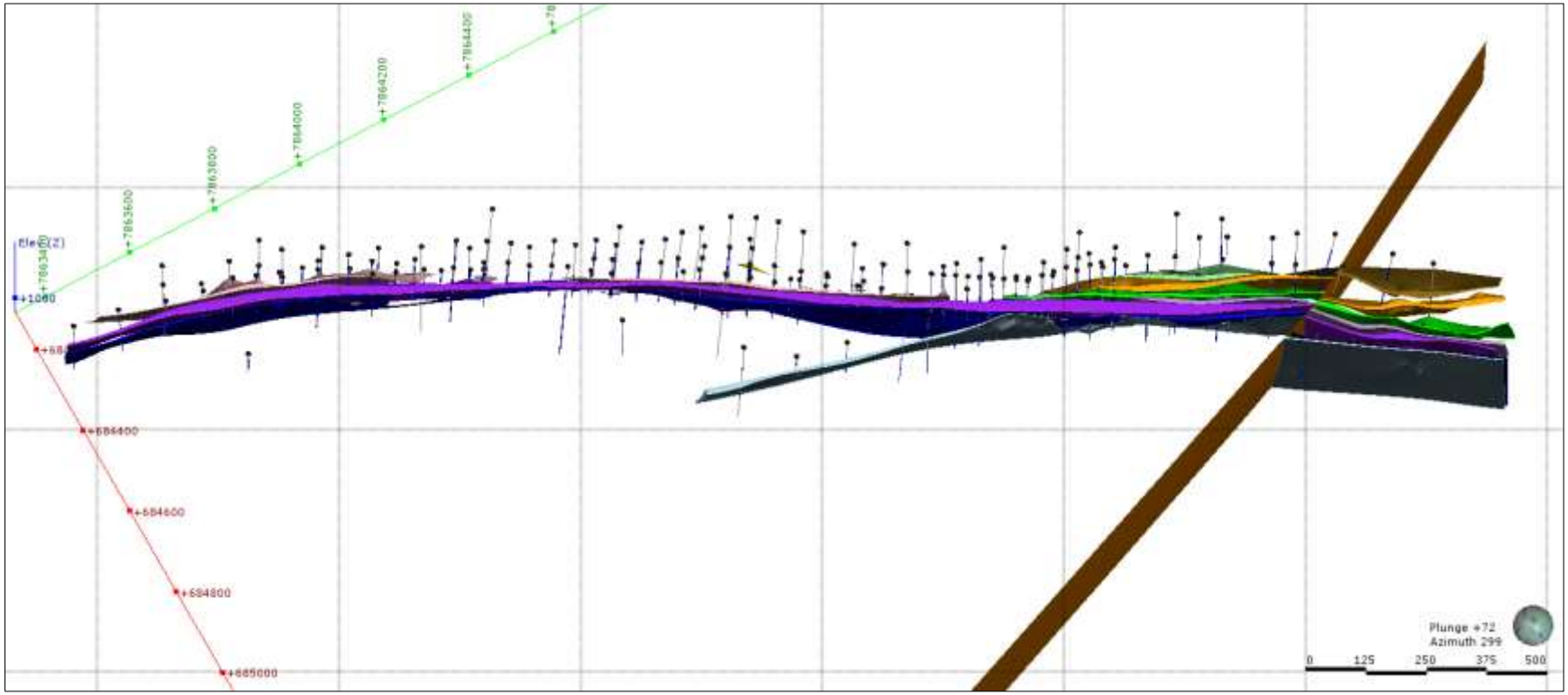


Figure 14-17: Bubi Mineralised Zones

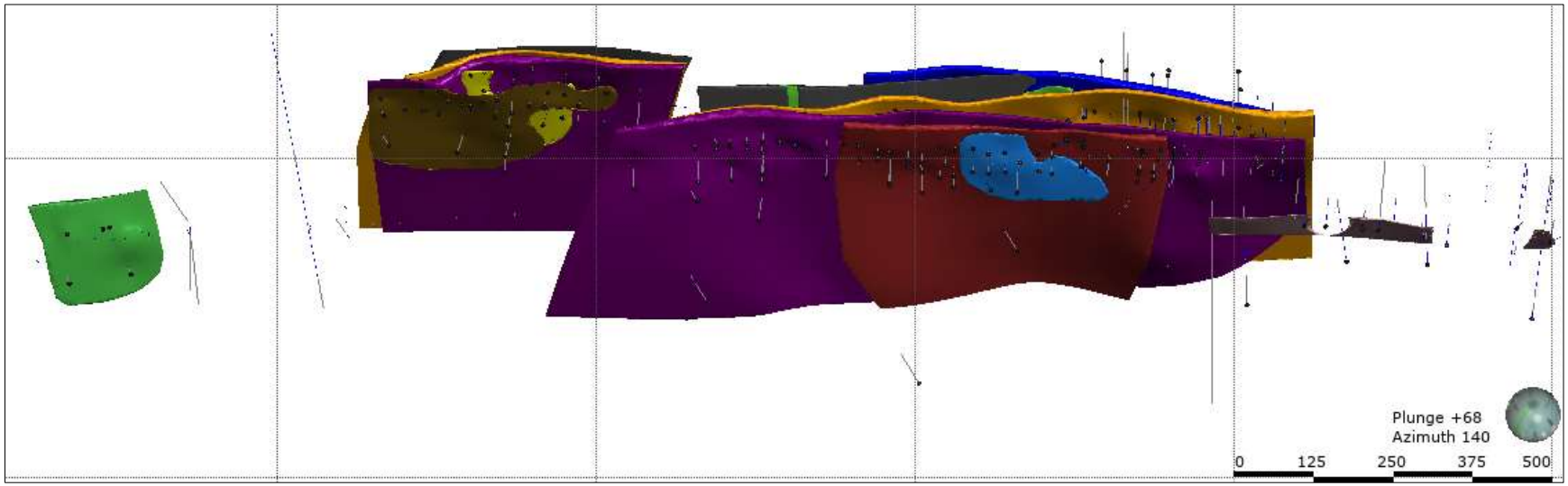


Figure 14-18: McCays Mineralised Zones

14.2.2 Weathering and Oxidation

Oxidation profiles are important in determining the different rock mass densities of ‘ore’ and ‘waste’ during mine planning. Oxidation is also important in determining metallurgical processing method, costs and recoveries. In the 2017 mineral resource review, CCIC recommended that the oxidation profile at Bilboes be revised to include a transitional zone. The latest resource models included a transitional zone, as illustrated in purple in Figure 14-19 below.

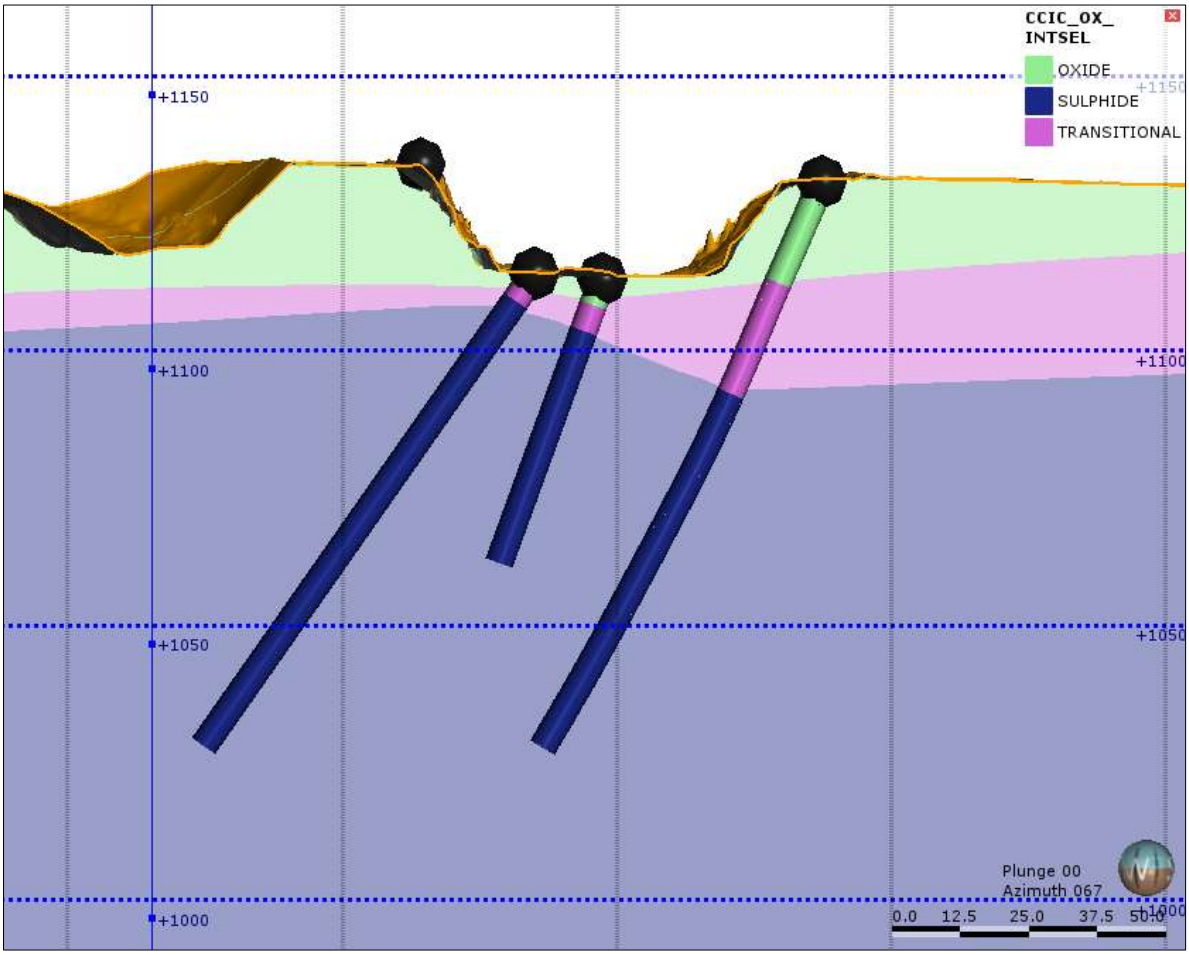


Figure 14-19: Section View showing Oxidation Profile at ISBS

14.3 Compositing

For all four properties, the predominant sampling interval was 0.5 m and 1.0 m; hence a composite length of 1.0 m was used. Statistics for sample lengths before and after compositing for ISBS are presented in Figure 14-20 below. Results for the other three properties are presented in Section 29.3 (appendix).

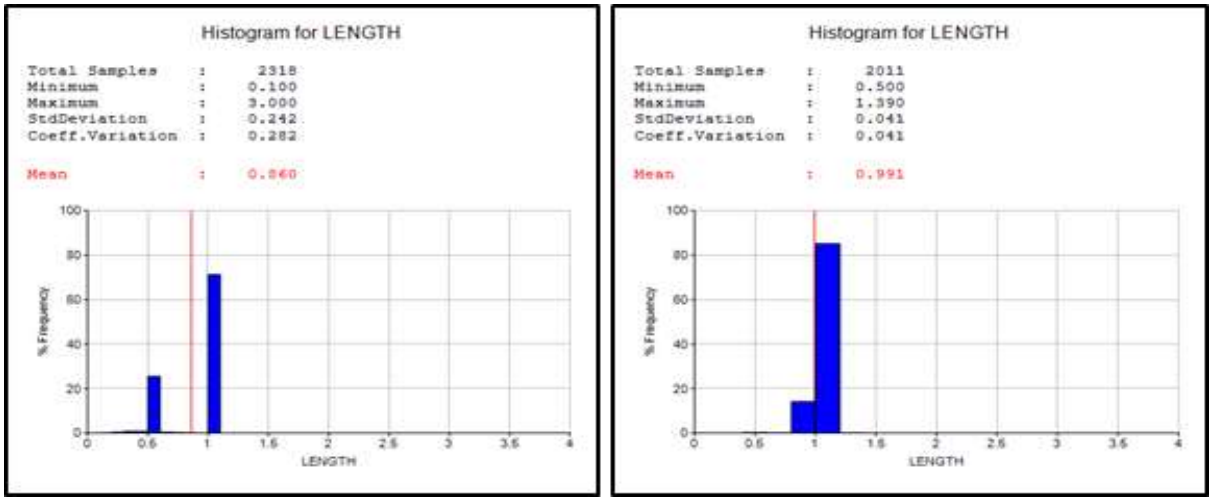


Figure 14-20: Histogram of Sample Length Prior (left) and After (right) Compositing for ISBS, Sulphide

14.3.1 Composited Statistics

In areas with limited Diamond or Reverse Circulation drilling, percussion drilling data was used to inform the mineralised zones during the geological modelling process. Where percussion holes were used for geological modelling, they were also included in the estimation.

Oxidation of the “ore zones” is a result of chemical alteration that postdates mineralisation. The moderately weathered part of the Transitional Zone was historically mined as part of Oxide resources because the two were considered economically viable by heap leaching process method. The weakly weathered material was considered together with the fresh sulphide ore. For these reasons, the moderately weathered Transitional Zone was estimated together with the Oxide Zone. All DD and RC samples that occur within a mineralised zone, irrespective of whether they are located in the Oxide, Transitional, or Sulphide Zone, were used to estimate grade in all three zones. Percussion samples that occur in the Transitional and Oxide parts of the model, were used to estimate grade in the moderately weathered Transitional and Oxide parts of the model. As a result, two sample files were created for each property: A Sulphide sample file that would be used to estimate in the Sulphide part of the model and an Oxide sample file that would be used to estimate in the Oxide and moderately weathered Transitional parts of the model. A Sulphide sample file consists of all DD and RC samples that occur in a mineralised zone, including any percussion samples that were used to inform the geological model within the Sulphide zone.

Statistical summary of the Sulphide sample files are presented in Table 14-7, Table 14-8, Table 14-9, Table 14-10 below. The statistics for the Oxide samples files are presented in Table 14-11 to Table 14-14 below. NMISVALS in the tables represents absent values. These are un-sampled intervals within wireframes.

Table 14-7: Composited Statistical Summary of Composited Sulphide Samples, ISBS

Name	Castile Main	Castile FW	Castile HW	Castile West-1	Maria Ext.	Maria North FW	Maria North HW	Maria South FW-1	Maria South FW	Maria South HW	Maria FW	Maria FW-1	Maria FW-2	Maria HW
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	815	268	115	32	44	116	34	53	38	23	219	42	23	142
Nmisvals	7	13	8	-	4	0	0	3	1	2	1	8	0	0
Minimum	0.02	0.02	0.02	0.40	0.02	0.02	0.40	0.02	0.04	0.18	0.02	0.40	0.02	0.02
Maximum	23.21	16.33	10.92	14.24	8.69	7.12	4.52	6.74	4.30	11.26	13.52	6.72	2.86	12.39
Mean	2.88	1.53	1.73	2.89	1.29	1.64	1.59	1.65	1.11	1.82	2.20	1.72	0.81	1.99
Variance	11.12	4.14	3.81	10.86	2.35	1.74	1.01	2.84	0.92	6.32	4.08	2.14	0.50	3.02
Standdev	3.33	2.03	1.95	3.30	1.53	1.32	1.00	1.69	0.96	2.51	2.02	1.46	0.71	1.74
Standerr	0.12	0.12	0.18	0.62	0.23	0.12	0.17	0.23	0.16	0.52	0.14	0.23	0.16	0.15

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-8: Composited Statistical Summary of Composited Sulphide Samples, ISBN

Name	Calcite 4 1	Calcite 4 2	Calcite 4 HW	Diana FW 6	Diana FW 1	Diana FW 3	Calcite 5	Diana FW 7	Diana Main 1	Diana Main 2	Diana HW	Diana HW 1	Diana FW 4	Diana FW 2	Diana FW 5	Diana HW 2
Field	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU	AU
Nsamples	7	4	-	224	158	136	27	82	620	477	187	93	190	202	67	106
Nmisvals	-	-	7	-	9	14	-	-	64	2	18	5	5	21	1	10
Minimum	0.37	0.57	-	-	0.09	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.08	-
Maximum	6.47	3.02	-	14.96	10.88	15.80	3.25	14.92	20.00	20.00	20.00	20.00	16.30	20.00	10.02	20.00
Mean	2.20	2.27	-	2.61	2.14	2.31	0.57	1.75	2.74	3.04	2.46	2.67	2.71	2.19	2.25	1.86
Variance	4.22	0.99	-	6.80	3.63	5.63	0.69	4.55	9.21	8.59	9.39	8.68	7.43	7.44	5.37	5.81
Standdev	2.05	1.00	-	2.61	1.91	2.37	0.83	2.13	3.04	2.93	3.06	2.95	2.73	2.73	2.32	2.41
Standerr	0.78	0.50	-	0.17	0.15	0.20	0.16	0.24	0.12	0.13	0.22	0.31	0.20	0.19	0.28	0.23

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-9: Composited Statistical Summary of Composited Sulphide Samples, Bubi

Name	Main	NHW	SHW	East	North Central	West	NHW-1	Main-2	FNHW	FW Minz
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	3,048	365	264	92	354	31	76	199	13	294
Nmisvals	31	4	9	10	-	-	-	-	-	4
Minimum	0.02	0.01	0.02	0.01	0.04	0.18	0.04	0.01	0.39	0.02
Maximum	18.20	9.15	17.13	5.58	10.06	8.31	19.40	20.75	1.59	11.44
Mean	2.21	0.97	1.67	0.78	1.17	2.50	1.14	0.88	0.64	0.88
Variance	6.37	1.02	4.39	0.58	1.56	4.66	5.10	2.67	0.10	1.60
Standdev	2.52	1.01	2.10	0.76	1.25	2.16	2.26	1.64	0.32	1.26
Standerr	0.05	0.05	0.13	0.08	0.07	0.39	0.26	0.12	0.09	0.07

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-10: Composited Statistical Summary of Composited Sulphide Samples, McCays

Name	Main-1	Main-2	Extension	FW-1	FW-2	Main FW South	FW West	HW	HW North	Main HW North	FW North 1	FW South 1	FW North 2	FW South 2	HW South
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	439	432	63	196	361	38	247	201	51	34	40	54	26	59	27
Nmisvals	10	12	-	2	7	6	9	9	3	-	-	6	-	2	-
Minimum	0.02	0.02	0.05	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.11
Maximum	35.64	19.32	10.08	17.54	28.74	7.63	23.46	47.96	6.72	3.98	12.02	5.76	6.47	7.00	10.06
Mean	3.19	2.44	0.97	2.11	2.11	1.21	3.08	3.96	1.01	0.92	1.52	1.03	1.28	1.07	1.70
Variance	14.20	9.87	2.04	7.19	12.32	2.49	15.86	43.51	1.66	0.79	4.12	1.06	2.27	1.93	4.65
Standdev	3.77	3.14	1.43	2.68	3.51	1.58	3.98	6.60	1.29	0.89	2.03	1.03	1.51	1.39	2.16
Standerr	0.18	0.15	0.18	0.19	0.18	0.26	0.25	0.47	0.18	0.15	0.32	0.14	0.30	0.18	0.42

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-11: Composited Statistical Summary of Composited Oxide Samples, ISBS

Name	Castile Main	Castile FW	Castile HW	Castile West	Castile West-1	Maria Ext.	Maria North FW	Maria North HW	Maria South FW-1	Maria South FW	Maria South HW	Maria FW	Maria FW-1	Maria FW-2	Maria HW	N-Minz
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	1,491	737	282	51	121	293	491	247	126	261	306	471	82	46	470	100
Nmisvals	7	13	8	-	-	4	0	0	3	1	2	1	8	0	0	0
Minimum	0.01	0.01	0.01	0.12	0.01	0.02	0.01	0.01	0.02	0.04	0.06	0.01	0.01	0.02	0.01	0.06
Maximum	23.21	41.40	16.08	16.71	14.24	8.69	7.99	9.66	6.74	6.23	11.83	16.44	10.60	7.03	13.05	3.15
Mean	2.34	1.59	1.76	3.09	1.68	1.09	1.35	1.54	1.35	1.07	1.37	1.99	1.57	1.20	2.24	0.73
Variance	7.49	5.65	3.64	12.98	4.49	1.09	1.41	2.35	1.86	0.80	2.87	4.51	4.51	1.56	3.95	0.20
Standdev	2.74	2.38	1.91	3.60	2.12	1.04	1.19	1.53	1.36	0.90	1.69	2.12	2.12	1.25	1.99	0.44
Standerr	0.07	0.09	0.12	0.50	0.42	0.06	0.05	0.10	0.12	0.06	0.10	0.10	0.10	0.20	0.10	0.04

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-12: Composited Statistical Summary of Composited Oxide Samples, ISBN

Name	Calcite 4 1	Calcite 4 2	Calcite 4 HW	Diana FW 6	Diana FW 1	Diana FW 3	Calcite 5	Diana FW 7	Diana Main 1	Diana Main 2	Diana HW	Diana HW 1	Diana FW 4	Diana FW 2	Diana FW 5	Diana HW 2
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	202	316	99	228	174	138	262	82	700	510	212	94	190	207	67	127
Nmisvals	0	0	7	0	9	14	0	0	64	2	18	5	5	21	1	10
Minimum	0.00	0.01	0.01	0.00	0.09	0.02	0.02	0.02	0.00	0.01	0.00	0.02	0.02	0.02	0.08	0.00
Maximum	6.49	11.98	19.08	14.96	10.88	15.80	8.10	14.92	38.54	28.75	20.57	55.99	16.30	169.66	10.02	37.32
Mean	1.26	1.07	1.47	2.58	2.06	2.28	0.82	1.75	2.67	2.97	2.20	3.03	2.71	2.81	2.25	2.02
Variance	1.82	1.76	4.74	6.73	3.41	5.59	0.71	4.55	10.86	9.50	8.92	35.57	7.43	140.96	5.37	13.03
Standdev	1.35	1.33	2.18	2.59	1.85	2.36	0.84	2.13	3.30	3.08	2.99	5.96	2.73	11.87	2.32	3.61
Standerr	0.10	0.07	0.22	0.17	0.14	0.20	0.05	0.24	0.12	0.14	0.21	0.62	0.20	0.83	0.28	0.32

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-13: Composited Statistical Summary of Composited Oxide Samples, Bubi

Name	Main	NHW	SHW	East	North Central	West	NHW-1	Main-2	FNHW	FW Minz
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	3,221	484	266	163	478	31	76	269	112	281
Nmisvals	30	4	9	10	-	-	-	-	-	4
Minimum	0.02	0.01	0.02	0.02	0.03	0.18	0.04	0.02	0.04	0.02
Maximum	18.20	9.15	17.13	8.06	10.06	8.31	19.40	20.75	3.54	11.44
Mean	2.13	1.05	1.66	1.08	1.09	2.50	1.14	0.82	0.70	0.91
Variance	6.17	1.09	4.37	1.69	1.29	4.66	5.10	2.02	0.44	1.65
Standdev	2.48	1.04	2.09	1.30	1.13	2.16	2.26	1.42	0.67	1.29
Standerr	0.04	0.05	0.13	0.10	0.05	0.39	0.26	0.09	0.06	0.08

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

Table 14-14: Composited Statistical Summary of Composited Oxide Samples, McCays

Name	Main-1	Main-2	Ext.	FW-1	FW-2	Main FW South	FW West	HW	HW North	Main HW North	FW North 1	FW South 1	FW North 2	FW South 2	HW South	Ext. North
Field	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au	Au
Nsamples	439	550	31	196	412	44	221	255	51	34	40	54	26	59	27	12
Nmisvals	10	12	-	2	7	6	9	10	3	0	0	6	0	2	0	0
Minimum	0.02	0.02	0.13	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.11	0.03
Maximum	35.64	19.32	10.08	17.54	28.74	7.63	23.46	47.96	6.72	3.98	12.02	5.76	6.47	7.00	10.06	2.23
Mean	3.19	2.09	0.96	2.11	1.99	1.06	3.33	3.36	1.01	0.92	1.52	1.03	1.28	1.07	1.70	0.74
Variance	14.20	8.41	3.11	7.19	11.12	2.30	17.04	36.23	1.66	0.79	4.12	1.06	2.27	1.93	4.65	0.30
Standdev	3.77	2.90	1.76	2.68	3.33	1.52	4.13	6.02	1.29	0.89	2.03	1.03	1.51	1.39	2.16	0.55
Standerr	0.18	0.12	0.32	0.19	0.16	0.23	0.28	0.38	0.18	0.15	0.32	0.14	0.30	0.18	0.42	0.16

Notes: NSAMPLES = number of samples, NMISVALS = samples with absent values, STANDDEV = standard deviation, STANDERR = standard error.

14.4 Variography

For ISBS, a reliable semi-variogram was obtained for Castile Main, because this zone contained the most samples. The variogram model parameters were used for all other zones in the Castile area (northern part of the project). For the southern part of the project (Maria area), samples from these zones were grouped together to increase the number of sample pairs, while paying attention to the across strike direction to ensure that samples from one zone don't form pairs with samples from another zone. At Bubi, the Main zone produced a reliable semi-variogram. All the other zones used these variogram parameters for estimation. For McCays, a reliable semi-variogram was obtained for Main-1 and footwall West mineralised zones, which occur in fault block 2 and fault block 3, respectively. The variogram obtained within fault block 2 was applied to all mineralised zones within block 2, similarly the variogram obtained within fault block 3 was used for zones within that block. For the remaining mineralised zones, the variogram for the mineralised zone with a similar orientation was selected. Diana Main was the zone that produced a robust semi-variogram in ISBN and was used for all other mineralised zones within ISBN. Table 14-15 below contains the variogram parameters used for the estimation. The X direction represents the along strike direction, the Y direction is the down-dip direction, and the Z direction is the across strike direction. All variogram models were normalised to a sill of one.

Table 14-15: Variogram Parameters used for Grade Estimation

Property	Zone	Normalised Variogram Parameters								
		Nugget (Co)	Spherical Range 1				Spherical Range 2			
			X1	Y1	Z1	C1	X2	Y2	Z2	C2
ISBS	Castile Main	0.26	4.1	4.1	4.1	0.56	42	42	14.2	0.19
	Maria Area	0.44	3.2	3.2	3.2	0.28	20.8	20.8	6.3	0.28
ISBN	Diana Main-1	0.31	17	17	4	0.32	36	36	7	0.38
Bubi	Main Zone	0.32	10.6	10.6	4.1	0.41	70	70	12.3	0.27
McCays	Main-1	0.26	4	4	4	0.51	30	30	5	0.23
	FW West	0.19	8	8	1	0.2	30	30	6	0.61

14.5 Top Capping

The top capping strategy considered various criteria to determine the optimum values. These included:

- Histograms of sample distributions
- Sample percentiles
- Spatial locations of "outlier" samples

- Validation of model estimates against samples

Based on the above criteria, it was determined that Au values should remain uncapped. Top and bottom capping for Density values is summarised in Table 14-16 below. Values bellow the bottom cap were set to the bottom cap value, and values above the top cap were set to the top cap values.

Table 14-16: Top and Bottom Capping Summary

Domain	Variable	Bottom Cap	Top Cap
ISBS - Oxide	Density	2.10	3.00
ISBS - Transitional	Density	2.40	3.00
ISBS - Sulphide	Density	2.50	3.10
ISBN - Oxide	Density	2.50	3.10
ISBN - Transitional	Density	2.50	3.10
ISBN - Sulphide	Density	2.50	3.10
McCays - Sulphide	Density	2.20	3.20
Bubi - Oxide	Density	2.40	3.40
Bubi - Transitional	Density	2.40	3.40
Bubi - Sulphide	Density	2.40	3.40

14.6 Grade Estimation

14.6.1 Krige Neighbourhood Analysis

The aim of Krige Neighbourhood Analysis is to determine the optimal theoretical search and estimation parameters during Kriging to achieve an acceptable Kriging Variance and Slope of Regression whilst ensuring that none or a minimal number of samples are assigned negative Kriging Weights.

A Kriging neighbourhood is described as having a significant impact on the outcome of the kriged estimate. It is deemed to be an important step in setting up any krige estimate. Quantified Krige Neighbourhood Analysis (QKNA) is defined as a method employed to quantitatively assess the suitability of a kriging neighbourhood. Kriging is often referred to as a minimum variance estimator. For this to be true, the neighbourhood must be properly defined. Rivoirard (1978) identified two parameters, the weight of the mean and the slope of regression (SLOR) as crucial in the process of choosing the neighbourhood. Results from running QKNA for a range of block sizes show that the SLOR and the weight of the mean rapidly become unacceptable as the block size is reduced. The exception being blocks that contain samples. Determining a combination of the search neighbourhood and block size that will result in conditional unbiasedness is the primary objective of QKNA.

This optimisation was based on a representative area within the deposit where there is representative drilling. Figure 14-21 indicates the test location as a red dot surrounded by drill holes.

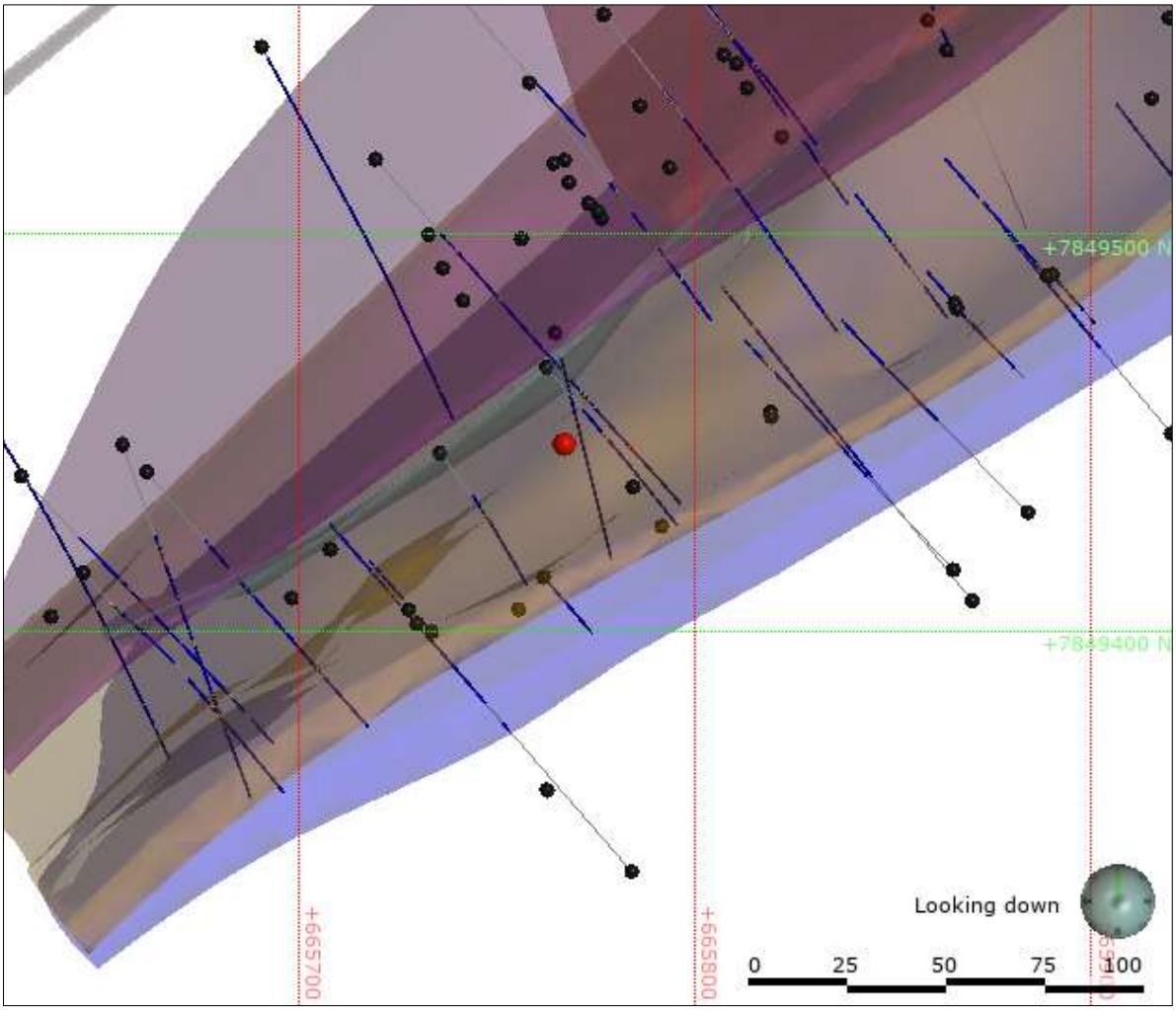


Figure 14-21: Plan showing Collars and Location (red dot) where a QKNA was run from, McCays

The following parameters in chronological order were optimised:

- Optimum parent cells size for the block model, in X, Y and Z directions
- Optimum search distances in the X, Y and Z directions

During parent cell size optimisation, the approach was to use the variogram ranges as a guide to set the search distances and not to apply any minimum and maximum number of samples to be used. Whilst all parameters remain constant, the parent cell size in the X direction was set to 10 m and then incrementally increased with every estimation. The Estimated Grade (Au), Kriging Variance (KVAR), Block Variance (BVAR), Kriging Efficiency (KEF), Slope of Regression (SLOR), Number of Samples used (NUMSAM) and the Percentage of samples with negative kriging weights (PCNEGWTH) were recorded for every

estimation. These outputs were then plotted against the incremental cell sizes to determine the optimum cell size in the X direction. The same process was then repeated for the cell sizes in the Y direction and then in the Z direction. Figure 14-22, Figure 14-23 and Figure 14-24 compare the plot (ISBS) of incremental Parent Cell sizes against Kriging Variance (KVAR) for X, Y and Z directions, respectively. The optimum parent cell size for ISBS, ISBN, and Bubi, taking practical mining constraints into consideration was set to 20 m x 10 m x 5 m in the X, Y, and Z directions, respectively. Due to width of mineralisation zones at McCays, the parent cell size was set at 10 m x 10 m x 5 m in the X, Y, and Z directions, respectively.

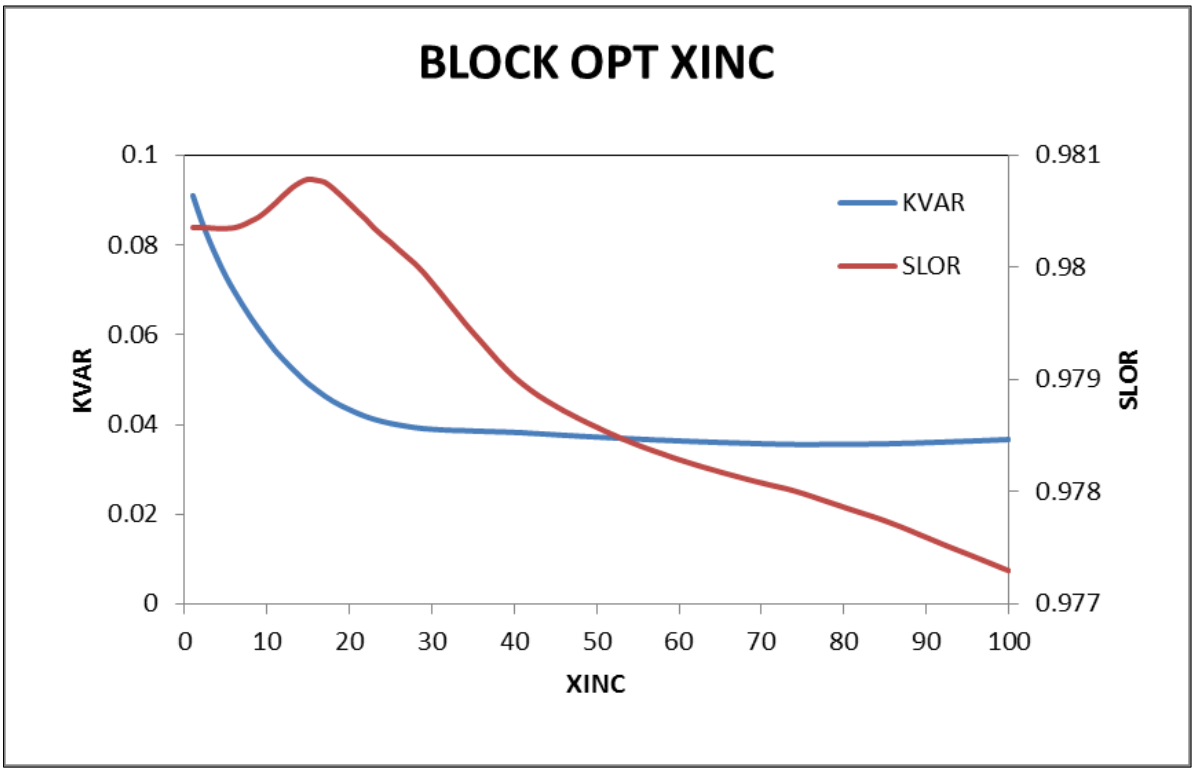


Figure 14-22: Parent Cell Size Optimisations X Direction, ISBS

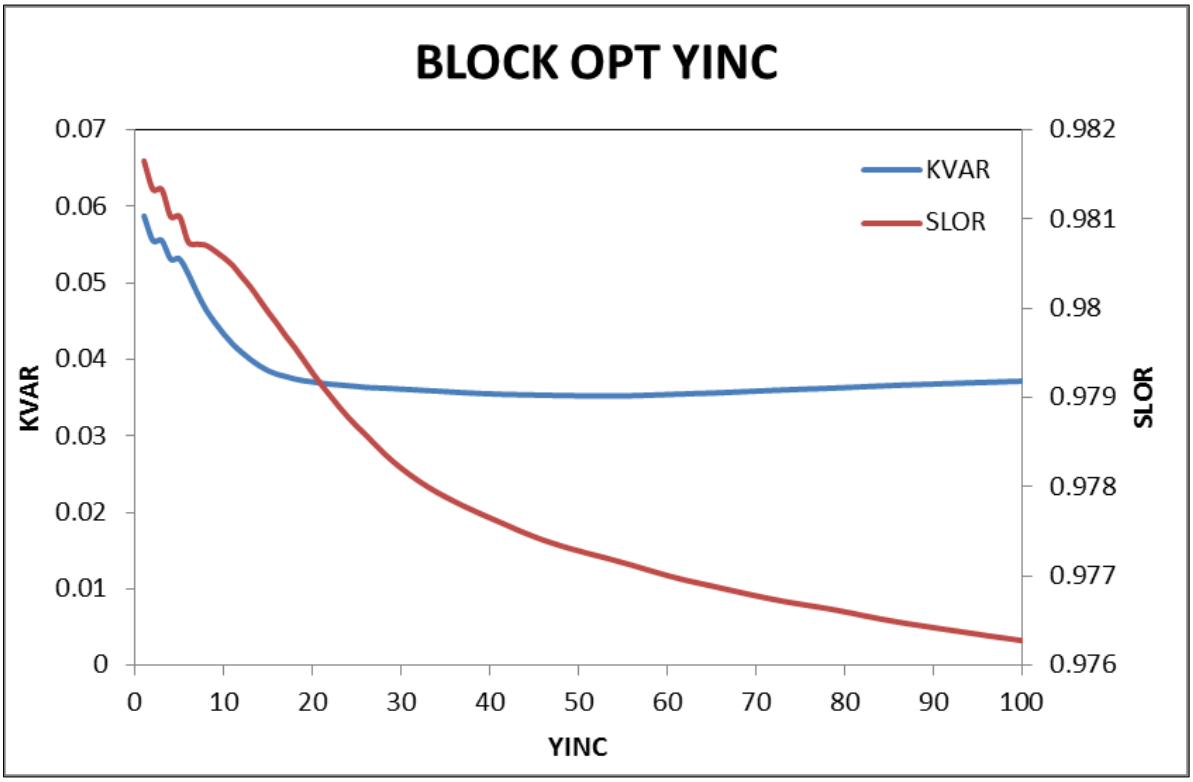


Figure 14-23: Parent Cell Size Optimisations Y Direction, ISBS

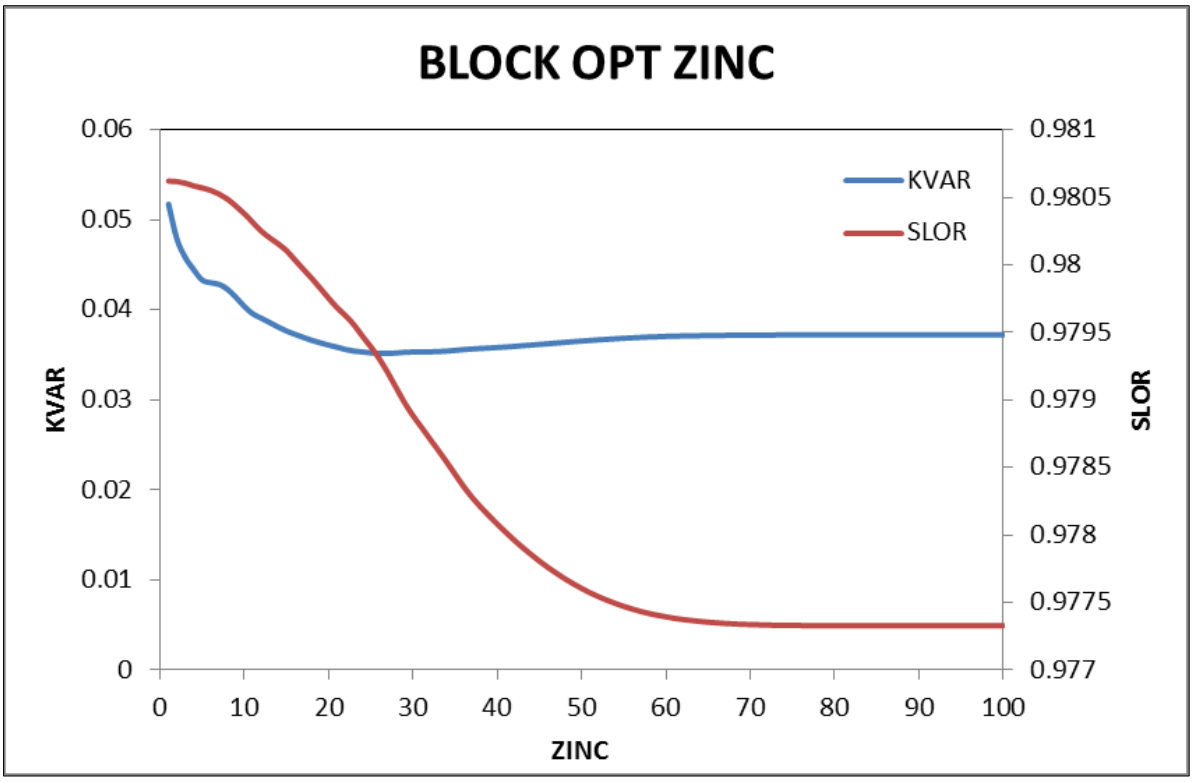


Figure 14-24: Parent Cell Size Optimisations Z Direction, ISBS

During search optimisations, the parent cell size was therefore set to 20 m x 10 m x 10 m and as described above, search distance in the X direction was incrementally increased. Results of the search optimisation for ISBS are plotted in Figure 14-25, Figure 14-26 and Figure 14-27 which compares both Kriging Variance (KVAR) and Slope of Regression (SLOR) against search distances. For the other three properties the results are contained in the appendix. Attention was also given the number of samples per estimate and the percentage of samples with negative Kriging weights. Optimum search distances, taking borehole spacing into account are outlined in Figure 14-25 below.

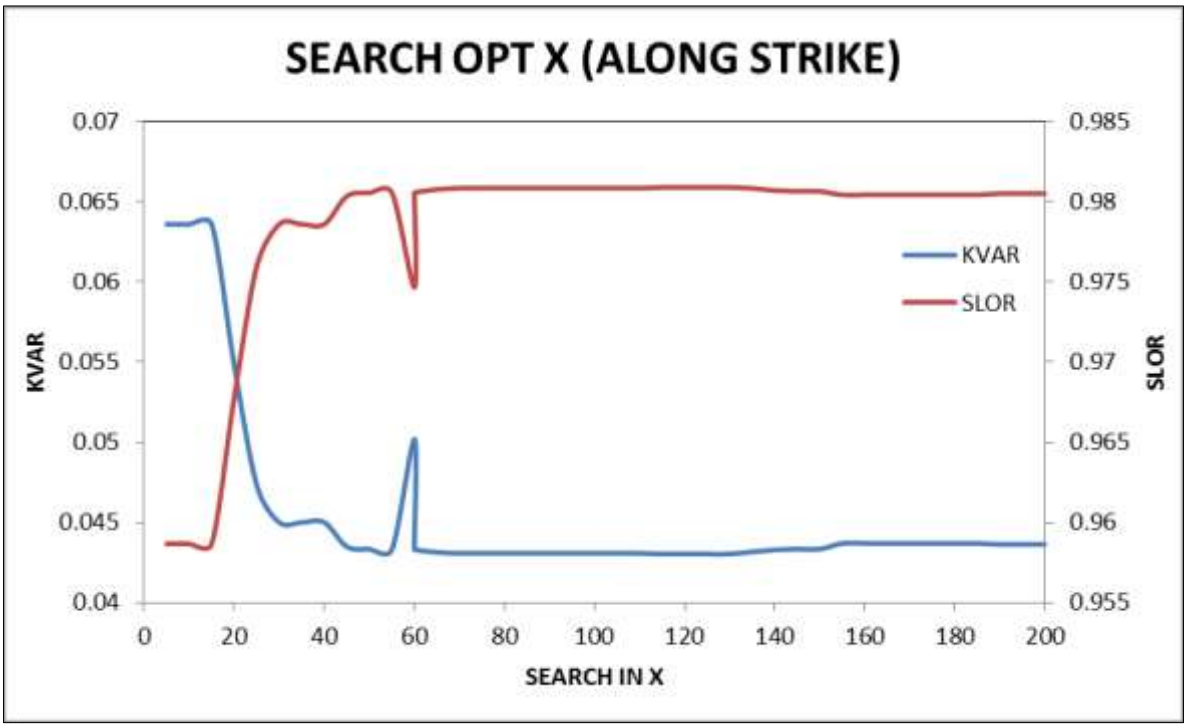


Figure 14-25: Search Distance Optimisations Strike Direction, ISBS

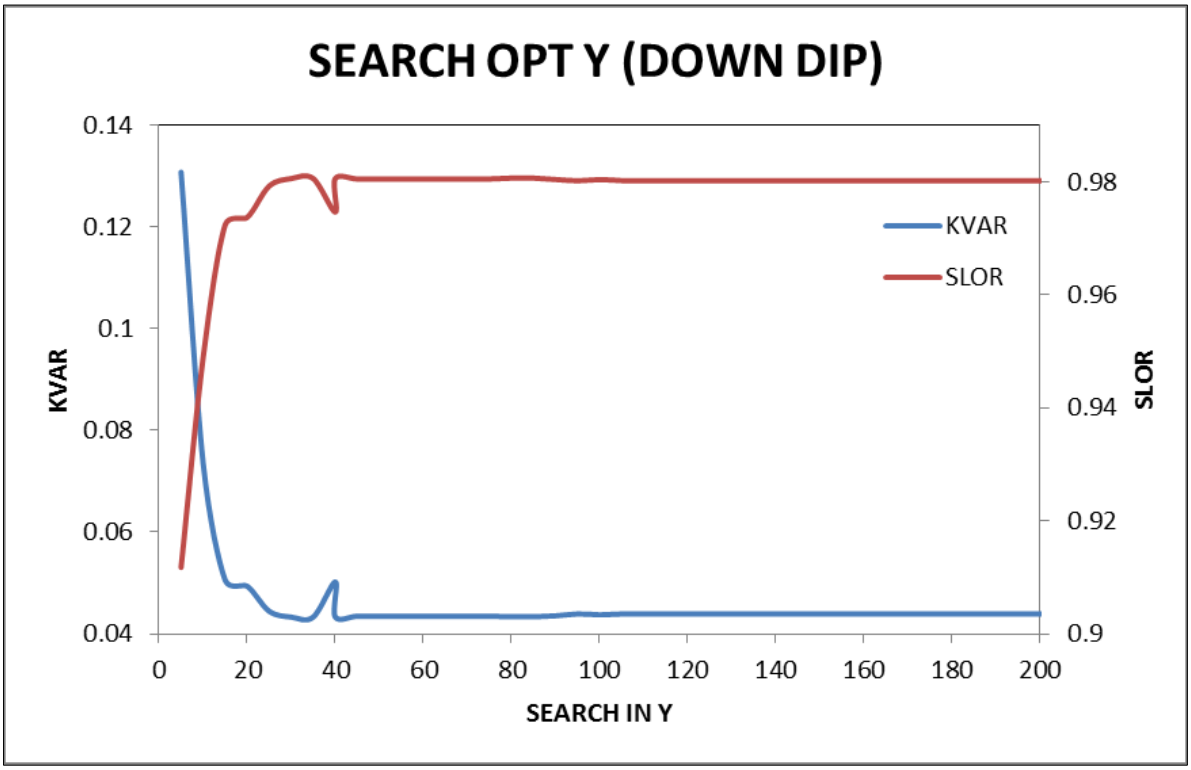


Figure 14-26: Search Distance Optimisations Down Dip Direction, ISBS

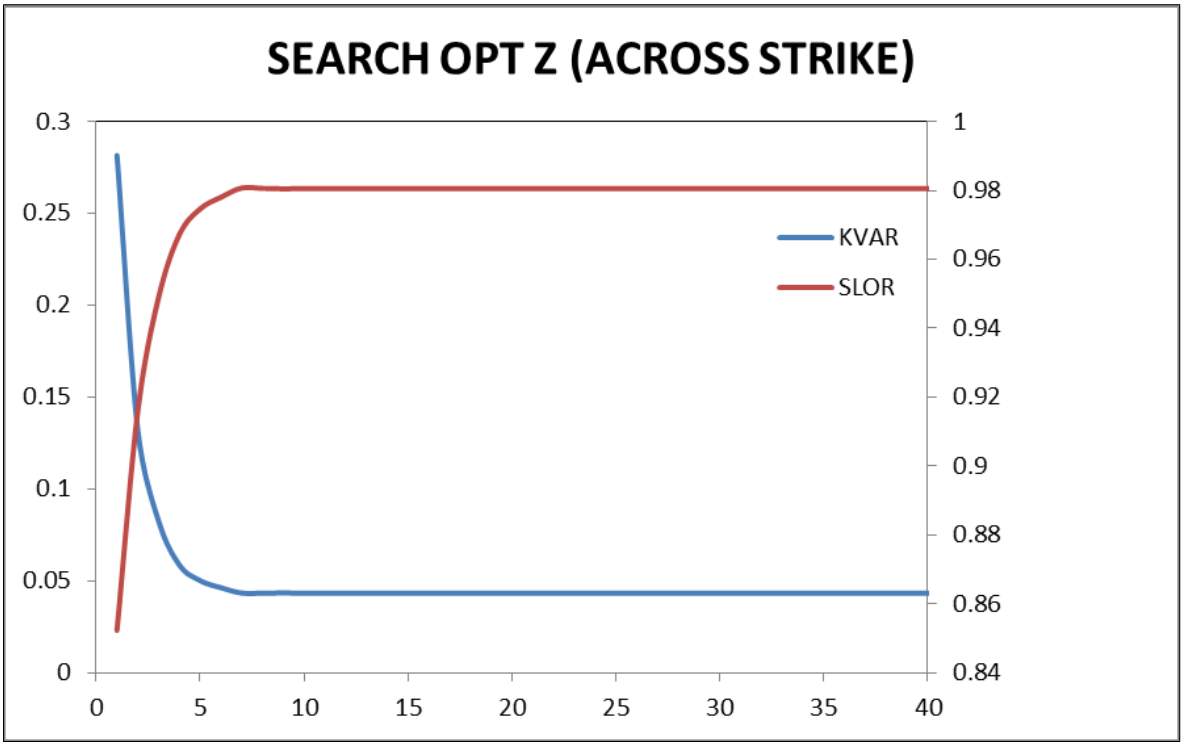


Figure 14-27: Search Distance Optimisations Across Strike Direction, ISBS

Search parameters used to estimate in all properties are summarised in Table 14-17 below.

Table 14-17: Summary of Search Parameters

Project	Search Method	Search Distance Along Axis (M)			3-1-3 Rotation Around Axis (°)			Search Volume Factor		Number of Samples					
										S vol 1		S vol 2		S vol 3	
		X (Strike)	Y (Down-Dip)	Z (Across Strike)	Z (3)	X (1)	Z (3)	S vol 2	S vol 3	Min	Max	Min	Max	Min	Max
ISBS	Dynamic Anisotropy (Rectangular)	60	40	6	150	62	0	2	50	24	48	12	60	12	72
ISBN	Dynamic Anisotropy (Rectangular)	70	50	20	140	80	0	1.5	5	24	54	20	60	2	72
Bubi	Dynamic Anisotropy (Rectangular)	100	40	20	300	80	0	2	50	24	60	12	60	12	72
McCays	Dynamic Anisotropy (Rectangular)	60	60	20	320	78	0	1.5	5	6	30	6	30	1	70

14.6.2 Estimation Method

The method of estimations for Au was Ordinary Kriging while density was estimated using Inverse Power of Distance with a Power of 2.0. Estimations were undertaken using the Estimate process in Datamine. The boundaries between the waste / ore were treated as hard boundaries. Parental cell estimation was used.

Dynamic Anisotropy was used to search for samples during estimation to account for the change in dip of the mineralised zones. Here the hangingwall surface of each mineralised zone created in Leapfrog was taken into Datamine®. A points file was then created from the surface containing X, Y, and Z coordinates. At each coordinate, dip and dip direction was estimated. These points were used as a sample file to interpolate the dip and dip direction in the block model. Grades were then estimated into the block model containing dip and dip direction. The Estimate process in Datamine then used the dip and dip direction in the blocks to search for samples during grade estimation.

Search volumes, as outlined in Table 14-17 above, were used for the estimate. A second search volume was created for any blocks that were initially un-estimated in the first pass, due to them lying outside the original search volume. Similarly, a third search volume was created for any blocks not estimated by the first or second search volumes. The intention of the third search was to populate those un-estimated blocks with the regional mean value. Figure 14-28 below, shows the blocks that were estimated with the three search volumes, in blue, green and red in ISBS.

14.6.3 Block Model Parameters

Block models with parent cell size of 20 m x 10 m x 5 m in the X, Y, and Z directions were created for Bubi, ISBS, and ISBN. For McCays, the parent cell size was 10 m x 10 m x 5 m, because the mineralisation at McCays is much narrower than the other three locations. Sub-cell splitting was used to ensure that the volumes are adequately represented in the block model. Zonal control was applied during grade estimation to ensure that samples from one zone were not used to estimate in another zone. Table 14-18 below shows the configurations used for block models at the various properties.

Table 14-18: Block Model Configuration

Field	Description	ISBS	ISBN	Bubi	McCays
XMORIG	Block Model Origin X Coordinate	661,200	662,100	684,150	665,100
YMORIG	Block Model Origin Y Coordinate	7,845,850	7,847,600	7,863,300	7,849,200

Field	Description	ISBS	ISBN	Bubi	McCays
ZMORIG	Block Model Origin Z Coordinate	750	690	900	730
XINC	Parent Block Dimension in the X direction	20	20	20	10
YINC	Parent Block Dimension in the Y direction	10	10	10	10
ZINC	Parent Block Dimension in the Z direction	5	5	5	5
NX	Number of Parent cells in the X direction	115	92	98	220
NY	Number of Parent cells in the Y direction	180	118	300	190
NZ	Number of Parent cells in the Z direction	90	112	70	100

The following fields were recorded in the estimated block model:

- Au; AUFIN; AU_FIN (N) : Gold grade, Ordinary Kriging estimate
- OX (N) : Oxidation zone (1 = Oxide; 2 = Transitional; 3 = Sulphide), flagged
- MINZ/KZONE : Mineralised zone numerical identifier, flagged
- SG (N) : Specific Gravity, Inverse Distance (to the power of 2) estimate
- CLASS (N) : Resource Classification (1 = Measured; 2 = Indicated; 3 = Inferred; 4 = Exploration Target), flagged

14.7 Model Validations

Model validation included the following:

- Visual comparisons of the estimated grades against the composite sample grades
- Statistical comparisons for the mean of estimated grades against the mean of the composited samples
- Trends (or swath analysis checking) to ensure that the regional grade trends from the drill holes were preserved in the model. The ordinary kriging algorithm calculates the best estimate by minimising the estimation error (kriging variance). This results in smoothing of the block estimates, compared to the samples. The objective of this exercise was therefore to ensure that both regional and local trends were best preserved

- Filtering out the upper and lower deciles of the sample distribution and comparing that to the same for the estimated blocks. This was to assess whether there was over or under extrapolation

A statistical comparison between the composited samples and the model estimates is presented in Table 14-19, Table 14-20, Table 14-21,Table 14-22, Table 14-23 Table 14-24, Table 14-25 and Table 14-26 below. The mean of the samples was weighted by length, while the model estimates were weighted by volume. Kriging has the effect of de-clustering sample data during estimation. The statistics of the sample presented below were however not de-clustered. The means between sample and model estimates compared favourably.

Table 14-19: Sulphide Sample Composite vs Model Estimate Statistics for Au, ISBS

Minz	Sample Composites						Model Estimates					
	Nsamples	Min	Max	Mean	Variance	Stddev	Nsamples	Min	Max	Mean	Variance	Stddev
1	815	0.02	23.21	**2.88**	11.12	3.33	429,520	0.44	7.95	**2.88**	0.86	0.93
2	268	0.02	16.33	**1.53**	4.14	2.03	378,462	0.48	5.81	**1.80**	0.33	0.57
3	115	0.02	10.92	**1.73**	3.81	1.95	314,581	1.04	3.06	**1.59**	0.07	0.26
5	32	0.40	14.24	**2.89**	10.86	3.30	174,693	1.30	3.96	**2.62**	0.08	0.28
6	44	0.02	8.69	**1.29**	2.35	1.53	455,054	0.69	2.06	**1.22**	0.01	0.09
7	116	0.02	7.12	**1.64**	1.74	1.32	150,289	0.75	2.99	**1.66**	0.07	0.27
8	34	0.40	4.52	**1.59**	1.01	1.00	35,442	1.15	1.87	**1.48**	0.01	0.10
9	53	0.02	6.74	**1.65**	2.84	1.69	181,508	0.76	2.67	**1.29**	0.04	0.20
10	38	0.04	4.30	**1.11**	0.92	0.96	240,524	0.76	1.45	**1.07**	0.00	0.05
11	23	0.18	11.26	**1.82**	6.32	2.51	178,278	0.79	3.48	**1.84**	0.01	0.10
12	219	0.02	13.52	**2.20**	4.08	2.02	384,580	0.63	3.41	**2.03**	0.08	0.29
13	42	0.40	6.72	**1.72**	2.14	1.46	248,913	1.07	3.07	**1.54**	0.10	0.31
14	23	0.02	2.86	**0.81**	0.50	0.71	162,559	0.55	0.98	**0.70**	0.00	0.04
15	142	0.02	12.39	**1.99**	3.02	1.74	314,069	0.68	3.31	**2.05**	0.11	0.33

Table 14-20: Sulphide Sample Composite vs Model Estimate Statistics for Au, ISBN

	Sample Composites						Model Estimates					
Kzone	Nsamples	Min	Max	Mean	Variance	Stddev	Nsamples	Min	Max	Mean	Variance	Stddev
1080	7	0.37	6.47	**2.20**	4.22	2.05	54,340	0.97	2.12	**1.60**	0.00	0.06
2080	4	0.57	3.02	**2.27**	0.99	1.00	59,768	1.98	2.73	**2.37**	0.00	0.04
2090							64,538	0.002	0.002	**0.002**	-	-
3040	216	-	14.96	**2.52**	6.17	2.48	204,472	0.90	5.55	**2.49**	0.29	0.53
3050	153	0.09	10.88	**2.12**	3.61	1.90	222,862	0.73	3.99	**2.28**	0.10	0.31

Sample Composites							Model Estimates					
Kzone	Nsamples	Min	Max	Mean	Variance	Stddev	Nsamples	Min	Max	Mean	Variance	Stddev
3060	115	0.02	15.80	**2.44**	6.09	2.47	238,579	0.98	4.16	**2.08**	0.18	0.42
3070	26	0.02	3.25	**0.55**	0.71	0.84	153,933	0.02	1.49	**0.88**	0.05	0.21
3090	82	0.02	14.92	**1.76**	4.57	2.14	146,865	1.11	4.93	**1.76**	0.05	0.22
4011	592	0.01	20.00	**2.80**	9.38	3.06	635,943	0.62	9.63	**2.60**	0.46	0.68
4012	475	0.01	20.00	**3.06**	8.59	2.93	393,377	0.81	11.65	**2.81**	0.91	0.95
4020	176	0.02	20.00	**2.42**	9.48	3.08	220,108	0.79	7.11	**2.47**	0.36	0.60
4030	92	0.02	20.00	**2.68**	8.78	2.96	113,777	0.97	7.00	**2.46**	0.57	0.75
4040	185	0.02	16.30	**2.70**	7.23	2.69	214,666	0.50	8.35	**2.62**	0.33	0.58
4050	201	0.02	20.00	**2.13**	6.77	2.60	323,194	0.50	5.95	**2.14**	0.25	0.50
4060	67	0.08	10.02	**2.25**	5.41	2.33	91,803	0.69	5.15	**2.04**	0.40	0.63
4070	101	-	20.00	**1.85**	6.02	2.45	117,050	0.74	4.62	**1.93**	0.35	0.59

Table 14-21: Sulphide Sample Composite vs Model Estimate Statistics for Au, Bubi

Minz	Sample Composites						Model Estimates					
	Nsamples	Min	Max	Mean	Variance	Standdev	Nsamples	Min	Max	Mean	Variance	Stddev
1	2,986	0.02	18.20	**2.20**	6.36	2.52	4,686,761	0.27	8.18	**1.95**	1.24	1.11
2	328	0.01	9.15	**0.98**	1.04	1.02	636,342	0.53	1.91	**0.94**	0.03	0.18
3	247	0.02	12.20	**1.58**	3.26	1.81	882,702	0.68	7.01	**1.47**	0.16	0.40
4	89	0.01	5.58	**0.78**	0.60	0.77	606,052	0.18	1.36	**0.76**	0.00	0.06
5	343	0.04	10.06	**1.18**	1.60	1.26	1,408,297	0.24	2.68	**1.15**	0.06	0.25
6	27	0.18	8.31	**2.63**	5.17	2.27	21,327	1.24	3.92	**1.96**	0.46	0.68

Minz	Sample Composites						Model Estimates					
	Nsamples	Min	Max	Mean	Variance	Standdev	Nsamples	Min	Max	Mean	Variance	Stddev
7	59	0.04	2.06	**0.69**	0.22	0.47	268,921	0.50	2.39	**0.84**	0.04	0.20
8	194	0.01	20.75	**0.90**	2.73	1.65	655,427	0.29	3.55	**0.87**	0.04	0.21
9	10	0.39	0.98	**0.56**	0.03	0.18	24,397	0.57	0.91	**0.67**	0.00	0.02
10	294	0.02	11.44	**0.88**	1.60	1.26	1,504,582	0.22	3.66	**0.82**	0.07	0.27

Table 14-22: Sulphide Sample Composite vs Model Estimate Statistics for Au, McCays

Sample Composites							Model Estimates					
Kzone	Nsamples	Min	Max	Mean	Variance	Stddev	Nsamples	Min	Max	Mean	Variance	Stddev
1002	63	0.05	10.08	**0.97**	2.04	1.43	33,113	0.32	2.65	**1.01**	0.19	0.43
2001	439	0.02	35.64	**3.19**	14.20	3.77	203,333	0.28	7.76	**2.48**	0.88	0.94
2003	196	0.01	17.54	**2.11**	7.19	2.68	110,175	0.50	3.87	**1.77**	0.24	0.49
2007	51	0.02	6.72	**1.01**	1.66	1.29	120,157	0.43	1.97	**0.94**	0.13	0.35
2009	34	0.02	3.98	**0.92**	0.79	0.89	44,155	0.49	1.66	**1.11**	0.08	0.28
2011	40	0.03	12.02	**1.52**	4.12	2.03	88,720	0.48	2.67	**1.10**	0.17	0.41
2012	26	0.02	6.47	**1.28**	2.27	1.51	30,675	0.35	2.37	**1.13**	0.23	0.48
3001	432	0.02	19.32	**2.44**	9.87	3.14	321,158	0.21	6.59	**2.07**	1.15	1.07
3003	361	0.02	28.74	**2.11**	12.32	3.51	283,915	0.42	9.64	**1.53**	0.58	0.76
3004	38	0.02	7.63	**1.21**	2.49	1.58	12,937	0.38	2.79	**1.22**	0.23	0.48
3005	247	0.02	23.46	**3.08**	15.86	3.98	146,886	0.42	12.44	**2.09**	0.95	0.97
3006	201	0.02	47.96	**3.96**	43.51	6.60	119,287	0.41	12.95	**3.99**	3.85	1.96
3011	54	0.02	5.76	**1.03**	1.06	1.03	37,670	0.22	3.08	**1.01**	0.25	0.50
3012	59	0.02	7.00	**1.07**	1.93	1.39	194,702	0.27	2.64	**1.17**	0.10	0.32
3013	27	0.11	10.06	**1.70**	4.65	2.16	71,254	0.51	3.12	**1.57**	0.15	0.39

Table 14-23: Oxide Sample Composite vs Model Estimate Statistics for Au, ISBS

Minz	Sample Composites							Model Estimates					
	Nsamples	Min	Max	Mean	Variance	Standdev		Nsamples	Min	Max	Mean	Variance	Stddev
1	1,491	0.01	23.21	**2.34**	7.49	2.74		72,411	0.92	6.55	**2.41**	0.86	0.93
2	737	0.01	41.40	**1.59**	5.65	2.38		139,831	0.60	4.49	**1.61**	0.18	0.43
3	282	0.01	16.08	**1.76**	3.64	1.91		52,865	0.70	2.70	**1.46**	0.10	0.32
4	51	0.12	16.71	**3.09**	12.98	3.60		3,390	1.69	4.45	**2.61**	0.14	0.37
5	121	0.01	14.24	**1.68**	4.49	2.12		12,556	0.90	4.39	**2.02**	0.44	0.67
6	293	0.02	8.69	**1.09**	1.09	1.04		57,153	0.66	1.87	**1.03**	0.04	0.20
7	491	0.01	7.99	**1.35**	1.41	1.19		47,715	0.55	2.30	**1.16**	0.04	0.21
8	247	0.01	9.66	**1.54**	2.35	1.53		25,589	0.68	2.81	**1.26**	0.07	0.26
9	126	0.02	6.74	**1.35**	1.86	1.36		18,231	0.68	1.74	**1.08**	0.02	0.14
10	261	0.04	6.23	**1.07**	0.80	0.90		15,846	0.69	1.58	**1.03**	0.01	0.11
11	306	0.06	11.83	**1.37**	2.87	1.69		13,679	0.62	2.17	**1.26**	0.09	0.31
12	471	0.01	16.44	**1.99**	4.51	2.12		37,526	0.74	3.20	**1.72**	0.29	0.54
13	82	0.01	10.60	**1.57**	4.51	2.12		19,742	0.63	2.42	**1.25**	0.09	0.30
14	46	0.02	7.03	**1.20**	1.56	1.25		20,950	0.84	2.58	**1.19**	0.04	0.20
15	470	0.01	13.05	**2.24**	3.95	1.99		32,140	0.63	4.73	**2.00**	0.71	0.84
16	100	0.06	3.15	**0.73**	0.20	0.44		46,067	0.49	0.99	**0.70**	0.01	0.11

Table 14-24: Oxide Sample Composite vs Model Estimate Statistics for Au, ISBN

Sample Composites								Model Estimates					
Kzone	Nsamples	Min	Max	Mean	Variance	Stddev		Nsamples	Min	Max	Mean	Variance	Stddev
1080	195	-	6.49	**1.22**	1.71	1.31		9,267	0.49	1.77	**0.93**	0.05	0.23
2080	312	0.01	11.98	**1.06**	1.75	1.32		43,612	0.32	1.52	**0.79**	0.03	0.18
2090	99	0.01	19.08	**1.47**	4.74	2.18		42,985	0.783	3.723	**1.56**	0.30	0.55
3040	11	0.51	11.61	**3.81**	16.94	4.12		7,319	1.48	7.33	**2.37**	0.43	0.66
3050	21	0.21	4.92	**1.67**	1.48	1.22		24,433	0.87	2.96	**1.42**	0.21	0.46

Sample Composites							Model Estimates					
Kzone	Nsamples	Min	Max	Mean	Variance	Stddev	Nsamples	Min	Max	Mean	Variance	Stddev
3060	6	0.42	6.30	**1.88**	4.43	2.11	11,184	1.07	3.24	**2.01**	0.15	0.39
3070	236	0.04	8.10	**0.84**	0.70	0.83	20,045	0.43	3.63	**0.88**	0.13	0.36
3090							12,310	1.65	3.99	**1.92**	0.06	0.25
4011	192	-	21.40	**2.34**	8.92	2.99	16,441	0.35	5.01	**2.08**	1.10	1.05
4012	35	0.02	8.40	**1.47**	3.85	1.96	3,967	0.60	5.20	**2.18**	1.99	1.41
4020	36	0.00	9.39	**1.11**	4.40	2.10	37,303	0.42	4.28	**1.61**	0.40	0.63
4030	2	0.14	1.08	**0.61**	0.22	0.47	3,145	1.55	4.00	**2.78**	0.09	0.30
4040	5	0.56	11.22	**3.14**	16.61	4.08	928	1.16	4.75	**2.76**	0.38	0.62
4050	17	0.45	12.14	1.36	7.30	2.70	28,153	0.70	4.88	1.70	0.42	0.65
4060							4,240	2.42	2.60	**2.45**	0.00	0.02
4070	32	0.06	9.35	**1.82**	4.02	2.00	3,825	1.35	3.54	**2.00**	0.33	0.58

Table 14-25: Oxide Sample Composite vs Model Estimate Statistics for Au, Bubi

Minz	Sample Composites						Model Estimates					
	Nsamples	Min	Max	Mean	Variance	Stddev	Nsamples	Min	Max	Mean	Variance	Stddev
1	338	0.03	9.44	**1.03**	1.44	1.20	117,866	0.36	5.02	**1.22**	0.42	0.65
2	228	0.01	7.61	**1.05**	1.07	1.03	61,350	0.46	1.89	**1.05**	0.05	0.22
3	16	0.07	17.13	**2.96**	20.57	4.54	71,695	1.02	4.05	**1.71**	0.23	0.48
4	84	0.02	8.06	**1.29**	2.62	1.62	72,111	0.29	3.88	**1.23**	0.28	0.53
5	159	0.03	4.67	**0.78**	0.39	0.62	110,758	0.36	2.05	**1.00**	0.08	0.28

Minz	Sample Composites						Model Estimates					
6	3	1.08	1.83	**1.44**	0.09	0.31	1,186	1.40	1.77	**1.50**	0.00	0.05
7	17	0.30	19.40	**2.70**	18.89	4.35	35,967	0.67	3.26	**1.32**	0.25	0.50
8	108	0.03	4.24	**0.61**	0.48	0.70	65,768	0.28	1.54	**0.64**	0.02	0.16
9	107	0.04	3.54	**0.71**	0.46	0.68	1,600	0.57	0.96	**0.67**	0.01	0.09
10	3	0.10	0.27	**0.21**	0.01	0.08	142,564	0.48	1.53	**0.84**	0.02	0.15

Table 14-26: Oxide Sample Composite vs Model Estimate Statistics for Au, McCays

Sample Composites							Model Estimates					
Minz	**Nsamples**	**Min**	**Max**	**Mean**	**Variance**	**Stddev**	**Nsamples**	**Min**	**Max**	**Mean**	**Variance**	**Stddev**
2001	439	0.02	35.64	**3.19**	14.20	3.77	4,291	1.04	7.22	**2.87**	1.06	1.03
3001	550	0.02	19.32	**2.09**	8.41	2.90	49,738	0.37	9.22	**1.82**	2.35	1.53
2003	196	0.01	17.54	**2.11**	7.19	2.68	3,522	0.585	3.873	**1.71**	0.27	0.52
3003	412	0.02	28.74	**1.99**	11.12	3.33	41,310	0.21	10.54	**1.84**	2.26	1.50
1002	31	0.13	10.08	**0.96**	3.11	1.76	10,999	0.36	0.73	**0.56**	0.02	0.12
3004	44	0.02	7.63	**1.06**	2.30	1.52	2,490	0.13	1.99	**0.92**	0.13	0.36
3005	221	0.02	23.46	**3.33**	17.04	4.13	26,911	0.64	12.77	**3.53**	4.16	2.04
3006	255	0.02	47.96	**3.36**	36.23	6.02	23,068	0.22	9.92	**2.16**	2.37	1.54
2007	51	0.02	6.72	**1.01**	1.66	1.29	2,000	0.44	1.37	**0.84**	0.16	0.40

Sample Composites							Model Estimates					
4008	12	0.03	2.23	**0.74**	0.30	0.55	5,340	0.44	1.57	**0.81**	0.02	0.14
2009	34	0.02	3.98	**0.92**	0.79	0.89	1,486	0.70	1.39	**0.87**	0.02	0.13
2011	40	0.03	12.02	**1.52**	4.12	2.03	7,995	0.61	1.57	**0.92**	0.05	0.22
3011	54	0.02	5.76	**1.03**	1.06	1.03	27,467	0.44	2.07	**0.94**	0.31	0.55
2012	-	-	-	-	-	-	-	-	-	-	-	-
3012	59	0.02	7.00	**1.07**	1.93	1.39	37,289	0.38	2.09	**1.11**	0.06	0.25
3013	27	0.11	10.06	**1.70**	4.65	2.16	17,153	0.51	3.12	**1.76**	0.23	0.48
3012	59	0.02	7.00	**1.07**	1.93	1.39	37,289	0.38	2.09	**1.11**	0.06	0.25
3013	27	0.11	10.06	**1.70**	4.65	2.16	17,153	0.51	3.12	**1.76**	0.23	0.48

Block on block analysis (Swath plots) compares local trends in the samples against model estimates. The approach was to divide the study areas into 50 m* 50 m* 20 m blocks in the X, Y and Z direction respectively, and to select samples within each block, and compare their mean against the mean of the model. Plots comparing the mean of the samples (blue) and mean of the estimates (red) for Au are presented in Figure 14-28. Sample and model mean compared favourably. The mean of the estimates is smoother and less variable than that of the samples, while preserving the grade trends of the samples.

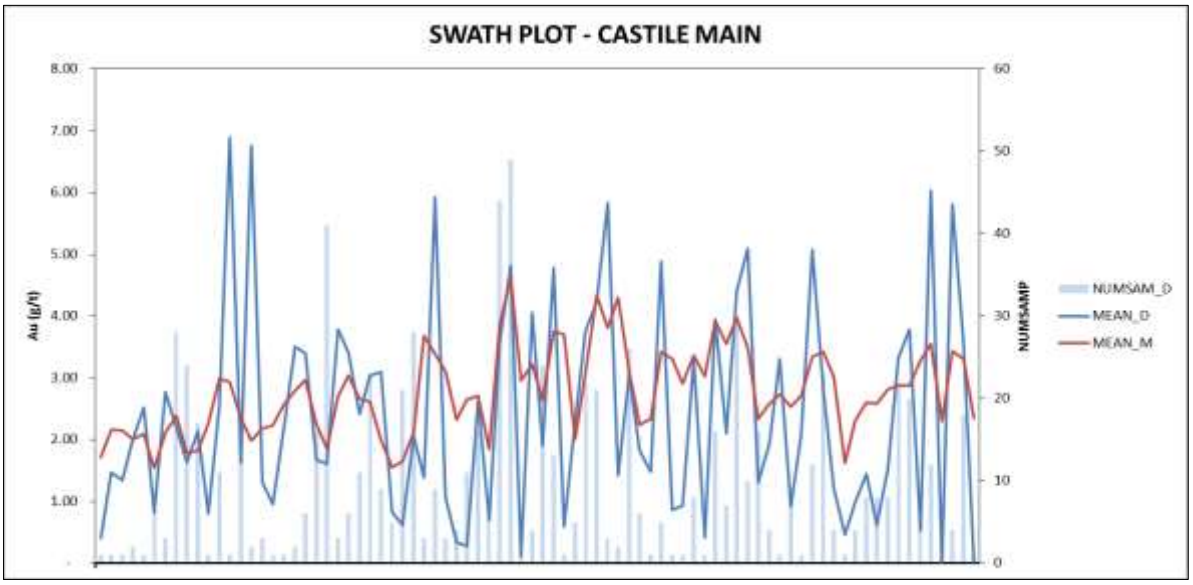


Figure 14-28: Swath Analysis for Au, ISBS - Castile Main (Blue = sample mean; red = model mean; pale blue = # samples)

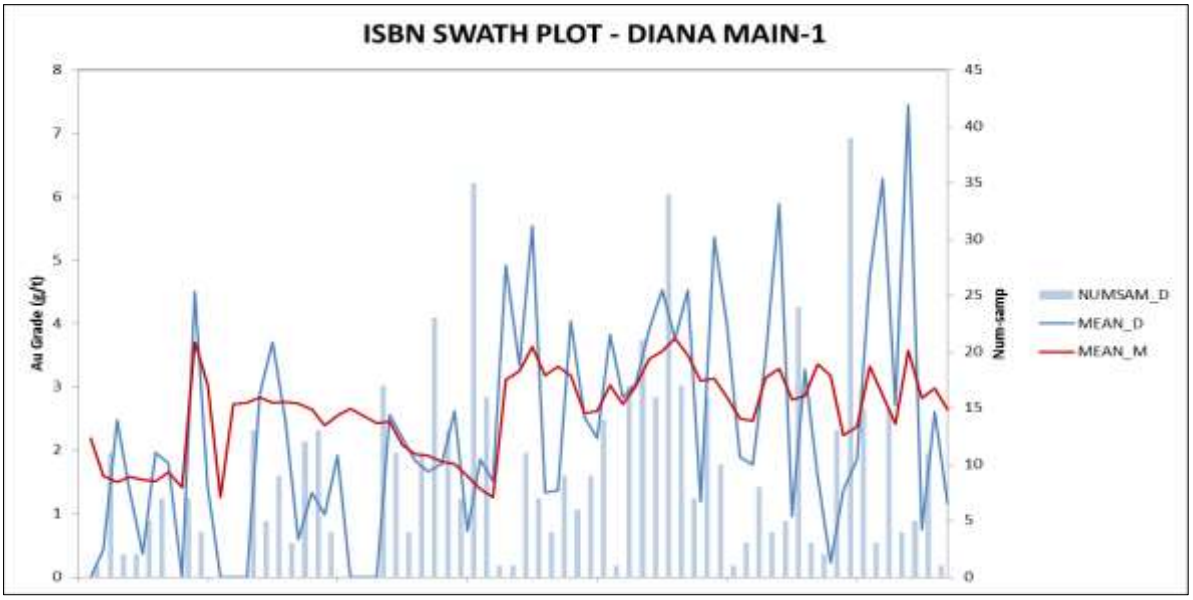


Figure 14-29: Swath Analysis for Au, ISBN - Diana Main-1 (Blue = sample mean; red = model mean; pale blue = # samples)

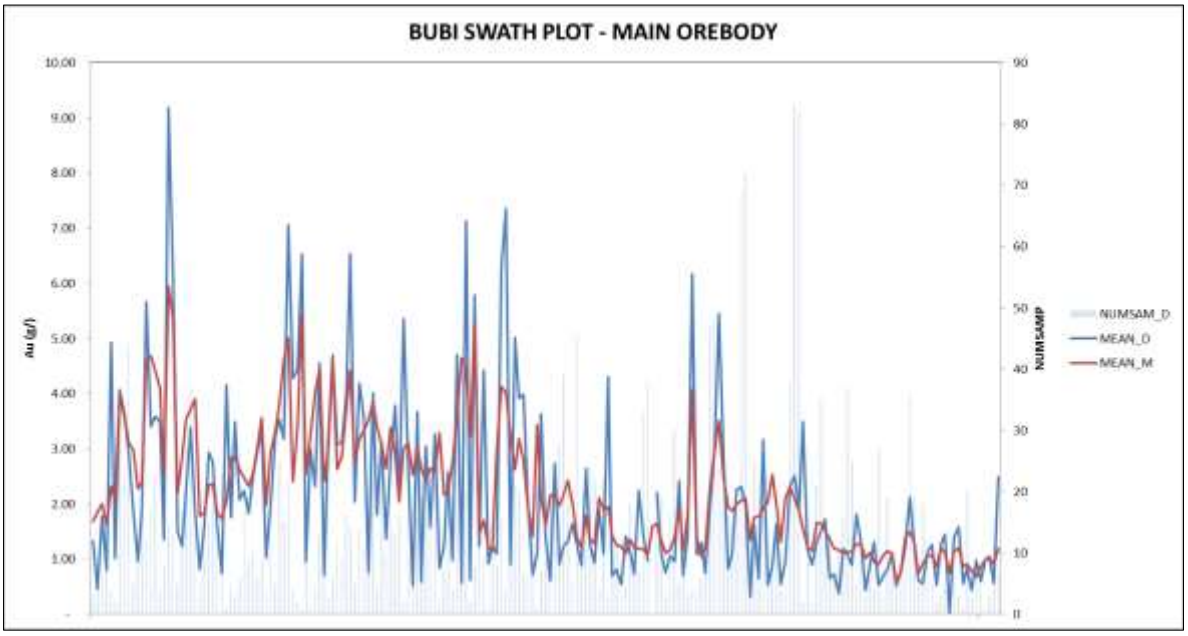


Figure 14-30: Swath Analysis for Au, Bubi - Main (Blue = sample mean; red = model mean; pale blue = # samples)

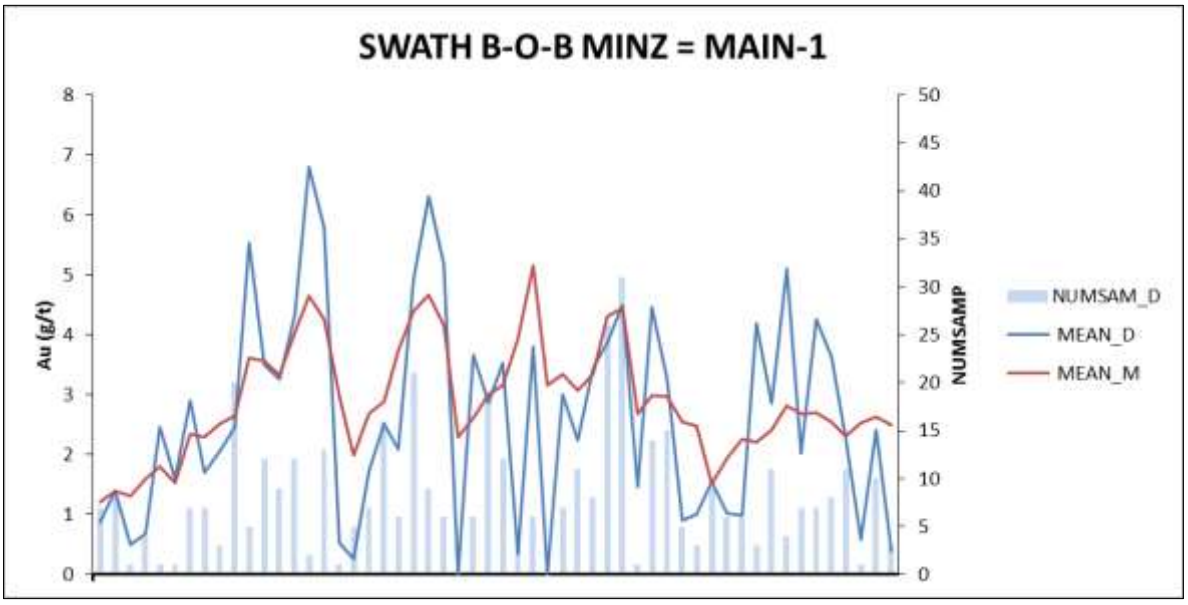


Figure 14-31: Swath Analysis for Au, McCays - Main-1 (Blue = sample mean; red = model mean; pale blue = # samples)

There is a good correlation between the grades in the drill holes and that of the block model as seen in grade distribution plots in Figure 14-32 and Figure 14-33.

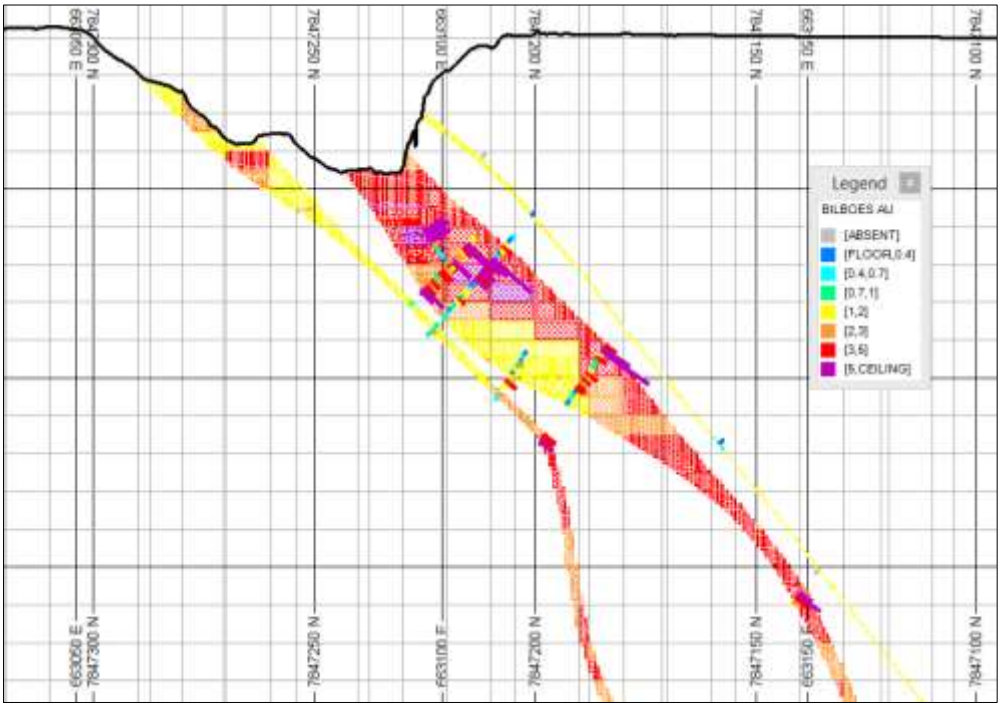


Figure 14-32: Section view showing Grades in the Sample Composite and Block Model, ISBS

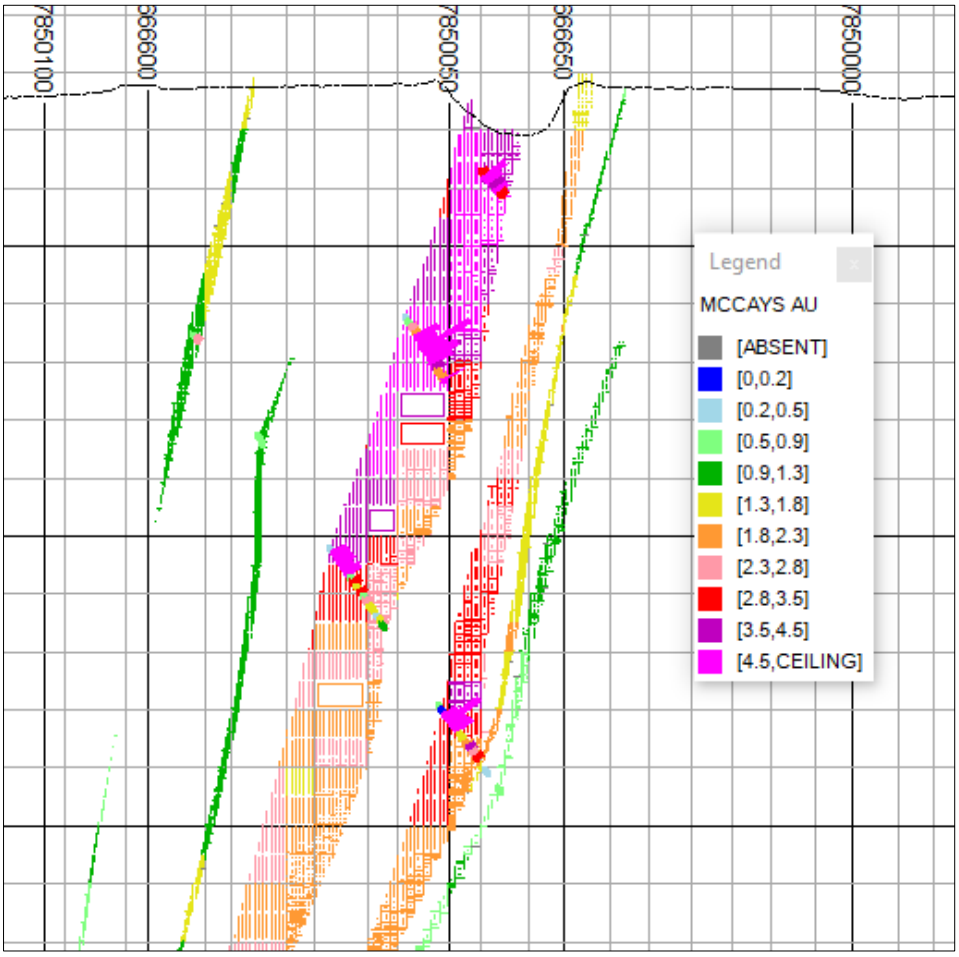


Figure 14-33: Section view showing Grades in the Sample Composite and Block Model, McCays

14.8 Resource Classification

Resource classification used a “Checklist” approach, where various criteria were considered and rated. These included:

- Data quality and integrity
- Data spacing for confidence in geological interpretations and grade interpolation
- Confidence in the geological interpretation from a regional and local perspective, and how that interpretation influences the controls for Au mineralisation
- Reliability of the estimate in the mined-out areas
- Geostatistical confidence in grade continuity
- Geostatistical parameters such as kriging variance, kriging efficiency and search distances, to measure the relative confidence in the block estimates

All the above criteria were linked to drill hole spacing as the minimal qualifier for consideration. Areas with drillholes spacing less than 25 m were considered for classification of Measured Resources; areas with drillholes spacing less than 50 m were considered for classification of Indicated Resources and less than 100 m was considered for Inferred Resources. The drill spacing distance buffer was created in Leapfrog Geo™. A checklist used for the assessment of the mineral resources during classification criteria is summarised in Table 14-27 below.

To determine what qualifies as open-castable resources, whittle shells provided by DRA using a gold price of $2,000/oz were used. Details of the additional Whittle parameters are presented in Table 14-27 below. Resources within these shells were considered to have the potential for eventual economic extraction by open cast mining methods.

Table 14-27: Checklist Criteria for Resource Classification

Items	Discussion	Confidence
Drilling Techniques	Diamond drill holes	High
	Reverse Circulation drilling	Medium
	Percussion drilling (predominantly in the oxidised zone)	Low
Logging	All drill holes were logged by qualified geologists using standardised codes. Completed logs are checked and signed off by the senior geologist prior to capture into the database. The logging was of an appropriate standard for resource estimation.	High
Drill Sample Recovery	Recoveries recorded for every core run.	High
Sampling Methods	Half core sampled at 1 m intervals for diamond drilling. Sampling occurs wherever there is evidence of alternation.	High

Items	Discussion	Confidence
	Portion of the rock chips collected at 1 m intervals sampled for RC drilling and Percussion drilling.	Medium
Quality of Assay Data and Laboratory Tests	An external independent commercial laboratory has been used for all analytical test work for diamond and RC drilling. Appropriate sample preparations and assaying procedures have been used. Duplicate samples and industry CRMs were inserted within the sampling stream. The data has been declared fit for the purposes of geological and resource modelling.	High
	Percussion drilling used Bottle-Roll Analysis that was performed in-house. Analytical results are considered of low reliability because the method can only measure acid soluble gold.	Low
Verification of Sampling and Assaying	Data integrity checks performed by CCIC MinRes and Bilboes have confirmed data reliability.	High
Location of Data Points	Drill hole collar location and orientation have been surveyed by a qualified surveyor.	High
Tonnage Factors (Density)	The Archimedes method of density determinations was used in-house. Verification analysis was performed at the University of Zimbabwe and. The comparison of the in-house density determination and the check analysis compare favourably.	High
Data Density and Distribution	Diamond and RC drilling was done at 25 m X 25 m on well informed area, 50 m X 50 m on moderately informed areas, and 100 m X 100 m on less informed areas. The level of data density is sufficient to place Mineral Resources into the Measured, Indicated, and Inferred categories, respectively.	High
Database Integrity	Data is stored in Datamine™ Fusion Database.	High
Geological Controls on Mineralisation	Geological setting and mineralisation are very well understood. Mineralisation is constrained to shear zones within a broad hydrothermal alteration halo.	High
Statistics and Variography	Anisotropic spherical variograms were used to model the spatial continuity for the main mineralisation domains.	Medium
Top or Bottom Cuts	No cutting was applied to the Au estimation. Top and bottom cuts were applied to the density during estimation.	High
Data Clustering	Drill holes were drilled on an approximately regular grid, with decreasing regularisation at depths.	Medium
Block Size	Determined by QKNA. 20 mE x 10 mN x 20 mRL 3D block model constructed for ISBS, ISBN, and Bubi. For McCays the blocks were 10 mE x 10 mN x 5 mRL.	High
Search Distance	Determined with the aid of QKNA as well as drilling spacing.	High
Grade Estimation	Au estimated using Ordinary Kriging. Density estimated using Inverse Distance to the power if two.	High
Resource Classification	Reported on a checklist bases with the drilling space.	High
Metallurgical Factors	Metallurgical parameters were considered during the whittle optimisation process, based on comprehensive testwork and pilot plant.	High
Block Cut-offs	0.9 g/t is considered the base case for block cut-offs. Other sensitivities at 0.0 g/t, 0.5 g/t and 1.5 g/t Au cut-off have also been presented.	High

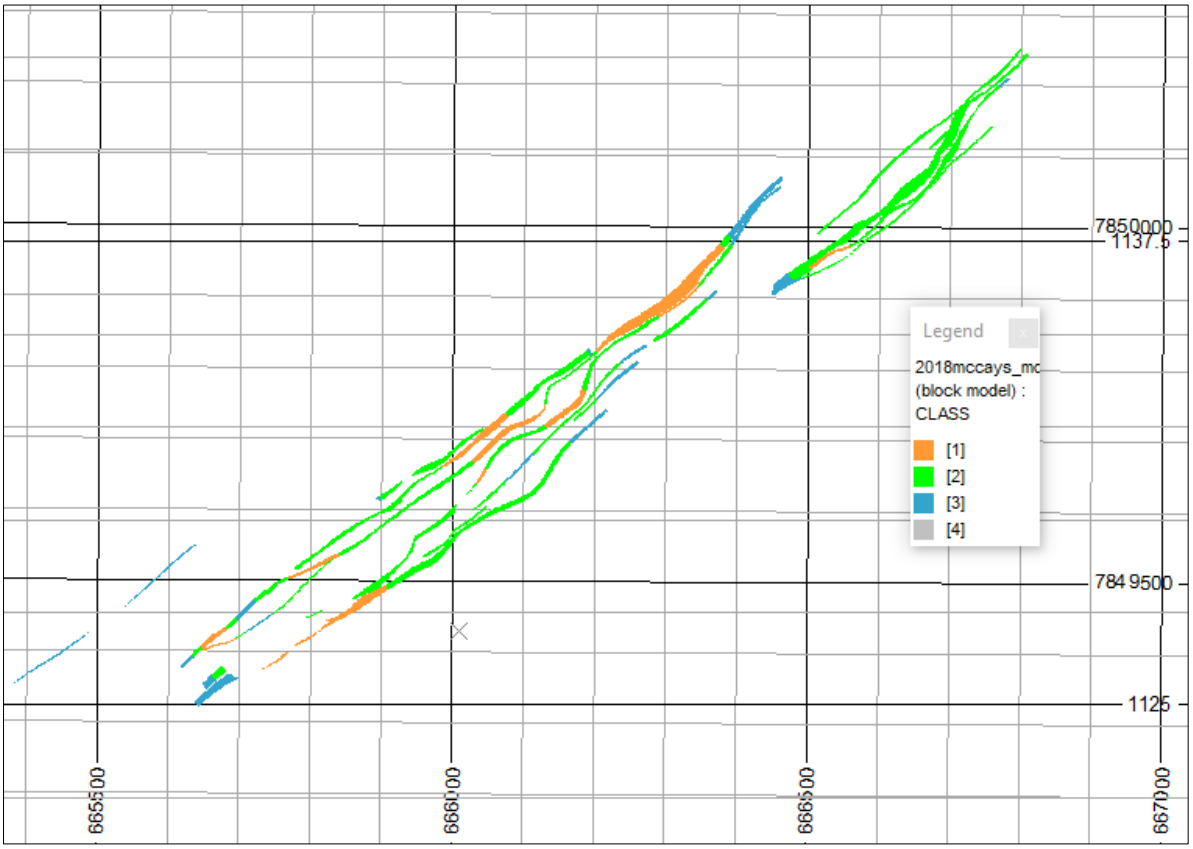


Figure 14-34: Plan showing Mineral Resource Classification, McCays (orange = measured; green = indicated; blue = inferred)

14.9 Mineral Resource Tabulation

The MRE is reported within the $2,400 /oz Lerchs-Grossmann pit shells, compared to the April 2019 MRE which were reported within the $2,000 /oz pit shells. The updated parameters used for the pit optimisation are presented in Table 14-28 below. Key positive changes are an increased gold price, pit slope angle in the fresh material, ore recoveries at Bubi, and a decrease in processing costs for sulphide ore. The key negative changes are an increased discount rate and increased mining costs. The overall effect of these changes has resulted in the pit shell being extended at depth and along strike. Mineral Resources reported for the base case used a 0.9 g/t Au block cut-off (Table 14-24). Compared to the April 2019 MRE for the Measured and Indicated categories, there is a 6 % increase in tonnage and 1 % decrease in grade. Significant change is the tonnage of the Inferred category which has increased by 78%, from 5.3 Mt grading at 1.99 g/t Au, to 9.47 Mt grading at 1.89 g/t Au. Tonnage and grade sensitivities at 0.0 g/t, 0.5 g/t, and 1.5 g/t Au block cut-offs are shown in Table 14-25, Table 14-26, Table 14-27 respectively. The resources are inclusive of Oxide, Transitional, and Sulphide material. For a breakdown of resources per oxidation zone, refer to the appendix.

Table 14-28: Summary of Optimisation Parameters used for the Lerchs-Grossmann Shells

Parameter	Description	Unit	Bubi	Isabella	McCays
Optimisation Parameters	Oxide Slope Angle - Weathered	Degrees	30	30	30
	Trans Slope Angle	Degrees	48	48	48
	Fresh Slope Angle	Degrees	51/55	51/55	48/51/55
	Production Rate	Ktpm	180	240	240
	Gold Price	$/Oz	2,400	2,400	2,400
	Discount Rate	%	10.0%	10.0%	10.0%
Mining Costs	Ore Cost	$/T Mined	3.3	3.20	3.20
	Waste Cost	$/T Mined	2.30	2.30	2.30
	Fixed Cost and Other	$/T Ore	10.25	4.053.21	3.09
Processing Costs	Processing Cost (Sulphide)	$/T Treated	32.81	19.02	10.02
	Recovery - Sulphides	%	88.9%	83.60%	83.60%
Financial Parameters	Royalties	%	5.00%	5.00%	5.00%
	Taxes	%	25.00%	25.00%	25.00%

Table 14-29: Mineral Resource Tabulation for the Four Properties using a Base Case Block Cut-Off Grade of 0.9 g/t Au

Base Case Mineral Resources (0.9 g/t Au)					
Property	Classification	Tonnes	Au (g/t)	Metal (g)	Ounces
ISBS	Measured	1,325,112	2.34	3,103,953	99,796
	Indicated	6,105,092	2.08	12,705,457	408,496
	Total Measured and Indicated	**7,430,204**	**2.13**	**15,809,410**	**508,292**
	Inferred	1,583,437	1.75	2,767,872	88,991
ISBN	Measured	2,589,257	2.68	6,939,262	223,106
	Indicated	4,865,729	2.27	11,068,764	355,874
	Total Measured and Indicated	**7,454,987**	**2.42**	**18,008,026**	**578,980**
	Inferred	1,704,219	2.15	3,666,721	117,890
Bubi	Measured	1,288,169	1.95	2,517,625	80,945
	Indicated	14,006,154	2.19	30,707,737	987,292
	Total Measured and Indicated	**15,294,323**	**2.17**	**33,225,363**	**1,068,237**
	Inferred	5,116,389	1.80	9,208,472	296,064
McCays	Measured	925,105	3.05	2,821,343	90,710
	Indicated	4,075,342	2.36	9,610,395	308,986
	Total Measured and Indicated	**5,000,446**	**2.49**	**12,431,738**	**399,696**

Base Case Mineral Resources (0.9 g/t Au)					
	Inferred	1,071,163	2.14	2,295,974	73,818
Totals (ISBS+ISBN+Bubi+ McCays)	Total Measured	6,127,643	2.51	15,382,184	494,556
	Total Indicated	29,052,317	2.21	64,092,352	2,060,649
	Total Measured and Indicated	**35,179,960**	**2.26**	**79,474,537**	**2,555,205**
	Total Inferred	9,475,209	1.89	17,939,038	576,762

1 CIM definitions (May 10, 2014) observed for classification of mineral resources.

2 Block bulk density interpolated from specific gravity measurements taken from core samples.

3 Resources are constrained by a Lerchs-Grossman (LG) optimized pit shell using Whittle software.

4 Mineral resources are not mineral reserves and have no demonstrated economic viability. The estimate of mineral resources may be materially affected by mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social and governmental factors ("Modifying Factors").

5 Numbers may not add due to rounding.

6 Effective Date of Resource Estimate is 25th of October 2021.

Table 14-30: Mineral Resource Tabulation for the Four Properties using a Block Cut-Off Grade of 0.0 g/t Au

Alternate Grade Sensitivity Mineral Resources (0.0 g/t Au)					
Property	**Classification**	**Tonnes**	**Au (g/t)**	**Metal (g)**	**Ounces**
ISBS	Measured	1,349,159	2.31	3,122,662	100,397
	Indicated	6,287,365	2.04	12,851,704	413,198
	Total Measured and Indicated	**7,636,524**	**2.09**	**15,974,365**	**513,596**
	Inferred	1,627,856	1.72	2,803,723	90,143
ISBN	Measured	2,599,533	2.67	6,947,633	223,375
	Indicated	4,952,367	2.25	11,131,262	357,884
	Total Measured and Indicated	**7,551,901**	**2.39**	**18,078,896**	**581,259**
	Inferred	1,795,007	2.08	3,729,652	119,913
Bubi	Measured	1,325,351	1.92	2,547,490	81,905
	Indicated	16,638,596	1.97	32,701,750	1,051,402
	Total Measured and Indicated	**17,963,947**	**1.96**	**35,249,240**	**1,133,307**
	Inferred	6,849,190	1.54	10,521,627	338,283
McCays	Measured	980,383	2.92	2,860,528	91,970
	Indicated	4,720,118	2.13	10,049,174	323,093
	Total Measured and Indicated	**5,700,501**	**2.26**	**12,909,702**	**415,063**
	Inferred	1,305,935	1.88	2,454,332	78,910
Totals (ISBS+ISBN+Bubi+ McCays)	Total Measured	6,254,427	2.47	15,478,313	497,647
	Total Indicated	32,598,446	2.05	66,733,889	2,145,577
	Total Measured and Indicated	**38,852,873**	**2.12**	**82,212,203**	**2,643,224**
	Total Inferred	11,577,988	1.69	19,509,334	627,249

Table 14-31: Mineral Resource Tabulation for the Four Properties using a Block Cut-Off Grade of 0.5 g/t Au

Alternate Grade Sensitivity Mineral Resources (0.5 g/t Au)					
Property	**Classification**	**Tonnes**	**Au (g/t)**	**Metal (g)**	**Ounces**
ISBS	Measured	1,349,110	2.31	3,122,640	100,397
	Indicated	6,286,858	2.04	12,851,462	413,190
	Total Measured and Indicated	**7,635,968**	**2.09**	**15,974,102**	**513,587**
	Inferred	1,627,856	1.72	2,803,723	90,143
ISBN	Measured	2,599,533	2.67	6,947,633	223,375
	Indicated	4,952,367	2.25	11,131,262	357,884
	Total Measured and Indicated	**7,551,901**	**2.39**	**18,078,896**	**581,259**
	Inferred	1,791,232	2.08	3,728,570	119,878
Bubi	Measured	1,325,351	1.92	2,547,490	81,905
	Indicated	16,585,003	1.97	32,680,314	1,050,713
	Total Measured and Indicated	**17,910,354**	**1.97**	**35,227,804**	**1,132,618**
	Inferred	6,814,606	1.54	10,506,511	337,797
McCays	Measured	978,885	2.92	2,859,843	91,947
	Indicated	4,599,067	2.17	9,995,974	321,383
	Total Measured and Indicated	**5,577,952**	**2.30**	**12,855,817**	**413,330**
	Inferred	1,264,701	1.93	2,436,539	78,338
Totals (ISBS+ISBN+Bubi+ McCays)	Total Measured	6,252,879	2.48	15,477,606	497,624
	Total Indicated	32,423,296	2.06	66,659,012	2,143,170
	Total Measured and Indicated	**38,676,175**	**2.12**	**82,136,619**	**2,640,794**
	Total Inferred	11,498,396	1.69	19,475,343	626,156

Table 14-32: Mineral Resource Tabulation for the Four Properties using a Block Cut-Off Grade of 1.5 g/t Au

Alternate Grade Sensitivity Mineral Resources (1.5 g/t Au)					
Property	**Classification**	**Tonnes**	**Au (G/T)**	**Metal (G)**	**Ounces**
ISBS	Measured	1,068,218	2.60	2,778,769	89,341
	Indicated	4,303,958	2.43	10,466,506	336,511
	Total Measured and Indicated	**5,372,176**	**2.47**	**13,245,275**	**425,852**
	Inferred	912,972	2.13	1,948,670	62,652
ISBN	Measured	2,392,436	2.79	6,684,699	214,921
	Indicated	4,424,543	2.38	10,526,501	338,440

Alternate Grade Sensitivity Mineral Resources (1.5 g/t Au)

Property	Classification	Tonnes	Au (G/T)	Metal (G)	Ounces
	Total Measured and Indicated	**6,816,979**	**2.52**	**17,211,199**	**553,361**
	Inferred	1,565,275	2.24	3,500,012	112,530
Bubi	Measured	824,449	2.36	1,949,015	62,663
	Indicated	8,642,770	2.83	24,465,881	786,608
	Total Measured and Indicated	**9,467,219**	**2.79**	**26,414,896**	**849,272**
	Inferred	2,423,987	2.53	6,126,487	196,974
McCays	Measured	723,427	3.56	2,577,891	82,882
	Indicated	2,851,238	2.86	8,153,011	262,129
	Total Measured and Indicated	**3,574,666**	**3.00**	**10,730,902**	**345,012**
	Inferred	671,276	2.74	1,837,508	59,078
Totals (ISBS+ISBN+Bubi+ McCays)	Total Measured	5,008,530	2.79	13,990,373	449,808
	Total Indicated	20,222,509	2.65	53,611,899	1,723,689
	Total Measured and Indicated	**25,231,039**	**2.68**	**67,602,272**	**2,173,497**
	Total Inferred	5,573,510	2.41	13,412,676	431,234

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BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 15
MINERAL RESERVE ESTIMATE

Document Number: JZWEBR6013-STU-REP-001

DRA

15. MINERAL RESERVE ESTIMATE

15.1 Mineral Reserves

The process to develop the Mineral Reserve estimate was as follows:

- Open pit optimisation was undertaken on the measured and indicated resources only.
- The grades and tonnes of the mineral resource model have been modified by a mining / geological recovery and a mining dilution based on ore body geometry and mining methodology. The Mining Model contains undiluted ore tonnes and ore grade. 95% ore recovery and fixed dilution parameters of 20 cm of hanging wall and 20 cm of footwall (4% in Whittle) were applied in the optimisations.
- The Whittle optimisation software was used to perform the pit optimisations. Whittle is an accepted industry optimisation tool. A range of operating costs and production parameters were applied. The parameters are summarised below, along with the source of the information:
    - A base gold price of $ 1,500/oz (PMI). A government royalty of 5.0% of revenue and a Refining/Selling Cost of 1.5% of revenue were then applied. This resulted in a Net Gold Price of ~$ 1,402.50/oz.
    - Pit slopes inter-ramp angles ranging from 30 to 55 degrees. Resulting overall pit slopes account for access ramps where applicable.
    - Gold recovery ranging from 70% to 88.9% dependent on mining area and ore type being processed.
    - Processing throughput of 2.88 Mtpa for phase 1 and 2.16 Mtpa for phase 2.
    - Mining contractor costs based on budget submissions from Southern African based mining contractors.
    - Average annual processing cost per tonne of ore, inclusive of general / administration costs range from $ 13/t to $ 27/t for all oxides, transitional and fresh ores depending on processing parameters.

A sensitivity assessment was done on gold prices of $ 1,600/oz and $ 1,700/oz. A gold price of $2,400/oz scenario assessment was also done to determine surface infrastructure boundaries only to ensure that no potential future resource is sterilised. This indicated the optimal shell inventory (i.e., the size and shape of the optimal shell and therefore the ore and waste generated) was relatively robust for all mining areas.

Optimal shells (maximum profit) were selected for each deposit area base on a $ 1,500/oz gold price that were then used as the basis for pit designs. These shell selection criteria are relatively conservative, based on a gold price of $ 1,500/oz.

A cut-off grade of 0.9 g/t based on project specific projected revenue and cost was applied to all Project resources to ensure tonnes milled generate enough revenue to cover costs.

Table 15-1 summarises the Mineral Reserve Statement based on the work detailed above, undertaken as part of the Bilboes Gold Mine Project.

Table 15-1: Bilboes Gold Project In-situ Mineral Reserve Statement

Deposit	Classification	Tonnage (Mt)	Au Grade (g/t)	K oz
McCays	Proven	0.8	3.00	81
	Probable	2.8	2.44	223
Isabella South	Proven	1.3	2.24	93
	Probable	5.1	1.98	323
Isabella North	Proven	2.5	2.57	207
	Probable	3.1	2.17	216
Bubi	Proven	1.2	1.90	75
	Probable	9.8	2.38	747
Total	Proven	5.9	2.42	456
	Probable	20.8	2.26	1,509
Grand Total	**Probable + Proven**	26.6	2.29	1,964

Note: All tonnes quoted are dry tonnes. Differences in the addition of deposit tonnes to the total displayed is due to rounding to one decimal place.

The Mineral Reserve estimate has been classified and reported in accordance with the Canadian National Instrument 43-101.

The estimate of Mineral Reserves of the Bilboes Gold Mine is not at this stage materially affected by any known environmental, permitting, legal, title, taxation, socioeconomic, marketing, political, or other relevant issue. Furthermore, the estimate of Mineral Reserves is not materially affected by any known mining, metallurgical, infrastructure, or other relevant factor.

15.2 DRA Comments

DRA is confident that enough geological work has been undertaken, and sufficient geological understanding gained, to enable the construction of an ore body model suitable for the derivation of Mineral Resource and Mineral Reserve estimates. DRA considers that both the

modelling and the grade interpolation have been carried out in an unbiased manner and that the resulting grade and tonnage estimates should be reliable within the context of the classification applied. In addition, DRA is not aware of any metallurgical, infrastructural, environmental, legal, title, taxation, socio-economic, or marketing issues that would impact on the mineral resource, or reserve statements as presented.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 16
MINING METHODS

Document Number: JZWEBR6013-STU-REP-001

DRA

16 MINING METHODS

16.1 Introduction

This section presents the main conclusions given in the Bilboes Gold Project Feasibility Study Mining Methods Section.

A Life of Mine (LoM) schedule has been developed to supply two processing phases. These consist of phase 1 at processing capacity of 2.88 mtpa (McCays, Isabella South and North) and Phase 2 at 2.16 Mtpa (Bubi). The LoM schedule considers the blending requirement that a maximum of 50% of feed to plant be sourced from Isabella North and the remainder from Isabella South (preferred blend) or McCays. A mining contractor will be used for all mining related earthmoving activities. All deposits will be mined utilising conventional truck and shovel method. Transitional and fresh ore and waste will be drilled and blasted.

Free dig and blasted waste will be loaded, hauled with 60 t haul trucks and dumped to designated waste dump locations which will be systematically dozed and levelled to allow the dumps to be raised to design heights.

Free dig and blasted ore will be loaded and hauled with 40 or 60 t haul trucks to the plant feed RoM pad. There it will either be direct tipped into the crushing facility or placed on the RoM pad stockpile areas.

The Bubi ore will be dumped on the pit rim stockpiles before being loaded and hauled with a fleet of road trucks to the central processing facility at north of the Isabella North pit. There it will either be direct tipped into the crushing facility or placed on the RoM pad stockpile areas.

The project is to be mined utilising proven drilling, blasting and earthmoving equipment operated by an experience contractor miner.

McCays will commence production first. This assists in delivering higher mill feed grades early in the project life.

Approximately eleven months of waste stripping will be required to expose sufficient ore to maintain a constant ore feed rate during phase 1 once the processing plant has been commissioned.

The mining of all five deposits runs for a period of approximately 10.8 years based on the current production schedule. The peak production requirements are 28.1 Mtpa (total material movement).

16.2 Mine Design and Operation

16.2.1 Optimisation Parameters

The optimisation parameters used are outlined below.

16.2.1.1 *Mining Costs*

Mining costs are based on December 2021 contractor price estimates. The cost estimates comprise the following elements:

- Mobilisation, establishment, and demobilisation
- Provision and maintenance of all equipment necessary to carry out the works
- Short term planning of the works
- Clearing and grubbing, topsoil stripping and stockpiling
- Drill and blast of all relevant ore and waste material, including pre-splitting
- Excavate and load of all materials
- Hauling, dumping, and stockpiling of all materials to the designated destinations
- Construction, or reconstruction and maintenance of all necessary haul roads
- Grade control drilling and sampling from dedicated drill rigs as per BoQ
- Re-handle of RoM stockpile to the RoM tip as per the plant feed schedule
- The provision and control of surface drainage
- The management and removal of all water within the open pit area and associated surface activities, including removal of storm water and ground water
- Provision of all pit and dump lighting facilities if required
- Profiling of final dumps and other disturbed areas as directed by the superintendent
- Carry out secondary breaking of ore as required
- Provision and management of all personnel for the mining activities
- Provision of safety, environmental and quality assurance plan
- Attend meetings and report progress of the works

16.2.1.2 *Slope Design*

The pit slope design parameters were provided by SLR Consulting. The slopes were provided based on the weathering codes within the block model (i.e., Oxide / Transition / Fresh). The design parameters are detailed in Table 16-1:, Table 16-2 and Table 16-3.

Table 16-1: McCays Slope Design Parameters

McCays Slope Configuration with Depressurised Slopes								
Sector	Wall Orientation	Weathering / Alteration	Depressurised Configuration				Un-Interrupted Slopes (No Ramp)	
			BFA (°C)	Bench Height (m)	Berm Width (m)	Inter-ramp Angle (°C)	Maximum Inter-ramp height (m)	Geotechnical Berm
South Sector	Mean Wall Direction 360°	Completely weathered/ soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
West Sector	Mean Wall Direction 90°	Completely weathered/ soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
North Sector	Mean Wall Direction 180°	Completely weathered/ soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	9	48	90	15
East Sector	Mean Wall Direction 270°	Completely weathered/ soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
Southeast Sector	Mean Wall Direction 325°	Completely weathered/ soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	9	48	90	15

Table 16-2: Isabella South and North Slope Design Parameters

Isabella South and North Slope Configuration with Depressurised Slopes								
Sector	Wall Orientation	Weathering / Alteration	Depressurised Configuration				Un-interrupted slopes (No Ramp)	
			BFA (°C)	Geotechnical Berm	Geotechnical Berm Width (m)	Inter-ramp Angle (°C)	Maximum Inter-ramp height (m)	Geotechnical Berm
North Wall Sector	Mean Wall Direction 180°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
Northeast Sector	Mean Wall Direction 225°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
East Sector	Mean Wall Direction 270°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
Southeast Sector	Mean Wall Direction 315°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
South Sector	Mean Wall Direction 180°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12

Isabella South and North Slope Configuration with Depressurised Slopes								
		Slightly Weathered to Unweathered	90	10	7	55	90	15
Southwest Sector	Mean Wall Direction 45°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
West Sector	Mean Wall Direction 90°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
Northwest Sector	Mean Wall Direction 135°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15

Table 16-3: Bubi Slope Design Parameters

Bubi Slope Configuration with Depressurised Slopes								
Sector	Wall Orientation	Weathering / Alteration	Depressurised Configuration				Un-interrupted slopes (No Ramp)	
			BFA (°C)	Geotechnical Berm	Geotechnical Berm Width (m)	Inter-ramp Angle (°C)	Maximum Inter-ramp height (m)	Geotechnical Berm
North Wall / Sector	Mean Wall Direction 180°	Completely weathered/soil	55	5	5	30	15	10
		Transition/	90	10	9	48	60	12

Bubi Slope Configuration with Depressurised Slopes								
Sector	Wall Orientation	Weathering / Alteration	Depressurised Configuration				Un-interrupted slopes (No Ramp)	
			BFA (°C)	Geotechnical Berm	Geotechnical Berm Width (m)	Inter-ramp Angle (°C)	Maximum Inter-ramp height (m)	Geotechnical Berm
		Sap rock						
		Slightly Weathered to Unweathered	90	10	7	55	90	15
Northeast Sector	Mean Wall Direction 225°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
East Sector	Mean Wall Direction 270°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15
Southeast Sector	Mean Wall Direction 315°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
South Sector	Mean Wall Direction 180°	Completely weathered/soil	55	5	5	30	15	10
		Transition/	90	10	9	48	60	12

Bubi Slope Configuration with Depressurised Slopes								
Sector	Wall Orientation	Weathering / Alteration	Depressurised Configuration				Un-interrupted slopes (No Ramp)	
			BFA (°C)	Geotechnical Berm	Geotechnical Berm Width (m)	Inter-ramp Angle (°C)	Maximum Inter-ramp height (m)	Geotechnical Berm
		Sap rock						
		Slightly Weathered to Unweathered	90	10	8	51	90	15
Southwest Sector	Mean Wall Direction 45°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
West Sector	Mean Wall Direction 90°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	8	51	90	15
Northwest Sector	Mean Wall Direction 135°	Completely weathered/soil	55	5	5	30	15	10
		Transition/ Sap rock	90	10	9	48	60	12
		Slightly Weathered to Unweathered	90	10	7	55	90	15

16.2.1.3 *Processing Recoveries and Costs*

Processing costs and recoveries for each metallurgical domain were received from DRA and modelled in 3D for each of the deposits.

16.2.1.4 *Financial Parameters*

The gold prices and discount rate used in the optimisations are summarised in Table 16-4.

16.2.1.5 *Whittle Input Parameters – Net Commodity Price*

Table 16-4: Optimisation Financial Parameters

Financial Parameters for Net Commodity Price	Unit	$2,400	$1,700	$1,600	$1,500
Date of Information:	Oct 2021	Resource	High	Middle	Base Case
Base Currency	USD	0	0	0	0
Annual Discount Rate (%)	(%)	10.0%	10.0%	10.0%	10.0%
Commodity Price	USD/Oz	2,400	1,700	1,600	1,500
Royalties	(%)	5%	5%	5%	5%
Refining Cost	USD/Oz	1.5%	1.5%	1.5%	1.5%
Total Selling Cost	USD/Oz	156.00	110.50	104.00	97.50
Nett Commodity Price	USD/g	72.15	51.10	48.10	45.09

16.2.1.6 *Whittle Input Parameters – Geotechnical - Mining*

Table 16-5: Geotechnical - Mining

Geotechnical Parameters	Unit	Value	Value	Value	Value
Primary Zone		**ISBN**	**ISBS**	**McCays**	**Bubi**
Inter-Ramp Slope Angle					
Oxide	degrees	30	30	30	30
Trans	degrees	48	48	48	48
Fresh	degrees	51/55	51/55	48/51/55	51/55
Bench Face Slope Angle					
Oxide	degrees	55	55	55	55
Trans	degrees	90	90	90	90
Fresh	degrees	90	90	90	90
Ramp Specifications – 70t truck					
Single Lane Width	m	12.5	12.5	12.5	12.5
Dual Lane Width	m	18.6	18.6	18.6	18.6
Design gradient (%)	(%)	10%	10%	10%	10%
Dilution and Mining Recovery	**Unit**	**Value**	**Value**	**Value**	**Value**
Mining Dilution	(%)	4%	4%	4%	4%
Mining Recovery	(%)	95%	95%	95%	95%
Distance ex-pit to Plant	km	2.5	3.5	2.6	28

Geotechnical Parameters	Unit	Value	Value	Value	Value
Mining Cost Parameters	**Unit**	**Value**	**Value**	**Value**	**Value**
Reference Level Elevation	RL	1,151	1,135	1,163	1,195
Mining Cost Adjustment Factor (MCAF)	USD/vert. meter	0.006	0.006	0.006	0.006
Waste Mining Cost					
Oxide - free dig	USD/tonne	1.80	1.80	1.80	1.80
Trans - including drill and blast	USD/tonne	2.30	2.30	2.30	2.30
Fresh - including drill and blast	USD/tonne	2.30	2.30	2.30	2.30

16.2.1.7 *Whittle Input Parameters – Mining Continued – Throughput - Process*

Table 16-6: Mining Continued – Throughput - Process

Mining Cost Parameters	Unit	ISBN	ISBS	McCays	Bubi
Total Ore Mining Cost	**USD/tonne ore**				
Oxide - free dig	USD/tonne	1.80	1.80	1.80	1.80
Trans - including drill and blast	USD/tonne	3.20	3.20	3.20	3.30
Fresh - including drill and blast	USD/tonne	3.20	3.20	3.20	3.30
Extra Ore Mining Cost (haul cost to plant)	**USD/tonne ore**				
Oxide	USD/tonne	0.51	0.51	0.51	0.51
Trans	USD/tonne	0.75	1.05	0.78	7.18
Fresh	USD/tonne	0.75	1.05	0.78	7.18
Mill throughput Requirement					
LOM throughput Requirement	Mtpa	2.88	2.88	2.88	2.16
Additional Ore Mining Cost	USD/tonne ore	0.90	0.90	0.90	1.00
Processing Cost Parameters	**Unit**	**Value**	**Value**	**Value**	**Value**
Processing Cost Base					
Oxide - Heap Leach	USD/tonne ore	2.05	2.05	2.05	2.05
Fresh - CIL 240(180) ktpm	USD/tonne ore	15.81	15.81	15.81	28.73
GA's	USD/tonne ore	2.31	2.31	2.31	3.07
Total Processing Cost					
Oxide - Heap Leach	USD/tonne ore	2.95	2.95	2.95	3.05
Fresh - CIL 240(180) ktpm	USD/tonne ore	19.02	19.02	19.02	32.81
WHITTLE PROCESSING COST					
Oxide - Heap Leach	USD/tonne ore	3.46	3.46	3.46	3.56
Fresh - CIL 240(180) ktpm	USD/tonne ore	19.77	20.07	19.80	39.99
Process Recovery					
Oxide - Heap Leach	(%)	70.0%	70.0%	70.0%	70.0%
Trans & Fresh - Biox & CIL Mean Recovery	(%)	83.6	83.6	83.6	88.9
Trans & Fresh - Biox & CIL Upside Recovery	(%)	88.2	88.2	88.2	91.7

16.2.2 Bench Height Selection

16.2.2.1 *Motivation for Bench Height Analysis*

The geological resource estimation was conducted on a parent cell size of 5 m x 5 m x 1 m (X, Y and Z respectively) block model size. To achieve mining selectivity and dilution reduction the decision was made to select mining equipment to mine the ore zone in 5 m flitches, the waste zones are to be mined in 10 m height.

16.2.2.2 *Ore Dilution and Ore Loss*

4% dilution and 5% loss were assumed because the ore domains are continuous and will be clearly delineated and marked. Sampling of blast holes would be the basis for grade control in this analysis. The accuracy of the resulting ore / waste boundary is limited by the resolution of the grade control, which is a function of the density of the drilling pattern. The lower the flitch height, the smaller the pattern, the smaller the distance between “ore holes” and “waste holes” and hence the smaller the potential for ore loss ore dilution. These dilution and loss percentages are accepted as being in line with smaller flitch heights such as the 5 m flitches associated with this mining operation. The Bilboes team has many years of experience in mining these various pit oxide ores and believes that the transitional and fresh ores will be more easily visually identifiable for grade control drilling and selective mining.

16.2.3 Whittle Optimisation Results

The Whittle Optimisation results of the median process recovery case are shown in Table 16-7 and the selection of the $1500/oz shell number 36 is highlighted in green.

Table 16-7: Whittle Optimisation Results

All Run Results Max Profit	Abb	Units	$1,500	$1,600	$1,700	$2,400
Parameter			5% loss & 4% dilution			
O-P Discounted Cashflow		**US$M**	**820.1**	**934.7**	**1,062.4**	**2,141.5**
Mine Life		Year	10.3	11.7	12.2	22.8
Mineable Inventory	Ore	Mt	26.2	27.9	29.1	53.8
Measured & indicated	Ore	Mt	26.2	27.9	29.1	38.2
Inferred	Ore	Mt	0.0	0.0	0.0	11.3
Unclassified	Ore	Mt	0.0	0.0	0.0	4.3
Mineable Inventory	Waste	Mt	190.4	203.6	214.7	488.0
Strip Ratio		t:t	7.27	7.31	7.39	9.07
Head grade		g/t	2.31	2.26	2.23	1.92
Au Recovery		%	85.2%	85.3%	85.3%	85.4%
Au Metal Recovered	Au	g	51,542,742	53,732,547	55,278,945	87,946,899
Measured & Indicated	Au	g	51,542,742	53,732,548	55,278,944	66,624,320
Inferred	Au	g	-	-	-	15,855,527
Unclassified	Au	g	-	-	-	5,467,051
Au Metal Recovered		oz	1,657,138	1,727,542	1,777,259	2,827,558
EBIT before CAPEX		**US$M**	**1,015**	**1,173**	**1,336**	**3,165**

For additional information, refer to appendix “FSOp - Whittle Results (Bilboes) - 20211013 Approved for Design”.

16.2.4 Optimisation Sensitivities

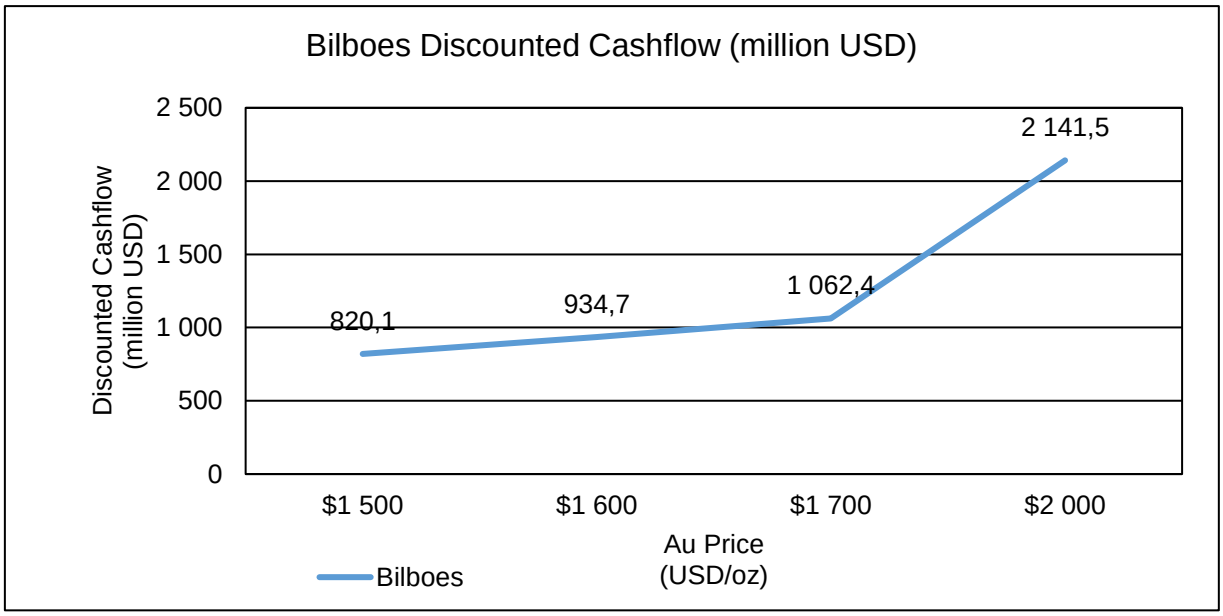
To gauge the project sensitivity to the gold price fluctuations, three scenarios were run at $1,500, $1,600, $1,700, and $2000

The influence of these variations was tested on the following key project performance indicators:

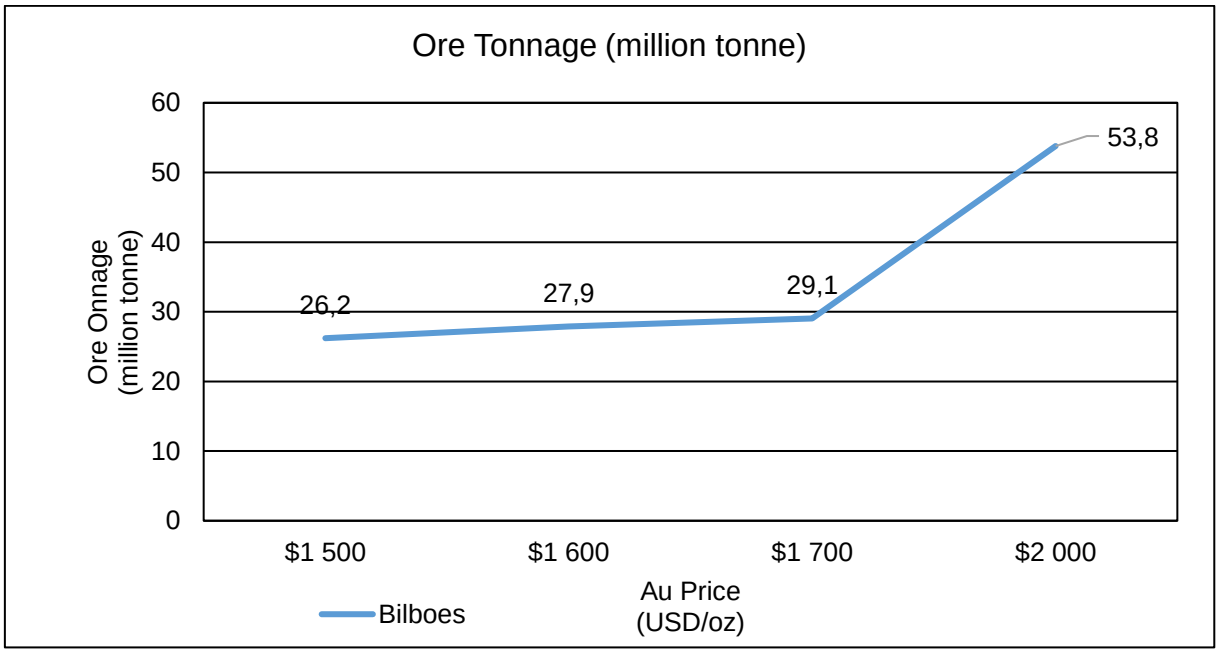
- Indicative Project Discounted Cashflow (Specified Case)
- Gold Metal Mined
- Mine Life in Years
- Ore Tonnes Mined

The resulting KPI variance is indicated in percentage change from the base case. The resulting project outcomes are indicated in Graph 16-1: to Graph 16-4:.

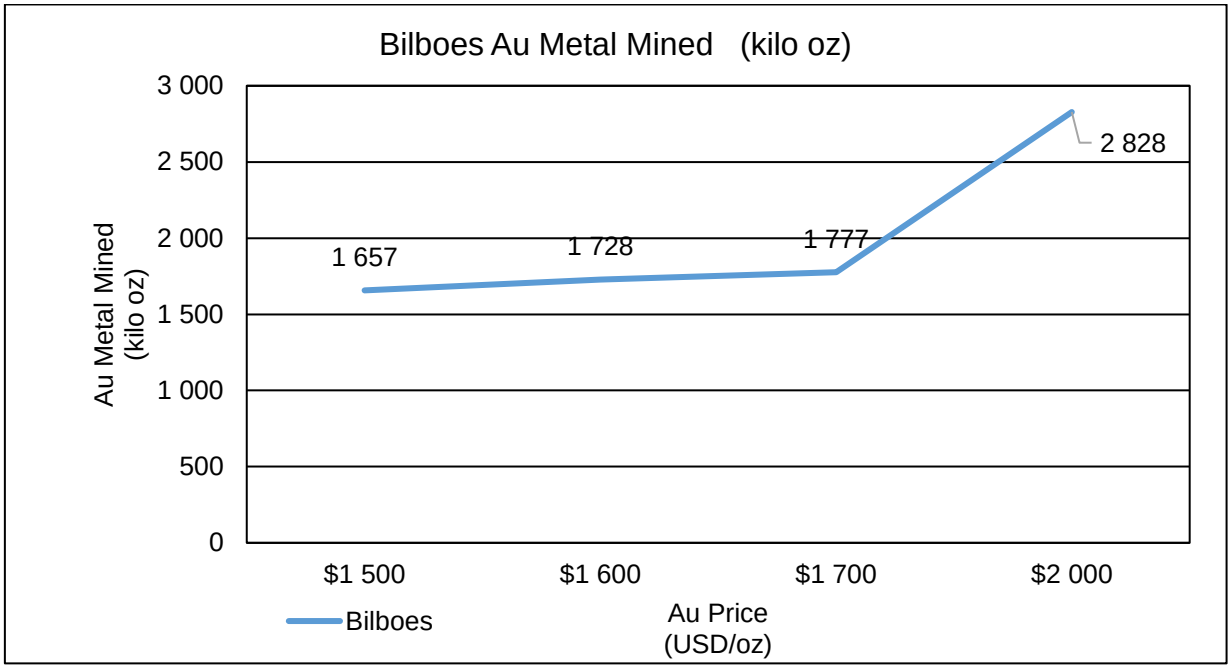
16.2.4.1 *Bilboes Sensitivities*



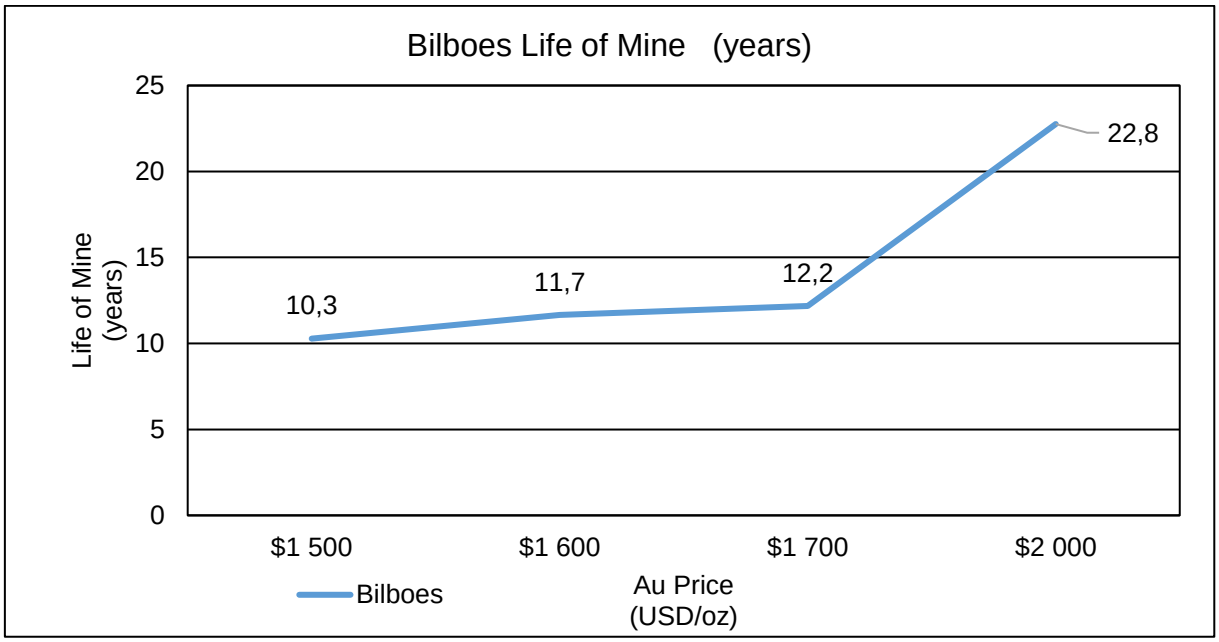
Graph 16-1: Bilboes Discounted Cashflow



Graph 16-2: Bilboes Ore Tonnes



Graph 16-3: Mining Metal Output



Graph 16-4: Mine Life

Predictably, the project value indicates linear sensitivity behaviour as result of commodity price variation. The Metal Mined, Mine Life and Ore Tonnes Mined sensitivities indicate that the resource is relatively robust and insensitive to commodity prices.

The above analyses confirmed the robustness of the optimal shells. Predictably, all DCF sensitivities to gold price fluctuations exhibit similar linear behaviour.

16.2.5 General

An indicative profit value was calculated from the Whittle Optimisation results using the revenue and various total costs determined by Whittle for each pit shell.

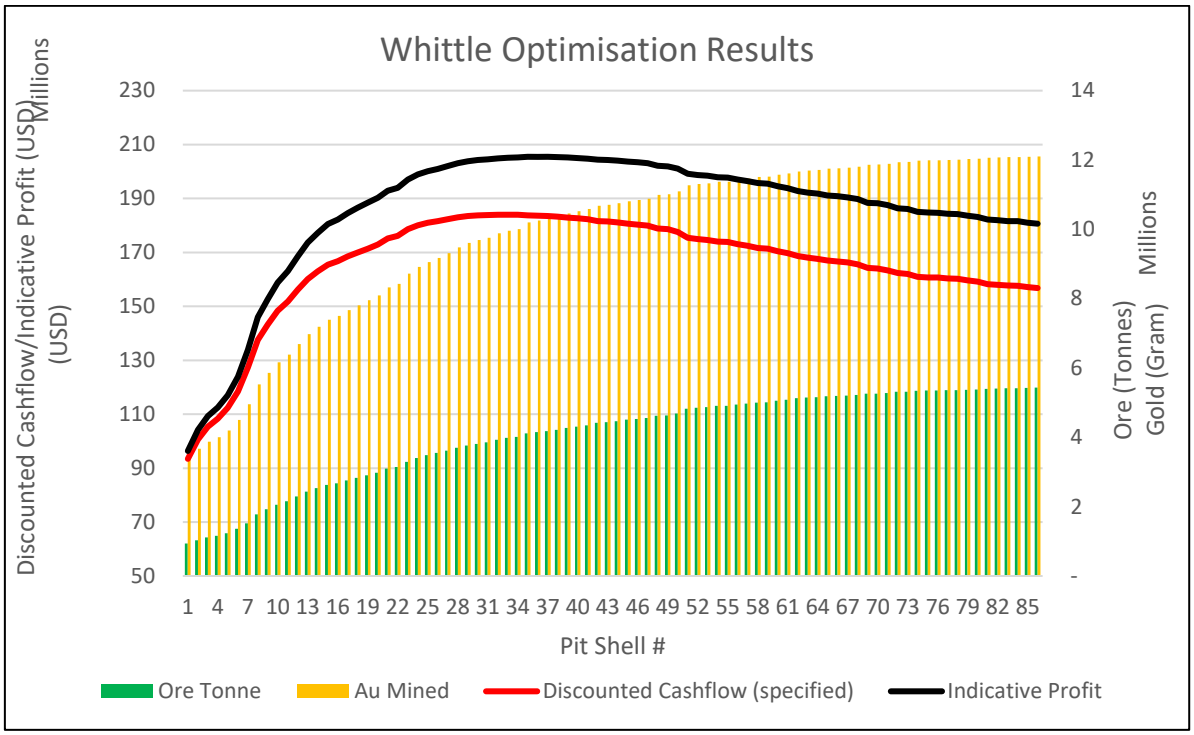
The pit shell with the largest indicative profit was selected as the preferred option for all the mining areas pit designs.

16.2.5.1 *McCays Shell Selection*

Table 16-8: McCays Optimisation Results

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne Mt	Au Mined t	Grade g/t
1	93.4	96.4	4.1	0.9	3.4	3.61
2	100.7	104.1	4.7	1.0	3.7	3.56
3	105.4	109.4	5.1	1.1	3.9	3.50
4	108.3	112.6	5.3	1.2	4.0	3.45
5	112.3	117.0	5.7	1.2	4.2	3.39
6	118.5	123.9	6.6	1.4	4.5	3.31

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne Mt	Au Mined t	Grade g/t
7	127.3	133.9	7.9	1.5	5.0	3.26
8	137.6	146.0	9.4	1.8	5.5	3.10
9	143.3	152.7	10.4	1.9	5.9	3.04
10	148.3	158.8	11.3	2.1	6.2	3.00
11	151.8	163.1	12.1	2.2	6.4	2.96
12	156.2	168.6	13.1	2.3	6.7	2.91
13	160.2	173.6	14.2	2.4	7.0	2.87
14	163.0	177.3	15.0	2.5	7.2	2.84
15	165.4	180.5	15.8	2.6	7.4	2.81
16	166.7	182.2	16.4	2.7	7.5	2.81
17	168.5	184.6	17.1	2.8	7.7	2.78
18	169.9	186.6	17.8	2.8	7.8	2.76
19	171.4	188.5	18.5	2.9	8.0	2.74
20	172.9	190.3	19.3	3.0	8.1	2.72
21	175.2	192.9	20.5	3.1	8.3	2.69
22	176.2	194.0	21.1	3.1	8.4	2.68
23	178.6	197.0	22.9	3.3	8.7	2.65
24	180.1	198.9	24.0	3.4	8.9	2.62
25	181.0	200.1	24.9	3.5	9.1	2.60
26	181.7	201.0	25.6	3.5	9.2	2.59
27	182.3	202.0	26.6	3.6	9.3	2.58
28	183.0	203.1	27.8	3.7	9.5	2.56
29	183.5	203.8	28.8	3.8	9.6	2.55
30	183.7	204.2	29.4	3.8	9.7	2.54
31	183.8	204.5	29.8	3.9	9.8	2.53
32	184.0	204.9	30.8	3.9	9.9	2.51
33	184.0	205.1	31.3	4.0	10.0	2.50
34	183.9	205.2	31.7	4.0	10.0	2.50
35	183.8	205.4	33.3	4.1	10.2	2.48
36	183.6	205.4	33.7	4.2	10.3	2.47
37	183.5	205.4	34.1	4.2	10.3	2.46
38	183.3	205.3	34.7	4.2	10.4	2.46
39	182.9	205.2	35.6	4.3	10.5	2.45
40	182.7	205.0	36.1	4.3	10.5	2.44



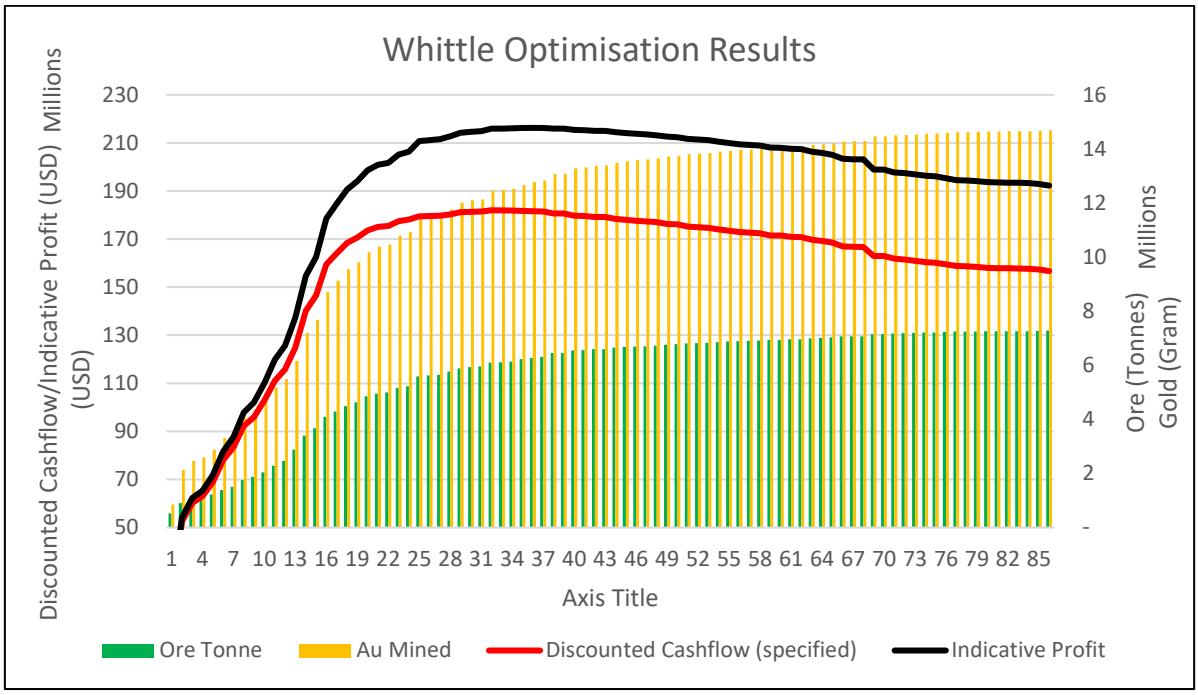
Graph 16-5: McCays Whittle Analysis

16.2.5.2 *Isabella South Shell Selection*

Table 16-9: Isabella South Optimisation Results

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne Mt	Au Mined t	Grade g/t
1	21.2	21.6	0.9	0.5	0.9	1.63
2	52.5	54.1	4.0	0.9	2.1	2.37
3	60.2	62.3	4.7	1.0	2.5	2.40
4	63.1	65.4	5.0	1.1	2.6	2.39
5	68.8	71.7	5.4	1.2	2.9	2.34
6	78.1	81.7	6.6	1.4	3.3	2.39
7	83.5	87.8	7.3	1.5	3.6	2.37
8	92.3	97.8	8.3	1.8	4.1	2.31
9	95.9	102.1	8.7	1.9	4.3	2.28
10	103.0	110.2	10.0	2.0	4.7	2.30
11	111.1	119.8	11.4	2.3	5.2	2.27
12	115.8	125.6	12.3	2.5	5.5	2.23
13	124.8	137.3	13.8	2.9	6.2	2.14
14	140.1	154.8	17.3	3.4	7.2	2.12
15	146.6	162.5	18.8	3.7	7.7	2.09
16	159.4	178.6	23.6	4.1	8.7	2.13

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne Mt	Au Mined t	Grade g/t
17	164.0	184.6	25.5	4.3	9.1	2.13
18	168.4	190.7	27.5	4.5	9.6	2.13
19	170.7	194.1	28.6	4.6	9.8	2.12
20	173.6	198.6	30.2	4.9	10.2	2.10
21	175.0	200.9	31.2	5.0	10.4	2.10
22	175.5	201.7	31.5	5.0	10.5	2.09
23	177.5	205.1	33.5	5.2	10.8	2.09
24	178.2	206.3	34.2	5.2	10.9	2.09
25	179.4	210.7	37.3	5.6	11.5	2.05
26	179.6	211.1	37.6	5.6	11.5	2.05
27	179.8	211.6	38.0	5.7	11.6	2.05
28	180.2	212.8	39.2	5.8	11.8	2.04
29	181.2	214.3	41.1	5.9	12.0	2.04
30	181.4	214.7	41.6	5.9	12.1	2.04
31	181.5	214.8	41.9	6.0	12.1	2.04
32	181.9	215.9	44.6	6.1	12.5	2.04
33	181.9	216.0	44.8	6.1	12.5	2.04
34	181.9	216.0	45.0	6.1	12.5	2.04
35	181.7	216.2	46.3	6.2	12.7	2.04
36	181.5	216.3	47.1	6.3	12.8	2.03
37	181.4	216.2	47.6	6.3	12.8	2.03
38	180.7	216.0	49.6	6.5	13.1	2.03
39	180.6	216.0	49.7	6.5	13.1	2.03
40	179.8	215.4	51.8	6.5	13.3	2.03



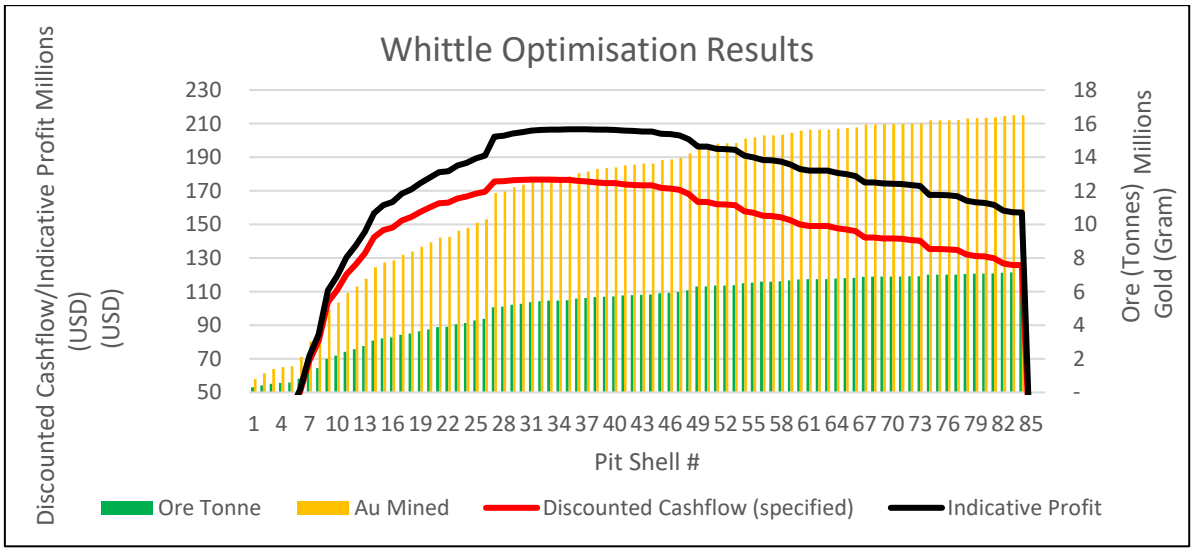
Graph 16-6: Isabella South Whittle Analysis

16.2.5.3 *Isabella North Shell Selection*

Table 16-10: Isabella North Optimisation Results

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne mt	Au Mined t	Grade g/t
1	20.2	20.4	1.2	0.3	0.8	2.68
2	28.6	29.0	1.7	0.4	1.1	2.70
3	34.5	35.1	2.2	0.5	1.4	2.67
4	37.3	38.0	2.4	0.6	1.5	2.65
5	38.4	39.2	2.5	0.6	1.6	2.63
6	50.3	51.7	3.7	0.8	2.1	2.57
7	68.8	71.6	5.5	1.2	3.0	2.50
8	80.6	84.5	7.0	1.4	3.6	2.51
9	103.7	110.8	10.1	2.0	4.9	2.47
10	111.0	119.4	11.2	2.2	5.3	2.44
11	120.3	130.3	12.8	2.4	5.9	2.44
12	126.2	137.3	14.1	2.6	6.3	2.45
13	132.7	145.4	15.6	2.8	6.8	2.45
14	142.4	156.8	18.3	3.1	7.4	2.41
15	146.5	161.5	19.4	3.2	7.7	2.41
16	148.1	163.3	19.8	3.3	7.9	2.40
17	152.3	168.2	21.2	3.4	8.2	2.40
18	154.5	170.8	22.0	3.5	8.4	2.39
19	157.5	174.5	23.3	3.6	8.7	2.38
20	160.1	177.8	24.5	3.7	8.9	2.38

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne mt	Au Mined t	Grade g/t
21	162.7	181.1	25.8	3.9	9.2	2.38
22	163.1	181.6	26.0	3.9	9.3	2.38
23	165.5	185.1	28.1	4.1	9.6	2.37
24	166.6	186.7	29.1	4.1	9.8	2.36
25	168.3	189.4	30.8	4.3	10.1	2.35
26	169.4	191.0	32.0	4.4	10.3	2.35
27	175.5	202.2	41.6	5.1	11.9	2.34
28	175.8	202.7	42.0	5.1	12.0	2.34
29	176.3	204.1	43.8	5.2	12.2	2.34
30	176.6	205.0	44.9	5.3	12.4	2.34
31	176.7	205.8	46.4	5.4	12.6	2.34
32	176.7	206.2	47.2	5.4	12.7	2.34
33	176.6	206.5	47.9	5.5	12.8	2.34
34	176.6	206.5	48.1	5.5	12.8	2.34
35	176.5	206.6	48.4	5.5	12.9	2.34
36	176.0	206.6	49.9	5.6	13.0	2.34
37	175.6	206.6	50.7	5.6	13.1	2.34
38	175.0	206.4	52.1	5.7	13.3	2.34
39	174.7	206.3	52.6	5.7	13.4	2.34
40	174.5	206.3	52.8	5.7	13.4	2.34



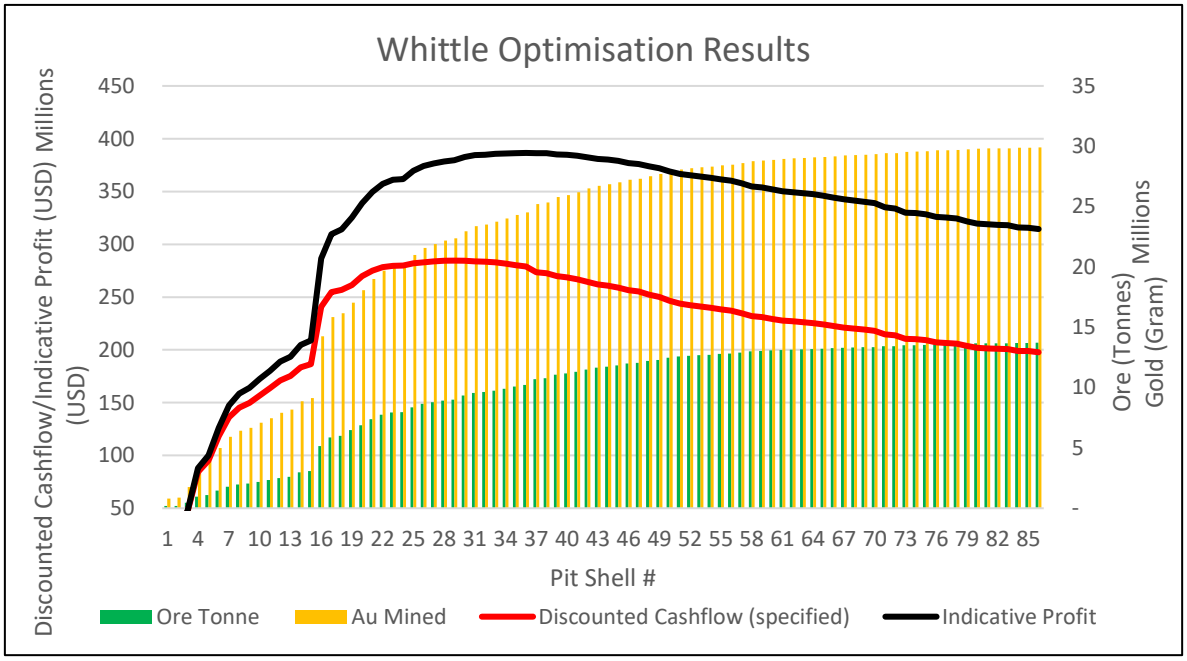
Graph 16-7: Isabella North Whittle Analysis

16.2.5.4 *Bubi Shell Selection*

Table 16-11: Bubi Shell Selection

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne mt	Au Mined t	Grade g/t
1	23.2	23.4	0.6	0.2	0.8	4.46
2	25.6	25.8	0.7	0.2	0.9	4.45
3	47.4	48.3	1.4	0.5	1.8	3.85
4	84.3	87.9	2.9	1.0	3.4	3.52
5	95.2	99.9	3.5	1.1	3.9	3.51
6	118.3	126.3	4.6	1.5	5.0	3.38
7	136.1	147.3	5.7	1.8	5.9	3.30
8	145.4	158.6	6.4	2.0	6.4	3.27
9	149.7	163.9	6.8	2.1	6.7	3.25
10	156.9	172.5	7.7	2.2	7.1	3.23
11	163.6	180.2	8.4	2.3	7.5	3.21
12	171.1	188.8	9.3	2.5	7.9	3.16
13	175.1	193.5	9.8	2.6	8.2	3.15
14	183.4	204.6	11.0	3.0	8.9	2.99
15	186.6	208.8	11.5	3.1	9.1	2.96
16	240.8	286.6	25.5	5.2	14.2	2.76
17	254.7	309.7	29.3	5.9	15.8	2.70
18	256.8	314.0	29.9	6.0	16.1	2.69
19	261.4	325.3	31.5	6.5	17.0	2.63
20	269.8	338.9	35.3	6.9	18.1	2.62
21	275.1	349.6	37.4	7.4	19.0	2.58
22	278.3	357.2	39.2	7.7	19.7	2.54
23	279.7	361.1	40.2	7.9	20.1	2.53
24	280.0	361.8	40.5	8.0	20.1	2.53
25	282.1	369.5	43.8	8.4	21.0	2.51
26	283.0	374.2	46.1	8.6	21.6	2.50
27	283.9	376.7	47.7	8.8	21.9	2.49
28	284.3	378.6	48.9	8.9	22.2	2.49
29	284.5	379.7	49.9	9.0	22.4	2.48
30	284.3	382.6	52.2	9.3	23.0	2.46
31	283.7	384.4	54.1	9.5	23.4	2.45
32	283.4	384.9	54.8	9.6	23.5	2.44
33	282.8	385.6	56.0	9.7	23.7	2.44
34	281.7	386.1	57.1	9.9	24.0	2.42
35	280.2	386.4	58.7	10.1	24.3	2.41
36	278.9	386.5	59.7	10.2	24.5	2.40
37	273.5	386.3	62.2	10.7	25.2	2.36

Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne mt	Ore Tonne mt	Au Mined t	Grade g/t
38	272.5	386.2	62.9	10.8	25.3	2.35
39	269.7	385.2	65.2	11.1	25.8	2.33
40	268.6	384.8	66.2	11.2	26.0	2.33



Graph 16-8: Bubi Whittle Analysis

16.2.5.5 *Shell Selection Summary*

The inventories of the selected shells are summarised in Table 16-12.

Table 16-12: Summary of Selected Shells

Area	Pit Shell #	Discounted Cashflow (specified) MUS$	Indicative Profit Million $	Waste Tonne Mt	Ore Tonne mt	Au Mined t	Grade g/t
McCays	36	183.6	205.4	33.7	4.2	10.3	2.47
Isabella South	36	181.5	216.3	47.1	6.3	12.8	2.03
Isabella North	35	176.0	206.6	49.9	5.6	13.0	2.34
Bubi	36	278.9	386.5	59.7	10.2	24.5	2.40

16.2.6 Mine Design

All the pit designs were developed using the DeswikCAD software package. They were based on the optimal shells selected as detailed in 16.2.4.5 and utilised the latest CCIC resource block models.

The models were coded with appropriate batter angles, berm widths, bench, and stack heights for different rock / material types for each deposit. These slope design parameters,

summarised in the tables below were based on geotechnical design criteria provided by SRL Consulting as used in the open pit optimisation (refer to Table 16-1:, Table 16-2 and Table 16-3).

The criteria for pit and waste dump ramp designs were based on the width and turning circle of a Caterpillar 773, as this size truck is likely to be used by mining contractors. Ramp gradients are 10%. Wherever possible, the ramp exits were located at the closest possible distance to the waste dumps to minimise ex-pit haulage.

The pit and waste dump design outlines recognised lease boundaries, neighbouring villages, and the local road infrastructure. An additional requirement to siting the dump locations was to avoid all identified future exploration zone so as not to sterilise these areas. This had a slightly negative impact of increasing the ex-pit hauling distances in some cases.

Within the pit designs, a minimum distance of 50 m is required between the pit edge and final dump toe, which is considered acceptable. However, this is only a minimum separation distance, as a previous $2,000/oz gold pricing scenario was used to demarcate surface area to be left free of infrastructure that might sterilise remaining open pit/underground resource. Hence, pit rim to WRD toe distances will exceed the minimum of 50 m in most cases.

In general, a minimum mining width of 25 m is maintained, although tight conditions in and around the existing pits sometimes result in pinch points where narrower widths are inevitable. However, these occurrences are only over limited lateral and vertical distances.

16.2.6.1 *Haul Roads*

Where possible existing haul roads will be re-used, but where none exist several new haul roads will be required. All haul roads have been laid out on the overall site plans. Refer to chapter 18 for further details regarding the haul road network.

16.2.6.2 *Bilboes Pit Designs*

The Bilboes Project area consists of four mining areas containing between one to three pits each. These areas are McCays, Isabella South, Isabella North and Bubi.

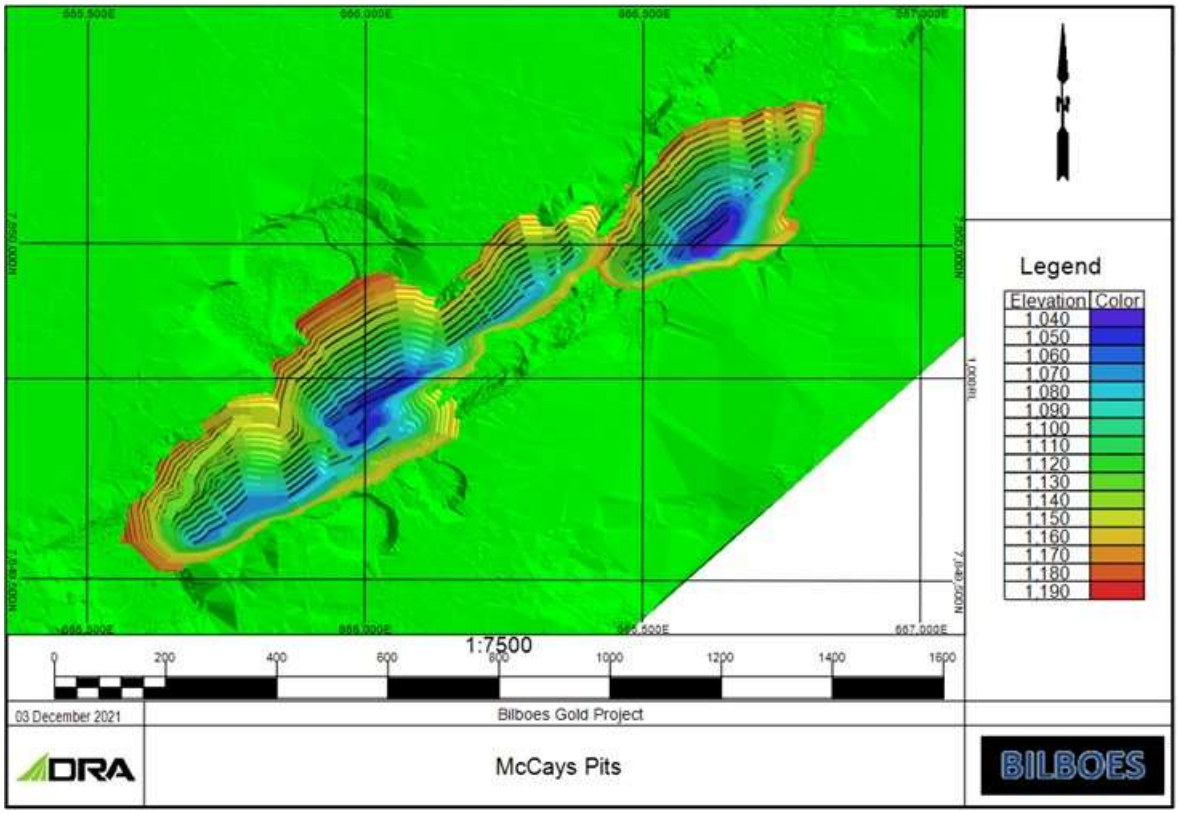


Figure 16-1: McCays Pits

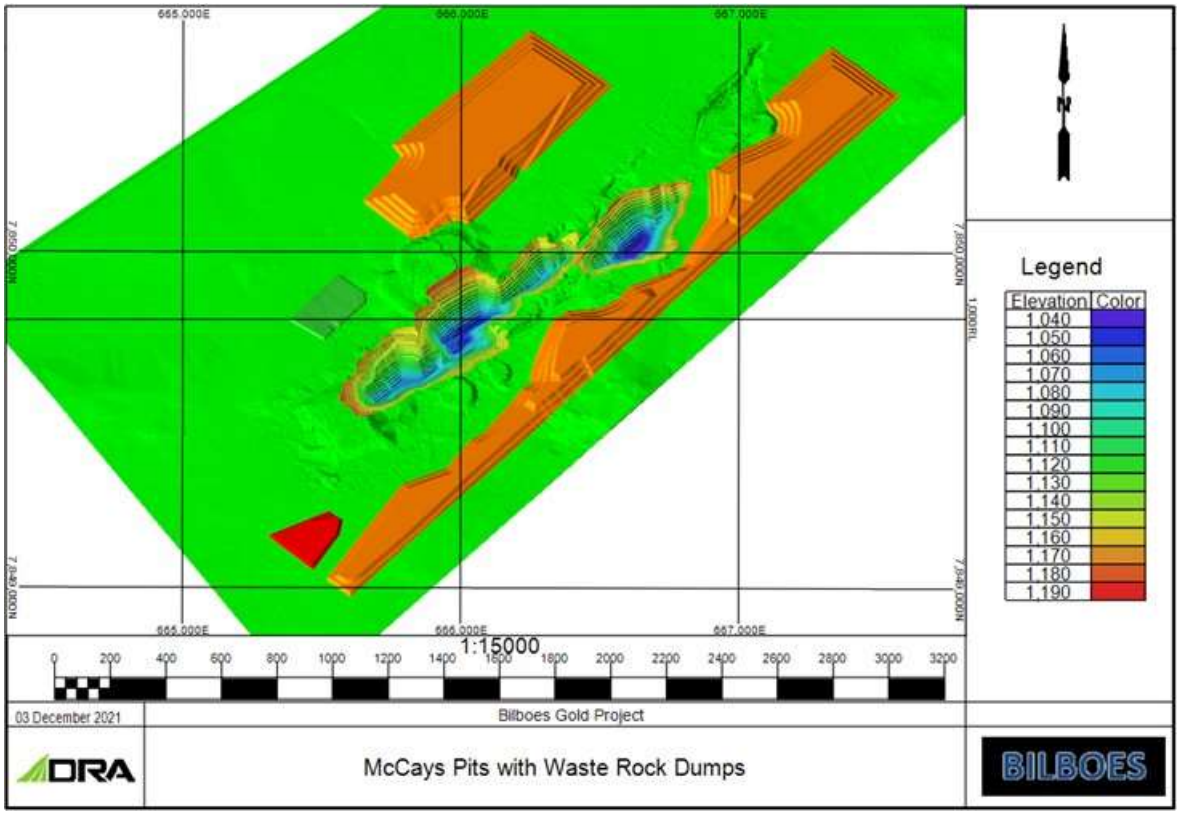


Figure 16-2: McCays Pits and WRD Designs

16.2.6.3 *Isabella South Pits Designs*

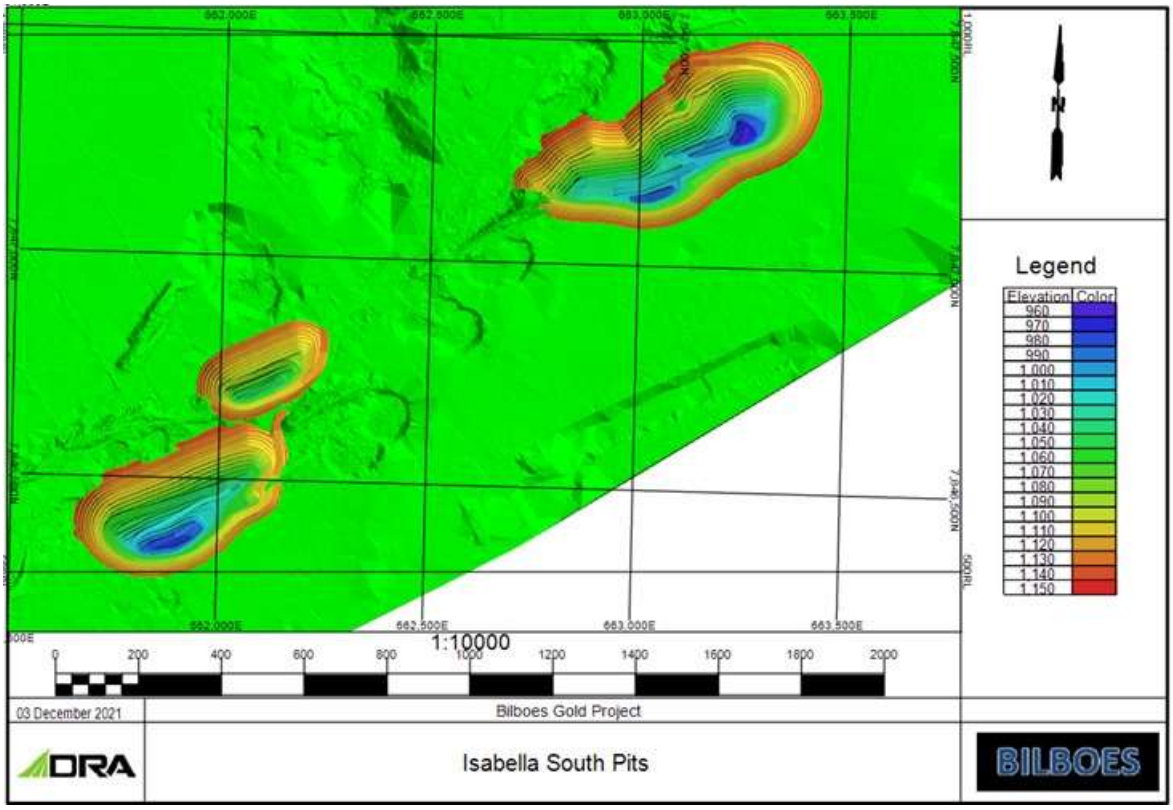


Figure 16-3: Isabella South Pits

16.2.6.4 *Isabella South Pits and Dumps*

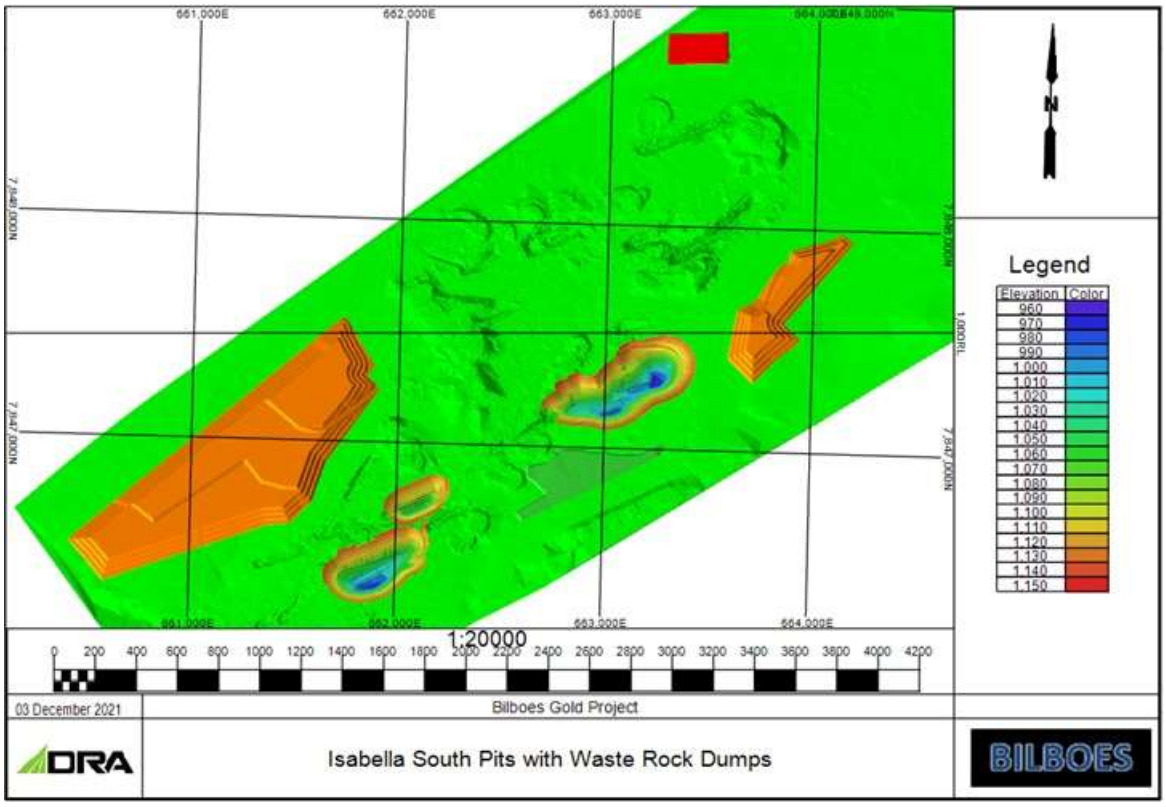


Figure 16-4: Isabella South Pits and Dumps

16.2.6.5 *Isabella North Pit Design*

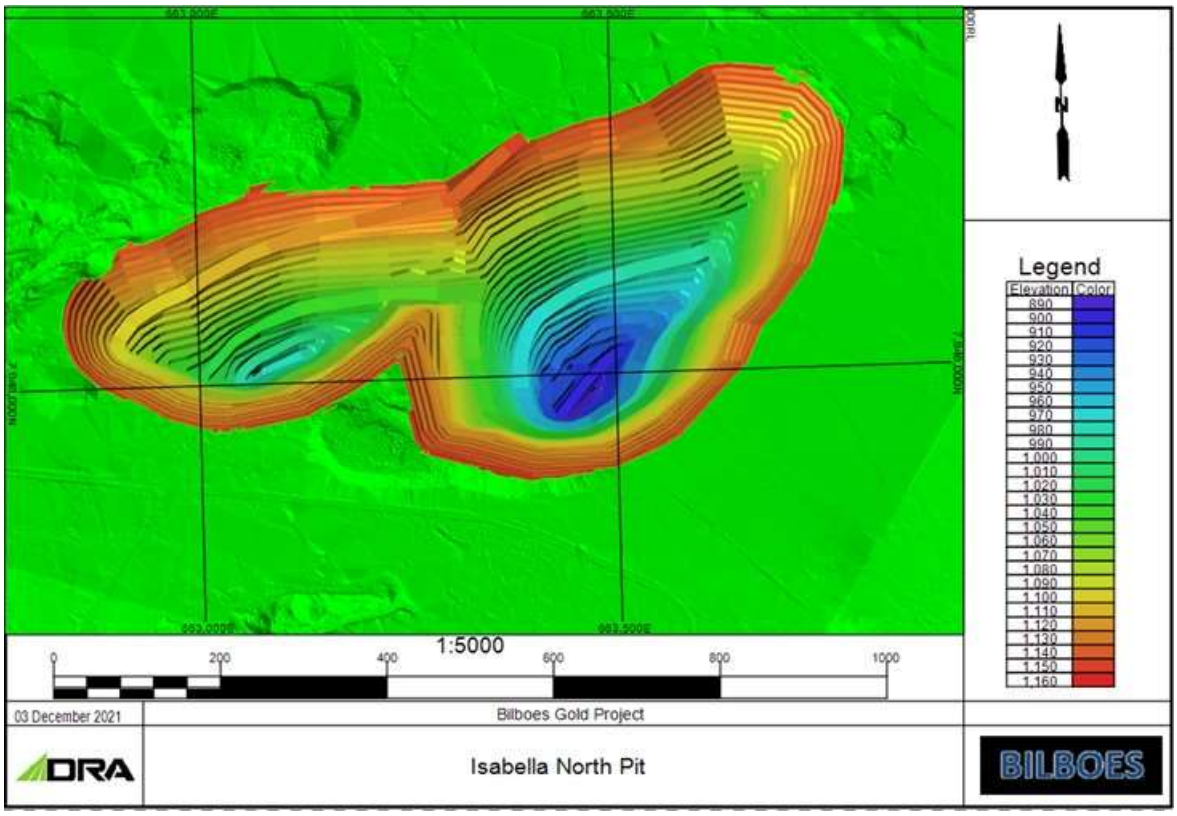


Figure 16-5: Isabella North Pit Design

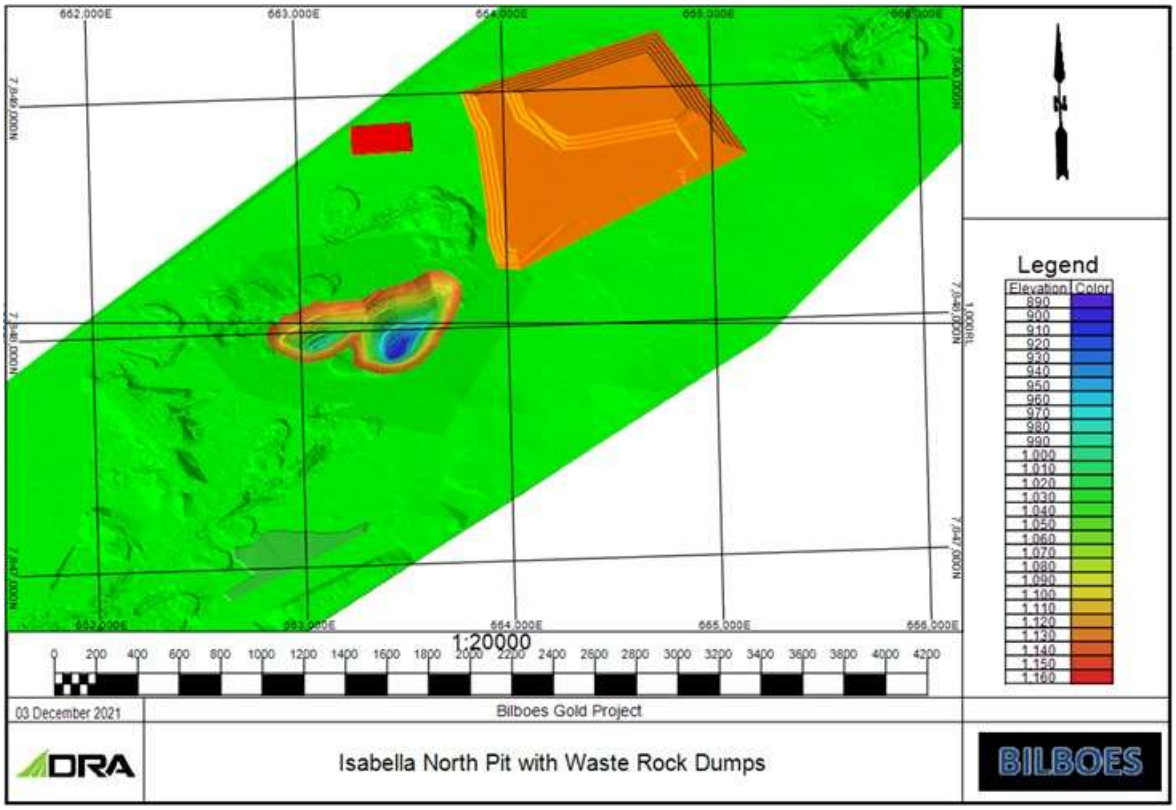


Figure 16-6: Isabella North Pit Design and Dumps

16.2.6.6 *Bubi Pits Designs*

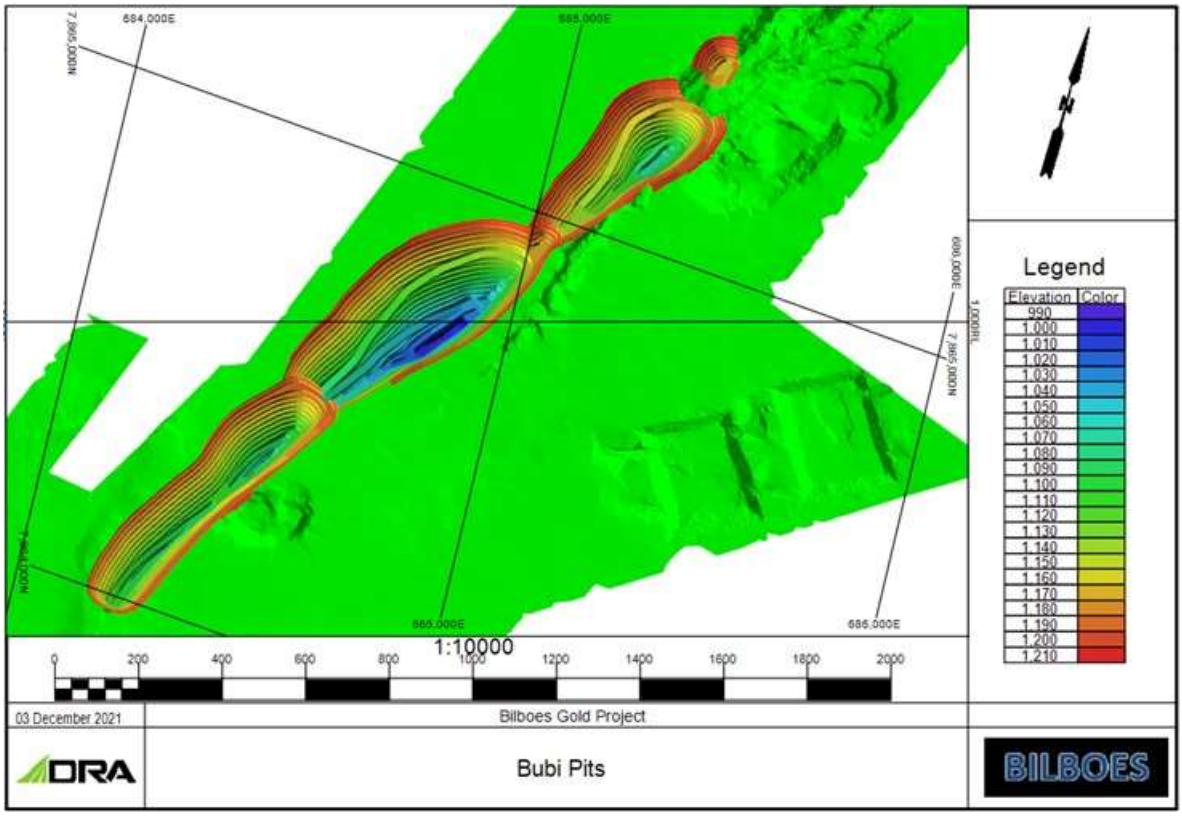


Figure 16-7: Bubi Pits Designs

16.2.6.7 *Bubi Pits with waste dumps*

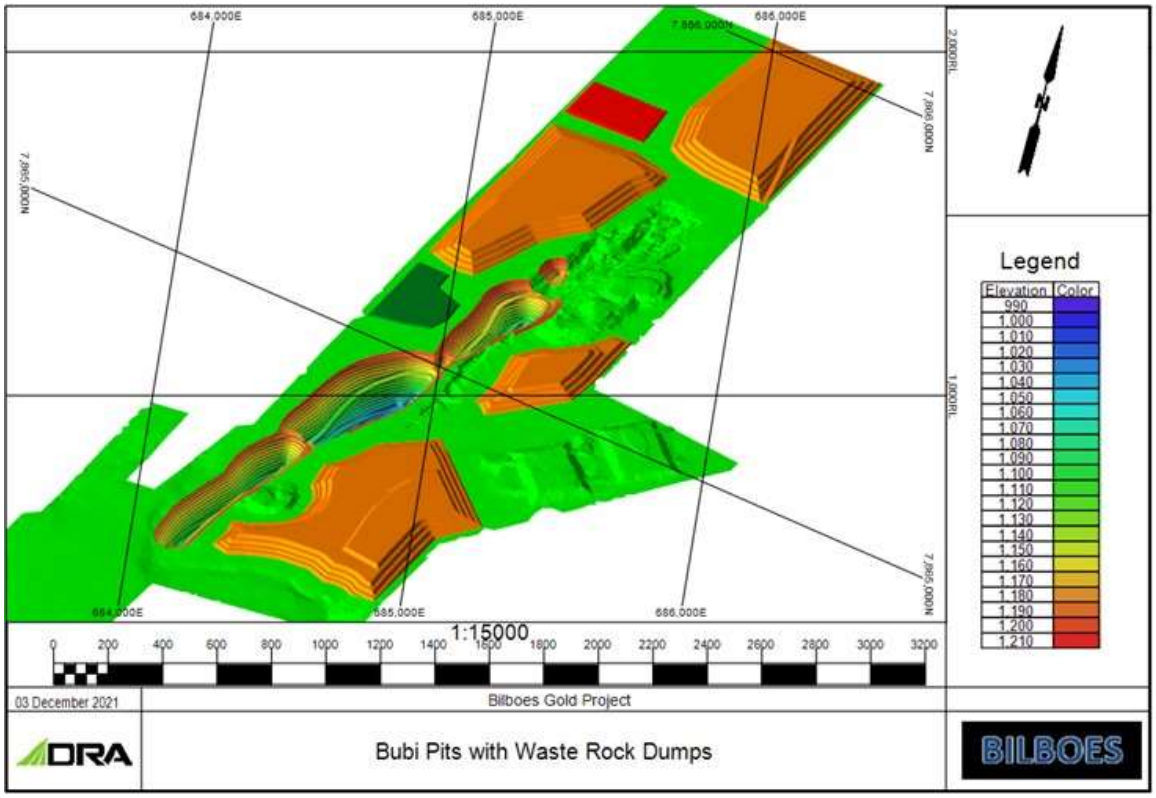


Figure 16-8: Bubi Pits and Dumps

16.2.7 Mine Production

The scheduling undertaken for the Study is based on the ore and waste inventories for each of the pit designs. The aim of the scheduling component was to ensure that the mining process allowed for:

- Pre-stripping and stockpiling of sufficient ore in time for commissioning of the processing plant and then reaching the annual processing plant feed rate
- A practical and realistically achievable schedule in terms of fleet deployment, equipment productivities and bench turnover rates

The mining schedule aims to maximise value by:

- Reducing waste mining during the early years as much as possible
- Mining high grade materials during early years of mine life
- Delaying mining of deposits with higher ore mining cost
- Limit the waste excavator fleet to four excavators

Further requirements for the mining schedule were:

- McCays to be mined first due to highest average grade
- Isabella North ore must be blended with that of Isabella South (or McCays) with maximum of 50% of the feed to plant coming from Isabella North
- Bubi mined last due to long transport distance to plant

The mining schedule aims to meet the following processing plant feed criteria, during each scheduling period:

- Phase 1 production ramp up to 2.88 Mtpa of ore from McCays, Isabella South and North combined
- Phase 2 feed to plant rate of 2.16 Mtpa of ore from Bubi

Due to the relatively short life of each of the mining areas the entire production schedule was done in months. For reporting purposes, the monthly production schedule was also aggregated into calendar years.

All mining schedules were generated in XPAC, RPM's propriety scheduling software.

16.2.8 Operating Assumptions

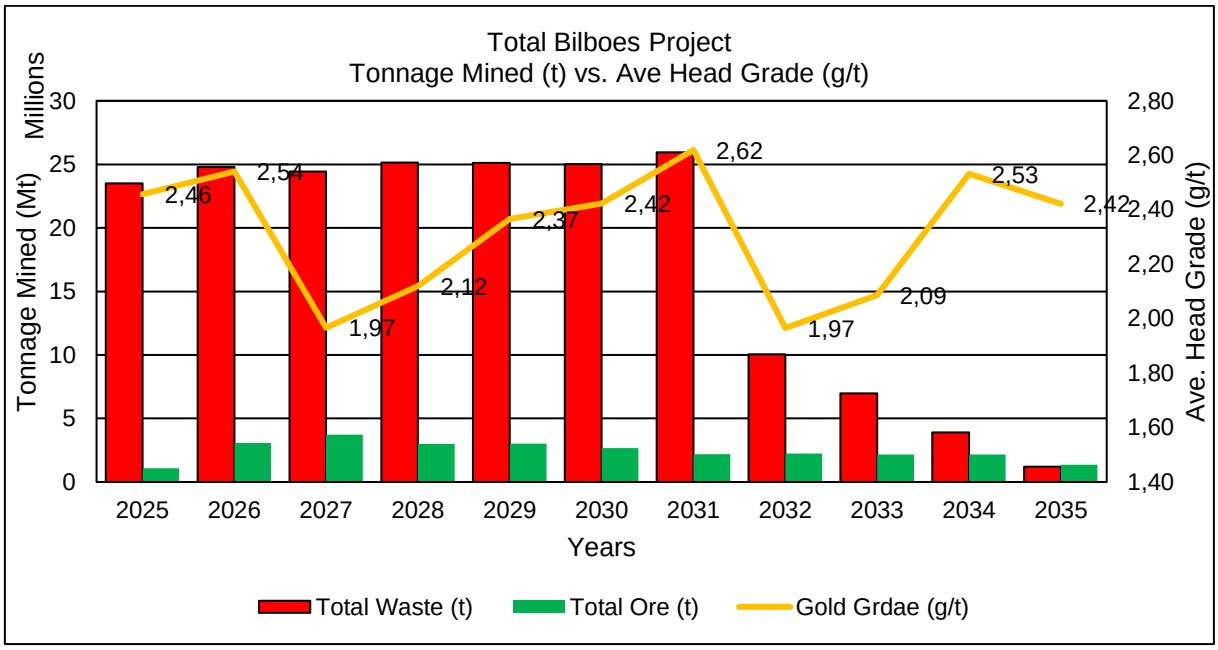
16.2.8.1 *Available Operating Hours*

The operation is planned to utilise three crews on a two 10-hour shift roster for 353 days (365 / year less 12 public holidays) of the year based on mining being carried out by a mining contractor.

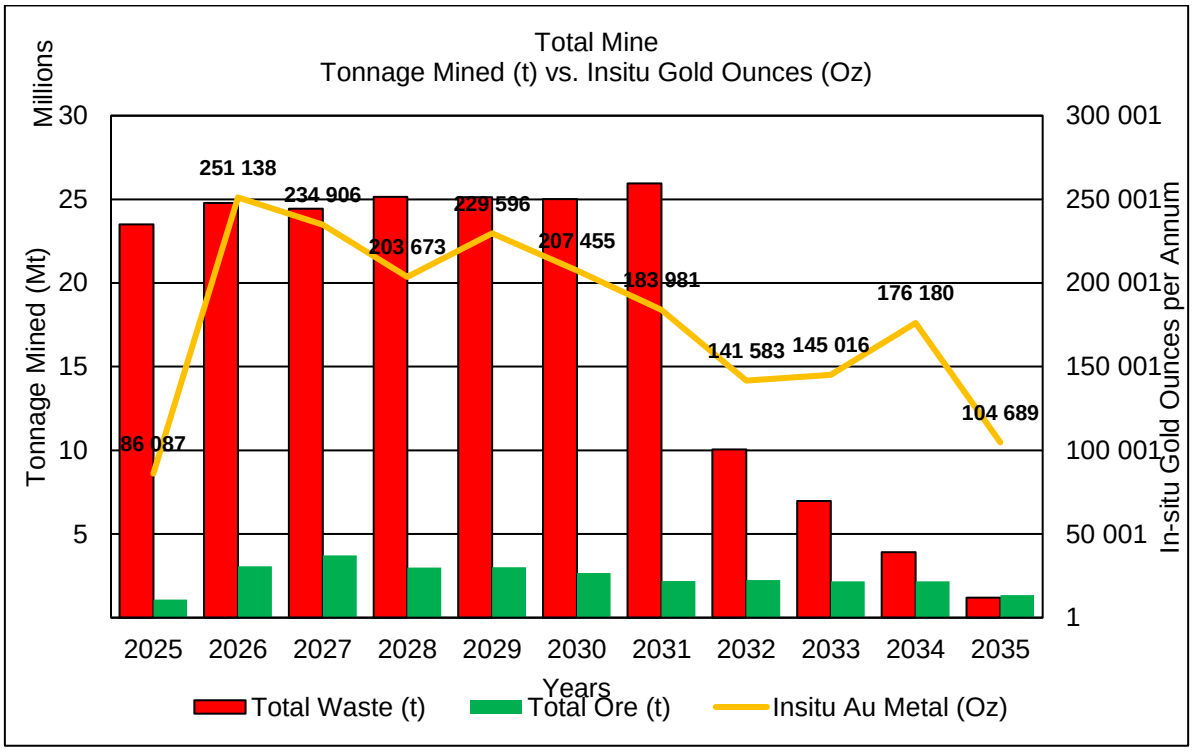
16.2.9 Scheduling Results

The scheduling results are summarised in Graph 16-9: to Graph 16-14: . The results show that the schedule is a practical solution that targets value and meets all mining and processing goals monthly. The key features of the final Base Case schedule include:

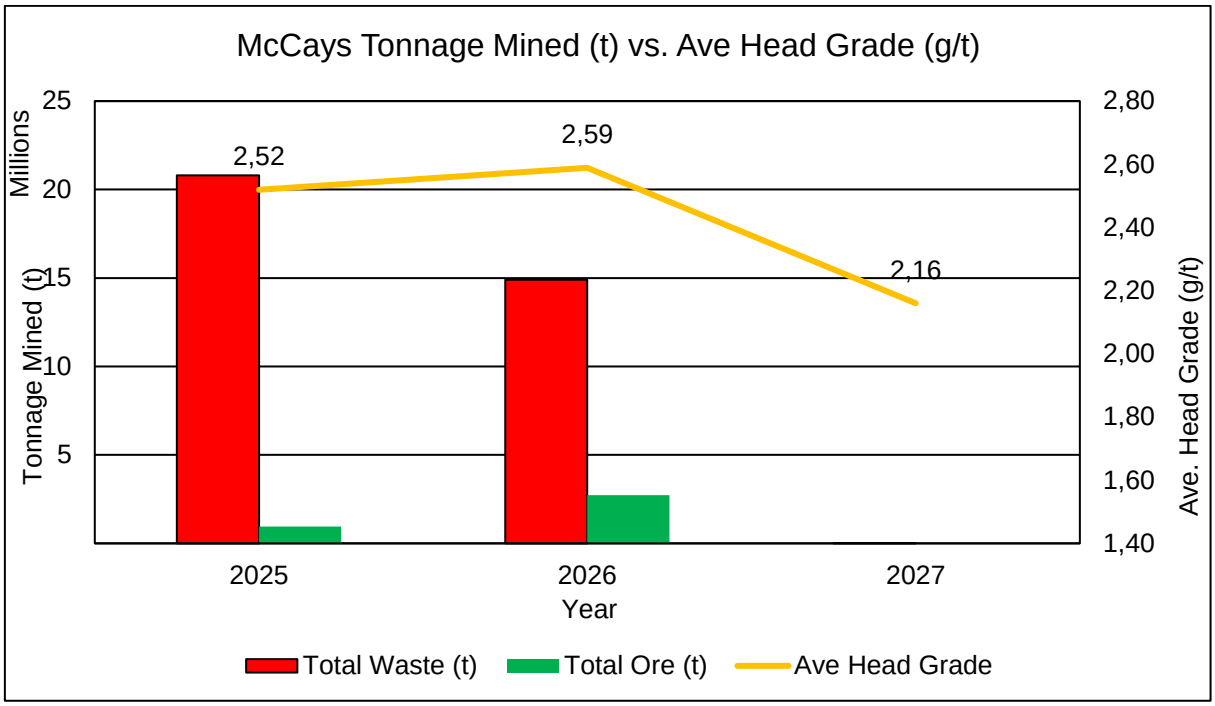
- The need for 13 Mt of pre-strip material movement over seven months of pre stripping in the McCays and Isabella mining area will allow the process plant to commence its throughput ramp up.
- Both Isabella South and North need to be pre-stripped while producing ore from McCays. The pre-strip requirements for these areas are 3.6 Mt and 8.1 Mt for Isabella South and North respectively
- A maximum annual materials movement of 28.1 Mtpa in 2027
- The initial production ramp up needs four waste excavators and two ore excavators during the production ramp up for McCays, Isabella South and North. This remains constant during the LoM at Bubi except at stages all the excavators are not fully utilised.
- The ore excavators are never fully utilised mining ore only and are used to mine the waste partings between the various reefs



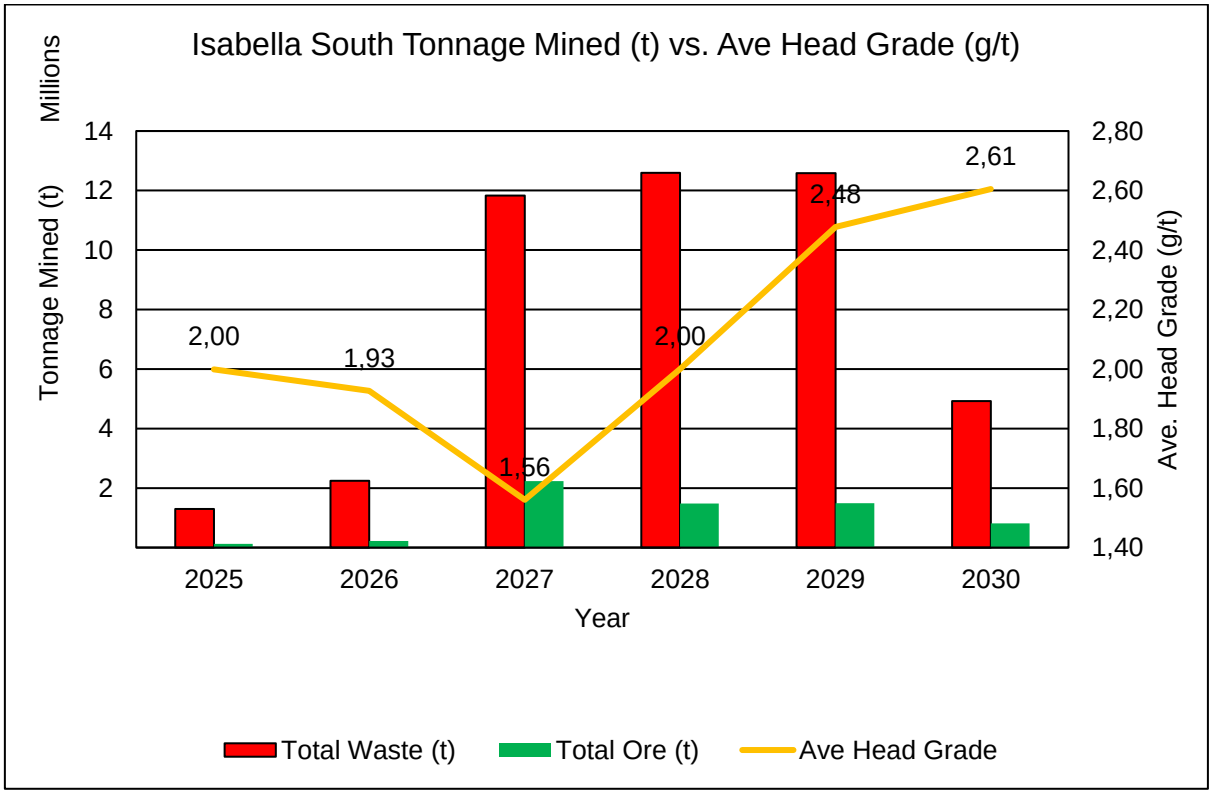
Graph 16-9: Total Mine Material Movements vs. Gold Grade for LOM



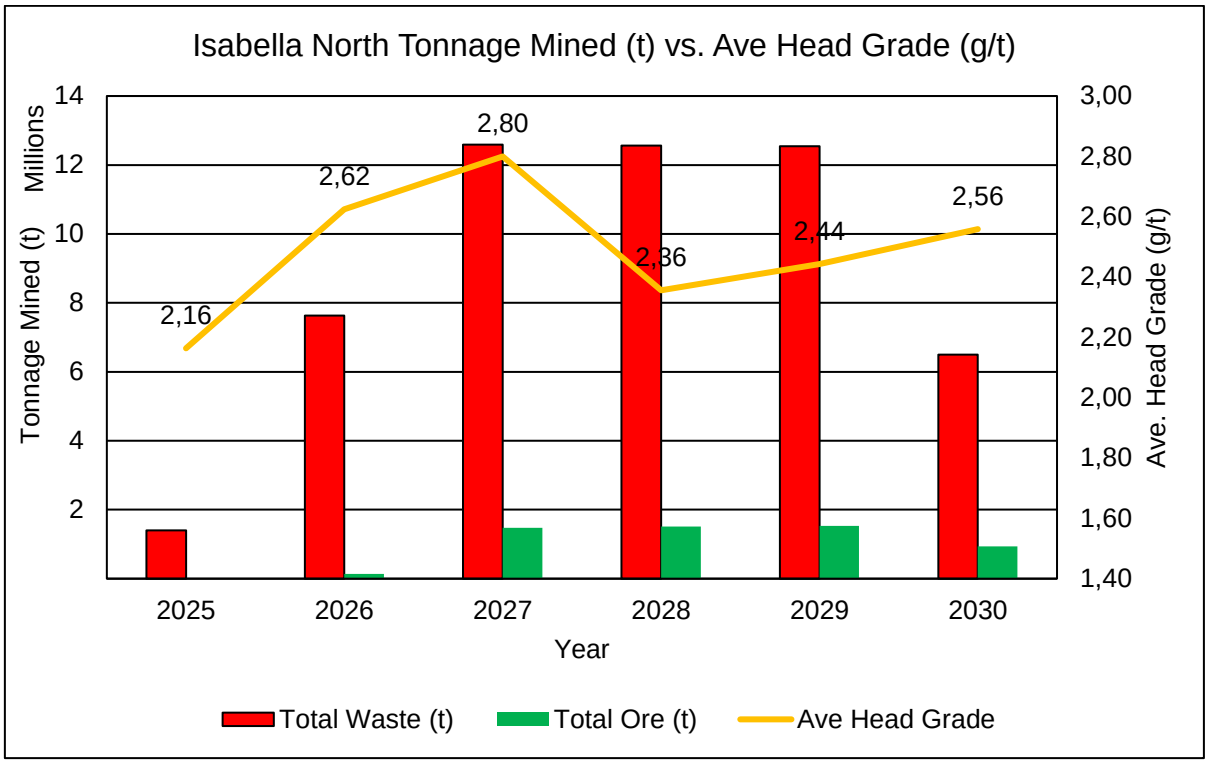
Graph 16-10: Total Mine Material Movements vs In-situ Gold Ounces for LOM



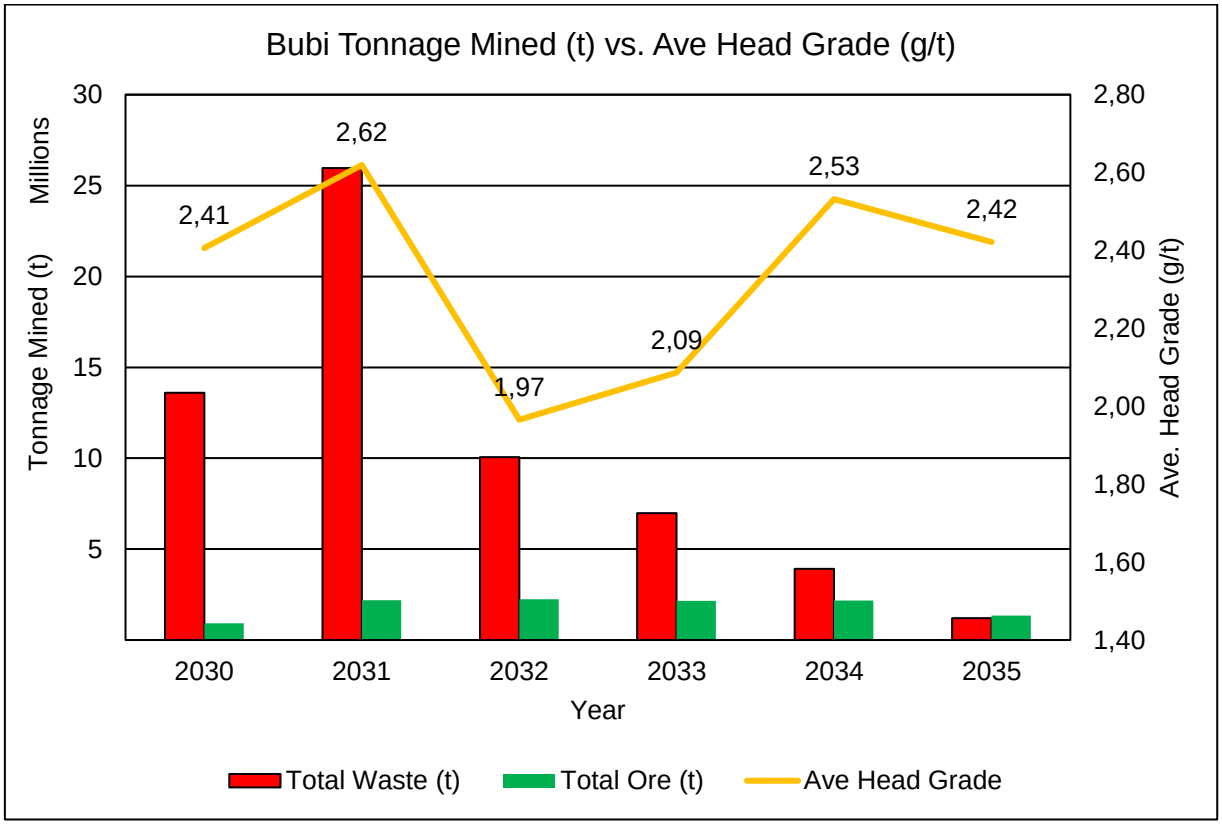
Graph 16-11: McCays Production Profile



Graph 16-12: Isabella South Production Profile



Graph 16-13: Isabella North Production Profile



Graph 16-14: Bubi Production Profile

16.2.10 Scheduling Period Progress Plots

The production scheduling in results from XPAC are depicted is the Figure 16-9: through to Figure 16-24: showing the mining progression in each of the three main mining areas of the Bilboes Projects from Jan 2025 to Aug 2030.

16.2.10.1 *Scheduling Period Progress Plots McCays*

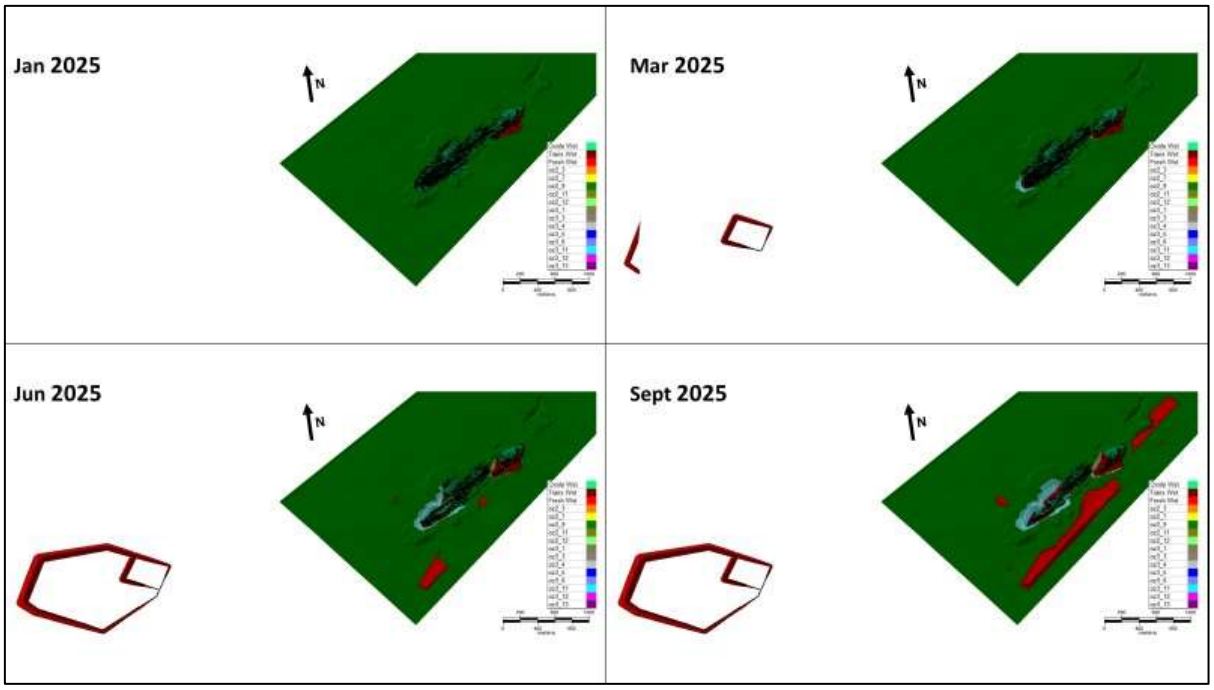


Figure 16-9: McCays Jan 2025 to Sep 2025

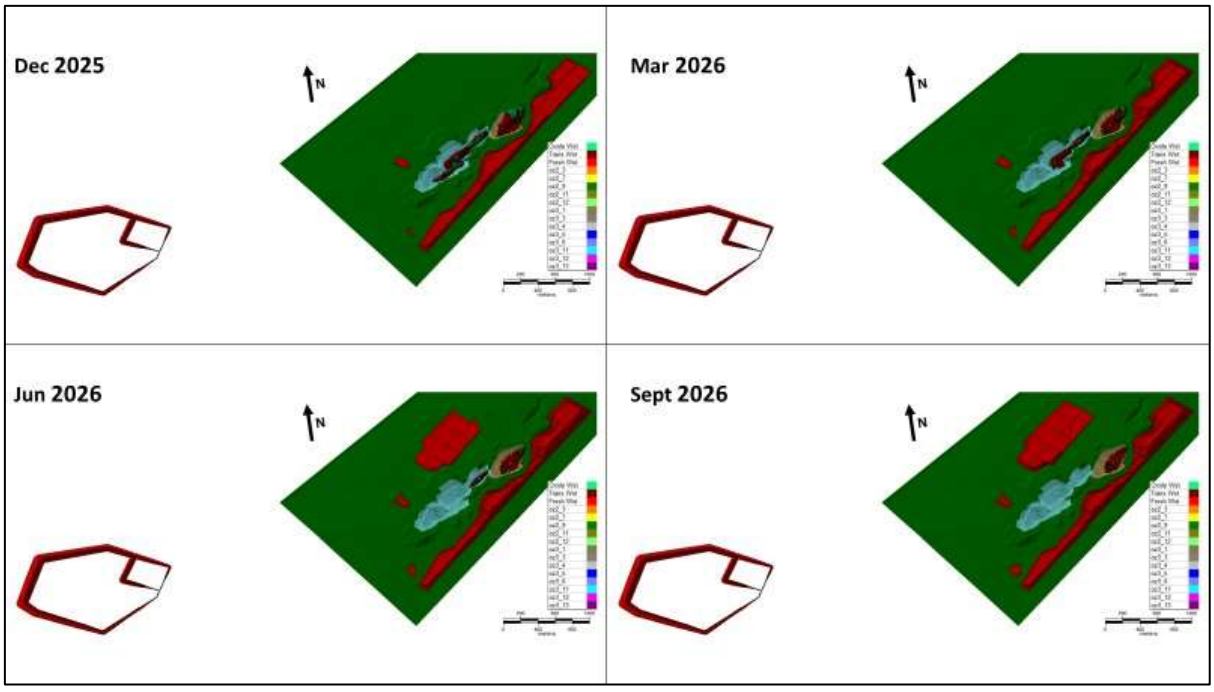


Figure 16-10: McCays Dec 2025 to Sep 2026

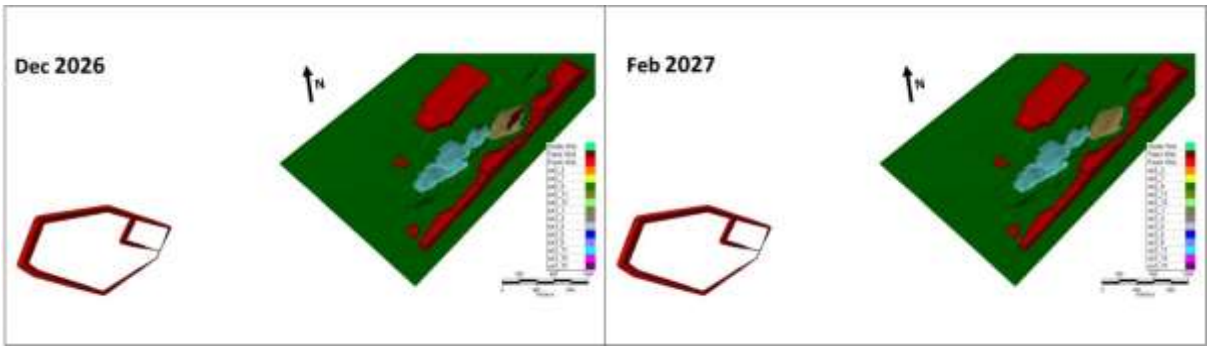


Figure 16-11: McCays Dec 2026 to Feb 2027

16.2.10.2 *Scheduling Period Progress Plots Isabella North*

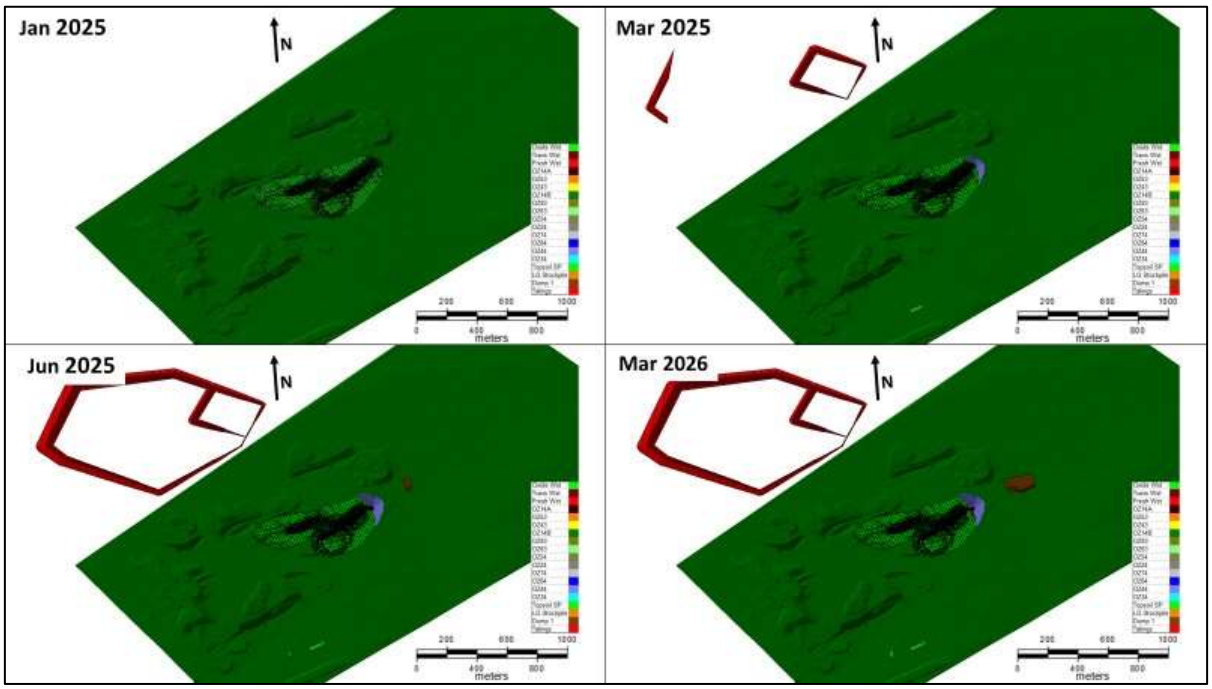


Figure 16-12: Isabella North Jan 2025 to Mar 2026

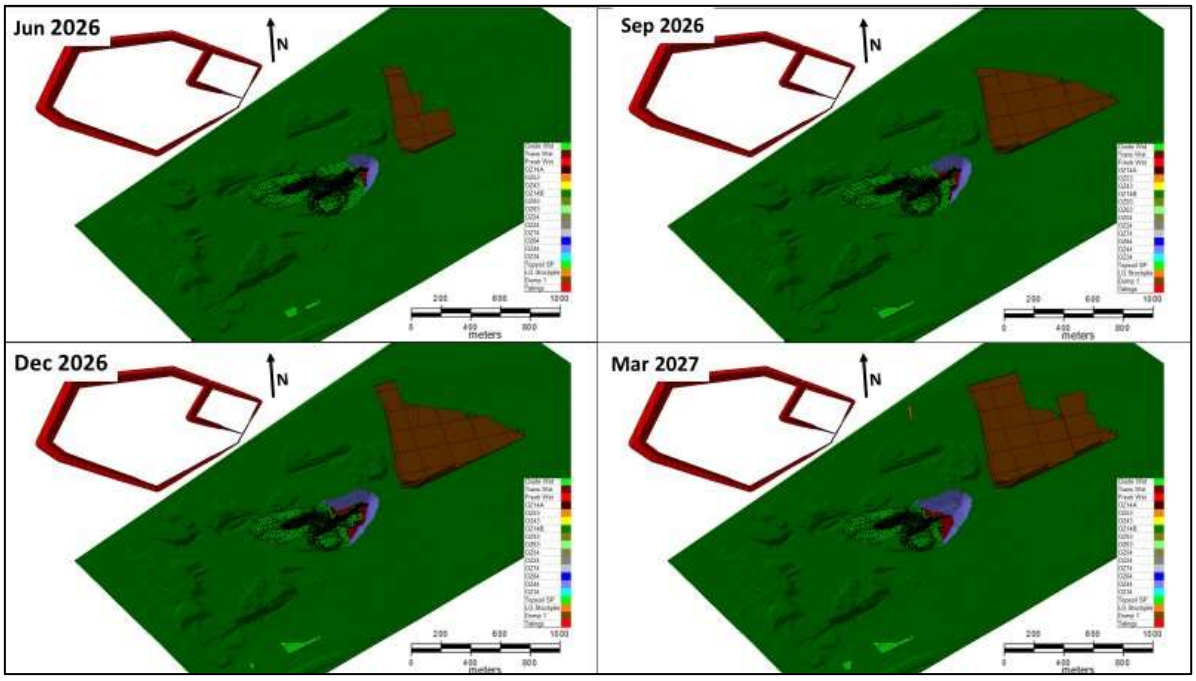


Figure 16-13: Isabella North Jun 2026 to Mar 2027

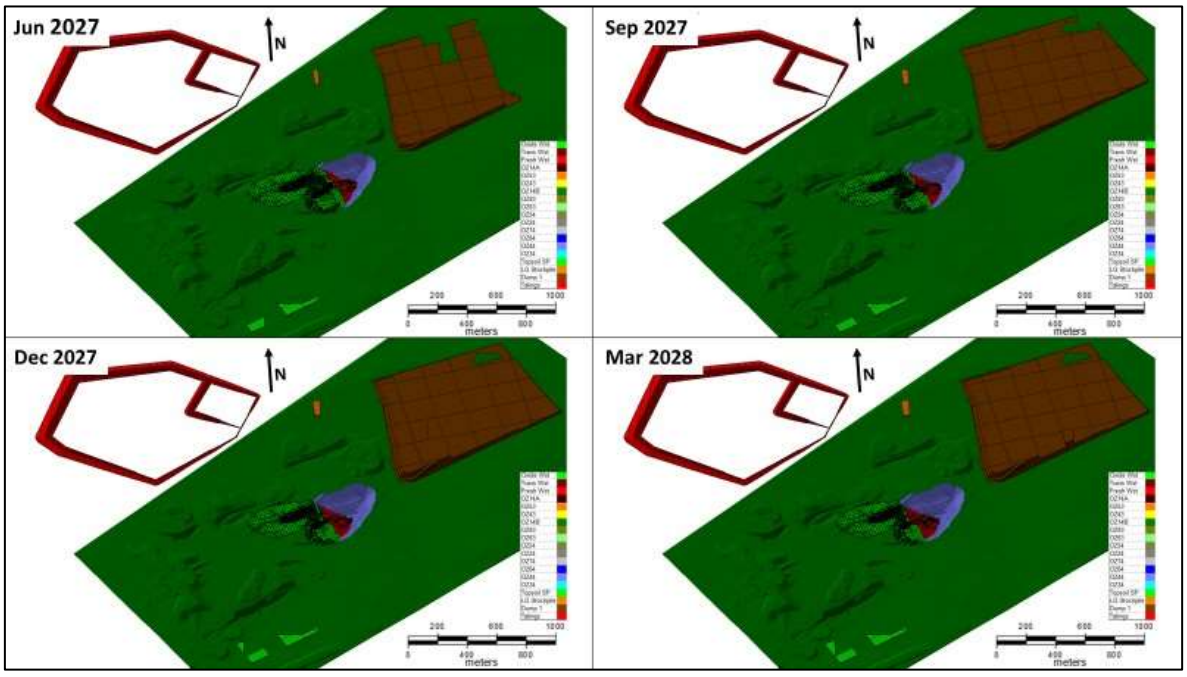


Figure 16-14: Isabella North Jun 2027 to Mar 2028

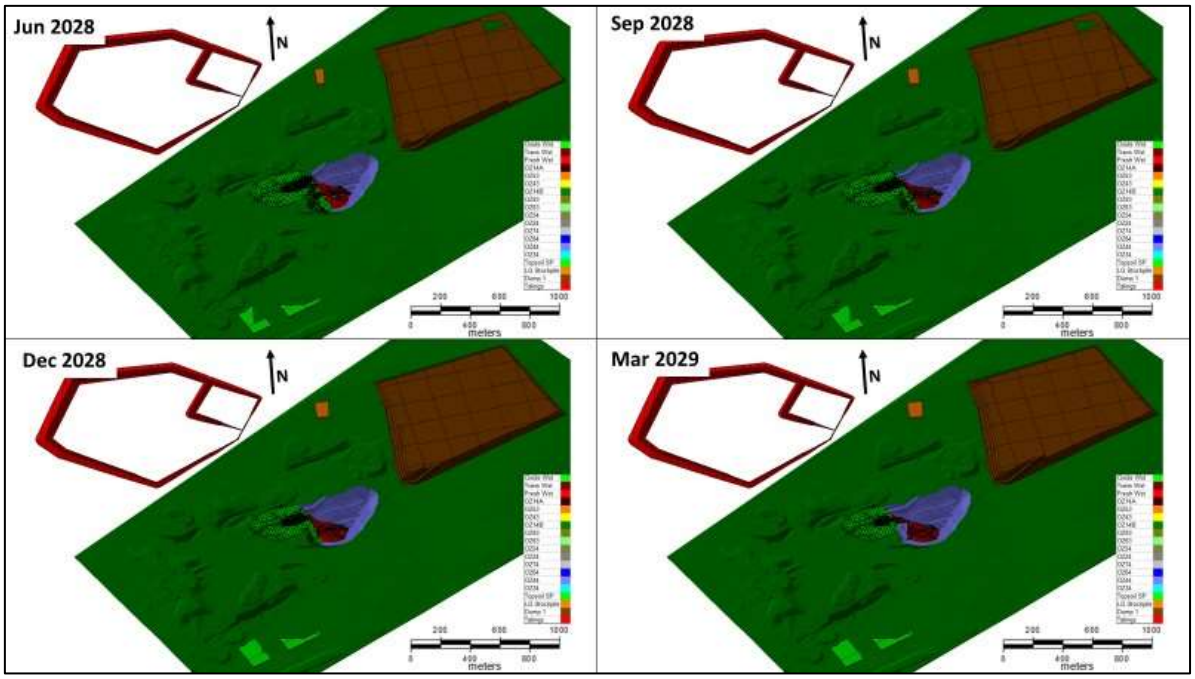


Figure 16-15: Isabella North Jun 2028 to Mar 2029

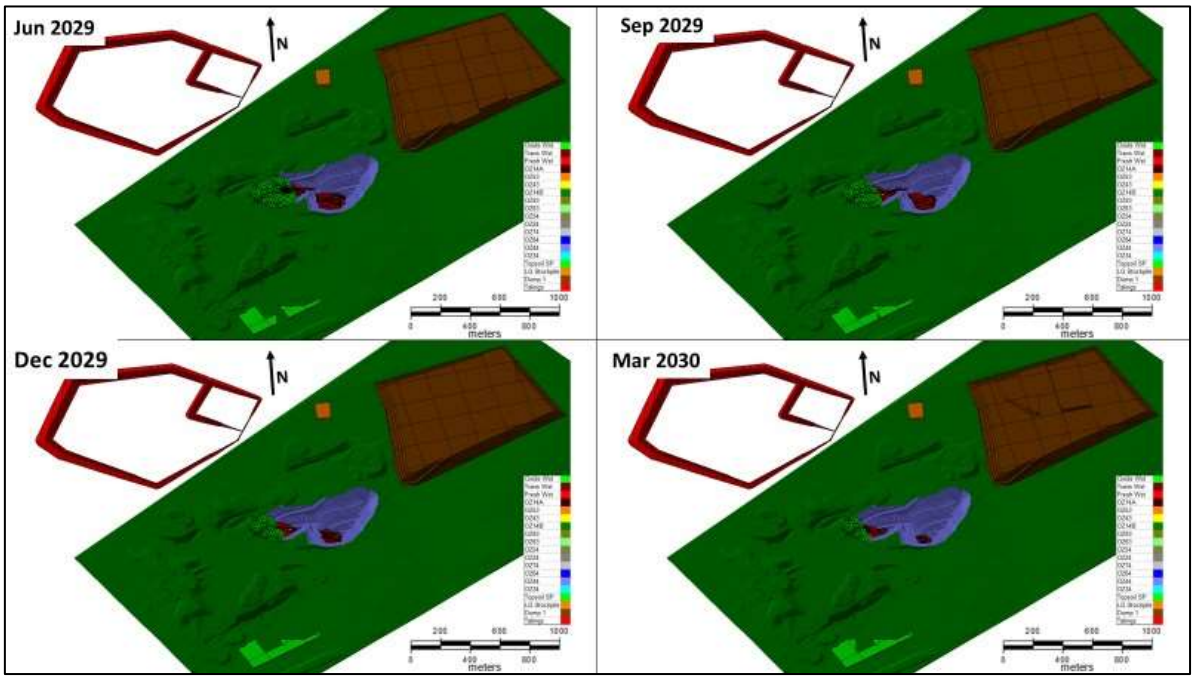


Figure 16-16: Isabella North Jun 2029 to Mar 2030

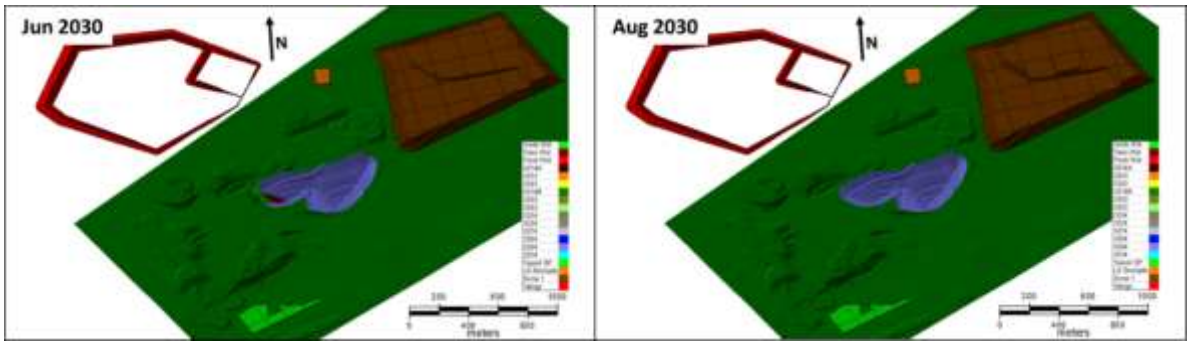


Figure 16-17: Isabella North Jun 2030 to Aug 2030

16.2.10.3 *Scheduling Period Progress Plots Isabella South*

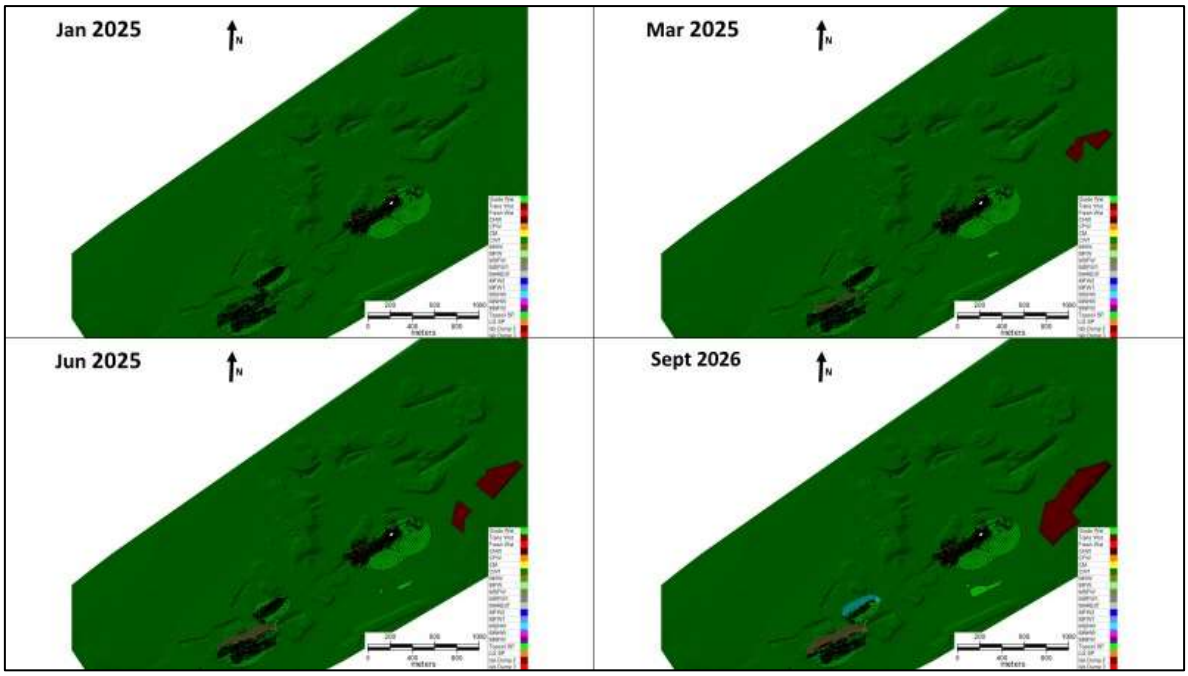


Figure 16-18: Isabella South Jan 2025 to Sep 2026

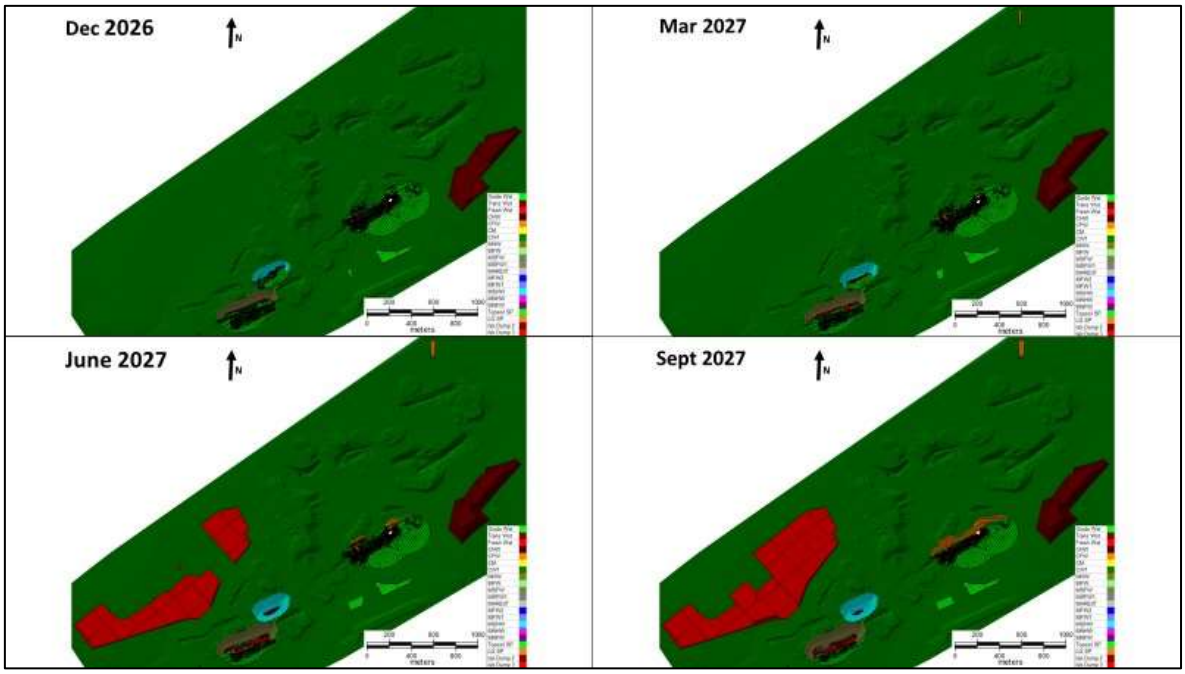


Figure 16-19: Isabella South Dec 2026 to Sep 2027

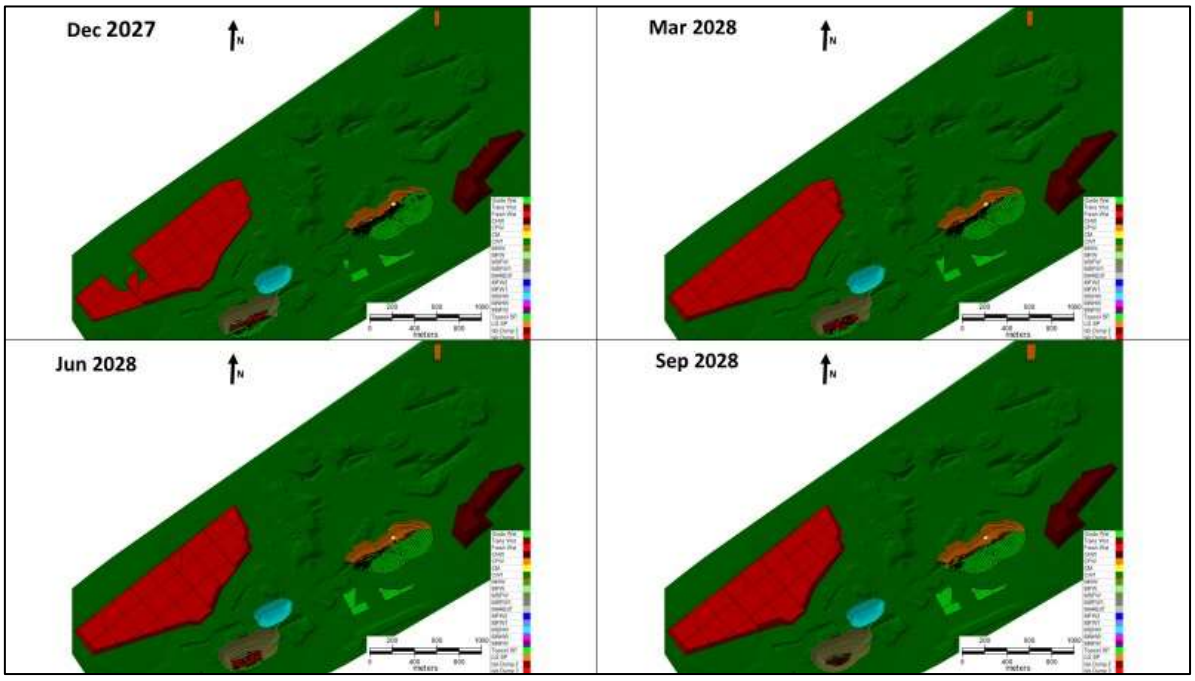


Figure 16-20: Isabella South Dec 2027 to Sep 2028

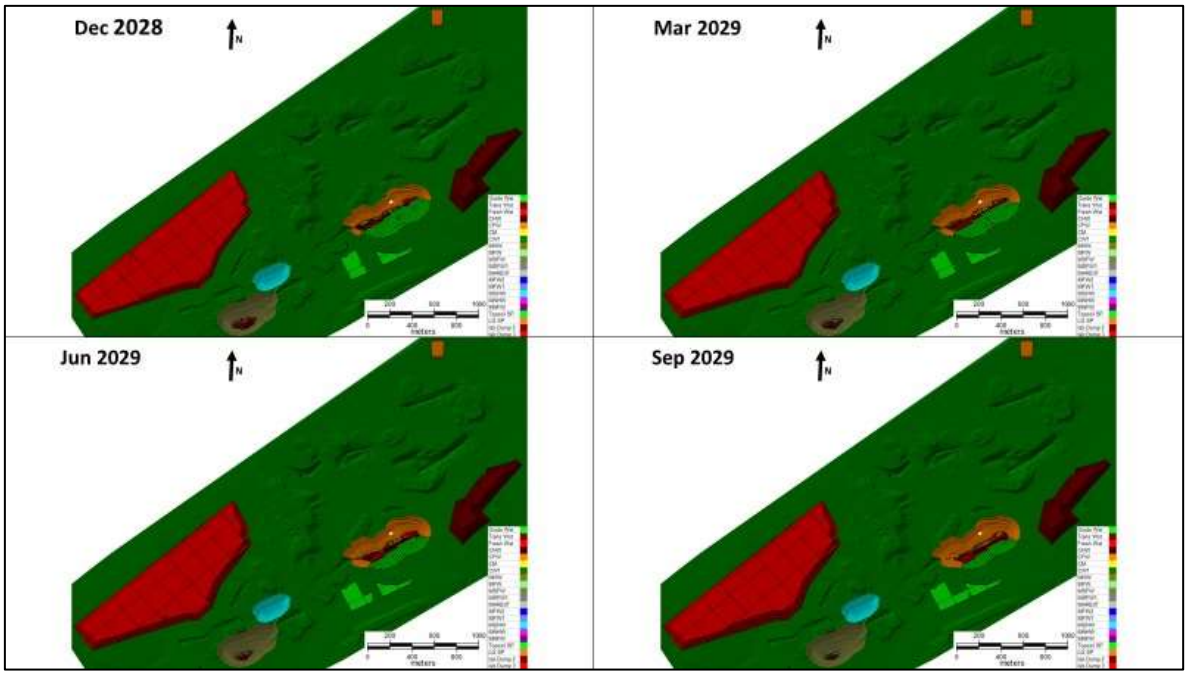


Figure 16-21: Isabella South Dec 2028 to Sep 2029

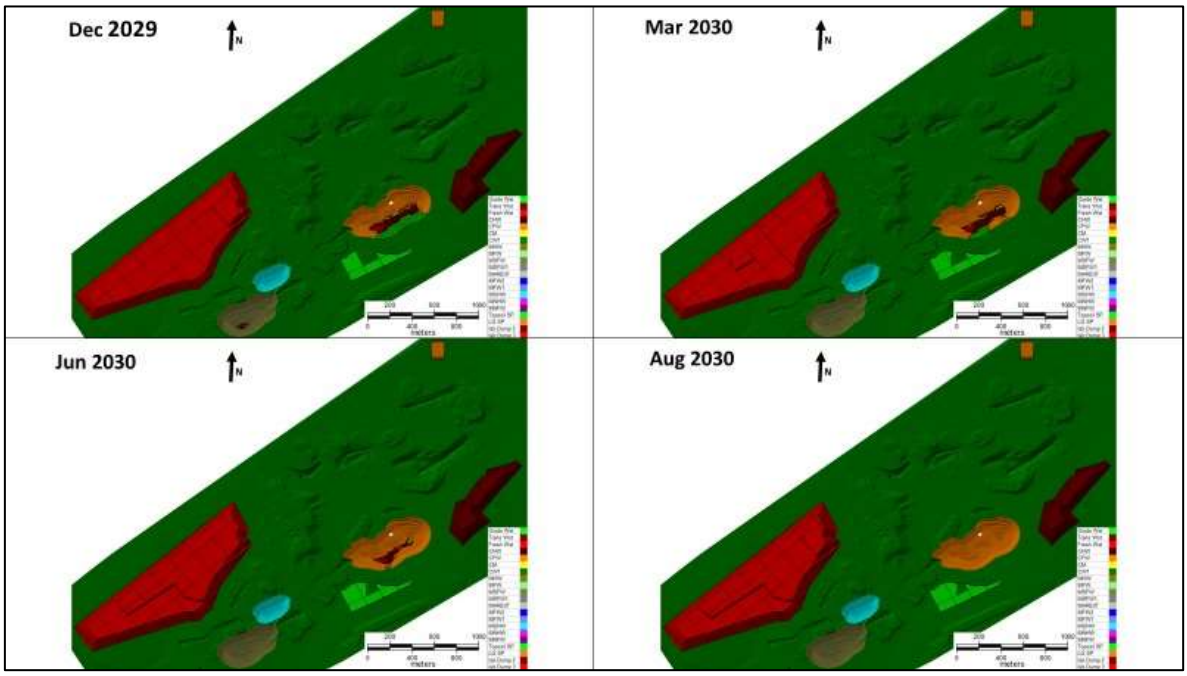


Figure 16-22: Isabella South Dec 2029 to Aug 2030

16.2.10.4 *Scheduling Period Progress Plots Bubi*

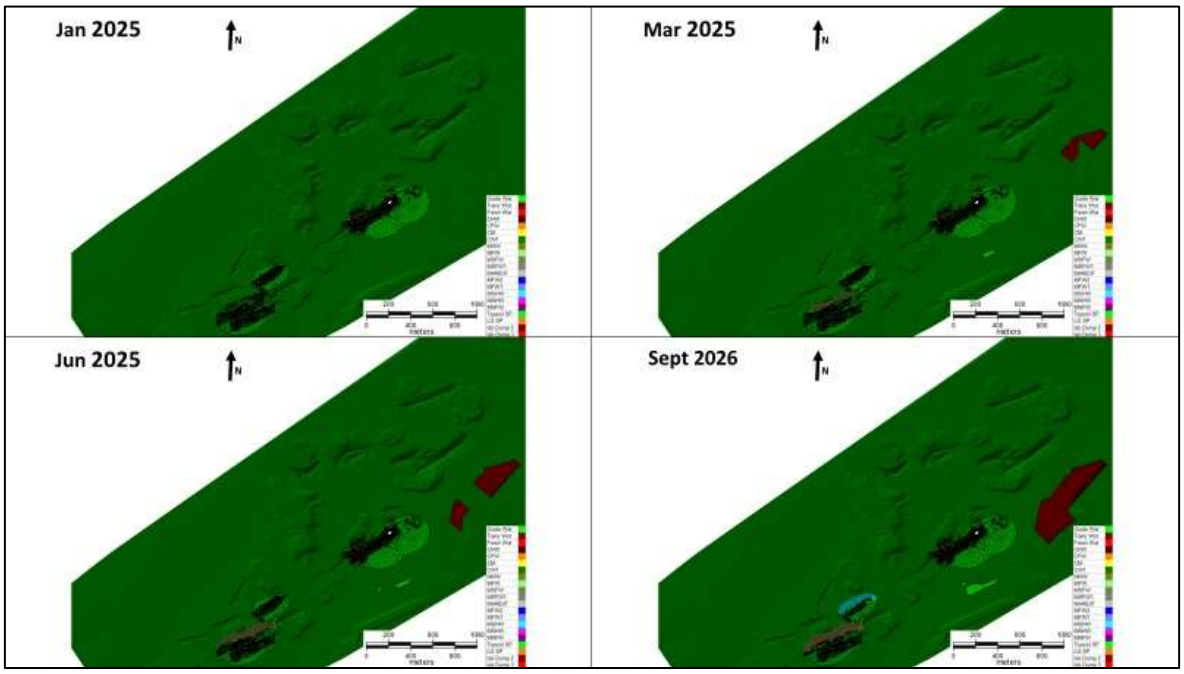


Figure 16-23: Bubi Jan 2025 to Dec 2026

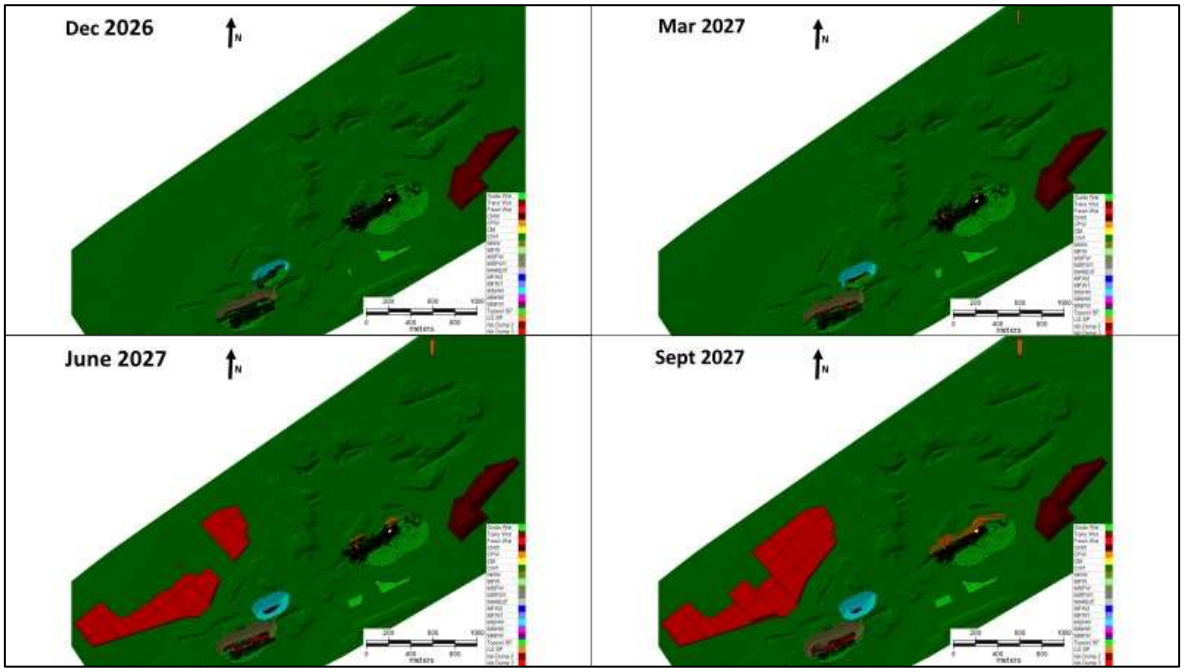


Figure 16-24: Bubi Dec 2026 to Sep 2027

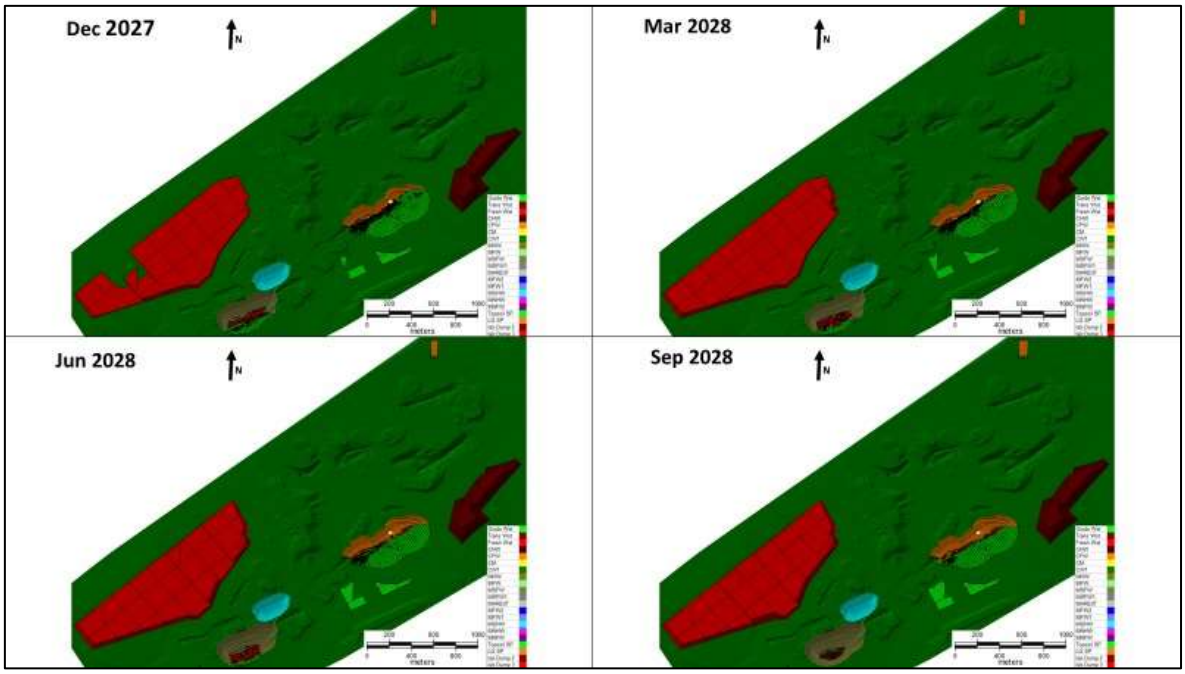


Figure 16-25: Bubi Dec 2027 to Sep 2028

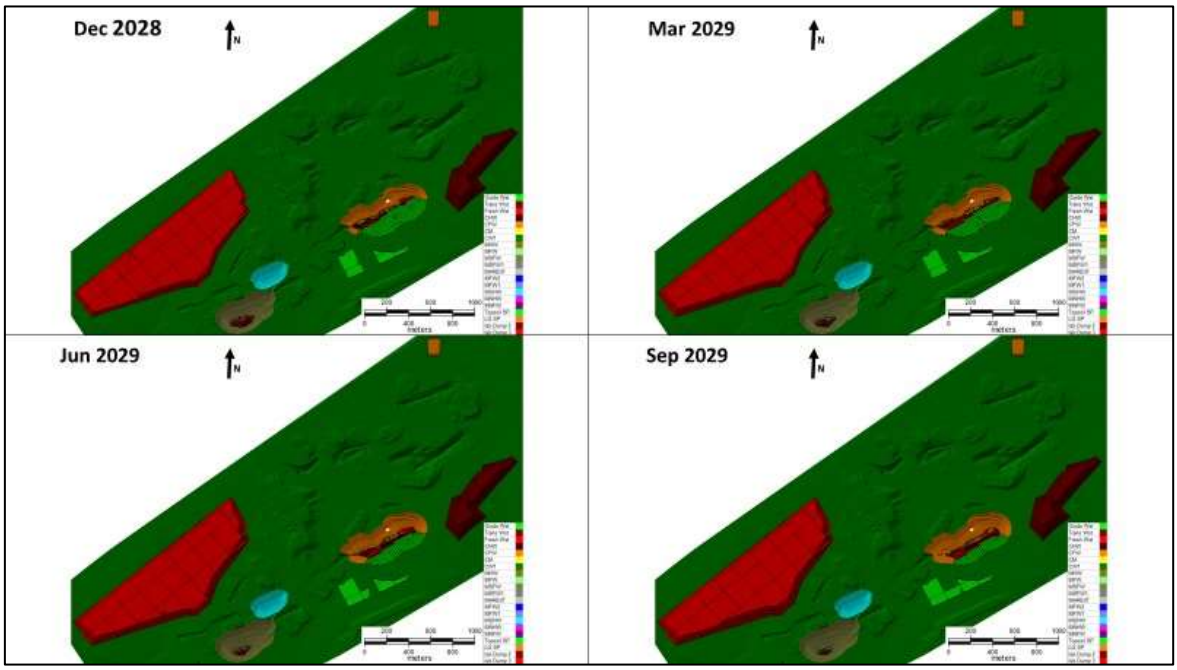


Figure 16-26: Bubi Dec 2028 to Sep 2029

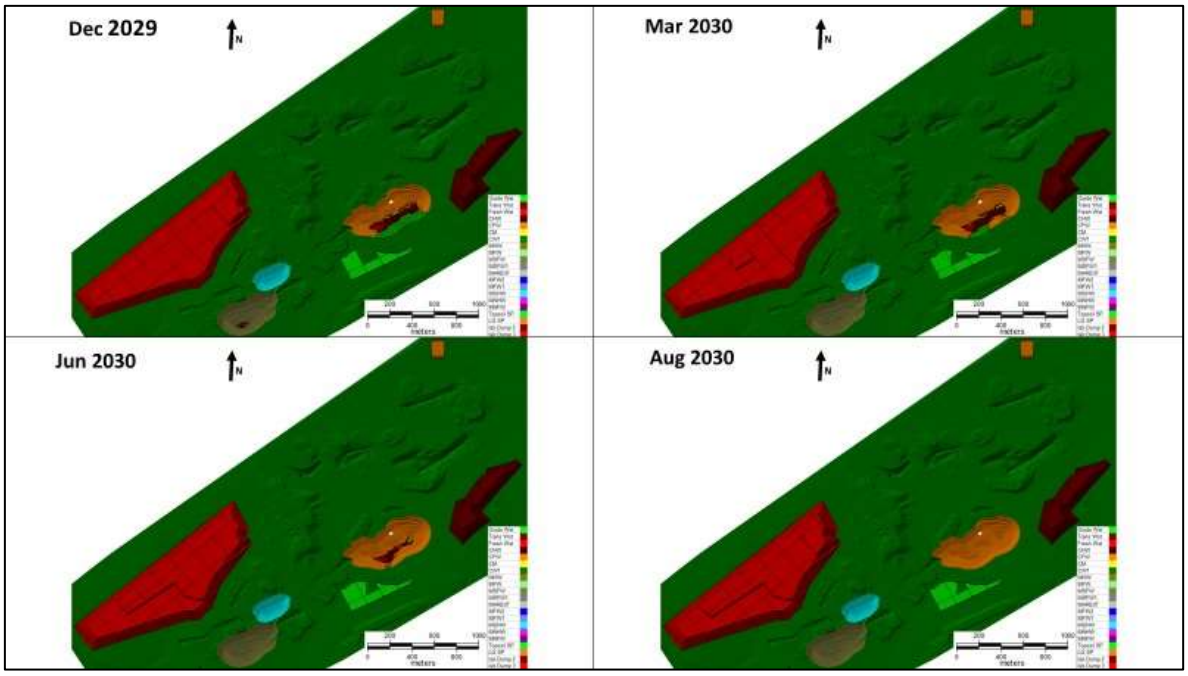


Figure 16-27: Bubi Dec 2029 to Aug 2030

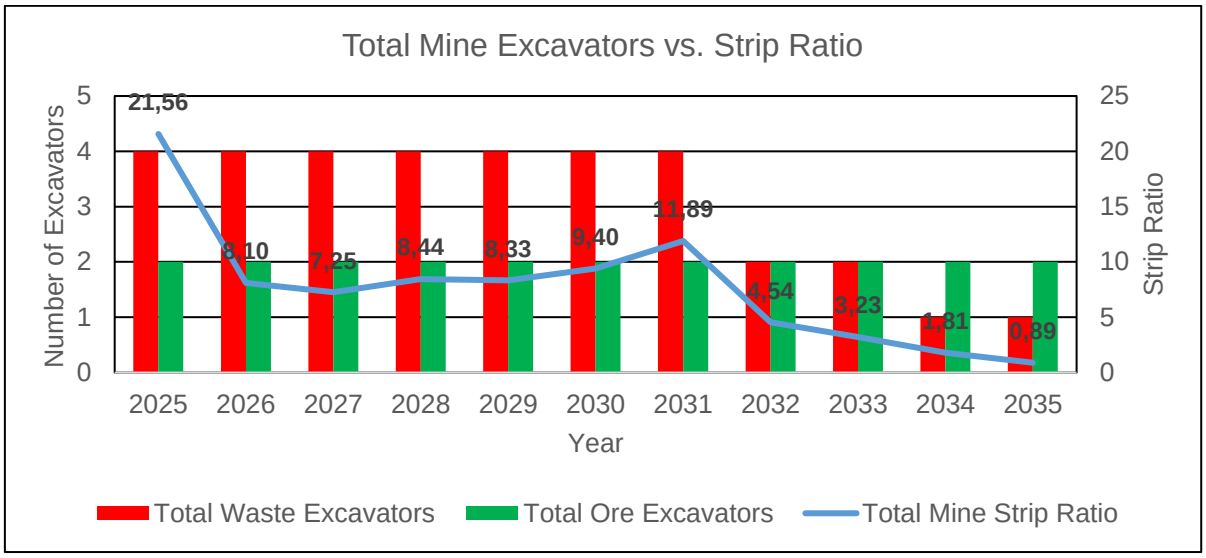
16.2.11 Fleet Requirements

16.2.12 Equipment Size

The scheduling in XPAC is driven by the excavating capability during each period (i.e.

the product of the number of excavators and their productivity).

For scheduling purposes, it was assumed that 100 t excavators with 6m^3 bucket will be deployed on waste and 75 t excavators (4m^3 bucket) on ore. These excavators will be loading trucks with a payload capacity of 60 t and 40 t respectively. The first principal productivity calculations for determining period by period material movement were based on Caterpillar 390, Caterpillar 374 excavators and Caterpillar 773 dump trucks and Caterpillar 740 articulated dump trucks respectively. The envisioned excavator fleet deployment is shown in Graph 16-15: below:



Graph 16-15: LOM Excavator Fleet

This selection was based on the likely equipment size that will be used by the mining contractors and this equipment size is used throughout the study including pit designs.

16.2.13 Excavator Productivity

Excavator productivity varies with material type as indicated in the table below.

Table 16-13: Excavator Productivity

Machine Type	Truck Fleet	Heaped Volume SAE (m³)	Simulated Hours Sched. 72%	Estimated Prod. Rate Tonne Per Hour tph	Estimated Annual Production Capacity per Annum tpa
Waste Excavator 6m³	35 m³	33	5,056	1,111	5,618,557
Ore Excavator 4m³	35 m³	33	50,56	561	2,835,301

During the first four months of operation, the excavator productivity is reduced to reflect commissioning, shift ramp-up and the ramping up of operator skill level.

16.2.14 Waste Rock Dumps

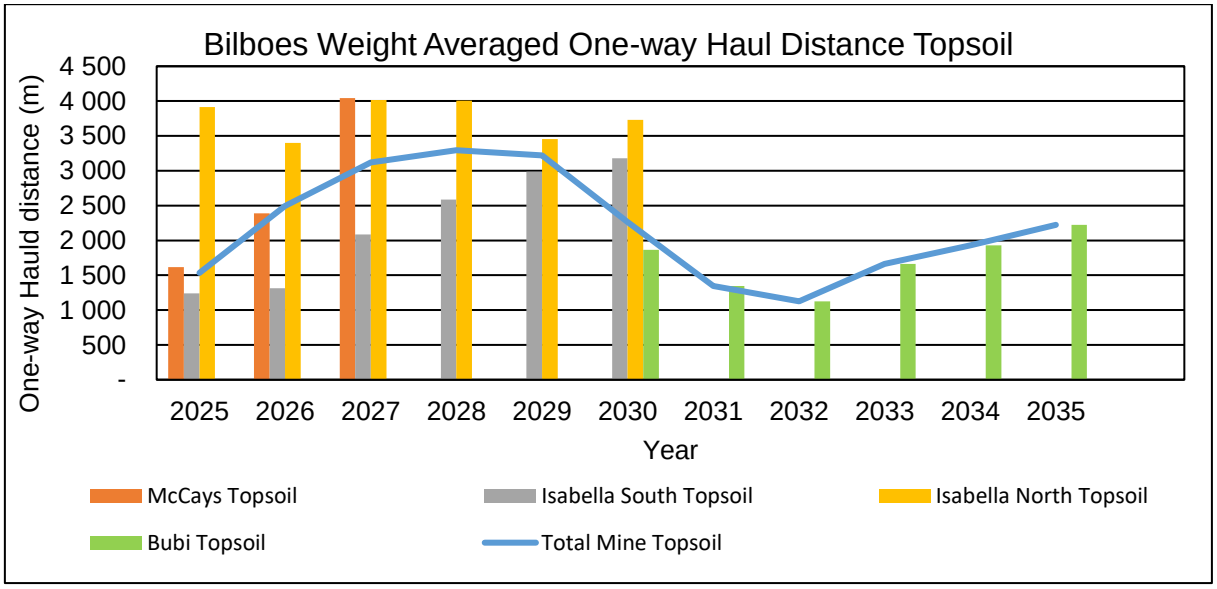
The waste dumps were staged appropriately to minimise haul distances throughout the LoM.

The waste dump construction and final landform are based on the following criteria:

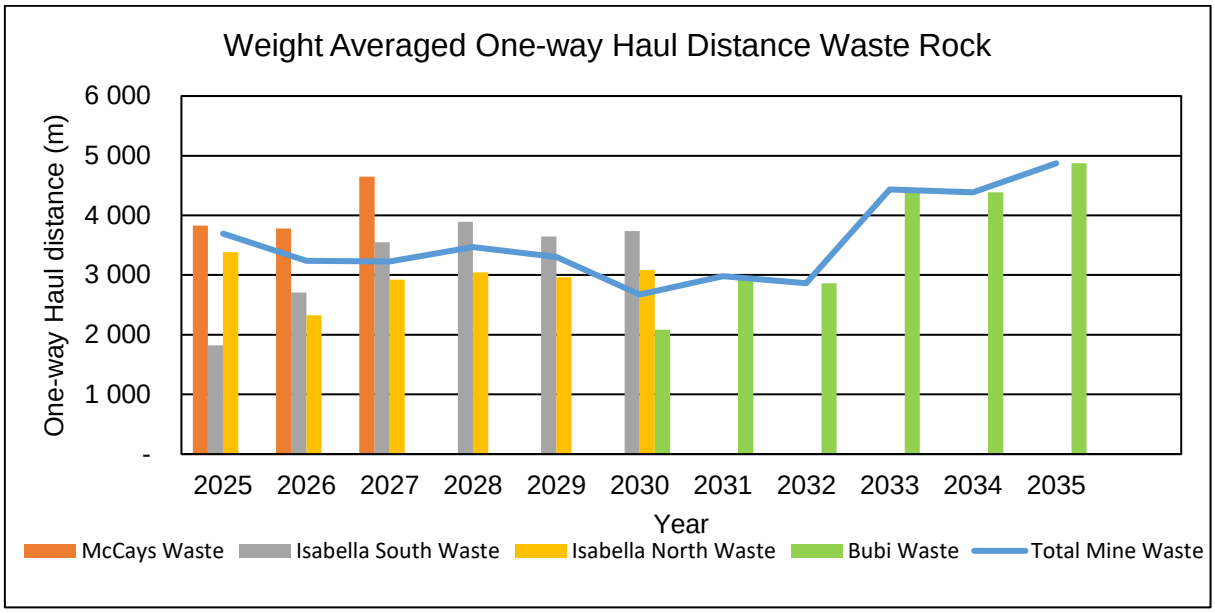
- The maximum height of waste dumps is currently set at 40 m above ground level
- A swell and re-compaction factor of 50% was utilised to calculate a material placement density of waste on the waste dumps

- Dump bench face angle is designed at 30 degrees during construction, with 10 m berms separating benches. During the rehabilitation phase, the WRD side slopes will be progressively dozed down into continuous slopes without benches, as required for agricultural use. After rehabilitation, the final landform slope will not exceed 19 degrees overall slope angle
- The waste dumps will be built with a minimum 1:100 gradient on the top surface to ensure effective water shedding
- All dump locations were selected outside the boundaries as indicated by the Whittle gold price scenario of $2,000/oz. Future prospecting zones were also considered so as not to sterilise any potential resource
- The minimum operating width on the waste dump is 40 m
- All the waste dumps were designed with ramps of 10% gradient
- It has been assumed that all waste is benign and does not require any neutralising treatment, or containment

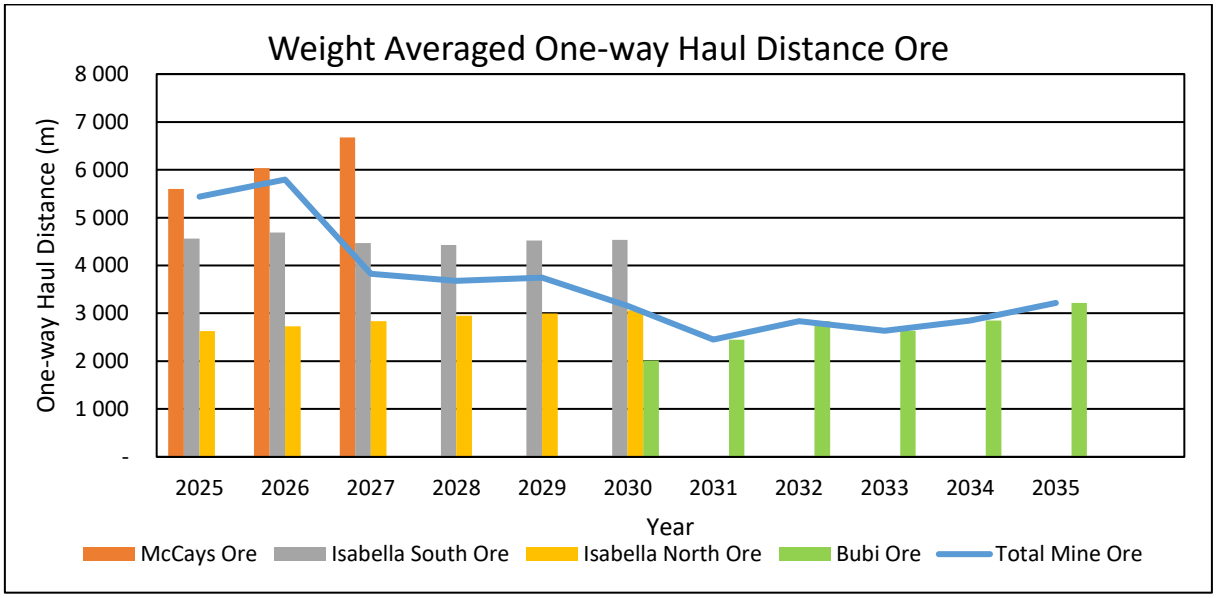
The placement of the waste rock dumps was used to determine the expected hauling distances over LoM. These are shown in Graph 16-16: to Graph 16-18: below for Topsoil, Waste Rock and Ore. The haul distances for ore for McCays, Isabella South and Isabella North is the direct haul to the processing plant. The Ore haul distances for Bubi only reflect the distance to the Bubi RoM pad where the ore will be re-handled onto on-road trucks for transport to the processing plant.



Graph 16-16: Weight Averaged One-way Haul Distances for Topsoil



Graph 16-17: Weight Averaged One-way Haul Distances for Waste Rock



Graph 16-18: Weight Averaged One-way Haul Distances for Ore

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 17
RECOVERY METHODS

Document Number: JZWEBR6013-STU-REP-001

DRA

17 RECOVERY METHODS

17.1 Process Testwork Results

Extensive testwork (Section 13) was undertaken during the conceptual phase preliminary economic estimate PEA) and Feasibility Study (FS) phase. The ore (fresh sulphide) is refractory to normal free milling processing due to the ultrafine gold particles being largely encapsulated (and generally appearing in solid solution) within the sulphide minerals. As a result, the selected process encompasses a biological sulphide destruction step (Outotec proprietary BIOX® process) to liberate the gold particles and allow dissolution by a cyanide solution in the CIL circuit. The testwork results were used to derive the Process Design Criteria (PDC) for the processing plant as depicted in Table 17-1.

Table 17-1: Process Plant Design Criteria

Description	Unit	Design	Remarks
Plant Annual RoM Throughput			
Phase 1 Isabella McCays	tpa	2,880,000	Years approx. 1-6
Phase 2 Bubi	tpa	2,160,000	Years approx. 6-11
Plant Monthly RoM Throughput			
Phase 1 Isabella McCays	tpm	240,000	
Phase 2 Bubi	tpm	180,000	
Head Grade Analysis			
Au			
Isabella Mc Cays	g/t	2.51	Average
Bubi	g/t	1.80	
Sulphides			
Isabella McCays	%	1.0	Average
Bubi	%	2.6	
Ore Characteristics			
SG (specific gravity)			
Isabella McCays	t/m³	2.77	Average
Bubi	t/m³	2.85	
BBWi (Bond ball work index)			
Isabella McCays	kWh/t	17.00	Average
Bubi	kWh/t	21.45	
Ore Product Sizes			

Description	Unit	Design	Remarks
Crushed Ore (P80) (80% passing size)	mm	13	
Milled Ore (P80) (80% passing size)	microns	75	
Flotation Mass Pull			
Isabella McCays	%	5	
Bubi	%	10	

17.2 Process Flow Description

Ore will be derived from two main mining areas, namely Isabella McCays and Bubi, with production throughput to be phased over the LoM based on tonnage, proximity to the process plant and metallurgical characteristics. Bubi ore, destined to be processed over the latter part of the LoM will be trucked approximately 23 km to the processing plant which will be situated at the Isabella McCays complex. The envisaged phasing is as depicted in Table 17-1 .

Operations in the process plant can essentially be divided into seven main sections.

- Comminution (ore size reduction by crushing and milling to facilitate liberation of the mineral particles for subsequent downstream concentration)
- Flotation (concentration of sulphides and gold into a small concentrate mass)
- Biological oxidation - BIOX® (destruction of the sulphides in the concentrate using oxidising bacteria to expose the gold particles for downstream recovery)
- Carbon in leach (cyanidation leach of the BIOX® residue and recovery of the solubilised gold onto activated carbon)
- Carbon treatment
- Electrowinning and smelting
- Tailings handling

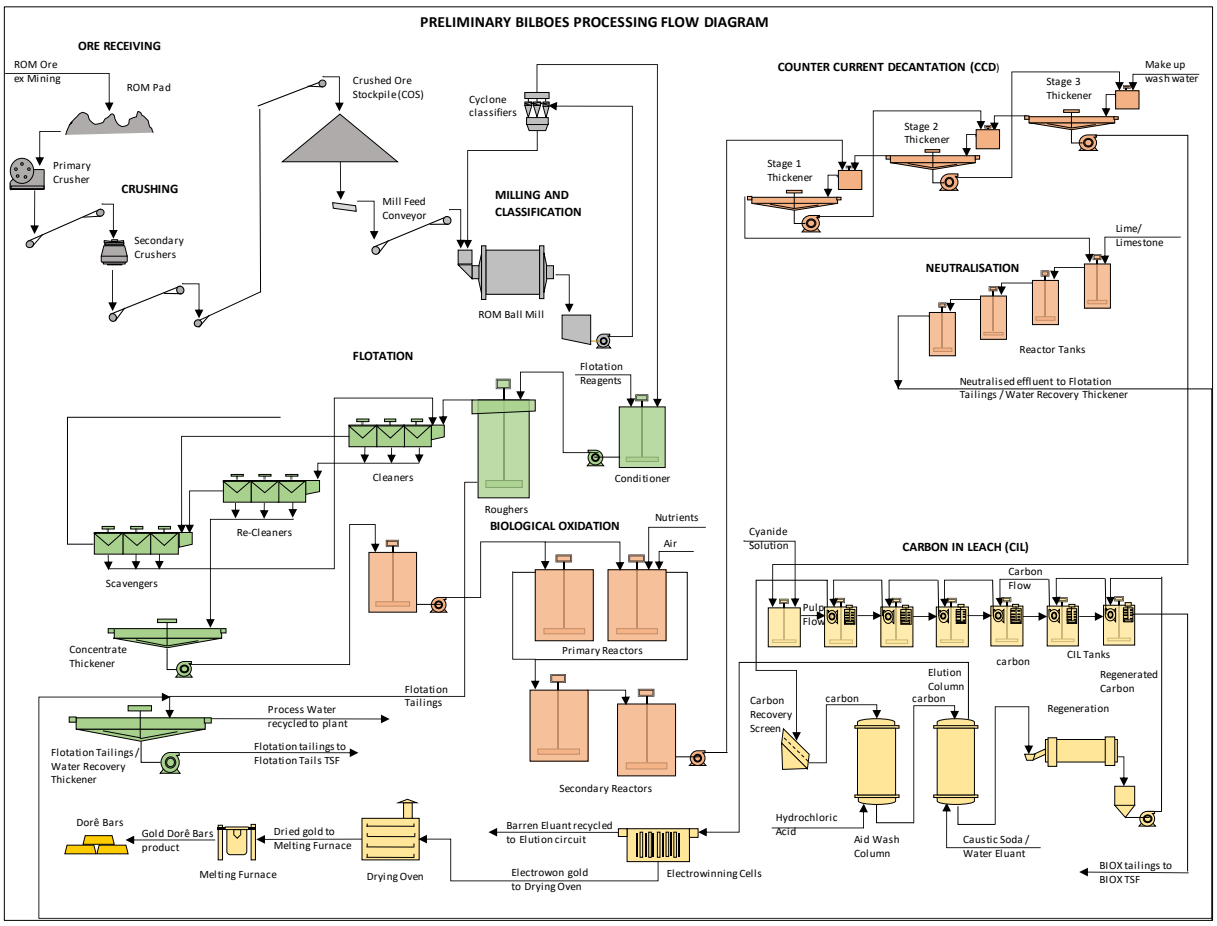


Figure 17-1: Bilboes Simplified Process Flow Diagram

17.2.1 Comminution

17.2.1.1 Crushing

The crusher circuit has been designed to process the full LoM design monthly tonnage (240 ktpm ISBM). When processing Bubi ore the crushing circuit monthly throughput will reduce to approximately 180 ktpm due to the harder nature of the Bubi ore. Ore with a top size of approximately 900 mm is received from the open pit mining operations at the RoM Pad by haul truck. The ore may be stockpiled on the RoM Pad (for blending or delayed feeding purposes) or directly tipped into the primary jaw crusher. The crusher circuit comprises primary jaw and secondary cone stages to produce a product with P80 of 30 mm for stockpiling on the COS (crushed ore stockpile) ahead of the milling circuit. Total capacity of the COS is approximately 26 ktpm t with a live capacity of 8 ktpm (24 hours). In times of ore shortages, the excess stockpile capacity may be processed using dozers and loaders to feed through the COS chutes.

17.2.1.2 Milling and Classification

The crushed ore is withdrawn from beneath the COS and fed onto the mill feed conveyor by vibratory feeders. The mill feed conveyor discharges directly into the single RoM Ball Mill feed hopper. The conveyor is fitted with a weightometer to measure the throughput as well as control the speed of the vibratory feeder to give the set tonnage to the mill. The ball mill is grated discharge mill with steel liners and utilising steel balls as the grinding media. Milled slurry discharges via a trommel screen into the mill discharge sump and is pumped to the cyclone classification circuit. The cyclone overflow containing the fine particles gravitates to the flotation conditioning tank in the flotation section. The coarse particles exit in the cyclone underflow stream and return to the ball mill. Product size from the milling section is 80% passing 75 microns. During processing of the Bubi ore monthly milling throughput will reduce to 180 ktpm due to the harder nature of the Bubi ore.

17.2.2 Flotation

Cyclone overflow from the milling section discharges into the flotation conditioning tank where it is adjusted with process water to the set flotation feed density. Flotation reagents are also added in this tank and the slurry is allowed to condition for a set period prior to being pumped to the flotation cells. The circuit will operate at natural pH and be configured in a rougher, cleaner, recleaner and cleaner scavenger format to facilitate maximum gold and sulphide recoveries while minimising the carbonate recovery to the concentrate. Sodium Ethyl Xanthate (SEX) is used as the collector for the sulphide minerals, copper sulphate as an activator for the sulphide minerals while starch and sodium carbonate are used as depressants for the carbonates. The rougher tails, forming the tailings product, are dewatered in the water recovery thickener circuit, and pumped to the flotation tailings storage facility. The recleaner concentrate forms the concentrate and is pumped to the concentrate thickener for dewatering ahead of processing in the biological oxidation section. Supernatant water from the tailings and concentrate thickeners is recycled to the milling and flotation sections. The supernatant solution is recycled back to the process plant.

17.2.3 Biological Oxidation (BIOX®)

In the BIOX® section bacterial oxidation of the sulphide minerals occurs, (by mesophilic bacteria, operating in the range of 15 – 45 ^{o}C) resulting in liberation of the included gold particles for further downstream recovery.

17.2.3.1 Biological Leaching

Dewatered flotation concentrate is pumped to the BIOX® surge tank where it is diluted to the required density of approximately 18% solids. The slurry is then fed to the primary reactors (in parallel), with slurry overflowing to the secondary reactors (in series). Oxygen and carbon dioxide (air), nutrients, defoamer and sulphuric acid are added to the tanks. The required bacteria cultures are contained within the tanks; oxygen, solids feed rate, pH and temperature control are essential to ensure the bacterial activity level is maintained. Bacterial oxidation of the sulphides optimally takes place at a pH of 1.5 - 2.2 and a temperature of approximately 42°C. As the concentrate contains a relatively high amount of carbonate the addition of sulphuric acid will be required to maintain the required pH. Temperature is maintained by the circulation of cooling water via cooling coils within the reactors. Aeration of the tanks (oxygen supply) is by medium pressure air blowers (240 kPa). Air hold-up in the tanks is approximately 17% of live volume. Total required residence time in the reactors is 6.5 days. The oxidised slurry product exits the final stage 2 reactor and is pumped to the counter current decantation (CCD) section for separation of the acidic liquid and oxidised solids components.

17.2.3.2 Counter Current Decantation (CCD)

A 3 stage CCD (counter current decantation) circuit allows for removal of the acidic solution components from the oxidised solids. The thickener underflow solids are progressively washed of acidic solution in an up-flow manner from thickener 1 to 3, exiting as thickener 3 underflow, while the acidic solution is progressively concentrated in a down flow manner exiting as thickener 1 overflow. Make up water is added to the feed of thickener 3 to maximise the washing efficiency. The thickener 3 underflow slurry (washed oxidised product) is pumped to the Carbon in Leach (CIL) section for final gold recovery, while the thickener 1 overflow acidic solution is pumped to the neutralisation section for precipitation of the acidic and other acidic deleterious components.

17.2.3.3 Neutralisation

The neutralisation circuit comprises 8 stages, where the acidic solution is initially neutralised to a pH of approximately 4.5 with limestone (stage 3) and then to a pH of 7 (stage 7) with lime. The acidic components and solubilised arsenic are precipitated to the various sulphates with the arsenic fixed insolubly as basic ferric arsenate. The slurry is pumped to the water recovery thickener, where it combines with flotation tails, where the solids are dewatered (thickener underflow) and thereafter pumped to the Flotation tailings storage facility. The supernatant thickener overflow solution is channelled to the process water circuit for recycling to the process

plant in general. Residence time per neutralisation stage (8 off) is 1.5 hours thereby resulting in a circuit residence time of 12hrs.

17.2.4 Carbon in Leach (CIL)

Washed oxidised slurry from the neutralisation section is pumped to the pre-leach tank (CIL tank 1) of the CIL circuit, where the slurry will be subjected pH adjustment with lime and additional aeration to ensure complete oxidation of cyanide consumers. The slurry will then overflow to CIL tank 2 where cyanide is added and from there down the circuit to the final CIL tank. Tanks 2 to the final tank all contain activated carbon, retained within the tank by an interstage screen. Slurry residence time in the circuit is set at 36 hours, by which time maximum gold dissolution will have occurred and the carbon will have adsorbed approximately 99% of the soluble gold. The exiting slurry from the final CIL tank will pass over a carbon safety screen to ensure no loss of carbon due to possible interstage screen perforations, before gravitating to the tailings surge tank. From here the slurry is pumped to the detoxification circuit for cyanide destruction before being pumped the BIOX® tailings storage facility. The carbon within the CIL tanks is pumped counter currently to the slurry flow, together with the relevant slurry, upstream from the last CIL tank to the CIL tank 2. The carbon Au value increases as it progresses upstream in the circuit while the slurry solids and liquids Au values decrease as the slurry flows downstream in the circuit. Loaded carbon is recovered from CIL tank 2 by pumping the carbon / slurry to the Loaded Carbon Screen. The slurry passes through the screen and returns to CIL tank 2. The loaded carbon discharges from the screen into a hopper from where it is transferred the Acid Treatment Vessel at the head of the carbon treatment circuit.

17.2.5 Carbon Treatment

A loaded carbon batch (5 t) is treated at ambient temperature with a 3% hydrochloric acid solution for approximately 1hour in the acid wash vessel to remove inorganic foulants, predominantly calcium, ahead of the elution process. At the end of the process the spent acid is washed from the column with water and pumped to the BIOX® tailings tank and ultimately sent to the BIOX® tailings storage facility.

The acid washed carbon is transferred by water eduction to the elution column ahead of desorption of the Au. The elution process is the split AARL (Anglo American Research Laboratory) type. This process separates the elution (desorption) cycle from the electrowinning cycle thereby adding flexibility to the process. The loaded carbon is pre-soaked at 110 ^{o}C with a solution comprising 1% cyanide and 2% caustic soda solution for approximately 1 hour. After this the carbon is eluted with high quality water at 125 ^{o}C for a period of approximately 4hours.

The gold bearing solution (preg solution) is stored in the Preg Solution Tank in readiness for gold recovery in the electrowinning section. For flexibility a second preg solution tank is installed to allow fully independent electrowinning to take place. The total elution cycle (including acid treatment) takes approximately 10 hours. The barren carbon is transferred by water eduction from the elution column to the regeneration kiln feed hopper.

The Regeneration Kiln is a horizontal retort type, operating at a temperature of 750 ºC (hot zone) in a non-oxidising atmosphere to prevent ignition of the carbon. In this process organic foulants such as oils, greases and flotation reagents are removed thus returning the carbon close to its original virgin activity in readiness for reuse in the CIL circuit. Carbon discharges the kiln into a quench tank (cold water filled) and is then recycled by eductor back to the CIL circuit.

17.2.6 Electrowinning and Smelting

The preg solution is pumped to the electrowinning circuit (situated in the Gold Room), comprising 2 electrowinning cells, each with 16 cathodes and 18 anodes. The cathode is stainless steel mesh wrapped around a stainless-steel frame, connected to the negative terminal, and encapsulated in a non-conducting, perforated cathode box. The anode comprises a stainless-steel perforated plate connected to the positive terminal. DC power to each cell is supplied by a dedicated rectifier (2,000 amps). The preg solution is circulated through the electrowinning circuit over 12 hours. Au in the preg solution deposits onto the stainless-steel mesh in the cathode box with the generation of hydrogen gas (resulting in localised acidic conditions in the cell). The pH in the preg solution must be maintained at approximately 13 to prevent excessive corrosion of the stainless-steel anode due to localised low pH. Oxidation reactions at the anode result in the generation of ammonia and hydrogen amongst others. The gases are vented off in a very diluted form to the atmosphere via an extraction system. Once the residual Au value in the preg solution has reached the low setpoint the process is deemed to be complete and is halted.

The cathode boxes are removed periodically from the electrowinning cell and the gold recovered from the stainless-steel mesh by high pressure water jets. The gold is then filtered and dried in a drying oven. The dried gold is mixed with fluxes (generally borax, silica and sodium carbonate) and melted in a single pot diesel fired furnace at a temperature of approximately 1,100ºC. (Melting point of gold is 1064ºC). Once molten the gold is poured into moulds, cooled, cleaned, stamped and stored in the vault awaiting despatch to the refinery.

17.2.7 Tailings Handling

Tailings from the CIL circuit are detoxified to reduce the Weak Acid Dissociable Cyanide (WAD) levels to below 50 ppm prior to discharge to the BIOX® tailings TSF. This is accomplished using the INCO SO_2 / Air-process. The process requires a copper catalyst, added as $CuSO_4$ (copper sulphate). The SO_2 source is sodium meta bi-sulphite (SMBS), while oxygen is generally sourced from compressed air. Minimum O_2 requirement is generally 1 - 2 ppm. Optimum pH is 8 - 10. The process results in the generation of sulphuric acid and thus requires the addition of lime (generally) or caustic soda to maintain pH at the optimum level.

17.3 Plant Design

The plant design is based on the Process Design Criteria (PDC) as derived from the testwork results and subsequent modelling and simulation work undertaken by the DRA inhouse consultants.

17.3.1 Crushing Circuit

The circuit design is based on the outcome of crusher modelling and simulation by DRA inhouse comminution experts. The circuit comprises of a 2-stage crushing and screening with a final product size of -13 mm. The crusher has been selected based on the maximum tonnage from the Isabella McCays pits of 240 ktpm, with crushing operations over 12 hours per day (50% utilization). Processing of the harder Bubi ore at 180 ktpm will require approximately 13hrs per day operation (54% utilization). The crusher will be fed directly from the haul trucks as well as by front end loader with ore stockpiled on the RoM Pad.

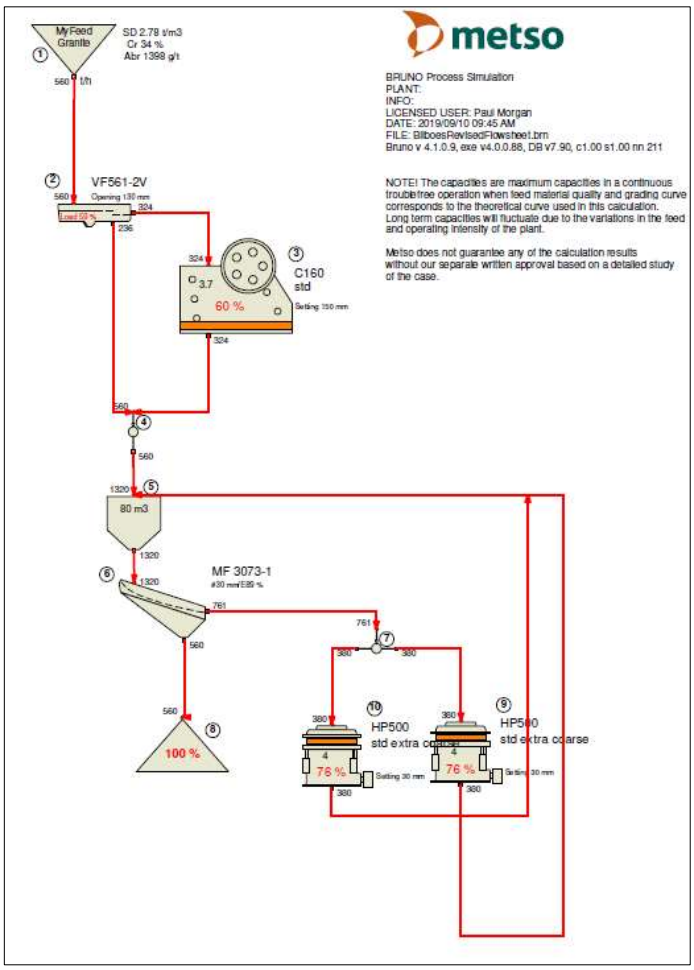


Figure 17-2: Bilboes Crusher Plant Design Simulation

17.3.2 Milling Circuit

The milling circuit design is based on modelling undertaken by DRA inhouse expert consultants. Milling will be accomplished in single stage ROM Ball milling, operating in closed circuit with hydrocyclone classification. The hydrocyclone classification circuit will be designed to cater for the 240 ktpm throughput with the installation of additional cyclones in the cluster unit. The throughput for the harder Bubi ore (Phase 2) will be 180 ktpm.

Table 17-2: Milling Plant Design Parameters

Equipment	No Off	Type and size	Power kW	Product Size mm	Throughput
Ball Mill	1	Grated, steel liners, 360 tph, max 26% ball loading, 7.2 m Ø x 11.6 m L	13,000	80% passing 250 microns	360 tph
Hydrocyclone Cluster	1	6-unit cluster; 600 mm Ø cyclones phase 1, 4 operating cyclones; phase 2, 3 operating cyclones		80% passing 75 microns	1,600 m³/h

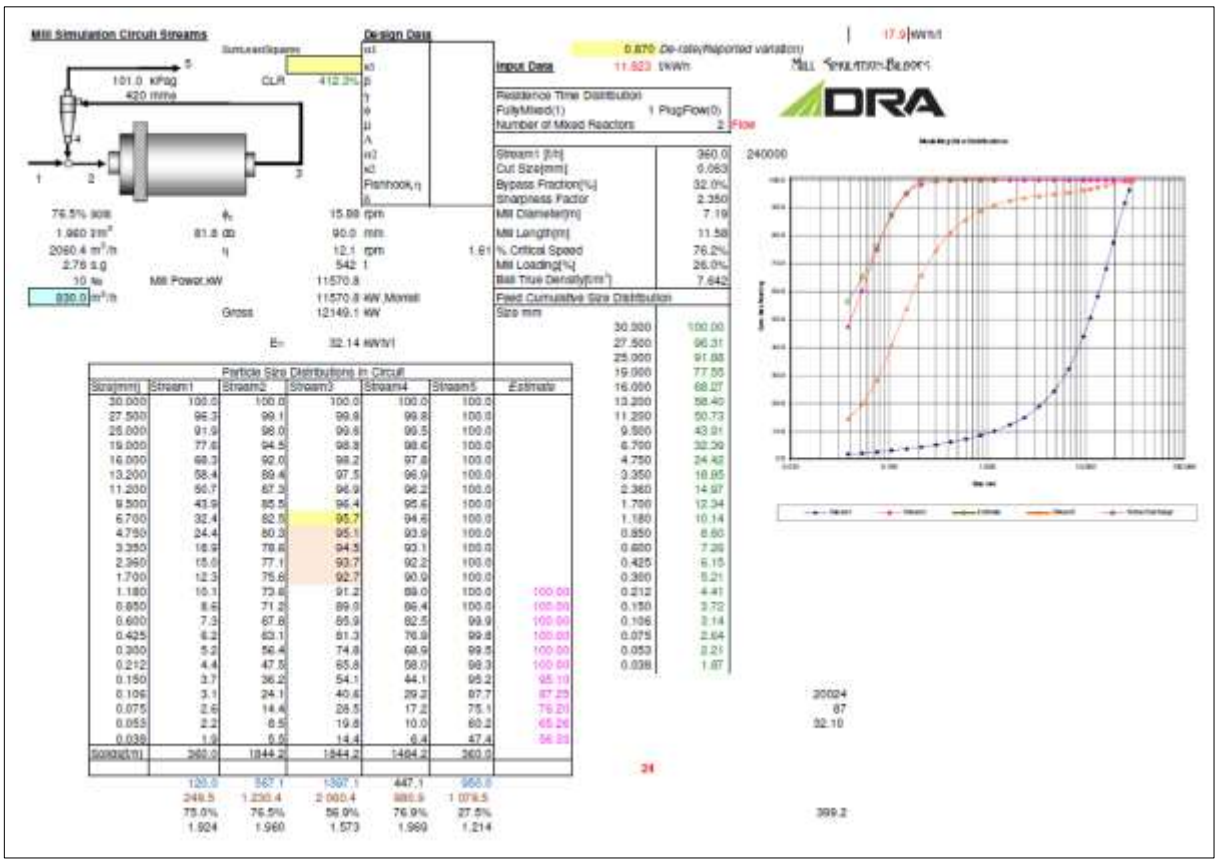


Figure 17-3: Bilboes Milling Plant Design Simulation

17.3.2.1 Flotation Circuit

The flotation circuit design is based on laboratory and pilot plant testwork, industry expert opinion and mass balance / modelling by a leading flotation cell manufacturer. Both flotation tailings and concentrate will be thickened in high-rate thickeners ahead of processing at the next stage.

Table 17-3: Flotation Plant Design Parameters

Parameter	Units	Phase 1	Phase 2
Flotation Reagents		SEX, Na2CO3, Starch, CuSO4, frother	SEX, Na2CO3, Starch, CuSO4, frother
Conditioning Tank	#	1	1
Conditioning Tank details		603 m³: 9.2 m Ø e 10.2 m H	603 m³: 9.2 m Ø e 10.2 m H
Rougher Cells	#	10	10
Rougher Cells details		130 m³, forced draft	130 m³, forced draft
Cleaner Cells	#	6	9
Cleaner Cells details		30 m³, forced draft	30 m³, forced draft
Re-Cleaner Cells	#	6	9

Parameter	Units	Phase 1	Phase 2
Re-Cleaner Cells details		10 m³, forced draft	10 m³, forced draft
Scavenger Cells	#	6	6
Scavenger Cells Details		30 m³, forced draft	30 m³, forced draft
Tailings Thickener dia.	m	26	26
Concentrate Thickener dia.	m	8	8
Overall Flotation Conc. Mass Pull	%	5	10

17.3.3 Biological Oxidation Circuit

The design of the biological oxidation circuit was undertaken by Outotec (RSA) Proprietary Limited based on their proprietary BIOX® processing technology. The design is based on pilot testwork and batch kinetic oxidation testwork on each of the Isabella McCays and Bubi flotation concentrate samples as well as inhouse proprietary technology. The BIOX® plant design and installation will be phased to cater for the concentrate production over the 2 build-up periods. Phase 1 (based on 240 ktpm Isabella McCays ores) will treat the equivalent of 12 ktpm concentrate and phase 2 (based on 180 ktpm Bubi ores) will treat the equivalent of 18 ktpm concentrate.

17.3.3.1 Biological Oxidation Circuit

The design of the BIOX® circuit was undertaken by Outotec with the major parameters depicted below.

Table 17-4: BIOX® Circuit Design Parameters

Parameter	Units	Phase 1	Phase 2
Concentrate feed	tpd	3,720	2,871
Concentrate feed S2- content	%	28	28
Concentrate feed As content	%	5	5
Concentrate feed Fe- content	%	30	30
Concentrate feed CO32- content		3.6	3.6
Primary Reactors	#	4	8
Reactor Live Volume	m3	1,547	1,547
Secondary Reactors	#	4	8
S2- Oxidation	%	90	90
Design concentrate mass loss	%	15	15
Design oxidised solids to CIL	tpd	3,348	2,503

17.3.3.2 Neutralisation Circuit

The design of the acid solution neutralisation circuit was undertaken by Outotec with the major parameters depicted in the tabulation below.

Table 17-5: Neutralisation Circuit Design Parameters

Parameter	Units	Phase 1	Phase 2
Solution feed	m³/d	5,2000	7,800
Neutralisation Stages	#	6	8
Neutralisation Stage volume	m³	1,025	1,025
Neutralisation stage residence time	hrs	9	12
Lime addition	kg/t	110	68
Limestone addition	kg/t	100	100
Water Recovery thickener diameter	m	40	40
Precipitate tonnage to BIOX® TSF	tpd	11,600	17,400

17.3.4 Carbon in Leach (CIL) Circuit

CIL design parameters were developed from modelling and simulation of the laboratory and pilot plant test results with relevant input from Outotec (existing BIOX® operations). These are shown in the tabulation below.

Table 17-6: CIL Circuit Design Parameters

Parameter	Units	Phase 1	Phase 2
CIL total retention time	hrs	36	36
CIL Pre-Leach volume	m³	170	170
CIL Pre-Leach stages	#	2	2
CIL Adsorption stages	#	12	14
CIL Adsorption stage volume	m3	170	170
CIL loaded carbon design Au value	g/t	5,000	5,000
Loaded Carbon Batch	t	5	5

17.3.5 Tailings Detoxification and Handling

2 different tailings streams will be produced by the Bilboes process operations.

Flotation tailings, containing no cyanide or other deleterious contaminants, will not be subject to any detoxification process and will be stored in the main TSF. All supernatant water (process water) will be recycled to the milling / flotation sections as well to the head BIOX® section for use as dilution water ahead of bio-oxidation.

CIL tailings, containing high levels of cyanide, up to 1,500 ppm, in solution will be subject to a detoxification process to reduce the level to below 50 ppm ahead of pumping to the separate BIOX® TSF. From a water balance perspective approximately 30% of this water is recyclable back to the CIL and carbon treatment sections of the plant. The remaining water will either be allowed to evaporate off or further treated to remove relevant contaminants prior to recycling back to the process plant.

The detoxification process that will be employed is the proprietary INCO SO2 / air process which is the standard process in use in many cyanide detoxifications plants worldwide. This process has been shown to remove total cyanide in a single step and is the preferred process for pulp steams. The process is based on the oxidation of cyanide to cyanate. Oxygen from either air, or in the case of Bilboes, O2, due to the high cyanide level, together with sulphur dioxide (generally sourced from sodium meta bisulphite – Na2S2O5) is the oxidant while copper (II) is required as a catalyst. If this copper does not naturally occur in the ore, then it will need to be added at the detoxification stage, generally as CuSO4. The reaction results in the formation of sulphuric acid (H2SO4) requiring that the detoxified tails be adjusted to a pH of approximately 8.5 prior to discharge to the TSF.

Tailing's detoxification design parameters are obtained from values in the pilot test phase and general commercial plant practice.

Table 17-7: CIL Tailings Detoxification Circuit Design Parameters

Parameter	Units	Phase 1	Phase 2
Residence time	hrs	2	2
Tailing's inflow rate	m^3/h	54	58
Tanks active volume	m^3	60	60
Number of tanks	#	2	2
Minimum dissolved O2 concentration	ppm	2	2
Discharge WAD value (design)	ppm	25	25
Discharge pH	pH	8.5	8.5

17.3.6 Carbon Treatment

The carbon treatment circuit is designed to cater for a single elution per day under maximum tonnage conditions (Isabella McCays 240 ktpm case). Design of this circuit is based on the SimCIL model using a loaded carbon design batch size of 5 t.

Table 17-8: CIL Carbon Treatment Circuit Design Parameters

Parameter	Units	Phase 1	Phase 2
Loaded Carbon movement	t/d	3.91	2.93
Loaded Carbon Batch size	t	5	5
Elution Column no. off	#	1	1
Carbon batch volume	m³	10.7	10.7
Elutions per month	#	24	18
Acid Wash type		3% HCl pre-elution	3% HCl pre-elution
Elution type		Split AARL	Split AARL
Loaded Carbon design Au loading	g/t	5,000	5,000
Eluted Carbon design Au loading	g/t	50	50
Carbon Regeneration Kiln type		Horizontal electrical	Horizontal electrical
Regeneration Kiln no. off	#	1	1
Regeneration Kiln design capacity	kg/h	250	250
Electrowinning Cells no. off	#	3	3

17.4 Water Services

The summarised plant water balance, indicating the various incoming and outflows is shown below.

Table 17-9: Process Plant Water Balance

Plant Water Parameter	Phase 1,240 ktpm ISBM		Phase 2 180 ktpm Bubi	
	m³pd	m³pa	m³pd	m³pa
Process Water Storage Dam to Plant	31,243	11,397,275	24,653	8,993,311
Process Water Recovery in Plant to PW storage	23,359	8,521,357	18,683	6,815,684
Process Water Recovery ex TSF	2,821	1,028,943	2,008	732,380
Process Water Make Up Requirement	5,063	1,846,975	3,962	1,445,246
BIOX® Water Storage Tank to Plant	2,890	1,054,396	4,385	1,599,551
BIOX® Water Recovery in Plant to BW storage	2,870	1,046,998	4,354	1,588,341
BIOX® Water Recovery (potential) ex BIOX® TSF	1,290	470,429	1,942	708,264
BIOX®W ater make up requirement	-1,269	-463,031	-1,911	-697,054
BIOX® CN contaminated Water Recovery ex BIOX® TSF	1,290	470,429	1,942	708,264
BIOX® TSF CN contaminated Water requirements	480	175,104	792	288,922
BIOX® TSF CN contaminated water make up requirement	-810	-295,325	-1,150	-419,342
Raw Water Usage Requirement	2 472	901 786	3 528	1,287,014
Process Potable Water Usage Requirement	70	25 536	70	25,536

The total daily water requirement is thus 3,601 m³/day, equivalent to 109,474 m³/month. Equivalent Phase 1 and Phase 2 water make requirements are 7,535 m³/day, equivalent to 229,063 m³/month and 7,490 m³/day, equivalent to 227,688 m³/month, respectively.

17.4.1 Raw Water

Raw water will be supplied to the raw water storage tank, with a live capacity of 2,560 m³, from the pit dewatering pumps and several borehole pumps.

The raw water is used for gland service, carbon transfer duties, elution, gravity concentrator circuit water, reagent make-up and fire service duties.

The raw water storage tank will have a reserve for firefighting purposes. This reserve will be maintained by suitability positioned fire water and raw water pump suctions.

Raw water requirement under phase 1 conditions is approximately 3,500 m³/day.

17.4.2 Process Water

Process water is stored in the process water dam, an earthen lined structure with a live volume of 10,400 m³. The process water dam collects water from the water recovery thickener, flotation tailings TSF and any plant run-off from pollution control dams. Process water is supplied to all sections of the plant for hosing and screen spraying and specifically to the milling and flotation sections for slurry dilution purposes. The process water balance is negative and relies on a make-up volume (from raw water) of approximately 4,000 m³/day under phase 2 conditions.

17.4.3 Fire Water

Firewater is drawn from the raw water tank. The firewater pumping system contains:

- An electric jockey pump to maintain fire water ring main pressure
- An electric fire water delivery pump
- A diesel driven fire water pump that automatically starts if power is unavailable for the electric firewater pump
- Fire hydrants and hose reels are placed throughout the process plant, fuel storage and plant offices at intervals that ensure coverage in areas where flammable materials are present.

17.4.4 BIOX® Water

BIOX® water is derived from the BIOX® residue tailings storage facility. This water, associated with the CIL plant tailings product is only usable in the CIL section of the plant unless it has undergone treatment for the removal thiocyanates, which are poisonous to the BIOX® bacteria. No such treatment plant has been considered for the project and as such reliance will be made on evaporation of this water on the TSF or in a separate return water facility. The positive water balance here requires the evaporation of approximately 1,900 m³/day under phase 2 conditions.

17.4.5 Potable Water

Potable water is taken from the borehole water line. It is pumped through a water treatment unit before being stored in the potable water tank. The potable water tank feeds the plant potable water tank, from where the plant and mining potable water is distributed. The contractors' camp potable water tank is also fed from the potable water tank.

17.5 Reagent Services

The Bilboes plant will use a substantial number of chemical reagents / commodities due to its complexity. Limestone will be sourced locally; all the other reagents will require importation into Zimbabwe. The reagent requirements are summarised in the tabulation below.

Table 17-10: Process Plant Major Reagents / Commodities

Reagent / Commodity	Delivery Form	Area(s) of Use	Make up Facilities
Quick / Burnt lime CaO (85%)	Bulk powder, -1 mm solids	Milling, BIOX® Neutralisation, CIL, Cyanide Detoxification	Bulk Slaking (Hydration)plant supplying hydrated lime – Ca (OH)2 - via a ring main system
Limestone (CaCO3) (45%)	Bulk crushed, -40 mm solids	BIOX® Neutralisation	Milling plant with dedicated supply to neutralisation area
Flocculant (various)	Dry powder, 25 kg bags	Flotation tails thickener, Flotation Conc. thickener, BIOX® CCD thickeners, Water recovery thickener	Dedicated batch make up plants at each relevant site supplying liquid flocculant
Flotation Collector: Sodium Ethyl Xanthate (SEX)	Dry pellets, 850 kg bulk bags	Flotation	Dedicated batch make up plant supplying liquid reagent
Flotation Activator Copper Sulphate (CuSO4)	Dry powder, 25 kg bags	Flotation	Dedicated batch make up plant supplying liquid reagent

Reagent / Commodity	Delivery Form	Area(s) of Use	Make up Facilities
Flotation Frother	Dry powder, 200 kg drums	Flotation	Dedicated batch make up plant supplying liquid reagent
Flotation Depressant 1 Sodium Carbonate (Na2CO3)	Dry powder, 25 kg bags	Flotation	Dedicated batch make up plant supplying liquid reagent
Flotation Depressant 2 Starch	Dry powder, 25 kg bags	Flotation	Dedicated batch make up plant supplying liquid reagent
Sulphuric Acid	Bulk tanker liquid 93% H2SO4	BIOX®	Ring main system feeding from storage tank to BIOX® circuit.
BIOX® Nutrients	Dry powder, 25 kg bags	BIOX®	Dedicated batch make up plant supplying liquid reagent
Sodium Cyanide NaCN	Briquettes, 1,000 kg bulk bags	CIL, Elution	Solution make-up and storage facility
Caustic Soda NaOH	Pellets, 1,000 kg bulk bags	Carbon Treatment, Cyanide make-up facility	Solution make-up, storage and distribution facility
Hydrochloric Acid HCl	33% Liquid, 200 l plastic drums	Carbon Treatment Acid Wash	Direct pumping from drum into Acid Wash solution make up tank
Sodium Metabisulphite Na2S2O5	Powder, 1,000 kg bulk bags	Cyanide Detoxification	Solution make-up, storage and distribution facility
Diesel	Bulk Tanker	Fire water system, Elution and Gold Room	Local diesel storage tank for distribution
Milling grinding media 80 mm dia. forged Cr-Mo steel	200 l steel drums	Milling	Ball loader onto Mill feed conveyor

17.6 Plant Energy Requirements

The installed plant energy requirement has been calculated from the mechanical equipment list as 38 MW. Power supply will be sourced from the Zimbabwean National electrical power grid.

17.7 Process Control Philosophy Summary

The general plant control philosophy is for a plant with a medium level of automation. The plant will be provided with a Crushing Area control room and a Central Plant control room from which the status of the major electrical equipment can be monitored, and from which all regulatory control loops can be monitored and adjusted. The starting and stopping of most electrical drives

will be performed at the stop / start control station located adjacent to each drive or in the case of major equipment started locally or remotely from the Central control room.

The crushing circuit will be provided with a sequence start facility from the Crushing Area control room panel.

The mill drive circuits will be started from the mill control panel adjacent to each of the mills.

The elution circuit will be automated where practical from the elution control panel. A dedicated Programmable Logic Controller (PLC) will be provided for this purpose.

A PLC will be utilised to accept status signals from the electrical switchgear for monitoring drive status conditions.

An Operator Interface Terminal (OIT) will be provided in the plant control room to monitor and trend critical process and engineering parameters. The OIT will be provided with sufficient alarm pages for diagnostic purposes.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 18
PROJECT INFRASTRUCTURE

Document Number: JZWEBR6013-STU-REP-001

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18 PROJECT INFRASTURCTURE

18.1 Geotechnical Scope

18.1.1 Mining - Open Pit Geotechnical Investigation and Design

The Bilboes Gold Project geotechnical engineering investigation scope involved the following study areas:

- Geotechnical Investigation for the Tailings Storage Facility (TSF), the Process Plant (Plant) and Waste Rock Dump (WRD) foundation material analysis - this involved undertaking site geotechnical investigation and laboratory geotechnical test work to determine the foundation material characteristics for the feasibility level design of the TSF, Plant and WRD.
- Open Pit Design - This comprised a field investigation, core drilling and logging, laboratory testing of rocks and soils, rock mass characterisation, geotechnical mapping, analysis and interpretation of test results and a feasibility design of the pit slopes
- WRD analysis - Undertaking a geotechnical analysis of the waste rock material and furnishing Bilboes with the information

18.1.1.1 Field Investigation and Data Collation

SLR Rock Engineers visited the site at various stages of the geological drilling campaign during 2018 which included, review of geological and geotechnical data, geotechnical logging of core and the collection of intact rock samples for laboratory testing. The laboratory test work included the following:

- Uniaxial Compressive Strength Testing (UCS)
- Brazilian Tensile Strength Testing (BTS)

Wireline Workshop collected structural data using both the Acoustic and Optical Televiewer, from the geotechnical boreholes following a proposal by SLR. Packer testing was also carried out in each borehole to determine the hydrogeological parameters for the rock mass, for groundwater modelling.

A total of 18 boreholes: ten at the Isabella McCays and five at Bubi, varying in depth from a minimum of 120 m to a maximum of 260 m were logged. The cumulative length of the boreholes at Isabella McCays Isabella McCays was about 1.67 km; and those at the Bubi was about 0.88 km.

18.1.1.2 Site Geology

The Bilboes stratigraphic presentation is depicted in Figure 18-1 below:

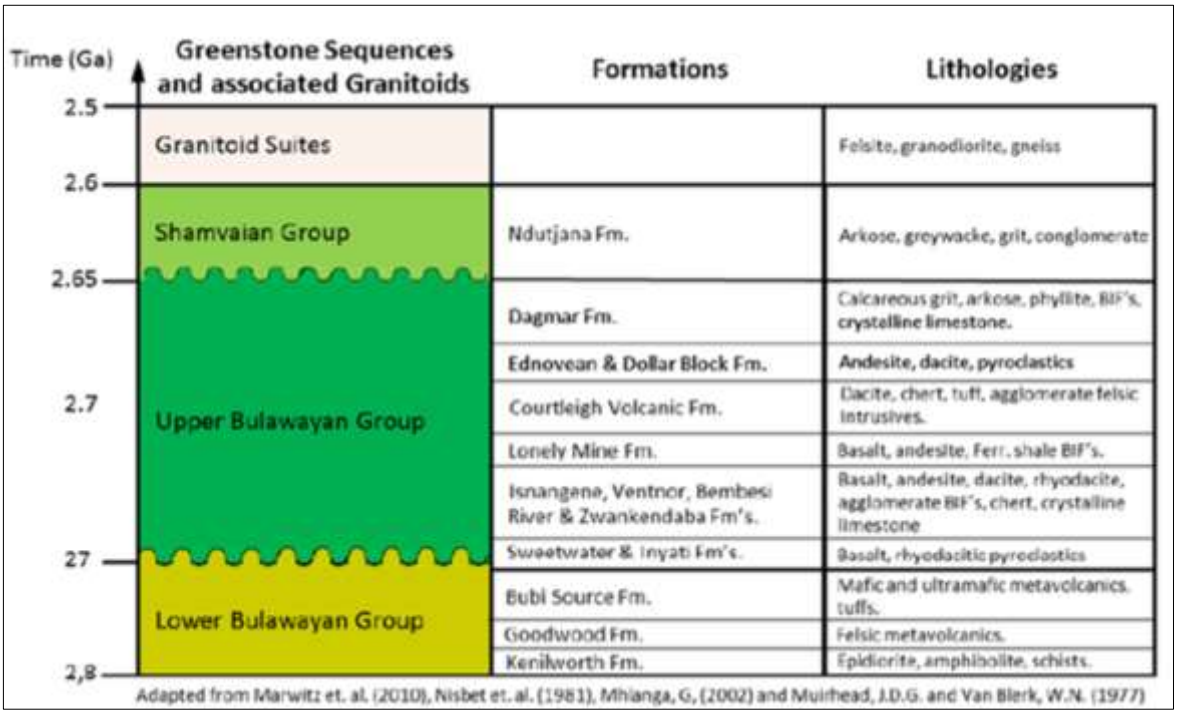


Figure 18-1: Bilboes Site Stratigraphy

18.1.1.3 Engineering Geology

18.1.1.3.1 Weathering

- At Isabella South, the maximum depth of completely weathered rock is 3.0 m with a mean of 1.6 m. The maximum depth of highly weathered rock is 62 m with a mean of 28 m.
- At Isabella North, the maximum depth of completely weathered rock is 3.0 m with a mean of 1.7 m. The maximum depth of highly weathered rock is 60 m with a mean of 29 m.
- At McCays, the maximum depth of completely weathered rock is 2.0 m with a mean of 1.0 m. The maximum depth of highly weathered rock is 6.3 m with a mean of 3.6 m.
- At Bubi, the maximum depth of completely weathered rock is 3.0 m with a mean of 1.7 m. The maximum depth of highly weathered rock is 56 m with a mean depth of 15.7 m.

18.1.1.4 Major Rock Domains

Following the geotechnical logging of the boreholes, the following major rock domains were encountered:

Table 18-1: Percentage Rock Types at Different Mining Pits

Rock Type	Percentage Rock (%)			
	Isabella South	Isabella North	McCays	Bubi
Arkose	26	14	-	-
Chlorite Schist	23	-	-	-
Schist	16	-	-	-
Felsic Schist	35	83	-	-
Mafic Schist	-	2	21	13
Meta-Basalt	-	1	65	28
Banded-Iron Formation (BIF) / Chert	-	-	4	-
Meta-Andesite	-	-	10	55
Saprock	-	-	-	4

18.1.1.5 Rock Mass Classification

The rock mass quality for the different Bilboes pits (Isabella South, Isabella North, McCays and Bubi) was assessed using the Rock Mass Rating (RMR) RMR89 classification system developed by Bieniawski (1976, 1989). The results of the rock assessments show that the rock mass for all the four mining pits is considered to be fair to good.

18.1.1.6 Conclusions and Recommendations

Based on the analysis of the engineering geological aspects of the investigated deposits which included rock mass characterisation, hydrogeology, intact rock properties and structural geology, a geotechnical model comprising design parameters was developed. Using these design parameters; kinematic, empirical and limit equilibrium analysis was carried out to determine the optimal slope configuration for the various deposits.

Based on the analysis carried out, it is understood that the capacity of the slopes should be affected by the following:

- Completely weathered slopes should be a maximum of 3 m in height, and it is recommended that the material is pushed back from the crest

- For the transitional rock (highly to moderately weathered), by a combination of rock mass strength and adverse structural orientation. Inter-ramp heights of 60 m are achievable with inter-ramp angles between 45 degrees and 50 degrees
- For the unweathered rock slopes adverse structural orientation should determine the slope angle which is achievable. Inter-ramp heights of 90 m are achievable with inter-ramp angles of between 50 degrees and 55 degrees, depending on the wall direction

The controls on slope design are listed below for the Bilboes pits with comments on the reliability of the data and descriptions of how the design issues were addressed for the purposes of the slope design.

Table 18-2: Slope Design

Slope Design Issue	Confidence	Mitigation
Faulting Faults were inferred to be sub-vertical; however, the width of fractured / disturbed ground either side of the faults is not understood.	Moderate	Kinematics was used to assess the stability of inter-ramp and overall slope. Inter-ramp and slope angles are restricted to between 50 and 55 degrees and 45 to 50 degrees respectively to ensure sub-vertical faults do not daylight
Rock Fabric Large amounts of structural data w**ere** collected, defining the local occurrence, intensity**,** and orientation (dip and dip direction) of the structures	High	Good practice to collect and expand on the structural data collected to ensure that unknown structures are defined
Soil and Intact Rock Properties Intact samples of rocks were collected and tested.	Moderate	Good practice to have an ongoing soil and rock testing program to build on the database
Rock Mass Characterisation Rock mass characterisation was carried out and generally is representative of rock mass conditions.	High	Rock mass characterisation should be ongoing to expand on the rock mass database.
Groundwater The groundwater studies were carried out by SLR and included in the limit equilibrium analysis	High	-

The detailed pit slope design should require the following phasing once a final pit shell and pit stages are defined and inter-related.

- Additional intact strength testing is required for the rock and soil formations
- Additional structural data needs to be collected from the pits using a televiewer
- Continual collection of rock mass data from drilled core

- Carrying out of additional stability analysis using the new pit shells, generated from with recommended slope angles recommendations presented on this document, and the revised geological and geotechnical models
- Developing the Ground Control Management Plan
- Projecting major structures onto the pit phases and final pit for geotechnical review and development of remedial measures and the timing of their implementation as required
- Defining the locations of the initial vibrating wire piezometers, the initial prisms, survey stations and trial horizontal drains and their specifications and the target dates for their installations

18.1.2 Civil - Site Geotechnical Investigation for Process Plant, Tailings Storage Facility and Waste Rock Dumps Sites

The objectives of the investigation were as follows:

- Establishing the nature and engineering properties of the upper soil layers (up to a maximum target depth of about 2.0 m)
- Commenting on excavation characteristics and classification
- Commenting on the existing site soils for possible use as borrow materials during construction
- Commenting on whether shallow groundwater is likely to influence construction
- Providing recommendations on site preparation, bearing capacity / settlement estimates and the founding of the proposed structures
- Commenting on any other geotechnical issues which may impact the proposed development

Prior to the field investigation, a site reconnaissance study was conducted, during which the site was assessed with the view to planning the investigation methodology. This was followed by a desktop study investigation which involved the compilation and assessment of available information on the site including geology, aerial photography, and previous investigations on the site, where available.

The test pit locations were selected based on early conceptual site layouts of the TSF, RWD and Plant Site to gain maximum coverage of the area. The positions were surveyed with a handheld GPS (accuracy of 5 m). The co-ordinates surveyed were presented in WGS84 Datum, UTM grid zone 36 S.

Selected soil samples were retrieved from the test pits and were submitted to the Contech Geotechnical Testing laboratory in Harare, Zimbabwe. The samples were chosen to determine the design parameters of each material units encountered at the site.

18.1.2.1 Tailings Storage Facility Site Test Pits

33 Test pits were excavated at the proposed TSF to the depths of between 0.15 m to 2.55 m. Nine test pits were excavated at the proposed RWD to depths of between 1.16 m to 1.94 m. A total of six core boreholes were drilled at the proposed TSF site by Diamond drilling company, using one core drill rig. In-situ permeability tests were carried out at the proposed TSF site using the Guelph Permeameter 2,800 K1 which is a constant head device from the surface near test pits TPTSF26 and at boreholes BH01, BH02 and BH04.

18.1.2.2 Tailings Storage Facility Site Soil Profile

The soil profile observed in the test pits around the south-eastern portion of the proposed TSF site generally confirmed the presence of andesite in the form of fine-grained residual soils derived from the weathering of the parent rock with a gradual transition into competent weathered andesite rock occurring within several of the excavated pits. The residual andesite underlies the fine colluvium and can be described as sandy lean clay with scattered gravels. The following profile was encountered at the TSF:

- Alluvium: A topsoil layer of alluvium origin was encountered across the TSF site with the only variation being thickness of the layer and density and size of roots encountered. The topsoil layer can be described as dry, reddish brown, medium dense (cohesionless soils) or firm (cohesive soils) with many roots present, sandy lean clay, and scattered gravel mixture. The thickness of this layer ranges from a minimum of 0.2 m to a maximum of 0.7 m
- Fine Colluvium: The transported fine colluvium soil is generally intersected below the topsoil or from the surface on the central and north-eastern extent of the TSF site. The consistencies of soils derived from the fine colluvium are medium dense to dense. The fine colluvium can be described as dry, dark yellowish to reddish brown, clayey sand with gravel. The average thickness of the fine colluvium horizon is approximately 0.6 m with a minimum of 0.1 m and maximum of 1.0 m
- Residual Arkose: Residual Arkose occurs beneath the fine colluvium around the central and northeast portion of the TSF site. The residual Arkose was encountered to an effective depth of the excavator at depths approximately between 1.4 m and

2.3 m. The consistencies of soils derived from the residual Arkose are medium dense or firm. The residual Arkose can be described as dark yellowish to reddish brown, sandy lean clay with scattered gravel. The average thickness of the residual Arkose is approximately 0.4 m

- Arkose Bedrock: Arkose bedrock was exposed across the site and is described as light grey to yellowish, moderately to highly weathered, fine to medium grained, weak rock, Arkose. This horizon underlies the residual Arkose and was encountered at the refusal depth of the excavator
- Boreholes were drilled at the TSF site to depths of between 27 m and 36 m. Each borehole terminated in Arkose. The light grey, slightly weathered, fine grained, medium strong rock, Arkose was also encountered in BH01, BH02, BH03 and BH04 located in the central and north-western portion of the TSF site
- Residual Andesite: Residual andesite occurs beneath the transported topsoil and was encountered in in six pits (TPTSF01, TPTSF02, TPTSF03, TPTSF13, TPTSF14 and TPTSF15) of the 33 test pits positioned on the south-eastern portion of the TSF site. The consistencies of soils derived from the residual andesite are medium dense to dense. The residual andesite can be described as dry, reddish brown, micro shattered with some roots present, sandy-clay to clayey-sand with gravel. The thickness of the residual dolerite varies between 0.1 m to 0.9 m
- Andesite Bedrock: The andesite bedrock horizon underlies the residual andesite and was encountered in the above six mentioned test pits (TPTSF01, TPTSF02, TPTSF03, TPTSF13, TPTSF14 and TPTSF15). The andesite bedrock was observed as a horizon comprising abundant gravels, cobbles and the occasional boulders and was encountered at the refusal depth of the excavator. The andesite bedrock can be described as light greenish grey, moderately weathered, fine grained and medium strong.

18.1.2.3 Process Plant Site Test Pits

Eight test pits were excavated at selected grid positions to suit the proposed Plant layout. Excavation was done using a Doosan DX140 LC track-mounted excavator supplied by Bilboes. A total of four core boreholes were drilled at the Plant site by a Diamond Drilling Company. The boreholes were drilled to depths of between 27 m and 30 m as specified by the Geotechnical Specialist on site.

18.1.2.4 Process Plant Site Soil Profile

The drilled boreholes and excavated test pits at the Plant site generally show a consistent Arkose profile, although a varying degree of re-working of the residual soil is evident. The following profile was encountered at the Plant site:

- Alluvium: A prominent topsoil layer of alluvium origin was encountered around the plant site with the only variation being thickness of the layer and density and size of roots encountered. These soils can be described as moist, dark brown, sandy lean clay. This material was observed to have a soft to firm consistency. The average thickness of this layer is approximately 0.4 m with a minimum of 0.3 m and a maximum of 0.5 m
- Residual Arkose: Residual Arkose was encountered across the plant site. This horizon generally displays a variable consistency varying from firm to medium dense to dense and generally consisted of dry, reddish to yellowish brown, sandy clay with scattered gravel. The average thickness of the residual Arkose is approximately 0.5 m with a minimum of 0.10 m and maximum of 0.9 m
- Arkose Bedrock: Arkose bedrock underlies the residual Arkose and was described as yellowish, brown, moderately to highly weathered, fine to medium grained, and weak rock Arkose. The Arkose bedrock was encountered at the refusal depth of the excavator

18.1.2.5 Waste Rock Dump Sites Test Pits

Forty-one test pits were excavated at the proposed WRD sites at Isabella McCays and Bubi pit areas. The test pits were all excavated to refusal depth of the excavator which occurred at depths of about 2.3 m below ground surface.

18.1.2.6 Waste Rock Dump Sites Soil Profile

The area around the proposed Isabella WRD is underlain by siltstone, basalt, and felsic schist. Residual soils were derived from the weathering of Siltstone, Basalt and Felsic Schist. A prominent layer of transported soil of alluvium origin was encountered across the site and covers the reworked residual soils. No outcrops of Siltstone or Felsic Schist were encountered on site.

The eight test pits (TP01 to TP08) excavated within the McCays WRD area showed a consistent profile in terms of the succession of horizons encountered albeit varying significantly in thicknesses. The proposed WRD site appears to be overlain in its entirety by a relatively thin and organic rich, fine alluvium. The surface horizon was found to be dry to slightly moist and with an average thickness of 0.4 m. The alluvium horizon was

distinguishable from the underlying reworked residual soils and can be described as dry, dark brown, medium dense or firm, intact with many roots present and with sandy lean clay with gravel.

A total of 15 test pits were excavated at the proposed Bubi WRD. Five test pits (TP11 to TP15) were excavated in Bubi South and ten (TP01 to TP10) excavated in Bubi North. The profile encountered across the proposed Bubi North and Bubi South WRD site was found to be generally uniform with very little variation except for the test pit TP03 around the northern portion of Bubi North pit and TP09 and TP10 South-Eastern portion of Bubi South pit.

18.1.2.7 Conclusions and Recommendations

The following is concluded and recommended following this investigation:

18.1.2.7.1 TSF Site

- The profile encountered across the TSF, Plant, and RWD site was found to be generally uniform with very little variation. The andesite bedrock was observed as a horizon comprising abundant gravels, cobbles and occasional boulders and was encountered to the refusal depth of the excavator
- No seepage was encountered in any of the test pits. The presence of paedogenic material in the soil profiles of some test pits indicates that some areas are subjected to seasonal fluctuating perched water level. In areas where the bedrock is close to surface, seepage or springs are common feature and can often be observed along shallow slopes towards the end of the rainy season continuing into the early parts of winter. This is not a sustainable source of groundwater and is very dependent on rainfall
- In-situ permeability testing was conducted on surface and within the test pits of the TSF and RWD using a Guelph Permeameter. The in-situ permeability tests revealed that the fine colluvium exhibited a measured in situ permeability of approximately 1.2 x 10-6 m/s. The residual Arkose exhibited an in-situ permeability of between 1.0 x 10-6 m/s to 2.7 x 10-6 m/s
- Generally, the residual horizon encountered across the TSF site can be classified as a CL, SC, or CH according to the Unified Soils Classification System - ASTM D2487 (“USCS”) and can be described as either lean clay with sand, clayey sand with gravel, or a fat clay with sand depending on the degree of pedogenesis
- The soils are classified as soft excavation to a depth of between 1.0 m and 2.0 m below surface

- Most of the materials for the construction of the embankments for the TSF and RWD should be sourced from the existing WRD, and waste generated from mining the pit. Generally, except for the organic topsoil, all the material encountered should be suitable for use in general earthworks classified as G10 to G8, however, it is recommended to conduct appropriated laboratory testing to identify the material classifications
- Based on the material characteristics the residual Arkose and residual Andesite can be used to develop a low permeability liner

The following soil and rock properties were derived from the investigation and are recommended for use in design, slope stability analysis and seepage modelling.

Table 18-3: Proposed Soil and Rock Properties for Foundation Modelling on the TSF Site

Geotechnical Domain	Depth (m) [mean values]	USCS	Dry Density (kg/m^3)	v	Confined Modulus (MPa)	Effective Cohesion (KPa)	Effective Friction Angle (Degrees	K_{sat} (m/s)
Topsoil	0.0 - 0.6	CL	1,700	0.3	4	0	27	1 x 10^{-6}
Residual Arkose	0.6 - 1.0	CL/SC/ GC	1,700	0.3	8	0	27	1 x 10^{-6}
Residual Andesite	0.4 - 1.0	CL/SC	1,800	0.3	15	0	30	1 x 10^{-6}
Residual Meta-Basalt	0.1 - 0.6	CL/SC/ GC	1,800	0.3	8	0	30	1 x 10^{-6}
Rock Type	Depth (m) [mean values]	Rock Classification	Dry Density (kg/m^3)	v	GSI	Rock Strength (MPa)	Confined Modulus (KPa)	K_{sat} (m/s)
Arkose / Andesite / Meta-Basalt	1.0 - 2.0	Poor Quality Rock Mass	2,600	0.4	25 - 35	1 - 5	50	1 x 10^{-8}

18.1.2.7.2 Process Plant Site

From the results of the settlement analysis for the Plant site the following were concluded and recommended:

- Large settlements are anticipated within the firm residual arkose and with the micro-shattered structures noted during the field investigation, which indicates the potential for expansive clays, the following foundation design will need to be constructed for loads <250 kPa at a depth of 1.0 m to limit excessive settlement:
  - Remove all the expansive horizon to 1.0 m beyond perimeter of the structure and replace with inert backfill, compacted to 93% MOD-AASHTO density at

-1 to +2% of optimum moisture content. Normal construction with lightly reinforced strip footings

- Ensure that good stormwater management is implemented to keep water from ponding and seeping below the founding level
- Ensure that good stormwater management is implemented to prevent water ponding and ground water seepage below the foundations

➢ Alternative founding of all structures and structures with loads >250 kPa should be on the weak rock arkose at a depth of between 1.3 m and 1.5 m. For the settlement sensitive structures, it is recommended that a stiffened concrete raft be placed on top of the Arkose bedrock

Table 18-4: Proposed Soil and Rock Properties for Foundation Modelling on Process Plant Site

Geotechnical Domain	Depth (m) [mean values]	USCS	Dry Density (kg/m^3)	v	Confined Modulus (MPa)	Effective Cohesion (KPa)	Effective Friction Angle (Degrees)
Topsoil	0.0 - 0.4	Not considered suitable for founding					
Residual Arkose	0.4 - 1.0	CL	1,700	2		0	27
Residual Arkose - Medium Dense to Dense	1.0 - 1.3	CL/SC/GC	1,800	0.3	8	0	30
Rock Type	Depth (m) [mean values]	Rock Classification	Dry Density (kg/m^3)	v	GSI	Rock Strength (MPa)	Confined Modulus (KPa)
Arkose	1.3	Poor Quality Rock Mass	2,600	0.4	25 - 35	1-5	50

18.1.2.7.3 Waste Rock Dump Sites

➢ The Waste Rock Dumps classifies geotechnically as a Class II Low Hazard

➢ Waste Rock Dump lift heights should be limited to 10 m with a minimum of a 10 m berm, with an overall height of 40 m

18.2 Tailings Storage Facility

18.2.1 Introduction

SLR Consulting (Africa) (Pty) Ltd (SLR) was appointed to design and cost a new TSF and the associated sundry infrastructure which include RWD, silt traps, pollution control system, access roads and perimeter fencing.

18.2.2 Design Standards

It is understood that there are no specific Zimbabwean regulations or standards that are applicable to TSF designs, and as such the Bilboes TSF design complies with the following

regulations, standards, and guidelines where applicable to TSF design (in order of precedence):

- IFC Environmental, Health, and Safety Guidelines for Mining, 2007
- The applicable specifications of the International Commission on Large Dams (ICOLD) and the Australian National Committee on Large Dams (ANCOLD) (as required by the above IFC guidelines, or any other internationally recognised standards based on a risk assessment strategy), specifically the ANCOLD 2012 guidelines on the planning, design, construction, and closure of tailings dams
- South African regulations regarding the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation, Regulation R632, promulgated under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) published on 24 July 2015 in Government Gazette No. 39020

With regards to environmental protection associated with the disposal of mining waste, the Zimbabwe Statutory Instrument 6 of 2007 applies. The same regulations are also cited as the Environmental Management (Effluents and Solid Waste Disposal) Regulations, 2007. These regulations are however non-specific with regards to the type of liner or barrier system required for mining waste (tailings), apart from stating that all new solid waste sites shall be lined with the appropriate (as approved by the Agency) lining specific to the nature of the environmental risk". According to Bilboes, the Zimbabwe Environmental Management Agency (EMA) views the incorporation of a 1.5 mm thick HDPE geomembrane in the lining system as minimum best practice.

The Zimbabwe Standard Specification for Hazardous Waste Management (ZWS 806:2012) which prescribes minimum liner requirements for landfill liners of various hazardous wastes was also referenced to inform the Bilboes TSF liner specification.

18.2.3 Design Criteria

It is envisaged that the plant process will be a two-stage process incorporating the flotation circuit that produces flotation tailings and an ore concentrate that goes into the BIOX® circuit. The BIOX® circuit in-turn produces the gold and two streams of BIOX® tailings: the neutralised BIOX® tailings stream and the BIOX® CIL tailings stream. The neutralised BIOX® tailings constitute about 5% to 10% of the total run of mine (RoM) flotation tailings and are blended with the flotation tailings stream prior to disposal. It is understood that the flotation and BIOX® CIL tailings streams are chemically and physically diverse, and as a result, it was considered appropriate to design a facility with two separate compartments.

The general area for a TSF site was preselected by Bilboes. SLR conducted a trade-off study that compared various TSF construction, development, and deposition techniques over several TSF layout options on the pre-selected site area. The trade-off costing exercise demonstrated that the lowest start-up and sustaining capital costs were associated with a hybrid development system that incorporated full containment of tailings during the initial high Rate of Rise (RoR) deposition phases, followed by upstream development in the latter phases of development when the RoR reduces to the permissible 2 m/year.

Conventional tailings slurry disposal by way of spigotting with a maximum allowable RoR of 2 m/year above the containment wall crest was adopted for the project.

EPCM supplied the tailings production profile indicating three distinct phases of production as presented in Table 18-5.

Table 18-5: Production Profile

Phase		Year	Deposition Rate (tpm)		Cumulative Tonnage (t)	
			Flotation Tailings	BIOX® Tailings	Flotation Tailings	BIOX® Tailings
1	Base Case	1.75 to 7.25	240,000	12,000	14,977,000	803,000
2	Base Case	7.25 to 13	180,000	18,000	11,178,000	1,242,000
				TOTAL	28,549,000	2,171,000

Based on the production profile and plant process data supplied by DRA, the TSF was sized to accommodate a deposition rate of 28.5 Mt for the flotation tailings compartment, and 2.2 Mt for the BIOX® compartment.

TSF sizing was further based on an overall downstream (outer) embankment slope of 1V:4H which is considered an environmentally stable slope to encourage indigenous vegetation growth.

18.2.4 Site Geotechnical Investigation

SLR carried out a geotechnical site investigation for the TSF and its infrastructure to ascertain the founding conditions of the site, as well as to determine the availability and suitability of the in-situ material on site.

All test pits were mechanically excavated using a Doosan DX140 LC track-mounted excavator supplied by Bilboes.

- A total of 33 test pits were excavated over the TSF area to depths between 0.2 m and 2.6 m
- Nine test pits were excavated over the RWD areas to depths between 1.2 m to 1.9 m

- Three boreholes were drilled at the proposed TSF site
- Two boreholes were drilled at the proposed flotation RWD site

A total of six rotary core boreholes were drilled at the proposed Plant site, adjacent to the TSF site.

The boreholes were drilled to depths between 27 m and 30 m.

The site is blanketed by a medium dense to firm vegetative alluvial topsoil layer of approximately 400 mm thickness. The topsoil layer is underlain by a medium dense to dense layer of fine transported colluvium soils on the central and North-Eastern parts of the TSF site. The layer can be described as clayey sand with gravel of 400 mm average thickness.

Residual arkose was encountered beneath the fine colluvium at depths between 1.4 m and 2.3 m around the Central and North-Eastern portions of the TSF site. Moderate to highly weathered arkose bedrock was found beneath the residual arkose layer across the site.

In the South-Eastern portion of the TSF site, residual andesite occurs beneath the transported topsoil. The soils can be described as fine grained sandy lean clay with scattered gravels derived from the weathering of the parent andesite rock. The residual andesite materials are underlain by competent weathered andesite rock over this portion of the site.

In-situ permeability tests carried out at the TSF site indicated moderate to slow seepage potential for the site founding material with permeability values between 1 x 10 - 5 m/s and 1 x 10-7 m/s.

No groundwater was encountered in any of the test pits and boreholes, and as such groundwater is not expected to affect construction. The shallow bedrock conditions encountered along the South-Eastern flank where a ridgeline traverses the site in a North-East to South-West direction may give rise to seepages on the surface or springs in response to intense rainfall events.

Good to fair quality material suitable for embankment construction can be sourced from the TSF and RWD sites. This material would be used to construct the smooth finish on the inner waste rock containment embankment wall to allow for safe placement of geomembrane liner.

The residual arkose and andesite silt materials available on site are clayey and will require the lower Standard Proctor compactive effort rather than the Modified AASHTO compactive effort. In addition, compaction wet of optimum moisture content would be required to lower

the permeability of compacted clayey materials that would render these materials suitable for use in lining systems.

Mine waste rock materials available from previous mining and from future mining should be used to form the containment wall.

The following material physical properties were derived from the geotechnical site investigation and were used for stability analysis and TSF foundation design:

- Selected embankment fill material friction angle (Φ') : 25 degrees
- Selected embankment fill material cohesion (C') : 20 KPa
- Selected embankment fill material unit weight : 1,600 kg/m³
- Waste Rock friction angle (Φ') : 35 degrees
- Waste Rock cohesion (C') : 5 KPa
- Waste Rock unit weight : 2,100 kg/m³
- Foundation material (residual arkose / andesite) friction angle (Φ') : 30 degrees
- Foundation material (residual arkose / andesite) cohesion (C') : 12.5 KPa
- Foundation material (residual arkose / andesite) unit weight : 1,700 kg/m³
- Bedrock friction angle (Φ) : 50 degrees
- Bedrock cohesion (C') : 50 KPa
- Bedrock unit weight : 2,600 kg/m³

18.2.5 Tailings Physical Characterisation

A full suite of geotechnical laboratory tests including foundation indicator tests, consolidated undrained triaxial tests, slurry settling tests, volumetric shrinkage tests, dispersiveness tests, evaporation / air-drying tests were conducted on representative Isabella McCays composite and the Bubi flotation tailings samples provided by Bilboes from the on-site pilot plant. The Isabella McCays Isabella McCays composite sample was blended at the Isabella-North: Isabella-South: McCays ratio of 50%: 30%: 20% in line with the mining plan.

The following tailings physical properties were derived from the geotechnical site investigation and were used in the design of the Bilboes TSF:

- In-situ dry density of deposited tailings for capacity calculations : 1,35 t/m³
- Flotation tailings solids concentration in slurry (by mass) : 40%
- BIOX® tailings solids concentration in slurry (by mass) : 20%
- Flotation tailings specific gravity : 2,70

- BIOX® tailings specific gravity : 2,75
- Flotation tailings slurry density : 1,337 t/m³
- BIOX® tailings slurry density : 1,144 t/m³
- Flotation and BIOX® tailings effective friction angle (Φ') : 31°
- Flotation and BIOX® tailings cohesion (C' (KPa) : 0
- Flotation and BIOX® tailings unit weight (kg/m³) : 1,500

Against expectation, the Isabella McCays BIOX® tailings foundation indicator tests results showed a very fine uniformly graded material (99% passing 0.075 mm sieve).

Based on preliminary discussions with Bilboes regarding the tailings Particle Size Distribution (PSD), the design envisaged a hybrid system of TSF construction incorporating full wall containment using waste rock material during the initial stages of deposition (up to Year 7), together with upstream wall raises using dried consolidated tailings from Year 7 onwards. However, safe upstream construction will not be achievable using such fine tailings, and as such BIOX® tailings may require full containment. The Isabella McCays BIOX® tailings PSD will therefore need further testing and confirmation during the detailed design phase.

18.2.6 Tailings Chemical Characterisation

18.2.6.1 Tailings Geochemical Assessment and Liner Selection

18.2.6.1.1 Zimbabwe Effluent Discharge Classification

To classify the Bilboes tailings, a geochemical assessment was undertaken on representative flotation, neutralised and BIOX® tailings samples from the pilot plant testing conducted by Outotec on samples collected from the Isabella McCays and Bubi pits.

Tailings leach results were compared to the Zimbabwe Environmental Management (Hazardous Waste Management) Regulations, 2006 classification using effluent standards for discharge. The samples were classified as a Blue, Green, Yellow or Red waste based on the leachable concentrations determined by static leach tests. The hazard level of the waste is given based on the waste type. The hazard levels and colour codes relate as follows:

- High hazard : Red
- Medium hazard : Yellow
- Low hazard : Green

- Safe : Blue

The following tailings samples were classified as having a high hazard level (Red):

- Bubi BIOX® samples : High hazard (Red)
- Isabella McCays composite BIOX® : High hazard (Red)
- Isabella North flotation : High hazard (Red)
- Isabella South flotation : High hazard (Red)
- McCays flotation : High hazard (Red)
- Isabella McCays composite flotation : High hazard (Red)

The Bubi flotation samples were classified as low/safe hazard (Green / Blue) level.

18.2.6.1.2 South African Waste Classification

In South Africa, mineral and mining residues, including tailings, are classified, and assessed under the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA). The South African Waste Classification and Management Regulations (WCMR) (GN R.634) and the associated National Norms and Standards (GN R.635 and GN R.636) were also consulted to help inform the TSF liner decision making process.

The Bilboes tailings samples were assessed in terms of GN R.635. Representative tailings samples from both the flotation and BIOX® circuits were sent for geochemical laboratory testing. The laboratory test work results are detailed in a separate Geochemical Assessment of Tailings Material report.

A waste assessment was only conducted on samples where Total Concentration (TC) and Leachable Concentration (LC) were determined. The waste assessment indicates that the flotation samples require disposal to a facility with a composite liner per GN R.636.

The BIOX® tailings would require polishing / pre-treatment prior to disposal and then re-assessed to determine an applicable liner system. It is understood that such pre-treatment can be incorporated within the plant.

18.2.6.1.3 Liner Selection

Based on the XRF results for the Isabella McCays BIOX® material, the Zimbabwe Standard Specification for Hazardous Waste Management (ZWS 806:2012) prescribes the following liner system as the minimum liner required for the Bilboes BIOX® tailings:

- 2 mm HDPE
- 150 mm cement base

The design presented in this report is based on the following selected liner systems:

Table 18-6: Liner System

Layer Description	Flotation Tailings		BIOX Tailings	
	TSF	RWD	TSF	RWD
HDPE geomembrane thickness	1.5 mm	2 mm	2 mm	2 mm
Base layers	300 mm selected clayey material (compacted in 2x150 mm thick layers)	300 mm compacted clay liner (compacted in 2x150 mm thick layers)	600 mm compacted clay liner (compacted in 4x150 mm thick layers)	600 mm compacted clay liner (compacted in 4x150 mm thick layers)
In-situ base preparation	Rip and re-compact 150 mm in-situ layer	Rip and re-compact 150 mm in-situ layer	Rip and re-compact 150 mm in-situ layer	Rip and re-compact 150 mm in-situ layer
For the flotation compartment, the above only applies up to 200 m into the basin. The central portion of the flotation compartment will be lined with CCL as described below:		N/A		
Flotation Compartment Central Portion of Basin Liner				
1	600 mm CCL			
2	150 mm Base preparation			

18.2.6.2 Seepage / Leakage Quality

The geochemical assessment report also provides expected seepage and liner leakage water qualities following source term modelling.

It was found that for the flotation tailings solution the following constituents would exceed the WHO drinking water guidelines and IFC guidelines for mining effluent: Arsenic (As), Fluorine (F), Mercury (Hg), Nitrate (NO3), Nickel (Ni), Antimony (Sb), Selenium (Se) and Total Cyanide (CN).

For the BIOX® tailings solution the following constituents would exceed the WHO drinking water guidelines and IFC guidelines for mining effluent: Arsenic (As), Nickel (Ni), Antimony (Sb), Selenium (Se) and Total Cyanide (CN).

The geochemical assessment indicated that the BIOX® tailings are likely to be Potentially Acid Generating (PAG) whilst the flotation tailings are non-PAG.

18.2.6.3 Contaminant Plume Modelling

Using the results of the geochemical assessment and source term modelling of tailings, SLR further conducted contaminant plume modelling to determine plume extents because of seepage or leakage from the TSF and associated RWDs. This modelling is reported on in a standalone Hydrogeological report.

The contaminant plume modelling undertaken compared the expected maximum extent of plume migration under different pollution control scenarios as follows:

- Scenario 1: “Do-Nothing” i.e., no lining under any of the two TSF compartments
- Scenario 2: Compacted clay liner only over the basin of both TSF compartments
- Scenario 3: Composite liner incorporating a geomembrane overlying compacted clay (equivalent to a South African Class C Liner)

The modelling results clearly demonstrated that the “Do-Nothing” (i.e., no lining) scenario would not be a sustainable and environmentally acceptable solution due to the large extent of the resulting contaminant plume. A compacted clay liner solution provides for a large reduction in contaminant plume migration, however not sufficient to avoid contaminants reaching the drainage line to the North-West of the site. Further intervention could be considered under this scenario to further limit plume migration (e.g., scavenger wells) however these measures are unlikely to be sustainable following cessation of operations.

The composite liner option is expected to confine plume migration to the TSF site with the plume not expected to exceed 260 m from the source over a 100-year period.

18.2.6.4 TSF Stability and Seepage Analysis

The Bilboes TSF stability and seepage analyses were conducted on two critical sections taken from locations that give the highest profile of the two compartments. Underdrainage was included in the analysed sections.

The material parameters used in the analysis were based on the tailing’s laboratory test work and the geotechnical site investigational work conducted by SLR. The geomembrane liner interface friction parameters were assumed based on literature and SLRs’ previous experience with similar materials.

The analyses were carried out using the GeoStudio (2007) suite of software. The minimum required side slope stability factors of safety as recommended by the 2012 Australian National Committee on Large Dams Guidelines on Tailings dams (ANCOLD, 2012) were applied as follows:

- 1.5 for static (drained) stability
- 1.1 for seismic / dynamic stability, that is pseudo static loading stability (under Operating Basis Earthquake (OBE)

Two cases were considered:

- Normal operating conditions at the TSF final height with all drains functioning normally:
  - Pool located 100 m from the TSF crest
  - Pool located 50 m from the TSF crest
- The worst-case conditions at the TSF final height with all drains non-operational with the result that the phreatic surface in the facility is elevated:
  - Pool located 100 m from the TSF crest
  - Pool located 50 m from the TSF crest

The results of the seepage analysis were used in sizing the drainpipes.

The lowest flotation tailings compartment FoS for the worst-case scenario involving the pool located 50 m from the crests and the drains non-operational is 2.0 and that for the BIOX® tailings compartment is 1.9.

18.2.6.5 Pseudo Static Analysis

The pseudo static analysis considered the following Peak Ground Acceleration (PGA) values recommended for this project:

- OBE (1 in a 1,000-year recurrence interval) : 0.03 g (0.3 m/s²)
- MCE (1 in a 10,000-year recurrence interval) : 0.25 g (2.5 m/s²)

The lowest FoS values yielded by the pseudo static slope stability assessment considered for the worst-case scenario involving the pool located 50 m from the crests and the drains non-operational are as follows:

- Flotation tailings compartment : 1.3
- BIOX® tailings compartment : 1.2

The flotation and BIOX® TSF compartments are considered to be stable for all the cases analysed under both the static slope and the pseudo static slope stability. The FoS values satisfy the recommendations of ANCOLD (2012).

18.2.6.6 TSF Infrastructure

The TSF complex development incorporates an outer containment wall, constructed in stages using approved available mine waste and developed in a downstream manner and sized to fully contain all deposited tailings up to the point when the tailings deposition rate reduces from 240 ktpm to 180 ktpm. The remainder of the facility up to the Life of Mine (LoM) will then be raised progressively with upstream wall raises using compacted tailings.

An estimate of the required sizes and quantities of the slurry ring feed pipeline and spigot off-takes was included.

Consideration was made to line the facility up to the top of the downstream wall with a geomembrane liner. The inner slope of the waste rock containment wall will be lined with a layer of selected natural gravel material to protect the geomembrane liner against puncture. The BIOX® compartment liner comprises 2 mm HDPE geomembrane underlain by 600 mm thick compacted clay. The flotation compartment liner detail involves 1.5 mm HDPE geomembrane underlain by 300 mm thick selected clayey material. It is assumed that the geomembrane liner conforms to GRI-GM13 as amended in January 2016 and installed to SANS 10409. A compaction Quality Assessment CQA plan including technical specifications for the manufacturing and installation of geomembrane have been provided.

To help collect seepage above the liner and thus control the phreatic surface, toe drains were provided along the upstream toe of the starter wall together with a reticulation of finger drains located beyond the toe drains and with their extent limited to the final tailings crest line. These were sized in accordance with the seepage analysis conducted for the TSF. All outlet pipes from the TSF were specified as non-perforated solid wall HDPE pipes.

Penstock intakes and pipelines will be used to decant supernatant water off the TSF. Appropriately sized temporary penstock intakes with side-inlets were provided to allow for draining of supernatant water as soon as deposition starts. The temporary penstock intakes will be decommissioned and sealed once the tailings level reaches the intake elevation of the next tower.

Each compartment has one final penstock sized to safely drain both the slurry water deposited onto the TSF during operation as well as the 1:50 year storm run-off flow in four days. The flotation tailings final penstock intake includes a 9 m high reinforced concrete tower above which stacked rings will be extended to the total height of the penstock at the final crest elevation of the TSF. The BIOX® final penstock intake will be constructed entirely of stacked penstock rings.

The precast concrete penstock outfall pipeline discharges into a concrete lined solution trench. Provision was made to dissipate energy and the point of discharge into the solution trench.

Silt traps were included upstream of each receiving RWD to capture a portion of solids that washed through the penstock and other systems. The silt traps were each sized to perform optimally under normal operating conditions and under a 1:50 year storm. The following considerations were considered in sizing the silt traps:

- Limiting the design through-flow rate
- Selecting the associated minimum particle size to ensure 75% of particles settle

The layout configuration was optimised to give the required flow length on a smaller area by making use of diving walls. Two equally sized compartments were provided to allow for continuous operation during clearing of silt from the silt traps.

18.2.6.7 TSF Hazard Classification

The Bilboes TSF hazard classification was carried out in accordance with both SANS 10286:1998 and ANCOLD (2012).

Imagery from Google Earth was used to estimate the number of residents within the Zone of Influence (ZOI). Two homesteads together with their associated agricultural fields were noted to fall within the ZOI. It is estimated that each homestead is made up of between four and eight people. Thus, the number of people within the ZOI would possibly be in the range of eight to sixteen people. About the same number of people can also be expected to be working in the agricultural fields at any one time.

Part of the Bafana Dam located downstream of the TSF also falls within the ZOI. The dam is used for irrigation at the 60 ha Nkosikazi Irrigation Scheme and for livestock watering. Contamination of water in the Bafana dam may require some form of wastewater treatment.

Given the above, the Bilboes TSF can be classified as follows:

- A “High” hazard facility per the SANS 10286:1998 safety classification criteria
- A “High B” consequence category per ANCOLD (2012)

18.2.6.8 TSF Operation and Monitoring

The TSF operational aspects considered for this design are as follows:

- Method of deposition
- On-dam pipework

- Decant management
- Operation of on-site pump stations
- General maintenance
- Concurrent rehabilitation
- Monitoring

During the life of the TSF, various elements should be monitored to ensure the integrity of the TSF complex. Monitoring elements will typically include:

- TSF engineering parameters
- Groundwater monitoring programme
- Dust monitoring programme

Seepage around TSF toe and slope embankments, check for heaving at the TSF toe, checking for slip / wedge failures; general condition of solution trench, erosion gullies on slopes, safety around penstock intakes and catwalk, safe access to all other areas of the TSF, condition of the perimeter fence and warning signs.

18.2.6.9 TSF Closure Concept

The closure concept is envisaged to include a covering of the mine waste with a low hydraulic conductivity layer such as a clay or geosynthetic membrane, typically used as a composite system also incorporating several other layers to achieve the following:

- Limiting erosion to acceptable levels
- Ensuring sustainable plant growth
    - Limiting seepage flux through the cover

There will be on-going rehabilitation of the TSF complex through on-going vegetating of the embankment slopes.

The TSF design slopes adopted (1V:4H) are considered environmentally stable to allow for indigenous vegetation growth with minimal ongoing maintenance. To assist with the establishment of vegetation, the vegetation will be manually planted and irrigated during the initial stages.

A suitable cover material will be designed as part of the Bilboes TSF detailed design stage.

18.3 Civil Engineering and Earthworks

18.3.1 Infrastructure Capital

18.3.1.1 Earthworks and Infrastructure

The items listed below formed part of the infrastructure scope following further review of the initial scope provided:

- Haul road (± 26 km) between Isabella and Bubi
- Internal mining haul roads for Isabella and Bubi, between the proposed open pit mining access and RoM handling facilities
- Mine access roads to the proposed mining infrastructure including road to the Plant, Administration and Village terraces, Lime stockpile terrace, Substation terrace and existing mine infrastructure
- Service roads to the PCD, RWD and the relocated Explosive Magazines
- Re-alignment of a public gravel road around the McCays extension
- Internal plant roads, bus drop-off and parking
- Raw water pipeline from the wellfields supply to the Plant Process Water Dam
- Return water pipelines from the TSF to Plant PCD.
- Bulk earthworks for terraces at Isabella including the Plant, RoM tip ramp and platform, Substation, Village, Administration, Lime stockpile, Contractor's Laydown terrace and the RoM transfer terrace at Bubi
- Relocation of existing Explosives Magazines at Isabella and Bubi,
- Brake test ramp for the Contractor's Laydown terrace
- Mine Village and Administration building layout
- Sewer reticulation and Wastewater Treatment Works for the Plant, Administration and Village
- Fire and Potable water reticulation for the Plant, Administration and Village
- Stormwater channels for the Plant, Administration and Village
- Process Water Dam at the Plant
- PDC, provided for the Plant and Administration, as well as the Contractors Laydown terrace

Only the terraces, major roads and pipelines were modelled. Estimations for the remaining Works were done and necessary allowances were provided for in the BoQ.

18.3.2 General Design and Measurement Development Methodology

18.3.2.1 General Design and Measurement Methodology

The general approach adopted was to design / measure and quantify elements, identified as major capital expenses, from the compiled infrastructure layout drawings, and to make the necessary estimation and allowances for the balance of items.

18.3.2.2 Design and Measurement Inputs

The following documents provided the basis for the design and measurement:

- Developed Block Plan (Drawing Number: 0257-IH-3-000-00030),
- Engineering Design Criteria (Document Number: JZWEBR6013-CIV-DC-0024)

18.3.3 Project Specific Design and Measurement Development Methodology

18.3.3.1 Civil Works

Civil works were measured using identical elements from previous projects and general arrangement drawings used on similar previous projects.

Civils works measured and costed include the following major areas:

- RoM tip
- Primary Crusher
- Secondary Crusher
- Screening building
- Transfer Towers
- Floatation Concentrates Thickener
- Cooling Towers
- Neutralization Tanks
- Reactors
- BIOX® Area
- Flotation
- Reagents Area
- Gold Room
- Leaching Area
- Mill Structure

- Tailing's area
- Conveyors
- Water reticulation
- Sewer reticulation
- Buildings

18.3.3.2 Bulk Earthworks

The bulk earthworks for the following terraces were modelled and quantified:

- Plant Terrace
- RoM Tip and Blending Platform
- Substation Terrace
- Lime Terrace
- Contractor's Laydown Terrace at Isabella
- Mine Village and Administration terraces
- RoM Transfer Terrace at Bubi
- Explosive Magazine Terraces at Isabella and Bubi

Terrace slopes follow the natural ground level where possible to minimise the amount of fill material required. Terraces are to be raised at least 150 mm above Natural Ground Level (NGL) with a minimum 1:150 fall to ensure that the terraces are free draining. A maximum batter slope of 1:2 in the cut and fill scenarios was used.

The layer works for all the above-mentioned terraces, except the Contractors Laydown terrace, shall be for operational terraces only. This entails layer works to provide a terrace platform with gravel wearing course layer. Terraces would be constructed by removing 150 mm topsoil, ripping and re-compacting 150 mm of in-situ material followed by backfilling and further filling in 150 mm G7 layers, compacted to 93% Mod AASHTO, up to the G5 wearing course layer which should form the final terrace level. It was assumed that all buildings and heavy structures shall be founded using restricted excavations.

Layer works for the Contractors Laydown terrace was based on the layer works requirements of the CAT 773G mining haul road identified as the design vehicle.

18.3.3.3 Roads

The roads that were designed and measured were as follows:

- Haul road between Isabella and Bubi
- Service roads to PCDs, TSF and relocated explosive magazines
- Re-alignment of a public gravel road around the McCays extension
- Internal Plant roads

For the roads that were selected for costing, bulk earthworks quantities and allowances were generated.

No Geotechnical Investigation Report were made available for the haul road between Isabella and Bubi and this will be done during the operational phase of the project. To complete the pavement designs for the various roads it was assumed that the in-situ material contained G10 characteristics, which would provide a CBR of 2 when material is recompacted to 93% Mod. AASHTO.

Existing road alignments were utilized for the proposed roads where possible.

18.3.3.3.1 Isabella Plant and Bubi Haul Road

The proposed haul road would provide access from Bubi to the Isabella Process Plant and is approximately 26 km in length.

Bell B40E ADTs were selected as the preferred haul truck. The width of the haul road was determined using the design criteria of 3.5 times the truck width for two-way traffic along straight road sections. This resulted in a 13,0 m wide haul road, consisting of two lanes each 6,5 m wide. A road cross fall of 3% was provided with road edges being a minimum of 300 mm above NGL to assist with stormwater drainage.

Layer works were designed based on the B40E ADT corresponding wheel loads, resulting in the layer works cross section indicated on drawing 02576-IH-2000-00036.

Available survey information provided for the haul road route did not cover the proposed route's full extent. Topography information from InfraWorks had to be used to generate a complete terrain surface which could be used for modelling the haul road. Detailed design and measurements for build will be conducted during the operational phase of the project.

18.3.3.3.2 Internal Mining Haul Roads - Isabella / McCays and Bubi

Internal mining haul roads (± 21 km) will be designed and constructed by the Mining Contractor.

18.3.3.3.3 Mine Access and Service Roads

Mine access and service roads included roads to the Plant, Administration and Mine Village terraces, Bus Shelters, Lime stockpile terrace, Substation terrace, existing mine infrastructure, internal Administration and Mine Village roads, as well as access to the Sulphuric Acid and Lime Mix and Storage facilities at the Plant, PCD, Tailings RWD and Explosive Magazines.

The road widths provided ranged from 4,0 m to 8,0 m, with each road having two lanes. The roads all have a cross fall of 3% with road edges being a minimum of 300 mm above NGL to assist with stormwater drainage.

No anticipated traffic volumes or specified design vehicle was provided for these roads. The pavement design was based on the maximum allowable axle loading of 90 kN.

18.3.3.3.4 Re-alignment of Public Gravel Road

An existing gravel road currently intersecting with the proposed McCays mining site will need to be realigned outside the Bilboes mining claims. This would require approximately 7,6 km of gravel road to be constructed. A 10,0 m wide roadway was provided, which consists of two lanes, each 3,5 m wide, with 1,5 m wide gravel shoulders on either side. A road cross fall of 3% was provided with road edges being a minimum of 300 mm above NGL to assist with stormwater drainage.

No anticipated traffic volumes or specified design vehicle was provided for this road. The pavement design was based on the maximum allowable axle loading of 90 kN.

18.3.3.3.5 Internal Plant Roads

The internal plant roads will be 6 m wide and gravelled. A 150 mm wearing course layer shall be provided above the final terrace level. The roads shall be sloped so that storm water run-off and wash-down water are diverted in the direction of the storm-water channels. Provision for parking areas were made within the plant terraced areas.

18.3.3.3.6 Stormwater Management

Minimal allowances for earth shaped drains and stormwater culvert crossings along the various roads were made. No detail analyses of any drains or culvert crossings were done. Clean water cut off berms in and around the mining site were assumed to be constructed from stripped topsoil. Major culvert crossings were allowed for at Bubi's stream / river crossing.

18.3.3.4 Dams

The PCDs located on the Plant terrace was modelled and quantified based on the 10,400 m³ capacity indicated on the Mechanical plant layout.

PCDs were provided for the combined Plant and Administration building terraces and Contractors Laydown terrace.

Estimated catchment areas were determined in conjunction with proposed roads and dirty water channels. The resulting runoff from these areas and required PCD size were determined based on the following criteria:

- Storm Duration : 24 hours
- Annual Exceedance Probability : 1:50 years
- Design Rainfall Depth : 120 mm
- Average Runoff Factor : 60%
- Water height of 4,0 m for the Plant / Admin PCD and 3,7 m for the Contractor Laydown PCD

The resulting PCD volumes, included 800mm freeboard are as follows:

- Plant and Administration PCD : 51,875 m³
- Contractor Laydown PCD : 11,760 m³

The PCD sizing accommodates for the storage and freeboard requirements only and assumes that sediment settling will occur primarily in a silt trap. No silt traps, inlets and overflows structures, or sump pump cabin structures were designed.

18.3.3.5 Raw Water Pipeline

Raw water shall be provided via a pumped rising main from an envisaged wellfield in the vicinity of the Isabell Makokoba Village, south-west of Isabella. No information regarding the wellfield, such as average daily yield and borehole depths, were available.

A design flow rate of 7,200 m³/day for the pipeline was allowed for. The resulting rising main shall be a buried 280 mm diameter, HDPE, PE100, PN16 pipeline. The design battery limit was assumed at the provided pump, boosting the supply from the wellfields up to the Process Water Dam inlet at the Plant.

Allowances for air and scour valves, couplings, fittings, welds, thrust and anchor blocks along the pipelines were made.

18.3.3.6 Tailings Storage Facility Complex

The TSF Complex consists of the following:

- TSF for normal tailings
- BIOX® tailings area
- Two RWDs

A significant amount of detail design was completed by the TSF designers. This design formed the basis of the BoQ for the TSF Complex.

18.3.3.7 TSF Return Water Pipelines

The process plant water dam will be fed from two return water pipelines from the TSF, at a design flow rate of 3,600 m³/day per pipeline was provided by the Project Engineer. The resulting rising mains shall be buried 180 mm diameter, HDPE, PE100, PN8. The design battery limit was assumed at the provided pumps at each return dam, up to the Process Water Dam inlet at the Plant. No pipework, fittings or specials were allowed for downstream of the pumps.

Allowances for pumps, air- and scour valves, couplings, fittings, welds, thrust and anchor blocks along the pipelines were made. No allowances were made for any Civils associated with the pump house or Process Water Dam inlets.

18.3.3.8 Services

18.3.3.8.1 Potable Water

Potable water reticulation networks were indicated for the Plant, Administration and Mine Village. Supply to the above-mentioned areas was assumed to be from the water treatment plant and storage tank provided at the Plant. An allowance for a pumped rising main supplying storage tank located at both the Administration and Mine Village terraces was provided.

Due to the limited site information, only a bulk rising main was modelled and estimations and assumptions regarding the pipe sizes and classes required for the internal reticulation networks were made.

A design flow rate of 8.3 l/s was used for supplying the Administration Block and Mine Village. This was based on 300 people, each with a demand of 200 l/p/d. The resulting rising main line was a combination of buried 200 mm, 180 mm and 110 mm diameter, HDPE, PE100, PN16 pipes. The design battery limit was assumed as the provided pump, up to the

storage tanks at each terrace. No pipework, fittings or specials were allowed for downstream of the pumps. No storage tanks and associated civils were allowed for at terraces.

Allowances for valves, couplings, fittings, welds, thrust and anchor blocks along the networks were made.

18.3.3.8.2 Sewer Reticulation

Run-off from ablutions and buildings at the Plant and Administration terraces will discharge into a gravity sewer reticulation network connecting all buildings to a wastewater treatment plant, located West of the Plant terrace. Due to the distance from the Mine Village to the wastewater treatment plant provided above, a conservancy tank was allowed for the village which would require periodic emptying.

A 50 m buffer distance was established between the wastewater treatment plant and conservancy tank to the terraces in their immediate proximity.

Sewer networks have not been modelled. However, estimations and assumptions regarding the various pipe sizes required were made. Some of the design parameters used for the estimations were:

- Sewers designed to gravitate naturally towards sewerage treatment plant or conservancy tank
- Sewers to have a minimum self-cleansing velocity of 0.7 m/s
- Minimum pipe diameter shall be 110 mm
- Sewer pipes shall be uPVC heavy duty class 34
- Precast concrete ring sewer manholes to be installed at all changes in direction and at distances not exceeding 60 m
- One erf connection provided for each building identified

The wastewater treatment plant and the conservancy tank were not designed or sized, and the necessary allowances for these items would need to be made by the Project Engineer or Quantity Surveyor.

18.3.3.8.3 Stormwater Networks

Stormwater channel networks were provided for the Plant, Administration and Mine Village. A dirty (contaminated) - clean (non-contaminated) design philosophy was adopted.

The clean water system is run-off water occurring outside the plant area i.e., not affected by plant process or mining activities and includes run-off generated from the Mine Village terrace. This water will be controlled and drained naturally into the environment. The dirty water system is run-off or wash-down water falling within the Plant and mining areas which becomes contaminated with various deleterious materials from process operations or mining activities. This system includes run-off generated from the Plant and Administration terraces. The dirty water will be controlled and drained into the provided PCDs via a channelled system.

An estimated 6.0 km long network of concrete lined v-drains or trapezoidal channels were provided for the Plant, Administration and Mine Village. Approximately 16 stormwater culvert crossings were provided for the Plant Terrace, with additional culvert crossing allowances being made underneath access road to and inside the Mine Village and Administration blocks.

Note: that only pipe lengths for stormwater crossings were provided for and that all associated structures (headwalls, wingwalls, etc.) and reinforcement would need to be allowed for based on typical surveying allowances.

The detailed stormwater analysis and network modelling for the site will need to be done as part of the next project phase to determine accurate sizing of channels and culverts, tie-in levels of networks and the subsequent pollution control inlet depths required.

18.3.3.8.4 Fire Water Reticulation

A fire water reticulation network was provided for the Plant terrace only and is an indicative layout for quantity purposes only. The fire water reticulation network would need to be designed and signed off by a Fire Consultant. No separate fire reticulation network has been allowed for at the Administration or Mine Village. The potable water networks for each, including their storage tanks, would need to be designed and sized to accommodate the required fire flows at each terrace. Estimations and assumptions regarding the various pipe sizes and classes were made. Design parameters used for the estimations are detailed below:

- The fire water will be pumped from the raw water tank east of the Plant Process Water Dam
- Hydrants are located at a maximum of 100 m apart with a maximum reach of 50 m each
- Hydrants shall be gun metal 80 mm BSP x 65 mm
- Isolation valves are provided in the reticulation network

- Reticulation network design is based on peak flows which occur when a certain number of hydrants operate simultaneously during an emergency
- Fire water supply pipes shall be HDPE PE100 PN12.5

Allowances for valves, couplings, fittings, welds, thrust and anchor blocks along the PCD sizing accommodates for the storage and freeboard requirements only and assumes that sediment settling will occur primarily in the silt trap. No silt traps, inlets and overflows structures, or sump pump cabin structures were designed.

- All associated stormwater crossings structures (headwalls, wingwalls, etc.) and reinforcement required
- All Buildings and Structures, including their civils
- Services to / from the mining laydown terraces at Isabella and Bubi

18.3.4 Assumptions

The following assumptions were made in the measurements:

- Removal of topsoil shall be 150 mm thick
- 10% of bulk excavation assumed as intermediate excavation, 5% hard rock excavation
- No overhaul on material was allowed for assumed that all material could be obtained or spoiled within 2 km free haul distance. If not the case, Project Engineer to make necessary allowances
- Functional terraces provided only, which mean a terrace platform allowing stormwater drainage. Layer works shall be G7 fill, above 150 mm topsoil strip, up to G5 capping layer to form terrace platform
- Allowances for isolation, air valves and scours along the raw water pipelines were made based on the topography; no detailed analysis of valve placement was completed
- All heavy structures would be founded conventionally, with light buildings having restricted excavation below them with engineered soil mattress (no allowances)
- The Mean Annual Precipitation (MAP) for Bulawayo was adopted.
- A combined PCD for the Plant and Administration terrace was provided for a separate PCD would be required for the Contractor’s Laydown terrace and surrounding area
- PCD volumes and dimensions are for storage requirements only and assumes that sediment settling will occur primarily in the silt trap
- Utilizing existing Explosives Magazine sites for Nitrate Storage

Clean water cut off berms in and around the mining site were assumed to be constructed from stripped topsoil instead of storing material.

18.4 Mechanical Engineering

18.4.1 Engineering Design Criteria Applied

The mechanical design criteria cover the process plant and mining related equipment and is based on established technology and practices in the gold mining and processing industry.

In general, equipment shall be designed:

- "Fit for purpose", to perform duties specified in the process design criteria and under conditions prevailing at the site of the works
- For safe operation, inspection, maintenance, cleaning, and repair
- For a cost-effective operation (reliable, efficient, low initial and operating cost)

18.4.2 Basis of Mechanical Designs

Engineering aspects will be developed and optimised for clear definition of scope for the project. Mechanical equipment design shall be based on application of established technology and practices in the gold mining and processing industry. Equipment will be designed and selected on a "fit for purpose" basis, to carry out required duties over life of mine period.

Mining and process plant equipment and infrastructure will be designed for "LoM", of. approximately 15 years.

Mechanized and automated methods shall be implemented where there is clear contribution to a safer, more productive, and less labour-intensive environment.

Total life cycle costing of equipment and processes over "LoM" shall be considered during design and equipment selection phase.

Engineering design will endeavour to address outcomes of risk assessments and HAZOP studies. Resulting designs, selected equipment and processes shall be safe for operating and maintenance by personnel and shall be eco-friendly.

Value improving initiatives will be undertaken through application of practical value engineering techniques and the philosophy of standardisation and rationalisation of equipment (to reduce spares holding requirements). Design to capacity and process simplification will be applied where possible.

Conveyor equipment shall be designed in accordance with requirements detailed in Conveyor Design Criteria. Conveyor design standards and recommendations issued by the Conveyor Equipment Manufacturers Association (CEMA USA) and ISO 5048 requirements shall be used as guidelines.

Engineering designs, materials supplied, and construction shall comply with the latest edition, including all amendments, of National Acts, Provincial Ordinances and Acts, Municipal Byelaws, environmental, safety and licensing laws and any other laws, regulations, directions, permissions, and other requirements which are applicable to the works, as amended from time to time.

Zimbabwean Acts and Regulations i.e., Mines and Mineral Act (Chapter 165), Mining (Management and Safety) Regulations, Factories and Works Act, Chapter 14:08 of 1996, Statutory Instrument 109 of 1990 and Mining (Health and Sanitation) Regulations and Statutory Instrument 182 of 1995 will be applied during the design process.

18.4.3 Mechanical Equipment Sourcing and OEMs

Service factors for all equipment shall meet or exceed the design service factor based on the specified duty point.

Unless otherwise specified in the technical specification, material of construction shall be as recommended by the vendor, shall be new and in accordance with the relevant national or international standards.

Only equipment with proven service in similar applications shall be considered.

Mechanical equipment will be sourced from reputable international suppliers with a proven track record and approved by the Client.

Only the use of experienced suppliers for the supply of the large agitators in the BIOX® plant sections will be considered.

18.4.4 Mechanical Issues of Importance

Although the expected LoM is not extremely long, specific attention should be given to the materials of construction as well as the corrosion protection of equipment and structures. Extreme corrosion can be expected in the BIOX® plant sections as well as the elution and reagent areas. Adherence to the prescribed corrosion protection specifications in these areas is critical and no lower grade alternatives should be considered as this will result in early failure.

Stainless steel (316 L), duplex stainless steel (LDX 2101) and fibre grating have been specified for certain areas and applications. Quality control on these items is of critical importance specifically if fabricated on site.

Only the use of experienced suppliers for the supply of the large agitators in the BIOX® plant sections will be considered.

18.5 Electrical Power Supply and Reticulation (including Communications)

18.5.1 Interconnection to National Grid

Power will be supplied from the Zimbabwe National Grid by constructing a 70 km 132 kV Lynx line from Shangani Substation. To feed the line, a line bay will be constructed at Shangani. A mine substation will be constructed at Isabella. The estimate received is for a 132-kV substation, equipped with a 50 MVA 132 / 33 kV step-down transformer.

During detail design it should be considered to reduce the secondary voltage to 11 kV to enable the MV motors to be fed directly without an additional 33 / 11 kV transformer. The 1.5 MVA required by Bubi can also be supplied at 11 kV.

Power factor correction will be done with 11 kV capacitors.

Interfaces with other designs occur at the following battery limits:

- Zimbabwe Electricity Transmission and Distribution Company (ZETDC)
- 132 kV Substation

The bulk electricity supply for the project is being planned to cater for a production rate of 508 tph RoM. This corresponds to an electrical load of up to 34 MVA.

18.5.2 Basis of Design

The MEL was used as the basis to calculate the power required to operate the mining works envisaged. Two factors (Diversity and Utilization) are applied to the kilowatt value provided within the MEL. The Diversity Factor is a measure of the probability that a piece of equipment will be turned “ON” during the operation of the plant. Therefore, the diversity factor for equipment required to operate the mine is set at 100%. Equipment that is utilised as spare or standby, therefore, has a factor of 0% assigned for sump pumps a factor of 10% was applied.

The Utilization Factor is the ratio of the maximum load which could be drawn to the rated capacity of the specified equipment. The factors applied, are factors that have evolved from previous project experiences. The factors used for the DFS are as follows:

Table 18-7: Utilization and Diversity Factors

Equipment	Utilization Factor	Diversity Factor
Pumps	70%	
Mills	80%	
Float cells	80%	
Conveyors	60%	
Sump pumps	70%	10%
Screens	70%	
Feeders	70%	
Crushers	60%	
Hoists and Cranes	50%	
Standby (All Equipment)	0%	0%

All equipment is specified to meet at least the following conditions:

Table 18-8: Design Conditions

Description	
Lightning strike incidence:	High
Plant availability:	95%
The voltages used are:	ZETDC supply 132 kV three phase 50 Hz 11 kV for medium voltage reticulation 11 kV for motors above 1,000 kW * 525 V for motors up to 400 kW * 400 V for welding supplies 230 V for single phase socket outlets. Digital 24 Vdc Instrument supply 110 Vac Analogue 4-20 mA (2-wire)

* Motors between 400 kW and 1,000 kW will be assessed on an individual basis, depending on type, location, and application.

18.5.3 Power Requirements

The connected and anticipated running power demand of the mine and plant can be seen in Table 18-9 which compares the installed and anticipated running power and lists the estimated running maximum demand.

Table 18-9: Substation Loading

	Installed Power (kW)	Run Power (kW)	Estimated Maximum Demand (kVA)
Mills and other 11 kV motors	22,360	18,836	19,220

	Installed Power (kW)	Run Power (kW)	Estimated Maximum Demand (kVA)
Plant LV Load	18 960	13 858	14,146
Infrastructure	1,700	1,700	2,205
Total	**43,020**	**34,394**	**35 571**

18.5.4 Emergency Power

Four 2.5 MVA emergency power generator sets will be installed and connected to the 11 kV consumer substation. Emergency power is reticulated to downstream substations at 11 kV, where it is distributed to the MCCs.

18.5.5 MV Distribution

Reticulation through the plant is done at 11 kV with cables preferably running along structurers. Power distribution would be via 2,000 kVA 11 kV / 550 V distribution transformers for all process related equipment 11 kV / 400 V mini substations for all infrastructure and maintenance related equipment.

18.5.6 Power Factor Correction

In the ideal situation, equipment would consume all the power drawn from the main supply. However, this is not the case, and harmonic currents and possibly spurious voltages are introduced into the primary power network. Harmonics can damage cabling and equipment connected to this network. Electric motors have poor power factor as they draw current out of phase with the supply voltage. Power factor correction is therefore applied to create an almost unity power factor for the total load connected to the supply to reduce these harmful non-linear characteristics.

The main Consumer Substations is a single bus as there is no benefit in a sectioned or double busbar system if there is only a single supply. The generators and power factor correction will also be connected to the main consumer substation.

18.5.7 Motor Control Centres

Motor Control Centres (MCCs) are included in the design to allow for control of drives and supply of 525 V power to the motors installed in the plant.

There is a total of 13 MCCs throughout the plant area.

Key points of the design philosophy adopted include:

- The transformers were sized to allow for 15% spare capacity

- The MCCs were designed allowing for a spare capacity of 20%
- The study allows for forward and reverse switching incomers for the flotation cells
- All safety circuits i.e., E-stops and pull switches will be hard wired to the MCC bucket
- In the case of dual motor screens each motor is fed with its own independent cable

Cooling of the MCC is required and a cost provision was made for fans and air conditioners in the MCCs buildings. The HVAC system for the MCCs will comprise of split unit air conditioners and pressurization fans to prevent ingress of dust.

A fault level of 50 kA on the 525 V network was calculated for the Distribution Transformers. This is based on a 2,000-kVA transformer with an impedance of 5%.

A fault level of 25 kA on the 400 V Lighting Distribution network, was calculated for the Lighting Transformers. This was based on a 630 KVA transformer with an impedance of 4.5%.

The required motor sizes and loads were obtained from the MEL.

18.5.8 Earthing and Lightning Protection

No earthing design was done. A cost provision was made for the earthing installation based on the evaluation of plants of similar size.

The requirement for the earthing system for the project is a reading of 10 Ω or better for lightning protection and 1Ω or better for the electrical substation area.

Earthing will be done by a combination of earth rods, trench earth and, if needed, earth electrodes to achieve the required resistance to earth.

The 11 kV Reticulation earth fault capacity will be determined by the neutral earthing arrangements for the main supply transformer (typically 355 A).

Star points of 11 kV / 525 Volt distribution transformers will be connected to earth via a 33 Ω Neutral Earthing Resistors.

The detail engineering can be done once an earth resistance test of the soil conditions at the site has been completed.

18.5.9 LV Motors

All electric motors are to be supplied as per the Electrical Design Criteria and Motor Specification.

Generally, motors will be designed to IEC 60034, for continuous duty class S1. Insulation will be Class H. Temperature rise will be limited to 80 °C (Class B). Enclosures will be IP 55. All motors are to be specified for variable frequency invertor supplied duties.

All motors ≤ 400 kW will be rated 525 V. Motors >400 kW <1,000 kW shall be supplied at either 525 V or 11 kV as per the engineer's discretion. Motors >1,000 kW will be supplied at 11 kV. Motors sizes were specified according to the mechanical equipment list.

For motors supplied by Variable Speed Drive (VSD) from a dedicated converter transformer, the motor voltage was selected for the most economic transformer drive motor combination.

Mill motors are specified as slip ring induction motors with Liquid Resistance Starters.

18.5.10 Substation Buildings and Transformers Enclosures

The substation buildings are of the raised floor brick type to house either the MV switchgear or MCCs. Each building will contain an HVAC unit to transfer the heat load out of the building and to keep a positive pressure within the building. Fire detection has been allowed for each MV building and MCC.

Single transformers have been provided with a surrounding fence, but no firewalls were provided for transformers not immediately adjacent to other buildings. Where the transformer is adjacent to a building, a firewall will only be provided on the side adjacent to the building. Where two or more transformers are located together, firewalls have been provided between the transformers. Transformer bays have been provided with a pad lockable gate.

18.5.11 Fire Protection

An allowance has been made to install fire detection systems in the substation and MCC buildings.

18.5.12 Racking and Steelwork

In the plant area cables will be run on vertically mounted hot dip galvanized mild steel cable racks. Cable racks were sized to provide a minimum of 20% spare capacity after design. Separate electrical and instrumentation cable racks were allowed for.

Cables outside the plant area will be buried within dedicated cable trenches. Cognizance of cable theft was considered. Racking and steelwork are factored based on cable quantities using historical data. Costs are included in the E&I installation BoQ.

18.5.13 Cables

XLPE 6.35 / 11 kV individual screened copper conductor Type A XLPE/PVC/SWA/PVC cable to SANS 1339 will be used for the medium voltage reticulation.

Copper conductor PVC/PVC/SWA/PVC 600 to 1,000 volts cable SANS 1507 and SANS 1574 will be used for low voltage reticulation. Standard “red stripe” cable is to be utilized for surface installations. Power cables shall have four cores, the fourth core being utilized as an effective earth between the equipment (e.g., motor) and the substation earth bar. AC cables were sized for a 5% voltage drop during full load running conditions. Cables were not de-rated by more than a factor of 0.8.

MV and LV cable lengths were estimated from the envisaged block plan.

18.5.14 Lighting and Small Power

- Illumination General

  Lighting has been allowed for in all general plant areas. Conveyors will have lighting along the walkways, at the head, tail end, drive, and transfer points. General area lighting for non-plant and mining areas will be allowed for separately via high-mast general area lighting.

- Fittings - General

  Plant lighting including emergency lighting has been provided using energy efficient LED light fittings. Bulkheads and floodlights are to be used to achieve illumination levels as required by the Machinery and Occupational Safety Act and SANS 10114.

Typical values are:

- Change Rooms : 200 Lux
- Plant : 160 Lux
- Control Rooms : 300 Lux
- Outdoor Areas - General : 15 Lux
- Catwalks, stairways : 20 Lux
- Conveyors : 10 Lux
- Substations : 200 Lux
- Substation Yards : 15 Lux
- Offices : 500 Lux
- Workshops : 300 Lux

All light fittings will be positioned for ease of access from a step ladder for maintenance purposes. No security lighting along any perimeter fences, general areas, roadways, and crossings has been allowed for.

18.5.15 Control and Instrumentation

Instrumentation take-offs were derived from the available PFDs, MEL and Load List based on principles utilized in similar plants and In-line with the specifications outlined in the EDC.

The detail and requirements of valves and inline / piping instrumentation quantities were discussed in detail together with the Process Engineer to create an accurate BoQs.

A combination of intelligent and conventional types of instrumentation will be used. The instruments will be wired to a ProfiNet Fieldbus network. The vendor packaged instrumentation (where applicable) will be wired to ProfiNet based or AS-I Master panels and Remote I/O Panels.

Equipment enclosures shall be manufactured from Stainless Steel (304 SS) or Polycarbonate, depending on the application.

18.5.16 PLC Allowance

The Control System (CS) design was based on Siemens WinCC Runtime Professional Supervisory Control and Data Acquisition (SCADA) System with S7-1518 range of Programmable Logic Controllers (PLCs). The main PLCs will be centrally located in the Engineering Rooms except for the dedicated substation monitoring PLCs.

18.5.17 SCADA Control System

The plant will be controlled by a suitably configured PLC / SCADA Control System linked to a Central Control Room, equipped with comprehensive SCADA workstations.

All aspects of the concentrator Plant will be monitored and controlled from the CS.

Field mounted “Start” buttons will only be enabled in maintenance mode, and the “Stop” button always enabled. Interlocking is implemented in the PLC. Drives cannot run without a functional PLC unless specially configured.

18.5.18 Level of Automation

The automation design will be in accordance with the plant PIDs. Equipment selection will be in accordance with the project approved vendors list. All the motors will be equipped with Start / Stop stations which will communicate with the CS via the ProfiNet control network.

The CS will fully control and monitor all control and visualization functions of the plant including:

- Motor Control
- Valve Control
- Safety and Process Interlocking
- Analog Range and Limit Monitoring
- PID Control Loops
- Sequential Start-up and Shutdown Sequences
- Fire Suppression and Alarming

18.5.19 Process Network Communication

The backbone for the CS communication is based on a redundant ring optic fibre network. This communication will be used to support all critical CS data communication requirements for the Project.

18.5.20 Solar Plant

It was requested that the possibility of using alternative power also be investigated. The only feasible alternative energy source is solar.

The plant load was estimated to be about 34 MW and this value was used as the base case study as per Appendices, Chapter 29, ECI Information. Typical solar plant efficiency is about 84 %. The required installation would therefore be around 40,500 kWp.

Budget cost for the construction of a solar plant is US$ 850 / kWp. The indicative cost for a solar plant to feed the plant 7 hours per day would be USD 34,425,000.

An indicative maintenance cost of a solar plant is US$ 16.00 per kWp per annum. Indicative maintenance cost for a 40,500 kWp plant would be US$ 648,000 per annum.

The indicative cost for grid power is US$ 0.0986 / kWh. The indicative potential saving if grid power is not used for 34 MW, 7 hours per day for 365 days would be US$ 8,565,382 – US$ 648,000 = US$ 7,917,382.

To supply the plant, a 70 km, 132 kV Lynx line, capable of 118 MVA would be built from Shangani Substation and a 50 MVA step-down transformers and associated equipment installed.

It is therefore potentially possible to feed 50 MVA back into the grid. The required solar plant would be 60,000 kWp. At US$ 850 / kWp, the indicative cost for the plant would be US$ 51,000,000. Maintenance cost is estimated to be US$ 960,000 per annum.

In 365 days, 7 hour per day the plant will generate 125,195,000 kWh and the indicative sell price is US$ 0.08 / kWh. Potential income is US$ 10,015,600 – US$ 960,000 = US$ 9,055,600.

The cost of a solar plant to feed the mine and deliver 50 MVA to the grid will be 100,500 kWp x US$ 850 = US$ 85,425,000. Maintenance cost will be 100,500 kWp x US$ 16 = US$ 1,608,000 per annum

The indicative estimate is that the 100,500 kWp solar plant will require more than 100 hectares to construct.

The potential solar plant warrants a further detail study to confirm the indicative values.

18.6 General Infrastructure

Table 18-10 lists the building infrastructure that was allowed for in the FS.

Table 18-10: Building Infrastructure

Building	Type	Size (m^2)
Security and Access Control	Prefabricated building	170
Admin Building	A prefabricated building. Office furniture has been included in the square meter rate.	430
Plant Laboratory	A prefabricated building. Typical laboratory equipment has been included in the square meter rate.	540
Control Room	Prefabricated building	170
Changehouse/s	Prefabricated building/s	325
Stores	Two conventionally constructed buildings (brick and mortar)	220 and 100
General Workshop	A conventional constructed building (brick and mortar)	520
Crusher Workshop	Conventional constructed building (brick and mortar)	270
Electrowinning and Gold Room	Conventional constructed building (brick and mortar)	220
Crusher MCC	Prefabricated building	302
CIL MCCs	Prefabricated buildings	253
Floatation MCC	Prefabricated building	65
Substation	Prefabricated building	351
Return Water Dam Pumphouses	Two conventionally constructed buildings (brick and mortar)	38

18.6.1.1 Project / Construction Accommodation

Conventionally constructed (brick and mortar) residential units have been allowed for in the FS.

These include:

- Family units
- Single quarters
- Senior single units
- Executive single units
- Recreation centre

18.7 Water Management Infrastructure

18.7.1 Water Balance

18.7.1.1 Legislation and Design Standards

The stormwater collection dams, and the pollution control dams as proposed herein, were designed in compliance with the International Finance Commission (IFC) Environmental, Health and Safety (EHS) Guidelines for Mining (2007), together with the applicable local Zimbabwean Standards.

The IFC guidelines require the following:

- Establish a water balance (including probable climatic events) for the mine and the related process plant circuit and use this to inform the design of the water infrastructure
- Discharges to surface water should, without dilution, meet the IFC Effluent Guidelines (at least 95% of the time that the mine is operating) which should be calculated as a proportion of the annual operating hours

Compliance with the items above is demonstrated through the application of daily time step water balance modelling, where it must be ensured that the dam is only allowed to spill on an annual probability of 5% (i.e., the dam must not spill more than 5% of the days modelled in any given year).

The Zimbabwean administrative and regulatory frameworks and requirements that are pertinent to the hydrology assessments and management of water at the site were identified as follows:

- The Environmental Management Act (Chapter 20:27) which provides the platform for the formation and operation of the Environmental Management Agency (EMA) whose relevant role in the management of environmental quality as applicable to this study will be to ensure compliance with Part IX of the EMA 20:27 where the following applies:
  - Section 57: the mine should ensure that water quality is in line with standards set up in the Environmental Management (Effluents and Solid Waste Disposal) Regulations, 2007 (SI 6 of 2007)
  - Section 58: the duty lies with the mine to supply information on the quantity and quality of any effluent
- The Water Act (Chapter 20:24) which specifically incorporates the legislation around the use and storage of water as follows
  - Section 32 the need to apply for a permit to use water from a public stream, storage works or borehole or use of water
  - Section 45 subsections (4) to (11), a person who intends to conduct operations that will interfere with the banks, bed or course of a public stream, or any marshes, springs, etc, shall apply for a permit from the catchment council to do such activity
  - Section 96 subsection (1), the construction of small dams must be in line with Part IX on dam safety considerations and construction authorisation requirements as outlined in Section 99 to Section 101
- The Water Act Established Catchment Councils with each council responsible for water resource planning, considering applications for water permits and resolving disputes between water permit holders. The Water Act (Chapter 20:24) saw the establishment of the Zimbabwe National Water Authority (ZINWA) through the Zimbabwe National Water Authority Act (Chapter 20:25), an institution responsible for implementation of the Water Act and management of the catchment councils, hence the institution responsible for all water related mine requirements

In addition to the above legislation, the “Guide to Design and Construction of Medium Sized Dams in Zimbabwe” (Ministry of Water Development, 1977), was also consulted for guidance.

To ensure compliance with the Zimbabwean legislation above, Bilboes will undertake the development of a water-monitoring system, the management of water pollution through water quality assessments and the preventing of effluent discharge as part of the water balance and stormwater management plans. In the process, relevant consultation with EMA Matabeleland North provincial offices and the ZINWA Gwayi Catchment Council will be

undertaken for any water related activities such as abstraction of water and dam design and authorisation.

18.7.1.2 Hydrology

The project site falls within the Bembezi river sub-catchment which drains north towards the Zambezi River. The Gwayi catchment largely comprises the Northern Matabeleland area of hydrological zone A.

Daily and monthly rainfall were obtained from the Nkayi station from the Meteorological Services Department of Zimbabwe (MSD-Z) for 38 hydrological years (from 1980 to June 2018) and were analysed to determine the long-term monthly averages, minimum and maximum monthly rainfall. The Mean Annual Precipitation (MAP) is 657.0 mm; the wettest hydrological year saw 53% more rainfall than the MAP and the driest hydrological year saw only 60% of the MAP. The driest period was associated with the drought experienced in the 1990s.

Data from the Nkayi station was adopted as the design data owing to the weather station having an acceptable length of record of monthly rainfall data and being located closest to the site and at a similar altitude.

Ten years of monthly pan evaporation measurements for Bulawayo Goertz were provided by the MSD-Z. A pan coefficient of 0.75 was adopted for the conversion of Epan measurements to a reference evapotranspiration.

The annual maximum rainfall analysis for various duration storm events (from 24 hr up to 7 days) was undertaken on the 38 years of daily rainfall records supplied by the MSD-Z. The Generalized Extreme Value (GEV) distribution was then fitted to the annual maximum series to estimate storm depths for events with an annual probability of occurrence of up to 1:10,000 (0.01%).

18.7.1.3 Design Concepts

In the absence of specific local legislation, a conceptual stormwater management plan was developed in line with regulation GN 704 of the South African National Water Act, 1998 (Act No. 36 of 1998). The requirements of this regulation to which the stormwater infrastructure was designed, can be defined as follows:

- Clean water from the catchments upstream of the mining infrastructure will be diverted around the proposed infrastructure

- Dirty stormwater will be collected on site and reused. Dirty stormwater collected in these channels will be conveyed through silt traps before discharge into PCDs. Sediment will be recovered from silt traps and disposed of appropriately
- Dirty water conveyance infrastructure at the plant was sized for flows from a 1:50 year, 24-hour rainfall event using the SCS (Soil Conservation Services) methodology. GN 704 requires that dirty water containment facilities are designed, constructed, maintained, and operated so that they are not likely to spill into a clean water environment more frequently than once in 50 years.
- GN 704 further requires that as a minimum, capacity to contain the 1:50 year design volume and an additional 0.8 m freeboard, should always be available within the dam

Provision was made for lining of the stormwater channels in critical sections where velocities are too high to prevent erosion or scour. Circular concrete culverts were provided at the road crossings.

A site wide water balance was developed, to estimate the return water, the make-up water and / or the discharge requirements for the proposed infrastructure. This water balance was used to analyse the start-up, midlife, and end of life of mine conditions.

The water circuit was clearly defined together with a collection and water management strategy. The reuse of dirty water will be prioritised thereby reducing the impacts of the project on the surface water resources.

Impacts on the surface water quality and quantity were identified and mitigation measures recommended. Any substances which may potentially pollute surface water should be stored within a suitably sized bunded area and where practicable covered by a roof to prevent contact with rainfall and/or run-off. Additional mitigation measures are recommended as required. A monitoring plan is proposed for the monitoring of the water quality, quantity, and the water management infrastructure.

All measures implemented for the mitigation of impacts, should be regularly reviewed against best practice and in line with compliance requirements of the various licences issued on site by the authorities.

All mitigation and monitoring measures must be implemented for the project to proceed.

18.7.1.4 Steady State Water Balance

A site wide monthly water balance model was developed for the project to establish the following:

- Storage sizes for the proposed dirty water dams / sumps (complex PCDs)
- The average wet, dry season and average monthly water balance

The model focused predominantly on the interaction between rainfall, evaporation, groundwater ingress, mine water demands and make up water, with the aim of developing a water balance control philosophy for the management of water on the mine.

The water balance simulated water re-use associated with the processing plant, as a pump rate out of the PCD for each of the two mining phases as follows:

- Phase 1 – 240 ktpm
- Phase 2 – 180 ktpm

The water balance was simulated for the full record available and then analysed for both the wet and dry seasons.

18.7.1.4.1 Water Balance - Assumptions

The following assumptions concerning the water balance apply:

- It was assumed that the mine operation employs 140 people on a permanent basis and each person would require 150 litres per day
- From the water used per person per day 10% is lost and 10% is taken up in use
  - Operating hours were estimated on the basis of 10 working hours per day and 22 working days per month
- Evaporative losses in the Plant PCD were taken as 10% of the inflows
- Evaporative losses in the WRDs and PCDs were estimated at 20% of the inflows

18.7.1.4.2 Input Parameters

The following input parameters were used in the water balance model:

a) Climatic Data

Rainfall data used in the water balance model were sourced from the Meteorological Services Department of Zimbabwe (MSD-Z). Daily rainfall from 1980 to 2010 and from 2013 to 2018, as well as monthly rainfall records from 1998 to 2018, all obtained from the Nkayi weather station were used for the estimation of design storm intensity.

Monthly evaporation data used in the water balance model were sourced from the MSD-Z from the Bulawayo Goetz evaporation station.

b) Portable Water

It was assumed that the mine operation has 140 people throughout the day and each person would require 150 litres per day.

c) Open Pit Mining Water

- Groundwater - Groundwater inflows in the open pit mining were sourced from the Scoping Report for Isabela McCays and Bubi sites undertaken by SLR Consulting Pty (Ltd) (2018)
- Stormflow - Defined as the run-off response to a specific rainfall event consisting of both surface runoff and sub-surface flow but excluding base flow (delayed subsurface response). This was calculated as the product of daily stormflow depths and the corresponding contributing catchment areas
- Dust Suppression - Dust suppression volumes were provided by DRA
- Mining Water Requirements - Mining Water Requirements were obtained from the Scoping Report for Isabela McCays and Bubi -sites undertaken by SLR -

d) Plant Operations and Services

Operating hours were assumed based on current shifts. Total Process Water Demand values were obtained from the Scoping Report undertaken by SLR. The plant process and raw water values required were acquired from Plant Water Balance conducted by DRA.

e) Tailings Storage Facility

Tailings input into the site-wide water balance included the following information derived from the TSF design by SLR:

Tailings Slurry Characteristics - as tabulated below in Table 18-11.

Table 18-11: Bilboes Tailings Slurry Properties

Description	Value / Property		
Tailing's slurry characteristics	% Solid's concentration, C_w:	Flotation tailings Stream	40% (Supplied by Outotec / DRA)
		BIOX® tailings Stream	20% - 25% (Supplied by Outotec)
	Specific Gravity (SG):	Flotation tailings Stream	2.65 - 2.75 (Supplied by Outotec / DRA)
		BIOX® tailings Stream	2.70 - 2.80 (Supplied by Outotec)

Description	Value / Property		
	Slurry feed relative density	Flotation tailings Stream	1.337 t/m^3 (calculated)
		BIOX® tailings Stream	1.14 t/m^3 (calculated)

Penstock Decant from TSF - these were derived from a high-level run-off model of the TSF surface area considered for each of the two phases of tailings deposition with rates of 240 ktpm and 180 ktpm. The monthly average decant water was then calculated as a function of rainfall, evaporation, lock-up / interstitial water and slurry water.

18.7.1.4.3 Steady State Water Balance Analysis

The water balance results are summarised into monthly average wet and dry season water balances as well as the average monthly water balances.

The wet and dry seasons are represented by the average of January and the average of July results respectively, for the three phases of the LoM.

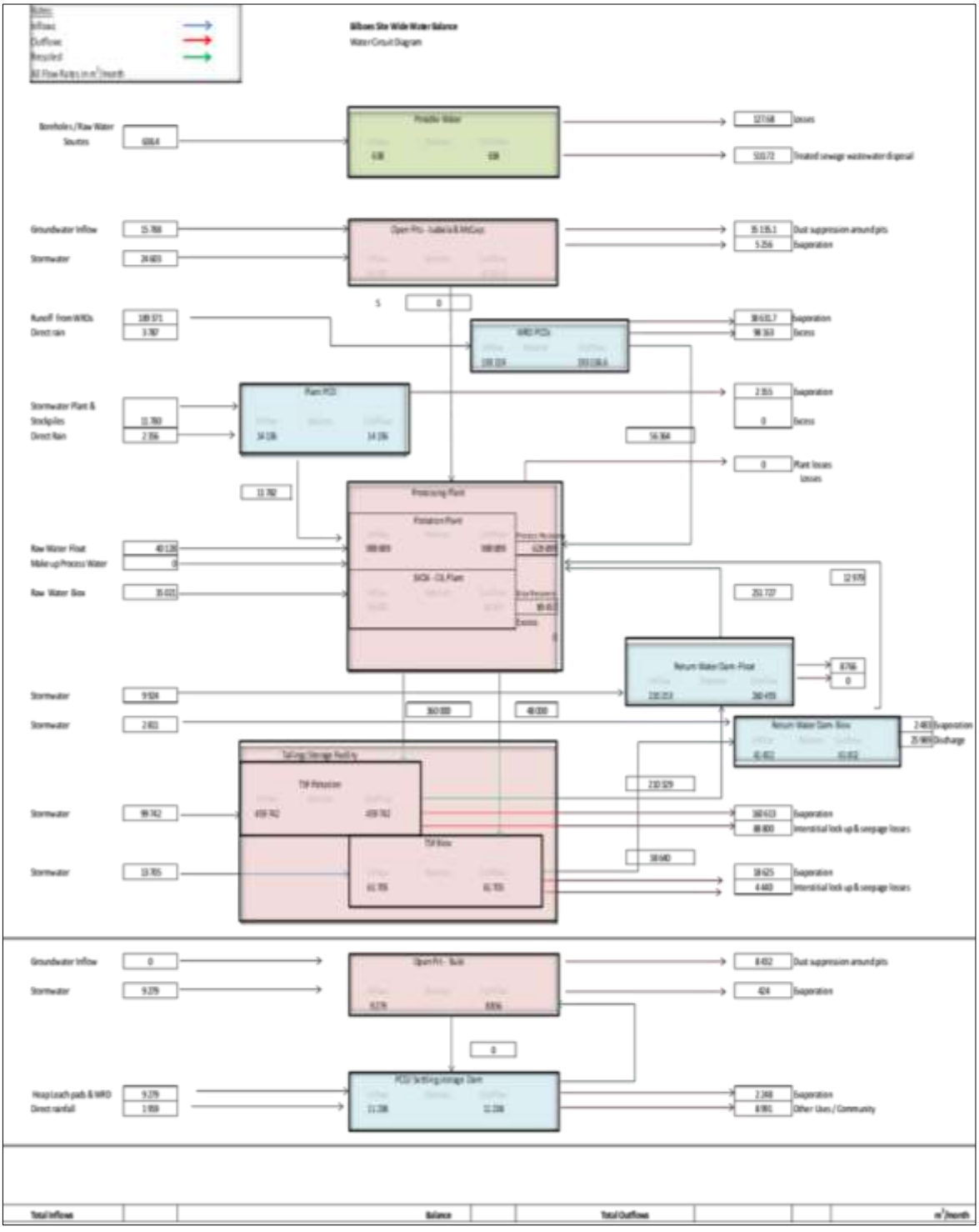


Figure 18-2: Phase 1 Monthly Wet Season Water Balance

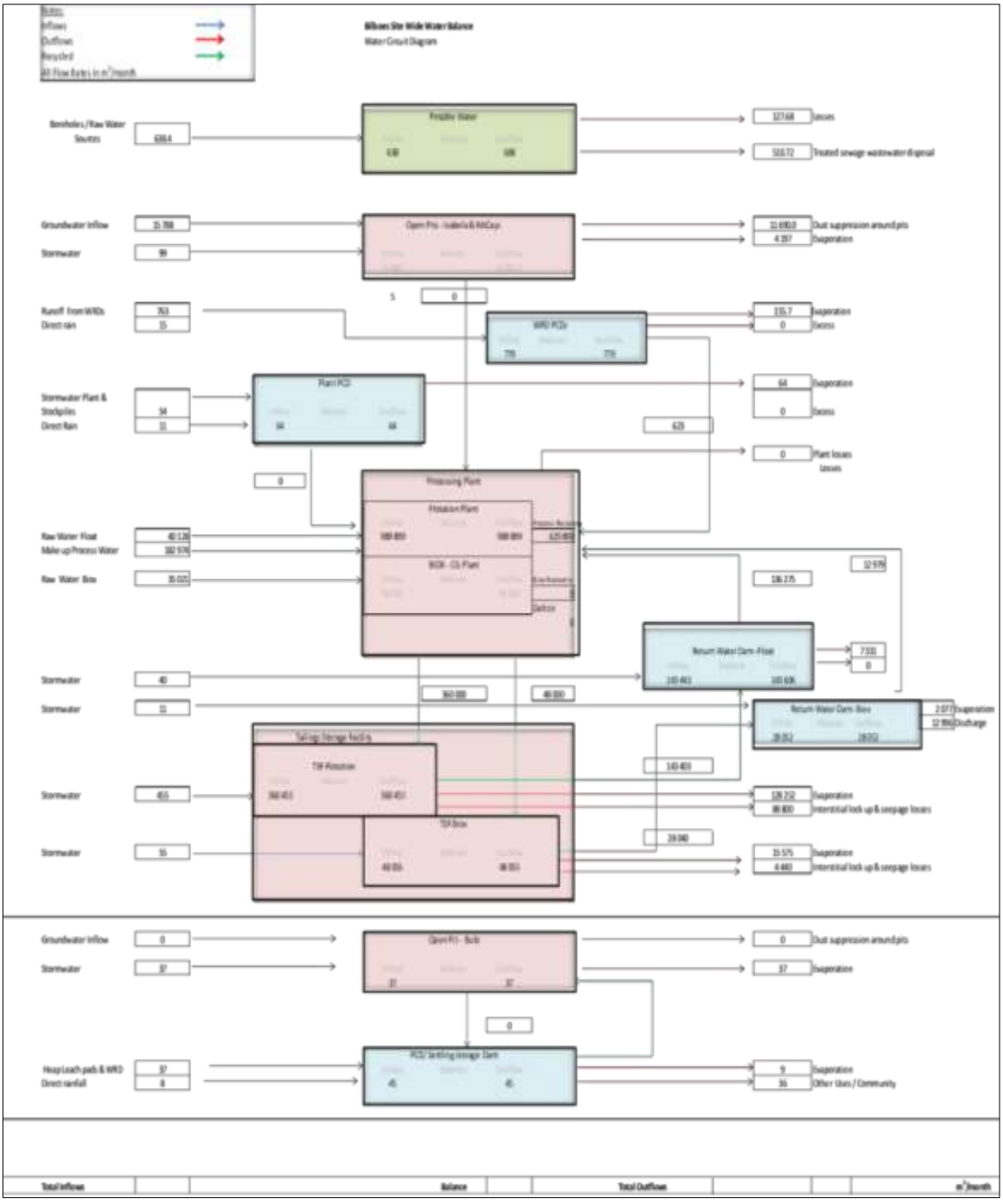


Figure 18-3: Phase 1 Monthly Dry Season Water Balance

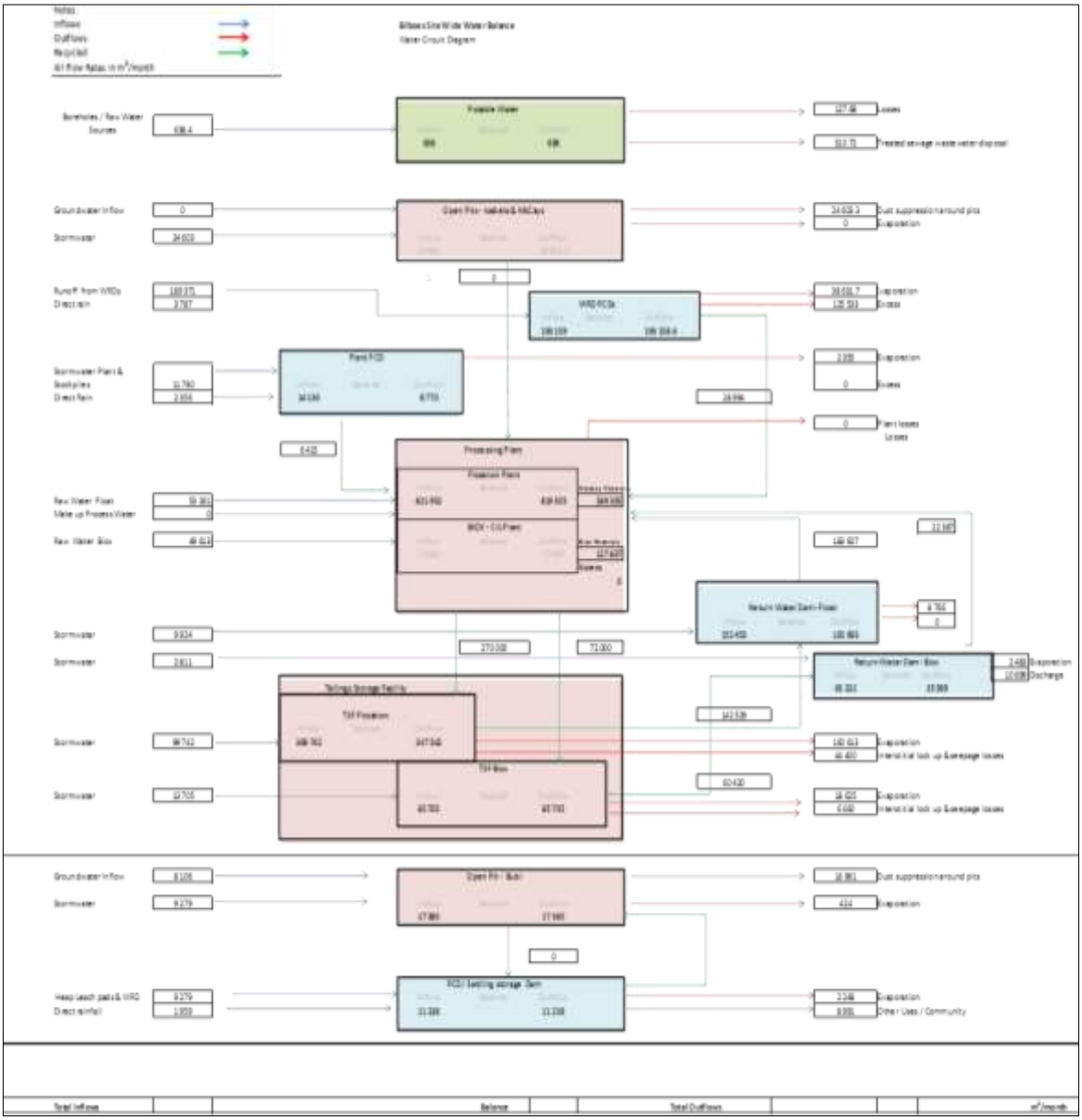


Figure 18-4: Phase 1 Monthly Average Water Balance

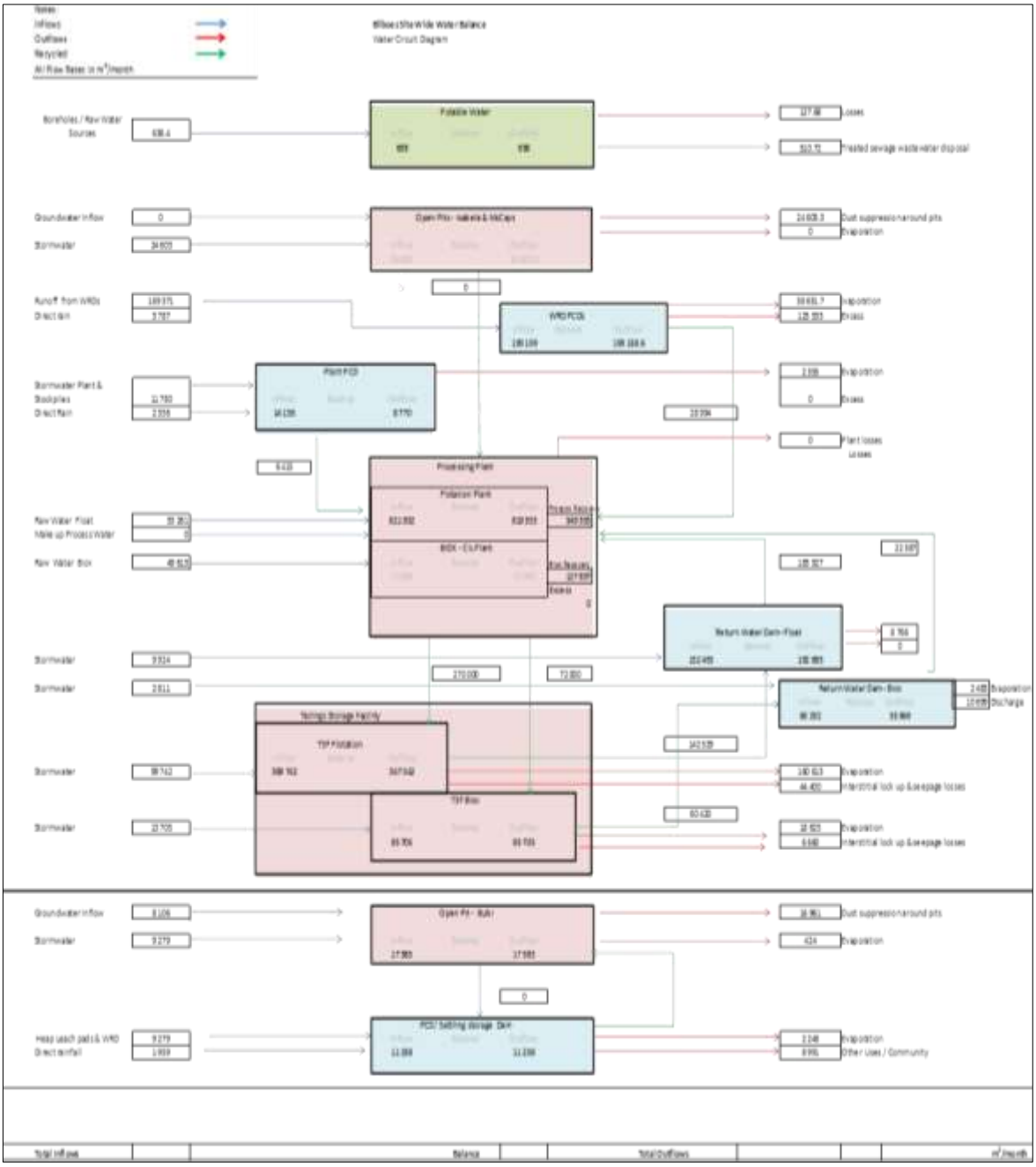


Figure 18-5: Phase 2 Monthly Wet Season Water Balance

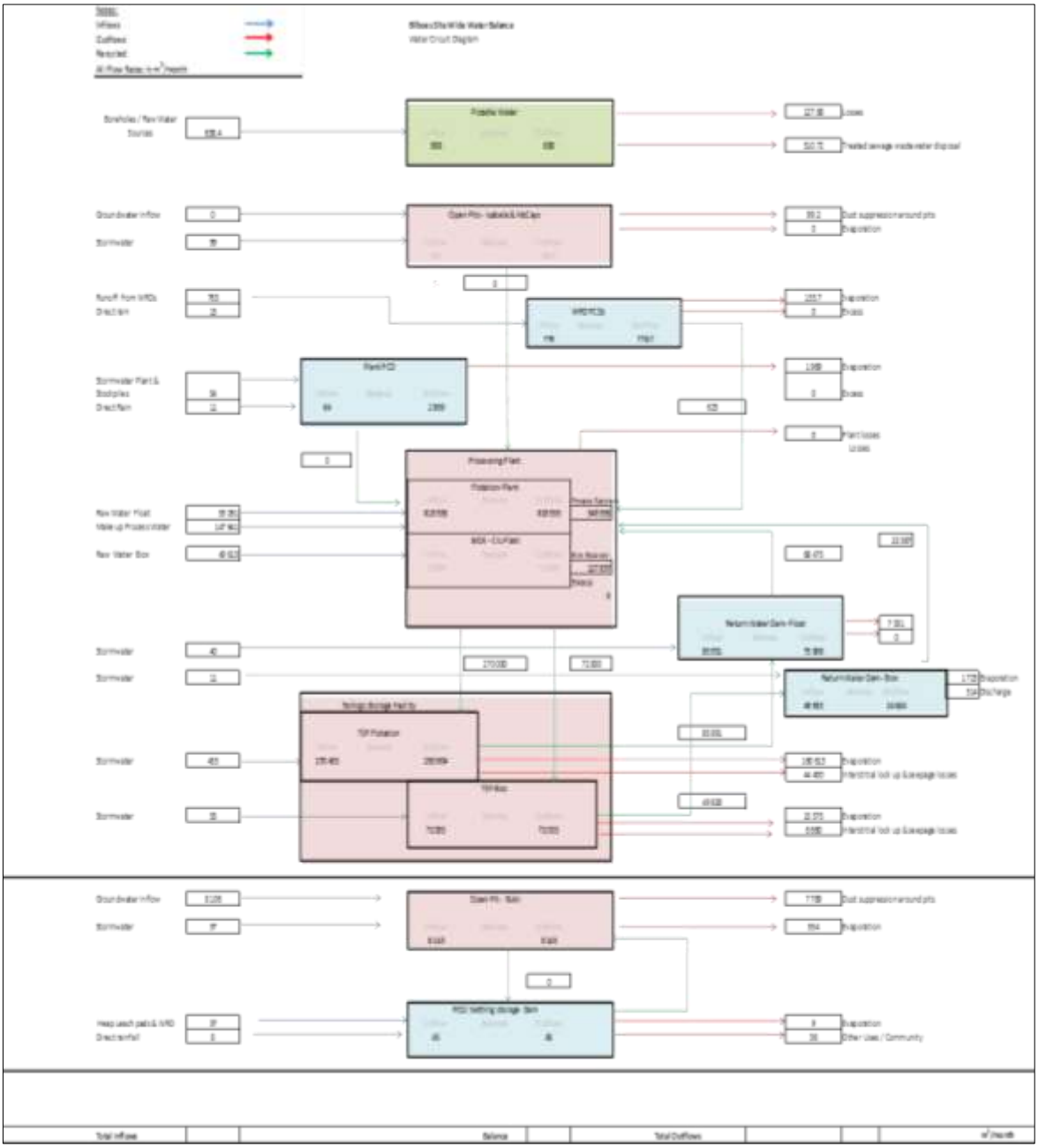


Figure 18-6: Phase 2 Monthly Dry Season Water Balance

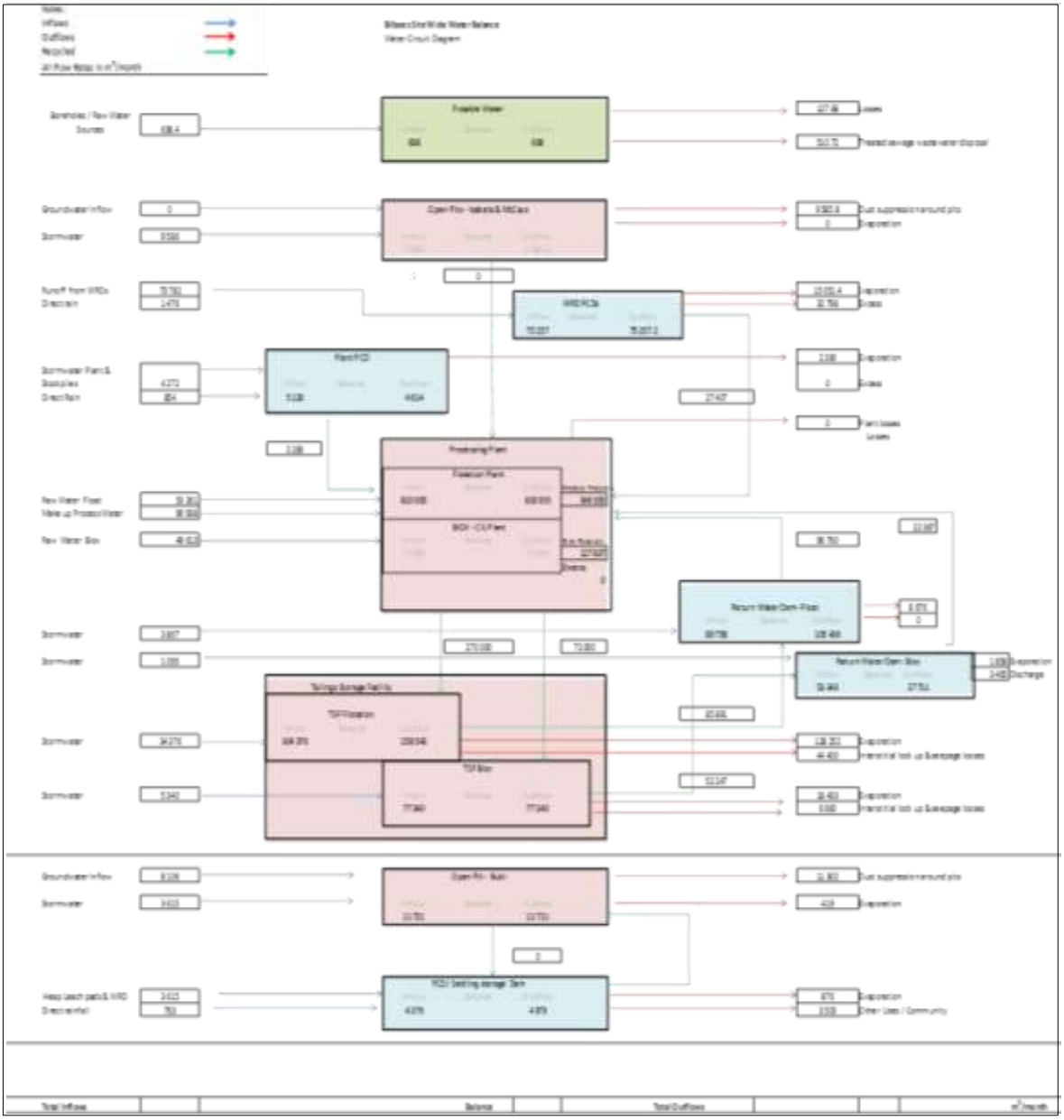


Figure 18-7: Phase 2 Monthly Average Water Balance

18.7.1.4.4 Steady State Water Balance Analysis Results

Table 18-12: Water Requirements and Pump-Out Rates during Dry Season for Flotation and BIOX® Compartments

Infrastructure	Flotation		BIOX®	
Tailings Deposition Rate	**240 ktpm**	**180 ktpm**	**120 ktpm**	**180 ktpm**
Required pump out rate (m^3/hr)	493	370	69	99
Available Pumping Rate (m^3/hr) *	196.4	117.7	38.4	68.3
Required Make-up Water (m^3/hr) *	250.6	201.3	0	0

Table 18-13: Water Requirements and Pump-Out Rates during Wet Season for Flotation and BIOX® Compartments

Infrastructure	Flotation		BIOX®	
Tailings Deposition Rate	**240 ktpm**	**180 ktpm**	**120 ktpm**	**180 ktpm**
Required pump out rate (m^3/hr)	493	370	69	99
Available Pumping Rate (m^3/hr) *	288.2	195.2	52.93	82.8
Required Make-up Water (m^3/hr) *	0	0	0	0

The steady state water balance analysis indicates that the Bilboes flotation circuit requires on average approximately 250 m^3/hr (6,015.6 m^3/day) during Phase 1 before decreasing to 201.3 m^3/hr (4,854.0 m^3/day) in Phase 2.

18.7.1.5 Dynamic Daily Time Step Water Balance Analysis

A site wide water balance simulation model using a daily time step was developed for the proposed project to dynamically simulate the movement of water throughout the key elements of the mine water infrastructure.

The daily time step water balance model aims to improve the understanding of the movement and the status of the water storage and transport infrastructure elements on the mine and how these changes in response to the varying climatic conditions. The model can be used to estimate the annual clean water / raw water requirements of the mine and evaluate the effectiveness of employing alternative water supplies and water demand management plans on the site.

The daily time step model was run using synthetically generated daily rainfall data derived from the available 38-year rainfall record from the Nkayi Weather station.

The model considered the following macro water management components of the mine.

- Water uses - potable water from boreholes, recycled water from the pits and WRD, potable water demands, and non-potable water demands (dust suppression and processing)
- Open pits (Isabella, McCays and Bubi) - stormwater inflow, groundwater inflow, evaporation losses, dust suppression and dewatering from the open pits
- Dams - stormwater inflows, pit dewatering, evaporation losses, spillages, and reuse of non-potable water
- Storage sizes for the proposed dirty water dams / sumps (complex PCDs)
- The average, wet and dry season flows, and the monthly water balances across the complex

The site wide water balance simulation was undertaken for Isabella and McCays excluding Bubi as there is no processing and therefore no raw water requirements.

18.7.1.5.1 Water Balance Control Philosophy

To ensure the safety of mine personnel, protection of the environment and to manage the anticipated future increases in the cost of water the following overall water balance priorities were defined in order of precedence:

- Water Balance Priority 1 - Surface water runoff management issues associated with management of stormwater include separation of clean and dirty water, minimizing run-off, avoiding erosion of exposed ground surfaces, avoiding sedimentation of drainage systems, and minimizing exposure of polluted areas
- Water Balance Priority 2 - Containment of dirty water to IFC Regulations any unpolluted runoff water (clean water) must be separated or diverted, away from any polluted water (dirty water) and/or polluted areas. The accumulation of water into the open pit must be limited to minimise the impact on mining activities and mine personnel within the open pit
- Water Management Priority 3 - Process make up water make up water must be kept to a minimum by optimising the re-use of existing dirty water sources and limiting the use of more costly and scarce clean water sources

The water balance simulated considers probable climatic events, minimization of make-up water and opportunities for the reuse, recycling, and treatment of process water.

18.7.1.5.2 Input Parameters

a) Climatic Data

A daily time series rainfall record of 70 years was generated from the available rainfall data obtained from the Nkayi weather station. This rainfall record as shown in Figure 18-7 was used to estimate the stormwater inflows into the pit sumps and dirty water dams / PCDs to simulate the effect of the varying climatic conditions.

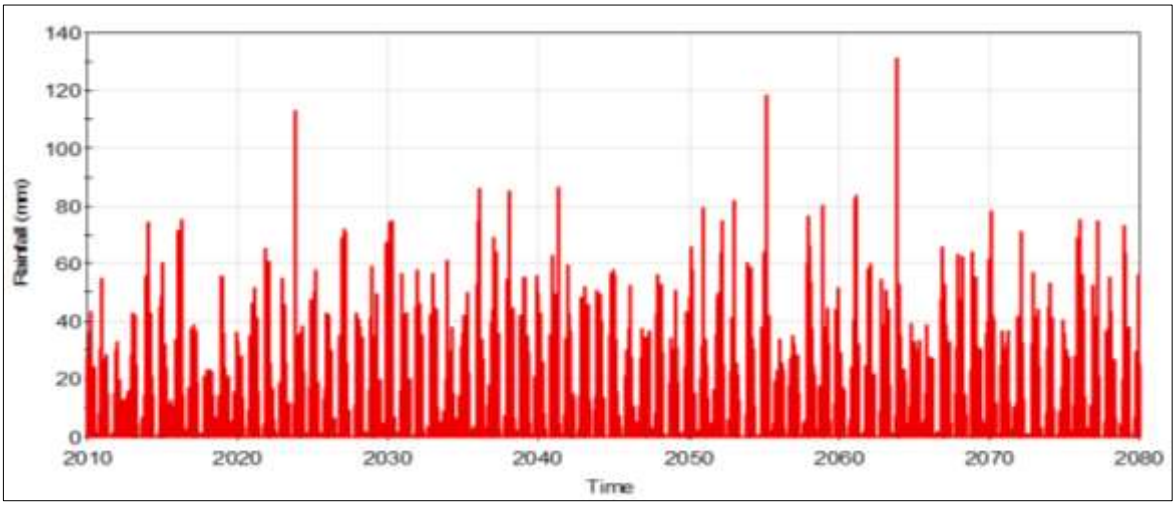


Figure 18-8: 70 years of Daily Rainfall Generated from the Nkayi Weather Station Record

Like the steady state water balance, the daily evaporation data used was generated from evaporation data obtained at the Bulawayo Goetz station. A factor of 0.75 was used to calculate the lake evaporation for the station and like the rainfall, a synthetic evaporation record of 70 years was generated as shown in Figure 18-9.

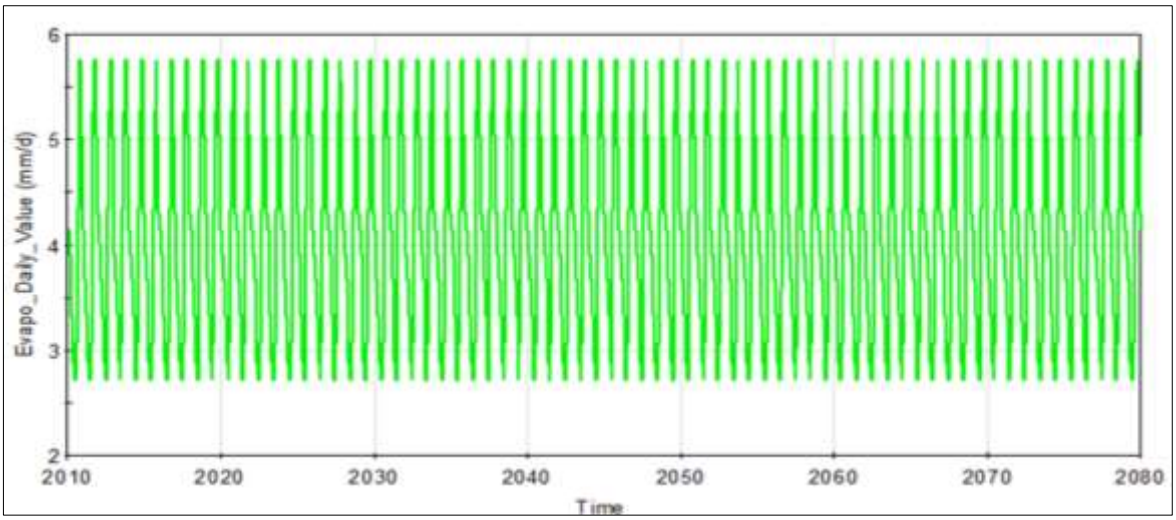


Figure 18-9: 70 years of Daily Evaporation generated from the Bulawayo Goetz Station

b) TSF Pool Evaporation Percentage

TSF pool evaporation was adopted as 100% considering that there will not be any aqua-guard or similar cover installed on the TSF surface.

c) Stormwater

A daily time-step rainfall runoff model was developed in GoldSim using the SCS methodology to estimate the infiltration and run-off fractions of the rainfall. A soil water budgeting procedure is used to vary the SCS curve number to reflect antecedent

catchment moisture conditions. The catchment descriptions, the associated SCS curve numbers and the catchment areas are shown in Table 18-14.

Table 18-14: Stormwater Catchments - SCS Curve Numbers and Areas

Catchment Type	SCS Curve Number	Catchment Area m^2		
		Pit Sump	Dirty Water Dam	Stormwater Dam
Tailings Catchment	70	0	1,153,161	0
Soil Catchments	86	0	120,000	0
Open Pit Catchments	76	1,700,000	0	0
WRD Catchments	70	250,000	0	0

d) Groundwater

Groundwater inflows into the open pit were sourced from the Groundwater Report (2018) for Isabela McCays and Bubi compiled by SLR.

e) Portable Water

As with the steady state water balance, it was assumed that the mine operation has 140 people throughout the day and each person will require 150 litres per day.

f) TSF and Tailings Slurry Characteristics

Table 18-15: TSF and Tailings Slurry Characteristics

Description	Value / Property		
Tailing's slurry characteristics	% Solid's concentration, C_w:	Flotation tailings stream	40% (Supplied by Outotec / DRA)
		BIOX® ® tailings stream	20% - 25% (Supplied by Outotec)
	Specific Gravity (SG):	Flotation tailings stream	2.65 – 2.75 (Supplied by Outotec / DRA)
		BIOX® tailings stream	2.70 – 2.80 (Supplied by Outotec)
	Slurry feed relative density	Flotation tailings stream	1.337 t/m^3 (calculated)
		BIOX® tailings stream	1.14 t/m^3 (calculated)

18.7.1.5.3 Dynamic Daily Time Step Water Balance Results

The results presented below give the average daily demand for potable water for the three phases of tailings deposition rates:

Table 18-16: Bilboes Phases of Tailings Deposition

Phase	Deposition Rate (tpm)	
	Flotation Tailings	BIOX® Tailings
1	240,000	12,000
2	180,000	18,000

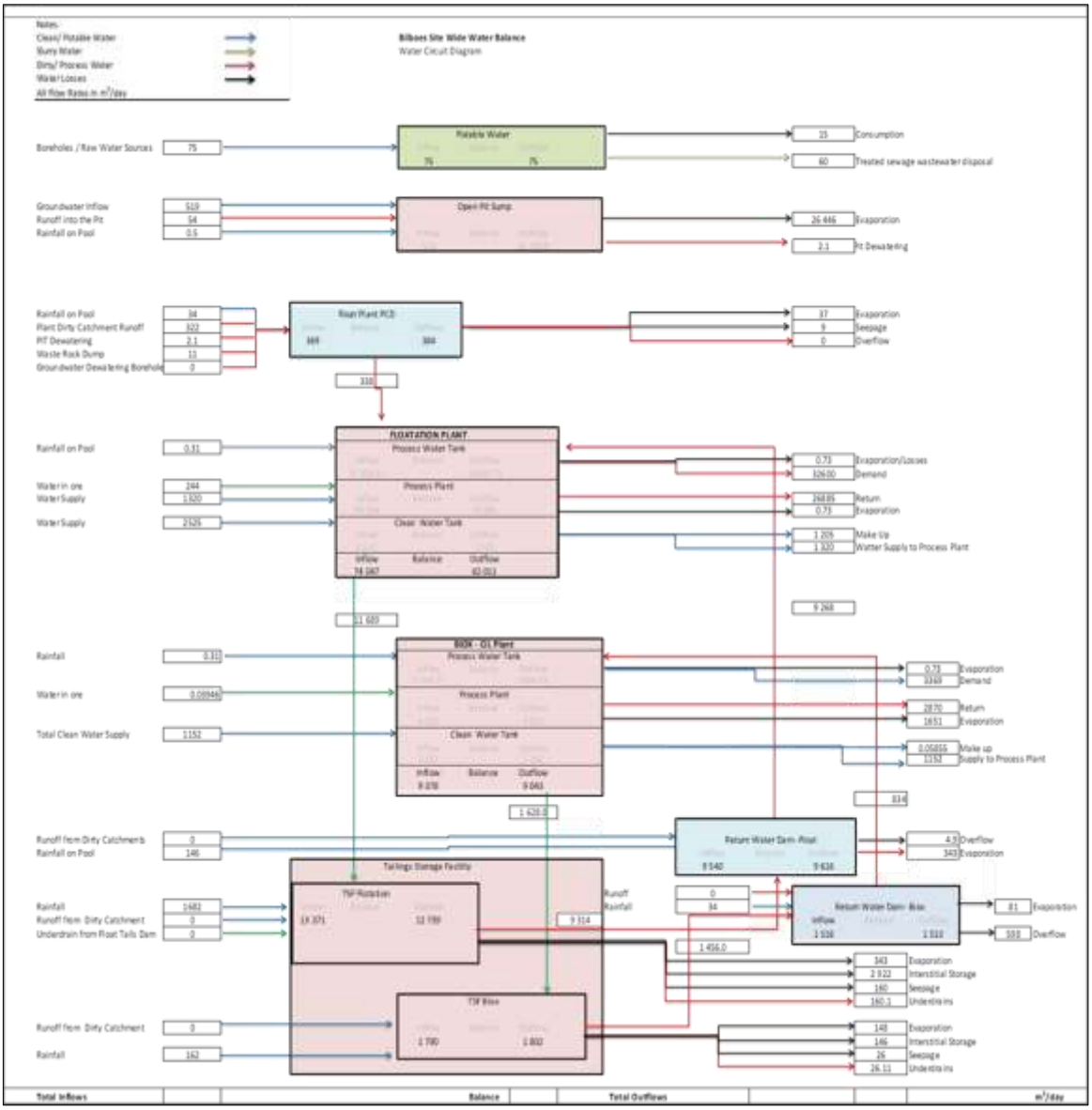


Figure 18-10: Simulated Daily Time Step Water Balance for the 240 ktpm Tailings Deposition Phase

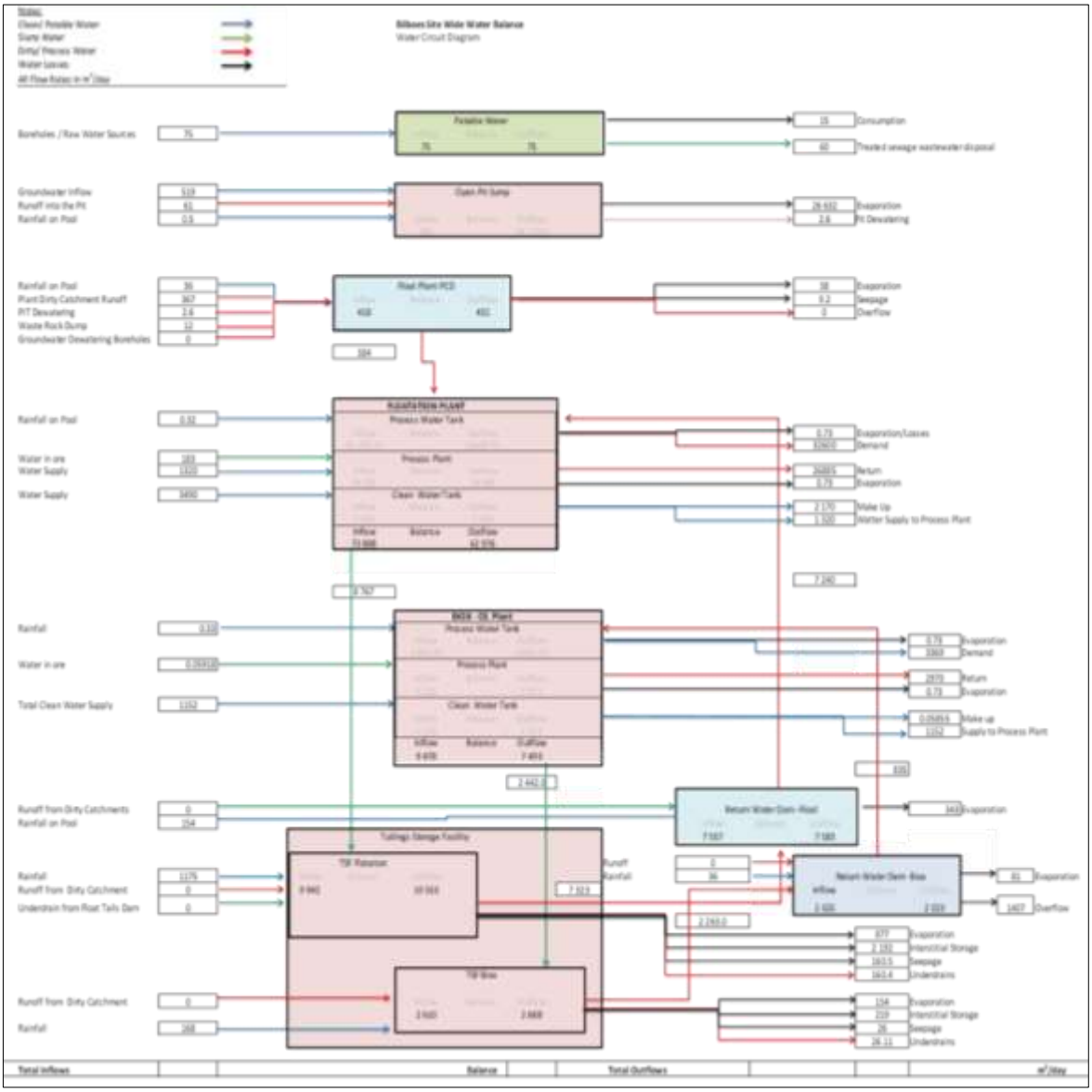


Figure 18-11: Simulated Daily Time Step Water Balance for the 180 ktpm Tailings Deposition Phase

18.7.1.6 Water Balance Analysis of the Flotation Return Water Dam Capacity and Spillage Potential for the 240 ktpm Tailings Deposition Rate

Each compartment of the Bilboes TSF will have its own RWD. These RWDs will capture supernatant pond decant water, underdrainage water and dirty water run-off.

The design and management of the RWDs is to be undertaken within the GN R.704 regulations. The following clause (6(d)) in GN R.704 relates to the design of RWDs:

“Design, construct, maintain and operate any dirty water system at the mine or activity so that it is not likely to spill into any clean water system more than once in 50 years”.

The inflow to the RWD is made up of mine plant process water and stormwater. The plant process water flows to the RWD are relatively constant and as such the return water to the plant is considered constant. Stormwater inflows on the other hand are highly variable and can far exceed the plant water demand from the RWD. The function of the RWD is therefore to provide buffer capacity against storm events thus allowing for a constant flow of return water to the plant without the RWD overflowing in line with the requirements of IFC.

A storage capacity of 380,000 m^3 was simulated for the flotation RWD with an associated return water pumping rate of 490 m^3/hr for the 240,000 tpm tailings deposition rate. The water balance analysis for the given RWD capacity and return water pumping rate yielded only two major spillages in a 70-year period which is in line with the IFC Environmental, Health and Safety guidelines for stormwater collection dams.

These major spills are attributed to continuous rainfall events occurring over approximately 10 days prior to each spill with an accumulative rainfall of greater than 90 mm for the 10-day period. Figure 18-12 indicates the RWD spillages. The peak overflow of approximately 71,826 m^3 was observed on the 2022/01/28 and an average spill of 1897 m^3/day was observed for the same day.

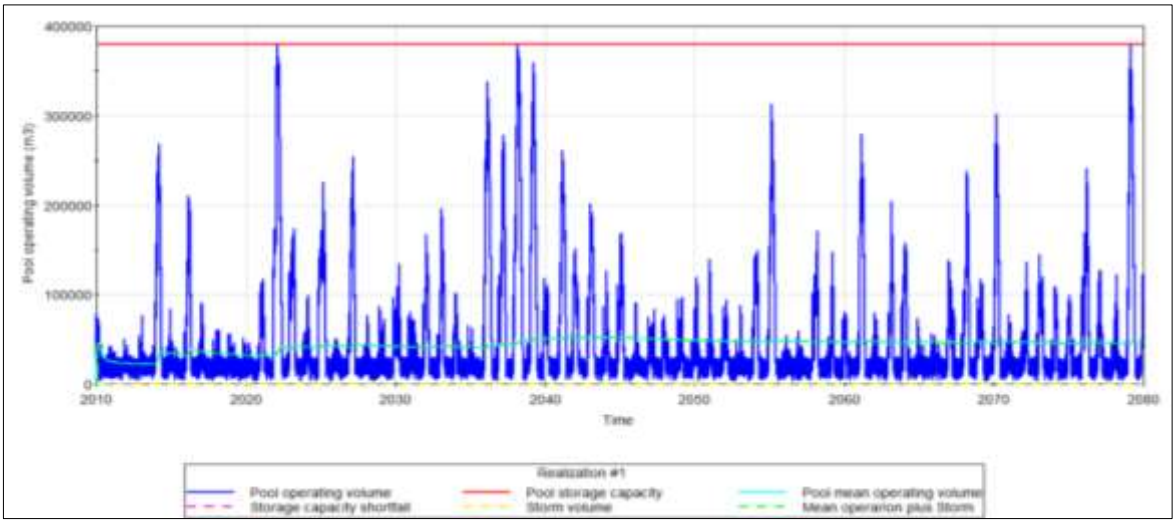


Figure 18-12: Flotation Return Water Dam Pool Capacity and Spillages

Table 18-17: Flotation Return Water Dam Pool Capacity and Spillages

Date	Average (m^3/day)
2022/01/28	3,828.5
2022/01/31	616.1
2022/02/02	2,677.8
2022/02/05	1,572.0
2022/02/08	1,493.0

Date	Average (m^3/day)
2038/02/18	2,080.3
2079/02/08	2,520.3
2079/02/13	1,703.1
2079/02/16	581.7

18.7.1.7 Conclusions and Recommendations

The project site falls within the Bembezi river sub-catchment which drains north towards the Zambezi River. The Bembezi river sub-catchment form part of the Gwayi catchment which largely comprises the Northern Matabeleland area of hydrological zone A.

The stormwater management plan was developed to comply primarily with the IFC EHS Guidelines for Mining (2007); while ensuring adherence to all the applicable local Zimbabwean Standards namely: the Environmental Management Act (Chapter 20:27) implemented by the EMA of Zimbabwe; and the Zimbabwe National Water Act (Chapter 20:24) implemented by the Zimbabwe National Water Authority (ZINWA) through the Zimbabwe National Water Authority Act (Chapter 20:25).

In developing the conceptual stormwater management plan, reference was also made to regulation GN 704 of the South African National Water Act, 1998 (Act No. 36 of 1998) which requires that:

- Clean water from the catchments upstream of mining infrastructure is diverted around the proposed infrastructure
- Dirty stormwater will be collected and reused on site
- Dirty water containment facilities are designed, constructed, maintained, and operated so that they are not likely to spill into a clean water environment more frequently than once in 50 years
- As a minimum, a 0.8 m freeboard must be maintained over and above the 1:50 year design volume

Daily and monthly rainfall were obtained from the ZMSD Nkayi Stations over 38 years of hydrological records (from 1980 to June 2018) and were analysed to understand the long-term monthly averages, minimum and maximum monthly rainfall. The MAP adopted for this project is 657 mm.

A site wide monthly static water balance model was developed for the Bilboes operation to establish the storage sizes of the pollution control systems; and the average wet, dry season and average monthly water balance.

The water balance simulated water re-use associated with the processing plant, as a pump rate out of the PCD for each of the two mining phases.

The steady state water balance analysis indicates that the Bilboes flotation circuit requires on average approximately 250 m^3/hr (6,015.6 m^3/day) during Phase 1 before decreasing to 201.3 m^3/hr (4,854.0 m^3/day) in Phase 2.

For the steady state water balance analysis, there is no make-up water required for the BIOX® circuit in all phases of mining.

To improve the understanding of the movement and the status of the water storage and transport infrastructure elements on the mine and how these changes in response to the varying climatic conditions, a Dynamic Daily Time Step Water Balance analysis was conducted for the project.

The daily time step water balance analysis for the RWD capacity of 380,000 m^3, a return water pumping rate of 490 m^3/hr and a worst-case tailings deposition rate of 240 ktpm yielded only two major spillages in a 70-year period which is considered to be in line with the IFC Environmental, Health and Safety guidelines for stormwater collection dams.

18.7.2 Ground Water

Groundwater numerical modelling was undertaken to simulate the mining operation at Bubi Isabella McCays and the related establishment of the TSF at Isabella McCays. The objective of the modelling is to determine the potential impact on the groundwater flow and groundwater quality during and post mining, for Isabella McCays and Bubi.

Isabella McCays and Bubi are located 32 km apart, and therefore a separate groundwater model was developed for each site.

18.7.2.1 Hydrogeological Modelling

The software chosen for the hydrogeological modelling was *Feflow (DHI - Wasy)*, which is a finite element numerical simulation model, widely used in mining and environmental applications.

The numerical models have been set-up based on the known geological formations and their related hydraulic properties. The changes in the hydrogeological regime and water

quality are determined through the numerical modelling of the identified hydraulic (Open pits) and geochemical stressors (TSF).

Each model domain was divided into 3-D triangular prisms where the hydraulic properties are assigned, and the flow equations are solved for each model node (intersections of triangular prisms).

Table 18-18 below summarises the hydrogeological units and their characteristics and lists the values of the assigned hydraulic properties.

Table 18-18: Hydrogeological units for Isabella McCays and Bubi

Domain	Formation	Lithology	symbol	Kh	Kv	Permeability	Classification
Isabella-McCays	Quaternary	Alluvium	alluvium	0.5	0.5	Good	Aquifer
	Karoo	Sandstone, grit	ks	0.005	0.0001	Good	Aquifer
	Intrusive igneous	Quartz porphyry	Fq	0.0005	0.0001	Poor	Aquiclude
	Intrusive igneous	Gabbro	H	0.0001	0.0001	Poor	Aquiclude
	Ndutjana Formation	Grit, conglomerate	xg, xc	0.001	0.0001	Slightly permeable	Aquitard
	Ndutjana Formation	Arkose, greywacke	xga, xgw	0.001	0.0001	Slightly permeable	Aquitard
	Dagmar Formation	Banded ironstone	fs, yi	0.005	0.0001	Medium	Aquifer
	Dagmar Formation	Grit, arkose, phyllite	p	0.001	0.0001	Slightly permeable	Aquitard
	Dagmar Formation	Grit, arkose, phyllite	y14	0.001	0.0001	Slightly permeable	Aquitard
	Lonely Mine Formation	Banded ironstone	yi	0.005	0.0001	Medium	Aquifer
	Bembesi River	Basaltic greenstones	y7	0.0005	0.0001	Poor	Aquiclude
	Ventnor	Basaltic greenstones	y8	0.0005	0.0001	Poor	Aquiclude
Bubi	Quaternary	Alluvium	alluvium	1.0000	1.0000	Good	Aquifer
	Kalahari System	Kalahari Sand	r	1.0000	1.0000	Good	Aquifer
	Intrusive igneous	Gabbro	H	0.0010	0.0005	Slightly permeable	Aquitard
	Intrusive igneous	Dolerite	D	0.0050	0.0010	Medium	Aquifer
	Dollar Block	Andesitic greenstones	y12	0.0010	0.0001	Slightly permeable	Aquitard
	Lonely Mine	Ferruginous shale, banded ironstone	fs, yi	0.0100	0.0010	Medium	Aquifer
	Zwangendaba Formation	Basaltic greenstones	y6	0.0005	0.0001	Poor	Aquiclude
	Inyati Formation	Basaltic greenstones	y4	0.0005	0.0001	Poor	Aquiclude

18.7.2.2 Isabella - McCays

Figure 18-13 shows the final 3-D numerical model constructed for Isabella - McCays.

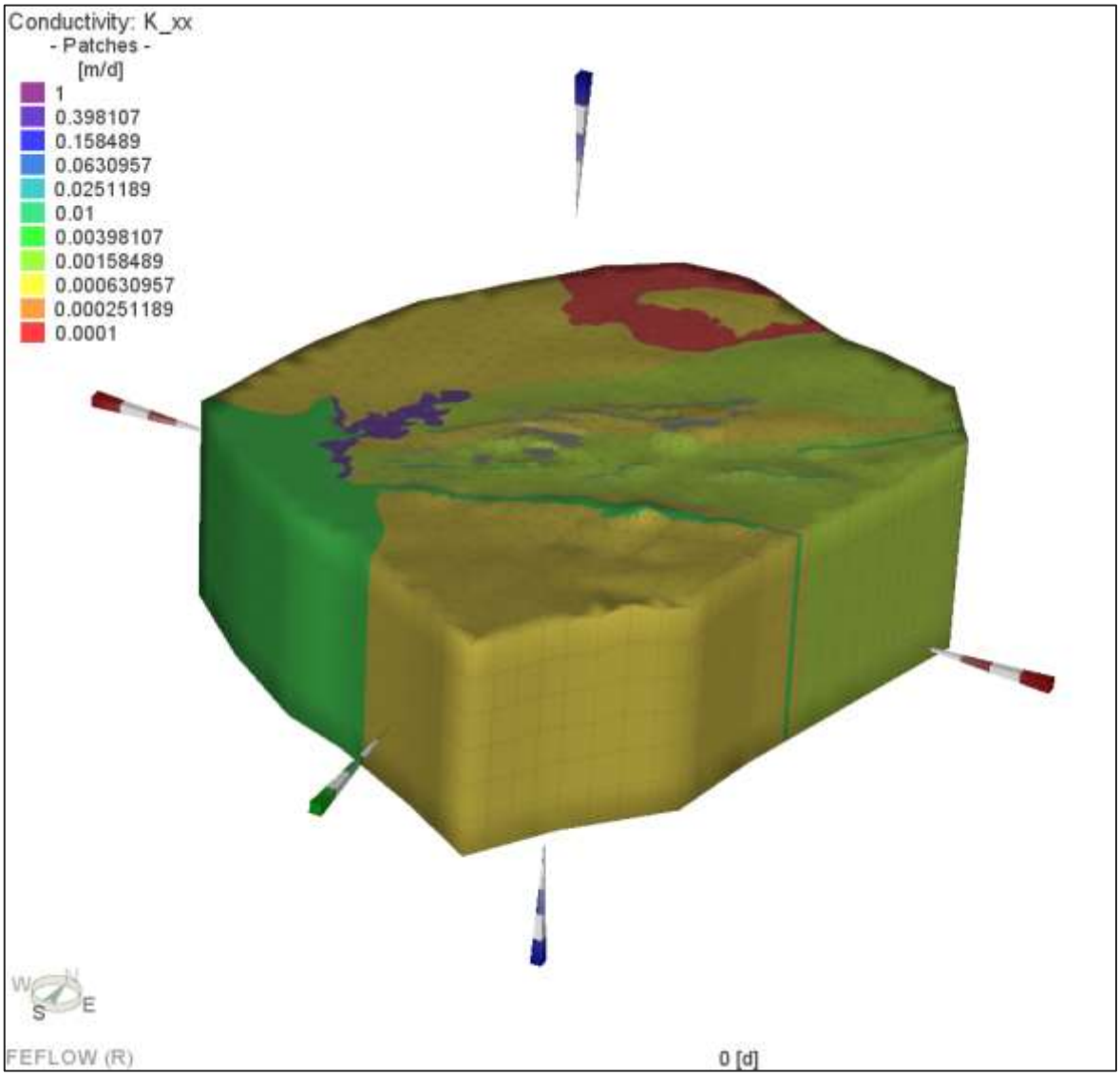


Figure 18-13: Isabella - McCays 3D model

The Isabella McCays model was run in transient mode for a period of 100 years (7 years of mining and 93 years post-mining), to simulate groundwater flow and development and migration of the contaminant plume.

As a result of the open pit mining, groundwater will flow into the voids created (passive inflows). During mining the volumes of groundwater flowing in will need to be pumped out of the open pits, generating a hydraulic gradient and a cone of drawdown around the hydraulic sinks.

Figure 18-14 shows the predicted groundwater inflows during mining of the Isabella McCays pits.

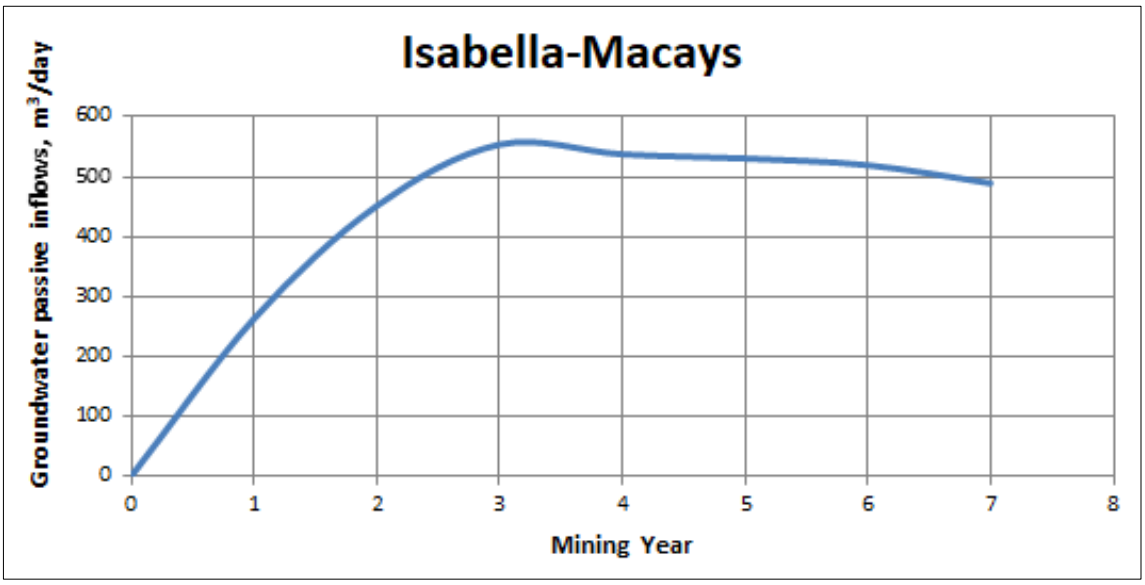
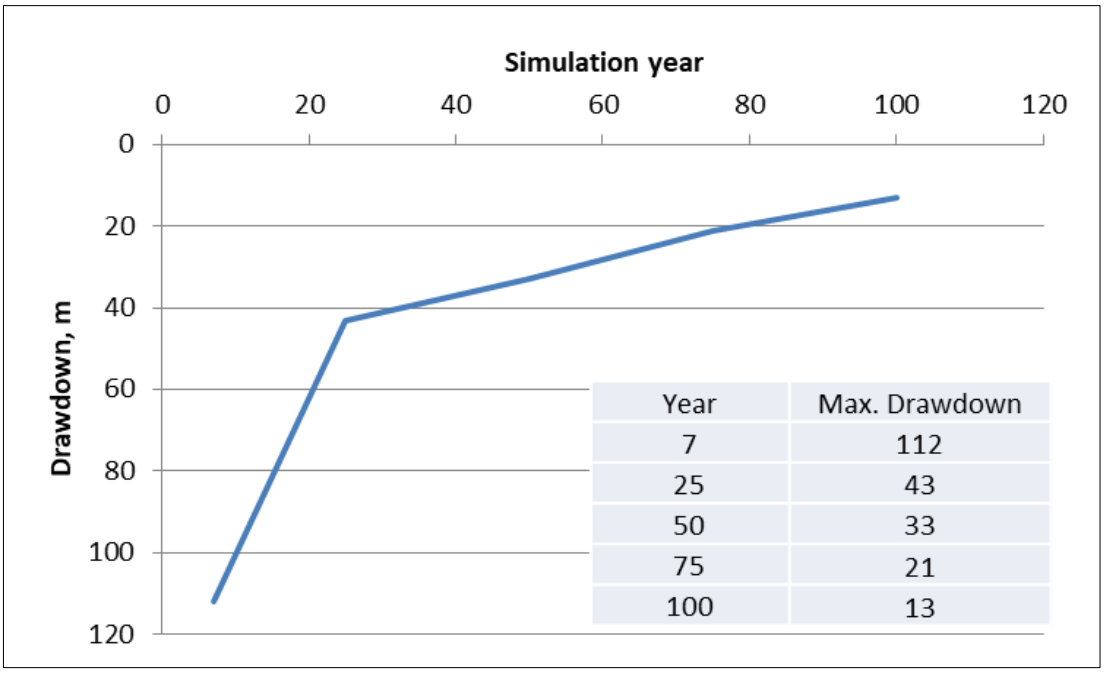


Figure 18-14: Isabella - McCays Passive Groundwater Inflows

The maximum groundwater inflow into the open pits is predicted to be at a rate of 554 m^3/day (6.4/ /s).

The cone of drawdown is at a maximum in year 7 (before sump pumping stops) and after that the groundwater levels enter the recovery period. Figure 18-15 shows the recovery of the groundwater levels.



Year	Max. Drawdown
7	112
25	43
50	33
75	21
100	13

Figure 18-15: Isabella - McCays - Predicted Groundwater Level Recovery

The mass transport was modelled for 3 scenarios:

- Scenario 1: “Do-nothing”; this scenario assumes that no liner is installed, and no soil compacting takes place; the mine waste (tailings) will therefore be deposited within the respective TSF walls, but this will be directly onto the cleared ground. The two RWDs (for flotation TSF; and RWD for BIOX® TSF) will both be fully HDPE lined
- Scenario 2: The flotation TSF compartment is lined with a Compacted Clay Liner (CCL); whereas a composite liner incorporating HDPE liner overlying a CCL is provided for the BIOX® TSF compartment and the two RWDs
- Scenario 3: A composite liner (HDPE liner on CCL) is provided for both flotation and BIOX® TSF compartments together with the RWDs

The results of the 3 scenarios are detailed in Table 18-19 and Figure 18-16.

Table 18-19: Isabella - McCays - Simulation of Contaminant Plume Migration

Scenario	Scenario 1	Bearing from Site*	Scenario 3
	Do-Nothing	500 mm thick Compacted Clay Liner (CCL)	Composite Liner (1.5 mm HDPE thick liner overlying 500 mm thick CCL)
Liner Permeability	-	K=0.005m/d	K=0.0005m/d
Study Period		Plume migration distance	
Year 7	1,050 m	630 m	218 m
Year 25	1,570 m	630 m	222 m
Year 50	2,100 m	645 m	237 m
Year 75	2,400 m	665 m	242 m
Year 100	2,550 m	675 m	260 m

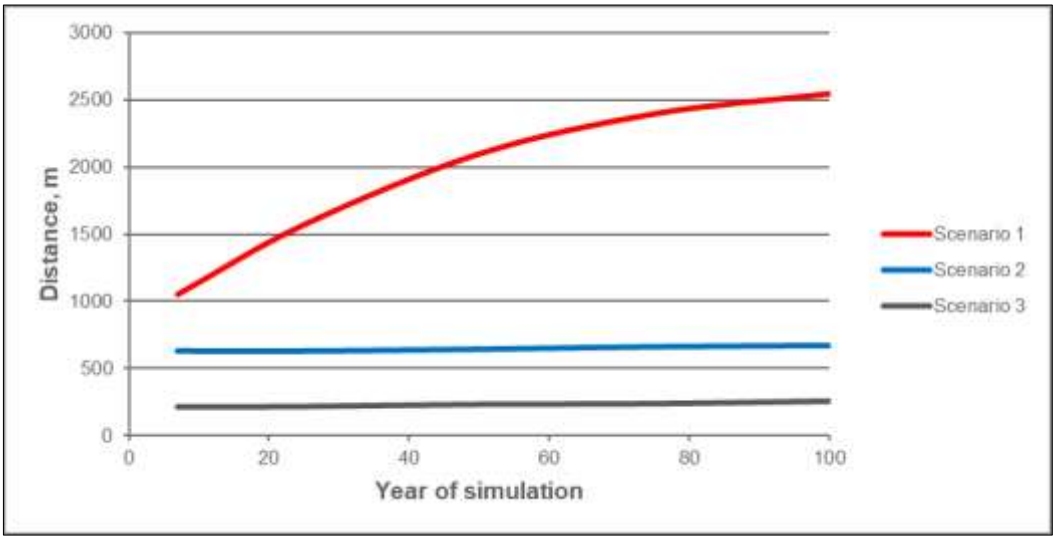


Figure 18-16: Plume Migration vs. Time for the 3 Defined Scenarios

Scenario 1 indicates that if no engineering solution is applied (that is, lining of contaminant sources), the contaminant plume will migrate to a significant distance after mining ceases.

Scenario 2 indicates that if an engineered clay liner is applied, the contaminant plume migration is restricted; however, the plume can reach the small stream lying north-west of the TSF site.

Scenario3 shows limited migration of the plume with no impact on any regional hydrological features. It is therefore recommended that the TSF be lined with a composite liner that incorporates an HDPE liner underlain by a CCL.

18.7.2.3 Bubi

The 3D numerical model constructed for Bubi is shown in Figure 18-17.

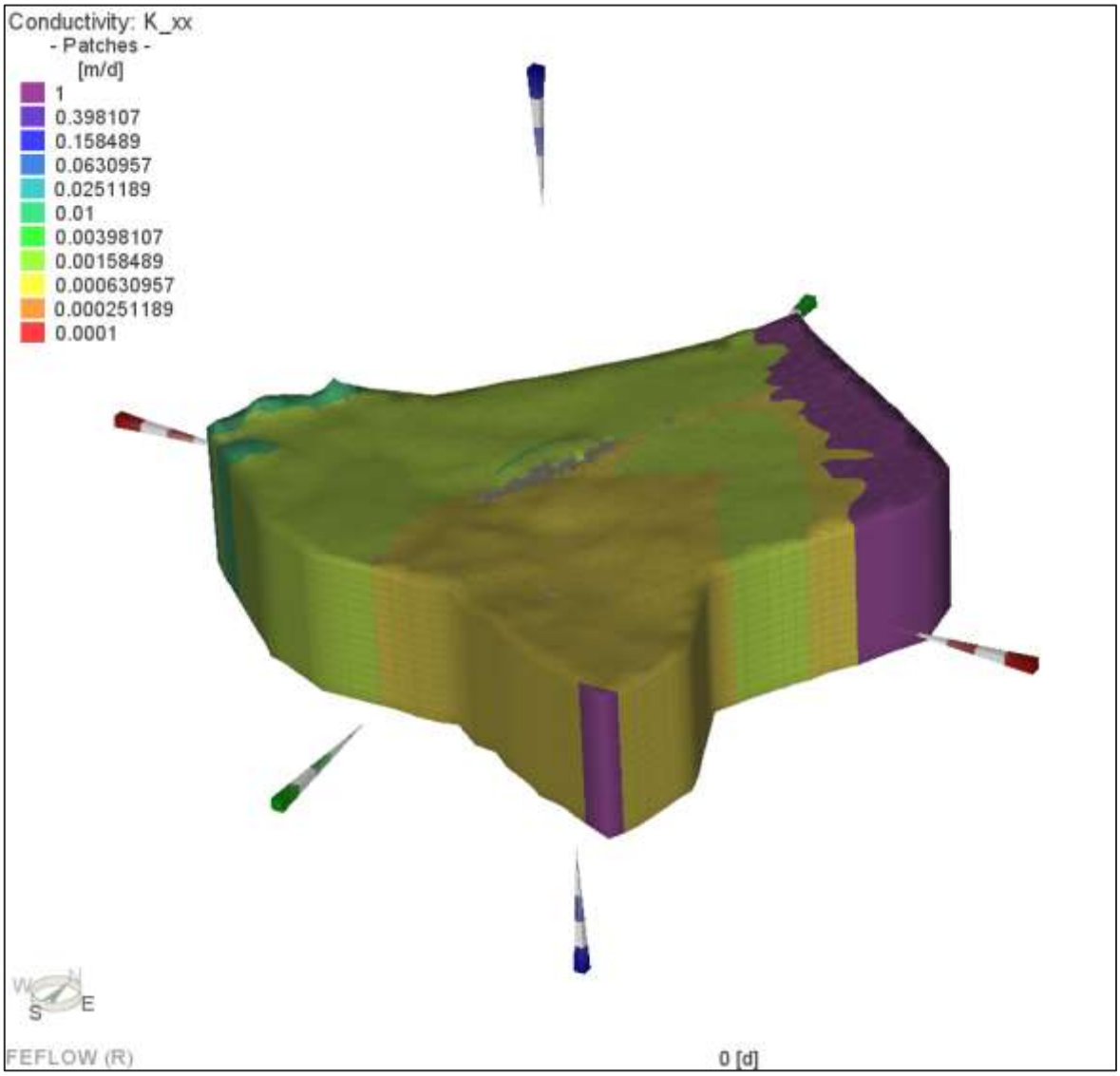


Figure 18-17: Bubi 3D Numerical Model

The Bubi model was run in transient mode for a period of 100 years (6 years of mining and 94 years post-mining), to simulate groundwater flow and mass transport from the WRDs source terms.

As a result of the open pit mining, groundwater will flow into the voids created (passive inflows). During mining the volumes of groundwater flowing in will need to be pumped out of the open pits, generating a hydraulic gradient and a cone of drawdown around the hydraulic sinks.

Figure 18-18 shows the predicted groundwater inflows during mining of the Bubi open pits.

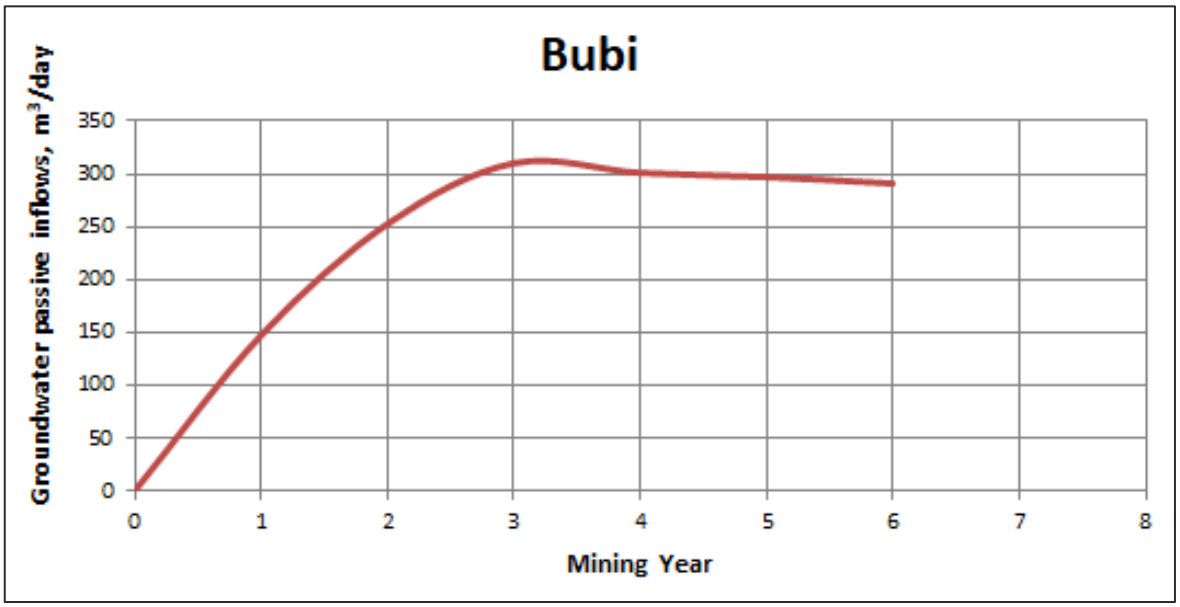


Figure 18-18: Bubi Passive Groundwater Inflows

The maximum groundwater inflow into the open pits is predicted to be at a rate of 310 m^3/day (3.5 l/s).

The cone of drawdown developed at Bubi Mine is at its maximum at year 6 (before sump pumping stops) and after that the groundwater levels enter the recovery period. Figure 18-19 shows the recovery of groundwater levels.

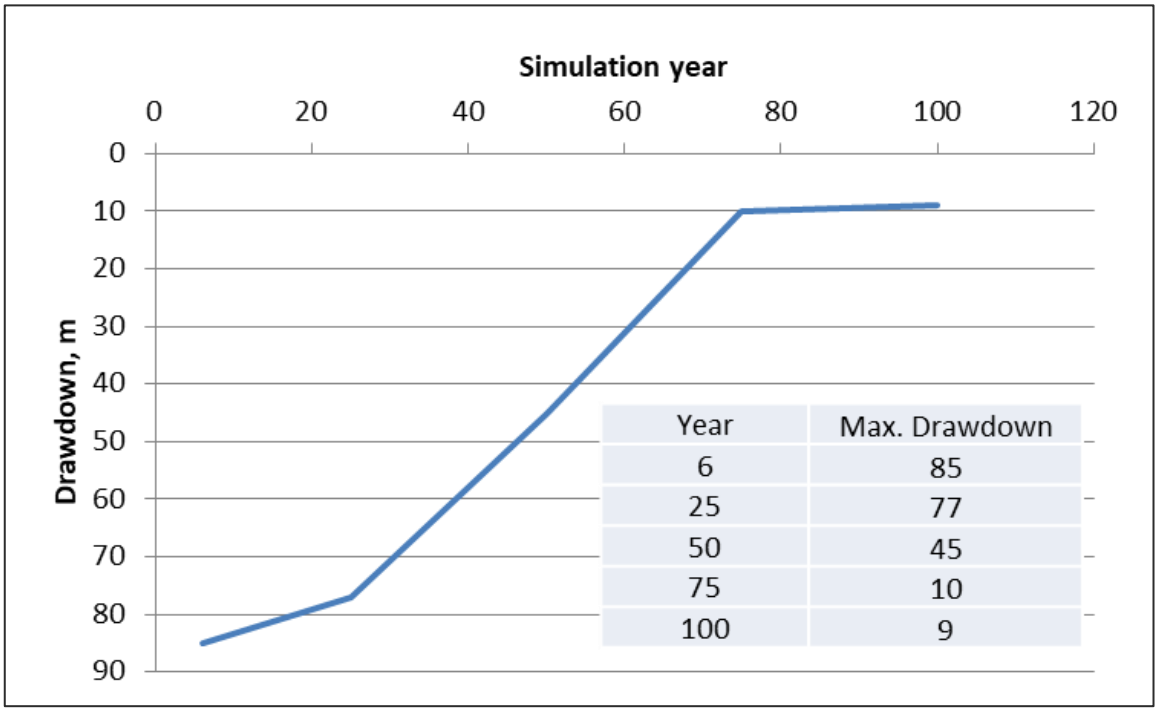


Figure 18-19: Bubi - Predicted Groundwater Level Recovery

The mass transport was modelled at Bubi for 1 scenario (“Do-Nothing”) - as the existing WRD are already unlined, with source term selected on the footprint of the WRD. The results are summarised in

and Figure 18-20 below.

Table 18-20: Bubi - Simulation of Contaminant Plume Migration

Year of Simulation	Plume Migration Distance, m
6	430
25	512
50	585
75	622
100	650

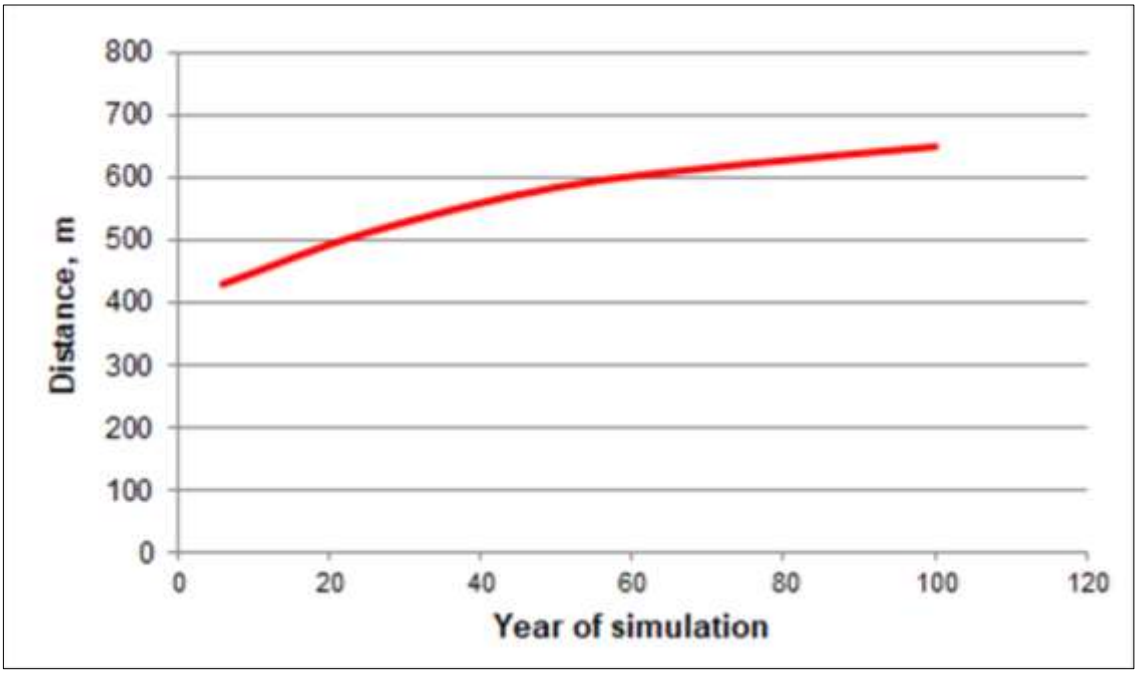


Figure 18-20: Bubi Contaminant Plume Migration vs. Time

18.7.2.4 Conclusion

The cone of drawdown predicted for both mines show that after 100 years of simulation, both pits will present a residual drawdown of approximately 10 m. However, the extent of each cone of drawdown is decreasing in time and will remain within the boundaries of the mine sites.

The mass transport simulations indicate that a liner is necessary to contain the migration of the contaminant plume from the contaminant sources.

18.8 Sewage Management

Waterborne sewage networks have been allowed for at the following areas:

- Process plant
- Admin area
- Residential Village
- Contractor area at Isabella McCays

All areas mentioned above will gravitate to a central sewage purification plant.

The purification plant was designed and costed for 400 people @ 150 litres per person per day. The purification plant will be a vendor supply package.

18.9 Project Execution

18.9.1 Project Execution Plan

This Project Execution Plan (PEP) defines the methods and project management elements that will be used to manage the execution of the project.

It establishes the execution plan and defines the organisation, work processes and systems necessary for management of the project.

The information outlined in this document is used to help ensure that the project is completed in a timely and efficient manner and that the facilities designed and constructed will satisfy the project functional requirements.

18.9.1.1 Execution Approach

18.9.1.1.1 Client

The client, Bilboes, has identified the requirement to extend the life of the open pits at Isabella McCays and Bubi by mining the deeper sulphide zones.

The project will be executed in close conjunction with Bilboes personnel, using EPCM procedures, structures, standards, departments, and IT software.

The CBE was compiled and priced on this basis of a “fit for purpose” plant and it is the intention to implement this approach throughout.

18.9.1.2 Project Scope

The project scope consists of the following:

Basis for project services will be Engineering, Procurement and Construction Management (EPCM). This will include the following:

- Detailed Design and Engineering
- Procurement on behalf of Bilboes
- Quality Control and Expediting
- Planning
- Construction Management
- Commissioning
- Project Accounting
- Project Reporting

- Specified hardware and software systems (e.g., PLC and Scada programming, development, and commissioning)
- Control of the approved CBE
- Safety Management.

Process

The processing facility will consist of:

- RoM Tip
- RoM Crushing
- Screen Feed Conveyor
- Screening
- Plant Feed Bin Conveyor
- Plant Feed Bin
- Flotation Plant
- Flotation Tailings Dewatering
- Flotation Tailings Thickener
- Clean water
- Process water
- Raw Water
- Flocculant Plant
- Flotation reagents
- Compressed Air
- BIOX® plant
- MCCs, transformers and in-plant Electrical Distribution
- Instrumentation, Control and Automation System

Infrastructure

- Bulk Earthworks
- Roads (mining and non-mining)
- Boreholes / Well fields
- Fire Water
- Overland Piping

- Dirty Water Dams
- Clean Water Diversion
- Storm Water Management
- Potable Water
- Dewatering borehole pumps, pipeline and OHL electricity supply, but excluding the dewatering design

Battery Limits (Project)

- Access road/s to the total mine complex
- MV terminals of the ZESA substation
- Access road termination at security entrance to site
- Borehole with piping to potable water tank

Exclusions

- Geo-hydrology services
- Geotechnical services
- Environmental consultants
- Tailings / process waste consultants
- Surveying services
- Financial modelling
- Environmental permitting activities
- Socio-Economic development services
- Skills development services
- Maintenance and refurbishment of old equipment
- Management of the client / owner's team
- Management of any Social and Labour Plan commitments, apart from local procurement
- Management of the recruitment process and any other process for establishment of owner's employees
- Arrange, or expedite environmental and/or other statutory permits
- Provision of QS Services (Management thereof is included)
- Infrastructure other than within the battery limits

- Mining infrastructure and mining contractor management
- Loading and transporting of gold on and off site
- Any legal or permitting requirements
- Any other items not specifically included in the Scope of Works

18.9.1.3 Key Project Objectives

The project objective is to provide a gold processing facility that will be capable of handling tonnage throughput from Isabella McCays and Bubi with particular attention to achieve:

- Bilboes' objectives on its gold production
- Zero LTIs and zero fatalities
- Highest possible achievable safety achievements and best possible working conditions for all employees, all within the standards and expectations of Bilboes
- Minimum environmental impact, as defined in approved ESIA
- Minimum capital costs
- Minimum working costs
- Maximum productivity
- Maximum local employment opportunities with a commitment to local community involvement and upliftment
- Fit for purpose designs to achieve maximum benefits
- Meeting and exceeding stakeholder expectations

18.9.1.4 Execution Strategy

Phase 1 of the project is to be executed from Oct 1mostly at Isabella McCays and will involve the engineering, detailed design, procurement, construction, and commissioning of a 240 ktpm gold plant and associated infrastructure.

Phase 2 of the project involves mining at Bubi and a step change in production to 180 ktpm, due to the higher mass pull expected from the different type of ore. Phase 2 will only commence later in Nov 2028 to suit the life of mine production schedule.

The project is intended to be executed on behalf of Bilboes by the EPCM consultants in conjunction with specialist consultants controlled and managed by DRA.

All detailed design work will be completed in Phase 1, as well as the civil works required for any future Phase 2 equipment scope. Appropriate procurement data packs can also be compiled in Phase 1 for use in the later phases. It will be Bilboes' prerogative to either

continue with the EPCM model to manage execution of Phase 2 or appoint a suitable turnkey contractor due to the smaller and low risk scope than Phase 1.

18.9.1.5 Organisation and Staffing

18.9.1.5.1 Project Organisation

- Client

  The client is Bilboes, and the project is led by the Technical Director, with the contractual status of “Engineer”.

- Bilboes Project Team

  This generally and mainly consists of an Engineer, Metallurgist, Geologist, Financial Manager and Bilboes support staff. This team is supported by the site personnel and consideration as far as requests and approval from them will be a standard procedure.

- EPCM Contractor

  The project organisation will consist of a Project Manager (who reports to Bilboes Technical Director) who, hereinafter referred to as the “Project Manager” shall be responsible for the project. Dedicated Project Engineers, reporting to the Project Manager, shall be responsible for the engineering of the Plant and Infrastructure. The Process Consultant and the Senior Process Engineer reporting to the Project Manager shall be responsible for the overall process engineering. The Lead Electrical Control and Instrumentation Engineer reporting to the Project Manager shall be responsible for the total electrical, control and instrumentation engineering.

  The Construction Management Team will consist of a Construction Manager supported by discipline Supervisors (civil, structural, mechanical, electrical, instrumentation and control) as well as Safety, Materials Control and Quality Control support personnel.

  Refer to the EPCM organogram (JZWEBR6013-PM-ORG-0035) for the required EPCM personnel and designations for Phase 1. Certain categories of staff may do multi-tasking due to the size of this project.

  The Project Team is made up of various speciality Management Contractors / Consultants, employed for the performance of specific tasks related to the Project, these are:

  EPCM Engineers - for detail engineering and design functions in respect of the infrastructure, buildings, and civil / structural disciplines.

- The project structure has been set up with the following in mind:
  - Bilboes performance to outsource projects.
  - Bilboes project teams experience in managing similar outsourced projects.
  - Achieving the technical objectives on time, within budget and quality, and at minimal cost.
  - A conviction that the contractors that are employed are competent, and that it is necessary to appoint only a small core of full-time supervisors to oversee them.
  - Best use of the “partnering” concept shall apply to the maximum benefit of the project.
  - The integration of the project’s various entities’ personnel into a singular “Project Team” identity, to create an environment of openness, common goal approach and trust to maximize co-operation and thereby effectively improve on the overall efficiency of the project execution.

18.9.1.5.2 Roles and Responsibilities

The project team headed by the Project Manager shall, as a unit, be responsible for the Managing, Engineering, Procurement, Accounting, Cost Control, Quality Control, Planning, Safety Management, Construction and Commissioning of the Bilboes project.

The contractual relationship of the various entities providing the personnel, skills, systems, processes, and technology that make up and equip the Project Team for the execution of the project is not detailed herein. However, it is detailed in the respective contracts placed with the respective entities, and in the definition of responsibilities shown in the Project Responsibility Matrix as contained in (JZWEBR6013-PM-MTX-0036).

The purpose of this Project Execution Plan is to document the Project Team structure, provide the methodology, concepts, procedures, and respective protocols that will be followed / utilised in the execution of the project.

The emphasis remains on the identification of the integrated entities into a singular Project Team. (See detailed roles and responsibility description - JZWEBR6013-PM-REP-0037).

18.9.1.5.3 Staff Acquisition

Key positions will be identified and sourced from within the EPCM contractor.

Cognisance must be taken of availability of personnel and possible time for demobbing from other projects.

Due to the nature of a project cycle, the construction crew will be finalised shortly prior to the requirements on site.

18.9.1.6 Project Initiation

Project initiation consists of several activities that occur at the start of the project. These activities include the Kick-off Meeting and Alignment sessions as required.

18.9.1.6.1 Kick-Off

A Kick-off meeting will be held with the EPCM project team and appointed Bilboes representatives, including information gathering visits to site as appropriate. This meeting will be documented by conference notes and distributed to all the relevant parties. The meeting briefing for the project team shall include safety, scheduling, CBE, design parameters, etc.

18.9.1.6.2 Process Design Criteria Review

The EPCM Process Engineer, working with the Lead Discipline Engineers, will perform an internal review to ensure that the required basis is still applicable for the process design.

18.9.1.6.3 Alignment

An Internal Alignment session will be held by the EPCM project team with the objective to formulate the strategy for execution of the project. The Project requirements will be reviewed during the meeting and activities which may improve the project cost or schedule will be investigated during the Internal Alignment session.

The objective will be to clarify execution strategy, share project values, clarify roles and responsibilities, identify critical activities, align Scope of Work, budgets, deliverables, and work processes.

A Client Alignment session will be held with the EPCM team and Bilboes team and included information gathering visits to the site as appropriate.

18.9.1.6.4 Activity Plans

Activity Plans will be prepared by the leaders of the various areas of the project set-up which will outline the anticipated activities expected for the project, the procedures to be used to perform the activities, and the individuals responsible for preparation, checking / review, and approval.

18.9.1.7 Records Management

18.9.1.7.1 Project Filing System

All filing will be carried out using the systems like what is described in the Document Control Procedure.

18.9.1.7.2 Record Retention

Hard copies of all procurement documents, manuals, and original drawings will be archived, and retained for a minimum period of 3 years.

Copies of all contract / order files will be handed over to Bilboes upon completion of the project.

The project documentation archiving and retention requirements are to be defined prior to Project Close-Out, for this purpose a project documentation / records filing and archiving procedure as well as a Project Close-Out procedure shall be developed. These documents will include orders, specifications, drawings, and items of a contractual nature.

This procedure shall also set out the method and manner which the final documentation will be handed over to Bilboes.

Specific attention shall be given to the update of final design drawings to “As Built” status.

The project document control procedure outlines the electronic and hardcopy documentation filing process, which take full cognisance of any Bilboes established principles, procedures and systems used.

18.9.1.8 Project Administration

18.9.1.8.1 Office Space, Equipment and Services

The EPCM project team will be located at site.

Unless specifically required by the Project Manager, additional outside specialist consultants will be resident in their own premises.

Construction site offices will include the necessary furnishings and computer equipment.

18.9.1.8.2 Security

- Consultants normal building security to be utilized with regards to safe keeping of drawings and documentation at the respective home offices
- 24-hour office security will be the responsibility of Bilboes

18.9.1.9 Project Communications

18.9.1.9.1 Project Meetings and Reporting

The Project Team will hold monthly scheduled progress meetings and regular internal design review meetings with other related Project Teams, the Project Sponsor and Bilboes discipline representatives. The progress meetings are followed by design reviews with either 2-D drawings, or 3-D model presentations.

EPCM Project team internal drawing office / engineering meetings are held weekly to ensure communication between the drawing office and the engineers is maintained and up to date.

The Project Teams discipline engineers shall, during the Construction phase, attend weekly or bi-weekly progress meetings on site.

The EPCM Project Manager will compile, with the assistance of the project team, a monthly progress presentation by the end of each month, covering the month's activities. The presentation will detail the following:

- Executive summary.
- Project Managers overview.
- Safety report.
- Project schedule.
- Project cost control.
- Procurement status.
- Quality control.
- Project engineering activities completion status.
- Project site construction and commissioning.
- Areas of concern and corrective actions.
- Project risks.
- Highlights.

18.9.1.9.2 Correspondence

Correspondence of a contractual nature shall be via email to the recipients with electronic signatures for tracking purposes.

Day to day correspondence shall be via email.

18.9.1.9.3 Project Procedures

The following documents and procedures will form part of the project setup:

- Safety, Health and Environment (SHE)
- Engineering Design Criteria
- Process Design Criteria
- Project Execution Plan
- Procurement Procedure
- Cost Controls and Change management
- Document Control
- Quality Control
- Commissioning procedure

18.9.1.10 Public Relations

All issues pertaining to Public Relations are to be addressed by Bilboes.

18.9.1.11 Safety, Health and Environment

18.9.1.11.1 Program Objectives

It is a primary objective of the project that the project is executed in Bilboes and Statutory Safety, Health and Environmental guidelines.

On the same objectives, Bilboes and EPCM contractor to ensure that all employees are medically fit and to provide all employees on the project with sufficient knowledge, training, and information to perform their tasks to the best of their abilities and safely.

18.9.1.11.2 Safety Management

It is the agreed project safety philosophy that Bilboes complies with international industry accepted best practice safety principals and standards.

The Bilboes safety philosophy is based on establishing and enforcing high safety standards supported by a “People Based Safety” (PBS) program.

The safety principles include:

Beyond Zero: Safety, Health and Environmental management goes beyond Zero Harm. Responsibility for identifying and correcting all at-risk behaviours and unsafe work conditions.

Active Involvement of All: Understanding of all at-risk behaviours and conditions, Bilboes and contractors to identify and eliminate such conditions and behaviours.

Actively Caring for people: Responsible for nurturing a culture of “actively caring for people”,

Non-negotiable Safety, Health and Environmental Standards: Embracing simple standards, rules, and regulations, in line with applicable laws and requirements.

18.9.1.11.3 Travel Safety

Night-time traveling will be avoided, and long-distance traveling should be avoided.

Contracting companies will be informed of all arrangements made and employees conveyed to and from the project will adhere to the standards specified by Bilboes. Statutory Road Safety shall be always adhered to.

18.9.1.11.4 Design Safety

All designs are ergonomically, safety, health and environmentally considered before approval.

All formwork and support work will be inspected and approved before handed over.

All structures will be inspected by a competent person before handed over.

Should a deviation be allowed to pass unnoticed it will be engineered out with minimal impact on SHE to the employees.

Continuous inspections and punch listing of constructed designs which includes aspects of SHE ensures that any deviation is promptly noticed and corrected.

18.9.1.12 Environmental

The main environmental objectives and targets for the project are:

- Compliance to all applicable environmental legal requirements and to the EMPR
- Compliance to all requirements of the Client’s construction environmental management plan (CMP)
- Good and transparent relations with the community and other interested parties around the project
- All environmental impact assessment issues will be addressed by compliance to the Clients CMP

18.9.1.13 Engineering and Design

18.9.1.13.1 Front End Engineering Design

It has been advocated that a short Front End Engineering Design (FEED) phase be implemented to bridge any gaps arising from the FS and Detailed Engineering period. The FEED phase will allow detailed design scoping to be done and focus on the key requirements for procurement planning and management.

18.9.1.13.2 Engineering

The Project Teams disciplines / sectors will carry out the execution of all required engineering to ensure the most effective and economical engineering and design complying with the Project's Design Criteria for the specific discipline/s of the Works and/or Services and the Works and/or Services as a whole.

All engineering and design works will be performed by the EPCM engineering and designers, with specialist design skills being sub-contracted if required

18.9.1.13.3 Engineering and Design Scope

The scope of work will include but not be limited to:

- The obtaining and verification of all data required to effectively engineer and design the respective plant, facility, equipment and / or system as may be applicable, as well as the required interfacing with the scope of other disciplines / sectors associated or interfacing thereto
- Performing specialized functions such as risk analysis, sensitivity analysis, simulations, and load studies to ensure optimum execution and interfacing of the work
- In the eventuality that certain Services are carried out by other Management Contractors / Consultants, the respective discipline / sector shall be responsible for the interface, co-ordination, input and flow of information, planning requirements, etc. associated therewith
- Provision of engineering support services during manufacturing, fabrication, erection, commissioning, and handover

18.9.1.13.4 Detail Engineering and Design

The Project Teams disciplines / sectors shall during the detail engineering responsible for:

- Development / review of the Project Process and Engineering Design Criteria.

- Detail operating philosophies.
- Detailed process, earthworks, infrastructure civil, structural, platework, electrical, instrumentation and control designs.
- Detail equipment schedules.
- Equipment specifications.
- Detailed draughting (excluding shop detail drawings).
- Process performance specifications.
- Construction specifications.
- Review of Construction execution plan.
- Provision of detailed Construction packages scope of work within the prescribed WBS structures for incorporation into the various enquiries / contracts and respective specifications.

18.9.1.13.5 Project Engineering Design Criteria

The Project Engineering Design Criteria is a document that details the project specific multi-discipline engineering design specifications and any client specific design requirements, as well as proven design criterion utilised on other successfully executed projects.

The Project Engineering Design Criteria sets out the basis for costing the project and provides the guidelines for the drawing office to base the design.

18.9.1.13.6 Equipment Specifications

Bilboes' standard specifications shall be used by the Project Team's Engineering disciplines / sectors, as a basis for the development of the project specific specifications for all the equipment. Only where Bilboes specifications cannot be adapted, shall the generation of the applicable specifications be permitted. However, these shall be subject to review and approval by the respective Bilboes' representative.

Where equipment is not pre-determined, Bilboes specifications shall apply.

Note: Specification approval by Bilboes is mandatory; however, this approval shall not relieve any Project Team Discipline / Sector of its contractual responsibility for the professional accuracy of such documents.

The circulation of specifications for comment and approval requires that all comments be captured for inclusion in the final document and until the necessary assurance is obtained

that this can be achieved by electronic circulation, “Hard Copy”, specifications shall be circulated under cover of a circulation list.

NB: Specifications shall always be ‘fit for purpose’.

18.9.1.13.7 Drawings and Standards

All civil, structural, platework, mechanical, piping, electrical and instrumentation drawings and schedules will be generated the EPCM contractor.

The functional design parameters and criteria, specifications and duties for the major plant equipment is the responsibility of the EPCM Contractor to generate and co-ordinate.

The EPC Contractors will consolidate the design information, duties, and specifications to produce the Process Design Criteria document, Process Flow Diagrams, equipment lists, equipment data sheets, Piping and Instrument Diagrams and control philosophy document for the approval of Bilboes.

The design office Section Leader, drawing office Manager and 3-D Model Co-ordinator will be appointed in the drawing office as required.

The conceptual 2-D layout drawings completed during the study phase will form the basis for the mechanical design layout drawings, which will be approved by Bilboes. When sufficient accuracy is attained in the mechanical design layout drawings and once certified information has been obtained, they will be converted into 3-D models which will be reviewed internally by the EPCM Contractor as well as presented to the Bilboes Team.

The 3-D building frame will be used for structural design and thereafter, be updated into a 3-D structural GA.

The 3-D Model Co-ordinator will manage the creation and export of conceptual 3-D platework drawings into the 3-D model. The conceptual 3-D platework drawings have a lower level of detail but will be dimensionally accurate. These conceptual 3D drawings will ultimately be passed onto draughtspersons for 2-D detailing and subsequently retro 3D modelling (if required) and re-insertion into the 3-D model. Platework will be fabricated from the detailed 2-D drawings, but the 3-D drawings are important to complete the 3D model and for subsequent piping design and cable routing interface control.

The equipment drawings will either be received as 3-D models from the Vendors or will be modelled by the EPCM design office from certified 2-D drawings and inserted into the working model.

The piping will be routed on the 3-D model and exported for detailing in a 3-D piping package, which has a data base to match the piping specifications. Completed piping is inserted into the 3-D model.

Flooring and handrails are matched to the floor steelwork in the model.

The working model is reviewed regularly by the project team for operating and maintenance access and suitable pipe and cable rack routes.

The completed structural model is issued to the steelwork fabrication contractor for electronic detailing. Their detailed erection drawing is later inserted in the model, replacing the original structure.

The 3-D modeller checks the model for clashes between components to ensure the integrity of the design is maintained by co-ordinating information as received from mechanical, platework, piping and structure components. In essence, the model is used as a checking tool during the design phase and is finally converted for General Arrangement purposes.

This modelling method minimises on site errors, which tend to be limited to fabrication errors. This is beneficial in reducing site construction time and in reducing the risk of remedial work claims.

18.9.1.14 Procurement

18.9.1.14.1 Procurement Strategy

Procurement, which includes purchasing, sub-contracts, expediting, inspection and delivery will be the responsibility of the Project Manager who will rely on the Project / Discipline Engineers to implement most of the procurement activities. The Project Procurement Coordinator will assist the Project Manager and Engineers in all procurement activities.

Purchase orders and re-measurable construction contracts will be placed on behalf of Bilboes.

Payment directly to vendors and site contractors will be made by Bilboes, after the necessary approvals have been obtained from the EPCM Contractor.

18.9.1.14.2 Equipment Supply

The vendor list will be generated by the EPCM Contractor and be approved by Bilboes. Where no vendor has been chosen, or the Project Engineer wishes to change the vendor from the one listed, the Client's prior approval will be required.

Equipment may be chosen for technical fit / design, or purely based on quality and price. Single source vendors will be identified by the Bilboes, or proposed by the EPCM Contractor, including a suitable motivation to use one vendor / contractor only.

All equipment will be ordered timeously, to meet the construction programme. However, due regard will be given to cash flow considerations and the risk of damage due to storage of equipment lying idle on site.

18.9.1.14.3 Structural Steelwork, Plate Work and Piping

The project philosophy is to procure these items from well-known Zimbabwean or South African based fabricators.

It is envisaged that the appointed fabricator will also perform the site installation works thus removing contractual interfaces.

18.9.1.14.4 Construction Contracts

18.9.1.14.4.1 Re-measurable

It is envisaged that separate re-measurable construction contracts will be placed for:

- Earthwork, civil works, and buildings
- Structural Steel, Platework and Piping supply, fabricate and erect including mechanical installation
- Electrical, Instrumentation and Control installation

All the above contracts will be based on rates applied to bills of quantities for the scope of work as defined and as such, will be re-measurable.

18.9.1.14.4.2 Commercial Terms and Conditions

A comprehensive set of commercial terms and conditions will be drawn up in conjunction with Bilboes. These are largely based on the [FIDIC ‘99] suite of contracts and will be reviewed in detail with the Bilboes project team.

Regarding re-measurable site-based contracts, FIDIC Red Book 99, shall form the basis of contract.

- Re-measurable Contracts shall incorporate, where applicable, the following as a minimum
- A detailed scope of work document
- Tender drawings - which were mechanical layout drawings

- Tender bill of quantity schedule with the Contractor's rates in
- The Contractors accepted signed bid document
- Pre-Contractual award Correspondence (letters and emails) between both parties
- Agreed upon Level 3 Schedule per plant structure, complete with intermediate beneficial handover dates
- Agreed upon free issue items
- Earthworks and Concrete cubes histograms
- Labour and supervision histograms
- Mobile equipment (cranes, dumper trucks, batching plant and histograms
- CVs of the site manager and senior supervisors
- Cash flow S curve based on forecast progress per month and agreed payment terms

18.9.1.14.5 Inspection and Expediting

QC Inspectors will visit the premises of equipment suppliers and fabricators and issue reports to ensure that quality standards are maintained to meet the technical requirements of the orders and sub-contracts placed. The inspector's written release will be required before any major item of equipment or fabrication is delivered to site.

Expeditors will expedite and report on the timeous supply of all equipment and fabricated items at regular intervals until delivery to site, to ensure that deliveries are made in accordance with contractual and construction requirements. The expeditors will also be responsible for the timeous and correct flow of documentation, including drawings between the EPCM Contractor, vendors, fabricators, and site.

Independent inspection authorities and specialized inspectors will be employed where considered necessary.

It is important to note that the EPCM Inspectors' role is not to duplicate the quality inspection function of a Supplier, but rather to ensure that a Supplier comply to a formalised quality inspection process (as formalised in the QCP documents).

18.9.1.14.6 Procurement Management

The primary goal of the Procurement System is to provide an auditable system of procurement tracking and approvals.

All procurement will be done using the Procurement Procedure (JZWEBR6013-PCM-PR-0038) and standard order forms. All orders will be placed in accordance with a Project Procurement Workflow, attached to the Procedure.

All documentation must be kept securely under the control of a Document Controller / Project Administrator.

18.9.1.14.7 Procurement Operating Plan (POP)

The procurement of equipment and / or services shall follow the Procurement Operating Plan. Dates used in the POP are based on the Project Programme.

The POP register will be generated and maintained by a Procurement Coordinator and shall detail the package number, package description, responsible EPCM engineer, proposed and selected vendors, enquiry issue and closing planned and actual dates, TEAR completion and approval planned and actual dates, and the order placement planned and actual dates.

The POP register needs to be reviewed on a weekly basis to track procurement progress.

18.9.1.14.8 Approved Vendor List

All proposed vendors will be approved in advance of issuing enquiries. The vendor list will be compiled by the EPCM Contractor in conjunction with the Bilboes.

Once the proposed vendors have been approved by the Bilboes, their names are reflected on the POP schedule, and enquiries are only issued to these vendors.

18.9.1.14.9 Vendor Data Control

A document management system will be put in place by the EPCM to track and expedite all drawings, datasheets, maintenance manuals and other data received from vendors / suppliers which form part of their contractual deliverables. This system will capture the “vendor data requirements” information defined in the purchase orders placed with the vendors and produce regular reports on what drawings and information is outstanding from the vendors. It will also identify the status of drawings and documents e.g. (i) Approved, (ii) Approved with comments, (iii) Rejected etc.

18.9.1.15 Change Management

18.9.1.15.1 Change Management Process

The change management process will track current budget and forecast and consider any deviations (trends), budget shifts, and change orders which have been identified.

The project team will use the following strategy to ensure that engineering, procurement, and construction efforts are appropriately matched to the project cost estimate and any deviations identified will be reported to project controls:

- Project deliverables and work hour estimates will be compared with the initial estimate to identify any significant changes in scope, duty, and size (and hence in the anticipated cost)
- Supplier prices will be compared with the prices used in the project estimate to identify any significant differences
- Quantities of bulk materials will be compared with the amounts included in the project estimate
- The Project Controls team will also perform comparisons to the control base that will include, but not be limited to, take-off quantities, unit prices, work hours, changes to equipment or specifications, and changes in project execution. Any deviations identified because of these comparisons will be processed through the project change notice system
- Refer to the Cost Control Procedure (JZWEBR6013-CC-PR-0039) for Change Orders, Project Deviation Notice and Project Variance
- No scope or design changes are to be executed until Bilboes has approved these in writing

Once a change or potential change has been identified, a decision will be taken between the Bilboes ‘’Engineer’’ and EPCM Project Manager as to whether work in the area concerned, is to be stopped, or continued on the previously agreed scope until such time as the change of scope is approved.

18.9.1.15.2 Contingencies

All Contingencies will be with Bilboes. To record all amounts deemed to be Contingencies, any claims from the Contingency account shall be motivated and applied for in writing to Bilboes via the Project Manager.

It is important to understand that any change or deviation from the approved budget needs to be categorised under one of the following three headings:

- Escalation - Funded from a separate escalation fund
- Project Contingencies (any changes in quantities and rates from the original budget and/or uncertainties associated with design detail) - Funded from Project Contingencies
- Scope Changes - Funded from Management / Bilboes Contingencies

18.9.1.16 Risk Management

18.9.1.16.1 Risk Management Plan

The project team will develop a Risk Management Plan to identify areas of potential risk, integrate potential risk events, courses of action and method of control and to establish a comprehensive risk response methodology.

18.9.1.16.2 Roles and Responsibilities

The Project Manager will be responsible for the following:

- Leads and co-ordinates the risk management process
- Approves identified corrective actions
- Obtains executive management approval for contingency applications
- Manages corrective action implementation
- Ensures formal record of lessons learnt

The Project Administrator will be responsible for:

- Raising contingency requests
- Managing the risk event record system
- Updating the Risk Management Plan when required
- Coordinating the updating of risk close-out data

18.9.1.16.3 Risk Assessment and Register

The risk assessment done as part of the FS Report (or any work prior to project execution) will be used as a basis. This risk register will be updated against action items and any new developing risks monthly.

18.9.1.16.4 Review Schedule

The Review Schedule forms part of the project risk management plan and indicates who or what parties will be involved in project reviews, including safety, HAZOPs, constructability, operability, and design reviews.

18.9.1.17 Materials Management

Materials management will be affected by expediting orders placed, managing supplier quality control and site material control.

18.9.1.17.1 Expediting

The responsibility associated with expediting order delivery within contractually agreed delivery schedules rests with the Area Discipline Engineers who originate the various orders. They in turn task the Project Expeditor / Inspector/s to expedite the supply of goods and services in accordance with order requirements. The expeditor/s is / are essentially the Engineers “eyes and ears” in the field and expedite progress against Engineer approved supplier manufacturing programmes, reporting back to the relevant Engineer/s their findings and actions taken to ensure timeous delivery.

18.9.1.17.2 Supplier Quality Control

The management of supplier quality control is also the responsibility of the Area Discipline Engineer. Equipment items deemed to be “critical” and “major” in terms of the Project Quality Plan (JZWEBR6013-HQC-PL-0040) shall be controlled by means of supplier generated (and Engineer approved) quality control plans (QCPs). The Expeditor / Inspector will inspect work against order documentation, approved construction drawings and approved quality control plans. All work will be subject to final inspection and release except where the Contractor is responsible for supply, erection, and commissioning of work. In such cases the EPCM Inspector will conduct random inspections of physical work and will review the Contractors quality control documentation during fabrication execution.

Where QCPs have been used to control fabrication method execution, quality data books will be compiled by the Contractors in accordance with the requirements of the Project Quality Plan.

The EPCM Inspector will work closely in conjunction with the EPCM Discipline Engineer; ensuring adequate notification is given for inspections of goods, as detailed on the Quality Plan.

18.9.1.17.3 Site Material Control

All deliveries to site shall be received by the Contractor who will direct the goods to the place of offloading or to the site-based Contractor's site establishments, as required. All goods that are free issued to the erection Contractors will be received into the site store by the Contractor's Material Controller who will check receipts against order and release note documentation. Over, short, or damaged goods discrepancies will be referred to the Site Construction Manager, the Area Engineer, the Supplier, and the Expeditor / Inspector for follow up and rectification.

18.9.1.17.4 Control of Delivery Documentation

The Contractors Material Controller to record all delivery documentation and report to the EPCM discipline site supervisor, copy to be kept on site and the original documentation to the EPCM Project Cost Controller on a weekly basis.

18.9.1.18 Project Controls

18.9.1.18.1 Planning

A project plan will be developed by EPCM Contractor. The initial Contract Plan will be developed at a level of detail necessary, in the opinion of the EPCM Project Manager, to ensure effective control over the work to be executed.

As requested by the Bilboes, Microsoft Projects will be used for this purpose. A detailed project plan will be developed for the Design phase through to the Start of the Hot Commissioning Phase.

The plan will be resourced and weighted to provide a balanced view of the relative efforts per phase. S-curves will be developed reflecting the Early and Late Percentage Progress per Phase, using the weighted efforts.

The Project Plan and S-curves will be presented to the Bilboes for feedback and buy-in. Once agreed the Project Plan will be baselined and incorporated into the EPCM contract.

The basis of the project planning will be the Work Breakdown Structure (WBS).

18.9.1.18.2 Scheduling

The Critical Path Method (CPM) technique of planning and scheduling will be used for the Project (JZWEBR6013-PLAN-PR-0041 Planning Procedure).

The project will utilize Microsoft Projects to develop the following types of schedules:

Management Level Schedule - Defines the major activities and interfaces between engineering, procurement, fabrication and construction, transportation, installation, and pre-commissioning, commissioning, and start-up. This is a high-level summary schedule and is issued in the monthly progress report.

Project Level Schedule - A CPM schedule is "rolled up" from the detailed control schedules. It will be broken down into various WBS Areas of the project. Development of the project level schedule will be based on the initial management level schedule and the WBS.

Control Level Schedules - Detailed schedules which are generated for tracking and control of various activities and deliverables for all phases of the project. Where possible, the schedules will break the work down to the discipline, area, or work package level. These schedules will be coded with the related WBS codes.

The following specialty control schedules will also be developed by the EPCM Contractor for all disciplines and utilized on the project:

- Drawing Issue Schedule.
- Procurement Schedules.
- Equipment Manufacturing and Material Delivery Schedules.
- Pre-Commissioning, Commissioning, Validation, and Start-up Schedules.

Suppliers and service providers to the project will be expected to prepare project plans to level of detail appropriate to the services rendered.

In the event of scope changes and / or changes in the levels of detail required, the project plan may be redeveloped and re-baselined at the discretion of the EPCM Project Manager and in agreement with Bilboes.

Progress will be monitored, and the program updated at regular intervals using information supplied by project team members, suppliers, and service providers. Actual and expected progress will be compared to the latest agreed and baselined project plan.

Routine reporting to Bilboes will be by means of S-curves prepared and incorporated in the Monthly Progress Report, showing the Actual and Expected Progress Percentage, compared to the Planned Early and Planned Late Percentages, again per Phase. The periodic variance from the agreed Baseline values will also be reflected in the report.

Gantt charts will be prepared and used for internal EPCM and / or contractor and service provider information only. Ad-hoc Gantt charts can be prepared on request for other interested and affected parties with prior consent from the EPCM Project Manager.

18.9.1.18.3 Cost Control

The project cost system will be set-up at project initiation and keep track of original budget, current budget, current forecast, commitments, and expenditures. The Cost Baseline Estimate (CBE) will be refined at the end of the design phase with the relevant final costs obtained during the tender period. This will serve as the cost control base for the project and will be loaded into the project cost control system for the Construction Phase. Budget and forecast will be input to the cost system by the Project Controls team from estimates and deviations.

The project controls team will analyse the data monthly (including commitments and expenditures) in a single report and inform the project management and Bilboes of the cumulative impact of any deviations to the project scope.

The project controls team, with assistance from engineering, procurement, and other project team members, will provide cash flow projections monthly. The cash flow projections will include projections of both committed and expended costs for the project.

The Project Team Disciplines / Sectors as well as other appointed personnel are responsible for cost control of their area/s, including their reimbursable man-hours. They will do so using a cost management system acceptable to the Project and with the capability of integrating with the Project Cost Control System.

The cost control will be in accordance with Cost Control Procedure JZWEBR6013-CC-PR-0039. EPCM Contractor cost control system will be always used.

The Project Cost Controller will be dedicated to the Project and report to the Project Manager and interface with the Bilboes Project Cost Controller.

18.9.1.18.4 Finance and Accounting

The EPCM Cost Controller will be responsible for processing of approved payments to Engineering Contractors / Consultants, Suppliers and Erection Contractors upon approval of invoices by the Project Team.

Progress payment certificates, invoices, etc., will be addressed by the vendor to the Purchaser.

A project specific invoicing, certification, invoice certification and payment procedure shall be developed. This procedure will address all the aspects relating to the project and cover all the Bilboes requirements. It shall address in detail the process of invoicing approval and the levels of authority.

18.9.1.19 Quality

18.9.1.19.1 Quality Assurance

Quality Control on work packages is the responsibility of the discipline engineer, supported by the QC inspector. Overall accountability for quality remains with the project manager.

The quality control will be in accordance with Fabrication Quality Control Procedure JZWEBR6013-HQC-PR-0042 Project Quality Plan JZWEBR6013-HQC-PL-0040 and Construction Quality Control Procedure JZWEBR6013-SITE-PR-0043.

The project quality plan (PQP) outlines the quality system procedures, organisational requirements, responsibilities, and activities necessary for the effective performance of project quality management of client specific contracts.

The Fabrication Quality Control Procedure is intended to instruct the contractor as to the minimum quality assurance (QA) and control requirements (QC) for the fabrication / manufacturing / supply / installation of goods in terms of the contract.

The document also serves to ensure that the communication, approvals, and quality acceptance criteria between the contractor, EPCM Contractor and Bilboes is clearly defined.

The Construction Quality Control Procedure outlines the construction quality activities which the construction team will perform on the project and deals with how construction quality will be controlled as an independent activity

The procedure will serve to ensure that the communication, approvals, and quality acceptance criteria between the EPCM contractor and Bilboes is clearly defined.

18.9.1.19.2 Quality Control and Expediting

The Project Team discipline responsible sector will provide the Pre-delivery, Quality Assurance (QA), Quality Control (QC) and Expediting functions for all Mechanical, Structural Steelwork, Platework, Piping, Electrical and Instrumentation equipment and materials procured for the Project.

For this purpose, a quality plan for approval by Bilboes Project team shall be developed.

The Project Team discipline / sector shall be responsible for interaction and liaison with the other discipline / sectors (specifically Project Procurement department and Planning) and other Management Contractors / Consultants.

18.9.1.20 CONSTRUCTION

18.9.1.20.1 Construction Philosophy

The EPCM Contractor will mobilise a Project Construction Management Team who, under the overall direction of the EPCM Project Manager, through the EPCM Construction Manager will manage and co-ordinate the activities of the appointed construction contractors.

These appointed construction contractors will perform the construction operations for the duration of the construction phase.

18.9.1.20.2 Construction Management

The project construction management process is described in detail in the project specific Construction Procedure (JZWEBR6013-SITE-PR-0043).

18.9.1.20.3 Construction Organisation and Responsibilities

The Project Construction Management Team will be responsible for the construction management of the various contractors appointed to construct / erect the plant.

The Project Construction Management Team will be headed by the EPCM Construction Manager who carries overall construction responsibility.

The EPCM Construction Manager will be assisted by EPCM Discipline Supervisors who are responsible for the supervision of the construction works on a discipline basis, which may or may not cross area boundaries.

Construction safety management is the responsibility of the EPCM Construction Manager who will be supported by a team of EPCM safety management specialist supervisors. The EPCM Construction Manager is further supported by the EPCM Discipline Supervisors who are directly responsible for safe work practices in their respective areas.

The Project Construction Team will be further complimented by a site administration staff including a site secretary and an external QS when required.

18.9.1.20.4 Geotechnical Survey

All foundation designs will be based on the FS Geotechnical work by SLR. Ongoing geotechnical works shall be performed as required to confirm the assumed design parameters.

18.9.1.20.5 Site Surveys

The site co-ordinate system is [UTM Arch 1950 S].

A site surveyor will be appointed and shall be utilised on a part time basis throughout the construction phase and shall confirm the respective contractors setting out points for the individual structures.

The appointed surveyor shall also conduct as-built measurements for QS purposes and shall verify construction tolerances comply with the project specification if required.

18.9.1.20.6 Construction Contractor Strategy

A single civil and earthwork contractor is proposed, as splitting the civil scope would have not been appealing to major civil contractors. The current scope is deemed of manageable size for an experienced civil contractor. The contractor will have teams on both sites with separate supervision for each.

Similarly, one SMPP (Structural, Mechanical, Platework and Piping) contractor is proposed, as the structural quantities, is deemed of manageable size for an experienced SMP contractor. The contractor will have teams on both sites with separate supervision for each.

18.9.1.20.7 Site Laboratory

A site construction quality laboratory will be established by the Civil Contractor so to ensure materials of construction are in accordance with the specifications, to confirm founding conditions are as per the design, and concrete strengths are within specification.

18.9.1.20.8 Site Security

Bilboes will supply security on both sites.

18.9.1.20.9 Construction Quality Assurance

Project construction quality management will be achieved via physical site works inspections / verifications carried out by EPCM Site Discipline Supervisors in accordance with the project construction quality procedure and the project specific construction

procedure and associated checklists / forms. This is covered in detail in the Construction Procedure (JZWEBR6013-SITE-PR-0043).

18.9.1.21 Commissioning - Testing, Handover and Acceptance

18.9.1.21.1 General

Commissioning is the phase of the project during which the completed installation is inspected, tested, and handed over.

This phase includes handing over custody and control of the Process Plant, its sections/areas, and systems to the Bilboes in an orderly manner and in a sequence to be agreed and reflected/ scheduled in the Project Program.

Process Plant start-up is a demanding and complex phase of the project. It involves the combined effort and co-operation of all parties, the Client, The EPCM construction and commissioning teams, Bilboes Engineering and Operations teams, Contractors and Vendors. A team of EPCM Commissioning Engineers will be established and will be appointed with overall responsibility for the commissioning of a particular system and handing over to the Client's team.

The commissioning team members will be identified, together with their areas of responsibilities, well in advance of the commissioning commencement date. It is essential to have Client's Start-up Team members also included in the Commissioning activities.

18.9.1.21.2 Commissioning Management

The project commissioning management process is described in detail in the project specific Commissioning Procedure (JZWEBR6013-SITE-PR-0044).

18.9.1.21.3 Commissioning Responsibilities

Cold commissioning (Commissioning phases C1 to C3) will be the responsibility of the Commissioning Manager. Bilboes Operations team will provide a full complement of operational and maintenance personnel as well as operational consumables.

Hot commissioning (Commissioning Phase C4) of the Contract Works will be the responsibility of and under the supervision of the Commissioning Manager. The commissioning, construction, and engineering team, with assistance from the appointed construction contractors and suppliers will be on hand to aid and facilitate the hot commissioning process. Bilboes Operations team will provide a full complement of operational and maintenance personnel as well as operational consumables.

Note that custody and control of the Process Plant reverts to Bilboes on completion of the C4 commissioning phase.

18.9.1.21.4 Commissioning Sequence

Commissioning will occur generally as per the sequence in Table 18-21 below; and as further described in the project specific commissioning procedure (JZWEBR6013-SITE-PR-0044):

Table 18-21: Commissioning Sequence

Term	Level	Definition	Examples
C1	Module / Unit	**Construction Completion** By signing the C1 certificate, signatories indicate acceptance that: ➢ Equipment has been installed as per the vendor requirements. ➢ Plant area construction is generally complete and safe to commence commissioning activities. ➢ Equipment and piping are clear of contaminants. ➢ Lubrication checked and carried out as required ➢ Any breathers and filters replaced (particularly for equipment that has been on site for more than a few weeks). ➢ Equipment is ready to have energy source (electrical power, air pressure, water pressure and/or hydraulic pressure) applied. All work from C2 onwards will be undertaken in accordance with the commissioning lockout / isolation procedures. Separate C1 certificates are required for each item reflecting the relevant engineering disciplines (civil, electrical, instrument and mechanical (inclusive of structural). Before signing off the certificate all mandatory punch list items must be signed off and various test sheets such as alignment tests must be signed off.	
C2	System / Unit	**No Load / Power on Commissioning** By signing the C2 certificate, signatories indicate acceptance that: ➢ Equipment has been direction tested ➢ Instrument air circuit is functional ➢ Control valves have been stroked. ➢ All ancillary equipment is functional ➢ Instruments are functional and calibrated ➢ Equipment is ready for load commissioning ➢ No load operating parameters are recorded, for example, no-load motor currents and vibration levels. ➢ As built protection settings are recorded. ➢ Mandatory and discretionary punch list items have been signed off. Relevant test C1 certificates will be attached to the C2 certificates. All equipment shall be run “empty” (bump test) and individually, for short periods in accordance with the running test procedures under supervision of the supplier	Pumps bumped, Valves stroked, Screens dry run, Mills turned, etc.

Term	Level	Definition	Examples
		(vendor, if required) and EPCM Discipline Engineer. The C2 certificate signifies completion of the “power on” test run.	
C3	System and/or Segment of System	**Run Plant on Water (Cold commissioning)** By signing the C3 certificate, signatories indicate acceptance that: ➢ All circuits satisfy their functional requirements ➢ All interlocks are functional ➢ All sequences are functional ➢ Conveyors are ready to accept material ➢ Wet circuits can be operated in accordance with the water balance developed for the circuit ➢ Instruments are recalibrated ➢ Circuits are ready to receive material The C3 activities shall cover a complete or sub section of a circuit, with all systems receiving a C3 commissioning acceptance certificate. At this stage conveyors are tracked, and water is introduced, and circuits balanced to allow steady operation. Tests are implemented to ensure that the functional specification has been met. The purpose is to run the works with water to ensure that the plant has been built and operates according to the functional design. **NOTE**: All C2 certificates must be signed off before a C3 test certificate can be issued for verification.	
C4	System / Unit (Operational but not necessarily to design specification)	**Feed System with Material (Hot commissioning)** By signing the C4 certificate, signatories indicate acceptance that: ➢ Facility modules are complete, subject to listed exceptions (non-critical punch list items) ➢ As built documentation has been completed and handover to operations ➢ Operating and maintenance manuals have been compiled and handed over to operations ➢ The system is ready to operate in a continuous operational phase but not necessarily at the design capacity. ➢ Quality product is delivered This C4 phase will include compiling a C4 punch list (should be non-critical items ONLY), checking instrumentation calibration, process flows and individual equipment throughput, building up to instantaneous design throughput. The issue of a C4 Certificate can indicate that a unit and/or the entire system (plant) is complete, tested and can operate with material (or process fluid). At this C4 stage, process commissioning has been satisfactorily completed and the plant is capable of being run with material (or process fluid) but not necessarily at the design capacity for a continuous period.	
C5	System (Operationally Complete)	**Facility Run at rated (nameplate) capacity** By signing the C5 certificate, signatories indicate acceptance that: ➢ The facility has run up and held at full continuous production at nameplate capacity for a duration as per	Concentrator Plant

Term	Level	Definition	Examples
		agreed contract conditions. ➢ The facility is reliable as per the agreed contract conditions. ➢ The facility has met the contractual performance guarantees. ➢ The Client insurer has been notified of plant handover and operational commissioning is completed. This is the final C5 handover certificate which shall be accepted jointly by the Contractor, the Client, and Operational Representative, could still have minor deviations (non-critical punch list items) attached.	

18.9.1.21.5 Responsibility during Commissioning

The commissioning sequence, responsibility and key inputs required for pre commissioning through to hot commissioning is summarised in Figure 18-17.

Table 18-22: Commissioning Sequence Responsibility

	Pre C1-2	Cold C3	Hot C4
EPC(M) Contractor			
Construction Manager	A	I	C
Commissioning Manager	I	A	A
Lead Discipline Engineer	R	R	R
Contractors Team	I	I	I
Process Control	C	R	R
Client (Through Operations Contracts)			
Maintenance Manager	C	I	R
Operations Engineer	I	I	R
Process Control	I	I	R

18.9.1.21.6 Operations and Maintenance

18.9.1.21.6.1 Operational Readiness Program

To form part of existing planned maintenance programme (by Bilboes).

The purpose of the Operational Readiness Programme is to:

- Establish systems of work in terms of organization, processes, and procedures to maximize start-up effectiveness of business operations.
- Establish data collection and information systems to maximize start-up effectiveness and ramp-up for the plant and facilities.
- Create a motivated and trained organizational capability to guarantee early returns and sustained business operations.

- Optimize the balanced life-cycle requirements for safety, availability, performance, and economy, particularly for operations and maintenance functions.

18.9.1.21.7 Operability, Safety and Maintainability Reviews

Operational and Bilboes Project staff will be involved on a continuous basis, in the project detailed engineering phase, with drawing reviews. During this review period all aspects of maintenance and suitable maintenance access will be addressed and resolved.

Following the completion of the PFDs and the piping and P and ID's, a complete HAZOP review will be conducted to ensure that the process is operator friendly with respect to safe access and operability and that equipment is adequately protected.

The critical members of the Bilboes team to be involved in the reviews are listed below.

- Plant Manager.
- Process Engineer.
- Engineering Manager.

18.9.1.22 Project Closeout

18.9.1.22.1 Project Close-Out Philosophy

This is the project phase in which the project is formally closed out, both from a commercial / contractual and administrative perspective.

18.9.1.22.2 Contractual Close-Out

Commercial / Contractual close-out is the process whereby the various project procurement packages are commercially and contractually closed out.

The EPCM Project Manager, with the assistance from the project procurement administrator and the project cost controller, ensures that commercial / contractual close-out is achieved whereby:

- Operational and Maintenance manuals are received form the vendors and dispatched to the Bilboes.
- All vendor performance / commissioning certification is in place.
- All commercial claims are resolved.
- Final contract values are agreed between the EPCM discipline engineers and the vendors.

- Re-measurable contract final measures have been agreed with the EPCM discipline engineers and the appointed Quantity Surveyors (if applicable).
- Contracts are amended accordingly to the final contract values.
- All contractual terms and conditions will be complied with where they prescribe specific procedures for contract close-out. (i.e., formal completion notices issued if applicable).
- Final invoices are received and processed for payment.
- Final close-out packs / files are generated per package.
- Retention schedules are generated and maintained.
- Retention and performance bonds returns are managed.
- A complete set of indexed records is be prepared for inclusion with the final project records.

Administrative project closure, co-ordinated by the EPCM Project Manager, will consist of documenting project results which will typically include:

- Formalizing acceptance of the facility by Bilboes.
- Obtaining EPCM / Bilboes contractual completion.
- Issuing of “As-Built” drawings and information.

Updating of project specific historical databases pertinent to the project (EPCM Documentation).

Archiving of relevant project documentation with particular attention being paid to the archiving of financial records, process design information and project detail drawings.

Recoding of lessons learned via project retrospective reviews and close out reports.

Note that administrative closure is an on-going process which should be dealt with as each phase of the project closes and not left until the end of the project. This will ensure that important and useful information is not lost.

18.9.1.22.3 Project Retrospective

An in-depth review, co-ordinated by the EPCM Project Manager, will be held at the end of the project or at any other significant project phase or completion milestone. This will ensure ‘learning after doing’ and represents a means for the project team to reach closure. The retrospective will be conducted in such a manner that it captures the knowledge gained prior to the team disbanding so that both positive and negative lessons can be transferred to similar projects.

A project close-out report is then typically prepared by the EPCM Project Manager with input from the EPCM Discipline Engineers and EPCM Construction Manager.

18.9.1.22.4 Project Close-Out Report

A typical EPCM project close-out report includes but is not limited to.

18.9.1.22.5 Purpose

A brief description of the reports purpose.

18.9.1.22.6 Project Description

A brief description of the project, the initial EPCM project scope of work and a description of any major changes in the scope if applicable.

18.9.1.22.7 Project Safety

This section contains the final project safety statistics, descriptions of any LTIs incurred, safety lessons, safety innovations, and safety successes.

18.9.1.22.8 Project Personnel / EPCM

This section contains details of the project's key resources and their contribution throughout the project, as well as detailing the man-hours expended verses those budgeted for (c/w reasons for variations). The Bilboes teams and relations are also discussed in this section.

18.9.1.22.9 Project Schedule

A summary of the project schedule and the milestones as well as a description of the actual progress and delays. Schedule lessons and opportunities should be discussed. The final project milestone bar chart should be included as well as the project S-curves.

18.9.1.22.10 Project Financial Performance

This section summarises the EPCM Contractor cost performance against the original budget and details the major cost variances. The major cost variances such as scope additions, estimating inaccuracies / omissions, escalation and foreign exchange impact should be discussed separately.

18.9.1.22.11 Quality Performance

This section describes any serious quality related issues / deviations experienced on the project, the mitigating actions implemented, and the lessons learned for future projects.

18.9.1.22.12 Design Performance

This section details the EPCM contractors drawing office performance with regards to number of drawings produced per discipline verses those budgeted for and notes any lessons learned with regards to innovative designs.

18.9.1.22.13 Procurement Performance

This section details the number of procurement packages and amendments placed, and comments on performance of the major equipment vendors. The duration of the procurement cycle should also be discussed if problematic.

18.9.1.22.14 Fabrication Performance

This section details the fabrication performance of the main re-measurable construction contractors and their respective sub-contractors.

18.9.1.22.15 Construction Performance

This section details the EPCM site set-up, the EPCM site team safety appointment structure, the construction personnel histogram, the site material handling issues, and construction lessons learnt.

This section also contains descriptions of the performance of the main erection / installation contractors complete with details of key personnel, peak resources, quantities installed and safety records.

18.9.1.22.16 Commissioning Performance

This section details the commissioning issues experienced, and the solutions that were employed. Also discussed is the make-up of the commissioning teams and a discussion on the control performance and the major control changes implemented during this phase.

18.9.1.22.17 Lessons Learnt

This section contains a photographic record of both positive and negative construction and commissioning issues experienced c/w descriptions of the respective problems and solutions.

18.9.1.22.18 Addendums

- The final project level 1 cost report.
- The final Change Notice Register.

- The final project quantity statistics.
- Project Photo Gallery.

18.9.1.23 Project Improvement Strategies

18.9.1.23.1 Alignment

A project team alignment between the different project organisations and key team members shall be arranged by the Project Manager in conjunction with Bilboes ‘’Project Manager’’, as early on as possible during the Project Execution Phase.

18.9.1.23.2 Lessons Learned

On completion of the Project a Close Out workshop will be held to document all lessons learned on the project. Lessons learnt discussion and updating shall not be a once off event, but rather an on-going effort on a month-to-month basis.

18.9.1.23.3 Knowledge Management

18.9.1.23.3.1 Peer Assist

Peer Assist meetings or workshops will be arranged during the project when the project is faced with a specific challenge or problem. This may also be prior to the launching of any new phase of work to ensure that learning gained from other projects is utilised in this project. People not directly involved in the project will be invited to share their experience, insights and knowledge and potentially recommend further areas of investigation.

The aim is to maximize the outcome for a specific piece of work.

18.9.1.23.3.2 Project Retrospectives

On completion of the Project, a Project retrospective will be held with the EPCM team and Bilboes team to capture learning from the project. Lessons learned discussion and updating of the lessons learned register shall not be a once off event, but rather an on-going effort. Also refer to the closeout section in this document.

18.9.2 Basis of Schedule

18.9.2.1 Introduction

This basis of schedule describes the basis and methodology used to prepare the Implementation schedule, (hereafter referred as the “Schedule”).

The schedule represents a Level 3 Gantt chart configuration based on information collected from FS.

The schedule is a deliverable of the Bilboes Base Economic Case FS as used for long term planning, including cash flow. The schedule will be revised to be aligned with the latest information available before the project can be progressed from the planning phase to the execution phase.

The sequence of events has been scheduled using the mine development schedule per work package as displayed in Figure 18-21.

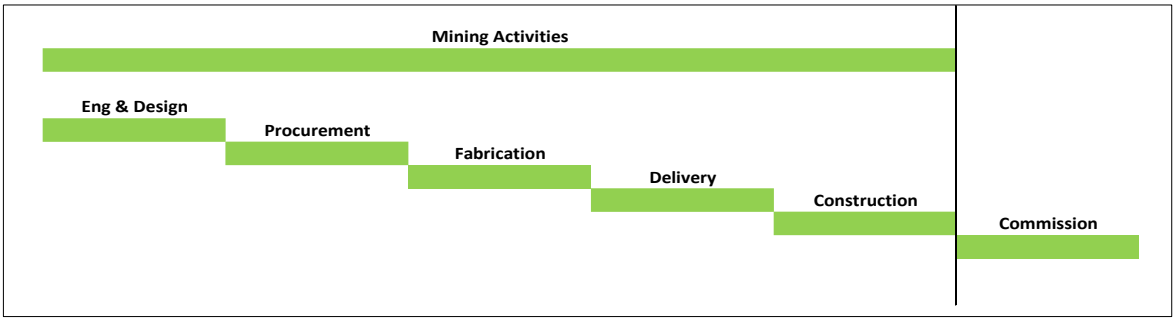


Figure 18-21: Sequence of Events Methodology

The schedule has a -10% to +25% confidence and accuracy level based on Analogues Estimating and current level of detail stipulated in the schedule. Previous project knowledge and expert judgment was utilised during the estimating of duration and sequencing of events.

18.9.2.2 Definitions

18.9.2.2.1 Milestone

This is an activity within the schedule that marks a point in time when a group of activities will start / complete and has 0 days duration.

18.9.2.2.2 Detail Level of Schedule

The schedule has been developed to detail level 3. At a later stage, the schedule will be used to develop the Sub contractor schedule to a level 5/6 schedule as more detailed information becomes available and contractors are appointed. The levels as per industry standards are as follows:

Table 18-23: Detail Level of Schedule

Detail Level	Description
Level 1	Project Areas

Detail Level	Description
Level 2	Project Sub Areas
Level 3	Work Packages
Level 4	Discipline Levels
Level 5	Tasks of Each Discipline
Level 6	Hourly tasks

18.9.2.3 Schedule Criteria

The Schedule is developed in accordance with the approved WBS and Scope of Work document.

The Schedule is divided into three project phases each consisting of the following sub phases:

- Project Setup.
- Engineering and Design.
- Procurement.
- Fabrication.
- Delivery.
- Construction and Commissioning.

The Schedule calendar is project specific, based on a standard calendar (5 days a week and 8 hours per day.

The Schedule makes allowance for all South African and Zimbabwe public holidays depending on where the specific work is foreseen to be conducted.

Sub-contractor schedule requirements:

- The schedule must define as much as possible detail, at least to level 5.
- The schedule must be coded with the EPCM Projects Coding Structure which will be expanded to make provision for all sub-contractor's schedules.
- The project calendar must be used and will be provided to the sub-contractor.
- Microsoft Projects or Primavera P6 must as far as possible be used to program the schedule.
- The schedule must have an approved Baseline saved using the EPCM Projects Baseline maintenance procedure.

- The schedule must be aligned with the client Implementation schedule in terms of key dates and Milestones which will be provided in the form of the enquiry document.
- The schedule must comply with EPCM Projects schedule specifications in terms of schedule integrity.
- The schedule is subject to approval by the EPCM Project Planner, Project Manager and Responsible engineer.

Schedule maintenance should be done in accordance with the EPCM Schedule management plan to ensure continuity and quality assurance.

18.9.2.4 Schedule Development Process

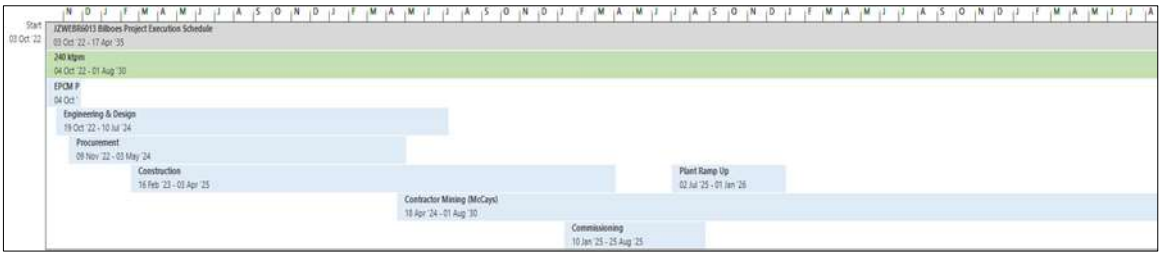
The schedule was developed using an enhanced systematic planning method. The process includes planning the schedule management, defining schedule activities, Sequencing activities using the critical path method, estimating activity durations, and finally developing the final schedule baseline. This was accomplished by means of scheduling workshops held with the project team on the following dates:

- Start Developing Schedule Structure: :16 Nov 2021.
- Individual input sessions: :19 Nov to 22 Nov 2021.
- Team schedule workshop: : 24 Nov 2021.
- Final team review session: : 25 Nov 2021.
- Client review: : TBA.

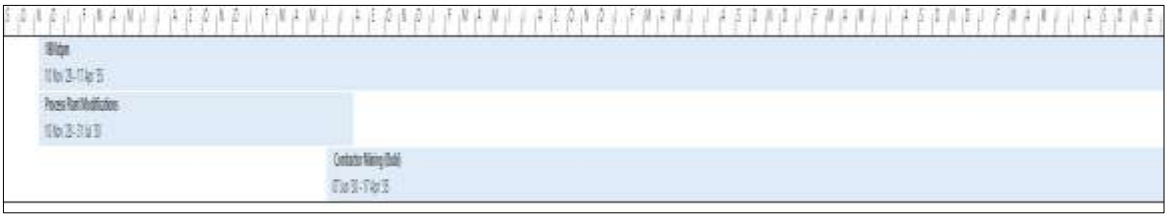
18.9.2.5 Project Timeline

The schedule duration start date is the October 2022 and completion date are the April 2035. The project is divided into two main phases. The first phase is to establish production at 240 ktpm from Isabella and McCays and lastly 180 ktpm from Bubi. This was done to smooth out the project cashflow on capital expenditure. The individual timelines for each phase are graphically represented below. The start date was determined by both mining development rates and long lead time items on the critical path.

240 ktpm – Year 1 to Year 8:



180 ktpm – Year 7 – Year 14:



18.9.2.6 Scope of Work

The project scope comprises of the following WBS:

Table 18-24: Work Breakdown Structure

LvL 1	LvL 2	LvL 3	DRA WBS Description	DRA WBS No.
A			MINING	A
A	01	00		A0100
B			PROCESS	B
B	01	00	ORE RECEIVING AND CRUSHING	B0100
B	02	00	MILLING, CLASSIFICATION & THICKENING	B0200
B	03	00	FLOTATION	B0300
B	04	00	BIOX	B0400
B	05	00	CARBON IN LEACH (CIL)	B0500
B	06	00	CARBON TREATMENT	B0600
B	07	00	GOLD ROOM	B0700
B	08	00	TAILINGS HANDLING & CN DETOXIFICATION	B0800
B	09	00	REAGENTS	B0900
B	10	00	PROCESS PLANT WATER SERVICES & RETICULATION	B1000
B	11	00	PROCESS PLANT UTILITY SERVICES	B1100
B	12	00	E, C & I PLANT	B1200
C			PROCESS PLANT INFRASTRUCTURE	C
C	01	00	PLANT SERVICES	C0100
C	02	00	PLANT BUILDINGS & WORKSHOPS	C0200
C	03	00	PLANT ELECTRICAL STRUCTURES	C0300
D			GENERAL SITE INFRASTRUCTURE	D
D	01	00	SITE WIDE SERVICES	D0100
D	02	00	ACCESS	D0200
D	03	00	TERRACES, DUMPS AND PLATFORMS	D0300
D	04	00	EC&I SERVICES	D0400
D	05	00	WASTE MANAGEMENT	D0500
E			INDIRECT - PROJECT FACILITIES	E
E	01	00	SHEQ	E0100
E	02	00	SECURITY	E0200
E	03	00	CONSTRUCTION SERVICES	E0300
E	04	00	CONSTRUCTION VEHICLES	E0400
F			INDIRECT - PROJECT SERVICES	F
F	01	00	CONSULTANTS	F0100
F	02	00	EPCM CONTRACTOR	F0200
F	03	00	GENERAL SERVICES	F0300
F	04	00	FIRST FILL & COMMISSIONING	F0400
F	05	00	SPARES	F0500
F	06	00	PROJECT INDIRECT COSTS	F0600
G			OWNERS COST	G
G	01	00	COMMUNITIES	G0100
G	02	00	ECONOMIC DEVELOPMENT PROJECTS	G0200
G	03	00	CONSULTANTS	G0300
G	04	00	RELOCATION	G0400
G	05	00	COMPENSATION	G0500
G	06	00	BBBEE	G0600
G	07	00	MEDIA & COMMUNICATION	G0700
G	08	00	ENTERPRISE DEVELOPMENT	G0800
G	09	00	FINANCIAL	G0900
G	10	00	EQUIPMENT	G1000
G	11	00	CONSUMABLES	G1100
G	12	00	SERVICES	G1200
G	13	00	CONSTRUCTION	G1300
G	14	00	ADMINISTRATION & OVERHEADS	G1400
G	15	00	PERMITS	G1500
G	16	00	INFRASTRUCTURE	G1600

18.9.2.6.1 Basis of Duration

All durations used in the schedule are based on previous project knowledge and industry standards known for the level of detail stipulated in the schedule. It is recommended that

further studies and planning are done to develop the schedule to with sufficient detail to support duration estimates, from various methods including but not limited to sub-contractors schedules. Bilboes Operational Processes have not been considered for procurement durations.

The schedule is only used for estimating and cashflow purposes. It cannot be deemed as an implementation schedule without further inputs from Engineering, Enterprise Environmental Factors, Operational Process Assets, Current and Future Agreements.

18.9.2.7 Exclusions

- Bulk Power supply from Zimbabwe government power supplier.
- EIA application process.
- Community relocation plan implementation.

18.9.2.8 Schedule Risks

The following schedule risks were identified with the regards to the execution phase of the project:

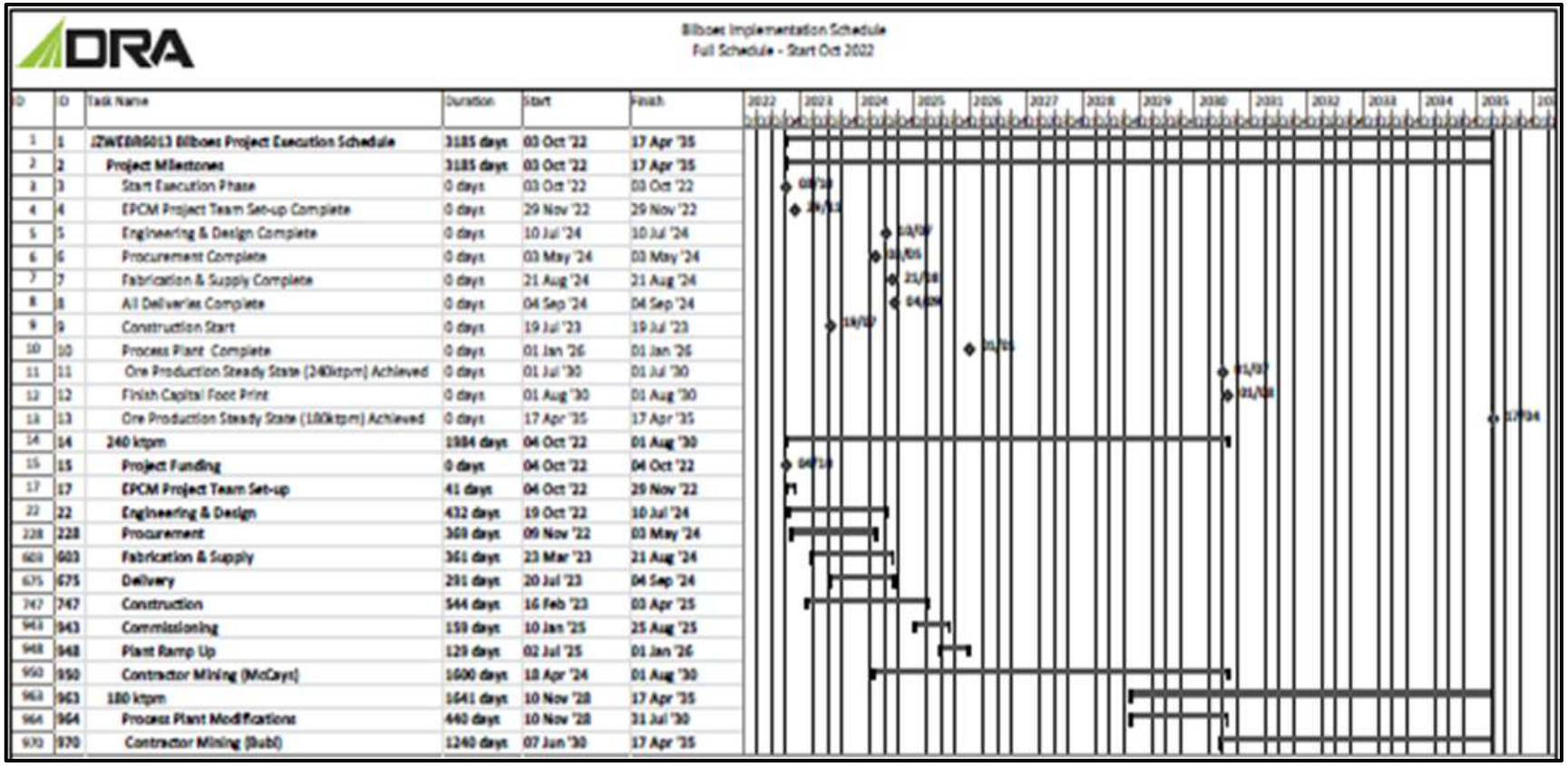
Table 18-25: Schedule Risks

Risk	Probability	Impact
No EIA Approval for surface construction work can cause a delay in critical path activities.	Low	High
Scope creep	Medium	Low
Construction durations are based on Estimated and not orders placed.	Medium	Medium
Delivery of Equipment - Site Accessibility	Low	Low
Funding non availability	Medium	Medium
Weather conditions are not allowed for and may impact negatively on the overall project timeline.	Low	Low

18.9.2.9 Software

The software used to program the schedule is Microsoft Projects.

18.9.3 High Level Project Master Schedule



ID	O	Task Name	Duration	Start	Finish
1	1	JZWEBR6013 Bilboes Project Execution Schedule	3185 days	03 Oct '22	17 Apr '35
2	2	Project Milestones	3185 days	03 Oct '22	17 Apr '35
3	3	Start Execution Phase	0 days	03 Oct '22	03 Oct '22
4	4	EPCM Project Team Set-up Complete	0 days	29 Nov '22	29 Nov '22
5	5	Engineering & Design Complete	0 days	10 Jul '24	10 Jul '24
6	6	Procurement Complete	0 days	03 May '24	03 May '24
7	7	Fabrication & Supply Complete	0 days	21 Aug '24	21 Aug '24
8	8	All Deliveries Complete	0 days	04 Sep '24	04 Sep '24
9	9	Construction Start	0 days	19 Jul '23	19 Jul '23
10	10	Process Plant Complete	0 days	01 Jan '26	01 Jan '26
11	11	Ore Production Steady State (240ktpm) Achieved	0 days	01 Jul '30	01 Jul '30
12	12	Finish Capital Foot Print	0 days	01 Aug '30	01 Aug '30
13	13	Ore Production Steady State (180ktpm) Achieved	0 days	17 Apr '35	17 Apr '35
14	14	240 ktpm	1984 days	04 Oct '22	01 Aug '30
15	15	Project Funding	0 days	04 Oct '22	04 Oct '22
17	17	EPCM Project Team Set-up	41 days	04 Oct '22	29 Nov '22
22	22	Engineering & Design	432 days	19 Oct '22	10 Jul '24
228	228	Procurement	369 days	09 Nov '22	03 May '24
603	603	Fabrication & Supply	361 days	23 Mar '23	21 Aug '24
675	675	Delivery	291 days	20 Jul '23	04 Sep '24
747	747	Construction	544 days	16 Feb '23	03 Apr '25
943	943	Commissioning	159 days	10 Jan '25	25 Aug '25
948	948	Plant Ramp Up	129 days	02 Jul '25	01 Jan '26
950	950	Contractor Mining (McCoy)	1600 days	18 Apr '24	01 Aug '30
963	963	180 ktpm	1641 days	10 Nov '28	17 Apr '35
964	964	Process Plant Modifications	440 days	10 Nov '28	31 Jul '30
970	970	Contractor Mining (Bubi)	1240 days	07 Jun '30	17 Apr '35

18.9.4 Project Execution Schedule

Refer to Appendix 18.4, Detailed Schedule.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 19
MARKET STUDIES AND CONTRACTS

Document Number: JZWFM2576-STU-REP-001

DRA

19 MARKET STUDIES AND CONTRACTS

No market studies for gold are applicable in Zimbabwe.

The Gold Trade Act empowers the Minister responsible for Finance to issue a Gold Dealers Licence which entitles entities to export and sell gold from Zimbabwe to customers of its choice. Prior to 1 June 2021, only Fidelity Printers and Refiners (Private) Limited (FPR) had the Gold Dealership Licence and therefore all gold bullion was sold to FPR. With effect from 1 August 2021, all gold producers are regarded as licenced and can directly export and sell any incremental production. As all Bilboes' production is considered incremental, Bilboes will be able to choose to export its gold directly to customers of its choice or to continue selling to FPR.

Bilboes is confident that it will be able to export and sell its gold production on similar terms as those obtaining from Fidelity.

Fidelity has two payment terms for its customers that gold producers may choose from as per the terms and conditions below:

19.1 Category A - Outright Purchase

- Payment within two days of lodgement of the gold using a spot price based on the London Bullion Market Association ("LBMA") price discounted by 2.5%.
- The applicable price is the day's afternoon fix on the date of lodgement at Fidelity.
- Melting and assaying charges of $21 /kg gross bullion weight applies.
- The applicable Government royalty is deducted from proceeds due to the customer.

19.2 Category B - Part Payment and Final Payment after a week

- Fidelity will pay 85% of value within two days of lodgement at Fidelity as initial payment.
- The LBMA price will be discounted by 1.25%.
- Final payment will be done after a week.
- Lodgements must be done by Tuesday 12:00 noon.
- Any deposit lodged after Tuesday cut-off shall be treated like a deposit for the following Tuesday, i.e., initial payment will be done the following Tuesday.
- Melting and assaying charges of $21/kg gross bullion weight apply.
- The applicable Government royalty is deducted from final payment due to the customer.

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

Document Number: JZWEBR6013-STU-REP-001

DRA

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

Key points with regards to the environmental and social aspects of the proposed Bilboes Sulphide Gold Project are outlined in the sections below.

20.1 Environmental Studies and Potential Impacts

This section summarises the outcomes of the environmental assessment and potential environmental aspects that could materially impact and/or impair Bilboes' ability to extract and process the mineral reserves.

20.1.1 Summary of Environmental Studies

Bilboes commissioned SLR in collaboration with GriynOva Environmental Consultancy (GriynOva) to undertake an Environmental and Social Impact Assessment (ESIA) in 2018 for exploiting and processing additional gold-bearing sulphide ores beneath the oxide zones within the existing open pits at the Isabella, McCays and Bubi. SLR is the lead consultant for the ESIA, while GriynOva, as the in-country partner, provided input and support at all stages of the process.

The ESIA and accompanying specialist studies were conducted in conformance with the relevant International Finance Corporation (IFC) Performance Standards and associated guidelines and in compliance with the legal framework of Zimbabwe. The ESIA covers project-specific activities and includes a description of the Project, the legal and administrative framework, the environmental and social setting, an assessment of the environmental and social impacts, proposed mitigation and management measures within an environmental management plan and a conceptual closure and decommissioning plan.

The baseline environmental conditions, as described in the ESIA, are summarised below (SLR, 2019).

Geologically, the Bilboes operations are located within the Bubi Greenstone Belt, within the Zimbabwe Craton. The sulphide within the orebody tends to weather readily and all the deposits are covered by oxide caps to a depth of 15 m to 50 m which are readily amenable to heap-leach extraction. It is these oxide caps that have been mined by Bilboes to date. The topography of the area is gently undulating and generally flat except for raised areas created by old waste rock dumps and heap leach pads, as well as the excavated open pits and related mine infrastructure associated with the existing mines.

Generally, the soils are susceptible to surface crusting and sealing following rainfall events, slow water infiltration, compaction and soil and water erosion. The associated land capability of the soil, with the assistance of modern technology (including ripping, ridging, microjet and drip water application), varies between “moderately suitable for well-managed irrigation” and “marginally not suitable” or “displaying moderately severe limiting conditions”. Land uses are predominantly cattle ranching (predominately due to the dry climate of the district), subsistence agriculture (mainly maize) and mining (formal and artisanal mining methods). Subsistence farming is supported by irrigation schemes.

The area is characterised by heavy rainfall (a Mean Annual Precipitation (MAP) is 657 mm) with drier months between May and September. The prevailing wind direction is westerly. There is limited variation in the annual temperature profile and evaporation and as a result precipitation is considered a driving factor in controlling levels of dust.

The Bembezi River, a regionally significant perennial watercourse, and the Mdutshane River, a non-perennial watercourse, drain the southern part of Bilboes’ Isabella and McCays. An unnamed tributary of the Bembezi River is located west and downstream of the proposed TSF. The Bubi River, a large non-perennial river, and its tributary drain the Bubi. Tributaries of the Bubi River cross through the proposed haul road route. The Bembezi and Bubi Rivers meet downstream of the mine and ultimately flow into the Zambezi River. A large dam (Bafana Dam) is located downstream of Bilboes on the confluence of the Bembezi River and the unnamed tributary of the Bembezi River.

Groundwater occurs within the higher conductive fractures, generally located above the 100 m depth. As depth increases, the fractures become less conductive with lower hydraulic properties. The general flow is in a north-east and south-west direction. Estimated water levels are in the region of 35 to 55 m at Isabella and 5 to 30 mat McCays. For the Bubi, the water levels are estimated to be 5 to 15 mand flow is in an east to west direction. The depth of weathering around the open pits is approximately 20 to 25 m. The weathered zone can be very conductive when the water levels occur above 20 to 25 m.

Surface water is the main water source to the communities, however Bilboes has facilitated the drilling of boreholes from some neighbouring communities. The Bafana Dam was used to supply the Nkosikazi Irrigation Scheme, although this is not operational currently. Groundwater use appears to be limited to groundwater abstraction by Bilboes for domestic water supply. Given the scarcity of water in the area, water within the flooded pits is used by wildlife and local farmers to water livestock (cattle). In addition to livestock watering, several people fish in the

flooded pits, and may also bathe in the pit water. Water within the Bubi pit is used to support a community irrigation scheme.

Surface water quality sampling was undertaken in the Isabella, McCays and Bubi open pits as well as the Bembezi, Mdutshane and Bubi Rivers. All surface water samples show elevated levels of suspended solids exceeding the IFC EHS Mining guidelines (2007) and Zimbabwe Effluent Standards (SI 6, 2006) - High Hazard / Red Class. Elevated levels of Arsenic exceeding effluent standards were recorded at some of the pits at the Isabella. Elevated levels of Cadmium and Iron exceeding the maximum permissible levels in terms of the Zimbabwe Drinking Water Standards and the Zimbabwe Effluent Standards (SI 6, 2006) – High Hazard / Red Class, respectively, were recorded from some of the river samples. Exceedances of other elements (Magnesium, Sodium, Dissolved Solids, Electrical Conductivity and Nitrate) above the maximum permissible levels in terms of the Zimbabwe Drinking Water Standards (Magnesium and Nitrate) and the Zimbabwe Effluent Standards (SI 6, 2006) – High Hazard / Red Class (Sodium, Dissolved Solids, Electrical Conductivity and Nitrate) were recorded in samples from the Isabella and McCays pits. Water has been accumulating in the Bilboes pits since the mine went into care and maintenance in 2016. Given the extended dry period experienced at the mine it is possible that concentration of elements has occurred to a degree as a result of evapotranspiration, however this would depend on the level of pit inflows which could also have taken place during this period.

The area is largely rural in nature although mining and community developments have influenced the visual landscape to some degree. There are no industrial noise sources, i.e., mechanised processes or diesel-powered equipment other than those used by Bilboes. The ambient daytime noise levels fall below the international guideline thresholds for residential areas (i.e., below 55 dBA). Existing activities within the area that contribute significantly towards air emissions such as dust fallout and particulate matter smaller than 2.5 µm (PM 2.5) include fugitive dust from de-vegetated areas, seasonal burning of vegetation, household combustion of solid fuel, vehicle exhaust emissions and various activities from the existing mine. However, the baseline sampling data shows PM 2.5 dust fallout concentrations generally fall below the local and international guideline limits.

The project area falls between the interface of the South African Bushveld ecoregions and Zambezian Baikiaea woodlands. Apart from Freshwater Resources (discussed further below) and Transformed Habitat areas (areas that have undergone transformation due to agricultural, rural and mining activities), three habitat units identified during field assessments. These include the Acacia Woodland Habitat Unit, associated with the South African Bushveld

ecoregion, at Isabella and McCays and the Baikiaea Woodland and Brachystegia boehmii Habitat Units, associated with Zambezian Baikiaea Woodlands ecoregion, at the Bubi. These habitat units are considered to have moderately high sensitivity, due to the unique landscape of the vegetation contributing to floral species diversity and the presence of floral species of Conservation Concern. The habitat units are largely intact with most of the area still in good condition.

Several freshwater resources were identified either within the claims' boundaries or within proximity thereof. These include the Bubi, Bembezi and Mdutshane Rivers and related tributaries. The Bubi River and its tributaries are deemed to be in a moderately modified state and of moderate to moderately high Ecological Importance and Sensitivity (EIS) with a high diversity of tree species and very limited alien invasive plant proliferation evident. The unnamed tributary of the Bembezi River, located west of the proposed TSF, is considered to be of moderate EIS due to its contribution to the functioning of the downstream system (i.e., the Bembezi River) as well as its connectivity to surrounding natural areas, providing a faunal migratory corridor and contributing to the overall biodiversity maintenance of the area.

The Bilboes operations are located within the Bubi District, one of nine districts within the Matabeleland North Province. The Bubi District is the seventh most populous district in the province with only 1.9% of the population located within urban areas. The Isabella-McCays area is the most populated of the four wards within which the proposed project will take place with a population of 5,190 people. The ward in which the Bubi project area is located has a population of 1,374 peoples. From the available census data, it is evident that there are more males than females in the district. This is likely due to an influx of male jobseekers looking for mining-related work opportunities.

Most of the local communities that surround the Bilboes operations are in Resettlement Areas. The specific villages identified to date that are deemed most likely to be affected by the proposed project are Dabengwa Village (located close to Isabella), Swati Village 2 (located close to the haul road route) and Rhino Village (located close to Bubi). A section of the proposed haul road would pass through communal fields associated with Rhino village. Other villages do occur within the vicinity of the project area. In areas where people were resettled under the Government's land reform programme, there is a lack of school and health facilities as well as insufficient basic services such as water and power supply.

The predominant economic and livelihood strategy employed by the local communities is cattle ranching. The Bilboes operations are located within large parcels of land that have been set

aside as grazing areas for these communities. The proposed haul road also passes through two parcels of Commercial Land (held by private farmers) used for ranching.

Subsistence agriculture (mainly maize) and mining (formal and artisanal mining methods) are the other two main economic and livelihood activities. The level of agricultural activity is largely dependent on household labour availability and access to farming implements. In order to support agricultural activities, irrigation schemes have been developed within some of the communities in the project area. These schemes reduce the likelihood of crop failure due to poor rainfall and where an excess has been produced, members of the local communities sell some of their maize to the Grain Marketing Board as an additional source of income.

Mining has been a major employer of the local population in the past, however over time several mines in the area have been closed. For the Bilboes operations the number of people currently employed is far lower than when the mine was operating at full capacity. Artisanal small-scale mining is now a leading source of income for households in the area, with most families now dependent on gold panning (especially outside of the rainy season). The increase in artisanal mining activities has also led to social conflicts, with many of the artisanal miners entering the district from other areas of Zimbabwe.

Potential vulnerable groups associated with the project area include the land users located within the footprint of the proposed haul road, communities reliant on water from the open pits for domestic and agricultural purposes, as well as woman, children and the sick or elderly.

No cultural heritage resources have been identified within the proposed project footprint, apart from potential grave sites located in proximity to the proposed TSF footprint. The layout of the proposed TSF has since been revised to avoid this area.

20.1.2 Environmental Issues

The natural environment within the project site has been significantly transformed by existing mining operations. The surrounding environment is more natural with disturbances from communities and subsistence farming activities. Other mining operations do occur in the region however over time several mines in the area have been closed. The EIA (SLR, 2019) identified the following potential environmental impacts:

- Potential loss of soils and related grazing land capability within the proposed project footprint. The new TSF, expansion of open pits and WRDs would remain after closure. In the mitigated scenario, the soils can be conserved and reused during rehabilitation which reduces the significance of this impact.

Significance after mitigation = **Low**

- Potential contamination of soils, surface water and/or groundwater features within the project site through the addition of contamination sources. Mitigation focussed on the design of potentially contaminating facilities and managing the storage and handling of polluting substances and related clean-up of spills reduces the intensity of these potential impacts.

Significance after mitigation = **Medium to High**

- Alternation of drainage patterns and related downstream functionality of aquatic habitat due to encroachment of the Bubi open pit into the non-perennial Bubi River. In addition, the establishment of stream crossings associated with the proposed haul road would potentially contribute to a cumulative loss / disturbance. In the mitigated scenario, where the Bubi River is diverted to ensure that that the hydraulic connectivity of the river is retained and pollution, sedimentation and erosion impacts are generally avoided, the significance of this impact reduces.

Significance after mitigation = **Medium**

- Potential contamination of surface and groundwater resources from various operational activities (short-term point-sources) and contamination from the new TSF and WRDs (long-term diffuse pollution source in the closure phase). Through the implementation of industry-aligned surface water management measures and a composite lining for the floatation compartment and full HDPE liner for the BIOX® compartment of TSF, as well as the differential handling of the sulphur form of waste rock lithology associated with the WRDs, the overall significance of these impacts is reduced.

Significance after mitigation for surface water = **Medium.**
Significance after mitigation for groundwater = **High**

- Lowering of groundwater levels potentially affecting third party water supply should third party boreholes be located within the dewatering cone of depression. The predicted cone of depression extends to areas outside of the Bilboes claims areas may impact on groundwater inflows into the Mbembesi and Bubi Rivers. While the extent and depth of drawdown reduces over time after mining activities stop, a degree of drawdown would persist in proximity to the open pits after 100 years. In the mitigated scenario, any third-party water sources that have a proven decrease in yield or dry up as a result of the proposed operations would be compensated with an alternative water supply of equivalent quality and quantity thus, reducing the significance of this impact.

Significance after mitigation = **Medium**

- Potential reduction in ambient air quality due to particulate emissions (from the open pit workings, WRDs and TSF, as well as gaseous emissions, namely nitrogen oxides (NOX), carbon dioxide (CO2), carbon monoxide (CO) and volatile organic compounds (VOC). The implementation of an air quality and dust management plan during the implementation and operation of the proposed project lowers the intensity, and probability of such impacts occurring, thus reducing the overall significance of the impact.

  Significance after mitigation = **Medium** (operational phase) to **Very Low** (construction and decommissioning phases)

- Elevation in ambient noise levels creating a potential disturbance to nearby receptors. During the construction and decommissioning phases, these would be of short-term duration and localised to the areas of construction. During the operational phase, it is anticipated that noise emissions would be more constant (noise disturbance) and have a lower impact than loud irregular noise (nuisance noise). Incorporating mitigation into the site design, as well as adopting sound management practices (e.g., maintaining machinery and equipment in good working order) reduces the overall significance of the impact.

  Significance after mitigation = **Medium** (operational phase) to **Low** (construction and decommissioning phases)

- Visual disturbance to nearby local communities. Considered to be generally limited when considered cumulatively with the existing mine infrastructure. Local communities located in closest proximity to the proposed TSF, WRDs and sulphide processing plant would have the greatest visual exposure to the proposed project. However, the sensitivity of these receptors is likely to be moderate as they would generally be desensitised to the presence of mining activities and associated infrastructure. By undertaking rehabilitation throughout the course of the proposed operations, the significance of visual impacts is reduced.

  Significance after mitigation = **Low**

- Physical destruction and general disturbance of terrestrial and/or aquatic biodiversity. By ensuring that the project footprint for planned clearing and infrastructure establishment is clearly demarcated and all areas of increased ecological sensitivity, outside of the mining footprint are designated as No-Go areas would limit the associated significance of these impacts.

  Significance after mitigation = **Medium**

The EIA (SLR, 2019) concluded that the proposed project presents several potential positive and negative impacts associated with the unmitigated scenario. With mitigation (in the residual impact scenario) some of the identified potential impacts can be prevented and the remainder can be managed and mitigated to remain within acceptable environmental limits so long as the mitigation set out in the Environmental and Social Management Plan (ESMP) is implemented and Bilboes develops, implements and annually reviews the Environmental, Social and Safety Management System (ESSMS). Positive impacts can be enhanced by developing and implementing a Community Development Plan as set out in the ESMP.

Bilboes is committed to implementing the mitigation measures within the ESMP together with the ESSMS which will be implemented as part of Bilboes' on-going efforts of continuous environmental improvement. The management system will contain plans and procedures to help manage environmental aspects and impacts and help ensure legal compliance.

20.2 Waste, Tailings, Monitoring and Water Management

This Section provides the requirements and plans for waste and tailings management, site monitoring, and water management both during operations and post mine closure.

20.2.1 Tailings Management and Disposal

Gold recovery at Bilboes would entail a two-stage process that would result in the generation of two different tailings streams - Flotation and BIOX® tailings. The TSF would be developed with two separate compartments to accommodate each tailings stream.

The proposed liner system for each comportment would incorporate (from top down):

- Floatation Compartment – A 1.5 mm HDPE geomembrane, a base layer of 300 mm selected clayey material (compacted in 2 x 150 mm thick layers)
- BIOX® Compartment – A 2 mm HDPE geomembrane, a base layer of 600 mm selected compacted clay liner (compacted in 4 x 150 mm thick layers).

Both compartments would have a ripped and re-compacted 150 mm in-situ base layer.

The TSF would incorporate a filter drainage system comprising an 8.5 m wide, 500 mm deep toe drain located immediately adjacent to the upstream toe of the starter wall for the Floatation compartment and a 7.5 m wide, 500 mm deep toe drain located immediately adjacent to the upstream toe of the starter wall for the BIOX® compartment.

Both compartments would have a reticulation of above-liner finger drains consisting of a configuration of 160 mm and 110 mm diameter slotted seepage collector pipes in the basin

discharging to the solution trench independently of the toe drains to allow monitoring. The proposed decant systems consist of temporary intake structures (designated FT) and permanent intakes (designated FP). The intake structures have both top and side inlets.

There would be on-going rehabilitation of tailings through the application of the rising green wall. The TSF design slopes adopted (1V:4H) are considered environmentally stable to allow for indigenous vegetation growth with minimal ongoing maintenance. To assist with the vegetation establishment, the vegetation will be manually planted and irrigated during the initial stages. A cover involving topsoil and subsoil (in combination with the rocky waste rock material placed during construction protruding) will be progressively placed onto the side slopes of the TSF as the same is developed. These protrusions are advantageous as the mimic natural slopes and dissipate the kinetic energy of rain drops as they strike the surface.

The tops surface will be covered with topsoil mixed into tailings. The top surface will then be paddocked into smaller catchments to reduce water flow lengths.

The Bilboes TSF is classified as a Medium Hazard to High Hazard facility due to the number of residents in zone of influence estimated to be between 8 and 16 (determined in accordance within terms of the South African Code of Practice for Mine Residue Deposits (SABS 0286:1998) and the requirements of Mineral Regulation 527 of 23 April 2004). The classification considered the two compartments as one facility.

20.2.2 Waste Rock Management and Disposal

The planned WRD construction method would entail the following:

- A nominal wall of waste material would initially be constructed to confine the extent of the dumping area within the planned WRD footprint.
- Waste material will be delivered to WRD by truck and tipped from the leading edge of the WRD towards the inside of the WRD footprint. The waste will then be spread and shaped as necessary by earthmoving equipment.
- The WRD would then be developed in successive lifts of up to 10 m in height, with each lift being completed before commencement of the subsequent lift.
- The WRD will be constructed at an angle of repose slopes of approximately 35°.

In principle, the WRD lift heights shall be limited to 10 m with a minimum of a 10 m berm, with an overall height of 40 m. Seepage from the toe of the WRD, as well as runoff from the slopes, would be controlled by the construction of an outer containment wall. The containment wall will

be the boundary between the clean and potentially contaminated water systems for the purposes of stormwater management.

Some compaction of the waste is expected to take place during placement as trucks pass repeatedly over previously placed material on their way to and from the advancing faces of the WRDs. While compaction of wastes is desirable to maximise density and storage capacity, it is not a requirement for structural stability. Compaction will assist in reducing differential settlements with time, which will assist in ensuring the longer-term integrity of surface water management measures.

20.2.3 Non-Mineralised Waste Management

Non-mineralised waste (including general industrial waste, medical clinic waste, hazardous industrial and domestic waste) would be temporarily handled and stored on site before being removed for recycling by suppliers, reuse by scrap dealers or final disposal at the existing waste disposal area located at Isabella. Bilboes has a designated burning site for all waste materials associated with cyanide packaging and hazardous waste on the heap leach pad where all leachate goes into the heap leach cyanide circulation stream as recommended by the cyanide suppliers. An internal waste management procedure will be developed for wastes generated by the project.

With respect to sewage, it is proposed that the existing sewage treatment facility located at Isabella would handle the sewage generated. It is proposed that a sewage treatment plant would be established at Bubi.

20.2.4 Site Environmental Monitoring

The proposed monitoring programme is detailed in the ESMP for the proposed project. The aspects for which monitoring is proposed includes:

- Annual monitoring (physical observation) for erosion, as well as slope / TSF failure.
- Monthly surface and groundwater monitoring (of parameters including water quality, volumes, levels, spillages, and management infrastructure).
- Monthly updating of the site-wide water balance (including biennial updates of the water balance model).
- Air and noise monitoring to establish baseline constituent concentrations / ambient noise levels, as well as regular monitoring during construction and operations, as applicable.

Requirements for post-closure monitoring to determine whether the mitigation and rehabilitation measures are effective would be incorporated into a final Closure Plan to be compiled for the operations prior to the commencement of decommissioning.

20.2.5 Water Management

20.2.5.1 *Surface Water*

As noted above, there is evidence that the Bembezi, Mdutshane and Bubi Rivers have been impacted open by various anthropogenic activities in the broader area. Furthermore, the planned widening of the open pits at Bubi would encroach directly on the Bubi River and the tributary located within Bubi claims area. This would have a material impact on this feature and may have an impact on downstream water users. It is thus recommended that the Bubi River be diverted around the proposed expansion of the southern open pit to: (i) ensure that the hydraulic connectivity of the river is retained, and that pollution, sedimentation and erosion impacts are avoided; and (ii) limit the risk of flooding the southern open pit during a high flow event in the Bubi River.

The measures to be implemented by Bilboes to address potential adverse water quality effects and to ensure that the planned infrastructure is constructed, operated, and maintained to comply with the provisions of the IFC guidelines, include:

- Separating clean water systems from dirty water systems
- Minimising the size of dirty areas and divert clean run-off and rainfall water around dirty areas and back into its normal flow in the environment
- Locating all activities and infrastructure outside of the specified zones and/or flood lines of watercourses, as far as possible. Where this is not possible, the affected area should be remediated / rehabilitated to restore the original ecological function post-closure
- Maintaining specified zones around surface water features in instances where flood lines are unknown or un-surveyed
- Incorporating suitable erosion protection measures at all discharge points, should any discharge be required. Furthermore, all discharges from the mine into the environment will comply with the IFC Effluent discharge standards

20.3 Project Permitting

20.3.1 Project Permits

An approved EIA is required in terms of the Environmental Management Act (Chapter 20:27) No. 13 of 2002 and the Mines and Minerals Act (Chapter 21:05) of 1996. The ESIA was undertaken for the project to satisfy the requirement and an ESIA Report was completed for submission to EMA within the first quarter of 2020. Thereafter, SLR held a public feedback meeting to disclose the findings of the ESIA Report to the identified stakeholders. A record of this disclosure process was compiled and submitted to EMA. An Environmental Impact Assessment (EIA) certificate was issued to Bilboes for the project in February 2021. The EIA certificate is valid for 2 years and will be renewed in February 2023 subject to conditions which include project update reports, compliance to Environmental Management Plans (EMP) outlined in the ESIA Report and notification to EMA for any changes in the project likely to alter the project as stipulated in the ESIA Report.

In addition, there are other permits associated with the processing plant, i.e., the regeneration kiln stacks, laboratory baghouse, electrowinning, gold room baghouse and clinic incinerator as required under section 14 of the Environment Management Act (Atmospheric Pollution Control) Regulations (SI 72 of 2009).

20.4 Social and Community Related Requirements and Plans

As part of the EIA, an Environmental and Social Management Plan has been developed (SLR, 2019). The ESMP contains the environmental, social and safety management and monitoring commitments that Bilboes will implement to manage the negative impacts and enhance the positive impacts identified in the EIA.

The ESMP is intended as a living document that will be regularly reviewed and updated by Bilboes in response to any changes to the operations, to address any findings and recommendations emanating from monitoring programmes, changes in the Bilboes organisational structure and/or changes in the relevant national legislation, as applicable. The key measures included in the ESMP relating to social / community requirements are listed below.

20.4.1 Livelihoods Restoration Plan

To mitigate against the loss of, or reduced access to, land for livelihood activities, an LRP will be compiled and implemented prior to the commencement of construction in accordance with international standards. In broad terms the LRP will include the following:

- The project, land uses and socio-economic context.
- Summary of the project description.
- Summary of affected land, assets, and persons.
- Legal and policy framework for land access and acquisition.
- Eligibility, entitlements, and possible compensation options of affected parties.
- Consultation and disclosure requirements including a grievance mechanism.
- Monitoring, evaluation, and reporting.
- Implementation, responsibilities, timeline, and funding requirements.

20.4.2 Community Development Plan

As part of the existing operations Bilboes have undertaken several Corporate Social Responsibility programmes. These include the supply of various community boreholes at communities and local schools, building and repairs of school blocks, the repair of various local roads, excavation and scooping of dams and provision of various other services including access to health facilities at the mines and transport in cases of emergency.

The EIA (SLR, 2019) identified the requirement to formalise the provision of community development initiatives through the development of a Community Development Plan which sets out its planned contributions to the development needs of the local communities impacted upon by the proposed project. The aims of the Community Development Plan include:

- Providing appropriate development support to communities impacted upon by the project.
- Building capacity in local communities to sustain development initiatives.
- Linking community development to business benefits.
- Providing additional support to the mitigation of negative impacts and the enhancement of positive impacts of the proposed project.

20.4.3 Labour, Working Condition and Recruitment Policy

To address potential issues related to employment, Bilboes will develop a fair and transparent labour, working condition and recruitment policy. The policy will comply with local law, IFC Performance Standard 2: Labour and Working Conditions, and International Labour Organisation (ILO) conventions including the following:

- ILO convention 87 on Freedom of Association and protection of the right to organise.

- ILO convention 98 on the right to organise and collective bargaining.
- ILO convention 29 on forced labour.
- ILO convention 105 on the abolition of forced labour.
- ILO convention 138 on the minimum age of employment.
- ILO convention 182 on child labour
- ILO convention 100 on equal remuneration
- ILO convention 111 on discrimination

The labour and recruitment policy will be advertised widely and appropriately, and an employment committee will be set up and maintained to ensure that the policy is implemented. Contractors will be required to abide by the labour and recruitment policy and will be audited on compliance. The policy will ensure that opportunities for meaningful employment and promotion for women and vulnerable groups are provided for and that a capacity-building programme to increase the local pool of skilled labour is developed and implemented.

20.4.4 Skills and Small Business Development

To optimise local small business development, a local procurement policy will be developed and implemented and communicated to all local stakeholders. Amongst other measures, a skills audit in terms of local business / technical–artisanal skills will be undertaken, and a register of existing small enterprises will be maintained to optimise skills and knowledge transfer to the community.

20.4.5 Stakeholder Engagement Plan and External Grievance Mechanism

The Stakeholder Engagement Plan developed for the project will be maintained and updated to provide a formal procedure for communications with the regulatory authorities and communities. Furthermore, an External Grievance Mechanism will be developed and implemented to enable community members and other stakeholders to raise issues of concern. The External Grievance Mechanism serves to receive and facilitate resolution of affected communities' concerns and grievances. The Grievance Mechanism shall also include detailed procedures around recording, tracking, and closing out of grievances received. All sub-contractors would be responsible for adhering to and implementing the Bilboes external grievance mechanism. Bilboes will inform the affected communities about the mechanism in the course of the stakeholder engagement process.

20.4.6 Social / Community Issues

Based on the EIA undertaken for the proposed project, social or community impacts that were identified and assessed include the following:

- Positive economic impact as a result of the direct construction and operational project expenditure, direct and indirect business opportunities, CSR contributions and macro-economic benefits and the recovery of mineral resources.

  Significance after mitigation = **Very High Positive**

- Potential reduction of access to land for livelihood activities (e.g., cattle ranching and subsistence agriculture) undertaken within the mine claims area. A key recommendation to ensure that these land users are appropriately identified, engaged and compensated is the compilation of a Land Acquisition and Resettlement Framework (LARF). The LARF will provide the framework for developing a plan to address any economic displacement caused by the project and such, reducing the significance of this impact in the mitigated scenario.

  Significance after mitigation = **Medium**

- Inward migration due to the expectation of employment. This in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around health, safety and security. The related mitigation measures focus on the implementation of appropriate and effective communication on the number of new employment and procurement opportunities and undertaking recruitment at designated locations outside of the mine footprint. In addition, Bilboes must aim to source most employees from the surrounding local communities, as far as possible.

  Significance after mitigation = **High to Medium**

- Various health and safety risks for third parties are associated with the proposed project. While the likelihood of incidents is deemed to be low (with mitigation) any injuries or fatalities of third parties would be of high intensity. Recommended mitigation measures aim to further reduce the intensity of such impacts, thereby lowering their significance.

  Significance after mitigation = **Medium**

- No cultural-heritage resources were found to be located within the proposed project footprint. However, any possible impacts on undiscovered cultural heritage would be most likely to occur, if at all, during the construction phase when most of the clearing and earthworks will occur. The implementation of a Chance Finds Procedure has been

recommended should any cultural-heritage material be discovered during project-related activities.

Significance after mitigation = **Very Low**

Key issues that may have a risk of impacting Bilboes' operations (e.g. resulting in disruption for minor or short periods of time) relate to the loss of grazing land available to the local communities, disagreements regarding the number of employment opportunities being made available to the closest neighbouring communities, disputes on the nature or implementation of planned Corporate Social Responsibility programme initiatives, or conflicts arising from in-migration of job-seekers into the proposed project area.

20.5 Mine Closure

A conceptual closure plan and LoM closure liability estimate, based on the environmental, social and economic risks identified in the EIA, is included in the EIA. Furthermore, the closure issues and concerns raised by stakeholders were also incorporated, where applicable.

Generally accepted "good international practise" mine closure methods were used as the basis for the conceptual closure plan, as well as, for determining the unit rates for the various closure components used in the LoM liability calculation. The mine closure methods also conform to the statutory requirements of Zimbabwe EMA who are the regulatory body.

Mine closure planning is a dynamic process that is integrated with LoM planning to ensure a seamless transition from the operational to the decommissioning phases in the mine life cycle. The environmental objective for closure is to minimise the impacts associated with the decommissioning and closure of the mine and to achieve a post closure land use as outlined below.

The conceptual closure plan objectives include the following:

- Environmental damage is minimised to the extent that they are acceptable to all parties involved
- The land is rehabilitated to achieve a condition approximating its natural state (as far as practicable), or so that the envisaged post closure land use / land capability is achieved
- Some of the smaller open pits shall be completely backfilled with material from the overburden / WRDs. Inert building rubble from the decommissioning activities can also be buried in the pit voids. The remaining open pits would not be backfilled and remain open. The pit side-walls and end-walls will only be 'made safe

- All surface infrastructure, excluding the TSF and any other surface infrastructure that will support the envisaged post-closure end use, will be removed from site after rehabilitation
- Contamination beyond the mine site by wind, surface run-off or groundwater movement will be prevented through appropriate erosion resistant covers, containment facilities (i.e., stormwater ponds) and drainage controls
- Mine closure is achieved efficiently, cost effectively and in compliance with the law
- The social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised

Based on the above, the closure outcomes for the mine site are assumed to be as follows:

- To achieve chemical, physical, and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure
- To protect surrounding surface water, groundwater, soils, and other natural resources from loss of utility value or environmental functioning
- To limit the rate of emissions to the atmosphere of particulate matter and salts to the extent that degradation of the surrounding properties' land value and land capability does not occur
- To create a final land use that has economic, environmental and social benefits for future generations that outweigh the long-term aftercare costs associated with the facility

These broad closure objectives and outcomes will be continually refined as operations continue.

20.6 Estimated Environmental Costs for Closure

The quantities used in the closure liability calculations were derived from the layout plans and general arrangements for the project; the project infrastructure details within the feasibility study report; and the proposed mining and deposition schedule. The closure liability calculation has been determined for the LoM (end of year 10) and is calculated to be $ 26,450,387 (excl. VAT). The closure liability calculations will be regularly reviewed and updated during the project up and until the commencement of closure activities (i.e., final closure plan).

20.7 Schedule for obtaining the Operating License

It is anticipated that the ESIA Report can be completed for submission to EMA within the first quarter of 2020. Thereafter, SLR would undertake public feedback meetings to disclose the

findings of the ESIA Report to the identified stakeholders. A record of this disclosure process would be compiled and submitted to EMA for decision-making purposes. Compile record of review process. Forward any comments to EMA. Based on experience, it is expected that EMA would take up to 60 days to issue a decision (i.e., within Q2 2020).

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 21
CAPITAL AND OPERATING COSTS

Document Number: JZWEBR6013-STU-REP-001

DRA

21 CAPITAL AND OPERATING COSTS

21.1 Capital Cost Estimate

21.1.1 Basis of Capital Estimate

Bilboes Holdings Limited appointed DRA Projects SA (Pty) Ltd (DRA) to undertake a revalidation of the FS completed 2019, to establish a 2021 Capital Cost Estimate (CCE) for the proposed 240 ktpm, phased Bilboes Gold Plant and associated Infrastructure, 80 km North of Bulawayo in Zimbabwe.

21.1.2 Estimate Scope

The basis of the CCE covers the process plant, associated infrastructure, and indirect costs for the 240 ktpm and 180 ktpm phased Bilboes FS for which DRA developed the estimate.

The CCE for the process plant and associated infrastructure was prepared by DRA based on the PFD's, MEL, GA drawings and layout drawings. These drawings were developed per process plant area.

Phases 1 and 2

- Phase 1: 240 ktpm milled ore originating from the Isabella McCays (ISBM) mining area (years 1-8)
- Phase 2: 180 ktpm milled ore originating from the Bubi mining area (years 7-14)

21.1.3 Estimate Accuracy

The capital cost estimate meets the required accuracy criteria of -10% + 15% and generally complies with a Class 3 FS as defined by the DRA Estimating Study Class Matrix. Note that this is equivalent to a Class 2 Estimate as defined by the American Association of Cost Engineers, (AACE).

21.1.4 Estimate Base Date

The base date for the CCE is November 2021.

21.1.5 Estimate Base Currency

The estimate has been presented in US Dollar ($) currency in present day (November 2021) terms. Prices obtained in other currencies have been converted to $ using the applicable exchange rates stated in the data sheet and below in *Section 21.1.28.1 Foreign Exchange*.

21.1.6 General Estimate Development Methodology

This section covers the estimating methodology adopted by DRA for the process plant and the associated infrastructure.

This estimate is categorised as a FS with a combination of detailed, semi-detailed and limited factored costs. Designs and costings were carried out specific to this project and specific to the locality of this mine.

The general approach to estimating was to measure / quantify each unit cost element from the engineering layout drawings, PFD's, MEL, motor lists, cable schedules, and instrument lists where possible, and then to factor the balance of items that were not possible to measure or quantify.

The CCE is based on a project execution strategy whereby major packages of construction work would be let to several specialised construction work contractors. Steelwork, platework and piping thus would, as an example, be supplied by the selected SMPP construction work contractor.

The estimate further assumes that the project would be executed on an EPCM basis.

21.1.6.1 Estimate Compilation

The 2019 Estimate was compiled by a Senior Estimator experienced in Process Plants, with the assistance of the various DRA Discipline Engineers as required. The 2021 revalidated estimate was updated by a Estimator experienced in Process Plants.

21.1.6.2 Estimate Reporting

The CCE is split into four main areas, namely:

- Mining
- Process Plant
- Infrastructure, Utilities and Ancillaries
- Indirect Costs

The CCE for the Process Plant and associated infrastructure has been presented as a fully detailed estimate, together with a summary sheet. The estimate considers the WBS. The areas and equipment identification coding as utilised in the estimate are thus in accordance with the MEL and PFD's and cover the various WBS areas associated with each area.

The CCE summary sheet consists of a rolled-up matrix of the WBS areas against which the discipline / cost categories are detailed.

Table 21-1: Work Breakdown Structure

Facility	WBS Code	Description
1-	1-0000	Mining
3-	3-0000	General Site Infrastructure
3-	3-0100	General Earthworks
3-	3-0600	Roads and Terraces
3-	3-0700	Fencing
3-	3-0800	Waste Disposal
3-	3-0900	Buildings
3-	3-1000	Flotation TSF
3-	3-1100	BIOX® TSF
4-	4-0000	Process
4-	4-0100	Ore Receiving and Crushing
4-	4-0200	Milling, Classification and Thickening
4-	4-0300	Flotation
4-	4-0400	BIOX®
4-	4-0500	Carbon in Leach (CIL)
4-	4-0600	Carbon Treatment
4-	4-0700	Gold Room
4-	4-0800	Tailings Handling and Cn Detoxification
4-	4-0900	Reagents
4-	4-1000	Process Plant Water Services and Reticulation
4-	4-1100	Process Plant Utility Services
4-	4-1200	E, C & I Plant
5-	5-0000	Process Plant Infrastructure
5-	5-0100	Plant Services
5-	5-0200	Plant Buildings and Workshops
5-	5-0300	Plant Electrical Structures
6-	6-0000	Haul Road (Bubi - Isabella)
6-	6-0100	Bulk Earthworks
6-	6-0200	Crossings
6-	6-0300	Lighting
6-	6-0400	Security
H	H	Indirect - Project Facilities
H	HC	Temporary Facilities
H	HD	Project Fleet
I	I	Indirect - Project Services

Facility	WBS Code	Description
I	IB	EPCM Contractor
I	IC	Contractor P&G's
I	ID	Project Implementation
I	IE	General Services
I	IF	Logistics and Freight
I	IG	First Fill and Commissioning
I	IH	Spares
K	K	Indirect - Owners Team
K	KA	General Administration Costs

21.1.6.3 Estimate Format

The estimate has been prepared in Microsoft Excel format and consists of a summary tab and multiple cost category input tabs.

The cost category tabs are as follows:

Table 21-2: Cost Categories Tabs

Item	Area	Description
0	WBS	Project Work Breakdown Structure
	Read Me	
	Revision Control	
1.	Summary	Cost Summary
1.	Summary PH1	Cost Summary PH1
1.	Summary PH2	Cost Summary PH2
1.	Summary PH3 (Base case only)	Cost Summary PH3 (Base case only)
1.1	Data Sheet	CBE Rates Input worksheet
1.2	Design Development	CCE Accuracy Calculations
1.5	Summary Chart	Charts
2.	Capital Cost Estimate	
	Mining	Capital Cost Estimate Discipline
	Earthworks	
	Civils and Infrastructure	
	Buildings	
	Steelwork	
	Conveyor Steelwork	
	Platework	
	Conveyor Platework	

Item	Area	Description
	Mechanical	Capital Cost Estimate Discipline Breakdown
	Conveyor Mechanical	
	Turnkey Packages	
	Tailings Storage Facility	
	Vendor Commissioning	
	Spares	
	Consumables	
	Piping and Valves	
	Electrical, Control and Instrumentation	
	Construction Services	
	Project Services	
	Owners Cost	

21.1.6.4 Estimate Inputs

The following documents provided the basis for the CCE:

- Block Plan
- Mining Production Schedule / BoQ
- Area Layout Drawings
- GA Drawings
- PFD
- EDC
- MEL
- Electrical Motor lists
- Electrical Cable Schedules
- HT SLD
- Instrument List
- I/O Schedule
- Control Network Diagram
- Equipment Quotations from Vendors
- Fabrication and Erection quotations from Construction Contractors
- Project Execution Programme
- Battery limits

21.1.6.5 Estimate Data Sheet

The Estimate Data Sheet is the core of the SMP cost estimate and contains the rates necessary to compile the Structural Steel and Platework Estimates. The Data sheet is linked to the Structural Steel and Platework Estimate sheets by means of Indexed Data codes and contains rates for Supply, Corrosion Protection, Shop Detailing, Transport and Erection of commodities required to complete the project. The Datasheet also contains the currency Rates of Exchange for the Project.

21.1.6.6 Estimate Quality Control

Each cost category tab contains arithmetic formula checks to ensure the accuracy of the costs for the project cost elements.

The final arithmetic check is carried out within the Summary tab at the bottom of the Summary table to confirm that the costs contained in the Cost Category tabs correlate with the final costs as detailed in the CCE Summary Table.

21.1.6.7 Estimate Review

Prior to final submission to the client, the estimate was reviewed by the Project Team comprising of the various DRA Discipline Engineers as well as the Study and Estimating Managers. Note that the GM of the DRA studies department would also typically be involved with these reviews.

Following the internal reviews by the DRA teams, the CCE would then be reviewed in a joint meeting with the Client representatives. Comments from this review would form the basis of the final CCE.

21.1.7 Project Specific Estimate Development Methodology

21.1.7.1 Mining Contractor

The basis of the Bilboes FS mining cost estimate was that all mining will be done by and experienced mining contractor. The pricing was based on a mining bill of quantities that was derived from the FS production schedule. The dump locations / RoM tip location and haul distances for all material types was provided on a monthly and annual basis. This methodology ensures that all budget pricing receive is of a high accuracy level in real terms.

The cost per area is shown in Table 21-3:.

Table 21-3: Mining Contract Budget Price BOQ for LoM

Item No for Indirect Costs	
1. Site Establishment	Sum
1. Site Disestablishment	Sum
2. Time Related G&A	Months
Item No - Direct Costs	
3a. Bush Clearing Hectares	$/ha
3b. Topsoil Stripping L and H and Dump and Level 2 km free haul	$/bcm
4. L and H Free Dig 2.5 km free haul	$/bcm
5a. Hards Drilling Cost per meter	$/m
5b. L and H Hards 2.5 km free haul	$/bcm
6a. Ore Drilling cost per meter	$/m
6b. L and H Ore 3.5 km free haul	$/t
7. Ore Re-handle at RoM Tip (max 400 m) (20%)	$/t
8. EO Haul Rate per 200 m (applied to increased haul distances)	$/bcm
9. Explosive Waste (Client Supplied Down the hole service)	$/bcm
10. Explosive Ore (Client Supplied Down the hole service)	$/t

21.1.7.2 Bulk Earthworks and Infrastructure

The earthworks and infrastructure Bills of Quantities produced by DRA for the 2019 FS were used and sent into the market for revalidation by the contractors. Initial preliminary BoQ was prepared and issued into the market for cost estimation purposes and to obtain relevant fix and firm rates. The initial budget was based on the known scope of works and a best estimate was done on quantities based on experience from previous DRA projects. Basic engineering was completed for major cost contributors. Major earthworks cost contributors were modelled to obtain required quantities. The preliminary priced BoQ's were then adjudicated, and a contractor was recommended. The recommended contractor's rates were incorporated into the final measured BoQ.

Once the layout drawings and engineering were completed, the QS updated quantities in preliminary BoQ's.

DRA Infrastructure quantified the Bulk Earthworks and General Infrastructure Services for all areas from layout drawings.

Preliminary and General (P&G's) have been taken as 16% of the total supply and installation cost, in line with the P&G value quoted from the chosen Earthworks, Mining and Civils contractor.

The following parameters were used for the different areas:

21.1.7.2.1 Terraces

Terrace size and volumes were ascertained by DRA. All terraces were modelled to the relevant terrain contours to determine bulk earthworks volumes.

The following terraces were included:

- Plant Terrace
- Mine infrastructure Terrace
- Parking and laydown areas
- RoM Stockpile Terrace

21.1.7.2.2 Roads

The following roads were included:

- Plant Access Road
- Haul road between Isabella and Bubi

DRA provided road lengths measured from layout drawings.

21.1.7.3 Civil Works

The civil Bills of Quantities produced by DRA for the 2019 FS were used and sent into the market for revalidation by the contractors. The civil works were quantified by DRA from the GA and layout drawings.

A preliminary BoQ was produced for all civil structures relevant to this FS.

Concrete quantities were ascertained using layout drawings based on the assumption that major structures will be constructed either on raft foundations or on large spread foundations, and smaller structures will be constructed on individual bases.

Each Civil structure was measured separately, and the Civil BoQ was priced by elected tenderers to ascertain a detailed priced BoQ for civil works. A contractor was selected, and their rates was applied to the quantities per area.

Preliminary were estimated 15.4% of the total supply and installation cost, which is in line with the P&G value quoted for the civil works scope.

21.1.8 Infrastructure Services

21.1.8.1 Stormwater

Allowances for stormwater management was made on the Isabella / Bubi haul road only. DRA generated preliminary BoQ's from layout drawings.

21.1.8.2 Sewage, Potable and RAW Water Reticulation and Fire Water

The length of all pipe reticulation including bends, valves, fittings, etc. has all been measured from layout drawings and provided by DRA. The length for the Water supply line from the existing water storage facility at the Mine site was provided by DRA.

Lengths for potable water reticulation within the Plant and Mine Areas was provided.

Fire Water Ring Mains have been provided for within the Plant and Mine areas.

DRA provided sewer Reticulation for the Plant and Mine areas up to the Sewer Treatment plant. A detailed price was obtained for the Sewerage Treatment Plant on site.

21.1.8.3 Pollution Control Dams

The HDPE lined Pollution Control Dam (PCD) was measured from layout drawings.

21.1.8.4 Fencing

Fencing quantities were drawn from layout drawings for the Plant, Mining and Residential Areas.

P&Gs were estimated at 16% of the total supply and installation cost and are in line with the P&G value quoted for civil works scope.

21.1.9 Infrastructure Building Works

The infrastructure buildings Bills of Quantities produced by DRA for the 2019 FS were used and sent into the market for revalidation by the contractors. Architectural layouts for selected building and structures were developed. Building works have been costed on detailed and measured BoQ. This was completed for all brick buildings, prefabricated panel wall building structures and sheeted steel portal frame structures.

Tender priced detailed bills were used for all the buildings required on site.

Building P&Gs of 31% have been used for the capital estimate for the total supply and installation cost, in accordance with the P&G value quoted from the chosen building works scope.

21.1.10 Structural Steelwork Supply and Erection

Steelwork quantities for all structures were estimated from GA and layout drawings produced by DRA.

The structural steel Bills of Quantities produced by DRA for the 2019 FS were used and sent into the market for revalidation by the contractors. One of the two contractors declined to revalidate their tender due to the short bidding period, hence the other contractors' rates were utilised in the estimate. A BoQ was produced by DRA to cover all steelwork and ancillary bought outs including sheeting, grating, stair treads and handrailing, amongst others. This was issued on enquiry to two prominent SMP fabricators / erectors, namely contractor South African (SA) and (Zimbabwean based). Because of the nature and geographical location of Bilboes it was deemed necessary to obtain current rates and P&G's specific to the area and the project. Rates and P&Gs were received from both contractors. A commercial adjudication was carried out, and the rates and P&Gs were benchmarked against current rates from previous DRA projects. The result was that the rates from SA contractors were market related and competitive. The estimate was then populated with the final steelwork quantities from DRA and rates received from contractor.

These rates were priced per tonne of steel, with separate rates being provided for shop fabrications, shop detailing, corrosion protection, delivery to site and erection on site.

Rates for steel fabrication, delivery and erection were categorised as either light, medium or heavy steelwork.

Structural steel P&Gs were applied at 74% of the total supply and installation cost, in line with the figure quoted by contractors.

Note: The SMP value includes for shop detailing, corrosion protection, supply, fabrication, transportation to site, off-loading and erection including all their associated costs with regards to induction, medicals, accommodation and meals, PPE, PPC, travelling, etc. to complete the works in full.

21.1.11 Platework and Lining

Platework and lining items were quantified by DRA from the equipment list, PFD's, GA, and layout drawings.

The platework and lining Bills of Quantities produced by DRA for the 2019 FS were used and sent into the market for revalidation by the contractors. One of the two contractors declined to revalidate their tender due to the short bidding period, hence the other contractors' rates were utilised in the estimate. BoQs were produced by DRA to cover all platework and lining

requirements. This was issued together with the SMP Enquiry as described in more detail above.

Rates for supply and erect of the platework and the required linings were obtained from the SMP Contractor quotation. The estimate was then populated with the final platework and the linings quantities from DRA and rates received from S A Contractors.

Note: The SMP value includes for platework shop detailing, corrosion protection, supply, fabrication, transportation to site, off-loading and erection including all their associated costs with regards to induction, medicals, accommodation and meals, PPE, PPC, travelling, etc. to complete the works in full.

Platework and lining P&Gs were applied at 74% of the total supply and installation cost, in line with the figure received from S A Contractor.

21.1.11.1 Corrosion and Protection

In accordance with the Engineering Design Criteria (EDC), all fabricated steelwork and platework will be painted in accordance with: Surface Preparation. All surfaces are to be dry abrasive blast cleaned in accordance with SA21/2 of the international standard ISO 8501-1:1988 to obtain a surface profile of 40 to 80 microns, with a Primer Coat; One coat of Carboline 193, DFT of 140 microns, and final coat; One coat of Carboline 134, DFT of 40 microns, colour; to match existing mine requirements.

The rates for surface preparation, galvanising, priming, and painting were quoted by the fabrication contractor, and these have been included in the estimate as part of the ex-works fabrication and supply rate.

An allowance has been provided for the touch-up of steelwork and platework on site after installation.

The cost of galvanizing or painting for piping is included in the piping price.

The Corrosion and Protection P&G costs were included in the steelwork and platework P&G's.

21.1.12 Mechanical Equipment

Most mechanical equipment was revalidated by DRA estimating department using the adjudicated quotes from the 2019 FS work. DRA received budget pricing where accurate quotes could not be provided within the available time frame. Where costs were not revalidated by vendors due to time constraints, 2019 costs were escalated.

From the MEL and PFD's, DRA issued enquires for all mechanical equipment to vendors for costing, requesting fixed and firm quotations valid for 30 days. All MEL quotations were sourced from selected and preferred vendors.

The erection cost for the mechanical equipment was based on rates received from the steelwork and platework fabrication / erection contractor. The mechanicals Bills of Quantities produced by DRA for the 2019 FS were used and sent into the market for revalidation by the contractors. One of the two contractors declined to revalidate their tender due to the short bidding period, hence the other contractors' rates were utilised in the estimate.

For minor and/or ancillary mechanical equipment items, supply costs were obtained from previous quotations and/or the DRA historical data base.

The mechanical P&Gs were applied at 74% of the erection component only, in line with the P&G value quoted by SMP contractors.

21.1.13 Conveyors

Design of all conveyors were carried out by the DRA in accordance with the conveyor profiles as depicted on the GA drawings and the developed PDC and EDC. MEL components and steelwork requirements were quantified from design outputs. Enquiries were issued to selected vendors for all mechanical equipment costing i.e., for belting, drives, idlers, pulleys, and minor ancillaries. The erection cost for the mechanical equipment and steelwork was based on rates received from SMP contractors.

Rates for conveyor steelwork and platework were as per the SMP rates received from the SMP contractors as described above.

Conveyor P&Gs are as per the percentages described above for mechanical equipment erection only, steelwork supply and erect, and platework supply and erect, in line with the P&G value quoted by SMP contractors.

21.1.14 Piping and Valves

The cost for the process in-plant piping and valves was derived as a factor of the mechanical equipment supply cost. The factors used were derived from the DRA historical data base and are area specific.

Piping P&Gs are inclusive of the factor applied to the mechanical equipment supply cost.

21.1.15 Electrical, Control and Instrumentation

This section defines the EC&I basis of capital cost estimate. Budget pricing was derived from third party pricing (i.e., tenders / RFQ) and database pricing.

21.1.15.1 Technical basis

The following technical documents and drawings formed the basis of the estimate:

- PCD's
- Site Block Plan
- MEL
- Client's input

21.1.15.2 Design / Drawings

The following documents and drawings were developed as part of EC&I deliverables to inform and define the scope from which estimates were derived.

- Electrical Load List
- MV SLD
- Electrical substation and associated transformers have been placed on the plant block diagram and used to estimate cable lengths and routing.
- Instrument Index/I/O list
- Electrical and Instrumentation Design Criteria.

21.1.15.3 Medium Voltage Reticulation

SLD were produced to indicate the 11 kV MV reticulation from the new

132 / 11 kV consumer substation to the main plant. The SLD indicates all major electrical equipment required for the project. This includes reticulation within the process plant area, mine, and plant office infrastructure. Budget prices were taken from recent and current DRA projects. Therefore, the prices were based on recent market related pricing.

21.1.15.4 Motor Control Centre

MCC prices were taken from recent and current DRA projects A budgetary quotation was received from a reputable equipment supplier. MCC's were sized in accordance with the motor list. Budget pricing was therefore based on recent market related pricing.

21.1.15.5 Power Factor Correction

Database pricing for PFC was utilised. Pricing for PFC yard preparation works is included in the civil works.

21.1.15.6 Transformers and Mini substations

Database pricing for transformers and mini substations was utilised. Pricing for transformers and mini substations exclude the civil works.

21.1.15.7 Earthing and Lighting Protection

A typical design was done to estimate quantities. Database rates from recent implementation projects have been used for this equipment to provide market related prices.

21.1.15.8 Lighting and Small Power

Quantities for plant lighting and small power distribution was calculated based on plant footprint, lux level requirements and comparable projects. Included in the estimate is a provision for high mast lighting to cover areas such as offices and workshops. DRA Database rates were utilised for high mast structures.

21.1.15.9 Cabling and Racking

Quantities for cabling and racking were estimated based on the plant block plan, motor list, and the SLD. Preliminary cable sizes were estimated based on the MEL and estimated average cable length.

21.1.15.10 PLC Equipment

PLC and remote I/O equipment costing is based on the PID plant IO and control requirements, from which quantities are derived. DRA database rates from recent implementation projects have been used to provide costs.

21.1.15.11 Instrumentation

An instrument list has been generated from the P&ID drawings. Database rates from recent implementation projects have been used to provide a cost.

21.1.15.12 Electrical, Control and Instrumentation Installation Works

The BoQ for the EC&I installation was sent to a reputable local installation contractor for pricing. The installation cost was based on the latest market prices.

21.1.15.13 Mechanical Vendor Packages

Electrical and instrumentation equipment supplied as part of a complete mechanical equipment package were adjudicated to ensure compliance to the EC&I criteria. Pricing for such equipment forms part of the mechanical portion of the capital estimate.

The EC&I P&Gs were taken as 30% of the total EC&I supply and installation cost; in line with the industry norm for a project of this magnitude and location of Bilboes.

21.1.15.14 Electrical, Control and Instrumentation Inclusions

The following costs have specifically been included in the cost estimate:

- All MV reticulation, LV reticulation, control, communication networks, instrumentation, lighting, small power, earthing and lightning protection for:
  - Process plant
  - Surface infrastructure up to the designated battery limit
  - Diesel emergency power generators, in accordance with the load schedule
  - Critical spares for long lead-time items
  - 132-kV overhead line. The cost for the bulk power supply was received from the client and incorporated into the budget

21.1.15.15 Electrical, Control and Instrumentation Exclusions

The following costs was excluded from the cost estimate:

- Fire suppression system / detection has been provided for CCTV cameras

21.1.16 Preliminary and General Costs

P&G costs include all main Contractors' overheads such as contractual requirements (e.g., safety, sureties, insurance, security during construction i.e., security contractor costs for construction period including their access control, turnstiles, etc. as required), the site establishment and the removal thereof including their own company and head office overheads.

The P&G costs also include for site management, site supervision, travel to and from the site, contractor supplied temporary facilities, offices and lay-down areas, cranes, tools and contractors' equipment including PPE / PPC requirements.

P&G costs have been allowed for as a percentage of the value of the works to be executed and are shown separately in the P&G column against each WBS / sub area in the estimate summary sheet.

Table 21-4: Preliminary and General Percentages

P&Gs	%
Earthwork P&Gs	16%
Civil P&Gs	15%
Infrastructure Buildings P&Gs	31%
SMP P&Gs	74%
Piping P&Gs (incl. in factor)	0%
EC&I P&Gs (On supply and install)	30%
Tailings Storage Facility	20%

21.1.17 Transportation

Transportation costs for steelwork and platework were quoted in the SMP rates. Other transport costs were based on a tonnage or “per load” basis. Rates from logistic service providers from recent DRA projects in the area were used in the CCE. These rates include for all costs involved in the transportation of goods to site, including the logistics and documentation, as well as the actual transportation of the goods.

21.1.18 EPCM and External Services

The method for calculation of EPCM costs (described below) has not changed from the 2019 Feasibility study, however the EPCM costs has been escalated to base date November 2021.The EPCM costs cover the project management, detailed engineering, procurement, and construction management costs directly associated with the implementation of the project.

Project Management and EPCM costs relating to the Process Plant and Associated Infrastructure were based on EPCM manhours calculated by DRA. The rates used are DRA rates and are valid to the end of 2019, after which they are subject to escalation.

The manhours were calculated using the project implementation scheduled / programme and a proposed project team organogram. The manhour costs are shown in the EPCM manhour schedule, which also includes reimbursable and sundry costs as well as a contractor’s fee.

The External Services costs allow for the utilisation of external consultants, as required.

21.1.19 Spares, First Fill and Consumables

Allowances have been made for the first fill of lubrication and grinding media, based on DRA’s calculations. The allowances used are the same used in 2019 and have been revalidated or

escalated if revalidated information was not available, to current November costs. Most of the costs were provided by the Client for use in the Operational Cost model and included in the Capital Cost Estimate as well.

Spare parts costs were included in the capital estimate to cover commissioning, and strategic spares for both mechanical and electrical equipment.

The spares holding costs were derived from the recommendations of the vendors quotations. The spare parts costs have been grouped per item of equipment in a separate tab within the estimate. Where no spares were quoted by the vendors, it has been deemed by DRA where there should be a spare holding, a percentage of the supply price has been applied:

- Mechanical Equipment Commissioning Spares 2.5%
- Mechanical Equipment Strategic Spares 5%
- EC&I spares 5%

21.1.20 Pre-Production Costs

Allowances have been allowed for in the CCE. Construction Services / Pre-Production costs and methodology applied in the 2019 DFS were used and escalated to current November 2021.

21.1.21 Owners Cost

An allowance has been made based on cost provided by the Owners Team. The “Owners costs” methodology applied in the 2019 DFS was used and escalated to current November 2021.

21.1.22 Mining Capital Costs

Mining costs are based on December 2021 mining contractor budget price estimates.

For this document, the capital cost associated with the mining operations was calculated as the cost of the first seven months of pre-development mining. The capital cost is made up of mining contractor site establishment, mining phase 1 capital and the first seven months of pre-development capital and the explosives contractors site establishment cost. The mining capital cost is summarised in Table 21-5.

Table 21-5: Mining Capital Costs

Cost Area	Units	Total
Mining Contractor Site Establishment	US$	2,714,473
Explosives Site Establishment	US$	9,975

Cost Area	Units	Total
Mining Pre-development Capital		
Contractor Fixed Costs	US$	4,004,656
Bush Clearing Cost	US$	44,787
Mining Cost Topsoil	US$	329,766
Mining Cost Softs	US$	13,804,740
Drilling Cost Hard Waste	US$	5,365,678
Blasting Cost Hard Waste	US$	2,315,461
Hard Waste Cost	US$	29,147,067
Drilling Ore Cost	US$	468,530
Ore Blasting Cost	US$	151,351
Bubi Hauling Cost	US$	3,632,925
Ore Load and Haul Cost	US$	-
Ore Re-handle	US$	203,885
Services Cost per Ore tonne	US$	381,359
Mining Cost Capital Cost	US$	62,574,654
	Opex Portion	29,850,206
Bilboes Mining Contractor Capital Cost	Capex Portion	32,724,448

21.1.23 Process Plant and Infrastructure Capital Costs

Table 21-6: Cost Category Components

Description	Total USD$
Ore Receiving and Crushing	24,518,732
Milling, Classification & Thickening	15,804,663
Flotation	16,250,891
BIOX®	59,741,050
Carbon in Leach (CIL)	3,667,566
Carbon Treatment	2,649,105
Gold Room	1,184,076
Tailings Handling and Cyanide Detoxification	1,258,855
Reagents	7,133,061
Process Plant Water Services and Reticulation	4,189,324
Process Plant Utility Services	13,295,213
E, C & I Plant	10,385,555
Plant Services	4,551,323
Fire Protection and Detection	254,947
Potable Water and Treatment	883,061

Description	Total USD$
Sewage Treatment	182,431
Storm Water Management	273,779
Fencing	647,854
Pipe and Cable Racks	927,539
Plant Buildings and Workshops	1,616,602
Plant Management Offices Facility	344,407
Security, Changehouse, Crib Room Facility	358,825
Security	107,063
Control Room	187,693
Metallurgical Lab Facility	432,511
Mechanical Workshop	809,892
Plant Electrical Structures	25,881
Overhead Line	14,458,715
MV Substation	281,132
MCCs (Motor Control Centres)	691,348
General Earthworks	3,673,895
Roads and Terraces	17,831,972
Buildings	3,991,944
Flotation TSF	29,140,623
BIOX TSF	10,258,205
Crossings	20,558
Temporary Facilities	410,152
Project Fleet	74,369
EPCM Contractor	21,217,771
First Fill and Commissioning	4,255,194
Spares	5,115,593
Forex	1,190,091
General Administration Costs	8,013,959
Contingency	29,383,006
Total Process and Infrastructure Costs	**321,690,423**

21.1.24 Discipline Cost Overview

The table below provides a percentage indication of the price source by discipline, as described per the disciplines above, to what was quoted, revalidated from database, escalated, or factored.

Definition of price sources:

- Quoted - Revalidated 2019 Project Information quoted specific to the Bilboes Project.
- Revalidated Database - Revalidated based on information from a recent study information.
- Escalated - 2019 Estimate cost escalated - SEIFSA Indices.
- Factored - Cost factored, cost impacted directly from other updates.

Table 21-7: Discipline Price Source Percentage

Description	Quoted	Revalidated	Escalated	Factored
Open Pit Mining	100%	0%	0%	0%
Earthworks	100%	0%	0%	0%
Tailing Storage Facility	90%	10%	0%	0%
Civils & Infrastructure	100%	0%	0%	0%
Building Works	100%	0%	0%	0%
Steelwork	97%	0%	3%	0%
Platework	100%	0%	0%	0%
Mechanicals	97%	1%	2%	0%
Turnkey Packages	0%	0%	0%	0%
EC&I	79%	13%	8%	0%
Piping & Valves	0%	0%	0%	100%
Transport	99%	0%	1%	0%
Project Services, EPCM & Consultants	7%	0%	93%	0%
Construction Services	0%	0%	100%	0%
Consumables And Spares	86%	0%	7%	7%
Owners Cost	0%	0%	100%	0%
Project Contingency	100%	0%	0%	0%
Client Contingency	0%	0%	0%	0%
Overall Average Percentages	**83.5%**	**2.6%**	**10.0%**	**4.0%**

21.1.25 Capital Estimate Summaries

Table 21-8: Capital Summaries Comparison between 2019 and 2021 by Discipline

Description	Bilboes 2019 $	Bilboes 2021 $	Delta $
Open Pit Mining	22,661,085	32,724,448	10,063,363
Earthworks	30,052,533	30,052,533	-
Tailing Storage Facility	37,369,070	39,398,828	2,029,758
Civils & Infrastructure	11,602,139	11,602,139	-
Building Works	7,743,901	7,743,901	-
Steelwork	15,157,856	21,048,907	5,891,051

Description	Bilboes 2019 $	Bilboes 2021 $	Delta $
Platework	25,631,235	32,423,888	6,792,653
Mechanicals	50,454,771	56,563,731	6,108,959
Turnkey Packages	-	-	-
EC&I	35,530,617	37,005,768	1,475,152
Piping & Valves	10,957,886	13,588,282	2,630,396
Transport	3,918,857	4,722,454	803,597
Project Services, EPCM & Consultants	22,173,198	23,046,382	873,184
Construction Services	472,895	484,521	11,625
Consumables And Spares	5,258,845	6,612,125	1,353,280
Owners Cost	7,057,591	8,013,959	956,368
Project Contingency	26,255,624	29,383,006	3,127,383
Client Contingency	-	-	-
Escalation	-	-	-
Total	**312,298,104**	**354,414,871**	**42,116,767**

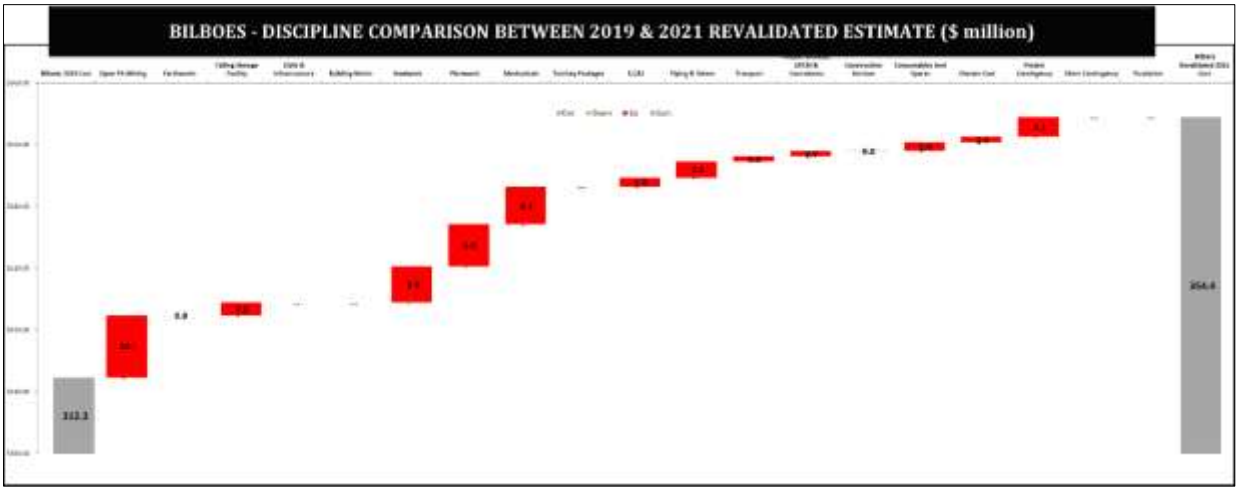


Figure 21-1: Waterfall Chart Comparison between 2019 and 2021 by Discipline

Table 21-9: Capital Summaries Comparison between 2019 and 2021 by WBS

Description	Bilboes 2019 $	Bilboes 2021 $	Delta $
1-0000 - Mining	22,661,085	32,724,448	10,063,363
2-0000 - Mining Service & Infrastructure	-	-	-
3-0000 - General Infrastructure	62,866,881	64,896,638	2,029,758
4-0000 - Process	141,709,234	160,078,091	18,368,857

Description	Bilboes 2019 $	Bilboes 2021 $	Delta $
5-0000 - Process Plant Infrastructure	22,723,731	27,035,001	4,311,271
6-0000 - Haul Road	20,558	20,558	-
Indirect Cost	62,316,616	69,660,135	7,343,519
Total	**312,298,104**	**354,414,871**	**42,116,767**

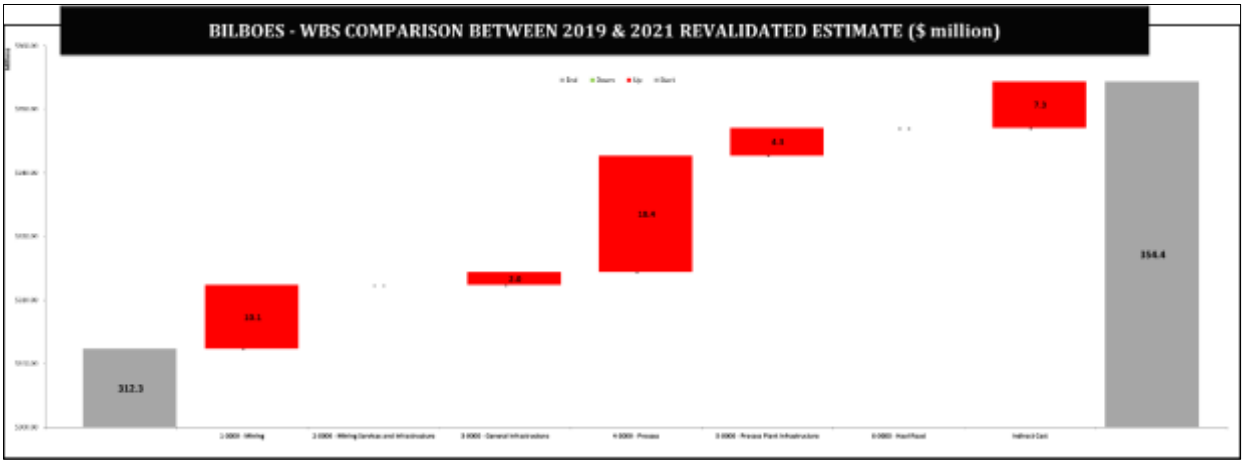
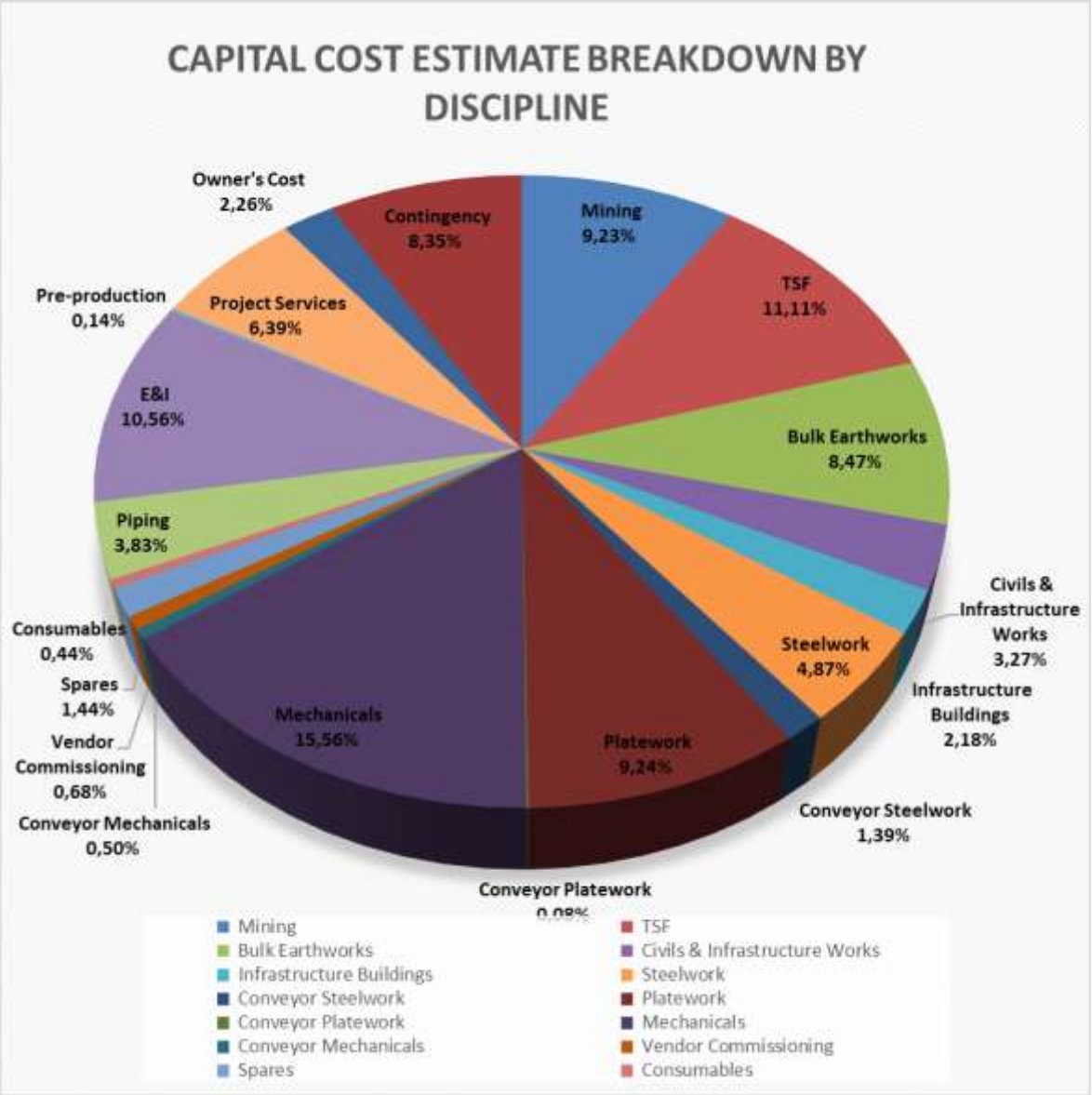


Figure 21-2: Waterfall Chart Comparison between 2019 and 2021 by WBS

Table 21-10: Capital Summaries per Project Phase

Description	Grand Total $	Sub Total Phase 1 $	Sub Total Phase 2 $
Mining	32,724,448	32,724,448	-
Process	160,078,091	134,213,663	25,864,428
Infrastructure, Utilities and Ancillaries	91,952,197	66,073,752	25,878,446
Indirect Cost	40,277,128	38,046,389	2,230,740
Contingency	29,383,006	24,352,206	5,030,801
Total Project Costs	**354,414,871**	**295,410,457**	**59,004,414**



Graph 21-1: Cost Breakdown by Disciplines

21.1.26 Stay in Business Operating Cost Estimate

Stay-in Business Operating Costs are included in the Mining Contractors Costs.

21.1.27 Exclusions and Assumptions

21.1.27.1 Exclusions

The scope of the estimate is restricted to the battery limits as shown on the Block Plan, PFDs, and MEL.

The following are items which are not included in the CCE:

- Escalation beyond capex base date

- Forex variation allowances
- Forward cover for any foreign content
- Environmental permitting activities
- Hydrological / water supply related costs
- Costs of Socio-Economic development
- Costs for Skills development
- Costs for Enterprise and Supplier development
- Costs for financial modelling and evaluation
- Cost of financing
- Sunk costs
- Legal costs
- All VAT, import duties, surcharges and any other statutory taxation, levies, or government duties
- Acquisition costs including mineral rights and the purchase or use of land
- All royalties, commissions, lease payments, rentals and other payments to landowners, title holders, mineral rights holders, surface right holders, and/or any other third parties
- Any provision for project risks outside of those related to design and estimating confidence levels

21.1.27.2 Assumptions

The following assumptions have been made in the preparation of this estimate:

- The project would proceed on an EPCM basis
- The project would generally be implemented as per the execution programme
- All material and equipment will be purchased from recognised vendors
- The EPCM would be granted a site office location near to the works

21.1.28 Risks and Opportunities to Capital Estimate

21.1.28.1 Foreign Exchange

A schedule of all the foreign content, together with the relevant exchange rates, has been included as a separate tab within the estimate. The schedule below details the currency used for the base date of the estimate (quoted rates aligned with base date).

Table 21-11: Foreign Exchange

	Value	
USD	$	1.00
ZAR	$	0.06
AUD	$	0.72
EUR	$	1.13
CNY	$	0.16
GBP	$	1.32
CAD	$	0.79
JPY	$	0.01

21.1.29 Escalation

Escalation can be divided into two categories, namely pre-escalation and post-escalation.

Pre-escalation can be described as escalating historical information, escalated to base date using SEIFSA indices and has been allowed for in the estimate. Q3, 2021 SEIFSA indices has been utilised for escalating to base date, various “buckets” have been carefully selected for the various disciplines and applied. Overall escalation indices by discipline are indicated in the table below.

Where vendors were not able to provide revalidated quotations or able to use recent database information from a project in the same region, the estimator reverted to escalation of the 2019 estimate information to the project new base date, November 2021.

Post-escalation would be escalating cost to future date, and this has not been considered past the quoted base date and is therefore excluded from the CCE.

It is recommended that the client allow an escalation contingency in his total project cost budget.

Table 21-12: Escalation by Discipline

Discipline Description	Escalated Indices
Open Pit Mining	10.76%
Earthworks and Tailing Storage Facility	10.76%
Concrete Works	20.14%
Building Works	10.72%
Steelwork Supply	51.04%
Steelwork Erect	10.97%
Platework Supply	55.72%
Platework Erect	10.97%

Discipline Description	Escalated Indices
Mechanicals Supply	30.42%
Mechanicals Erect	10.97%
Turnkey Packages	0%
EC&I	17.75%
Piping & Valves	34.4%
Transport	10.47%
Construction Services	12.68%
EPCM	12.32%
External Services	0%
Consumables And Spares	35.33%
Owners Cost	12.34%

21.1.30 Contingencies

21.1.30.1 Project Contingency (Design Development Allowance)

The calculation and application method of the Project Contingency costs (described below) has not changed from the 2019 Feasibility study. Project Contingency has been allowed for estimating inaccuracy, because of the limited detail engineering carried out in the FS (level of engineering approximately to 15%).

The risks applicable to estimate inputs have been assessed by the study team and estimating confidence levels have been assigned to the major estimate cost categories.

Estimate input confidence levels have been assigned as per the following scale:

- HH (High High Confidence) :5% (Fully complete)
- H (High Confidence) :7.5%(Mostly complete)
- HM (High Medium Confidence) :10% (Partially factored - Allowances)
- M (Medium Confidence) :12.5% (Mostly factored)
- ML (Medium Low Confidence) :15% (Fully factored)
- L (Low Confidence) :20% (Benchmarked)

These confidence levels were then factored to reflect as a percentage of the individual cost categories, from which an overall estimating contingency was derived, as indicated in the table below.

The details of this confidence calculation are contained in the Project Contingency (design development) tab of the detailed estimate.

Following the derivation of the Project Contingency (design development) allowance provision the results are shown at the bottom of the estimate summary sheet and equate to 9.04% average.

Table 21-13: Project Contingency Percentage by Discipline

Discipline Description	Contingency %
Open Pit Mining	5.0%
Tailing Storage Facility	8.75%
Earthworks & General Services	8.8%
Concrete Works	8.8%
Building Works	10.0%
Steelwork Supply	8.8%
Steelwork Erect	10.0%
Platework Supply	8.8%
Platework Erect	10.0%
Mechanicals Supply	6.3%
Mechanicals Erect	8.8%
Turnkey Packages	10.0%
EC&I	10.0%
Piping & Valves	17.5%
Transport	11.3%
Preliminary & General	10.6%
Construction Services	10.6%
External Services & EPCM	10.6%
Consumables And Spares	10.0%
Owners Cost	10.0%
Overall Average	**9.04%**

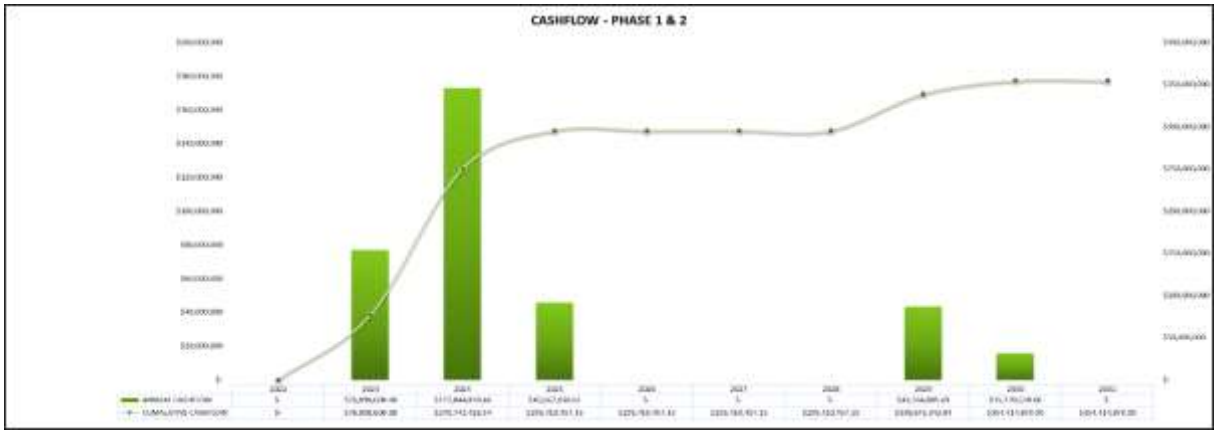
21.1.31 Project Risk / Management Contingency

The following project risk contingencies were not allowed for:

- Strike action
- Adverse weather conditions
- Changes to legislation
- Community disruptions
- Unplanned movement of shutdown dates
- The project / management risk contingency is specifically excluded from this estimate
- Risks associated with COVID-19

21.1.32 Cash Flow

Shown below is the preliminary cash flow forecast that has been provided for the overall project. These cash flow tables and graphs form part of the detailed estimate and can be found in the cash flow tab within the overall estimate document.



Graph 21-2: Preliminary Cash Flow forecast

DRA makes use of a Beta Distribution to model cashflows in instances where the project schedule is not cost loaded. The rationale for using a beta distribution (probability density function) is that it provides a conjugate distribution for various distributions like binomial, negative and positive binomial, and geometric distributions. The distribution uses two shape parameters which control the shape of the distribution. By controlling the shape of the distribution, the underlying probabilities can be determined. These probability factors are then applied to the costs / capital to determine the cashflow. The shape of the distribution to be used to calculate the cashflow is based on experience from previous and similar projects. At DRA, the beta distribution is derived and applied separately for discrete areas of the cost / capital estimate, each of which exhibits a characteristic spend. For example, fabrication and delivery of materials and equipment is distinguished by a positive binomial distribution where major cost is incurred upfront for early payment, fabrication, and delivery, with lower costs thereafter for storage. In instances where costs are time based, the distribution used would be relatively evenly spread over time – an example here will be construction management and professional services.

The beta distribution for cashflow modelling is a useful tool, however its use centres on expert judgement and prior experience which is provided by our engineers and estimating team. This tool, whilst subjective, has been used on recent projects to provide a best estimate for cost and cash flows.

21.2 Operating Cost Estimate

21.2.1 Mining Operating Cost

21.2.1.1 Basis of Cost Estimate

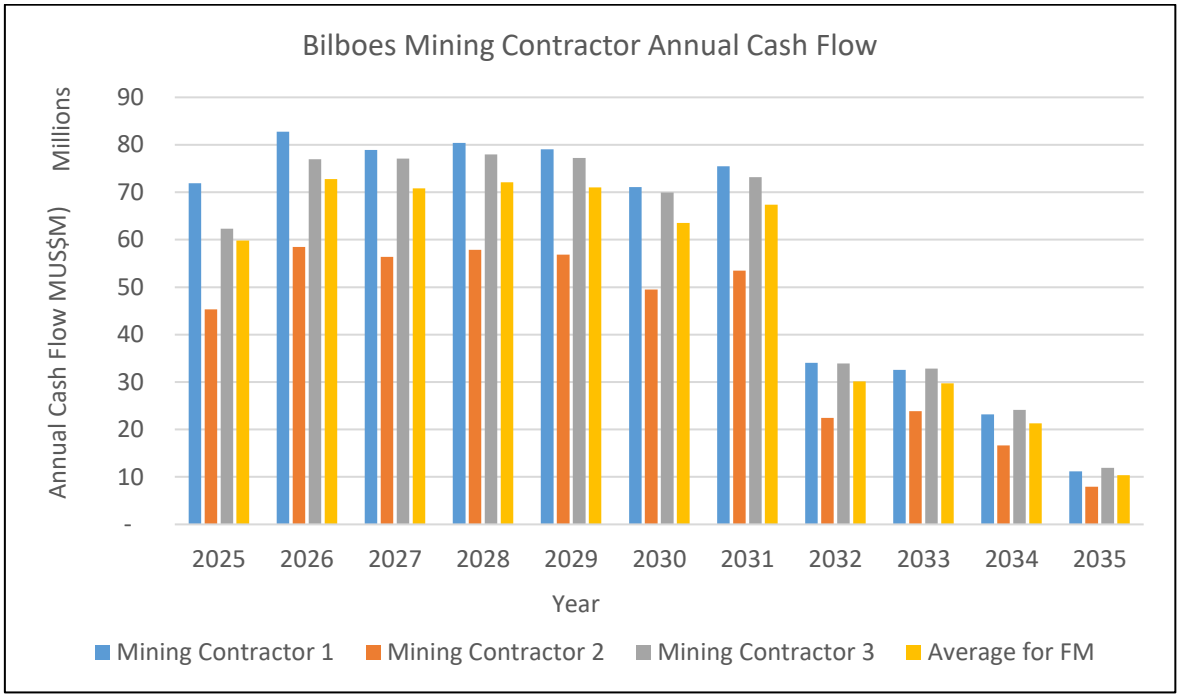
The operating cost estimate has been completed from a zero base and presented in USD. Costs associated with labour, materials and consumables were included in this estimate. The cost estimate has been based on information from the following sources:

21.2.1.1.1 Mining Contractor Budget Cost Adjudication

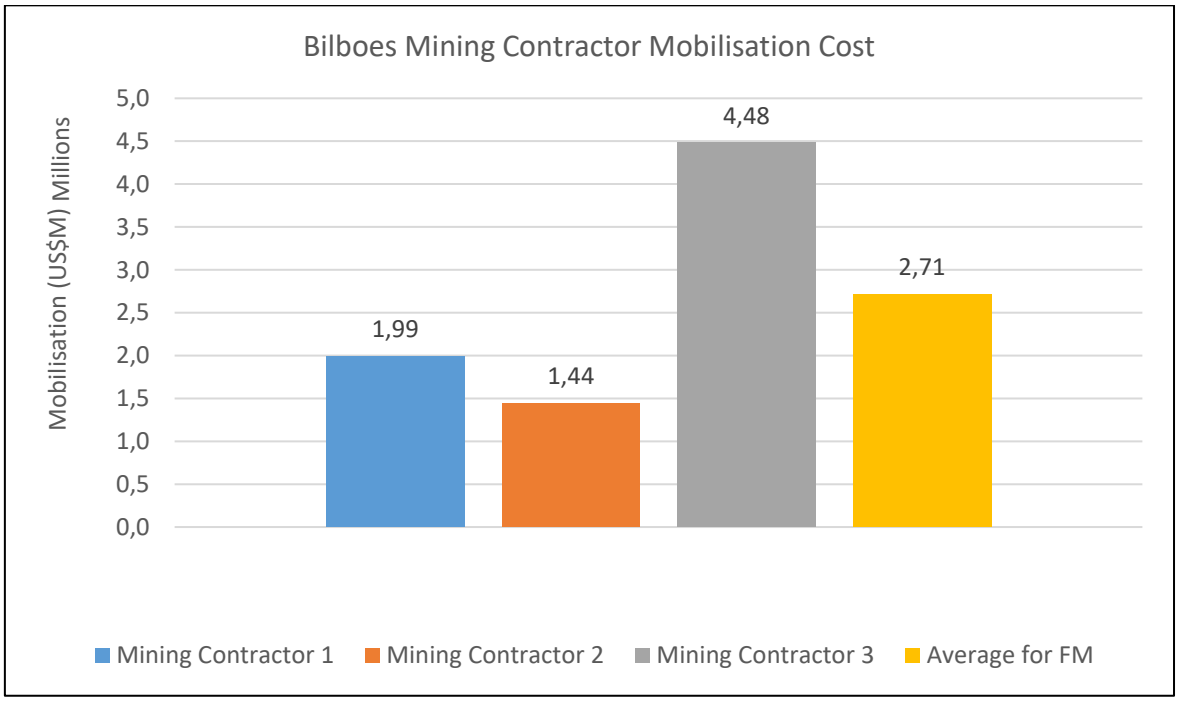
Four Southern African mining contractors agreed to submit budget pricing for the Bilboes Gold Project base case production schedule / BoQs. These contractors were asked to price the individual packages (Earthworks, Civils and Mining) and the full scope of works to evaluate potential fixed and variable cost saving. The TSF was also included in the Mining BoQs to reduce capital costs. Three contractors provided competitive bids, and these are summarised in the table and graphs that follow show the top three contractors that comprehensively priced the BoQ without applying undue political risk as per the Client request. The selected contractor/s would be considered as an investor in the Bilboes and would have the same rights to $ payments and access to foreign exchange to support their works and funding model as other investors.

Table 21-14: Bilboes Mining Contractor Adjudication Summary

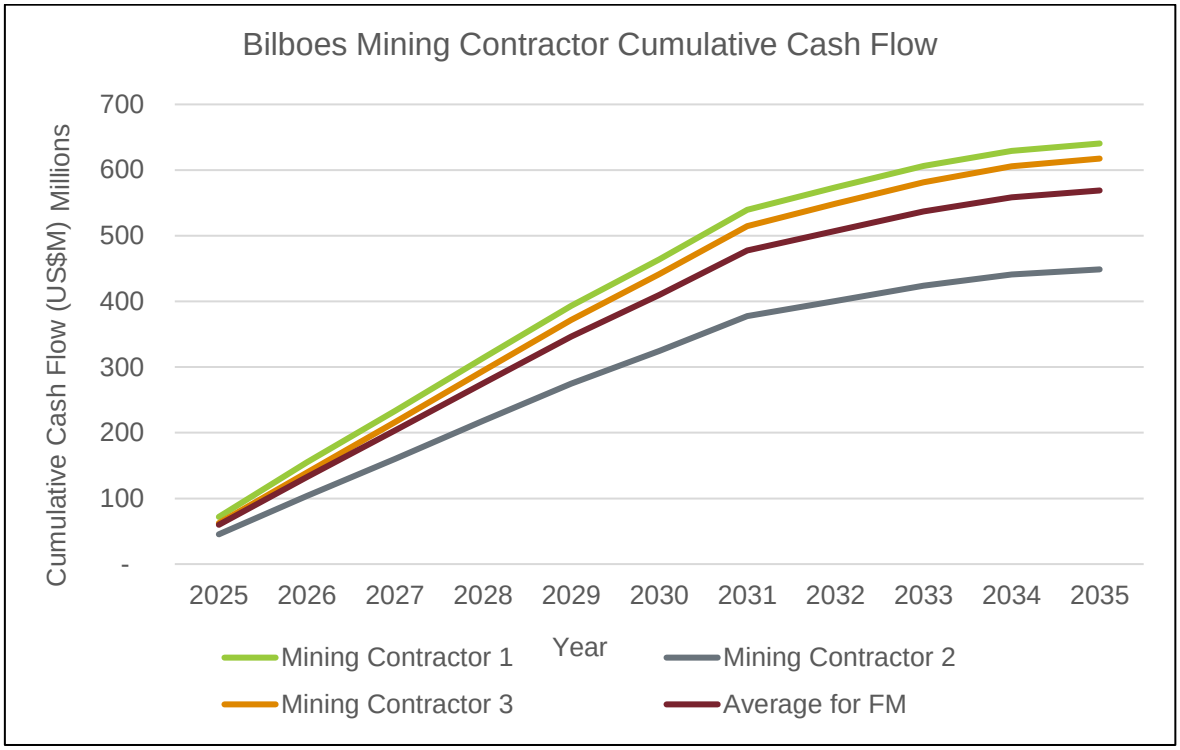
Bilboes BEC Mining Contractor Adjudication		
Contractor Annual Cash Flow		**Total**
Contractor 1	$	640,505,008
Contractor 2	$	448,794,858
Contractor 3	$	617,514,859
Average for FM	$	568,938,242
Contractor Cost Per Ore Tonne		**Total**
Contractor 1	$/ore t	24.04
Contractor 2	$/ore t	16.84
Contractor 3	$/ore t	23.18
Average for FM	$/ore t	21.35



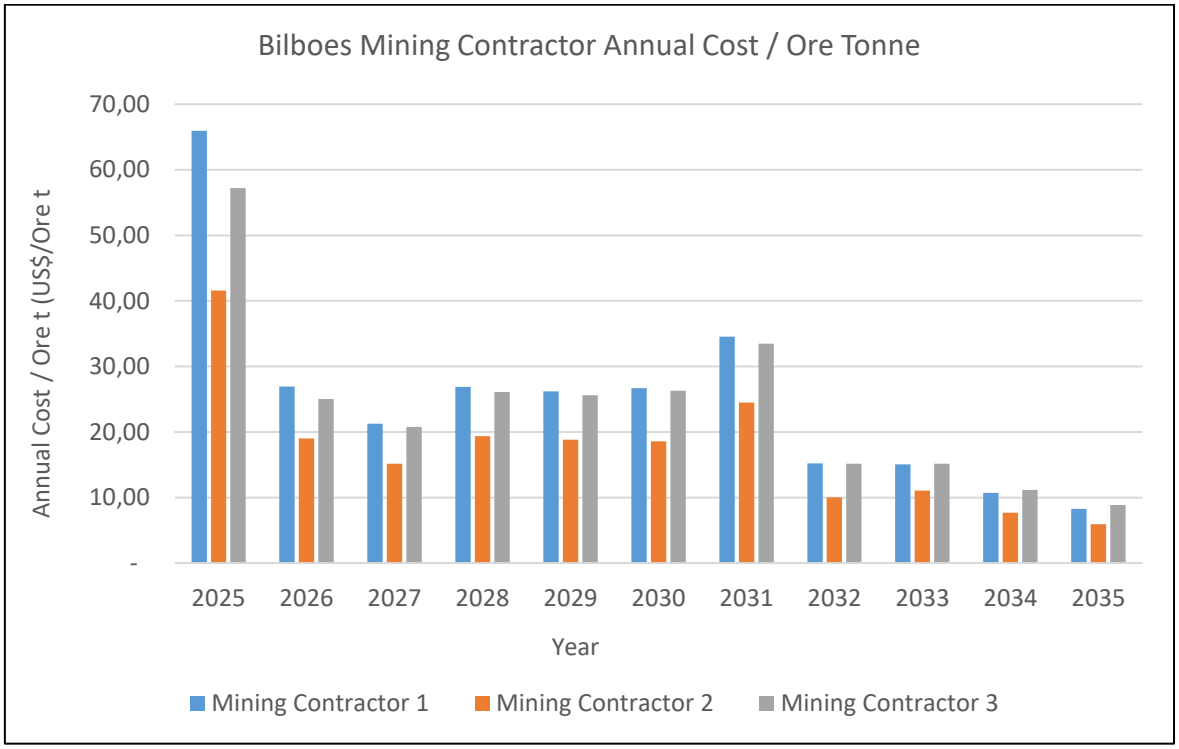
Graph 21-3: Bilboes Mining Contractor Adjudication Cost per Annum



Graph 21-4: Bilboes Mining Contractor Adjudication Mobilisation Cost



Graph 21-5: Bilboes Mining Contractor Cumulative Cost



Graph 21-6: Bilboes Mining Contractor Adjudication Cost per Ore Tonne

Table 21-15: Bilboes Mining Contractor Adjudication Ranking

Bilboes Adjudication per Cost Area		1	2	3
1. Site Establishment	$	1,992,719	1,458,350	4,482,500
2. Time Related G&A	$/month	291,740	225,562	448,413
3a. Bush Clearing Hectares	$/Ha	1,601	1,126	3,962
3b. Topsoil Stripping L&H and Dump and Level 2 km free haul	$/bcm	4.06	2.84	4.42
4. L&H Free Dig 2.5 km free haul	$/bcm	4.70	3.20	5.03
5a. Hards Drilling Cost per meter	$/meter	23.41	9.79	17.32
5b. L&H Hards 2.5 km free haul	$/bcm	4.70	3.65	4.71
6a. Ore Drilling cost per meter	$/meter	15.69	10.58	17.32
6b. L&H Ore 3.5 km free haul	$/tonne	2.71	1.47	2.53
7. Ore Re-handle at ROM Tip (max 400 m) (20%)	$/tonne	0.94	0.53	1.34
8. EO Haul Rate per 200 m (applied to increased haul distances)	$/bcm	0.25	0.23	0.20
Local Experience	Out of 10 max	**10**	**8**	**8**
Score	3	**-**	**30**	**3**
Score	2	**16**	**2**	**6**
Score	1	**3**	**-**	**6**
Total Score		**29**	**40**	**23**
Due to the high variability of Contractor Mining Budget Quotes an Average of the 3 will be used for the Financial Model				
Financial Model Sensitivities will be done to simulate Contractor Mining Capital and Operating Costs Fluctuations				

21.2.1.2 Explosive Supplier Budget Cost Adjudication

Two explosives' suppliers provided budget prices on explosive, accessory and down the hole supply to the Bilboes. The budget pricing submission are summarised in Table 21-16 :, Table 21-17: and Graph 21-7:. Supplier 1 was chosen to form the basis of explosives cost for the Bilboes Gold Project.

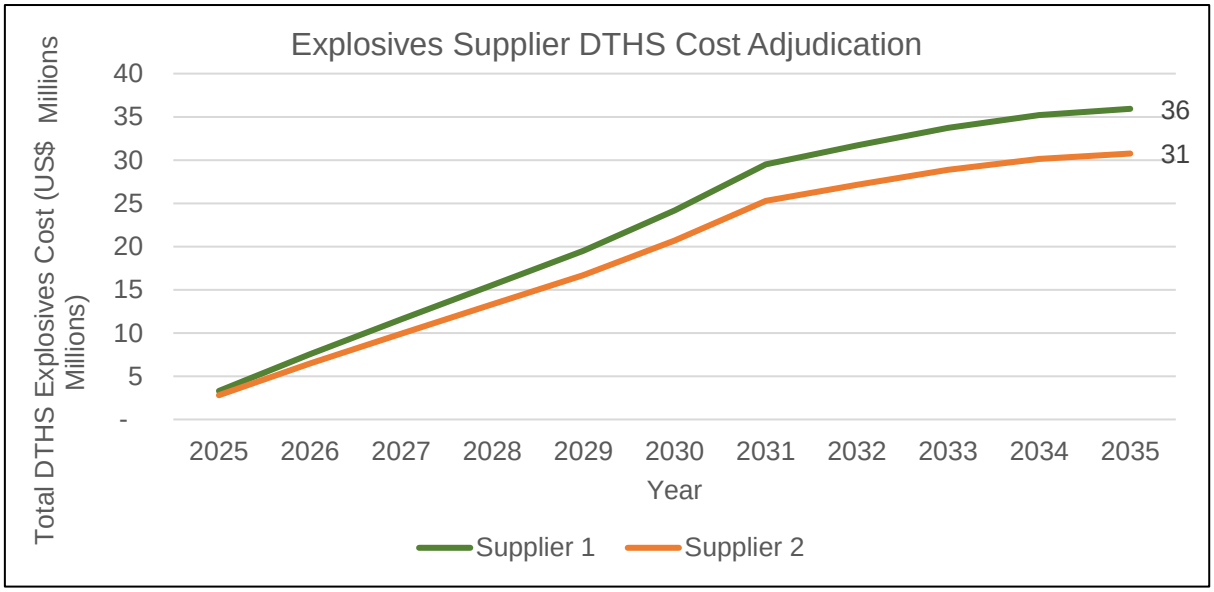
Table 21-16 : Bilboes Explosive Supplier 1 Budget Price

Supplier 1 Dedicated MMU on site = Down the Hole Service				
Description	**Amount**	**Rate Ex VAT**	**Value**	**Unit**
Mobilisation	1	$29,263	$29,263	Once Off
De-mobilisation	1			
Service and Equipment/facilities Rental Charge including LDV incl Labour	1	$28,803	$28,803	Monthly
	1			Monthly
Monthly Diesel Consumption	5000	$1.16	$5,800	Monthly

Supplier 1 Dedicated MMU on site = Down the Hole Service				
Description	**Amount**	**Rate Ex VAT**	**Value**	**Unit**
Emulsion (kg/ month)	342,821	$0.8867	$303,968	Monthly
Accessories Unit Cost per hole (10.2m Shock tube, Booster, Trunkline & Initiators	3,677	$7.35	$27,026	Monthly
Average Monthly Explosive DTH Cost			**$365,597**	**Monthly**

Table 21-17: Bilboes Explosive Supplier 2 Budget Price

Supplier 2 Dedicated MMU on site = Down the Hole Service				
Description	**Amount**	**Rate Ex VAT**	**Value**	**Unit**
Mobilisation	1	$9,975	$9,975	Once Off
De-mobilisation	1	$2,650	$2,650	
Service and Equipment/facilities Rental Charge including LDV	1	$4,325	$4,325	Monthly
Monthly Service inc. Labour Cost	1	$7,225	$7,225	Monthly
Monthly Diesel Consumption	5000	$1.16	$5,800	Monthly
Emulsion (kg/ month)	342,821	$0.76	$260,544	Monthly
Accessories Unit Cost per hole (10.2 m Shock tube, Booster, Trunkline & Initiators	3,677	$7.65	$28,129	Monthly
Average Monthly Explosive DTH Cost			**$306,023**	**Monthly**



Graph 21-7: Bilboes Explosive Supplier Adjudication Cost per Ore Tonne

21.2.1.3 Mine Operating Cost Summary

The basis of the Bilboes FS Update mining cost estimate was that all mining will be done by and experienced mining contractor. The pricing was based on a mining BoQ that was derived from the FS production schedule. The dump locations / RoM tip location and haul distances

for all material types was provided on a monthly and annual basis. This methodology ensures that all budget pricing receive is of a high accuracy level in real terms.

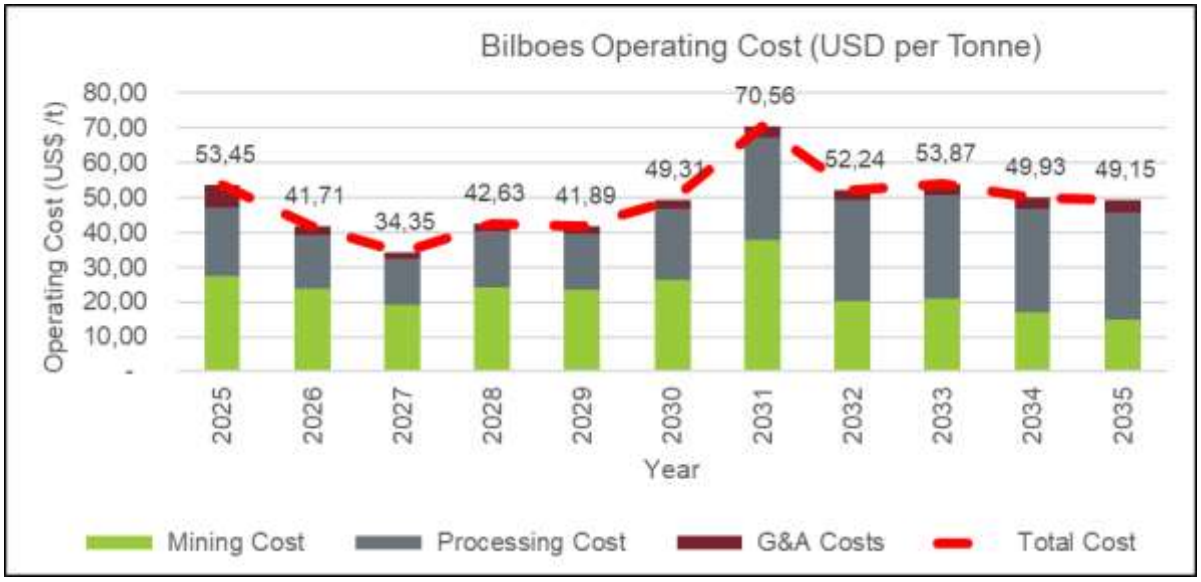
The average mining contractor based on pricing received for life of the Bilboes is $2.55/t including the ore transport cost from all mining areas except Bubi to the Bilboes process plant near Isabella North. The cost per area is shown in Table 21-18:.

Table 21-18: Mining Contractor Costs per Area ($/total tonne)

Area	Cost per Total Tonne Mined (Ore and Waste) (USD)
G & A	0.19
Drill and Blast	0.42
Load and Haul	1.88
Re-handle Ore	0.02
Services Cost	0.04
Total	2.55
Diesel Cost	$1.16 per litre supplied by the Client



Graph 21-8: Mining Cost Breakdown per Annum



Graph 21-9: Mining Unit Cost Breakdown per Total Tonne

21.2.2 Process Plant Operating Cost

21.2.2.1 Basis of Cost Estimate

The operating cost estimate has been completed from a zero base and presented in United States Dollar ($) denomination. Costs associated with labour, materials and consumables have been included in this estimate. The cost estimate has been based on information from the following sources:

Reagent's consumption and unit cost:

- Baseline data extracted from laboratory and pilot scale testwork
- Data from similar existing process operations
- Quotations obtained from local and international suppliers

Power consumption and unit cost:

- Equipment power consumption is calculated on data extracted from the MEL
- Power consumed in the crushing, milling and carbon treatment sections have been treated as a variable cost calculated as a factor of the tonnage milled
- Power consumed in the remaining sections of the plant are designated as either fixed or variable dependant on the type of equipment. Where the item operates continuously, irrespective of capacity, the relevant associated power draw is designated as fixed. Such items include agitators, thickeners, operating pumps, compressors, blowers, and cooling towers

- Unit supply cost is based on an agreed tariff, as negotiated by the Bilboes team, for ring fenced power supply with the local power utility fixed at $0.0986 / kWh.

Labour compliment and salary rates:

- Manpower has been based on the typical requirements for an operating metallurgical plant in Africa with a low to medium level of automation
- A four-shift system has been assumed
- Salary rates were based on local legislation and benchmarking to neighbouring process operations and have been provided by Bilboes
- Manpower cost is designated as a fixed cost

General and administration:

- Fixed cost as determined by Bilboes

Analytical laboratory:

- Based on the manpower required to operate the laboratory and on a pre-determined quantity of samples processed per month
- This is a designated fixed cost

Tailing's storage facility:

- Based on the manpower required to operate and maintain the facility as well as the supply of basis equipment spares

Maintenance:

- Maintenance costs associated with the plant has been factored at 2.5% of initial capital expenditure per annum

Contingency:

- A zero contingency has been applied to the plant operating costs

Accuracy of Estimate:

- An accuracy range of ±10% can be assumed for this level of study

21.2.2.2 Reagent Consumption and Supply Costs

The following section provides a summary of the expected nominal reagent consumption rates, based on results obtained from pilot and laboratory scale test work, vendor specifications (e.g., Outotec) and mass balancing. The prices include freight to site and include all clearance

charges and taxes that may be incurred. The unit costs are based on quoted supply costs as provided by reagents vendors.

Table 21-19: Reagents - Unit Consumption Rates and Supply Costs

Description	Consumption Rate, kg/t ore	Supply Cost, $/t
Isabella McKay's – Phase 1		
Collector (SEX)	0.150	2,500
Modifier ($CuSO_4$)	0.100	3,360
Frother (DOW)	0.045	2,450
Depressant (Na_2SO_3)	0.350	400
Depressant (Starch)	0.110	1,460
Sulphuric acid (H_2SO_4)	1.050	400
Lime	6.000	154
Nutrient	0.430	420
Anti-scalant	0.002	6,000
Corrosion inhibitor	0.002	6,700
Biocide	0.002	4,500
Defoamer - BIOX	0.001	2,000
Defoamer - CIL	0.005	6,000
Flocculant	0.017	3,250
Cyanide	1.000	2,400
Carbon	0.001	3,360
Hydrochloric acid	0.025	610
Caustic soda (NaOH)	0.065	960
SMBS	0.250	897
Copper sulphate ($CuSO_4$)	0.005	3,360
Bubi – Phase 2		
Collector (SEX)	0.150	2,500
Modifier ($CuSO_4$)	0.100	3,360
Frother (DOW)	0.045	2,450
Depressant (Na_2SO_3)	0.350	400
Depressant (Starch)	0.110	1,460
Limestone	32.927	27
Lime	12.000	154
Nutrient	0.860	420
Anti-scalant	0.003	6,000
Corrosion inhibitor	0.003	6,700
Biocide	0.003	4,500

Description	Consumption Rate, kg/t ore	Supply Cost, $/t
Defoamer - BIOX	0.001	2,000
Defoamer - CIL	0.020	6,000
Flocculant	0.030	3,250
Cyanide	2.000	2,400
Carbon	0.012	3,360
Hydrochloric acid	0.050	610
Caustic soda (NaOH)	0.130	960
SMBS	0.500	897
Copper sulphate ($CuSO_4$)	<0.1	3,360

21.2.2.3 Power Consumption and Supply Cost

The total connected electrical load, inclusive of all standby units in the plant is around 38.1 MW, by summation of all the equipment specified on the MEL. The estimated average running load has been calculated using expected power draw from the equipment and factored (in certain cases) to tonnage throughput.

A power unit supply cost of $ 0.0986 /kWh was used for the cost calculation and supplied by the Bilboes team. Total power costs are in this report.

21.2.2.4 Labour Compliment

The labour costs have been based on the organogram developed for the processing plant. The cost for labour has been determined by the Bilboes team and is based on legislative guidelines and benchmarking to similar operations in the area. Labour compliment requirements are presented in Table 21-20 and Table 21-21 below for phase 1 and phase 2 respectively

Table 21-20: Labour Compliment – Phase 1 (240 ktpm)

Role	Grade	Salary, $/month	No. Required
Process Manager	D3	9,450	1
GES	D2	4,500	1
Process Superintendent	D1	3,400	1
Stores Controller	B4	322	1
Cost Control & Data Clerk	B4	322	1
Driver	B2	467	1
Shift Supervisor	C2	477	4
Control Room Operator	C1	426	4
Shift Operator	B4	322	20
Process Attendants	B2	296	20

Role	Grade	Salary, $/month	No. Required
Day Shift Operator	B4	322	2
Day Shift Attendants	B2	296	6
Maintenance Co-ordinator	C2	477	2
Instrument Technician	C2	477	3
Boilermakers / Fitters	C2	477	6
Electricians	C2	477	4
Maintenance attendants	B2	296	13
Senior Metallurgist	D1	3,400	1
Metallurgist	C4	1,500	1
Chief Analyst	C4	1,500	1
Analyst	C2	477	2
Analytical Attendants	B2	296	2
BIOX® Head (Senior Met)	D1	3,400	1
Plant Metallurgist	C5	2,500	1
Shift Supervisor	C2	477	4
Shift Operator	B4	322	20
Process Attendants	B2	296	20

Table 21-21: Labour Compliment – Phase 2 (180 ktpm)

Role	Grade	Salary, $/month	No. Required
Process Manager	D3	9,450	1
GES	D2	4,500	1
Process Superintendent	D1	3,400	1
Stores Controller	B4	322	1
Cost Control & Data Clerk	B4	322	1
Driver	B2	467	1
Shift Supervisor	C2	477	4
Control Room Operator	C1	426	4
Shift Operator	B4	322	20
Process Attendants	B2	296	20
Day Shift Operator	B4	322	2
Day Shift Attendants	B2	296	6
Maintenance Co-ordinator	C2	477	2
Instrument Technician	C2	477	3
Boilermakers / Fitters	C2	477	6
Electricians	C2	477	4

Role	Grade	Salary, $/month	No. Required
Maintenance attendants	B2	296	13
Senior Metallurgist	D1	3,400	1
Metallurgist	C4	1,500	1
Chief Analyst	C4	1,500	1
Analyst	C2	477	2
Analytical Attendants	B2	296	2
BIOX® Head (Senior Met)	D1	3,400	1
Plant Metallurgist	C5	2,500	1
Shift Supervisor	C2	477	4
Shift Operator	B4	322	20
Process Attendants	B2	296	20

21.2.2.5 Summary

Operating costs have been estimated and based on the production profile over LoM. For illustrative purposes, static costs are presented below for phase 1 and phase 2 in Table 21-22 and Table 21-23 respectively. Main drivers in costs include reagents and power which collectively account for more than 80% of total plant operating costs.

Table 21-22: Phase 1 Plant OPEX (240 ktpm, excl. G&A)

Description	Unit	Value	% of Total
Variable	**$/a**	**36,428,267**	**78**
Reagents and Consumables	$/a	19,838,196	42
Power	$/a	9,504,610	20
Maintenance	$/a	7,085,462	15
Fixed	**$/a**	**10,325,329**	**22**
Power	$/a	9,101,573	19
Labour	$/a	911,636	2
Tailings deposition	$/a	62,424	0
G&A	$/a	0	0
Laboratory	$/a	249,696	1
Overview			
RoM	t/a	2,880,000	
Total variable	$/a	36,428,267	78
Total fixed	$/a	10,325,329	22
Total	$/a	46,753,596	100
Unit cost	$/t ore	16.2	

Table 21-23: Phase 2 Plant OPEX (180 ktpm, excl. G&A)

Description	Unit	Value	% of Total
Variable	**$/a**	**40,736,320**	**72**
Reagents and Consumables	$/a	25,472,004	45
Power	$/a	9,950,220	18
Maintenance	$/a	5,314,096	9
Fixed	**$/a**	**15,458,524**	**28**
Power	$/a	14,250,374	25
Labour	$/a	911,636	2
Tailings deposition	$/a	46,818	0
G&A	$/a	0	0
Laboratory	$/a	249,696	0
Overview	t/a		
RoM	$/a	2,160,000	
Total variable	$/a	40,736,320	72
Total fixed	$/a	15,458,524	28
Total	$/a	56,194,844	100
Unit cost	$/t ore	26.0	

21.2.3 General Administrative Costs

The G&A cost includes administrative personnel, general office supplies, safety and training, travel (both on site and off site), independent contractors, insurance, permits, fuel levies, security, camp power, camp costs, ICT, relocation, and recruitment.

Total G&A costs amount to $6,969,468 per annum in Phases 1 and 2.

Table 21-24: Bilboes Base Case General Administration Costs

Bilboes Base Case General Administration Costs $	
Security Transport and Sundry Costs	
Total Cost	710,821
Labour Related Costs	
Total Cost	4,065,080
Engineering	
Total Cost	672,641
Safety, Health and Environment	
Total Cost	215,026
Technical Services	
Total Cost	492,000
Sub-total	**6,155,568**

Bilboes Base Case General Administration Costs $	
Explosive Down the Hole Fixed Cost	327,900
Process Cost G&A Costs	486,000
Grand Total	**6,969,468**

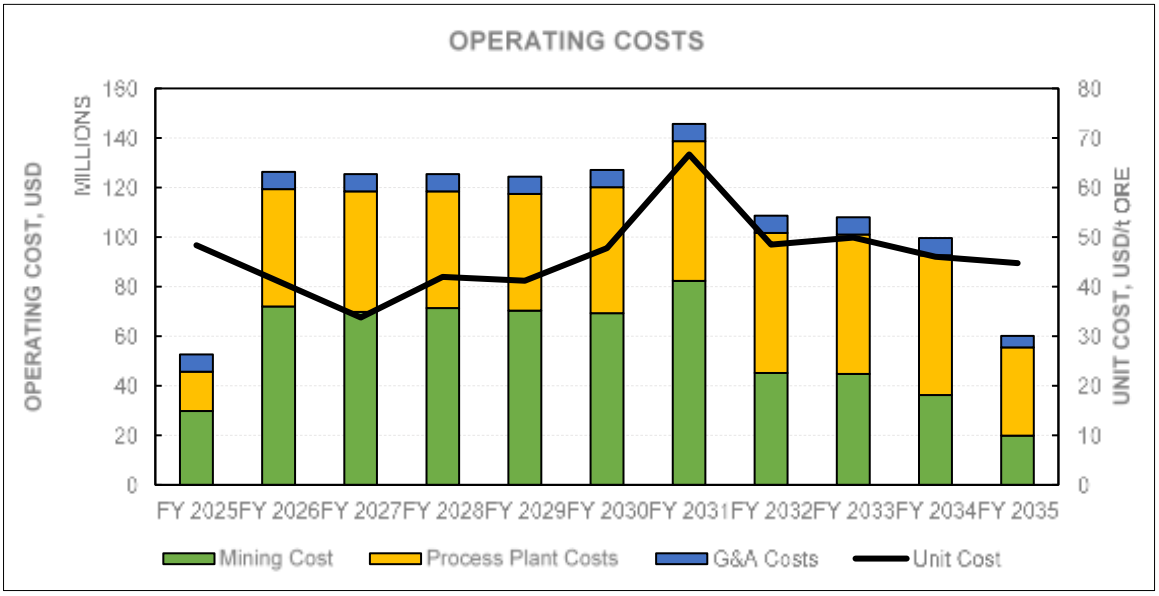
21.2.4 Overall Operating Cost Summary

The Bilboes Projects total operating costs have been estimated and based on the production profile over LoM. A summary of LoM operating costs is shown in Table 21-25 below.

Table 21-25: LoM Operating Cost Summary

Description	Unit	Value	% of Total	Reference
LoM Operating Cost Breakdown				
Total cost	$	1,202,922,518	-	OPEX model
Unit cost				
Mining	$/t ore	22.9	51	OPEX model
Process Plant	$/t ore	19.4	43	OPEX model
G & A	$/t ore	2.8	6	OPEX model
Total	$/t ore	45.2	100	OPEX model

Annual mining, process, and G&A are presented below over the LoM in Graph 21-10:.



Graph 21-10: Bilboes Total Operating Costs per Annum

BILBOES

BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 22
ECONOMIC ANALYSIS

Document Number: JZWEBR6013-STU-REP-001

DRA

22. ECONOMIC ANALYSIS

22.1 Introduction

The Bilboes base case adopts an accelerated two-phase main plant production profile with phase 1 and phase 2 achieving 240 ktpm and 180 ktpm respectively. The processing facility will be composed of a heap leach and a main processing facility. The heap leach circuit will receive oxide ore while transitional and fresh material will be fed to the main processing facility. The heap leach circuit is an existing facility and no allowance in terms of capital has been included for any form of refurbishment. The main processing facility front end design is based on a two-stage crushing circuit followed by a single ball mill. CIL is configured as a single train.

The economic analysis for this option has been carried out using Discounted Cash Flow (DCF) methodologies. The analysis has been based on earnings after taxation and does not consider the effects of inflation, interest, escalation and other financial charges. The economic model has been populated on a 100% equity basis and does not consider alternative financing scenarios. Financing related costs such as interest expense, withholding taxes on dividends and interest income, are excluded from the economic model. Additional exclusions pertaining to capital and operating costs can be sourced from the relevant report chapter detailing these sections.

The interpretation of the taxation and the associated legislation relevant to Zimbabwe has been based on information available in the public domain as well as guidance received from the Bilboes team. DRA does not provide expert advice on taxation matters. Value added tax (VAT) refunds and exemptions have not been considered in the economic model. Any other tax or levy, not explicitly defined, has not been considered in the model. The tax model used should be regarded as conceptual but is deemed to be suitable for this study. It is recommended, during the next project phase, to seek validation through a third-party consulting firm who specialise is taxation and legislative conformance in Zimbabwe.

Cash flows considered in the cash flow model include annual revenue, operating costs, initial capital expenditure, Stay in Business (SIB) capital allowance, capital contingency, environmental rehabilitation capital allowance, royalties and income tax presented on a year-by-year basis. The project start date has been based on year 2023, up to a cut-off period occurring in 2035. All currency figures are reported in United States Dollar ($).

22.2 Inputs and Assumptions

22.1.1 Process Parameters

Process specific parameters have been applied for each mineralisation property, informed from testwork outcomes, third party consultation and discussions with the Bilboes team.

Metal recoveries have been applied as static variables over the prescribed LoM. An overview of these inputs is shown in Table 22-1 below.

Table 22-1: Discounted Cash Flow Process Inputs

Description	Unit	Value	Reference
Metal Recoveries			
Oxides (Heap leach)	%	70.00	Client
McCays	%	83.62	Testwork / Third party / Client
Isabella north	%	83.62	Testwork / Third party / Client
Isabella south	%	83.62	Testwork / Third party / Client
Bubi	%	88.88	Testwork / Third party / Client

22.1.2 Revenue Parameters

A static metal price has been applied over LoM. Revenue has been discounted to account for refining costs equivalent to 1.5% of gross revenue generated. Refining costs have been provided by Bilboes which are negotiated tariffs applicable for gold refining. Inputs for the revenue estimate are shown in Table 22-2 below.

Table 22-2: Discounted Cash Flow Revenue Inputs

Description	Unit	Value	Reference
Revenue Generation			
Gold price	$/oz	1,650	Client
Refinery cost	%	1.5	Client

22.1.3 SIB Capital

The financial model includes an allowance for sustaining capital equivalent to 1% of total process plant operating costs. It is assumed any allowances for SIB capital associated with mining is covered by the contractor over LoM.

22.1.4 Environmental Rehabilitation and Mine Closure

An allowance for on-going environmental rehabilitation is included in the financial model together with a final closure cost of $ 28.4 million expended during the last year of operation. On-going environmental rehabilitation is based on a unit rate of $ 0.25 / t ore.

22.1.5 Royalty Tax

Royalty tax has been based on Zimbabwean legislation (Mines and Minerals / Finance Act) and supported by the Bilboes team. Royalties payable are a function of gross revenue and a royalty percentage. The royalty percentage is fixed at 5% for gold and enforced regardless of operating margin achieved. The formula used to calculate royalty's payable has been defined below:

$$Royalty\ (USD) = Gross\ Sales\ (USD) \times Royalty\ \%$$

Where royalty % is defined as:

$$Royalty\ \% = 5\%\ for\ gold\ sales$$

Note: *The interpretation of the taxation and the associated legislation relevant to Zimbabwe has been based on information available in the public domain as well as guidance received from the Bilboes team. DRA does not provide expert advice on taxation matters. It is recommended, during the next project phase, to seek validation through a third-party consulting firm who specialise is taxation and legislative conformance in Zimbabwe.*

22.1.6 Income Tax

Corporate income tax has been based on Zimbabwean legislation (Income Tax Act) and supported by the Bilboes team. Income tax payable are a function of pre-tax profit and a taxation rate. Pre-tax profit is inclusive of all revenue, capital and development costs, operating costs, depreciation, amortisation and royalties. Capital expenditure (and development costs) incurred prior to production are claimed in full during the first production year. Subsequent capital expenditure is expended in full during the year of occurrence. Losses are carried over indefinitely until a profit is realised following which tax is levied based on annual pre-tax profits. A fixed effective taxation rate of 24.72% has been applied and is inclusive of an AIDs levy.

Note: *The interpretation of the taxation and the associated legislation relevant to Zimbabwe has been based on information available in the public domain as well as guidance received from the Bilboes team. DRA does not provide expert advice on taxation matters. It is recommended, during the next project phase, to seek validation through a third-party consulting firm who specialise is taxation and legislative conformance in Zimbabwe.*

22.1.7 Discounted Cash Flow Parameters

The project is based on a execution start date of 2023 and a LoM ending in 2035. A 10% discount rate has been applied in the financial model.

22.1.8 Production Profile

The production profile is reported as ore fed to the plant from four mineralisation properties which are McCays, Isabella North, Isabella South and Bubi. A total of 24.9 million tonnes of mineralized material is delivered to the processing facility, with 196 million tonnes of waste

removed over the same period. Oxides are fed to the heap leach circuit which amount of 1.7 million tonnes. The average grade over life of mine is estimated at 2.34 g/t Au (excl. oxides fed to heap leach). The production schedule over life of mine is presented in Figure 22-1 below.

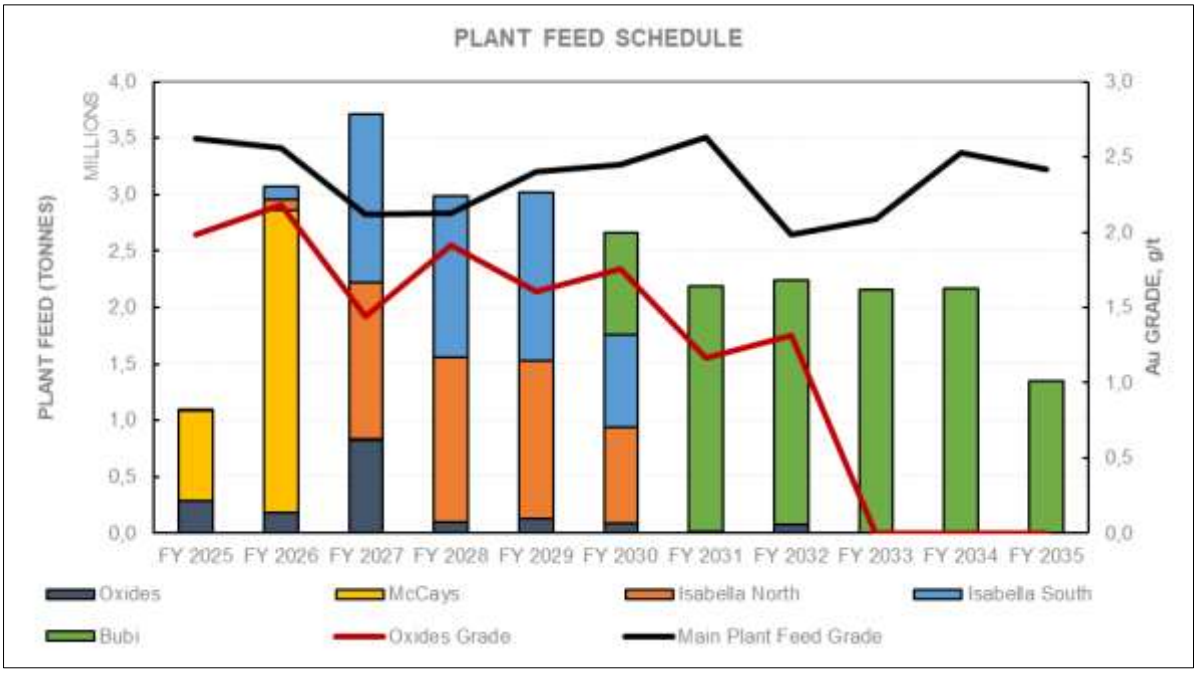


Figure 22-1: Production Profile

22.1.9 Initial Capital Costs

The total initial capital estimate for the project, which includes mining, process plant, infrastructure, Indirects and a contingency allowance is $ 354.4 million. A capital phasing schedule is discussed in the capital estimate chapter of the main report. Mining will be performed using contract mining. A summary of initial capital costs is shown in Table 22-3 below.

Table 22-3: Initial Capital Cost Summary

Description	Unit	Value	% of Total	Reference
Initial Capital Cost Breakdown				
Mining	$	32,724,448	9	CBE
Process plant	$	160,078,091	45	CBE
General Infrastructure	$	64,917,196	18	CBE
Process Plant Infrastructure	$	27,035,001	8	CBE
Indirect		40,277,128	11	
Contingency	$	29,383,006	8	CBE
Total	$	354,414,871	100	Calculated

22.1.10 Operating Costs

The operating costs over life of mine include contract mine operations, process plant operations and general and administrative costs. The cost reported excludes the cost of capitalised mine pre-development. A summary of LoM operating costs is shown in Table 22-4 below.

Table 22-4: LoM Operating Cost Summary

Description	Unit	Value	% of Total	Reference
LoM Operating Cost Breakdown				
Total cost	$	1,202,922,518	-	OPEX model
Unit cost				
Mining	$/t ore	22.9	51	OPEX model
Process Plant	$/t ore	19.4	43	OPEX model
G & A	$/t ore	2.8	6	OPEX model
Total	$/t ore	45.2	100	OPEX model

22.1.11 Working Capital

No allowance for working capital has been included in the financial model.

22.1.12 Salvage Value

No allowance for asset disposal at the end of life of mine has been included in the financial model.

22.3 Financial Model Outcomes

The financial model has been prepared on a 100% equity project basis and does not consider alternative financing scenarios. A discount rate of 10% has been applied in the analysis. The outcomes are presented in Table 22-5 below on a pre-tax and post-tax basis. A static metal price of $1,650 /oz has been applied. All-in sustaining costs have been reported as per the World Gold Council (WGC) guideline dated November 2018 and is exclusive of project capital, depreciation, and amortisation costs. Capital payback is exclusive of the construction period and referenced to the start of first production. Key financial outcomes are shown in Table 22-5 and Figure 22-2 below.

Table 22-5: Project Economics Summary

Description	Unit	Pre-Tax	Post-Tax
Project Economics			
NPV @ 10%	USD	439,947,750	323,359,945
IRR	%	38.4	33.4

Description	Unit	Pre-Tax	Post-Tax
Project Economics			
Peak Cash Funding	USD	249,743,427	249,743,427
AISC*	USD/ozt	826	826
Payback (UNDISCOUNTED)	yrs	1.5	1.5
NPV @ 10%	USD	439,947,750	323,359,945

**As per updated guidance note published by WGC, 2018. Excludes project capital, depreciation and amortisation costs*.

The projected cash flows over LoM is presented graphically in Figure 22-2 and Figure 22-3 for pre-tax and post-tax respectively.

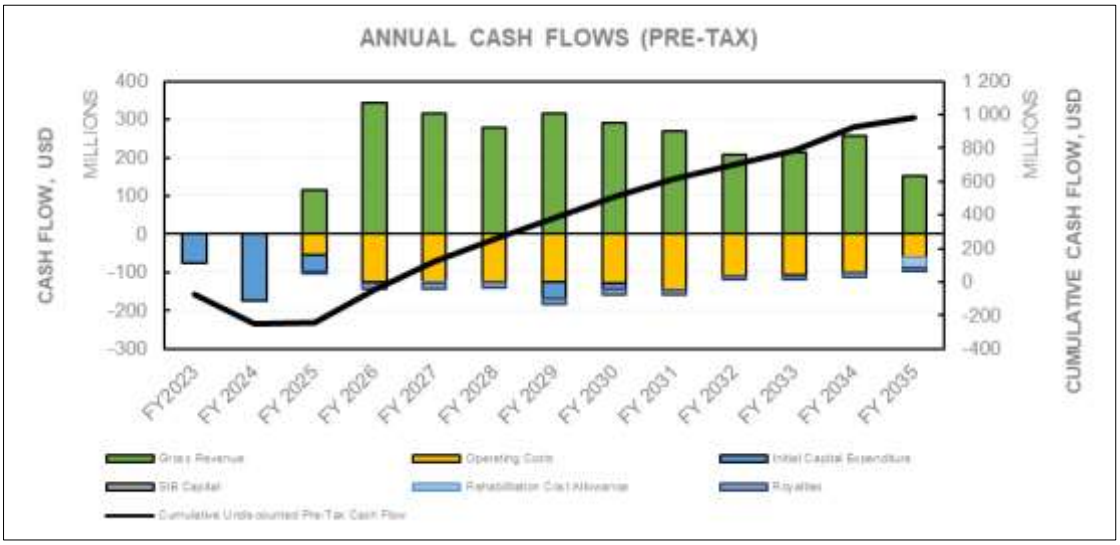


Figure 22-2: Annual Cash Flow (Pre-Tax)

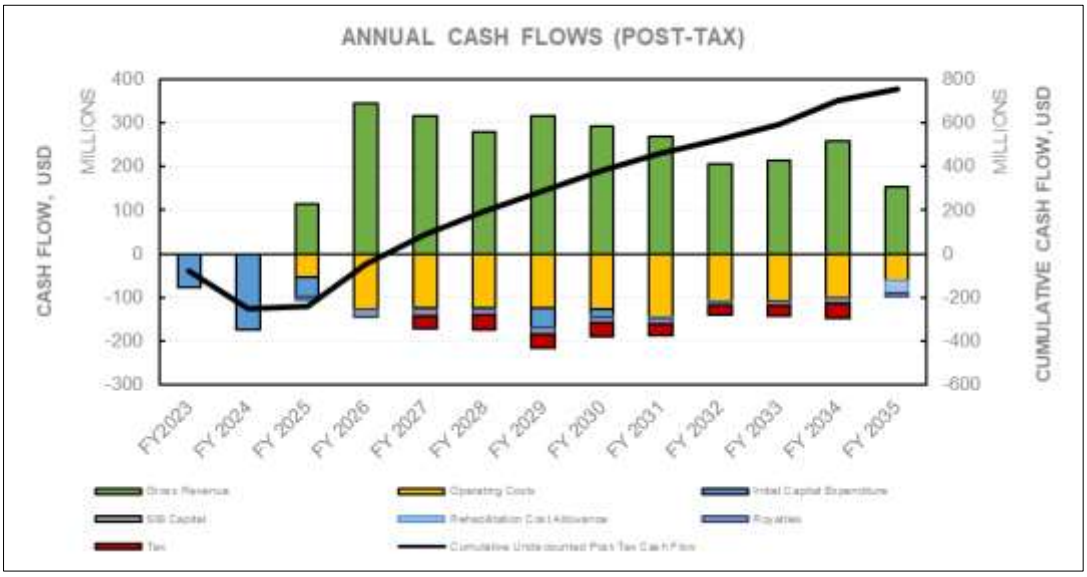


Figure 22-3: Annual Cash Flow (Post-Tax)

22.4 Sensitivity Analysis

A sensitivity analysis has been conducted assessing the impact of variations in initial capital cost, operating cost and metal selling price. Each variable is assessed in isolation to determine the impact on Net Present Value (NPV) and Internal Rate of Return (IRR).

The impact of initial capital costs has a limited elasticity in impacting overall project value due to the capital phasing profile and relatively low expenditure in comparison to revenue and operating costs over the prescribed LoM. A summary of these relative variations is shown in Figure 22-4 below.

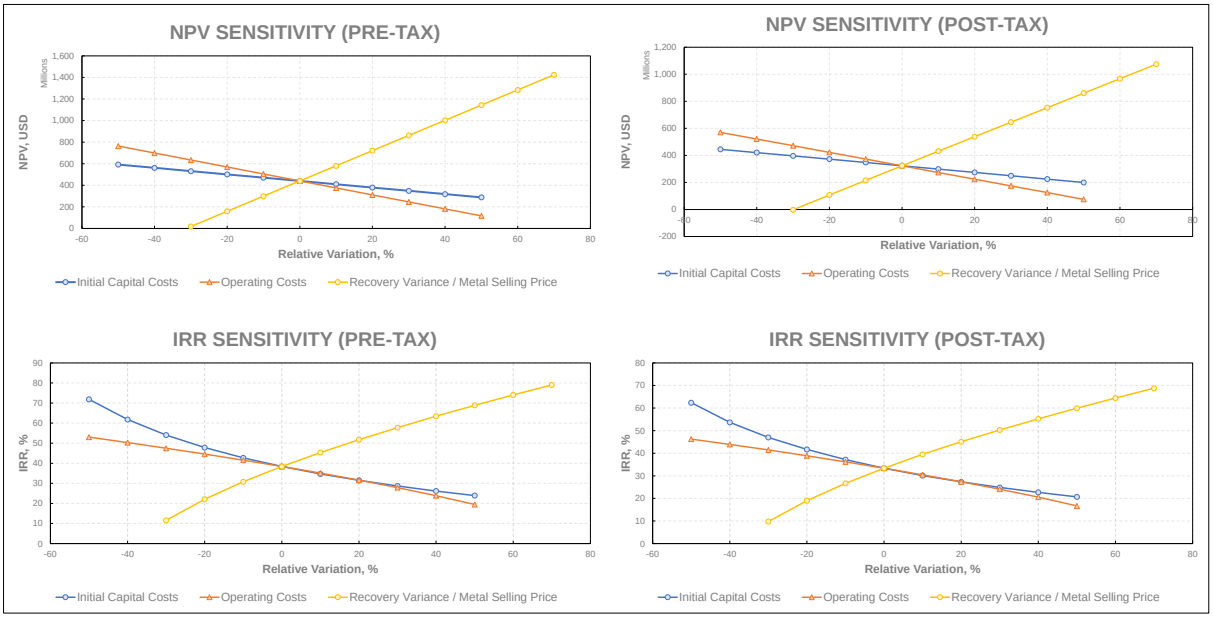


Figure 22-4: Sensitivity Analysis Summary

The impact of discount rate has been assessed and presented in Figure 22-5 below.

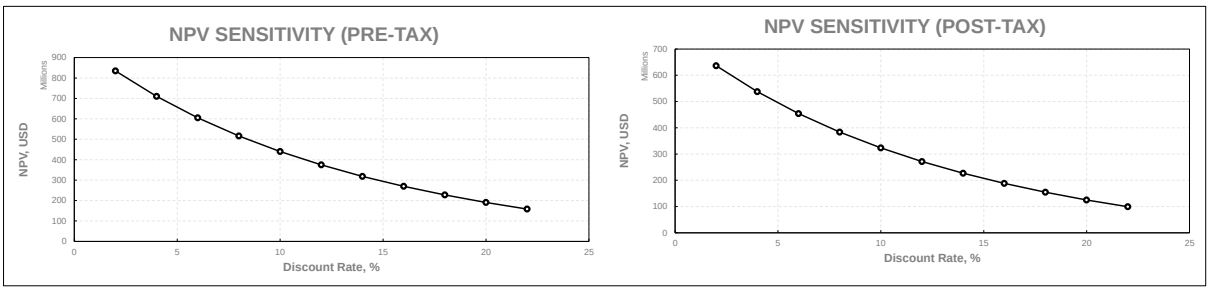


Figure 22-5: Discount Rate Sensitivity

22.5 Recovery Upside

Following discussions held with MMC, it has been identified that a metal recovery upside could be realised based on interpretation of historical testwork conducted. Further optimisation efforts would need to be considered during the next project phase. Testwork would need to be

focused on flotation optimisation (incl. variability) in order to establish a grade-recovery relationship and validate recovery upsides. An approximate 5% and 1% improvement in recovery on Isabella McCays and Bubi respectively was indicated by MMC as potential upside. The subsequent impact on NPV can range between a 10% to 15% improvement.

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SECTION 23
ADJACENT PROPERTIES

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23 ADJACENT PROPERTIES

Several small mines and two larger ones have operated in the past in the area around the Isabella property and within the Isabella and Gwizaan EPOs (Figure 23-1) but all of these had been dormant for at least 15 years prior to the renewal of exploration activity in the area in the early 1980s. The productions listed in Table 23-1 are for the period to 1980. The Calcite Mine is located in the area now covered by the Isabella operation and its production is included in the History section. The Motapa, Fossicker and Jupiter Mines are situated immediately to the south of the Mine and trend in the same general strike of Isabella, McCays and Bubi.

The Isabella EPO 1726 surrounds Isabella McCays while the Gwizaan EPO 1646 surrounds Bubi as well as a cluster of other Bilboes exploration claims namely When, Sandy and Ferroro. The two EPOs which are contiguous were approved for exploration through a government gazette of 13 July 2018 and have a combined ground holding of 67,419 ha. The EPOs has a three-year tenure which expires on 12 July 2021. Several high quality geological and aeromagnetic targets are located within the major northeast-southwest trending deformation zones that transect the EPOs such as along the Peter-Pan, Courtleigh and Gabriella-Mulungwane shear zones. These targets in addition to the existing exploration claims offer potential for organic growth of Bilboes' gold Mineral Resources.

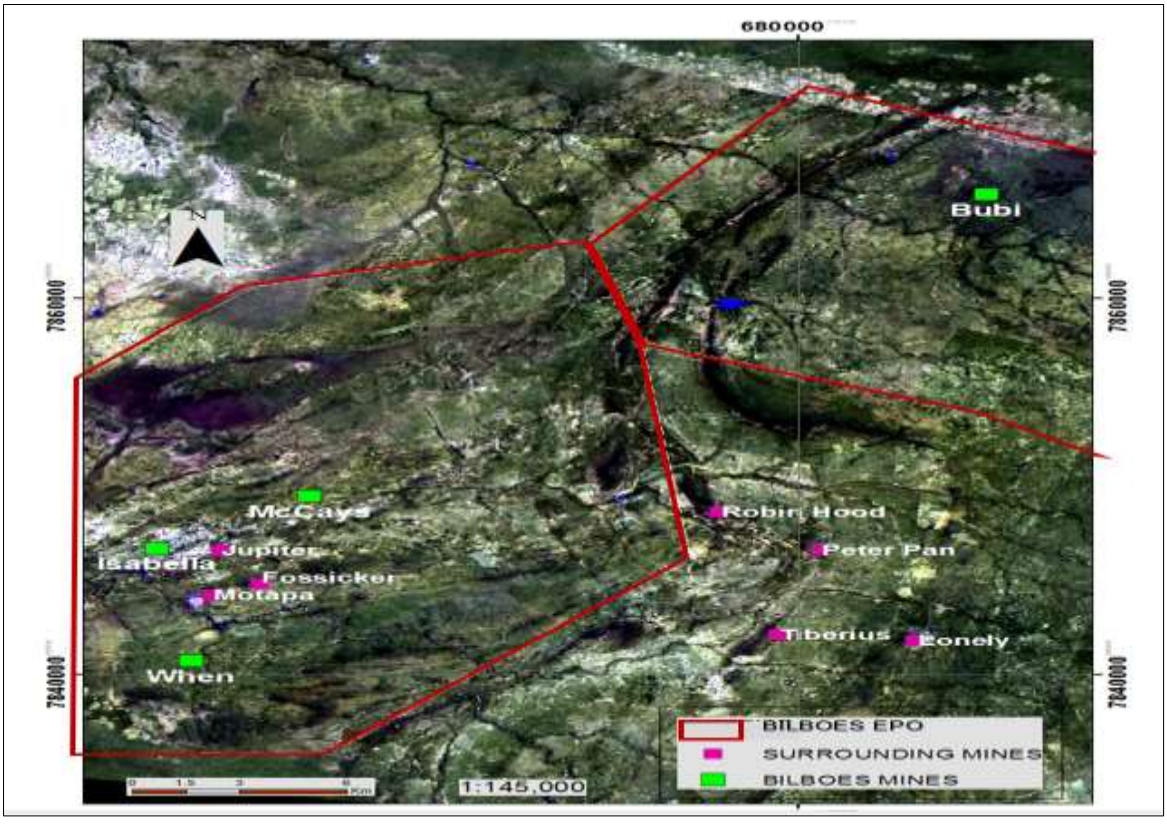


Figure 23-1: Adjacent Properties around Isabella McCays and Bubi

Table 23-1: Historic Gold Production from Mines around Isabella McCays and Bubi to 1980

Mine	Au kg	Grade g/t	Coordinates		Locality from Isabella
			Easting	Northing	
Motapa	9,467	4.3	663,613	7,844,250	2 km south
Fossicker	472	3.7	664,953	7,844,803	3 km south-east
Jupiter	201	3.9	663,870	7,846,633	1 km east
Lonely	34,786	17.5	683,276	7,841,837	20 km east
Peter Pan	968	2.9	680,606	7,846,618	18 km east
Robin Hood	248	2.1	677,790	7,848,663	15 km east
Tiberius	263	2.2	679,408	7,842,128	17 km east

Source Bartholomew (1990), Coordinate system: UTM, Arc1950, Zone 35S, Spheroid-Clarke 1880.

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BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 24
OTHER RELEVANT DATA AND INFORMATION

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24 OTHER RELEVANT DATA AND INFORMATION

Note: The information below relates to the fiscal year 2022 and is in Zimbabwe Dollars (Z$), unless otherwise stated. An appropriate exchange rate to the $ will be applied at the time of any transaction.

24.1 Royalties, Taxes and Economic Climate in Zimbabwe

The tax regime in Zimbabwe has remained relatively stable and favourable regionally over the past few years and those directly affecting the mining industry are listed below.

24.1.1 Royalties

Royalties are levied on gross revenue from sale of gold.

- Royalties are levied at source hence payments made by Fidelity Printers and Refiners (Private) Limited (“Fidelity”) (the entity that buys all of the official production in Zimbabwe) are net of royalties
- From 1 January 2020, mining royalties will be an allowable expense in the determination of taxable income
- For primary gold producers a two-tier system that is based on gold prices is applicable. For gold prices below US$1,200/oz the rate is 3% and for gold prices above $1,200/oz the rate is 5%
- Government is still considering other proposals submitted by mining houses to restore viability through review of other fees and charges
- Government is still considering other proposals submitted by mining houses to restore viability through review of other fees and charges.
    - The basis of determination of royalty payments on opaque mining products as follows:
    - Concentrate – computed on 80% of the international price of the refined mineral contained therein
    - Matte- computed on 85% of the international price of the refined mineral contained therein
    - Gold: invoice value as determined by Fidelity Printers and Refineries
    - Diamonds and all other minerals, the invoice value as determined by the Minerals Marketing Corporation of Zimbabwe (MMCZ).

24.1.2 Customs Duties

- Maximum applied on cost of imports : 10%
- Capital equipment imports : 0%

24.1.3 Value Added Tax

- Locally procured and imported inputs and equipment : 14.5%
- Exports are zero rated and input VAT is fully recoverable in most cases or can be used to set off against other tax liabilities. No output VAT is levied on gold sales as they are zero-rated. Silver is subject to VAT at 14.5%.

24.1.4 Withholding Taxes

- Supplies by unregistered traders (without Tax Clearance Certificate) [the minimum amount for which the tax must be deducted is Z$120,000 : 30%
- Non-Resident Shareholders' Tax on dividends : 15%
- On fees, royalties, dividends and interest : 15%
- On dividends distributed by a ZSE listed company : 10%
- Services from non-residents : 15%

24.1.5 Corporate Tax

- On taxable profits : 24% flat rate [plus 3% AIDS levy] to make effective rate 24.72%
- Capital redemption allowances in year incurred : 100%
- Deduction limits on passenger vehicles : Z$800,000
- Deduction limits on employee housing : Full deduction
- Deduction limits on donations to medical centres : USD100,000/year
- Deduction limits on donations to research and development institutions: Z$8000,000/year
- Pre-production operating expenditure : 100% in first year of production
- Carry forward of losses : Indefinite

24.1.6 Ring Fencing

- Each mining location is ring fenced and only costs applicable to location are deductible.

24.1.7 Employment Levies

- National Social Security : 4.5% of wage bill with a declared insurable earnings cap of Z$5,000 per month
- Workmen's compensation : 1.77%
- Manpower Development Levy : 1%
- Standards Development Levy : 0.5%

24.1.8 Electricity Levies

- Rural Electrification Levy : 6% of electricity bill

24.1.9 Rural Council Levies

- Unit tax : Z$12,000 / unit
- Number of units for each company is dependent on number of employees

24.1.10 Other Relevant Points

- Administration fees in excess of 1% of other tax-deductible expenses is disallowed and taxed as dividend.
- Capital gains tax

Table 24-1: Capital Gains Tax

Acquired	Rate	Currency
Before 22 February 2019	5% of gross capital amount	ZWL
	5% of foreign currency gross capital amount	USD
On or after 22 February 2019	20% of capital gain	ZWL
	20% of foreign currency capital gain	USD

- Capital gains withholding tax:
  - On listed marketable securities : 1.5%
  - On listed marketable securities held for less than 6 months : 2%
  - On unlisted marketable securities : 5%
  - On immovable property acquired before 22 February 2019 : 5%

- On immovable property acquired after 22 February 2019 : 15%
- All items consumer price index to be used in computing inflation allowance for ZWL disposals and 2.5% for USD transactions

Note: It shall be presumed that a marketable security was paid for in a foreign currency at the United States dollar market valuation of the security on the date of the sale, and that the capital gains tax thereon shall be paid in United States dollars accordingly, unless the seller provides documentary proof showing that the security in question was sold for Zimbabwe dollars.

- Deferment of VAT collection on imported capital equipment is as per below table:

Table 24-2: Vat Collection

Value of Equipment (Z$)	Deferment period (Days)
100,000 to 1,000,000	90
1,000,001 to 10,000,000	120
10,000,001 and above	180

- Mining claims fees are based on land area. The Mines and Minerals Act provides for maintenance of mining title through payment of annual protection fees. Protection fees for a gold / base metal block is Z$12,750 per 5 ha per annum. For Exclusive Prospecting Orders (EPOs) they have a two to three-year tenure and can be renewed for an additional period to a cumulative maximum of six years subject to approval by the Ministry of Mines and Mining Development's Mining Affairs Board and a renewal fee of Z$127,500 is required with the application. The annual rental fee Z$6.80 cents per ha in the first year, Z$9.35 in the second year and Z$12.75 in the third year. A company is allowed to peg claims during the tenure of the EPO subject to the following conditions:
- That the area to be Pegged is not prohibited from pegging under the Mines and Minerals Act after the acquisition of a prospecting licences at Z$6,375 per gold / base metal block
- Appointment of an Approved Pegger for the requisite groundwork and filing of paperwork for registration.
- Payment of registration fees of Z$12,750 for a gold block, Z$25,500 for a base metal block and Z$47,855for a special base metal block.
- Approval by the Ministry of Mines for erection of permanent beacons around the blocks as per Mines and Minerals Act.
- EIA fees charged based on a sliding scale from 0.8% to 1.2% of the relevant project cost (with a maximum cap of $2 million).

- Payroll tax (Pay as You Earn) is deducted from employees' earnings and paid to government. The tax-free band has been increased to Z$120,000 per annum or Z$20,000 per month. The upper income tax bands moved to Z$3,000,000 per annum or Z$250,000 per month. The effective maximum rate of tax (including AIDS levy) is 41.2%.
- Exemption of customs duty import tax and surtax on all capital goods during exploration phase of a mining project and for a period of up to 5 years from date of grant of a mining title, during the development phase of the mining project.
- A 2% Intermediated Money Transfer Tax ("IMTT") charged per e-commerce transaction - the tax-free threshold is Z$500 and the maximum tax payable per transaction by corporates for transactions with value exceeding Z$40,000,000 is Z$800,000.
- Thin capitalisation - Offshore borrowings require Reserve Bank of Zimbabwe approval, and interest paid on borrowings of a debt-to-equity ratio of up to a maximum of three to one is tax deductible. Beyond the maximum allowable ratio any interest paid is assumed to be a dividend pay-out and is liable to withholding tax at the non-resident tax rate.

24.1.11 Rebates of Duty

The following tax rebates are allowed:

- Rebate of duty on goods for the prospecting and search for mineral deposits.
- Rebate of duty on goods imported in terms of an agreement entered pursuant to a special mining lease.
- Rebate of duty on goods imported temporarily for an approved project.
- Rebate of duty on goods for incorporation in the construction of approved projects; and
- No export duties for all mineral commodities.
- Rebate of duty extended to capital equipment imported by mining, manufacturing sectors for values above 1 million, effective 1 January 2016.

24.2 Mining Legislation

The Government, as of 2019, had amended the mining laws, thereby decriminalizing the operation of small-scale miners to allow more locals to participate in the exploitation of the country's mineral wealth. More emphasis is being placed on the "use it or lose it" regulations, which allow the government to repossess unused mining claims from holders.

24.3 Indigenisation and Economic Empowerment

The Indigenisation and Economic Empowerment Act has since been amended and it now allows foreign entities to own 100% mining rights. Foreign shareholding will now be negotiated with investors.

All new foreign investment into Zimbabwe requires an investment licence issued by the Zimbabwe Investment Authority in terms of the Zimbabwe Investment Authority Act.

Moreover, in the mid-term budgetary review statement of 2019the Indigenisation and Economic Empowerment Act was repealed and replaced by the Economic Empowerment Act, which is consistent with the current thrust “Zimbabwe is Open for Business".

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BILBOES GOLD PROJECT FEASIBILITY STUDY

SECTION 25 INTERPRETATION AND CONCLUSIONS

Document Number: JZWEBR6013-STU-REP-001

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25 INTERPRETATION AND CONCLUSIONS

25.1 Risk Assessment Matrix

The risk assessment process commenced with a review of the main risks identified. Additional controls and / or mitigations were identified based on the engineering work completed as part of study. This was followed by rating the remaining risk on the likelihood of occurrence and possible degree of impact. The scoring system for the likelihood and the associated consequences is detailed in Figure 25-1.

Minxcon Projects			Consequence				
			1 - Insignificant	2 - Minor	3 – Moderate	4 - Major	5 - Catastrophic
		Schedule	Less than 1% impact on overall project timeline	May result in overall project timeline overrun equal to or more than 1% and less than 5%	May result in overall project timeline overrun of equal to or more than 5% and less than 20%	May result in overall project timeline overrun of equal to or more than 20% and less than 50%	May result in overall project timeline overrun of 50% or more
		Cost	Less than 1% impact on the budget of the project	May result in overall project budget overrun equal to or more than 1% and less than 5%	May result in overall project budget overrun of equal to or more than 5% and less than 20%	May result in overall project budget overrun of equal to or more than 20% and less than 50%	May result in overall project budget overrun of 50% or more
		Investment Return – NPV loss	Less than R5m	R5m to less than R50m	R50M to less than R500m	R500m to R5b	R5b or more
		Quality and Technical Integrity	No significant impact on quality of deliverables or effect on production	Quality issues that can be addressed prior to handover or could affect production by more than 1% and less than 5%	Quality issues that can be addressed during ramp-up or could affect production by more than 5% and less than 10%	Quality issues that require significant intervention to maintain performance or could affect production by more than 10% and less than 20%	Quality issues that require significant intervention to achieve performance or could affect production by 20% or more
		Safety/Health	First aid case / Exposure to minor health risk	Medical treatment case / Exposure to major health risk	Lost time injury / Reversible impact on health	Single fatality or loss of quality of life / Irreversible impact on health	Multiple fatalities / Impact on health ultimately fatal
		Environment	Minimal environmental harm - L1 incident	Material environmental harm - L2 incident remediable short term	Serious environmental harm - L2 incident remediable within LOM	Major environmental harm - L2 incident remediable post LOM	Extreme environmental harm - L3 incident irreversible
		Legal & Regulatory	Low level legal issue	Minor legal issue; non compliance and breaches of the law	Serious breach of law; investigation/report to authority, prosecution and or moderate penalty possible	Major breach of the law; considerable prosecution and penalties	Very considerable penalties and prosecutions. Multiple law suits and jail terms
		Reputation/ Social/Community	Slight impact - public awareness may exist but no public concern	Limited impact - local public concern	Considerable impact - regional public concern	National impact - national public concern	International impact - international public attention
			Risk Level				
Likelihood	90%	Near Certainty: 90% chance	Cannot avoid this risk with standard practices, probably not able to mitigate.	Medium - 11	Significant - 16	Significant - 20	High - 23	High - 25
	75%	Highly Likely: 75% chance	Cannot avoid this risk with standard practices, but a different approach may work.	Medium - 7	Medium - 12	Significant - 17	High - 21	High - 24
	50%	Possible: 50% chance	May avoid risk, but rework will be required.	Low - 4	Medium - 8	Significant - 13	Significant - 18	High - 22
	25%	Unlikely: 25% chance	Have usually avoided this type of risk with minimal oversight in similar cases.	Low - 2	Low - 5	Medium - 9	Significant - 14	Significant - 19
	15%	Rare: 15% chance	Will effectively avoid this risk based on standard practices.	Low 1	Low - 3	Medium - 6	Medium - 10	Significant - 15

Risk Level	Guidelines for Risk Matrix
High	A high risk exists that management's objectives may not be achieved. Appropriate mitigation strategy to be devised immediately.
Significant	A significant risk exists that management's objectives may not be achieved. Appropriate mitigation strategy to be devised as soon as possible.
Medium	A moderate risk exists that management's objectives may not be achieved. Appropriate mitigation strategy to be devised as part of the normal management process.
Low	A low risk exists that management's objectives may not be achieved. Monitor risk, no further mitigation required.

Figure 25-1: Risk Assessment

A risk assessment review was held during the feasibility study to identify the headline risks associated with the project.

Following the identification and rating of the inherent risks, controls or mitigations were identified that are already in place or are well-understood in terms of the specific risk identified. Based on the effectiveness of the controls, the likelihood and consequences of the risk were re-evaluated, which resulted in the residual risk profile of the Project.

The risk profile contains several indicators that will be useful in guiding the stakeholders in identifying appropriate actions that need to be taken in a subsequent action plan. These indicators include high levels of likelihood, consequence, and exposure, as well as borderline or defective controls.

The risks associated with the project sorted on risk rating are detailed in Table 25-1.

Table 25-1: Risks Associated with the Project sorted on Risk Rating

Risk Category	Risk	Description / Cause	Risk (%) Likelihood	Impact 1 to 5	Risk Rating	Mitigation / Control
Engineering	Insufficient water supply (both potable and for the mine critically at the process plant)	1. The project is located in a relatively dry area with low rainfall patterns. 2. Insufficient storage of water can cause a shortfall of make-up water supplied to the process plant	30%	3		1. Provision has been made in FS capital estimate for an increased wellfield supply. 2. Storm Water Dams and reservoirs have been provided for in the FS for storage of excess water. 3. Provision has been made for water recovery from the flotation and BIOX plants for recycling. 4. A Stormwater Management Plan which identifies clean and dirty water generating areas and stipulates how this is managed will be implemented.
Engineering	Insufficient Power Supply	1. Low power generation capacity from Hydro and Thermal power stations. 2. Inadequate foreign currency for power imports from neighboring countries.	15%	1		1. The company will be on ring-fenced power which makes use of foreign currency reserves generated from gold sales for guaranteed supply, as agreed between the power utility and the chamber of mines. 2. Provision has been made for a capital estimate for the construction of a dedicated power line from Shangani sub-station to link the mines 3. Provision has been made for the capital estimate of Diesel generators which will be used in supplying critical equipment specifically at the process plant. 4. Hwange Thermal power station units 7 & 8 under construction to come online in 2023 with an additional 600 MW to the national grid 5. Batoka Gorge Hydro power feasibility is at an advanced stage. 6. Several Solar Independent Power Producers (IPP) projects are under consideration.
Resources	Inaccurate resource models leading to lower than anticipated Ore Reserve tonnes and grades	1. Inaccurate resource models due to poor geological understanding of the deposit. 2. Inaccurate resource models due to geological complexity of the deposit.	10%	2		1. Contingency measures applied during resource modelling to ensure resource models remain conservative. 2. Extensive drilling conducted on the deposit to improve geological understanding of the deposit. 3. Provision has been made for infill drilling and on-going exploration drilling during LoM.
Resources	Inaccurate oxide, transitional and sulphide Ore Reserve tonnes and grades	Poor interpretation of the oxide, transitional and sulphide zones resulting in non-optimal planning.	10%	1		1. In-fill drilling (near surface and extending to the Oxide-Sulphide interface) was conducted for mine planning and scheduling. 2. Grade control drilling will be conducted pre-mining and the cost estimate for this was allowed for in the FS. 3. Capacity available at the mine to heap leach any identified oxide material and the transitional material can be blended with the sulphide ore for BIOX® treatment.
Mining	Pit high wall failure leading to loss of life, injuries and equipment damage.	Inaccurate pit design due to poor interpretation of pit geotechnical information.	10%	1		1. Extensive geotechnical information obtained from the geotechnical drilling around the pits and used in the open pit slope designs. 2. A conservative pit slope angle of 30 degrees allowed for in the design for the weathered zones of the pits.
Mining	Poor run of mine ore grade	Poor grade control of the RoM ore resulting in excessive dilution or the run of mine ore grades.	40%	3		1. Grade control drilling will be conducted pre-mining and the cost for this has been allowed for in the FS. 2. Grade controllers will be employed to monitor the mining team during operations.
Mining	Flooding of Bubi pit from Bubi River	Bubi River in close proximity to edge of Bubi Pit and could flood in case of a storm.	10%	1		1. Bund walls will be erected around the edge of Bubi River to avoid water flowing into the Bubi pit. The southern portion of Bubi deposit excluded in the pit design to allow for construction of bund walls. 2. Provision for the diversion of Bubi River could be allowed for in the event of a storm.

Risk Category	Risk	Description / Cause	Risk (%) Likelihood	Impact 1 to 5	Risk Rating	Mitigation / Control
Processing	Lower than budget gold recovery from the plant	Inaccurate gold recovery from the plant	10%	2		1. Gold recovery assumptions in the FS Study were informed by the on-site flotation and BIOX® pilot plant test work. 2. Bilboes procured a flotation and a BIOX pilot plant for on-site test works during the operational phase to optimise the flotation and BIOX® gold recovery. 3. Sulphide / Sulphur concentrate feed grade which ensures high bacterial activity and process stability is higher than the minimum of 4-6% required.
Processing	Operational inefficiencies in the BIOX® plant	1. As it will be the first BIOX plant in Zimbabwe there may not be local operators / metallurgists with appropriate expertise. 2. Shortage of BIOX critical skills in Zimbabwe.	25%	2		1. Provision made for experienced in the budget. 2. Bilboes will enter into a BIOX® Technology License Agreement with Outotec for technical support in the running of the BIOX plant. 3. Outotec will train and develop local personnel in the running of the BIOX® plant. 4. Bilboes will second personnel to similar operations for exposure before commencement of its own operation.
Processing	Contamination of ground water	Contamination of ground water from mine and plant effluent and from the flotation and BIOX® plant residues.	30%	3		1. Pollution Control Dams with lining have been allowed for in the FS to capture all polluted water. 2. The TSF will be lined appropriately to capture and minimise any seepage. 3. All the flotation and BIOX® residue will be pre-treated before discharging on to the TSF for stabilisation. 4. The Iron / Arsenic ratio for predicting the neutralisation performance and corresponding residue stability is greater than 3 required for stabilisation.
Processing	Poor pH control and neutralisation in the process plant for process optimisation	1. Unavailability of Limestone / Lime from local supplies. 2. Prohibitive Limestone / Lime costs from local suppliers.	10%	1		1. A major supplier of Limestone / Lime identified with competitive delivery costs to the mine and the cost estimate has been allowed for in the FS. 2. Bilboes has secured its own Limestone deposit of sufficient size and quality within 5 km of the BIOX® plant. 3. Isabella/McCays concentrate is self-neutralising thereby reducing the limestone requirements for the BIOX® plant.
	Bacteria poisoning in the BIOX® plant	Toxins that organic carbon sources, bactericides, fungicides, and Descalant, cyanide species, nitrates, excervive chlorides, mercury and antimony have potential to ingress into the BIOX® plant causing low or poor bacterial activity.	40%	1		1. Adequate training of the BIOX® plant personnel for dangers of toxins into the BIOX® system. 2. Provision for toxicity tests of all material inputs into the BIOX® plant. 3. Provision for a suitable filtration system of compressed air into the BIOX® plant to avoid hydrocarbon ingress into the plant.
	Tails Storage Facility breach	Fine material deposited or excessive rainfall.	15%	2		TSF design includes side wall buttressing with waste from the pits to reduce the risk of breaching.
Logistics	Hauling safety risk	Bubi ore haulage to Isabella has potential for accidents involving public transport, humans and animals.	40%	3		A properly designed standard private haul road has been provided for in the FS.
	Critical spares and reagents cost and delivery time risk	Long lead delivery time as most of these are imports.	15%	1		1. Provision for adequate stores buffer stock has been made in the FS. 2. Costs are US$ based and based on firm quotes in which inflation rates will be factored in.
Finance	Inflation	The project is in Zimbabwe, which is facing severe economic challenges, which seriously undermines confidence for investment in major projects.	**10%**	**1**		The project earns its revenues and pays all its costs in $ and has minimal exposure to Zimbabwe inflation.

25.2 Geology and Resource Estimates Risks

The mineral resources were estimated and reported in accordance with the Canadian National Instrument 43-101. Mineral resource classification used a “Checklist” approach, where various criteria were considered and rated, and these included:

- Data quality and integrity
- Data spacing for confidence in geological interpretations and grade interpolation
- Confidence in the geological interpretation from a regional and local perspective, and how that interpretation influences the controls for Au mineralisation
- Reliability of the estimate in the mined-out areas
- Geostatistical confidence in grade continuity
- Geostatistical parameters such as kriging variance, kriging efficiency and search distances, to measure the relative confidence in the block estimates

DRA believes that from the criteria used the mineral resources were sufficiently estimated for the purpose of FS requirements.

25.3 Mining and Reserves

The process to develop the mineral reserve estimates were as follows:

- The open pit optimisation on the measured and indicated resources only and the application of modifying factors (mining recovery, gold recovery and dilution)
- A range of operating costs and production parameters were applied during the Whittle optimisation exercise along with a net gold price of $1,168.75/oz after accounting for government royalty and refining costs.
- Relevant pit slope angles considering the access ramps where applicable
- Application of a cut-off grade of 0.9 g/t to all mineral resources to ensure tonnes mined generate enough revenue to cover costs

The mineral reserve estimates are not at this stage materially affected by any known environmental, permitting, legal, title, taxation, socioeconomic, marketing, political, or other relevant factors.

25.4 Processing

Metallurgical test work was concluded in different phases over a period extending from September 2013 to March 2019 covering sample characterisation, comminution, flotation and BIOX® tests. The onsite flotation and BIOX® testwork provided the basis of the PDC.

The test work campaigns, and optimization work yielded gold recovery ranges used in the economic model development.

Ore will be derived from the two main mining areas (Isabella McCays and Bubi) with production throughput to be phased over the LoM based on tonnage, proximity to the process plant and metallurgical characteristics. Bubi ore, destined to be processed over the latter part of the LoM will be trucked approximately 23 km to the processing plant at Isabella.

Operations in the Process Plant can essentially be divided into 5 main sections.

- Comminution (ore size reduction by crushing and milling to facilitate liberation of the mineral particles for subsequent downstream concentration)
- Flotation (concentration of sulphides and gold into a small concentrate mass)
- Biological Oxidation - BIOX® (destruction of the sulphides in the concentrate using oxidising bacteria to expose the gold particles for downstream recovery)
- Carbon in Leach (cyanidation leach of the BIOX® residue and recovery of the solubilised gold onto activated carbon)
- Carbon treatment
- Electrowinning and Smelting

25.5 Infrastructure

Infrastructure facilities of the Project include the Isabella North and South, McCays and Bubi open pits, gold processing plant, TSF, waste stockpiles, buildings and accommodation, main power line, internal mine roads and a 70 km 132 kV Lynx power line from Shangani Substation. Raw water will be provided from open pit dewatering and the wellfield boreholes located across the mine license area.

All infrastructure facilities have been adequately sized for the scale of the project and these are considered sufficient.

25.6 Economic Outcomes

The financial model has been prepared on a 100% equity project basis and does not consider alternative financing scenarios. A discount rate of 10% has been applied in the analysis. The outcomes are presented in Table 25-2 below on a pre-tax and post-tax basis. A static metal price of $1,650 /oz has been applied. All-in sustaining costs have been reported as per the World Gold Council (WGC) guideline dated November 2018 and is exclusive of project capital, depreciation, and amortisation costs. Key financial outcomes are shown in Table 25-2 below.

Table 25-2: Project Economics Summary

Description	Unit	Pre-Tax	Post-Tax
Project Economics			
NPV @ 10%	USD	439,947,750	323,359,945
IRR	%	38.4	33.4
Peak Cash Funding	USD	249,743,427	249,743,427
AISC*	USD/ozt	826	826
Payback (UNDISCOUNTED)	yrs	1.5	1.5

**As per updated guidance note published by WGC, 2018. Excludes project capital, depreciation and amortisation costs*.

25.7 Country Risk

25.7.1 Political

Political uncertainties are risks, which may lead to unfavourable legislative and taxation framework changes, exchange control restrictions, international monetary fluctuations, civil unrest or any other political instability. However, the current political environment is looking favourable due to the recent reforms by the Government under the new dispensation. It is expected that this or any other political related risks will not affect Bilboes now or in the foreseeable future.

25.7.2 Economic

Significant economic difficulties have been experienced in Zimbabwe in recent times. Over the past few years, the Government has experienced hyper-inflation, high interest rates and a worsening trade balance leading to critically low foreign currency reserves. Over the last three years the Government through its monetary and fiscal policies has implemented a wide range of initiatives aimed at putting the economy on a recovery path. Bilboes is confident that it will get guarantees to retain 100% of its foreign currency offshore and market its own gold for purposes of securing loans and capital.

All the properties belonging to Bilboes are protected in respect of the Mines and Minerals Act. All the blocks of claims are registered with the Mining Commissioner's office and are regularly inspected in compliance with the mining regulations and preserved against forfeiture.

25.7.3 Security

Zimbabwe has not experienced any significant security issues and this situation is expected to remain the same in the foreseeable future

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SECTION 26 RECOMMENDATIONS

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26 RECOMMENDATIONS

The following recommendations are meant to provide enhancements, cover the gaps and mitigate risks identified during the FS Geology and Resources

- A regional geological model combining all four resource areas to take a mineral systems approach should be developed. This will enable better interpretation of existing ore bodies and targeting of new deposits in the rest of the Bilboes Claims and EPO's.
- During the operational phase, drilling is required to develop an advanced grade control model prior to mining. A drill spacing study will be required to determine the optimum spacing for "grade control" drilling. The closed space drilling will also enable a more accurate estimation of tonnage and grade as well as a greater definition of oxide, transitional and sulphide ore boundaries.
- The Mineral Resources remain open on strike and at depth. Further exploration is recommended during the operational phase to extend LoM.

26.1 Mining

- Conduct Whittle optimisation studies at higher gold prices than the base case used in the FS to investigate potential for additional Mineral Reserves.
- On-going geotechnical analysis is recommended during future mining operations to assess pit slope angles to investigate if improvements can be made for less waste stripping, reduced operating costs, and improve overall business economics.

26.2 Processing

- If still required, further optimisation efforts could be considered during the project execution front-end engineering and design phase, by conducting further testwork focused on flotation optimisation (including variability tests) to establish a grade-recovery relationship and validate recovery upsides.
- Development of the skills base to effectively run the BIOX® operations is crucial for the business and should be prioritised prior and during the operational phase.
- A sufficiently sized water storage dam should be constructed to collect and store water during the wet season and times when the operation is water positive to cater for the dry season.

26.3 Economic Analysis

- Updating of the financial model for the next project phase considering the changing parameters such as gold price and gold recoveries after additional test works.

26.4 Project

- Environmental and social issues are considered to be an integral part of the business and it is recommended that the company takes a proactive approach in mitigating the impacts by adhering to regulatory compliance requirements and continually engaging the community and key stakeholders from the onset of operations as recommended in the ESIA study.

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SECTION 27 REFERENCES

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27 REFERENCES

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27.2 Legal and Title

Solicitors Scanlen & Holderness completed a due diligence specific to the validity of Bilboes Holdings (Private) Limited’s mining claims in November 2019. The complete Scanlen & Holderness report is available in Appendix 29.6.18.

27.3 Geotechnical

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