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Mining Industry Consultants

NI 43-101 TECHNICAL REPORT

Mineral Resource and Mineral Reserve Update for the Youga Gold Mine, Burkina Faso

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Report prepared for

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Disclaimers

Purpose of this document

This Report was prepared exclusively for Avesoro Resources Inc. ("the Client") by CSA Global (UK) Ltd ("CSA Global"). The quality of information, conclusions, and estimates contained in this Report are consistent with the level of the work carried out by CSA Global to date on the assignment, in accordance with the assignment specification agreed between CSA Global and the Client and in accordance with the requirements of NI 43-101 Technical Reporting. and in compliance with NI 43-101 Technical Reporting.

Notice to third parties

CSA Global has prepared this Report having regard to the particular needs and interests of our client, and in accordance with their instructions. This Report is not designed for any other person's particular needs or interests. Third party needs and interests may be distinctly different to the Client's needs and interests, and the Report may not be sufficient nor fit or appropriate for the purpose of the third party, other than its prescription as it relates to NI 43-101 reporting.

Results are estimates and subject to change

The interpretations and conclusions reached in this Report are based on current scientific understanding and the best evidence available to the authors at the time of writing. It is the nature of all scientific conclusions that they are founded on an assessment of probabilities and, however high these probabilities might be, they make no claim for absolute certainty.

The ability of any person to achieve forward-looking production and economic targets is dependent on numerous factors that are beyond CSA Global's control and that CSA Global cannot anticipate. These factors include, but are not limited to, site-specific mining and geological conditions, management and personnel capabilities, availability of funding to properly operate and capitalise the operation, variations in cost elements and market conditions, developing and operating the mine in an efficient manner, unforeseen changes in legislation and new industry developments. Any of these factors may substantially alter the performance of any mining operation.

Element of Risk

The interpretations and conclusions reached in this report are based on current geological theory and the best evidence available to the author at the time of writing. It is the nature of all scientific conclusions that they are founded on an assessment of probabilities and, however high these probabilities might be, they make no claim for absolute certainty. Any economic decisions which might be taken on the basis of interpretations or conclusions contained in this report will therefore carry an element of risk.

Certificates

Certificate of Qualified Person – Maria O'Connor

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, Maria O'Connor do hereby certify that:

1. I am a Principal Resource Geologist of CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone +44 1403 255 969, email: maria.oconnor@csaglobal.com).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report – Mineral Resource and Reserve Update for the Youga Gold Mine, Burkina Faso" and is dated effective 31 July 2018.
3. I hold a BSc (Hons) degree in Environmental Geochemistry from University College Dublin, Ireland (2004) and am a registered Member in good standing of the Australian Institute of Geoscientists (MAIG Member Number 5931) and a Member of the Australasian Institute of Mining and Metallurgy (MAusIMM Membership Number 307704). I am familiar with NI 43-101 and, by reason of education, experience in exploration, evaluation and mining of hydrothermal gold deposits, and professional registration; I fulfil the requirements of a Qualified Person as defined in NI 43-101. My experience includes 12 years in mineral exploration and resource evaluation.
4. I have not visited the project that is the subject of this Technical Report.
5. I am responsible for the following sections of this Technical Report; Section 14, excluding disclosure of those Mineral Resources in Table 14-33 that remain unchanged since 2017 disclosure (those tabulated which exclude A2N East, A2N Middle, Gassore and Balogo).
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have had prior involvement with the properties that are the subject of this Technical Report, being technical input in to the update of Mineral Resources, reported in 2017.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

Maria O'Connor BSc (Hons), MAIG, MAusIMM
Principal Resource Geologist
CSA Global (UK) Ltd

Certificate of Qualified Person – Malcolm Titley

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, Malcolm Titley do hereby certify that:

1. I am an Associate Principal Consultant of CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone +44 1403 255 969, email: maria.oconnor@csaglobal.com).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report – Mineral Resource and Reserve Update for the Youga Gold Mine, Burkina Faso" and is dated effective 31 July 2018.
3. I hold a BSc degree in Geology and Chemistry from the University of Cape Town (1979) and am a registered Member in good standing of the Australian Institute of Geoscientists (MAIG Member Number 2546). I am familiar with NI 43-101 and, by reason of education, experience in exploration, evaluation and mining of hydrothermal gold deposits, and professional registration; I fulfil the requirements of a Qualified Person as defined in NI 43-101. My experience includes over 30 years in mining and resource evaluation.
4. I have not visited the project that is the subject of this Technical Report.
5. I am responsible for the following sections of this Technical Report; Section 14 - Table 14-33, Mineral Resources that remain unchanged since 2017 disclosure (those tabulated which exclude A2N East, A2N Middle, Gassore and Balogo).
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have had prior involvement with the properties that are the subject of this Technical Report, being technical input in to the update of Mineral Resources, reported in 2017.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

Malcolm Titley BSc, MAIG
Associate Principal Consultant
CSA Global (UK) Ltd

Certificate of Qualified Person – Matthew Randall

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, Matthew Randall do hereby certify that:

1. I am an Associate Consultant Mining Engineer to CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, Suite 2, First Floor, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone +44 1403 255 969, email: axevalleymining@gmail.com).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report, Mineral Resource and Mineral Reserve update for the Youga Gold Mine, Burkina Faso" and is dated 31 July 2018.
3. I hold a Hons BSc in Mining Engineering and a PhD in Rock Mechanics and am a registered Fellow in good standing of the Institute of Materials, Minerals and Mining (IMMM). I am familiar with NI 43-101 and, by reason of education, experience in exploration, evaluation and mining of gold, and professional registration; I fulfil the requirements of a Qualified Person as defined in NI 43-101. My experience includes 10+ years in gold.
4. I have visited the Youga and Balogo Projects that are the subject of this Technical Report, between 19 and 22 April 2018 for a combined total of four days on site.
5. I am responsible for the following sections of this Technical Report; Sections 2.4.3, 12.2.2, 15, 16, 18, 19 21.1 and 22.
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have had prior involvement with the properties that are the subject of this Technical Report, being technical input in to the update of Mineral Reserves, reported in 2017.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

Matthew Randall, B.Sc. (Hons), PhD, FIMMM
Associate Consultant Mining Engineer
CSA Global (UK) Ltd

Certificate of Qualified Person – Gary Patrick

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, Gary Patrick do hereby certify that:

1. I am a Mineral Processing Consultant to CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, Suite 2, First Floor, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone +44 1403 255 969).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report, Mineral Resource and Mineral Reserve update for the Youga Gold Mine, Burkina Faso" and is dated 31 July 2018.
3. I hold a BSc degree in Chemistry and Extractive Metallurgy from the University of Murdoch, Western Australia. I am a Professional Member of the Australasian Institute of Mining and Metallurgy (MAusIMM (CP), Membership Number 108090). I am familiar with NI 43-101 and, by reason of education, and 25 years' experience I fulfil the requirements of a Qualified Person as defined in NI 43-101 for the evaluation of the project under consideration. My experience includes most aspects of study/project/plant operations management in many aspects of small and large mineral processing plants.
4. I have not visited the projects that are the subject of this Technical Report.
5. I am responsible for the following sections of this Technical Report; Sections 13, 17 and 21.2.
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have not had prior involvement with the property that is the subject of this Technical Report.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

Gary Patrick, BSc, MAusIMM (CP)
Associate Mineral Processing Consultant
CSA Global (UK) Ltd

Certificate of Qualified Person – Galen White

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, Galen White do hereby certify that:

1. I am a Director and Principal Consultant of CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone +44 1403 255 969; email: galen.white@csaglobal.com).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report, Mineral Resource and Mineral Reserve Update for the Youga Gold Mine, Burkina Faso" and is dated 31 July 2018.
3. I hold a BSc (Hons) degree in Geology from the University of Portsmouth, England and am a registered Fellow in good standing of the Australasian Institute of Mining and Metallurgy (Membership Number: 226041). I am familiar with NI 43-101 and, by reason of education, experience in exploration, evaluation and mining of shear-hosted vein gold deposits, and professional registration; I fulfil the requirements of a Qualified Person as defined in NI 43-101. My experience includes 20 years in mineral exploration, mining and resource development with the last 12 years in technical consulting.
4. I have not visited the projects that are the subject of this Technical Report.
5. I am responsible for the following sections of this Technical Report; Sections 1, 2.1 – 2.3, 2.4.1, 3-6, 9, 10, 20 and 23-27.
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have had prior involvement with the properties that are the subject of this Technical Report, being technical input in to the update of Mineral Resources and Mineral Reserves, reported in 2017.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

Galen White, BSc (Hons), FAusIMM, FGS
Principal Consultant
CSA Global (UK) Ltd

Certificate of Qualified Person – Belinda van Lente

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, Belinda van Lente do hereby certify that:

1. I am a Senior Resource Geologist of CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, First Floor, Suite 2, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone + 44 (0) 1403 255 969, email: belinda.vanlente@csaglobal.com).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report, Mineral Resource and Mineral Reserve update for the Youga Gold Mine, Burkina Faso" and is dated 31 July 2018.
3. I hold a MSc degree in Geology from the Rand Afrikaans University, South Africa and a PhD degree in Geology from the University of Stellenbosch, South Africa. I am a registered Professional Natural Scientist (PrSciNat, 400119/10) in good standing of the South African Council for Natural Scientific Professions. I am familiar with NI 43-101 and, by reason of education, experience in evaluation of gold deposits, and professional registration; I fulfil the requirements of a "Qualified Person" as defined in as defined in National Instrument 43-101 Standards of Disclosure for Mineral Projects (NI 43-101). I have been practicing my profession continuously since 2005 and my experience includes over 13 years in the consulting and production environment.
4. I have visited the Youga and Balogo Projects that are the subject of this Technical Report, between 19 and 22 April 2018 for a combined total of four days on site.
5. I am responsible for the following sections of this Technical Report; Sections 2.4.2, 7, 8 and 12.2.1.
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have not had prior involvement with the property that is the subject of this Technical Report.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

Belinda van Lente, BSc. PhD, PrSciNat, MGSSA
Senior Resource Geologist
CSA Global (UK) Ltd

Certificate of Qualified Person – David Muir

As a Qualified Person of this Technical Report covering the Properties of the Youga Gold Mine, Burkina Faso, I, David Muir do hereby certify that:

1. I am a Senior Data Geologist of CSA Global (UK) Ltd and carried out this assignment for CSA Global (UK) Ltd, First Floor, Suite 2, Springfield House, Springfield Road, Horsham, West Sussex, RH12 2RG, UK (telephone: + 44 (0) 1403 255 969, email: david.muir@csaglobal.com).
2. The Technical Report to which this certificate applies is titled "NI 43-101 Technical Report, Mineral Resource and Mineral Reserve update for the Youga Gold Mine, Burkina Faso" and is dated 31 July 2018.
3. I hold a BSc (Hons) degree in Geology from the University of Natal, Durban, South Africa and am a registered Member in good standing of the Australian Institute of Geoscientists (Membership Number: 9102). I am familiar with NI 43-101 and, by reason of education, experience in exploration, evaluation and data management, and professional registration; I fulfil the requirements of a Qualified Person as defined in NI 43-101. My experience includes ten continuous years in the exploration and mining industry.
4. I have not visited the projects that are the subject of this Technical Report.
5. I am responsible for the following sections of this Technical Report; Section 11, 12.1 and 12.3-12.6.
6. I am independent of the issuer as described in Section 1.5 of NI 43-101.
7. I have had prior involvement with the properties that are the subject of this Technical Report, being a review of data collection methodologies, data management and quality assurance/quality control, contained in a Technical Report prepared in 2017.
8. I have read NI 43-101 and the parts of the Technical Report I am responsible for, and the parts of the Technical Report that I am responsible for have been prepared in compliance with N1 43-101.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the parts of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of July 2018.

"signed and sealed"

David Muir, BSc. (Hons), MAIG, FGS
Senior Data Geologist
CSA Global (UK) Ltd

Glossary

%	percent
°	degrees (in Radians)
°C	degrees Celsius
2D	two-dimensional
3D	three-dimensional
A$	Australian dollar(s)
AAS	atomic absorption spectroscopy
ABA	acid-base account
AMD	acid mine drainage
AMEC	International
ARD	acid rock drainage
Ashanti	Ashanti Goldfields Company Limited
ASL	above sea level
Au	gold
Avesoro	Avesoro Resources Inc.
BCEAO	Central Bank of West African State
BD	bulk density
BDL	below detection limit
BMC	Burkina Mining Company S.A.
CAPEX	capital expenditure
CIL	carbon-in-leach
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
cm	centimetre(s)
CRM	certified reference material
CSA Global	CSA Global (UK) Ltd
CSR	Community and Social Responsibility
CSV	comma separated values
Cu	copper
CV	coefficient of variation
DCF	discounted cash flow
DD	diamond (drillhole)
DGRE	Direction Générale des Resources
DH	drillhole
doh	direct operating hour
DTM	digital terrain model
DWA	Digby Wells and Associates

E	east
Echo Bay	Echo Bay Mines Limited
EIA	Environmental Impact Assessment
Endeavour	Endeavour Mining Corporation
EM	electromagnetic (survey)
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
Etruscan	Resources Burkina Faso SA
FA	fire assay
FEL	front-end loader
FS	feasibility study
g	gram
g/t	grams per tonne
G&A	General and Administration
Geostats	Geostats Pty Ltd (Perth)
GMR	Golden Rim Resources Ltd
Golder	Golder Associates
GPS	global positioning system
ha	hectare(s)
HARD	half absolute relative difference
HR	Human Resources
HSE	Health, Safety and Environment
ICP	inductively coupled plasma
IDW	inverse distance weighting
IFC	International Finance Corporation
IGR	International Gold Resources Inc.
Incanore	Resources Ltd
IP	induced polarisation
IRA	inter-ramp angle
IRR	internal rate of return
ITS	Inchcape Testing Services
JORC	Australasian Joint Ore Reserves Committee Code
KE	kriging efficiency
kg	kilogram(s)
km	kilometre(s)
km^2	square kilometres
KNA	kriging neighbourhood analysis

KP	Knight Piésold
kt	thousand tonnes
LDL	lower detection limit
LLG	Low-Low Grade
LOM	life of mine
m	metre(s)
M	million(s)
Ma	million years
MCC	motor control centre
mE, mN, mRL	metres east, north and relative level
mm	millimetre(s)
MNG	MNG Gold Exploration Ltd
MNG	MNG Gold Burkina SARL
Moz	million ounces
MRE	Mineral Resource estimate
Mt	million tonnes
Mt/a	million tonnes per annum
N	north
NAF	non-acid forming
NI 43-101	National Instrument 43-101 for the Standards of Disclosure for Mineral Projects within Canada
NMC	Netiana Mining Company
NPV	net present value
NPVS	NPV Scheduler
NSR	net smelter return
OK	ordinary kriging
OREAS	Ore Research and Exploration Pty Ltd (Melbourne)
OSA	overall slope angle
oz	troy ounce, 31.1034768 g
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
QAQC	quality assurance/quality control
QC	quality control
Q-Q	quantile-quantile
RAB	rotary air blast (drillhole)
RAP	Resettlement Action Plan
RC	reverse circulation (drillhole)
RC-DD	reverse circulation with diamond tail (drillhole)

RCP	Rehabilitation and Closure Plan
RMS	root mean squared
ROM	run of mine
RQD	rock quality designation
S	south
SCR	solid core recovery
SD	standard deviation
SE	South East
SG	specific gravity
Socrege	Société de Conseil et de Réalisation pour la Gestion de l'Environnement
SQL	structured query language (database)
t/a	tonnes per annum
t/h	tonnes per hour
t/m^3	tonnes per cubic metre
TMF	tailings management facility
TR	trench
TSF	tailings storage facility
US$	US dollar(s)
UTM	Universal Mercator Project
VOD	velocity of detonatiob
VOIP	voice over internet protocol
VSAT	very small aperture terminal
W	west
WGS1984	World Geodetic System 1984
WHO	World Health Organization
WRD	waste rock dump
Youga Gold Mine	The "Project" comprising the Youga, Ouare and Balago Properties.

Contents

Figures

Tables

1 Summary

1.1 Overview

Avesoro Resources Inc. (Avesoro), through their in-country, wholly-owned subsidiaries Burkina Mining Company S.A. (BMC) and Netiana Mining Company (NMC) commissioned CSA Global (UK) Ltd (CSA Global) to assist them with evaluating the properties of the Youga Gold Mine Project (Youga, Ouare and Balogo), and to complete the required technical evaluations, verification and review works to facilitate disclosure of an update to the Mineral Resource and Mineral Reserve inventory for the Project. The scope of work represents an update to a similar scope of work completed by CSA Global over the Project in 2017 (CSA Global, 2017). The Project comprises multiple properties that are to be developed together.

In addition, and in support of the declaration of Mineral Reserves, CSA Global has produced a long-term life of mine (LOM) schedule and financial model for the Project.

All technical works have been undertaken in under the guidelines of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council and disclosed within the context of the Canadian Securities Administrators National Instrument 43-101 (NI 43-101).

The Project includes a significant number of near-mine satellite deposits which have been the subject of various levels of exploration activity ranging from early-stage evaluation (surface works and defined anomalies), advanced exploration (drilling), resource development and mining. Only those deposits that represent a material change (either with the availability of additional resource development drilling facilitating Mineral Resource estimate (MRE) update, and/or the focus of current mining activity) have been included in this study.

Mineral Resources for Youga deposits – Main Pit, Zergoré, NTV, A2NE (revised naming), East Pit, West Pit 1, West Pit 2, West Pit 3, West Pit 4 and Leduc and one deposit at Ouaré (Ouaré) have not been the subject of recent resource development or mining activity and as such, remain current and unchanged from that information reported by CSA Global in June 2017 (CSA Global, 2017). Infill drilling completed by the Avesoro in the period 2017–2018 has better defined the A2NE mineralisation trends at Youga. As a result, A2NE has been re-interpreted, extended and subdivided into A2N East and A2N Middle, and the MREs for these deposits updated as part of this study, along with Gassore. In addition, the MRE for the Balogo deposit has also been updated. Subsequent Mineral Reserve analysis, updated scheduling and financial modelling activities have been completed based on existing current Mineral Resources, and those updated in 2018 as part of this study.

1.2 Sources of Information

Various technical reports have been used to support the findings documented here. These are listed in Section 3 (Reliance on Other Experts) and Section 27 (References).

Licence and tenure documents, exploration and resource data, mining data and information, mining costs and financial information were provided via a dataroom and reviewed. Note that no legal due diligence has been undertaken by CSA Global to independently verify the status of the Project licences.

Dr Belinda van Lente and Dr Matthew Randall (Qualified Person for Mineral Reserves) visited the Youga deposits during the period 19 to 21 April 2018, and the Balogo deposit on 22 April 2018, which allowed for firsthand observations, discussions with site technical staff and data collection activities to be completed.

Additional information relied upon during the course of the technical work is contained in Section 27 (References) of this Technical Report.

1.3 Property Location, Description and Geology

1.3.1 Youga and Ouaré Properties

The Youga and Ouaré properties are all situated in the province of Boulgou, Burkina Faso, West Africa, approximately 180 km southeast of the capital city Ouagadougou, adjacent to the Ghanaian border. The licences are separated by the Nakambé River.

The Youga Exploitation Permit covers an area of 29 km^2 and was granted to Burkina Mining Company S.A. (BMC, a wholly-owned subsidiary of Avesoro) by Decree no. 2003-186\PRES\PM\MCE on 8 April 2003 and is valid for 20 years with five-year renewal periods.

An Exploitation Permit for Ouaré is currently not granted. However, BMC has reported that there is no known impediment to the issuing of an Exploitation Permit for the Ouaré resource area should BMC apply. BMC applied for an exceptional renewal of the Bitou Sud and Nord permits, which was rejected. The BMC is currently in the process of re-applying for new licence permits over these areas.

All resource and exploration data are projected in WGS1984, Universal Mercator Project (UTM) Zone 30 North.

The Youga Mine site is located within the catchment area of the Nakambé River. The area is typified by undulating terrain with several ranges of moderately sloped hills that rise about 100 m above the surrounding land. Population density is low and scattered with severely limited infrastructure, social structures and services.

The mining industry in Burkina Faso is active and has been expanding as new mines are opened. There are an increasing number of local mining personnel available, as well as expatriate mine workers and professionals from neighbouring countries. Except for Ouaré, for which an Exploitation Permit has not yet been granted, there is sufficiency of surface rights for mining operations, potential tailings storage areas, potential waste disposal areas, heap leach pad areas, and potential processing plant sites.

The Tarkwaian outlier, which hosts most the Youga gold deposits is comprised of a succession of arkosic sandstones consisting of quartz and feldspar in roughly equal proportions. The Zergoré sequence is an inlier within the Birimian, located east of the Tarkwaian domain and is characterised by rocks that are predominantly pelitic in composition with variably sized arenitic and silty intercalations. The Youga volcanogenic schists are representative of the area south and to the west of the Tarkwaian Basin, more commonly exposed in the Songo and Zerbogo II licences.

Ouaré is located within a Birimian package of volcanogenic schists dominated by an intermediate to mafic volcanic unit dominantly composed of basalt with associated andesite, gabbro and dolerite; a gabbro unit associated with diorite, basalt, amphibolite and andesite; a felsic unit composed of quartz-feldspar porphyritic rocks associated with tonalite, granite and quartz diorite intrusions. These rocks (100–500 m wide, west to east trending) occur in the central part of the mapped area; orthogneiss, mylonitic, granitic to dioritic, in the northern portion of the mapped area; and a granodiorite unit with tonalite and quartz diorite in the southern portion.

Within the Youga deposit there are two distinct styles of mineralisation; the moderately to weakly silicified arkose with quartz stockwork veining and pyrite is the predominant sulphide which generally grades between 0.5 g/t and 2 g/t and the intensely silicified arkose with abundant quartz veins and more diverse sulphides which generally grades >3 g/t.

At the Ouaré Main zone, mineralisation occurs as quartz veins within shear zones at the contacts between felsic and mafic volcanics. Orpailleur workings have been developed along mineralised structures in two orientations: 090° and 315°. The 090° portion of these workings have multiple parallel quartz veins along shears in an interpreted dilation zone. The 315° portion is interpreted as a 100 m wide deformation zone, terminating the 090° trend.

The gold mineralisation appears to preferentially follow the lithologic contacts between felsic volcanics and mafic volcanics, particularly within a shear zone of inter-layered quartz-feldspar porphyritic and intermediate to mafic volcanic rocks. Gold mineralisation appears to be confined to a major 090° trending deformation corridor of dextral strike slip.

1.3.2 Balogo Property

The Balogo property currently comprises two contiguous Exploration Permits: Balogo (due to expire in May 2018) and Dabinyan III (due to expire in February 2019) for a total area of 360 km^2. The renewal process must be completed three months prior to expiry.

These permits are in the Centre-Sud region of Burkina Faso, approximately 100 km south of the capital, Ouagadougou and about 22 km from the Nazinon River. Access from Ouagadougou is via sealed roads until after the town of Pô, 50 km from the Project.

The general climate for the region is semi-arid, with a rainy season lasting from June to October. The Project area is generally flat land with some minor undulating hills and lateritic mesas.

Resources and amenities are limited in the region. Pô, the nearest town to the Balogo property, has a population of approximately 30,000. Ouagadougou, the capital city of Burkina Faso, is located 100 km to the north.

The principal gold-producing areas of Burkina Faso are associated with Lower Proterozoic Birimian volcano-sedimentary units arranged in elongated greenstone belts across the West African Craton. The host geology at Netiana (the deposit at Balago) is a basement sequence of metasediments (talc chlorite/quartz sericite schists and quartzites) which have been intruded by dioritic plugs and dykes controlled by the northeast-trending regional shears. Mineralisation is typically associated with networks of quartz mineralisation or associated with disseminated sulphides within strongly deformed alteration zones.

1.4 Project History and Exploration

1.4.1 Youga and Ouaré Properties

Avesoro Resources Inc. acquired the Youga and Ouaré properties from Avesoro Holdings in December 2017. Prior to this, Avesoro Holdings acquired the properties from Endeavour Mining Corporation (Endeavour) in April 2016. The Youga and Ouaré properties are located within a greenstone belt found on the south-eastern margin of the Archean-Proterozoic Man Shield (also known as the Leo Shield) which forms the southern half of the West African craton. The Projects have had many owners since 1991, when Incanore was awarded the Youga Exploration Permit.

- 1991: Incanore Resources Ltd (Incanore) was awarded the Youga Exploration Permit.
- 1994: Youga property was optioned to International Gold Resources Inc. (IGR).
- 1995: Echo Bay Mines Limited (Echo Bay) entered an agreement with IGR for a 50% interest.
- 1999: Ashanti Goldfields Company Limited (Ashanti) purchased IGR and the project became a 50/50 joint venture (with Echo Bay) with Ashanti as the operator. Ashanti incorporated the following projects into the joint venture:
  - 1997: Ashanti obtained the Bitou Exploration Permit
  - 1998: Ashanti was granted the Bitou Est Exploration Permit.
- 1999: Ashanti completed a feasibility study on the Youga gold deposit.
- 2003: Etruscan reached an agreement to acquire the Youga property.
- 2006: Feasibility study for Youga deposit completed by Etruscan.
- 2008: Commercial production began.

- 2009: Feasibility study for the Ouaré deposit completed by Etruscan.
- 2010: Endeavour purchased Etruscan and Etruscan's name was changed to Endeavour Resources Inc. For this report, all work completed by either Etruscan or Endeavour is collectively referred to as Endeavour.
- 2011: MRE update by Endeavour.
- 2015: MRE update by Endeavour, effective 31 December 2014 (Endeavour, 2015).
- 2016: MNG Gold Burkina SARL (MNG), a subsidiary of Avesoro Holdings, finalises their acquisition of the Youga and Ouaré assets from Endeavour in April 2016.
- 2017: Avesoro Resources Inc. acquires the Youga and Ouaré assets.

1.4.2 Balogo Property

Golden Rim Resources Ltd (GMR) acquired the Balogo property in 2010 and conducted geochemical sampling, geological mapping, trenching, geophysical surveying and completed multiple reverse circulation (RC) and diamond drilling programs that led to the delineation of the Netiana and adjacent gold deposits.

In April 2015, MNG (a subsidiary of Avesoro Holdings) executed an agreement with GMR to acquire its entire interest in the Balogo property. In December 2017, Avesoro Resources Inc. acquired the project from Avesoro Holdings.

Mining commenced in May 2017. Informal/artisanal mining is present and extensive around the Netiana deposit.

The Balogo property also includes a significant number of near-mine satellite prospects which have been the subject of various levels of exploration activity ranging from early-stage evaluation (surface works and defined anomalies), advanced exploration drilling, resource development and mining. The only areas of the Balogo property which contain enough detailed geological and drill data are the Netiana and Netiana South East (SE) deposits. The Mineral Resource drill database for Netiana and Netiana SE consists of eight trenches, 228 diamond (DD) drillholes and 124 RC holes. The total drilling available for the geological model and MRE update was 360 holes and trenches for 52,017 m.

1.5 Drilling

Prior to MNG acquiring the Youga and Ouaré properties from Endeavour in April 2016, drilling has been undertaken by various contractors. A significant amount of drilling has been completed across Youga and Ouaré with the database containing the following:

- 854 DD holes for 112,599 m
- 11,185 RC drillholes for 381,676 m (includes grade control drilling up to May 2017)
- 857 trenches for 57,696 m.

Avesoro has completed 436 DD drillholes (56,602 m), 189 RC drillholes (8,428 m) and 98 trenches (9,927 m) at Youga and Ouaré since the acquisition of the properties.

At the Balogo property, GMR drilled 376 drillholes and trenches between 2011 and 2014, and MNG drilled 209 drillholes and trenches between 2016 and 2017. All drilling completed at Balogo follow procedures employed by GMR.

In 2017 and 2018, Avesoro completed additional resource development drilling activities over several of the deposits at Youga (A2NE and Gassore) and Balogo.

Drillhole collars were surveyed using a differential global positioning system (GPS) and all project location data were collected in WGS 84, UTM Zone 30 North. Downhole surveying has been undertaken using a digital Reflex Ez-shot camera. Core recovery, rock quality designation (RQD) and solid core recovery (SCR) is logged in the exploration camp with a mean recovery of >94% at Youga and Ouaré, and >92% within mineralisation at Balogo.

1.6 Sample Preparation, Analysis and Security

Sampling of RC chips is at 1 m sample intervals and the entire sample was transported under supervision to a central sample processing site where they were weighed and split through a riffle splitter to obtain a sub-sample of approximately 2–3 kg. Wet samples were collected at the drilling rig in their entirety and were sun-dried before being riffle split. The remaining portions of the split samples were retained in the Youga and Balogo Sample Logging, Preparation and Storage Facilities. To ensure drill-site quality control (QC), a trained technician and/or a geologist is permanently on site during all RC drilling.

At Youga and Ouaré, diamond core was placed into plastic core-boxes at the drill site by the contract drillers who also inserted plastic blocks, indicating the meterage, into the core boxes at the end of each run (normally every 3 m). Geologists and geotechnicians collected measurements of all geotechnical details, core recovery, geological logging as well as photographing the core. Samples were usually collected over 1 m intervals but ranged in length from 0.5 m to 1.5 m due to geological contacts. At least two hangingwall and footwall samples were collected before and after the possible mineralised zone. Care was taken to consistently collect assay samples from one side of the core.

At Balogo, fractured zones were reconstructed by joining pieces of core and wrapped with tape prior to cutting. Broken or soft sections of the core were sampled by the geologists using a spatula and spoon method before being placed in labelled sample bags and dispatched for analysis. After cutting, both pieces of core were replaced in the core tray. MNG geologists were required to supervise the technician sampling the drillhole. The technician was also responsible for the insertion of the required quality assurance/quality control (QAQC) control samples.

Each sample was bagged and assigned a unique sample number (sample ID) and stored at the secured core shed at Youga Mine site until sufficient samples had been collected to send to the assay laboratory. The prepared samples were placed into empty rice sacks for transport to the laboratory in Ouagadougou, where they were delivered directly to the laboratory by the MNG driver.

GMR used five laboratories (BIGS, SGS, ACTLABS, ALS Ouagadougou and ALS Johannesburg) to prepare and analyse Balogo drilling and geochemical samples. ALS Ouagadougou was used by MNG for the 2016 diamond core and surface samples.

ALS Youga, a mine laboratory, has been used as the primary laboratory for the Youga and Ouaré grade control drilling since it was established in 2007. The assay method is a 50 g fire assay with over-limit results assayed using a gravimetric finish. The lower detection limit is 0.01 ppm Au.

ALS Ouagadougou is the primary laboratory for exploration and resource development drilling. The sample is crushed to 70% less than 2 mm in size, riffle split, and pulverised to better than 85% passing 75 microns. The primary gold assay method is a 50 g fire assay with an atomic absorption finish (lower detection limit of 0.005 ppm Au). Over-limit results are assayed using a gravimetric finish.

Endeavour and MNG implemented QAQC procedures to monitor the accuracy and precision of the analytical and assay data received from all laboratories during the exploration programs at Youga and Ouaré. In addition to the QAQC procedures put in place by Endeavour and MNG, the assay laboratories also included internal QC samples.

CSA Global separately reviewed the RC and diamond drilling gold blank, certified reference material (CRM) and duplicate results for the 2017 MRE where numerous failures of CRMs and blanks were noted as well as apparent misidentification of these samples. Most of the deposit areas had unacceptably high failure rates in CRMs and blanks, although CRM results were generally accurate (but imprecise). An improvement on the previous reporting period was noted in the 2018 QAQC review, but there were still issues with apparent misidentification of QC material. In addition, there are no controls on potential cross contamination and there were precision issues with the Youga duplicates, which could be a result of non-representative sampling.

Data management requires improvement. There are numerous examples of duplicated data in the databases, as well as apparent misidentified QC records. These issues could potentially decrease confidence in the input data used for the Mineral Resource estimation work.

1.7 Data Verification

CSA Global loaded the Youga, Ouaré and Balogo excel exploration and drill data, respectively, into Structured Query Language (SQL) relational databases, which is an industry standard for exploration project databases. Minor validation issues were noted and resolved during the above process and validated databases were provided for downstream work.

Dr Belinda van Lente and Dr Matthew Randall (Qualified Person for Mineral Reserves) visited the Youga and Balogo properties during the period 19 to 22 April 2018 for the purposes of inspection, ground truthing, review of activities, procedural review and information data collection and collation and to satisfy NI 43-101 “personal inspection” requirements.

1.7.1 Youga and Ouaré Properties

Where laboratory assay certificates were provided, a random selection were checked against the database data with no differences noted between the hard copy and the database assay results.

CSA Global ground truthed exploration target and mined deposits at Youga, inspecting open pits, drill collar locations (where preserved) and having geological discussions with the client representative.

Seven drill collars were verified at the Youga Project, located within the A2N Middle and Gassore deposits.

RC data was verified at each deposit using diamond data as a benchmark.

Limited recovery data was available for three deposits at the Youga property – NTV, A2N (East and Middle) and Gassore while none was available at the Ouaré property. Core sample recovery averaged 92% at NTV, 95% at A2N East, 94% at A2N Middle, and 97% at Gassore. Core recovery was significantly lower in weathered material; however, this has generally been mined off and makes up a minor proportion of the Mineral Resources there.

Data verification limitations noted include the following:

- A relational geological database is not in use, instead data were provided in various Microsoft Excel sheets. An industry standard database should be implemented which can serve as a single point of truth for the project data as well as being secure and have automated backups.
- ALS Youga gold assay results for the period 2010 to 2016 and SGS assay certificates for the 2012 Ouaré drilling were randomly verified against the database assay results. As such, only spot checks were completed.
- Numerous failures in the QAQC including apparent misidentified CRMs and blanks can potentially decrease confidence in the input data used for the MRE work.
- No sample weight data were captured in the database for Youga or Ouaré samples. Therefore, no review of recovery vs. grade could be made for any of the RC samples.

1.7.2 Balogo Property

Drillhole totals were verified against the 2015 GMR technical report and no significant differences were observed.

Database gold assay results were compared against PDF assay certificates with no differences noted between the hard copy and the database assay results. However, no assay certificates were provided for any of the BIGS laboratory data.

Twin samples from 23 RC and DD drillholes, of which 11 intersect mineralisation, were reviewed by NMC which resulted in the exclusion of several RC holes and one DD hole. CSA Global agrees with the exclusion of these holes.

A significant portion (30%) of the data are RC. To assess the compatibility between the RC and DD drilling, procedures for both kinds of sample collection were reviewed and are considered appropriate.

The composited drillhole data gold assay data were compared at each cut-off for each drill type. RC tended to have slightly more accumulated Au at higher cut-offs than DD data but for the most part, the two datasets were found to be quite compatible at the cut-offs reviewed.

A test estimate was run using only DD data to assess the impact, if any, of using the combined dataset. The result was within 1% on metal (2,500 ounces Au) with the DD only scenario reporting a slightly lower tonnage, and higher grade than the combined dataset. This, alongside the data review, supported the decision to proceed using RC, DD and trench data in the MRE.

1.8 Mineral Processing and Metallurgical Testing

The diminishing ore grades at the current Youga operation will be upgraded by supplementing the feed material with additional material from the satellite zones around the mine, and a substantial quantity of material from the Ouaré mine which will be trucked 44 km and blended at the site. In addition, higher grade material from the Balogo mine will be trucked 154 km and dumped at the site.

- The Youga process plant comprises of a three-stage crushing, and single-stage ball milling circuit; a gravity section; a single-stage cyanide leach and a five-stage integral carbon-in-leach (CIL) circuit.
- Operating performance since production start-up has confirmed the pre-production recovery assumptions (both gravity and leach extractions).
- Netiana samples contain higher levels of tellurium (average of 30 g/t) and sulphur (average of 1.75% S) compared to the Youga ore samples. However, the measured gold leach extractions averaged 90.6% and 91.8% after 24 and 48 hours respectively. The five higher-grade samples (>4 g/t) peaked at >94% after 48 hours.
- Overall cyanide consumption in the Netiana samples tested considerably higher than those recorded for the Youga samples and actual ore treated in 2016.
- To achieve the same recovery as that in the current plant, a finer grind than is currently being achieved (P80 of ~75 microns) will be required.
- The average hardness of the Ouaré ore is harder than that of material from the Youga and Netiana deposits.
- Gold recoveries from the Ouaré ores will range from 86% to 96%, with the unweighted average being between 89% and 91%; 89% has been used for the financial modelling.
- Gold recoveries from the Netiana deposit are dependent on head grade. Higher head grade material (>10 g/t Au) will achieve a recovery of 93–94%, whilst lower-grade material will achieve a recovery of 88–92%; 91% has been used for financial modelling.
- Performance of the satellite ores, including the zone A2NE which has provided much of the ore feed since October 2016, and Zergoré zones will comprise a significant proportion of the feed material going forward which was also positive. The samples tested were lower in hardness than currently being treated, and also showed an improvement in Au recovery with a finer grind. Recovery of 86% was achieved at a grind size of 106 microns (the current plant average size), increasing to 94% at a grind size of 75 microns.

1.9 Mineral Resource Statement

CSA Global considers that data collection techniques are adequate and suitable for use in the preparation of an updated MRE inventory to be reported in accordance with NI 43-101. QC data supports the integrity of the analytical data which has been utilised.

The MREs compiled by CSA Global have been classified and are reported as Measured Mineral Resources, Indicated Mineral Resources and Inferred Mineral Resources under the guidelines of the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council, and procedures for classifying the reported Mineral Resources were undertaken within the context of the Canadian Securities Administrators NI 43-101.

The current Mineral Resource inventory is shown in Table 1-1 as at 31 December 2017.

Table 1-1: Youga, Ouaré and Balogo Mineral Resources, reported at a 0.55 g/t Au cut-off, effective 31 December 2017

Deposit	Measured			Indicated			Measured and Indicated			Inferred		
	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)
Main Pit	-	-	-	2.96	1.53	145.6	2.96	1.53	145.6	0.8	1.4	36
Zergoré	-	-	-	2.57	1.20	99.1	2.57	1.20	99.1	1.0	1.2	39
NTV	-	-	-	1.88	1.10	66.6	1.88	1.10	66.6	1.5	1.3	61
A2N East	-	-	-	0.21	1.38	9.0	0.21	1.38	9.2	0.1	1.6	6
A2N Middle	0.08	5.52	14	0.09	5.60	16.6	0.17	5.56	30.6	0.0	6.0	5
Gassore	-	-	-	1.20	3.89	150.0	1.20	3.89	150.3	0.5	4.0	62
East Pit	-	-	-	0.68	1.55	33.0	0.68	1.55	33.8	0.0	1.2	2
West Pit 3	-	-	-	0.64	1.53	31.0	0.64	1.53	31.5	0.2	1.2	7
West Pit 2	-	-	-	0.57	1.46	26.0	0.57	1.46	26.8	0.2	1.5	8
West Pit 4	-	-	-	0.34	1.53	16.0	0.34	1.53	16.6	0.4	0.9	13
West Pit 1	-	-	-	-	-	-				0.1	1.6	5
LeDuc	-	-	-	-	-	-				1.0	1.0	34
Ouaré	-	-	-	5.10	1.39	228.3	5.1	1.39	228.3	7.2	1.8	406
Netiana (Balogo pit)	0.16	9.81	49	0.16	6.98	36.8	0.32	8.40	85.8	0	2.2	2
TOTAL	**0.24**	**8.20**	**63**	**16.4**	**1.63**	**861.1**	**16.64**	**1.73**	**924.2**	**13**	**1.7**	**685**

Notes:

- *Reporting cut-off is 0.55 g/t Au for all deposits.*
- *The MRE has been depleted for mining up to 31 December 2017. The effective date of the Mineral Resource is 31 December 2017.*
- *Figures have been rounded to the appropriate level of precision for the reporting of Resources.*
- *Due to rounding, some columns or rows may not compute exactly as shown.*
- *The Mineral Resources are stated as in situ dry tonnes. All figures are in metric tonnes.*
- *The Mineral Resource has been classified under the guidelines of the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council, and procedures for classifying the reported Mineral Resources were undertaken within the context of the Canadian Securities Administrators NI 43-101.*
- *The model is reported above a surface based on the NPVS shell from a US$1,500 gold price pit optimisation run to support assumptions relating to reasonable prospects of eventual economic extraction.*
- *Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues.*
- *Mineral Resources have been reported inclusive of Mineral Reserves, where applicable.*
- *No Mineral Reserves have been estimated for the Ouaré, West Pit 1 and LeDuc deposits.*

1.9.1 Youga and Ouaré Properties

Three-dimensional (3D) block models representing the mineralisation have been created for each deposit by CSA Global, in collaboration with BMC geologists, using Datamine™ software. High-quality RC and DD samples were used to estimate grades into blocks using ordinary kriging (OK). The block models were validated visually and statistically.

The total drilling available for the geological models and MRE updates were 13,615 holes and trenches for 375,885 m. Grade control data was included to interpret mineralisation wireframes, but were excluded from the grade estimation, with the exception of West Pit 1, where there was insufficient exploration/resource development drilling to support the MRE.

The A2N East model contains 11 domains, 2,405 samples and 2,362 composites used in Mineral Resource estimation.

The A2N Middle model contains five domains, 577 samples and 556 composites used in Mineral Resource estimation.

The updated Gassore model contains 15 domains, 1,708 samples and 1,785 composites used in Mineral Resource estimation.

Density data was made available for review by CSA Global from A2N (East and Middle) and Gassore. The data was flagged by the modelled weathering profiles and reviewed by weathering domain. The BD values applied to the remaining Project MREs have been informed by review of previous technical reports (AMEC, 2013a&b; Endeavour, 2015), inspection of DD core photos, and communication with site. The values used for non-fresh material have been informed by experience of other deposits in the region, given that samples measured in these materials are generally competent and tend to be overstated in the density measurements provided.

Following contact analysis, a decision was made to use hard boundaries between mineralisation domains and soft boundaries across weathering zones for all geostatistical analysis and estimation. Variograms were modelled using normal score transform for the largest domains in each deposit for Au using composited data, with outliers excluded where appropriate. The variogram model was back transformed prior to use in kriging.

Grade was estimated into parent blocks using OK, controlled by dynamic anisotropy. Grade estimates were validated against drill data. There is good correlation between the input composites and output model for the estimated Au grade. Generally, the model grade trends follow the pattern of the drill samples grades, with acceptable levels of smoothing of the higher and lower grades.

The MREs at Youga and Ouaré satisfy the requirements for Measured, Indicated and Inferred Mineral Resource categories as embodied in the NI 43-101 Canadian National Instrument for the reporting of Mineral Resources and Reserves.

The MRE indicates reasonable prospects for economic extraction, supported by resource shells produced in NPV Scheduler (NPVS) using a US$1,500 Au prices and basic assumptions regarding costs.

The MRE for Youga and Ouaré reports 16.32 million tonnes (Mt) at 1.60 g/t for 838,400 ounces of Au of Measured and Indicated Mineral Resources, and 13.0 Mt at 1.7 g/t Au for 683,000 ounces of Au of Inferred Mineral Resource. Mineral Resources are reported at a cut-off grade of 0.55 g/t Au.

1.9.2 Balogo Property

A twinning program and QAQC review completed by NMC resulted in the exclusion of 19 drillholes (18 RC and one DD) from use in the MRE. A comparison of RC vs. DD vs trench (TR) data completed by CSA Global concluded that a combined drill type dataset was suitable for use in the estimation of Mineral Resources.

A 3D block model representing the mineralisation has been created by CSA Global, in collaboration with NMC geologists, using Datamine™ software. High-quality RC, TR and DD samples were used to estimate grades into blocks using OK and inverse distance weighting (IDW). The block model was validated visually and statistically.

The total drilling available for the geological model and MRE update was 360 holes and trenches for 52,017 m.

A total of 1,534 samples in six domains were flagged within the mineralised volume and composited downhole to 1 m lengths. The resultant 1,341 composite samples were used in the estimate.

A review of 798 in-situ dry bulk density (BD) measurements in mineralisation resulted in a BD of 2.86 t/m^3 being assigned to fresh material, which aligns with the mineralisation hosted in diorite. A review of core photos indicated that the BD for oxide and transitional material based on measurements was likely to be too high, since competent pieces of core (often quartz vein) were used for the measurements, but these are not considered representative of the mixed nature of these zones. Geological logging of intensity of weathering was used to derive a length weighted average for oxide and transitional. Highly weathered material was assigned 2.00 t/m^3; 2.14 t/m^3 for oxide and 2.35 t/m^3 for transitional.

Following contact analysis, a decision was made to use hard boundaries between mineralisation domains and soft boundaries across weathering zones for all geostatistical analysis and estimation. A variogram was modelled for the largest domains in Netiana and Netiana SE for Au using 1 m top-cut composites, with outliers excluded where appropriate.

Grade was estimated into parent blocks of 10 m x 10 m x 10 m (X Y x Z) using OK, controlled dynamic anisotropy. Grade estimates were validated against drill data. There is good correlation between the input composites and output model for the estimated Au grade. Generally, the model grade trends follow the pattern of the drill samples grades, with acceptable levels of smoothing of the higher and lower grades.

The Balogo MRE satisfies the requirements for Measured, Indicated and Inferred Mineral Resource categories as embodied in the NI 43-101 Canadian National Instrument for the reporting of Mineral Resources and Reserves.

The MRE indicates reasonable prospects for economic extraction, supported by a resource shell produced in NPVS using a US$1,500 Au price and basic assumptions regarding costs. While Netiana is located more than 100 km from the Youga Plant (operated by a related party), the assumptions around transport costs assume a closer plant location, to support the criteria that a Mineral Resource must have the potential for eventual economic extraction.

The MRE for Balogo reports 0.16 Mt at 9.81 g/t for 49,000 ounces of Au of Measured Mineral Resources, 0.16 Mt at 6.98 g/t for 36,800 ounces of Au of Indicated Mineral Resources and 10Kt at 2.2 g/t Au for 2,000 ounces of Au of Inferred Mineral Resource. Mineral Resources are reported at a cut-off grade of 0.55 g/t Au.

1.10 Mineral Reserves

The Mineral Reserves for Youga, Ouaré and Balogo are supported by a LOM plan, which was developed using the following key parameters:

- The overall slope angle (OSA) for the open pit was set to 38° for the weathered material (Regolith and Oxide) and 45° for the Transition and Fresh material.
- The pit limit design and Reserve estimate are based on a metal price of US$1,300/Troy ounce. A deduction of 4% was made to account for royalty payments.
- The waste and ore-based costs applied for pit optimisation and mine planning were based on a combination of a Mine Cost model developed by CSA Global and the 2017 Budget costs supplied by

MNG and Avesoro Holdings, the holding company of NMC. The assumed mining cost in 2017 was U$2/t and the 2018 costs has been adjusted to US$1.48/t for Balogo and US$1.76/t for A2NEdle and Gassore. The total ore-based costs (including processing, G&A) estimated in 2017 was US22/t. This cost was adjusted in 2018 to US$22.78/t ore for Balogo and U$24.69/t for A2NEMiddle and Gassore. In addition, the grade control cost (US$0.15/t) was added to 2018 optimizations.

- Ore-based costs included an additional US$4.0/t for Ouaré, US$13.87/t for Balogo, and U$0.15/t for A2NEMiddle and Gassore, overland ore haulage cost from Ouaré and Balogo, respectively to the processing plant at Youga.
- Using either Datamine's NPVS software or Geovia's Whittle pit optimisation software a series of pit shells were determined by varying the Price Factor. The pit limit was selected at a Price Factor of 100% in order to maximise the Reserve and a set of pushbacks were constructed based on the shells.
- Modifying factors of 91% mining recovery (i.e. 10% ore loss) and 5% waste dilution were included in the estimate of the Mineral Reserves of A2NEMiddle, Gassore and Balogo.
- The Mineral Reserve for Youga, Ouaré and Balogo (Table 1-2) were converted from the Mineral Resource and are classified as Probable based on a Resource classification of Indicated. Inferred and Unclassified Resources have been excluded from the conversion of Resources to Reserves.

Table 1-2: Youga, Ouaré and Balogo (Netiana) converted Mineral Reserves

Mineral Reserve estimated for the Youga Gold Mine, Burkina Faso, as at 31 December 2017										
Deposit	**Cut-off grade (g/t)**	**Proved**			**Probable**			**Total Mineral Reserve**		
		Tonnes (Mt)	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**
Balogo	1.10	0.2	8.88	45.9	0.2	5.91	31.8	0.3	7.36	77.7
A2NE	0.70				0.0	2.12	1.6	0.0	2.12	1.6
Mid Pit (A2NW)	0.70	0.1	5.02	13.3	0.1	5.04	12.4	0.2	5.03	25.7
Gassore	0.70				1.0	3.99	125.0	1.0	3.99	125.0
Zergoré	0.70				1.5	1.22	57.1	1.5	1.22	57.1
West Pit 2	0.70				0.4	1.34	15.8	0.4	1.34	15.8
West Pit 3	0.70				0.4	1.61	20.2	0.4	1.61	20.2
West Pit 4	0.70				0.3	1.53	12.9	0.3	1.53	12.9
Main Pit	0.70				1.3	1.63	66.6	1.3	1.63	66.6
East Pit	0.70				0.5	1.47	22.4	0.5	1.47	22.4
NTV	0.70				1.2	1.07	41.6	1.2	1.07	41.6
Ouaré	0.82				2.6	1.67	141.4	2.6	1.67	141.4
TOTAL (exc. stocks)		**0.3**	**7.59**	**59.2**	**9.3**	**1.83**	**548.8**	**9.7**	**1.97**	**608.0**
ROM Stockpiles (LG, MG, HG) – Balogo					0.1	7.12	13.0	0.1	7.12	13.0
ROM LG Stockpiles – Youga					0.2	1.14	6.3	0.2	1.14	6.3
ROM LLG Stockpiles – Youga					1.4	0.73	32.8	1.4	0.73	32.8
TOTAL (inc. stocks)		**0.3**	**7.59**	**59.2**	**10.9**	**1.71**	**600.9**	**11.2**	**1.84**	**660.1**

Notes:

- *The Mineral Reserves have been depleted for mining up to the 31 December 2017.*
- *Figures have been rounded to the appropriate level of precision for reporting. Due to rounding, some columns or rows may not compute exactly as shown.*
- *The Mineral Reserves are stated as dry metric tonnes.*
- *The Mineral Reserves were prepared under the guidelines of the CIM, for reporting under NI 43-101.*
- *The Mineral Reserve is reported at a US$1,300/oz gold price.*
- *A cut-off grade of 0.70 g/t Au was applied to all the Youga deposits.*
- *A cut-off grade of 0.82 g/t Au was applied to the Ouaré deposit.*

- *Modifying factors for mining recovery of 95% and waste dilution of 10% at 0 g/t Au have been applied to A2NE, Mid Pit and Gassore.*
- *Modifying factors for mining recovery of 90% and waste dilution of 10% at 0 g/t Au have been applied to all other deposits.*
- *Probable Mineral Reserves were derived from Indicated Mineral Resources.*
- *Mineral Reserves are inclusive of Mineral Resources.*
- *There are no known legal, political, environmental, or other risks that could materially affect the Mineral Reserves.*
- *An additional marginal grade surface stockpile of 6.7 kt at 0.62 g/t Au was not included.*

Factors that may affect the assumptions in this report are:

- Commodity price and exchange rate assumptions are important factors that affect revenue and costs.
- At Youga and Ouaré, changes in process cost, mining cost or slope angle (±10%) generally have a relatively small impact (<5%) on the estimate of contained metal and confirm that the pit limits are not as sensitive to these parameters.
- The mine plan has been limited by an assumed annual mill throughput of 1.2 million tonnes per annum (Mt/a). No bulk metallurgical tests have, to date, been carried out.
- If certain delivered blends of rock types have lower throughputs than currently modelled, this would increase the processing cost, which would in turn increase the mill cut-off grade. If all other things held constant, this would tend to reduce the tonnage of the Mineral Reserve and the amount of contained metal.
- If the currently planned water management methods prove to be inadequate, additional sumps and pump systems may be required which would add to the capital and operating costs.
- Transport of ore between Ouaré and Balogo and the process plant at Youga is a key part of the plan and relies on the efficient planning of the transport routes, good road maintenance and proactive management of community relations.

1.11 Mining Methods

The proposed method of mining for the deposits at Youga, Ouaré and Balogo is a conventional open pit method using drilling and blasting, loading with hydraulic excavators, and hauling with articulated dump trucks. Consideration of underground mining has not been necessary at this stage of the Project.

- The optimal mine production rate is constrained primarily by the capacity of the plant at Youga. The installation of an oxygen plant in May 2018, which will increase the plant throughput by 8% to 1.2 Mt/a, is provisioned for.
- Mining rates vary over the life of the mine, depending on the stripping ratio for the individual deposits or pits. The cut-off grade applied to each pit depends mainly on the location and ore transport cost. Other costs (Processing, General and Administration (G&A) etc.) were constant across all deposits.
- At Youga and Ouaré there is limited opportunity to create pushbacks or stages within a final pit limit and it has generally only been possible to divide the individual deposits into sub-pits that may or may not be contiguous.
- The Netiana pit was subdivided into two stages with a smaller starter pit to allow the mining sequence to target high grade with a low strip ratio in the first year of production. The starter pit has now been largely mined out and the remaining reserves will be mined out by Q4 2023.
- The price used in this study was US$1,300/Troy oz, which was agreed with Avesoro as an appropriate price to be used for determining the Mineral Reserves. A near linear relationship between contained metal and price meant that the optimal pit limit coincided with the pit limit at a Price or Revenue Factor of 1.0.
- It was noted that a 10% change in process or mining cost, and OSA, all have a similar impact of less than 5% change in the contained metal. It was concluded that the Ore Reserve is not particularly sensitive to these parameters.

- The cut-off grade was calculated for each deposit and for the majority of the Youga deposits was set to 0.70 g/t Au. The exception being Ouaré where the cut-off was set to 0.82 g/t Au due to the additional cost of transporting the ore to the run of mine (ROM) pad. The cut-off grade at the reference bench at Netiana was calculated to be 1.1 g/t Au, which accounts for the additional cost of rehandling material during transport to Youga, and the incremental haulage cost as the pit deepens.
- It is assumed that all material above the cut-off grade will be transported to the ROM pad at Youga where the blend will be determined by the number of front-end loader (FEL) loads from each ROM stockpile (HG, MG, LG and LLG).
- Marginal material at Youga between 0.5 g/t Au and the cut-off is stockpiled separately as a Resource that could be converted to a Reserve in the future, should it become economic to process.
- Marginal material at Ouaré (between 0.5 g/t Au and 0.82 g/t Au) is stockpiled separately near to the pits. This material is a potential Resource should the economics improve, and it would be advisable to segregate this stockpile into a high and a low-grade portion.
- Material that is normally classified as Low Low Grade is stockpiled at Balogo as a potential future ore source and is not included in the Ore Reserve as it is currently uneconomic. Material with a grade ≥ the marginal cut-off grade is split into Low, Medium and High-Grade piles and stockpiled on a temporary ROM stockpile close to the pit exit.
- The level of geotechnical data in the design at Youga and Ouaré are limited however some experience through the mining undertaken to date has been gained, which allows for a basic understanding of the risk associated with the slope design. It is concluded that additional work is required to improve the accuracy of the estimates and to improve the reliability of the mine design criteria. The geotechnical parameters also need to be updated with data from ongoing exploration drilling and face mapping.
- The geotechnical parameters used to describe the competency of the rocks at Netiana are of international standard and are believed to be sufficiently comprehensive for the purposes of reporting Ore Reserves.
- It is proposed that the final pit walls are double benched to 10 m, which will provide a catch bench every 10 m that will have sufficient capacity to contain localised slope failures.
- The Ouaré project will be managed alongside the existing projects at Balogo and Youga as these projects share a lot of the same infrastructure and therefore it makes sense to standardise the fleet across all operations.
- A bench height of 5 m has been selected to ensure selective mining of the ore. The bench will be blasted on 5 m intervals and loaded on two flitches of 2.5 m. This is the practice at Youga where it works well for the given rock types and distribution of ore.
- The minimum mining floor width has been designed at 30 m to allow for the turning radius of the trucks (SAE turning radius of 8.7 m).
- A mining recovery and waste dilution of 90% and 10% respectively have been assumed for the majority of the deposits, the exceptions being Balogo, A2NE, A2N Mid Pit and Gassore where the mining recovery was increased to 95% and Balogo where the dilution was reduced to 5%.
- Considerable care needs to be taken with the blasting to minimise movement and as a consequence the blast design assumes choke blasting with a relatively low powder factor of 0.29 kg/m^3.
- The pit limits generated by Whittle are based on an OSA that includes the provision for safety berms and ramps.
- The waste dump capacities are based on a swell factor of 25% and no allowance for backfilling of the pits has been made, which may be a potential cost saving.

- The mining sequence for Youga, Balogo and the satellite deposit of Ouaré, are sequenced in order of profitability so as to maximise early cash flow.
  - The earliest production from Ouaré has been set to October 2020 due to the need to develop this project and complete mining at Balogo. This includes building a 44 km access road and constructing a bridge over the Nakambe River.
  - Production rates from individual pits are constrained by access space and bench sinking rate. Typically, the bench sinking rate is limited to less than one bench per month.
  - No more than three active pits should be operational at any one time. This is a function of the available equipment and limits on logistics of running multiple pits.
  - If possible, a deposit is mined out before moving to the next one. This allows the pit to be closed and rehabilitation to proceed as the project continues.
  - Where two pits of a single deposit are joined then some pre-stripping may have to be done to develop a common access ramp. For example, this occurs with Main and East Pits.
- To transport ore from Ouaré to Youga up to 30 Volvo trucks (40-t capacity) on two shifts per day, with each truck completing two trips per shift, or four trips per day, have been assumed. With an 80% availability, this translates into a capacity of 120,000 t/month.
- The support equipment consists of drills, dozers, graders, FELs, light vehicles and other service equipment such as a fuel truck and service truck. The explosive truck is included with the blasting contract service.

1.12 Recovery Methods

The processing facility at Youga comprises of a three-stage crushing, and single-stage ball milling circuit; a gravity section; a single stage cyanide leach and a five-stage CIL circuit:

- One of the zones tested as part of the 2012 program was A2N, which is the current majority ore source at the operation. This has been running since October 2016 and is due to be processed for another quarter. The predicted mill performance for these samples was an average combined recovery of 90.6% from an average head grade of 1.86 g/t, which corresponds almost exactly to the actual first quarter performance.
- The current mine plan projects the material from Youga, Netiana and Ouaré deposits will be processed over the LOM plan in proportion of 73%, 3.5% and 23.3% respectively of the proposed mill annual throughput.
- Circuit simulations with a simple mill model (calibrated to actual mill performance results) show that the Ouaré material should on average be able to be processed at the required average throughput (148 t/h) at the required grind size P80 of 75 microns to achieve the predicted recoveries for Ouaré ores. A range of 89% to 91% is predicted, subject to consistently achieving the required grind size (80% passing 75 microns).

At Netiana, due to its lower intrinsic hardness, the new high-grade material will be processed through the existing Youga comminution circuit at a finer grind (a P80 of 75 microns) than is currently being achieved on the Youga material.

1.13 Project Infrastructure

1.13.1 Youga and Ouaré Properties

The mine has been operating since 2008 and was taken over by Avesoro Holdings in February 2016, and by Avesoro Resources Inc. in 2017. Shortly after the acquisition, the mining contract was terminated and following a period of processing ore from existing stockpiles, MNG subsequently restarted the mining operation under its own control in October 2016. Under the management of Endeavour, the mine operations were run by a mining contractor, PW Mining International Ltd, but since the takeover by MNG in 2016 the mine has been run by Avesoro. This has not substantially changed the operation other than to introduce new mining equipment.

The one area of change is that the Ouaré deposit has been included in the Reserves for Youga and is treated as a satellite deposit that will be run from Youga. Consequently, the facilities at Ouaré will be kept to a minimum.

1.13.2 Balogo Project

The mine infrastructure is essentially unchanged from that of the Feasibility Study published in March 2016:

- Infrastructure for the mining includes open pit, waste rock stockpile, ore stockpile and related facilities which include prefabricated office building and change house.
- Electrical power required for office building, change house and lighting are sourced from a 150kVA diesel generator.
- There are no camp facilities on site as the camping area will be located 6.3 km east of the Balogo property area. The camping area consists of prefabricated and containerised buildings.
- The ore from Netiana is transported back to the processing plant at Youga. It is assumed that this fleet of trucks will be based at Youga.
- As processing and refining of the ore is done at Youga there will be no requirement for these facilities at Balogo.
- Other administrative functions, including Health, Safety and Environment (HSE), will be sourced from Youga and there will be minimal need to accommodate additional staff at Balogo.

1.14 Market Studies

Gold is freely traded commodity and as such there has been no market study made nor is one proposed.

The plant at Youga currently produces Dore bars that are sold to independent refineries under normal commercial conditions. Ore from Ouaré and Netiana is trucked to the Youga plant. The gold is collected from site and is transported to Ouagadougou, from where it is flown to Europe for further refining. Funds are repatriated into Burkina Faso.

1.15 Environmental Studies, Permitting and Social or Community Impact

1.15.1 Youga Property

Current Condition and Status

The current condition and status of the Youga property site is derived from the Wardell Armstrong (WA) site visit and report (2016) and is summarised below:

- Mining has terminated in Main Pit, East Pit, West 1, 2a, 2b, 3 Pits, NTV 1, 2, 3 and 4 pits, and Zergoré B and C pits; with most pits being flooded.
- Open pit closure and rehabilitation will continue to comprise either backfilling with waste rock or flooding. Backfilled pits are to be returned to farming or cultivation land use, while flooded pits may be used as water-storage facilities with offtake for irrigation and farming.
- The Youga waste rock dumps are spread out across the site, with each pit area having dedicated waste rock dumps (WRDs). All dumps are below 45 m in height and are generally in good condition with no apparent stability concerns and some vegetation regrowth.

- The tailings storage facility (TSF) is situated 500 m from the processing plant and contains tailing slurry, domestic wastewater and surface runoff. It appears to be reaching maximum capacity with <1 m freeboard, therefore the mine plans to construct an additional 3 m lift to increase the capacity of the TSF for continued operations.
- The water management system on the Youga site includes a water tower and pumping station on the Nakambé River, pipelines from the river and pits to the process plant; and a sump facility at the receiving point of the pipeline.
- The mine infrastructure includes process plant and mine offices; stores and warehouse, garage, contractor workshops, fuel farm, and generator sets. The Project is served by approximately 10 km of roads of which the majority are in good condition and suitable for both mine and civilian traffic. Many local people use the mine roads outside the restricted areas.

Environmental and Social Impact Assessment

The original Youga Environmental Impact Assessment (EIA) report was prepared with local consultancy Société de Conseil et de Réalisation pour la Gestion de l'Environnement (Socrege) which resulted in the granting of an Exploitation Permit in April 2003. An updated EIA study for the Youga Project was undertaken by SGS in 2005 due to changes from the original mining plan and associated EIA upon which the permit was granted.

- Youga environmental baseline studies assessed the climate, air quality, surface and groundwater hydrology, ecological, land and socio-economic characteristics.
- Description of rainfall and other climate parameters were based on data obtained from the closest national meteorological stations covering a 40-year period and was sufficient to determine likely site conditions for planning and impact mitigation.
- Detailed soil and vegetation studies show that flora diversity is considered relatively rich but is under pressure from population demands. Fauna surveys are less well detailed. Human activity including agriculture, grazing livestock, gold washing and hunting has impacted the area ecology.
- The main agricultural and other land uses were surveyed and include cultivated annual crops; fallow land; animal husbandry and pasture; savannah woodland; artisanal gold washing; mine exploration areas, access roads and accommodation camp; and villages and scattered small hamlets.
- In 2005, the population of the area was estimated at 6,200 with socio-political relations between the various communities still largely administered by traditional authorities. The economy of the district is dominated by agriculture followed by livestock, and since 1993, artisanal mining. There is strong emigration of young people away from the area in search of employment and other opportunities. Prior to mining the economic development of the area was severely hampered by restricted road networks, poor spatial distribution of very limited social infrastructure and the lack of skilled workforce.

Impact Assessment and Mitigations

The Youga EIA identified impacts for both construction and operational phases of the property. Impacts of enforced relocation and loss of land and crops were identified as significant, with preliminary surveys showing up to four hamlets needing resettlement and approximately 100 ha of farms requiring compensation. Appropriate compensation was acknowledged as critical to mitigate local socio-economic risk and confrontation. The EIA also identified many potential positive impacts of the project relating to employment, economic opportunities and social/infrastructure benefits for local communities and to national and regional government through payments of royalties and taxes.

The EIA incorporated a preliminary Environmental Management Plan (EMP) which included waste management; community relations and compensation; a basic monitoring program; Reclamation Closure and Decommissioning Plan; Emergency Response Plan; and provisions for environmental and social auditing and review. Total social expenditure for the years 2013 to 2015 was US$1,134,635, considerably more than the projected annual budget in the 2005 EIA EMP.

Environmental and Social Management Plan

The operational working Environmental and Social Management Plan (ESMP), circa 2011, covers the general requirements for Project environment and social management. Most of these management activities are also contained in the more recent 2015–2016 environmental management system, developed after Project acquisition. Social/community management measures for ongoing stakeholder consultation, compensation and influx issues are also recorded in the 2015 “Respect to Commitment” document.

No budget is given for these current management plans, but CSA Global believe that for a project of this size, a minimum of US$100,000 per annum should be allowed for ESMP implementation, with community assistance and ongoing compensation and resettlement costs additional to this.

Stakeholder Engagement

As part of the EIA studies, stakeholder engagement included meetings with local representatives (governmental and traditional) for project disclosure and to gain information about the views of local communities. No major objections to the proposed development were received from any of the government officials, chiefs or villagers interviewed. Compensation issues remain the main area of contention at the project.

Closure and Rehabilitation

The 2005 EIA included a preliminary Closure Plan for the property where closure and rehabilitation costs were calculated in some detail, giving a total of US$1,495,733, including post-closure monitoring. According to the National Mining Code, any holder of a mining licence must make deposits in a fiduciary account to cover the costs of rehabilitation. The EIA Closure Plan proposed accrual of the estimated cost for reclamation and decommissioning on a yearly basis to reflect the mining schedule.

The Closure Plan has subsequently been revised and updated during operations. The 2016 WA review of Youga closure included visual assessments of the open pits, WRDs, TSF and site infrastructure which suggest that closure activities so far have been effective. However, the review also recommends significantly more investment in social and community capacity building in preparation for post-closure. The report provides an updated estimate of scheduling and costs for proposed future rehabilitation works, with total costs given as US$3,768,000, which CSA Global believes is realistic.

1.15.2 Ouaré Property

Socrege was contracted to undertake an initial environmental and social review of the area in 2012 as a precursor to developing an ESIA study. Much of the review was desktop-based research, using available data from nearby meteorological stations and government records:

- There is much detail on the rural activities in the area and land-use conflicts between agricultural, pastoral and artisanal mining activities
- The area is heavily impacted by 15 years of intense artisanal mining, with rapid deforestation along the river banks, multiple excavations (some to considerable depth) and significant siltation and contamination of local rivers and streams, particularly the Ouaré River
- The report also provides recommendations for stakeholder engagement, additional studies and project impact assessment and provides a good basis for ESIA scoping studies.

A preliminary feasibility study was undertaken on the proposed Ouaré project in early 2017 by HCG Cement and Mineral Processing Technologies. This cursory report, of only 68 pages, has no specific environmental content, but refers to the previous Socrege scoping baseline:

- No details are provided on the planned WRD.
- The ore is to be stockpiled at site and hauled to Youga for processing which will require construction of a new 44 km road and a new 100 m bridge crossing the Nouaho River. It is understood the government is to build the road from Ouaré to the Nakambé River, with Avesoro required to construct the bridge and the further 11–14 km of road to Youga. The haul road and bridge will require a separate ESIA study with investigation of ambient conditions, consultation with route communities and impact assessment.
- Beside this, the ESIA process covering the mining activities at Ouaré Project and ore transportation from Ouaré to Youga was submitted to the Ministry of Environment in June 2018, for its review and subsequent approval.

CSA have been able to briefly review this ESIA which appears to be reasonably comprehensive but lacking in detail. CSA sets out the following comments with respect to this document;

- The ESIA includes an explanation of the legal and regulatory context in Burkina Faso and the legislation applicable to the project. There is an overview of the Project description, including mining, processing and employment and economic implications, but this at a relatively high level.
- There are no details of the waste rock management and design, or project water balance and proposed management.
- Baseline studies are generally extensive and cover all the required areas of investigation, although, as in previous studies, the level of detail demonstrates the strengths and weaknesses of the study team, with a strong coverage of vegetation, soils, agriculture and landuse, but cursory fauna or geochemical studies.
- Evaluation of Project alternatives is very superficial, looking only at mining and processing methods and waste rock locations, with little reference to relative impacts.
- Impact identification and assessment appears to be reasonably thorough, given the limited Project detail, and covers construction, operations and closure phases. It is not clear how much coverage of the proposed haul road is included in the assessment or stakeholder engagement. Suitable, though high level, mitigations are proposed, and these are incorporated into evaluation and addressing of Project risks and a framework ESMP, which includes implementation of measures, monitoring and capacity building. There is a 4 page conceptual Closure and Rehabilitation plan and an even shorter proposal for public consultation.
- There does not appear to be a specific Relocation Action Plan for the removal and resettling of people in the project footprint, or a functional grievance mechanism in-place for the Project.
- The ESIA report gives total costs for implementation of the ESMP, including for monitoring, as FCFA 755,480,000 or under US$1.5M which may be underestimated, especially as it is unclear if this includes provision for the RAP for relocation of people within the mine areas.
- Closure costs are estimated based on US$0.05/t of ore and waste extracted, which corresponds to approximately US$800,000. This is to be paid in instalments over the life of the project but completed at least 12 months before the end of the project. While this estimate is understood to be preliminary and subject to revision, CSA believe this will need to be significantly increased to include social preparations and livelihood restoration.

1.15.3 Balogo Property

Climate and hydrology baseline studies are detailed and there is a good understanding of the water resources in the area, with documented research into the hydrogeology and aquifers together with data from wells and boreholes, and surface flow data from existing flow gauges and stations. Groundwater is recharged through rainfall and the water table is relatively shallow.

The geology and mineralogy of the deposit is described but no geochemical studies were undertaken for the ESIA study. Soils and land-use studies are detailed, and vegetation surveys were undertaken, and inventories made.

The social study captured the demographics, ethnic, religious, and population dynamics; the social, administrative and political frameworks; traditional and social organisation in the study area. Land issues are complex, but ownership is well defined with access to land via inheritance, gifting or borrowing. Traditional and modern systems are employed for conflict resolution.

Potential impacts are anticipated to be resettlement, compensation for loss of land and access to grazing, water and natural forest resources. Potential contamination of water resources and soils from acid mine drainage (AMD) and metal leaching from the open pit and WRD is identified but has not be evaluated with testwork and is a significant gap in the ESIA.

Other impacts include the lowering of water table through pit dewatering drawdown affecting local wells and boreholes; and health and safety issues associated with road traffic accidents and access to mine infrastructure. Positive impacts from the operation will include creation of jobs; new business opportunities for local populations (trade, catering etc.); and economic benefits to the State and local authority from tax gains. The main additional impacts from the rehabilitation and closure phase include the loss of direct and indirect jobs and business opportunities for local populations.

The preliminary ESMP provides for the implementation of environmental and social mitigation measures, as well as for monitoring and supervision, and capacity building. The overall budget for the implementation of the ESMP for the Project is estimated at US$1,454,514. A detailed Resettlement Action Plan (RAP) was developed for the Balogo project in 2016.

In 2016–2017, Socrege undertook an ESIA study on the proposed Balogo-Youga haul route, issuing the EIES report in April 2017. The ore mined at the Netiana deposit will be transported by truck along a 154 km long route to the Youga mine for processing. Of this route, 150 km are on the existing national highway RN25 (from Koumbili to Youga), and the dirt road from the project site to the RN25 has been rebuilt.

1.15.4 CSA Global Recommendations

There were some gaps and deficiencies noted in 2017 relating to investigations, impact assessments and mitigation and management measures, which are highlighted below, along with comment from Avesoro as to the current status. The most significant gap was the apparent lack of environmental and social work on the haul routes from Ouaré to Youga. This required urgent work to describe ambient conditions, identify potential impacts and engage with affected communities – together with completion of the Ouaré ESIA – to develop suitable environmental and social management plans prior to start-up of haulage. An ESIA study was completed and submitted to the Ministry of Environment in June 2018, and that the RAP (Resettlement Action Plan) studies are ongoing. CSA has cited the ESIA document, and whilst progress has been made addressing many of the gaps, additional works are required and are ongoing.

Required work to address gaps in the Project environmental and social work include:

- Undertake more detailed follow-on study on the haul route from Ouaré to Youga, including baseline data collection, stakeholder consultation, impact assessment and mitigations.
- Establish site meteorological stations at Youga and Ouaré (as required)
- Install permanent flow gauges at Project streams and depth rods at ponds/dams
- Undertake more detailed faunal biodiversity studies at Youga to determine the most appropriate measures to avoid and/or offset for Project impacts

- Implement and publicise a formal grievance mechanism for Youga and Ouaré
- Undertake geochemical testing, including metal leaching tests on ore material and tailings from Youga; representative WRD material and ore from Netiana; and from Ouaré as required.
- Define and implement ecological and social monitoring at Youga
- Develop and disclose an appropriate procedure for evaluating post start-up demands for compensation at Youga (for expanding Project area)
- Assess impacts on- and from- artisanal mining in the Youga area (and Ouaré in particular) and establish dialogue to reduce environmental impacts and conflicts.

1.16 Capital and Operating Costs

It is assumed that two additional drill rigs will be required in 2018 to achieve the production rates proposed in the updated mining schedule. There is no need for additional capital spend on the mining fleet at Youga/Ouaré and Netiana apart from that as all the fleet has been purchased already. This means that the capital spend is limited to US$3.6 million and the sustaining capital for mining fleet is at US$14.9 million for the remaining life of the mine.

Other capital costs included in the financial analysis are:

- To accommodate the increase in the Reserves to 11 Mt, the TSF needs to be extended with a capital expenditure of US$4.4 million
- There is also an expenditure of US$10.1 million for the waste dumps, which is spread over the life of the mine and can be treated as either a capital or an operating cost
- The capitalised environmental and social expenditures are estimated at US$6.6 million and are spread across the mine life.

The mine operating costs were provided by Avesoro and reconciled against the first principal estimates which were done last year and actual operating cost for year 2017 and Q1 2018. The operating cost was set to US$1.72/t of material mined for Youga/Ouaré.

A summary of the operating costs is given in Table 1-3.

Table 1-3: Summary of operating costs for the Youga/Ouaré and Netiana projects

Cost area	Units	Youga/Ouaré	Netiana
Mining cost	US$/t mined	1.76	1.63
Ore transport	US$/t ore	4.05	14.06
Processing (variable)	US$/t ore	17.58	17.58
G&A	US$/annum (,000)	6,907	2,106

Note: The ore transport cost is from the pit exit (or ROM pad in the case of Ouaré) to the ROM pad at Youga. For Ouaré the transport cost over the 44 km route is US$4.05/t ore. For Netiana pits, the ore transportation is US$14.06/t ore. For Youga, the transport cost is included into mining cost.

1.17 Economic Analysis

1.17.1 Youga/Ouaré and Netiana Projects

This economic analysis of the Youga/Ouaré and Netiana projects is based on the Mineral Reserves presented in Section 15. The analysis is based on discounted cash flow (DCF) approach. Results are expressed as pre-financing terms. The analysis takes into account 4% royalty paid on revenue, 1.8% royalty on revenue paid to Endeavour. The profit tax is applied at 17.5% for Youga pits and 22.5% for Ouaré and Netiana pits. The profit tax rates were provided to CSA Global by Avesoro and 22.5% rate is assumed to be a weighted average between various tax rates applicable to the projects. No inflation or escalation of revenue or costs has been incorporated into the base case economic model. Project expenditures prior to January 2018 are considered as sunk costs and are excluded from the cash flow model.

The model is developed in US dollars at current prices and does not include considerations for exchange rate fluctuations.

With revenue based on a gold price of US$1,300/ounce, the following pre-tax economic indicators were calculated as:

Table 1-4: Summary of economic indicators

	Youga and Ouaré	Netiana	Total
Gold recovered (koz)	522	92	**614**
Undiscounted cash flow (US$M, before tax)	166,100	59,410	**225,510**
Undiscounted cash flow (US$M, after tax)	135,670	46,040	**181,720**
NPV US$M (5% discount rate, before tax)	133,050	55,270	**188,320**
NPV US$M (5% discount rate, after tax)	108,750	42,840	**151,580**
Cash cost (US$/oz)	910	550	**860**
All-in cost (US$/oz)	980	600	**920**

Internal rate of return (IRR) and payback period assessments are not applicable to the project as its cash flow positive from year one. Due to lower grades, the Project shows high sensitivity to gold price and cost and recovery variations in stress scenarios:

- NPV at 5% discount rate with project mining costs 20% higher than the base case and gold price at US$1,100/ounce is at US$67.6 million
- NPV at 5% discount rate with processing recoveries for Youga/Ouaré and Netiana ores at 4% lower than the base case and gold price at US$1,100/ounce is at US$72.4 million.

1.18 Hydrology

CSA Global undertook a review of the available hydrological and hydrogeological aspects of the Youga, Ouaré and Balogo properties to evaluate the level of understanding of the hydrology and hydrogeology at each of the two sites and to identify any potential mine water management issues and risks at each site.

1.18.1 Youga Property

According to the Youga Gold Project updated EIA (2005), the rocks are low yielding and not ideally suited to exploitation using boreholes. There are likely to be two main aquifer units within the mine; a shallow weathered aquifer and a fractured bedrock aquifer. No groundwater level data are provided and therefore it is not currently possible to infer groundwater flow direction at the Youga Mine site.

- Potential issues concerning water management and pit stability were raised in technical site visit reports. Measures to counteract these concerns were detailed, but it is not clear if these measures were successful in effectively managing the effect of surface water and groundwater ingress on pit stability.
- Pit dewatering is achieved utilising in-pit sumps. It is reported that the quantity of water pumped from the pits is recorded on a daily basis and that water quality is monitored daily and monthly.
- Process water is recycled from the TSF lagoon where it is pumped to the plant process water tank and then subsequently on to the process plant as a water supply.
- Raw water is pumped from the Nakambé River, stored in a de-sanding holding tank and then pumped to the raw water pond. Potable water is supplied from the raw water pond and is treated through a filtration and sterilization system.

- Surface water quality is measured at upstream and downstream points on the Zera River and at the Gossé Stream. Surface water on site was found to be unsuitable for human consumption owing to extensive microbial contamination.
- A detailed EMP is provided in "Youga Mine Environmental Management Plan" which sets out actions, reporting procedures and corrective actions.

1.18.2 Ouaré Property

The Feasibility Study (FS) indicates that there is limited groundwater use within the Ouaré property area. It contains a short section on potential aquifers in the area, but no site-specific hydrogeological investigation data were provided, except for limited groundwater quality data. Groundwater in the area is reported to be calcium magnesium bicarbonate type with low conductivity and low turbidity. Microbial contamination of groundwater is reported in the project area.

As the ore will be transported to Youga, the processing water requirements for the Ouaré site are likely to be minimal. A water supply strategy for the Ouaré property, including water supply options and their potential yields, quality and long-term sustainability have not been provided for review.

Three open pits, with depths up to 130 m, are proposed for the Ouaré Mine. A specific water management plan, including both groundwater and surface water management, is not provided for the Ouaré site.

The recently submitted ESIA document contains additional information. CSA Global has cited this document and comments that useful additional hydrogeological information has been collected.

1.18.3 Balogo Property

The hydrogeological information available for the Balogo property area relies predominantly on literature values and limited site-specific data.

The ESIA and FS report for the Balogo property contain short sections on aquifer properties, but are poorly referenced, and conclude that the three sub-basins that the Balogo property area intersects have low interstitial porosity.

Groundwater level data to a point, lacks spatial information and as a result it is not possible to infer groundwater flow direction.

The Netiana mine water supply requirements will depend upon the operation of the mine and may include requirements for dust suppression, ablution and potable water. As the ore will be transported to the Youga mine for processing, the processing water requirements for Netiana are likely to be minimal.

Water supply options for the Balogo property are presented in the ESIA however a water supply strategy including potential yields, quality and long-term sustainability of the water supply options has not been provided for review.

1.19 Conclusions

1.19.1 Geology and Data

CSA Global considers the drillhole data for the Youga, Ouaré and Balogo properties to be sufficiently reliable for Mineral Resource estimation and associated downstream work. However, data management for all projects requires improvement. A centralised managed database should be implemented which can serve as a single point of truth for the project data. No controls on potential cross contamination were used and coarse blanks should be urgently implemented.

Youga and Ouaré Properties

The Youga Gold property straddles an outlier of epiclastic Tarkwaian sediments that unconformably overly Upper Birimian Series volcanics, volcaniclastics and sediments of the Bole-Navrongo Belt, which extends across northwestern Ghana into southern Burkina Faso. The Tarkwaian outlier at Youga is dominated by a succession of arkosic sandstones, comprised of quartz and feldspar in roughly equal proportions. The arkoses are intercalated with thin subordinate polymitic matrix supported conglomerate horizons manifest as chlorite schists, often accompanied by carbonate alteration.

Mineralisation is preferentially developed within the arkosic sequences. Structural controls to mineralisation may superficially relate to a dextral dilatational jog in a major 070º structure represented by the A2 West 2, 3 and 4 mineralised zones, continuing on the same orientation to the northeast as a structure defined by intense carbonate alteration developed within Birimian phyllites to the east of the A2 Main-A2 East deposits. The sulphide content is extremely low (usually <1%), comprising pyrite, pyrrhotite, arsenopyrite and trace galena. The style of mineralisation is distinctly brittle in character, represented by irregular fracturing, quartz veining and occasional brecciation.

At the Ouaré Main zone, mineralisation occurs as quartz veins within shear zones at the contacts between felsic and mafic volcanics. Orpailleur workings have been developed along mineralised structures in two orientations: 090° and 315°. The 090° portion of these workings has multiple parallel quartz veins along shears in an interpreted dilation zone. The 315° portion is interpreted as a 100 m wide deformation zone, terminating the 090° trend.

CSA Global concludes that the sampling quality and methods and survey procedures appear to be appropriate and representative. There is intrinsic sample bias and/or potential for contamination associated with soil, grab and auger sampling, however these datasets have not been used in the estimation of resources and are for indicative/exploration purposes only.

QAQC procedures appear adequate, but it is unclear whether they are always implemented. Numerous failures of CRMs and blanks were noted as well as apparent misidentification of these samples. Most of the project areas require improvement in CRM and blanks QAQC although CRM results were generally accurate (but imprecise).

Balogo Property

A twinning program and QAQC review completed by NMC resulted in the exclusion of eight drillholes (seven RC and one DD) from use in the MRE. By excluding these holes, a comparison of RC vs. DD data completed by CSA Global concluded that a combined drill type dataset was suitable for use in the estimation of Mineral Resources.

A review of core photos indicated that the BD for oxide and transitional material based on measurements was likely to be too high, since competent pieces of core (often quartz vein) were used for the measurements, but these are not considered representative of the mixed nature of these zones. Geological logging of intensity of weathering was used to derive a length weighted average for oxide and transitional. Highly weathered material was assigned 2.00 t/m^3; 2.14 t/m^3 for oxide and 2.35 t/m^3 for transitional.

Apparently misidentified CRMs potentially reduces confidence in the Project data management and there are indications of lab drift. QAQC data should be continually collected and assessed during drilling, so that issues can be addressed, as they arise.

1.19.2 Mineral Resources

Mineral Resources for 11 deposits at Youga and Ouaré were estimated during 2017. These were Main Pit, East Pit, West Pit 1, 2, 3 and 4, NTV, Zergoré, A2NE, Leduc, and Ouaré. The current Mineral Resource update was focused on the re-interpretation, extension and subdivision of the 2017 A2NE MRE into three areas, namely A2N East, A2N Middle and Gassore.

Data verification included spot checks on six drillhole collars during a site visit, verification of core, review of core photos for several drillholes and review of core recovery. These checks support the use of the data for Mineral Resource and Mineral Reserve work.

The Mineral Resources have been classified as Measured Mineral Resources, Indicated Mineral Resources and Inferred Mineral Resources according to the "CIM Definition Standards for Mineral Resources and Mineral Reserves" (May 2014).

For reporting purposes, the resources have been constrained within US$1,500 pit shells using reasonable assumptions to support the criteria that Mineral Resources must have the potential for eventual economic extraction.

1.19.3 Mineral Reserves

Mineral Reserves are classified as Probable based on a Resource classification of Indicated Mineral Resources. Inferred Mineral Resources and Unclassified material have been excluded from the conversion of Mineral Resources to Mineral Reserves. The Qualified Persons are of the opinion that potential modifying factors have been adequately accounted for using the assumptions in this report, and therefore the Mineral Resources within the mine plan can be converted to Mineral Reserves.

- Changes in process cost, mining cost or slope angle (±2°) generally have a relatively small impact (approximately 5%) on the estimate of contained metal and confirm that the pit limits are not as sensitive to these parameters as they are to price.
- Effective surface and groundwater management is important to the safety and productivity of the mining operation. Although this is only really an issue during the rainy season, if the currently planned water management methods prove to be inadequate, additional sumps and pump systems may be required.
- Transport of ore between the Ouaré and Balogo properties and the process plant at Youga is a key part of the plan and relies on the efficient planning of the transport routes, good road maintenance and proactive management of community relations.

1.19.4 Recovery Methods

Preliminary circuit simulations with a simple mill model (calibrated to actual mill performance results) show that the Ouaré material should on average be able to be processed at the required average throughput (148 t/h) at the required grind size P_{80} of 75 microns to achieve the recoveries predicted from the testwork for Ouaré ores. A range of 89% to 91% is predicted, subject to consistently achieving the required grind size (80% passing 75 microns).

The current mine plan projects the Youga, Netiana and Ouaré material to be mined and processed as a blend of 73%, 3.5% and 23.3% respectively. The new ore types should proceed through the existing Youga comminution circuit at a fine grind size P_{80} of 75 microns in order to achieve the overall weighted gold recovery of 91%.

1.19.5 Mining Methods

The proposed method of mining for the deposits over the Project is a conventional open pit method using drilling and blasting, loading with hydraulic excavators, and hauling with ATDs. Consideration of underground mining has not been necessary at this stage of the Project.

- The optimal mine production rate is primarily constrained by the capacity limit of the plant at Youga.

- The cut-off grade applied to each pit depends mainly on its location and ore transport costs. Other costs (Processing, G&A etc.) were constant across all deposits.
- It was noted that a 10% change in process or mining cost, or a 2° change in the OSA, all have a minor impact (approximately 5%) on the contained metal. It was therefore concluded that the Ore Reserve was not particularly sensitive to these parameters.
- Price is the main driver for most of the deposits and a 10% change in price resulted in a 13% change in contained metal. This is consistent with the charts of cumulative contained metal vs. price where there is a near linear relationship for most deposits, which supports the notion of selecting the pit at a Price Factor of 1.0.
- The cut-off grade for the majority of the Youga deposits could be set to 0.7 g/t Au, the exception being Ouaré where the cut-off was set to 0.82 g/t Au due to the additional cost of transporting the ore to the ROM pad. Due to transport costs, the cut-off grade for Netiana at 1.1 g/t Au is significantly higher than that seen at Youga.
- As a consequence of the raised cut-off grade for Netiana, the material that is normally classified as Low Grade (grade range of between 0.7 g/t Au and 1.1 g/t Au) is stockpiled at Balogo as a potential ore source in the future as it is currently uneconomic.
- A detailed quantification of the rock mass properties could not be found in the documentation provided. Therefore, the slope design parameters have been estimated with a high factor of safety for this rock type.
- Netiana has a significant impact on the overall feed grade to the plant due to the high grade of the starter pit. The overall mine development strategy therefore prioritises feed from Netiana so as to maximise cash flow in the early periods.

1.19.6 Project Infrastructure

The Youga mine has been operating since 2008 and was taken over by Avesoro Holdings in February 2016. Shortly after the acquisition, the mining contract was terminated and following a period of processing ore from existing stockpiles, MNG subsequently restarted the mining operation under its own control in October 2016. Under the management of Endeavour, the mine operations were run by a mining contractor, PW Mining International Ltd, but since the takeover by MNG in 2016 the mine has been run by the owner. This has not substantially changed the operation other than to introduce new mining equipment.

The one area of change is that the Ouaré deposit has been included in the Reserves for Youga and is treated as a satellite deposit that will be run from Youga. Consequently, the facilities at Ouaré will be kept to a minimum.

The estimate of the Balogo mine infrastructure is essentially unchanged from that of the FS published in March 2016. Proposed infrastructure includes open pit, waste rock stockpile, ore stockpile and related facilities which include prefabricated office building and change house. Ore from Netiana will be transported back to the processing plant at Youga. It is assumed that this fleet of trucks will be based at Youga. Other administrative functions, including HSE, will be sourced from Youga and there will be minimal need to accommodate additional staff at Balogo.

1.19.7 Environmental Studies, Permitting and Social or Community Impact

There has been a considerable amount of environmental and social work undertaken on the Youga and Balogo properties and EIA reports are of reasonable content and quality. Baseline data collection has been detailed and comprehensive and impact assessment and mitigations are appropriate. While not to Standard Operating Procedure detail, the ESMPs are at an adequate level for implementation.

- The Youga operation received environmental permitting and an exploitation mining licence and has been active for over 10 years. While this review cannot comment on operational environmental and social performance, the current condition and status of the Youga site; apparent lack of environmental penalties or social conflict; and proposed continuation of activities imply that there have not been any significant non-compliance or grievance issues.
- However, ongoing community complaints about compensation and water resources suggest that there is room for improvements on some issues, and the current operation can address these with increased SE, community consultation and demonstrated transparency.
- Inclusion of the Ouaré deposit in the Youga Project has a good (if now five years old) scoping baseline data resource to initiate ESIA studies and can learn from experiences at Youga. Avesoro communicate that an ESIA report was submitted in June, 2018. CSA Global has not cited this document.
- Both the ESIA and RAP have been approved and an environmental permit has been granted for the Balogo project.

1.19.8 Capital and Operating Costs

The capital spend on mining fleet is limited to US$3.6 million over the life of project and there is a sustaining capital is US$14.9 million for the remaining life of the mine. The capital expenditure relating to the TSF is expected to be US$4.4 million, and a further $10.1 million to extend the waste dumps, which is spread over the LOM and can be treated as a capital or an operating cost. The capitalised environmental and social expenditures are estimated at US$6.6 million and are spread across the mine life.

1.19.9 Economic Analysis

In the base case, the Project shows positive pre-tax NPV of US$188.3 million and after-tax NPV of US$151.6 million at 5% discount rate. However due to lower grade it shows high sensitivity to recovery and cost variations with NPV dropping significantly in stress scenarios tested.

The project base case results were tested for sensitivities to gold price fluctuations in the range from US$1,100/oz to US$1,450/oz and mining cost variation from current levels to increase by 20% from the base case, as well as processing recoveries change from -4% to +2% from the current base case. The project shows its viability in both stress scenarios.

1.19.10 Hydrology

Based on the information provided for review, there appears to be a good understanding of most operational water management issues at the Youga mine site. However, additional assessments and site-specific investigations would improve future operational water management, including:

- Long-term prediction of dewatering and depressurisation requirements
- Long term water supply security
- Optimisation of overall site water management
- Assessment of potential impacts from mine water management on the environment.

Whilst hydrological and hydrogeological assessments have been completed for the FS and ESIA for the Ouaré and Balogo properties, some uncertainty remains with respect to water management for these projects. Additional site-specific assessments are recommended to ensure that the water management aspects of the Project are fully understood, and appropriate surface water and groundwater management strategies are developed and costed.

1.20 Recommendations

1.20.1 Geology and Mineral Resources

Data Management and QAQC

An industry standard SQL database solution is recommended to host the data. Currently, Microsoft Excel sheets are used which are inadequate to securely host the project data and carry risks in terms of data security, verification and document control. CSA Global can advise if required.

QAQC data should be continually collected and assessed during drilling, so that issues can be addressed as they arise. QAQC recommendations are as follows:

- Preparation blanks should be included to monitor potential contamination.
- A high-grade gold CRM should be included with the samples to monitor samples >2.0 ppm Au.
- Ongoing vigilance is required to reduce CRM and blank misidentification.
- The Youga field duplicates should be biased towards mineralised samples.
- Laboratory QC results should be routinely reviewed and captured in the database.
- External check samples (umpires) should be sent to an accredited laboratory. CRMs must be included with these samples.
- Investigation of the poor precision and bias noted in the field duplicate samples to determine whether sampling issues (sample size or non-representative sampling) are factors. Consider analysing pulp duplicates and employing screen fire assays.

Youga and Ouaré Properties

A sound geological and structural model should form the basis of any future MREs, so that faulting and other mineralisation controls are integrated in the model.

Additional dry BD data should be collected routinely during grade control and/or mine production and reviewed to build up a useful BD database of values that can be used to improve the confidence of the tonnage factors for the MRE. The methodology and measurements should be verified and standardised.

The current level of understanding of the Au distribution and geological controls are sufficient for mine planning purposes. CSA Global recommends that instead of additional infill drilling to upgrade Indicated Mineral Resources to Measured Mineral Resources, grade control drilling should be sufficient to delineated blast and dig lines during open cast mining.

The resource is open down dip at A2N Middle, A2N East and Gassore, as well as along strike at Gassore. CSA Global recommends additional drilling for resource delineation with depth to allow Inferred Mineral Resources to be considered for an Indicated Mineral Resources classification level. A drill spacing of about 25 m Z (down dip) is recommended to potentially allow the classification of Indicated Mineral Resources.

Balogo Property

CSA Global recommends the following actions are completed prior to completing MRE updates in the future and to assist with current operations:

- Create a geological model to support and constrain the mineralisation model, to ensure that continuity and grade variability are well understood by correctly interpreting the structural and geological controls on high grades.
- Conduct a grade control program and estimate a grade control model to assist with short term planning.
- Create a set of procedures that allow for accurate end of month reconciliation and compare this with the long-term model.

- Additional BD data should be collected in oxide and transitional material during open pit production and reviewed regularly to build up a useful BD database of values that can be used to determine the tonnage factors for the Netiana deposit. Methodology and measurements should be verified and standardised in the resource model.
- CSA Global recommends that instead of additional infill drilling to upgrade Indicated Mineral Resources to Measured Mineral Resources, grade control drilling should be sufficient to delineate blast and dig lines during open pit mining.

1.20.2 Mineral Reserves

The mill throughput process is dependent on the ore type. This is particularly relevant to the new deposits such as Netiana and Ouaré, as bulk metallurgical tests have not been carried out yet. It is recommended that bulk metallurgical tests are undertaken on the various ore types.

Detailed reconciliation of ore production is required to confirm the modifying factors that should be used for each individual deposit. Currently global factors are used, and this may have an adverse or a beneficial impact on the Reserves. This needs to be established to improve the accuracy of the estimate.

There is a significant amount of Inferred material (approximately 1.5 Mt) within the pit limits for the Ore Reserves and further drilling is required to convert this into a Reserve. The priority is Ouaré where the Inferred Mineral Resource is around 892 kt.

1.20.3 Mining Methods

CSA Global recommends the following:

- To improve the reliability of the mine design criteria, additional geotechnical parameters will have to be collated from exploration drilling and face mapping. These parameters must then be used in a logical methodology to establish stable slope angles.
- CSA Global consider the pit design parameters a reasonable assumption at this stage. However, these parameters should be reviewed prior to mining.
- Considerable care needs to be taken with the blasting to minimise movement and as a consequence the blast design assumes choke blasting with a relatively low powder factor of 0.29 kg/m^3.
- No more than three active pits should be operational at any one time. This is a function of the available equipment and limits on logistics of running multiple pits.
- If possible, a deposit should be mined out before moving to the next one. This allows the pit to be closed and rehabilitation to proceed as the project continues.

1.20.4 Environmental Studies, Permitting and Social or Community Impact

There are some gaps and deficiencies in investigations, impact assessments and mitigation and management measures, which are highlighted below. The most significant gap is the apparent lack of environmental and social work on the haul routes from Ouaré to Youga. This requires urgent work to describe ambient conditions, identify potential impacts and engage with affected communities – together with completion of the Ouaré ESIA – to develop suitable ESMPs prior to start-up of haulage.

Required work to address gaps in the Project environmental and social work include:

- Urgently undertake full ESIA studies on the Ouaré component of the Project, building on the Socrege review. At the time of reporting CSA Global understands that this has been completed by Avesoro. CSA Global has not cited the document.
- Undertake EISA studies on the haul route from Ouaré to Youga, including baseline data collection, stakeholder consultation, impact assessment and mitigations. At the time of reporting CSA Global understands that this has been completed by Avesoro. CSA Global has not cited the document.

- Establish, if not already in place, site meteorological stations at Youga, Ouaré and Balogo (as required)
- Install permanent flow gauges at Project streams and depth rods at ponds/dams
- Undertake more detailed faunal biodiversity studies at Youga to determine the most appropriate measures to avoid and/or offset for Project impacts
- Implement and publicise a formal grievance mechanism for all components of the Projects
- Undertake geochemical testing, including metal leaching tests on ore material and tailings from Youga; representative WRD material and ore from Netiana; and from Ouaré as required
- Define and implement ecological and social monitoring
- Calculate Netiana Mine water requirements and identify supply source
- Develop and disclose an appropriate procedure for evaluating post start-up demands for compensation at Youga (for expanding Project area)
- Assess impacts on- and from- artisanal mining in the Youga, Ouaré and Balogo areas and establish dialogue to reduce environmental impacts and conflicts
- Evaluate potential social impacts from influx of people to the Balogo area and develop measures to alleviate these.
- Increase frequency of surface and groundwater quality and quantity; ecology and biodiversity; and social monitoring at Balogo
- Develop measures for social interventions and community preparation for closure in the Netiana Rehabilitation and Closure Plan (RCP).

1.20.5 Hydrology

Additional studies are recommended to improve the level of understanding relating to the hydrology and hydrogeology at Youga and Balogo. This additional information would also increase the confidence with regards predictions for mine water management at Youga and Balogo.

More specifically, CSA Global recommends the following:

- An integrated surface water management plan should be developed for the Youga mine site to optimise surface water management systems, minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.
- Operational groundwater management strategies for the entire Youga mine site should be reviewed and where possible integrated to optimise water use and management across the mine.
- A surface water management plan should be developed for the proposed Ouaré and Balogo mine sites to minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.

2 Introduction

2.1 Terms of Reference

Avesoro Resources Inc. (Avesoro), through its wholly-owned subsidiaries relating to the Youga and Ouaré properties, Burkina Mining Company S.A. (BMC) and Balogo Mine, Netiana Mining Company (NMC) engaged CSA Global (UK) Ltd (CSA Global) to assist them with evaluating the Youga, Ouaré and Balogo properties of the Youga Gold Mine, referred to herein as the "Project" and to complete the required technical evaluations, verification and review works to facilitate disclosure of an update to the Mineral Resource and Mineral Reserve inventory for the Project, and to complete an update to the LOM schedule and financial model. The Project comprises multiple properties that are to be developed together.

All technical works have been undertaken under the guidelines of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council and disclosed within the context of the Canadian Securities Administrators National Instrument 43-101 (NI 43-101).

The Project include a significant number of properties and near-mine satellite prospects which have been the subject of various levels of exploration activity ranging from early-stage evaluation (surface works and defined anomalies), advanced exploration (drilling), resource development and mining.

Previous operator/owners of the Balogo Project include Golden Rim Resources Ltd (GMR), between 2010 and 2015 and MNG Gold Burkina Sarl (MNG) between 2015 until 2017.

2.2 Disclaimers

2.2.1 Independence

Neither CSA Global, nor the authors of this report, have any material present or contingent interest in the outcome of this report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence in the preparation of this report. The report has been prepared in return for professional fees based upon agreed commercial rates and the payment of these fees is in no way contingent on the results of this report. No member or employee of CSA Global is, or is intended to be, a director, officer or other direct employee of Avesoro. No member or employee of CSA Global has, or has had, any shareholding in Avesoro. There is no formal agreement between CSA Global and Avesoro as to CSA Global providing further work for Avesoro.

2.2.2 Notice to Third Parties

CSA Global has prepared this report having regard to the particular needs and interests of our client, and in accordance with their instructions and in compliance with NI 43-101 Technical Reporting. This report is not designed for any other person's particular needs or interests. Third party needs and interests may be distinctly different to Avesoro's needs and interests, and the report may not be sufficient, fit or appropriate for the purpose of the third party, other than its prescription in relating to NI 43-101.

2.2.3 Results are Estimates and Subject to Change

The ability of any person to achieve forward-looking production and economic targets is dependent on numerous factors that are beyond CSA Global's control and that CSA Global cannot anticipate. These factors include, but are not limited to, site-specific mining and geological conditions, management and personnel capabilities, availability of funding to properly operate and capitalise the operation, variations in cost elements and market conditions, developing and operating the mine in an efficient manner, unforeseen changes in legislation and new industry developments. Any of these factors may substantially alter the performance of any mining operation.

2.2.4 Element of Risk

The interpretations and conclusions reached in this report are based on current geological theory and the best evidence available to the author at the time of writing. It is the nature of all scientific conclusions that they are founded on an assessment of probabilities and, however high these probabilities might be, they make no claim for absolute certainty. Any economic decisions which might be taken on the basis of interpretations or conclusions contained in this report will therefore carry an element of risk.

2.3 Sources of Information

Sources of information, data and reports reviewed as part of this study can be found in Section 27 (References) of this Technical Report. The relevant Qualified Persons take responsibility for the content of their sections and believe the data review to be accurate and complete in all material aspects.

Licence and tenure documents, exploration data, resource development data, mining data, reconciliation information and cost/financial information requested by CSA Global were provided via a secure CSA Global-Avesoro dataroom set up in February 2018 for the purposes of data transfer.

Exploration, drill, sampling, assay and quality assurance/quality control (QAQC) data was loaded to a structured query language (SQL) database and validated by David Muir (Data Management Geologist – CSA Global) prior to evaluation and estimation of the Mineral Resources and Reserves.

2.4 Site Inspections

2.4.1 Overview

CSA Global visited the Youga and Balogo properties from 19 to 22 April 2018. This visit was completed for the purposes of site inspection, ground truthing, review of activities, procedural review and information data collection and collation and to satisfy NI 43-101 "personal inspection" requirements. Mining operations are current at the A2NE Middle and Gassore deposits (Youga) and Netiana deposit (Balogo).

Dr Belinda van Lente and Dr Matthew Randall carried out the site inspections on behalf of CSA Global.

2.4.2 Geology – Belinda van Lente

The following items were inspected, and conclusions made from the site visit:

Youga Property

- Local company geologists associated with the project are familiar with the geology, deposit type and mineralisation within the tenements.
- The Youga property is located approximately 180 km southeast of the capital city Ouagadougou, adjacent to the Ghanaian border. Access to the property is good, with the Youga deposits located close to power, water and road infrastructure. Several unsealed roads are present and can be readily negotiated by vehicle.
- CSA Global verified the locations of seven drillholes with visual inspection and by handheld global positioning system (GPS). These drillholes are primarily located within and between the A2NE Middle and Gassore deposits. The collar locations as recorded in the database compare well to the CSA Global GPS readings.
- Drilling, drill core cutting, sampling and logging procedures were reviewed and witnessed, and found to be suited to the deposit type and style of mineralisation.

- Density determination is by the water immersion method. The procedure for density measurement was reviewed and is considered acceptable.
- Drill core and sample storage and security is considered good.
- The mineralisation at the Youga property contains elevated gold grades within several identified deposit areas, over reasonable strike lengths. The extent of the mineral distribution and continuity is currently being tested by exploration drilling.
- Mineralisation shows good continuity within well-defined geological constraints. Drillholes are located at a nominal spacing of 20 m on 20 m sections extending out to 40 m. The drill spacing is sufficient to allow the geology and mineralisation zones to be modelled into coherent wireframes for each domain.
- Drill core from the 2017 drilling campaign at Gassore was inspected for five drillholes, GASS-17-001, GASS-17-067, GASS-17-068, GASS-17-070 and GASS-17-072. Arkosic sandstones consisting of quartz and feldspar was inspected, with detrital magnetite lamination. Thin chlorite schists intercalate the arkoses. Alteration observed comprise of chlorite, carbonate, silica, sericite and haematite. Strong silicification is associated with zones of quartz veining, fracturing, sulphide development and gold mineralisation. Generally, the sulphide content is low, comprising predominantly of pyrite.
- A single mineralised intersect within each of the five inspected drillholes, averaging 2 m to 3 m downhole and grading >3 g/t Au, were observed. This mineralisation is associated with intensely silicified arkose with abundant quartz veins and more diverse sulphides.
- The A2NE Middle and Gassore deposits consist of several steeply, north dipping zones along an east-west trend. These zones were observed in the pit walls of A2NE.
- The geology consisting of mainly arkosic sandstones and chlorite schists was inspected within freshly dug rip lines for grade control within the A2NE Middle and Gassore deposit pits.

Balogo Property

- Local company geologists associated with the project are familiar with the geology, deposit type and mineralisation within the tenements.
- The Balogo property is located approximately 100 km south of the capital city Ouagadougou, and about 22 km from the Nazinon River. Access to the property from Ouagadougou is via sealed roads until after the town of Pô, 50 km from the property. Several unsealed roads are present and can be readily negotiated by vehicle.
- CSA Global verified the locations of four drillholes (BDH106, BDH112, BDH113 and BDH261) with visual inspection and by handheld GPS. It was not possible to view the collars of any other exploration drillholes associated with the Balogo Mineral Resource estimate (MRE), due to mining activities. The collar locations as recorded in the database compare well to the CSA Global GPS readings.
- Drilling, drill core cutting, sampling and logging procedures were reviewed, and found to be suited to the deposit type and style of mineralisation.
- Drill core storage and security is considered good.
- The mineralisation at the property contains elevated gold grades over reasonable strike lengths. The extend of the mineral distribution and continuity is currently being tested by exploration drilling.
- Mineralisation shows good continuity within well-defined geological constraints. Drillholes are located at a nominal spacing of 10 m on 10 m sections extending out to 20 m. The drill spacing is sufficient to allow the geology and mineralisation zones to be modelled into coherent wireframes for each domain.
- Drill core from the 2016/2017 drilling campaign at Netiana was inspected for three drillholes (BDH-091, BDH-093 and BDH-188). The inspected drill core contained examples of the host geology,

consisting of talc chlorite/quartz sericite schists and quartzites. These are intruded by diorite, dykes and late-stage felsic porphyries/granites. Most of the mineralisation occurs near the contact between the metasediments and dioritic rocks. Gold mineralisation is typically associated with networks of quartz mineralisation or associated with disseminated sulphides within strongly deformed alteration zones.

- High-grade mineralised intersects (with visible gold) within each of the three inspected drillholes were observed. These were:
  - BDH-091: 298.50 m to 302.60 m (weighted average 171.21 g/t Au)
  - BDH-093: 252.00 m to 256.50 m (weighted average 209.96 g/t Au)
  - BDH-188: 257.90 m to 260.60 m (weighted average 267.86 g/t Au).
- The Netiana deposit consist of several steeply northwest-dipping zones along a northeast trend. These zones were observed in the pit floor and walls of Netiana.
- The geology consisting of mainly talc chlorite/quartz sericite schists and quartzites was inspected within the freshly dug pit floor within the Netiana pit.

CSA Recommendations

The following risks were noted during the visit, and recommendations made:

Youga property:

- Grade control is currently through rip line sampling and logging. Through discussions with Avesoro personnel, it is understood that grade control drilling by reverse circulation (RC) is due to start within the next three months. Once in place, it is recommended that a study be made comparing the grade control and resource definition sampling methods from both the A2NE Middle and Gassore deposits, to see if grade control samples can be used in the grade interpolation.
- Avesoro use quantile-quantile plots and "Half Absolute Relative Difference" (HARD) plots to monitor the performance of the field duplicates against the original sample.
- Avesoro survey the locations of artisanal mine shafts and attempt to get depth measurements, from which they may be able to construct a model of underground voids. There is a degree of risk in both location of, and extent of underground voids.

Balogo property:

- The Project campsite, offices and core yard are well laid out. However, core trays are not stored within a building, but are stacked outside within the core yard, covered by plastic sheets. NMC should commit time and funds to the refurbishment of the Balogo core storage facility, or relocation of core trays to a more suitable location, to preserve the geological information stored in the drill core.
- NMC use QQ plots and "Half Absolute Relative Difference" (HARD) plots to monitor the performance of the field duplicates against the original sample.
- NMC survey the locations of artisanal mine shafts and attempt to get depth measurements, from which they may be able to construct a model of underground voids. There is a degree of risk in both location of, and extent of underground voids.

Figure 2-1: Artisanal mine shafts at Netiana, Balogo Project (Dr Matthew Randall looking on)

Source: CSA Global, 2017

2.4.3 Mining – Matthew Randall

The objectives of the visit were to:

- Inspect the mine sites
- Inspect the maintenance facilities
- Inspect the tailings management facility
- Review the pit designs
- Review the blasting practices
- Review the grade control practices
- Review all available technical studies.

Youga Property

The operation at Youga is well run and is generally achieving its production targets having achieved a total production (Youga and Balogo) during 2017 of 9.5 million tonnes (Mt). However, production from Youga tailed off in the latter part of 2017 and into January and February 2018 but has improved in the last three months to around 1,000 tonnes per hour (t/h). The mining rate needs to be increased 1,350 t/h to achieve the target total material movement for the Youga pits of 8.9 Mt for the period April to December 2018.

The ability to meet the production targets will be dependent on a number of factors:

- Controlling mining recovery and waste dilution.
- Focus on maintenance to maintain high utilisation of equipment
- Matching the truck fleet to the variable haul requirements
- Blending to grade and to rock type (fresh, transition and oxide)
- Continued development of new deposits such A2N Mid and Gassore
- Redevelopment of WP2, WP3, WP4, Zergoré, NTV, East and Main in the longer term.

There is potential to continue to expand the existing Mineral Reserves as a result of the ongoing exploration program. This is focused on expansion of existing pits and development of new pits.

There is the potential to assist Avesoro with several operational aspects, such as:

- Improved cost modelling, particularly the mine
- Haul route studies to refine the inputs to the models
- Advice on fleet management to improve accountability
- Reconciliation studies to refine the modifying factors
- Assistance with optimisation, design and evaluation of the new pits
- Design and evaluation of the underground options.

Balogo Property

Observations from the site visit included:

- Development of Netiana commenced in March 2017 and has progressed well with the development of the high-grade starter pit. Stripping has commenced on the stage 2 pit in preparation to expose ore before the starter pit is depleted.
- So far, the mined ore grade has significantly exceeded the budget plan, which highlights the issues of grade estimation where there is a string nugget effect.
- The total rock movement for Netiana was 3.9 Mt in 2017 which equates to a mining rate of 600 t/h. This rate has dropped off in the first quarter of 2018 to around 400 t/h, mainly due to the constricted nature of the starter pit. A planned rate of 650 t/h needs to be achieved in the future to meet the plan. Failure to do this will significantly reduce the gold production forecast due to the very high grade of this deposit and the reliance on maintaining the blend with lower-grade ore from stockpile reclaim and mine production from the Youga pits.
- The Netiana ore appears to contain a much higher proportion of free gold and the gravity circuit at Youga may need to be expanded. The high-grade zones also appear to be clay-like and may pose material handling issues.
- The subvertical nature of the Netiana deposit results in a high stripping ratio (48:1), which means that the positioning of the ramp system will be critical to the design. It will also necessitate diligent production staging due to high vertical sinking rates to achieve schedules.
- A higher cut-off grade is required at Balogo since the ore must be transported by road over a distance of around 154 km. The cost of transporting the ore to the Youga plant is US$13.9/t.
- Hauling on public roads, including passing through at least five villages between Balogo and Pô, will pose a significant safety hazard to the locals. However, there is a police escort at the front of the convoy followed by a safety truck. A further safety truck also follows at the rear of the convoy. There is likely to be opposition to hauling through the night and hence restricting haulage to daylight hours seems reasonable.

3 Reliance on Other Experts

CSA Global is relying on information provided by Avesoro and its in-country subsidiaries; BMC and NMC, concerning legal, political, environmental, or tax matters relating to the Youga, Ouaré and Balogo properties. CSA Global has been provided scans of tenement/permit documents however CSA Global has not independently verified the status of, nor legal titles relating to, the mineral concessions.

CSA Global has also not independently verified nor undertaken any due diligence regarding the legal and tax aspects relating to the joint venture agreements pertaining to the Youga, Ouaré or Balogo properties.

In addition to this; no warranty or guarantee, be it express or implied, is made by CSA Global or the author(s) with respect to the completeness or accuracy of the legal aspects of the Youga, Ouaré and Balogo properties. Neither CSA Global nor the author(s) accept any responsibility or liability in any way whatsoever to any person or entity in respect to these parts of this document, or any errors in or omissions from it, whether arising from negligence or any other basis in law whatsoever.

4 Property Description and Location

4.1 Property Location and Description

The Youga and Ouaré properties are all situated in the province of Boulgou, Burkina Faso, West Africa, approximately 180 km southeast of the capital city Ouagadougou (Figure 4-1), adjacent the Ghanaian border. The licences are separated by the Nakambé River.

The Balogo property currently comprises two contiguous Exploration Permits (Balogo and Dabinyan III) for a total area of 360 km^2 (250.5 km^2 for Balogo and 109.5 km^2 for Dabinyan III). These permits are located in the Centre-Sud region of Burkina Faso, approximately 100 km south of the capital, Ouagadougou, and about 22 km from the Nazinon River (Figure 4-1).

Between Ouagadougou and Pô, a good sealed road (N5) is used (about 120 km). After Pô, an unsealed road (about 50 km) is used to reach the Project area. The Kabore Tambi National Park separates Balogo from the Nazinon River.

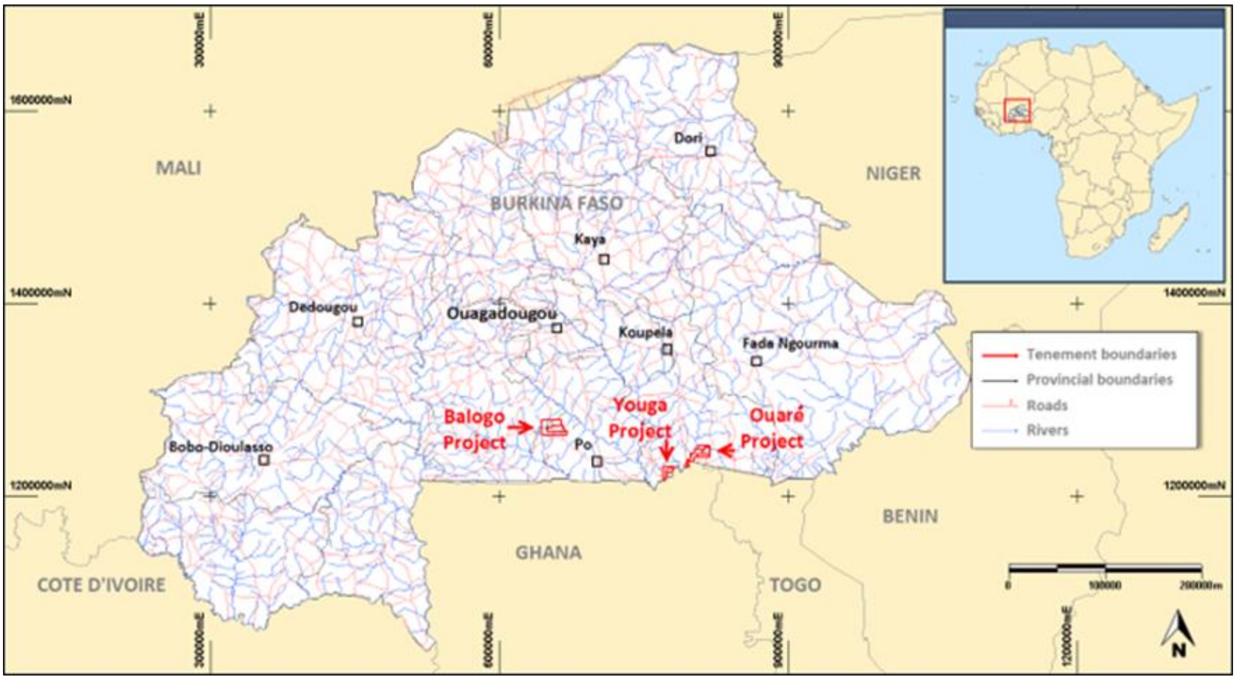


Figure 4-1: Location map – Youga, Ouaré and Balogo properties, Burkina Faso, West Africa

4.2 Mineral Tenure and Surface Rights

4.2.1 Youga and Ouaré Properties

The Youga property consists of one Exploitation Permit (Youga), and two Exploration Permits (Songo and Zerbogo II). The Ouaré property is comprised of two Exploration Permits (Bitou 2 and Bitou Est), all situated in the province of Boulgou, Burkina Faso, West Africa, approximately 180 km southeast of the capital city, Ouagadougou (Figure 4-1), adjacent the Ghanaian border.

The Youga Exploitation Permit covers an area of 29 km^2 and was granted to BMC by Decree no. 2003-186\PRES\PM\MCE on 8 April 2003 and is valid for 20 years with five-year renewal periods. See Figure 4-2 and details are tabulated in Table 4-1, Table 4-2 and Table 4-3.

An Exploitation Permit for Ouaré is currently not granted. However, BMC has reported that there is no known impediment to the issuing of an Exploitation Permit for the Ouaré resource area should BMC apply.

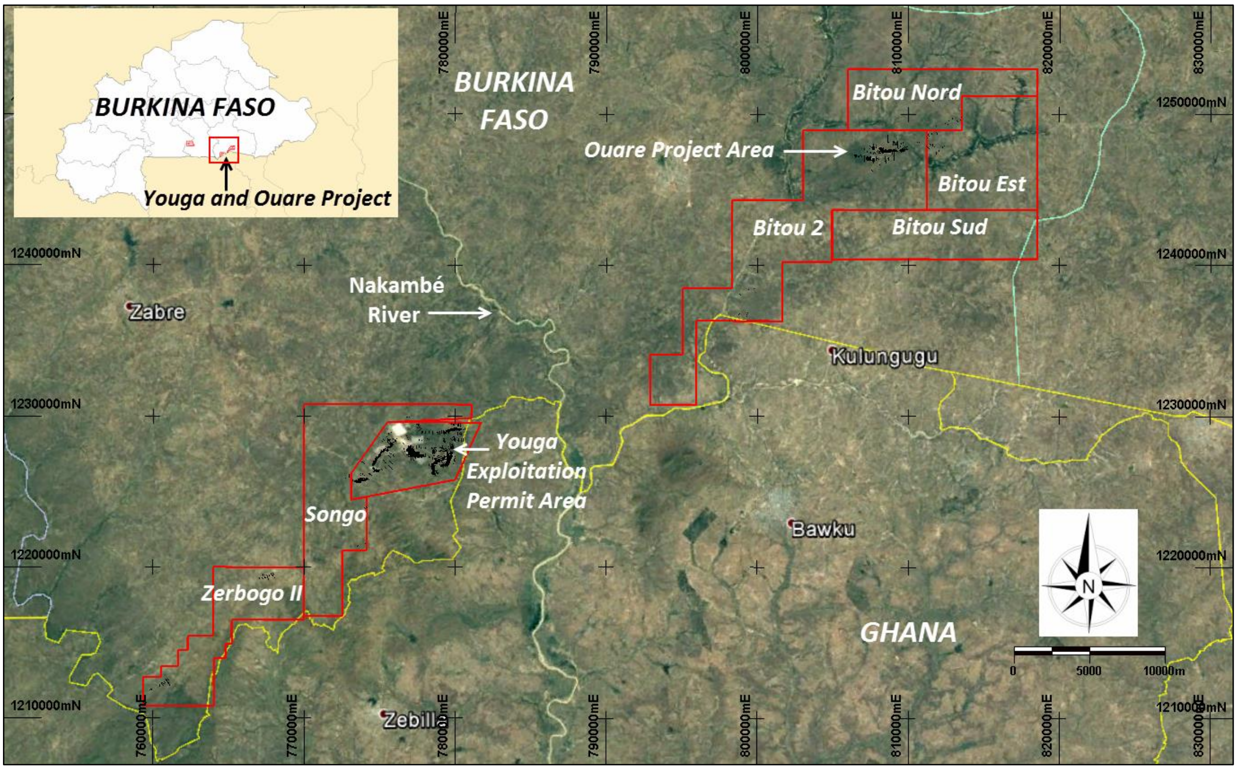


Figure 4-2: Youga and Ouaré tenement corners (note that Bitou Nord and Bitou Sud are the subject of pending permitting)

Source: CSA Global, 2017

Table 4-1: Youga and Ouaré licence details

Name	km²	Licence ID	Status	Type	Date granted	Expiry date	Holder
Zerbogo II	39	BFZERB	Active	Exploration	09/06/2009	09/06/2018 (renewal pending)	ERBE
Songo	58	BFSONG	Active	Exploration	09/06/2009	09/06/2018 (renewal pending)	ERBE
Bitou Est	34	BFBE	Active	Exploration	07/04/2009	07/04/2018 (renewal pending)	ERBE
Bitou 2	101	BFBIT	Active	Exploration	21/11/2006	21/11/2018	ERBF
Youga	29	Youga	Active	Exploitation	08/04/2003	08/04/2023	BMC

Table 4-2: Exploitation permit details: Youga (WGS1984, UTM Zone 30N)

Licence	Corner	Easting	Northing
Youga	A	779981	1225995
	B	773114	1224676
	C	773114	1226429
	D	775485	1229792
	E	781709	1229792

Table 4-3: Exploration permit details: Youga and Ouaré (WGS1984, UTM Zone 30N)

Licence	Corner	Easting	Northing
Songo	A	769980	1216956
	B	769980	1230981
	C	781061	1230981
	D	781061	1230076
	E	775485	1229792
	F	773114	1226428
	G	773114	1224676
	H	774133	1224848
	I	774133	1221306
	J	772513	1221306
	K	772513	1216956
Zerbogo II	A	762300	1215656
	B	763980	1215656
	C	763980	1220211
	D	769980	1220211
	E	769980	1216712
	F	765211	1216712
	G	765211	1215106
	H	764801	1215106
	I	764801	1214186
	J	764026	1214186
	K	764026	1211008
	L	759350	1211008
	M	759350	1212950
	N	760550	1212950
	O	760550	1213650
	P	761650	1213650
	Q	761650	1214700
	R	762300	1214700

Licence	Corner	Easting	Northing
Bitou 2	A	811200	1248945
	B	811200	1243672
	C	804913	1243672
	D	804913	1240211
	E	801664	1240211
	F	801664	1236312
	G	795959	1236312
	H	795959	1230748
	I	792891	1230748
	J	792891	1234100
	K	795074	1234100
	L	795074	1238472
	M	798316	1238472
	N	798316	1244313
	O	803025	1244313
	P	803025	1248945
Bitou Sud (pending)	A	804973	1243248
	B	818543	1243248
	C	818543	1239988
	D	804973	1239988
Bitou Nord (pending)	A	806001	1252588
	B	818543	1252588
	C	818543	1250788
	D	813520	1250788
	E	813520	1248521
	F	806001	1248521
Bitou Est	A	811200	1248945
	B	813520	1248945
	C	813520	1251212
	D	816385	1251212
	E	816385	1243672
	F	811200	1243672

4.2.2 Balogo Property

The Balogo property is covered by two contiguous Exploration Permits (Balogo and Dabinyan III) held by MNG Gold Burkina and an Exploitation Licence held by NMC (see Figure 4-3). Details are tabulated in Table 4-4 and licence coordinates in Table 4-5 and Table 4-6. The Balogo licence expired in May 2018 and a renewal application has been submitted to the Ministry by Avesoro and a response is currently awaited at the time of reporting.

Table 4-4: Balogo licence details

Company	Licence name	Licence status	Licence type	km²	Date granted	Expiry date
MNG Gold Burkina	Balogo	Active	Exploration	249	13/05/2015	13/05/2018
MNG Gold Burkina	Dabinyan III	Active	Exploration	109	18/02/2015	18/02/2019
Netiana Mining Company	Netiana	Active	Exploitation	2	23/01/2017	23/01/2021

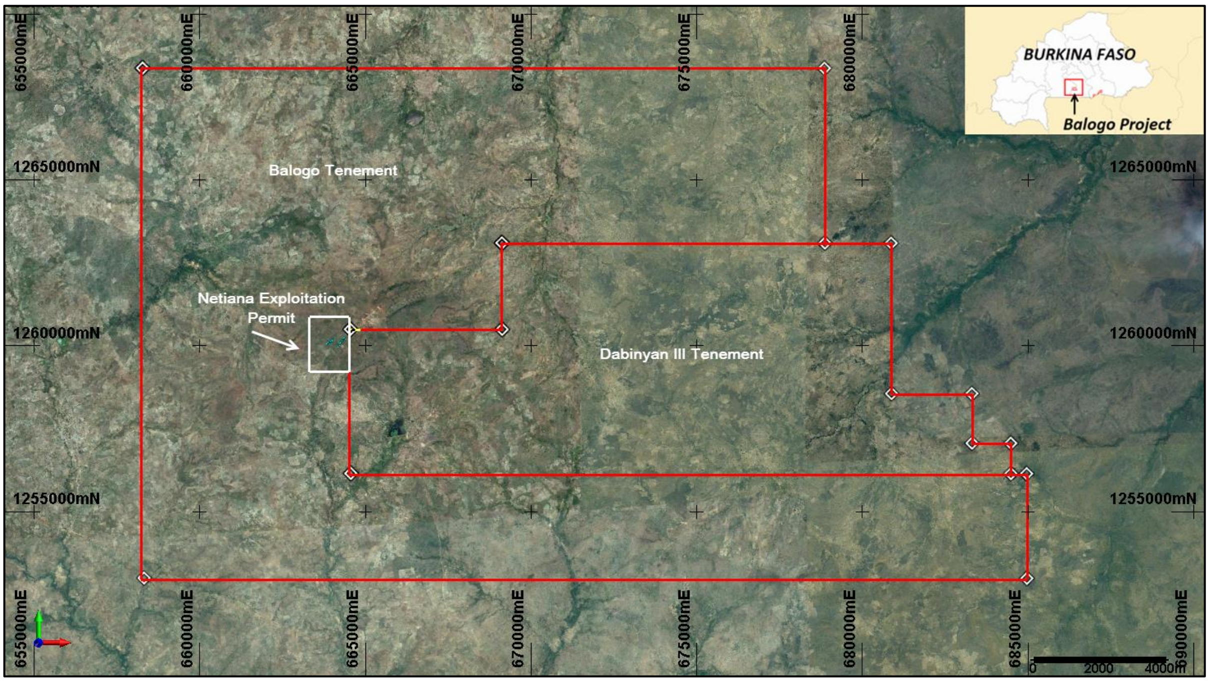


Figure 4-3: Balogo and Dabinyan III tenement corners (WGS1984, UTM Zone 30N)

Source: CSA Global, 2017

Table 4-5: Balogo and Dabinyan III exploration permit details (WGS1984, UTM Zone 30N)

Licence	Corner	Easting	Northing
Balogo	1	658239	1268365
Balogo	2	678882	1268365
Balogo	3	678882	1263080
Balogo	4	669106	1263080
Balogo	5	669106	1260468
Balogo	6	664513	1260468
Balogo	7	664513	1256112
Balogo	8	684970	1256112
Balogo	9	684970	1252946
Balogo	10	658239	1252946

Licence	Corner	Easting	Northing
Dabinyan III	1	669106	1263080
Dabinyan III	2	680887	1263080
Dabinyan III	3	680887	1258532
Dabinyan III	4	683319	1258532
Dabinyan III	5	683319	1257032
Dabinyan III	6	684494	1257032
Dabinyan III	7	684494	1256112
Dabinyan III	8	664513	1256112
Dabinyan III	9	664513	1260468
Dabinyan III	10	669106	1260468

Table 4-6: Exploitation permit details: Netiana (WGS1984, UTM Zone 30N)

Licence	Corner	Easting	Northing
Netiana	1	663313	1260871
Netiana	2	664513	1260871
Netiana	3	664513	1259209
Netiana	4	663313	1259209

4.3 Datum and Projection

All resource and exploration data are projected in WGS1984, Universal Mercator Project (UTM) Zone 30 North.

4.4 Royalties

At present the Burkina Faso government gross revenue royalty for gold projects is 4%.

The government of Burkina Faso would receive a 10% free-carried interest in any operating company created to exploit the Ouaré deposit. The proceeds of production would be subject to a net smelter return

(NSR) royalty of 3% if the price of gold is less than US$1,000/ounce (oz), 4% if the price of gold is between US$1,000 and US$1,300/oz, and 5% if the price of gold is more than US$1,300/oz. This royalty is levied by the government of Burkina Faso and is payable within 60 days from the date of signing the weighing and packing statement.

To make an application for an Exploitation Permit for the Ouaré gold deposit, both a Feasibility Study (FS) and an environmental impact assessment, or a statement, are required.

Section 78 of the Mining Code of Burkina Faso provides that a mining permit holder must open a trust account at the Central Bank of West African State (BCEAO) or in a commercial bank in Burkina Faso, to deposit funds to implement the environmental preservation and rehabilitation program the permit holder has adopted. The account is in the name of the permit holder, but the funds are held in trust and all withdrawals are subject to prior approval by the Minister of Economy and Finance of Burkina Faso. BMC has opened such an account and has been funding it on a yearly basis in accordance with the legislation.

In addition, a 1.8% (minus withholding tax of 6.25%) NSR is payable to Endeavour Mining Corporation (Endeavour) on revenues derived from mining at Youga and Ouaré, on a quarterly basis. Avesoro has the right to a buyback option and may exercise this right at an applicable price.

CSA Global is not aware of any other back-in rights, payments, or other agreements and encumbrances to which the Youga, Ouaré and Balogo properties are subject.

4.5 Permitting

Exploration Permits in Burkina Faso are applied for using “paper-staking”, providing the latitude and longitude of the vertices of the individual permits to the Ministry of Mines for approval. The Ministry includes the property coordinates in the granted approval. Mineral title regulations in Burkina Faso provide for a renewal of all Exploration Permits after three years and a second renewal after an additional three years, at which time a 25% reduction in the size of the property is required.

Application for an Exploitation Permit requires that:

- The Exploration Permits involved are in good standing
- A FS has been submitted, containing development and exploitation plans for the deposit
- An environmental impact assessment or a statement that includes the results of public enquiry has been submitted, outlining the negative and positive impacts of development, and including a plan for remedial or mitigating actions and an environmental monitoring plan.

Exploitation Permits for large mines are issued for 20 years and are valid as of the date of the decree. They are renewable by right of law for additional terms of five consecutive years until depletion of the deposit. Unless otherwise authorised, the holder of an Exploitation Permit must commence development and production work within a maximum period of two years, starting from the first day of validity of the permit.

During the validity of an Exploration Permit, its holder also has the right to apply for an Industrial Operating Permit if, in conducting exploration activities, the holder has outlined a mineable reserve in compliance with the mining code. Industrial Operating Permits (Permis d’exploitation industrielle) are granted by the Council of Ministers on the proposal from the Minister of Mines, following the opinion of the Minister of the Environment and the National Commission on Mines. These are granted to holders of Exploration Permits who are in compliance with the Mining Code and have submitted an application at least three months before the expiry of the validity period of the Exploration Permit. Applications must include a FS and a mining and development plan, noting any environmental impacts with associated attenuation and monitoring plans. Any change to the FS, ore deposit development, and production plan during the life of the permit must be approved by the Mining Administration and the National Mining Commission.

4.6 Liabilities

4.6.1 Youga and Ouaré Properties

BMC currently has all required permits for exploitation of the current Mineral Resources and Mineral Reserves of the Youga Gold Mine; however, require an Exploitation Licence for Reserves at Ouaré to be mined. The application for an Exploitation Licence around Ouaré is reported by BMC as in progress, and BMC report that there are no known reasons for this licence to not be granted.

The Environmental and Social Impact Assessment (ESIA) submission for the original Youga Project was obviously sufficient for National Burkina Faso requirements as the Youga operation received environmental permitting and exploitation mining licence and has been active for over 10 years. While this review cannot comment on operational environmental and social performance, given that no operational or monitoring reports have been seen, the current condition and status of the Youga site; apparent lack of environmental penalties or social conflict; and proposed continuation of activities imply that there have not been any significant non-compliance or grievance issues.

The most notable environmental/social liabilities are in respect to areas where the potential impacts have not yet been adequately assessed, namely the potential geochemical-, artisanal mining- and immigration risks; from insufficient monitoring plans; and from underestimated compensation, closure and social costs.

A portion of the Bitou 2 Exploration Permit, which holds the Ouaré gold deposit, is located within a pastoral reserve which has been set aside for the use of indigenous nomads (Fulany people).

4.6.2 Balogo Property

Baseline studies for the Balogo property are detailed and the Environmental Permit was granted in September 2016 following submission and approval of the Project ESIA and Resettlement Action Plan (RAP), both conducted by Société de Conseil et de Réalisation pour la Gestion de l'Environnement (Socrege). The ESIA Report is a comprehensive study of the baseline conditions at the site, identification and assessment of potential Project impacts, and proposed mitigations to address these. The ESIA also includes risk analysis, an Environmental and Social Management Plan (ESMP) and a preliminary Rehabilitation and Closure Plan (RCP). CSA Global undertook an environmental and social review as a part of this technical study and further comment is provided in Section 20.

The most notable environmental/social liabilities are in respect to areas where the potential impacts have not yet been adequately assessed, namely the potential geochemical-, artisanal mining- and in-migration risks; from insufficient monitoring plans; and from underestimated compensation, closure and social costs. Also, while hydrological and hydrogeological assessments have been completed for the FS, CSA Global believes that significant uncertainty remains with respect to water management for the Balogo property.

5 Accessibility, Climate, Local Resources, Infrastructure and Physiography

5.1 Accessibility

The Youga, Ouaré and Balogo properties are in southern Burkina Faso, in the "Centre-Sud" region. Road links to Ouagadougou are good for most the distance (Figure 5-1).

Youga is approximately 190 km from Ouagadougou by road and a journey time of 3.5 hours via the paved N5 highway south towards Pô for 70 km, then southeast for 23 km on the paved road N17 reaching Manga, then continuing in the same direction for approximately 100 km via Zabré on a well-maintained gravel road.

A network of bush roads provides vehicle access within the Youga Exploitation Permit and surrounding Exploration Permits during the dry season. Portions of the properties are not easily accessible during the wet season due to the inundation of the roads and a lack of bridges over seasonal water courses.

The Ouaré exploration camp is approximately 280 km from Ouagadougou by road and a journey time of approximately three hours via the paved N4 highway east to Koupela (150 km), then south for 130 km on the paved N16, continuing through Bittou village (Figure 5-1) followed by 11 km east on a poorly-maintained gravel road with two undeveloped river crossings that cannot currently be traversed during periods of heavy rain.

Access to Balogo is via sealed highway (N5) from Ouagadougou to Pô (approximately 120 km), then via unsealed road (R15) to the Project area (approximately 50 km). The Project area is accessible throughout the year on all-weather sealed and laterite roads (MNG, 2016)

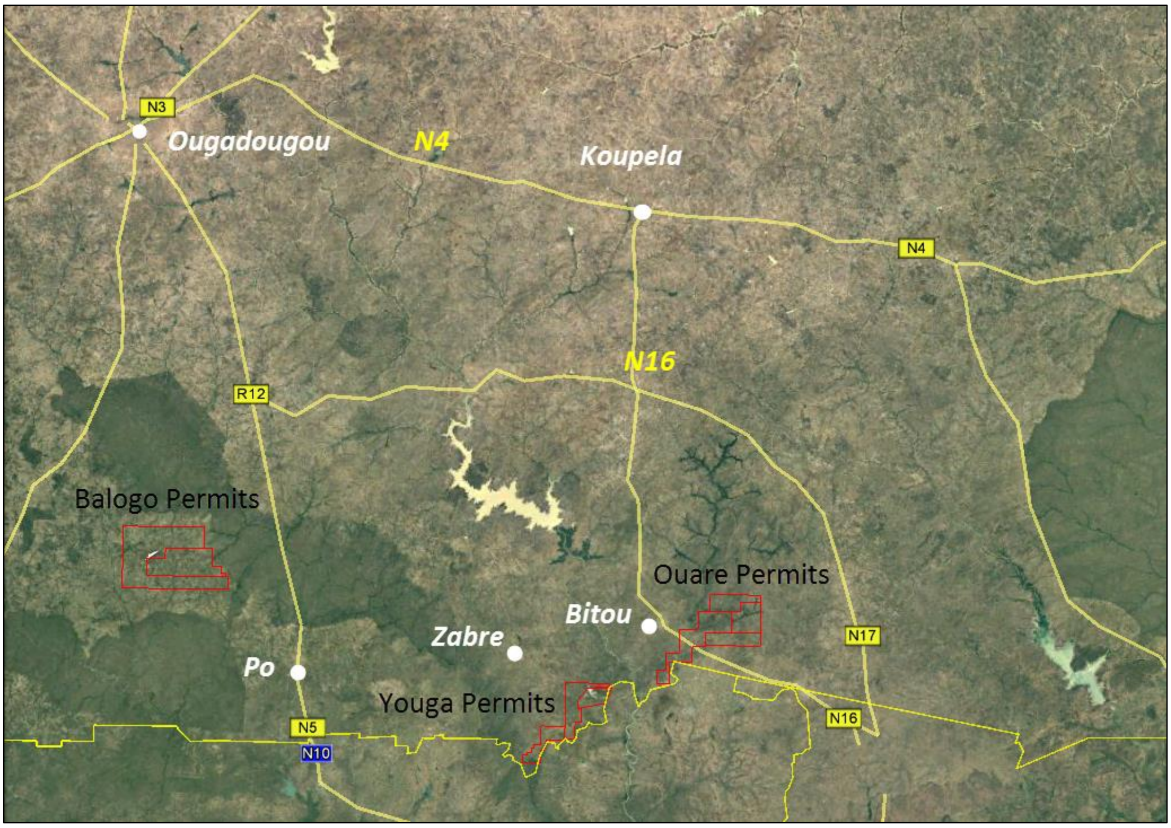
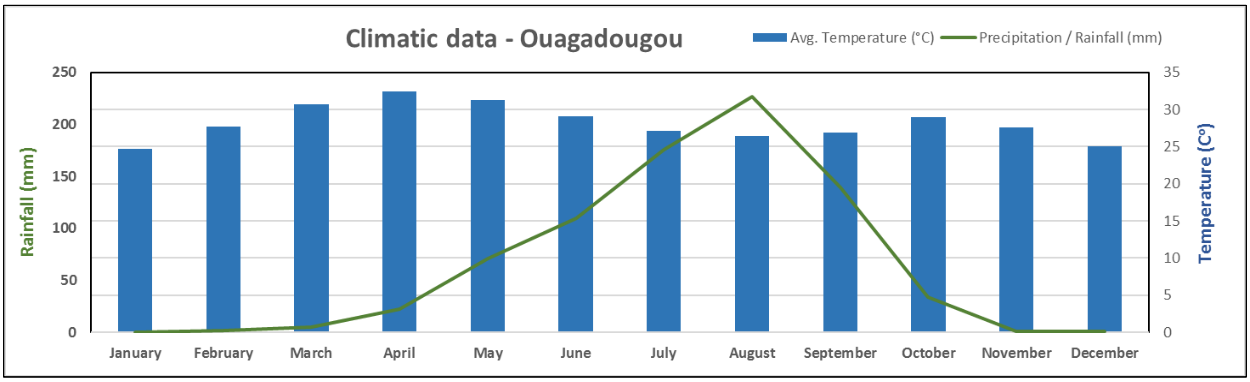


Figure 5-1: Road access to Youga, Ouaré and Balogo permits (Avesoro, 2017. N at the top)

5.2 Climate

The Youga, Ouaré and Balogo property areas are located within the Sudanese climatic type of southern Burkina Faso but influenced by the south Sudano-Sahelian zone, where annual evaporation exceeds rainfall. The wet season runs from May to October, bringing around 900 mm rainfall on south and south-westerly winds, while the dry season from November to March is associated with dusty north and northeast "Harmattan" winds. Annual evaporation is around 2,870 mm. Highest temperatures occur at the end of the dry season with mean monthly maxima exceeding 39°C (Figure 5-2).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average temperature (°C)	24.7	27.7	30.7	32.4	31.3	29.1	27.1	26.4	26.9	29	27.6	25.1
Rainfall (mm)	0	2	5	22	71	110	176	227	139	34	1	1

Figure 5-2: Climatic data for Ouagadougou, 190 km north from Youga and 100 km north of Balogo

Source: https://en.climate-data.org

No meteorological station or rain gauge is currently in operation at the Youga site. Data from four meteorological stations proximal to the Youga site was used to extrapolate the likely pattern of on-site rainfall. Seasonal rainfall patterns for three of the four meteorological stations are provided in Table 5-1. Seasonal rainfall data from the Gon-Boussougou rainfall station was not presented.

Table 5-1: Seasonal rainfall patterns (mm) proximal to the Youga mine site

Station name	AAR	AAR	AAR	AAR	AAR
	Pre-wet season	Wet season	Post-wet season	Dry season	Total
Pô	31.8	859.7	21.6	16.8	929.9
Tiébélé	34.2	879.4	11.4	22.1	947.1
Zabré	11.1	854.5	16.1	11.2	892.9

Based upon best available meteorological data, the rainy (humid) season lasts for approximately 170 days, with 80% of annual rainfall occurring during this period. Yearly rainfall at the Youga site is estimated at approximately 900 mm from 1961 to 1998, with an average 60 days of rain.

Average annual potential evapo-transpiration from 1988 to 1991 significantly exceeds rainfall reported as 1,858 mm.

Air temperature and relative humidity at the Youga site were estimated based upon data from the Pô synoptic station. Over the period 1978 to 1997, mean annual minimum and maximum temperatures were 21.9°C and 34.3°C, respectively. Over the period 1983 to 1998, mean annual minimum and maximum humidity ranged from 35% to 68%, with lowest values recorded in January, February and March.

5.3 Physiography

The Youga mine site is located within the catchment area of the Nakambé River. There are two main rivers in the vicinity of the Youga mine site; the Zéra River and the Gossé Stream.

The Zéra River flows across the mine area from south to north, then from west to east. Several small tributaries, draining the northern and southern parts of the mine area, flow into the Zéra before joining the Nakambé in Ghana. The Gossé Stream is about 5 km long and joins the Zéra downstream of the mine area. With the exception of the Gossé Stream, which is spring-fed, all of the surface water bodies in the vicinity of the Youga mine site are ephemeral. The area is typified by undulating terrain with several ranges of moderately sloped hills that rise about 100 m above the surrounding land.

Surface water at the Balogo mine site is largely ephemeral and rain-fed groundwater fluctuates seasonally, giving rise to water supply issues for people, livestock and wildlife.

These parts of Burkina Faso are entirely rural with savannah woodland cover but with rapidly expanding agricultural cultivation and pastoralist activities, as well as artisanal mining and felling for firewood and charcoal, causing significant deforestation. On areas of transported black soil or alluvial flats, crops such as maize, millet, sesame, cotton and sorghum are grown.

There is minimal native wildlife remaining in the project areas, believed to be due to subsistence hunting.

5.4 Local Resources

Population density is low and scattered with severely limited infrastructure, social structures and services.

Resources and amenities are limited in the region immediately surrounding the Youga, Ouaré and Balogo properties, with subsistence farming being the main enterprise. However, Ouagadougou, located 120 km to the north of Youga and Ouaré, and 100 km north of Balogo, is the administrative, communications, cultural and economic centre of the nation and has a population of approximately 1.5 million, an international airport and supports a wealth of modern industries. Pô, the nearest town to the Balogo Project, has a population of approximately 30,000, a selection of basic shops and an airport with regional flight connections.

The mining industry in Burkina Faso is active and has been expanding as new mines are opened. There are an increasing number of local mining personnel available, as well as expatriate mine workers and professionals from neighbouring countries.

5.5 Infrastructure

Burkina Faso's total annual power generation is 700 million kWh (2009), most of which is generated for use within the major cities of Ouagadougou and Bobo Dioulasso. There is no Burkinabe national power grid in the Youga area; however, the village of Mogandé, located 10 km south-southwest of Ouaré, is connected to the grid. A 10 MVA powerline is now in operation supplying grid-power to Youga from Ghana.

Plant water is supplied to the Youga mine via an 11 km long pipeline from the Nakambé River to the northeast of the mine.

Facilities and infrastructure at Youga consists of:

- 10 open pits consisting of A2NE, A2NW, Main, East, West 1, 2 and 3, Zergoré (two pits) and NTV (one pit)
- Four waste rock dumps (WRDs)
- Stockpiles (run of mine (ROM) and marginal)
- Fleet of mobile mining equipment
- An explosives storage site with magazines, and a fuel storage facility
- A 1.0 Mt/a gold ore processing plant and associated tailings storage facility (TSF)
- A maintenance shop and warehouse

- An on-site ALS assay laboratory
- Two administration buildings
- A diesel generating station for back-up site electrical power
- An 11 km water pipeline to the plant
- A camp complete with kitchen and catering facilities
- Security building and personnel.

With the exception of Ouaré, for which an Exploitation Permit has not yet been granted, there is sufficiency of surface rights for mining operations at the Youga Project, potential tailings storage areas, potential waste disposal areas, heap leach pad areas, and potential processing plant sites.

Facilities at Ouaré are limited, and include an exploration camp, including kitchen, offices and sample yard.

NMC has a 2 km^2 Exploitation Permit at the Balogo Project, with sufficient area for waste stockpiles. Ore is to be trucked to Youga and therefore no rights are required for tailings storage areas, heap leach pad areas or processing plant sites.

There is no landline telephone service to the Project areas, but there is adequate cell service (including data transmission) within the area of the mines. A satellite system providing access to the internet, and voice communications, has been installed for the administration offices, and the Youga plant.

6 History

This section, in the context of Youga and Ouaré, has been modified from Endeavour (2015), and in part taken from the CSA Global Technical Report of 2017 (CSA Global, 2017). The Qualified Persons take responsibility for the content of this section and believe it is accurate and complete in all material aspects. For this report, all work completed by either Etruscan or Endeavour is collectively referred to as Endeavour.

6.1 History Overview, Prior Ownership and Historical Exploration

6.1.1 Youga and Ouaré Properties

The Youga property has experienced several acquisitions, option agreements and joint ventures. For clarity, these are listed below in chronological order:

- 1991: Incanore Resources Ltd (Incanore) was awarded the Youga Exploration Permit.
- 1994: Youga property was optioned to International Gold Resources Inc. (IGR).
- 1995: Echo Bay Mines Limited (Echo Bay) entered an agreement with IGR for a 50% interest.
- 1999: Ashanti Goldfields Company Limited (Ashanti) purchased IGR and the property became a 50/50 joint venture (with Echo Bay) with Ashanti as the operator. Ashanti incorporated the following permits into the joint venture:
    - 1997: Ashanti obtained the Bitou Exploration Permit
    - 1998: Ashanti was granted the Bitou Est Exploration Permit.
- 1999: Ashanti completed a FS on the Youga gold deposit.
- 2003: Etruscan reached an agreement to acquire the Youga property.
- 2006: FS for Youga completed by Etruscan.
- 2008: Commercial production began.
- 2009: FS for Ouaré completed by Etruscan.
- 2010: Endeavour purchased Etruscan and Etruscan's name was changed to Endeavour Resources Inc. For this report, all work completed by either Etruscan or Endeavour is collectively referred to as Endeavour.
- 2011: MRE update by Endeavour.
- 2015: MRE update by Endeavour, effective 31 December 2014 (Endeavour, 2015).
- 2016: MNG (a subsidiary of Avesoro Holdings) finalises its acquisition of the Youga and Ouaré properties from Endeavour in April 2016.
- 2017: Avesoro Resources Inc. acquires MNG from Avesoro Holdings.

Exploration completed by Incanore, IGR and Ashanti/Echo Bay is tabulated below (Table 6-1).

Table 6-1: Incanore, IGR and Ashanti exploration activities (1991 to 1999)

Date	Operator	Type of work	Description
Early 1994	Incanore	Soil geochemistry, geological mapping/prospecting	1,263 samples, 500 m x 500 m grid, inductively coupled plasma (ICP), 1:50,000 scale
1995	Incanore	Trenching	52 trenches for 8,000 m
1996	IGR	Mapping, trenching and RC drilling	1:2,000 scale, 9 holes, 254 m, 135 samples
1997–1999	Ashanti/Echo Bay	Regional study, induced polarisation (IP) survey, petrology trenching, RC and diamond (DD) drillhole drilling	22,550 soil samples, 140 trenches for 25,870.5 m, 52 holes for 5,379 m of RC drilling and 100 holes 16,743.4 m DD drilling
1999	Ashanti	Ashanti FS	

Source: Endeavour, 2016

6.1.2 Balogo Property

Golden Rim Resources Ltd (GMR) acquired the Balogo property in 2010 and conducted geochemical sampling, geological mapping, trenching, geophysical surveying and multiple RC and DD drilling programs that led to the delineation of the Netiana and adjacent gold deposits.

In April 2015, MNG Gold Burkina Sarl (MNG), the privately held Burkinabe gold exploration and development company, executed an agreement with GMR to acquire its entire interest in the Balogo property.

6.2 Historical Mineral Resources and Mineral Reserves

6.2.1 Youga and Ouaré Projects

Prior to acquisition by Avesoro Holdings, Mineral Resource estimation (Table 6-2) for the Youga deposits was completed by Endeavour, effective 31 December 2014. The MRE for Ouaré was completed by AMEC International (AMEC), effective 6 August 2012. The Youga Mine end-2014 key modifying parameters upon which the Mineral Reserve estimates were reliant are summarised in Table 6-3 with the Mineral Reserves shown in Table 6-4.

Table 6-2: Youga and Ouaré Mineral Resources, reported at a 0.5 g/t Au cut-off, effective 31 December 2014

Deposit	**Mineral Resources (including Mineral Reserves)**											
	Measured			**Indicated**			**Measured + Indicated**			**Inferred**		
	kt	**g/t**	**koz**	**kt**	**g/t**	**koz**	**kt**	**g/t**	**koz**	**kt**	**g/t**	**koz**
A2 Main	432.4	2.36	32.8	513.3	2.24	37.0	945.7	2.29	69.8	81.5	2.23	5.8
A2 East	223.0	1.87	13.4	108.6	1.52	5.3	331.6	1.76	18.7	3.8	1.08	0.1
A2W Z1	24.0	2.08	2.0	25.0	1.45	1.0	49.0	1.90	3.0	6.0	2.00	0.4
A2W Z2	186.4	1.93	11.6	411.0	2.07	27.4	597.4	2.03	38.9	19.5	1.83	1.1
A2WZ3	133.6	2.45	10.5	87.9	3.31	9.4	221.5	2.79	19.9	44.0	2.53	3.6
Zergoré	1,700.3	1.63	89.3	1,480.8	1.43	67.9	3,181.1	1.54	157.2	969.7	1.60	49.9
NTV	1,605.1	1.13	58.3	596.0	1.20	23.0	2,201.1	1.15	81.3	219.4	1.26	8.9
A2NE	23.4	2.78	2.1	1,105.8	1.54	54.7	1,129.2	1.57	56.8	636.0	1.64	33.5
LeDuc	-	-	-	-	-	-	-	-	-	221.7	1.56	11.1
Ouaré	1,071.6	1.14	39.4	5,368.2	1.55	268.2	6,439.8	1.49	307.7	571.3	1.49	27.4
Stockpile	1,919.3	0.94	58.2	-	-	-	-	-	-	-	-	-
Total	**7,319.4**	**1.35**	**317.2**	**9,696.4**	**1.58**	**493.7**	**17,015.8**	**1.48**	**811.9**	**2,772.5**	**1.59**	**141.5**

Source: Endeavour, 2015

Table 6-3: Youga and Ouaré – 2014 Reserve key modifying parameters

Applied modifying parameters	**End 2014**
New optimisation	Yes
Gold price	US$1,250/oz
Royalty	4%
Process cost (US$/t milled)	24.3
Process recovery	92%
Mining cost	PW Mining International Ltd new contract (May 2014)
Mining dilution	7%
Mining recovery factor	97%
Pit slopes degrees	46° to 55°
G&A cost (US$/t milled)	9.6
Other processing cost (US$/t milled)	3.5
Average cut-off grade applied across all pits	1.1 g/t

Source: Endeavour, 2015

Table 6-4: Youga estimated Mineral Reserves as at 31 December 2014

Deposit	Mineral Reserves								
	Proven			Probable			Total		
	kt	Au (g/t)	koz	kt	Au (g/t)	k oz	kt	Au (g/t)	Koz
A2 Main	92	2.50	7.4				92	2.50	7.4
A2 West 3	4	3.15	0.4	6	2.65	0.6	10	2.83	1
A2 West 2	209	2.27	15.2	220	2.20	15.6	430	2.23	30.8
Zergoré	808	2.07	53.8	277	1.95	17.4	1,085	2.04	71.2
A2NE	13	3.81	1.6	281	2.39	21.6	294	2.45	23.2
NTV	641	1.27	26.5	180	1.37	7.9	821	1.30	34.4
Total pits	**1,767**	**1.85**	**104.9**	**966**	**2.03**	**63.0**	**2,733**	**1.91**	**167.9**
Stockpiles	777	1.35	33.6	-		-	777	1.35	33.6
Youga Total	**2,544**	**1.69**	**139**	**966**	**2.03**	**63.0**	**3,510**	**1.79**	**202**

Source: Endeavour, 2015

6.2.2 Balogo Project

Prior to acquisition by Avesoro Holdings, GMR announced a maiden MRE for the Netiana lodes at Balogo in February 2013. The MRE was conducted by Mining Plus Pty Ltd. An Inferred Mineral Resource of 850,000 t at 6.8 g/t gold for 185,000 oz of contained gold reported above a 0.5 g/t gold cut-off was estimated and reported under the guidelines of the JORC Code (2004) (Coffey, 2013).

In November 2015, MNG commissioned HCG Cement & Mineral Processing Technologies to prepare a FS for the Balogo Project in Burkina Faso. An Inferred Mineral Resource of 885,000 t at 4.3 g/t gold for 122,000 oz of contained gold reported above a 0.5 g/t gold cut-off was estimated.

In November 2016, MNG commissioned AMC Consultants Pty Ltd (AMC, 2016) to undertake an open pit mine planning study at Netiana. This work was completed on a Mineral Resource model produced internally by MNG. The study suggested that an open pit development on the Netiana lodes would be robust, with an estimated net present value (NPV) of A$46 million (after tax and royalties) and an investment rate of return (IRR) of >100%, giving a Capital Cost (CAPEX) payback of <6 months.

6.3 Historical Production

Gold production at Youga as at 31 December 2017 is listed below in Table 6-5. No formal historical mining has occurred within the Balogo or the Dabinyan III licence; however, informal/artisanal mining is present and extensive around the Netiana deposit.

Table 6-5: Historical production at Youga, 2008 to end of 2017

Year	*Tonnes Milled*	*Head Grade, g/t*	*Au Recovery*	*Oz Produced*
2008	*663,334*	*2.37*	*92.79%*	*45,264*
2009	*871,740*	*2.64*	*91.57%*	*65,648*
2010	*891,202*	*3.10*	*93.62%*	*82,405*
2011	*940,168*	*3.18*	*93.77%*	*87,266*
2012	*1,012,829*	*2.92*	*93.61%*	*89,022*
2013	*1,005,876*	*2.99*	*92.36%*	*89,448*
2014	*990,852*	*2.57*	*90.63%*	*73,291*
2015	*1,060,983*	*2.20*	*89.85%*	*68,407*
2016	*1,119,197*	*1.39*	*88.54%*	*44,403*
2017	*1,199,577*	*3.34*	*89.90%*	*115,321*

Source: Avesoro, 2018

7 Geological Setting and Mineralisation

This section, in the context of Youga and Ouaré, has been modified from Endeavour (2015). The Qualified Persons take responsibility for the content of this section and believe it is accurate and complete in all material aspects.

7.1 Regional Geology

The geology of Burkina Faso can be subdivided into three major litho-tectonic domains:

- Lower Proterozoic (Birimian) basement underlying most of the country
- Neoproterozoic sedimentary cover developed along the western, northern, and south-eastern portions of the country
- Cenozoic belts located in small inliers in the north-western and extreme eastern regions of the country.

The principal gold producing areas of Burkina Faso are associated with Lower Proterozoic (Birimian) volcano-sedimentary units arranged in elongated “greenstone” belts across the West African Craton.

The Youga and Ouaré properties are located within a greenstone belt found on the south-eastern margin of the Archean-Proterozoic Man Shield (also known as the Leo Shield) which forms the southern half of the West African Craton.

The Youga and Ouaré exploitation and exploration permits cover the northeast extension of the Youga Greenstone Belt (known as the Bole-Navrongo Belt in Ghana) that trends from Bole, in western Ghana, beyond the village of Bittou, in southern Burkina Faso, for approximately 400 km (Figure 7-1).

The Balogo licence area is crossed by a significant northeast-trending fault splay which is connected to the major Markoye Fault system. This fault system controls many major gold deposits in Burkina Faso, such as Taparko/Bouroum (1.6 million ounces (Moz) gold), Kiaka (5.9 Moz gold), Bomboré (5.2 Moz gold) and Essakane (6.2 Moz gold) (Figure 7-1 – The Qualified Persons have been unable to verify the Mineral Resources associated with the deposits noted in this figure).

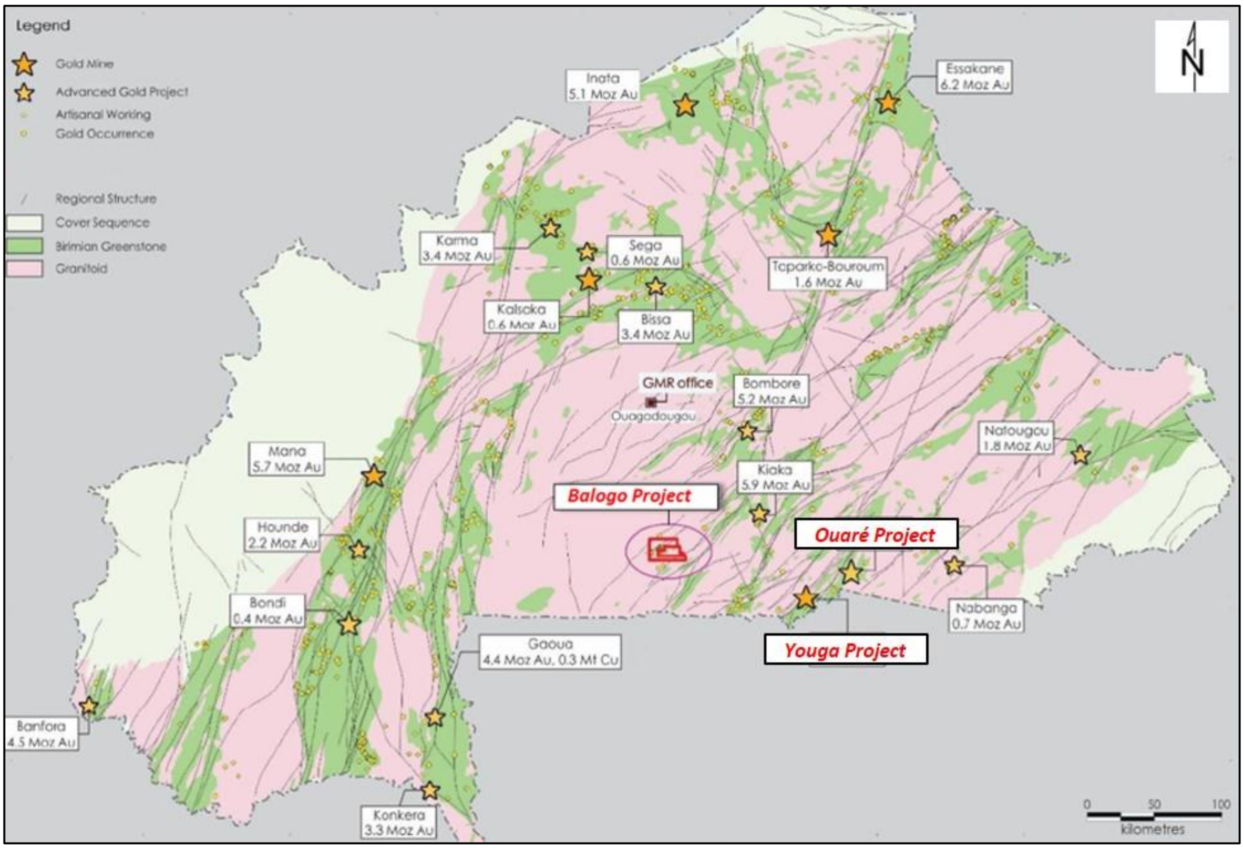


Figure 7-1: Distribution of Lower Proterozoic Birimian greenstone belts across Burkina Faso (the location of the Youga, Ouaré and Balogo properties are annotated)

Note: The Qualified Persons have been unable to verify the Mineral Resources associated with the deposits noted in this figure.
Source: GMR, 2015

7.2 Local Geology

Locally, the Youga Greenstone Belt is composed of weakly to moderately metamorphosed, lower Birimian mafic-volcanic flows, syn- to post- Birimian intermediate to felsic intrusions and subordinate Tarkwaian sediments comprised of arkosic sandstones. The belt is bounded by older Liberian basement rocks comprised of high metamorphic grade assemblages and related intrusives. Northwest-trending, gabbro/dolerite dykes crosscut all lithologies (Figure 7-2).

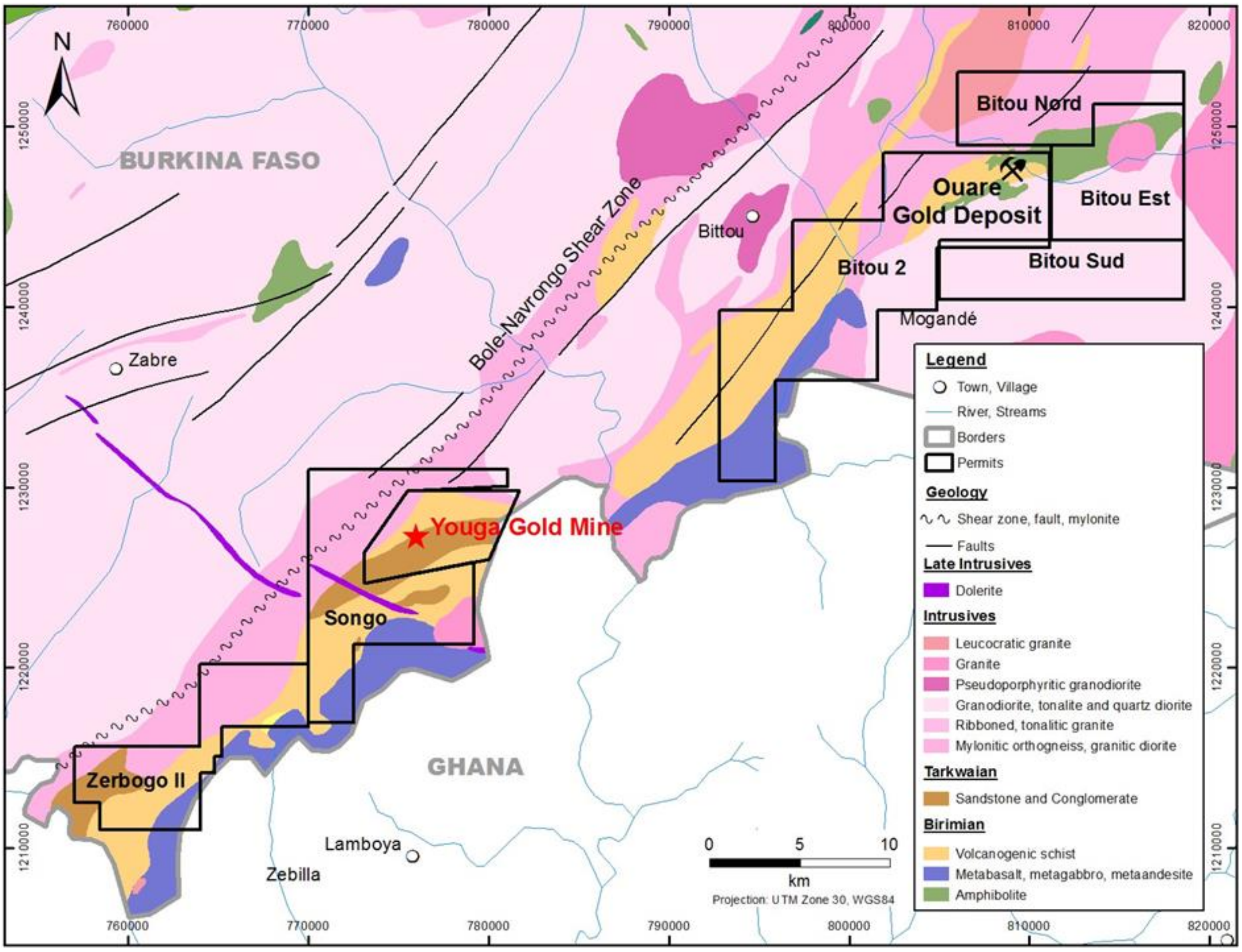


Figure 7-2: Youga Greenstone Belt geology and structure

Source: Endeavour, 2015

7.3 Project Geology

7.3.1 Youga Property Geology

The Tarkwaian outlier, which hosts most the Youga gold deposits (Figure 7-3), is comprised of a succession of arkosic sandstones consisting of quartz and feldspar in roughly equal proportions.

Bands and lamellae of detrital magnetite are evident, particularly at or near the lower contact of coarse units; otherwise no distinctive bedding is evident. The arkoses are intercalated with thin subordinate chlorite schists. The chlorite schists have been identified in mapping by various geologists as volcanic horizons, mafic dykes and as fine-grained sediments; definitive confirmation for the provenance of these units has yet to be undertaken, and they are typically un-mineralised.

Conglomerates occur in very different settings within the arkosic sequences, and their components have extremely variable size and composition. Pebble composition within the boulder conglomerate is mostly (if not exclusively) granitoid, with quartzite being the rare exception. The strongly rounded shape of granitoid pebbles is most probably related to weathering before transport and deposition, rather than a long transport distance being the predominant factor.

The Zergoré sequence is an inlier within the Birimian, located east of the Tarkwaian domain (Figure 7-3), and is characterised by rocks that are predominantly pelitic in composition with variably sized arenitic and silty intercalations. The sequence is characterised by sedimentary structures such as slumping and "rip-up" clasts within the matrix-supported conglomerate units. The Zergoré unit may be considered as a faulted segment of the lowermost part of the Tarkwaian basin, or an individual small Tarkwaian basin formed to the east of the main basin.

The Youga volcanogenic schists are representative of the area south and to the west of the Tarkwaian Basin, more commonly exposed in the Songo and Zerbogo II licences. These sequences are composed of andesites, volcanoclastics, poorly bedded pelitic sequences and minor intercalated cherty layers. Abutting these units to the south are packages of more mafic metabasalt and metagabbroic units (Figure 7-2).

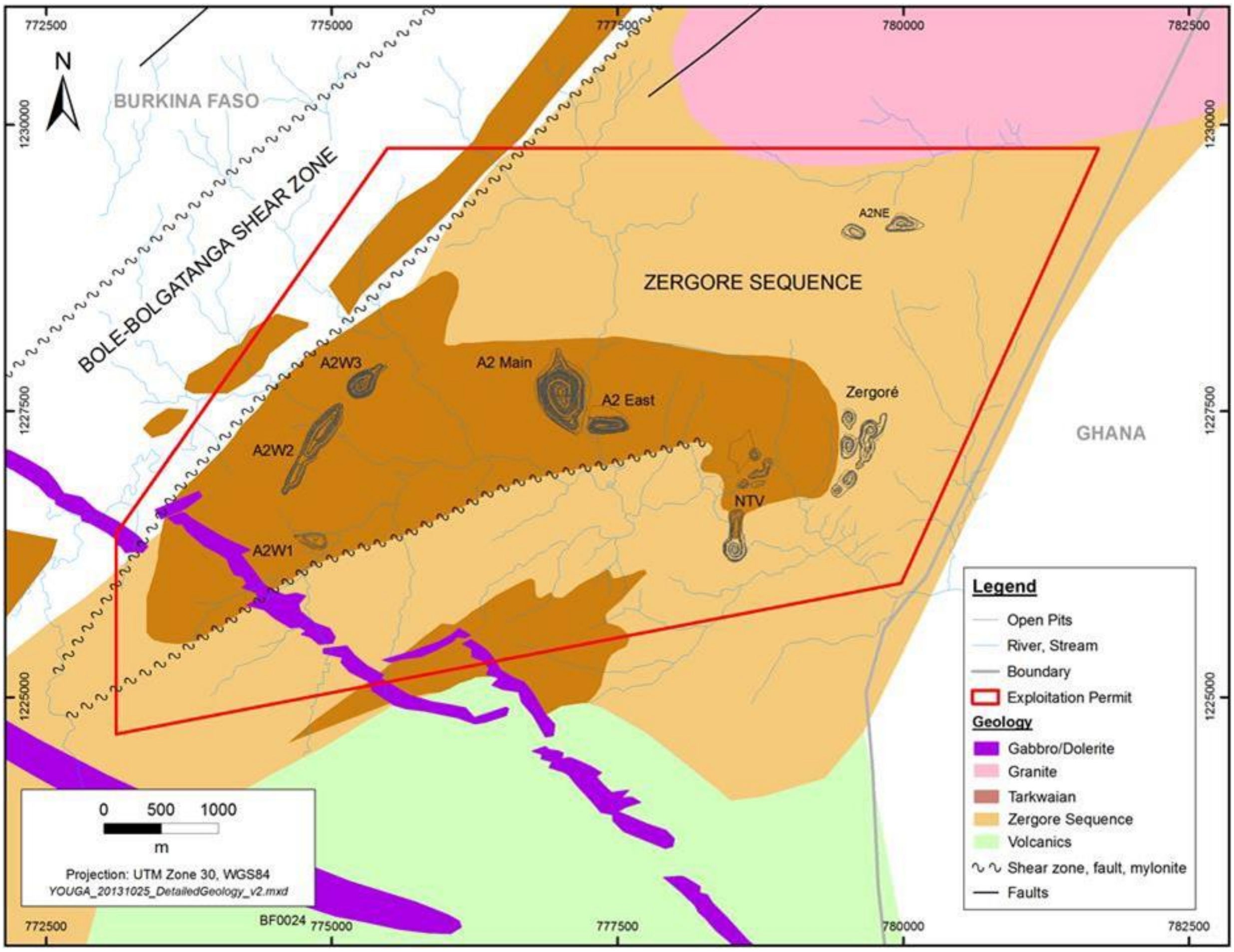


Figure 7-3: Youga property geology and structure

Source: Endeavour, 2015

7.3.2 Ouaré Property Geology

Ouaré is located within a Birimian package of volcanogenic schists dominated by:

- An intermediate to mafic volcanic unit dominantly composed of basalt with associated andesite, gabbro and dolerite.
- A gabbro unit associated with diorite, basalt, amphibolite and andesite.
- A felsic unit composed of quartz-feldspar porphyritic rocks associated with tonalite, granite and quartz diorite intrusions. These rocks (100 m to 500 m wide, west to east trending) occur in the central part of the mapped area.
- Orthogneiss, mylonitic, granitic to dioritic, in the northern portion of the mapped area.
- A granodiorite unit with tonalite and quartz diorite in the southern portion (Figure 7-4).

Minor mafic dykes have been observed, as well as mylonites composed of quartz sericite schist and chloritic schist along faults.

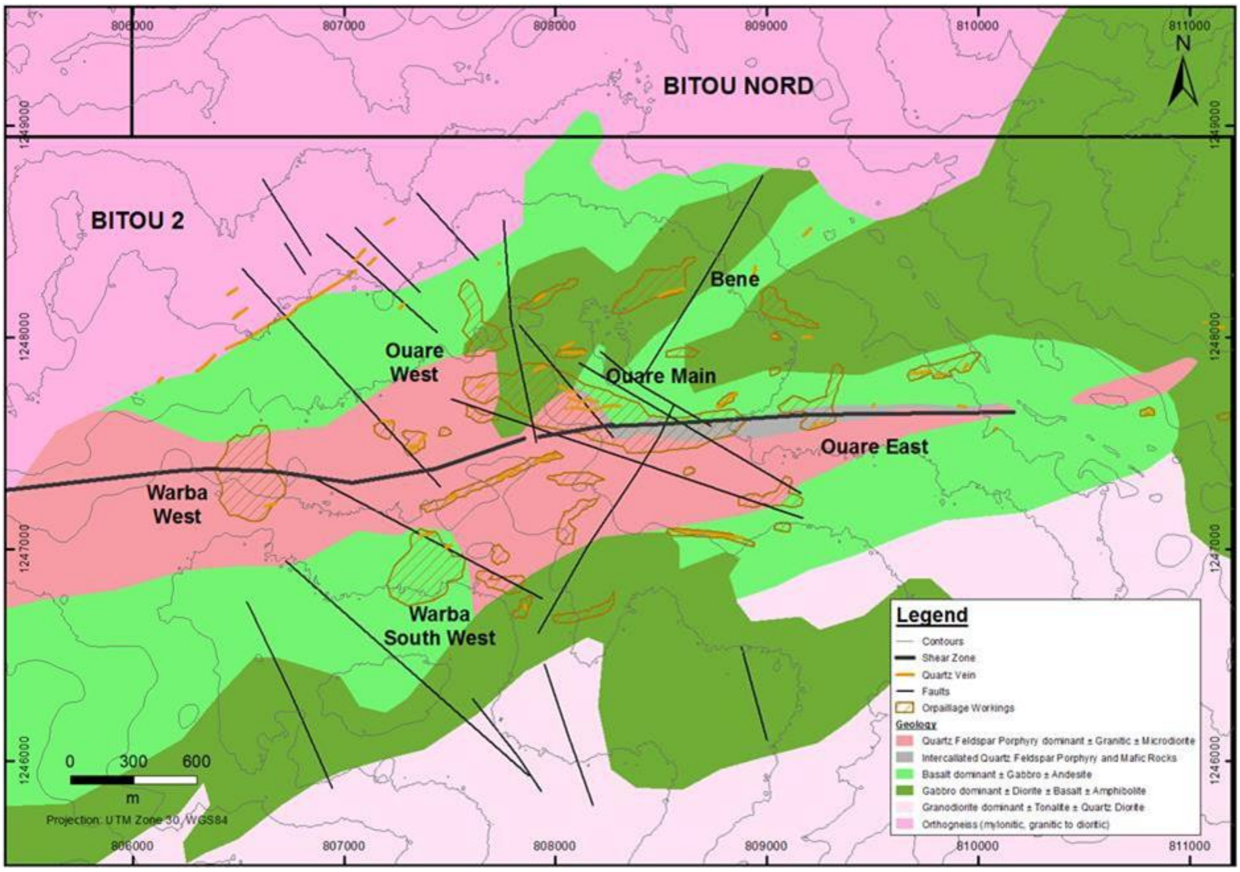


Figure 7-4: Ouaré property geology and structure

Source: Endeavour, 2015

7.3.3 Balogo Property

The geology of the Balogo property area consists of mixed volcano-sedimentary sequences and dioritic to granitic basement rocks which have been multiply intruded by late-stage granites. Interpretation of detailed aeromagnetic data has identified two units of metavolcanics in the central part of the permit area which are predominantly sequences of schist, quartzites and mixed metavolcanics.

Late-stage granites occur as isolated plugs and small enclaves of mafic intrusives also occur in the area. The geology map of the Balogo and Dabinyan III tenements is given in Figure 7-5.

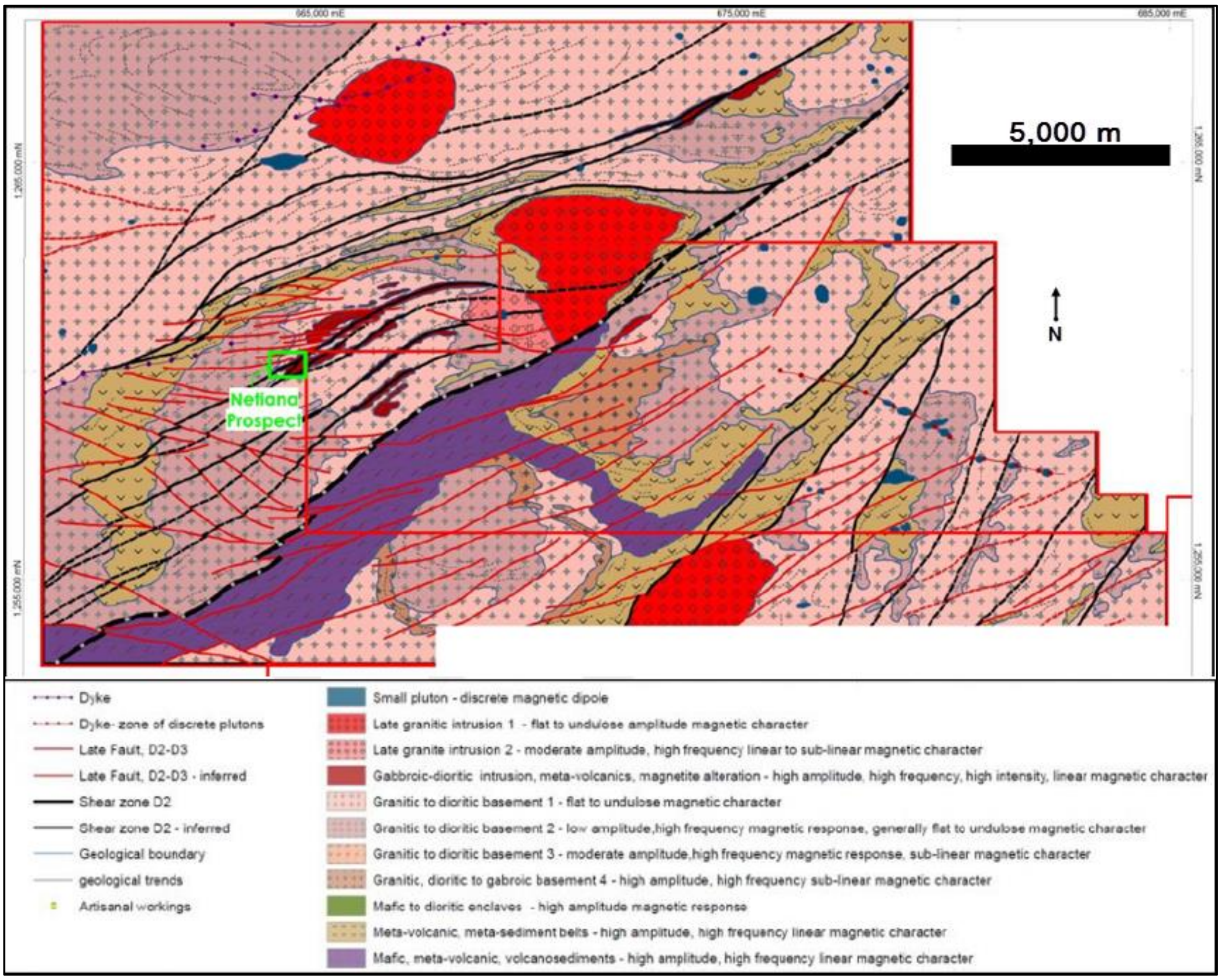


Figure 7-5: Geology of the Balogo and Dabinyan III tenements (location of the Netiana deposit is annotated)

Source: GMR, 2015

7.4 Structure

7.4.1 Regional Structure

The Youga Greenstone Belt is bounded to the north by the Bole-Navrongo shear zone, which consists of a northeast-southwest trending deformation corridor that can be traced for more than 100 km.

7.4.2 Youga Property Structure

Mineralisation is almost exclusively associated with brittle deformation within the more competent arkosic sequences, with the strongly chloritised conglomerates absorbing strain in a more ductile manner.

Where the two lithologies are intercalated, as within the A2NE deposit, the arkosic units are strongly mineralised while the adjacent chlorite schists are effectively barren (although exceptions to this are reported). Figure 7-6 shows the arkosic unit and chloritic schist in a pit face in A2N East pit, where ore was mined with a ROM grade of 3.5 g/t Au.

Figure 7-6: Arkosic unit (brown) within chloritic schist (grey), A2N East pit, 205 bench

Source: CSA Global, 2017

In contrast, the most significant feature of the **Zergoré** unit is the widespread development of quartz veins at various scales, and the extreme folding with an apparent single axial planar schistosity. Kinking is widespread and is at the origin of the complex structural pattern. Figure 7-7 depicts drill core from Zergoré, showing intense structural deformation.

Figure 7-7: Drill core (YZ-11-39) from Zergoré, showing intense structural deformation

Source: BMC

The known orientations of the mineral deposits are described in Table 7-1 below. The project locations are presented in Figure 10-2.

Table 7-1: Youga mineral deposits known orientations

Deposit	Strike	Dip
Main Pit	NW-SE	50-75
East Pit	E-W	45
WP1	E-W	0-90
WP2	NE-SW	75
WP3	NE-SW	75
A2N East	E-W	75
A2N Middle	NE-SW	75
Gassore	E-W	75
Zergoré	NNE-SSW	55-75

7.4.3 Ouaré Property Structure

Two principal generations of structures, D1 and D2, were recognised:

- D1 is the earlier compressional strain event, forming a weak foliation, S1. S1 is oriented N300° to N315°, dipping towards the northeast and is presumed to be axial planar to an early F1 fold system.
- D2 represents the principal compressional deformation and produces a prominent regional S2 schistosity, the associated F2 fold set and the L2 mineral lineation. S2 schistosity varies in orientation from N205° to N110° and is moderately to steeply dipping towards the northwest. Fold hinges plunge moderately (40° to 45°) towards the northeast, subparallel to the L2 lineation.

The known orientations of the mineralised zones at Ouaré are summarised in Table 7-2 below.

Table 7-2: Ouaré mineral deposit known dimensions and orientations

Deposit	Strike	Dip
Ouaré Main	E-W	50-75
Ouaré Main NW	NW-SE	60-70
Ouaré East	E-W	50-75

7.4.4 Balogo Property Structure

The main structural trend in the area appears to be northeast-trending sinistral shears and associated splays. Some later-stage northwest-striking cross faults occur, but these are subordinate to the major northeast trending shears.

The host geology at Netiana is a basement sequence of metasediments (talc chlorite/quartz sericite schists and quartzites) which have been intruded by dioritic plugs and dykes controlled by the northeast-trending regional shears. Late-stage felsic porphyries/granites have intruded both the rock sequences.

The main area of interest is defined by a northeast trending, crescent shaped zone with a distinct magnetic signature which occurs over a strike length of about 6 km. This feature is a complex contact zone between predominantly meta-sedimentary units to the northwest and intrusives to the southeast. Late-stage intrusives occur at the southern end of this structural feature. Most of the mineralisation located to date occurs near the contact between metasediments and dioritic rocks. A prospect-scale geological map is presented in Figure 7-8.

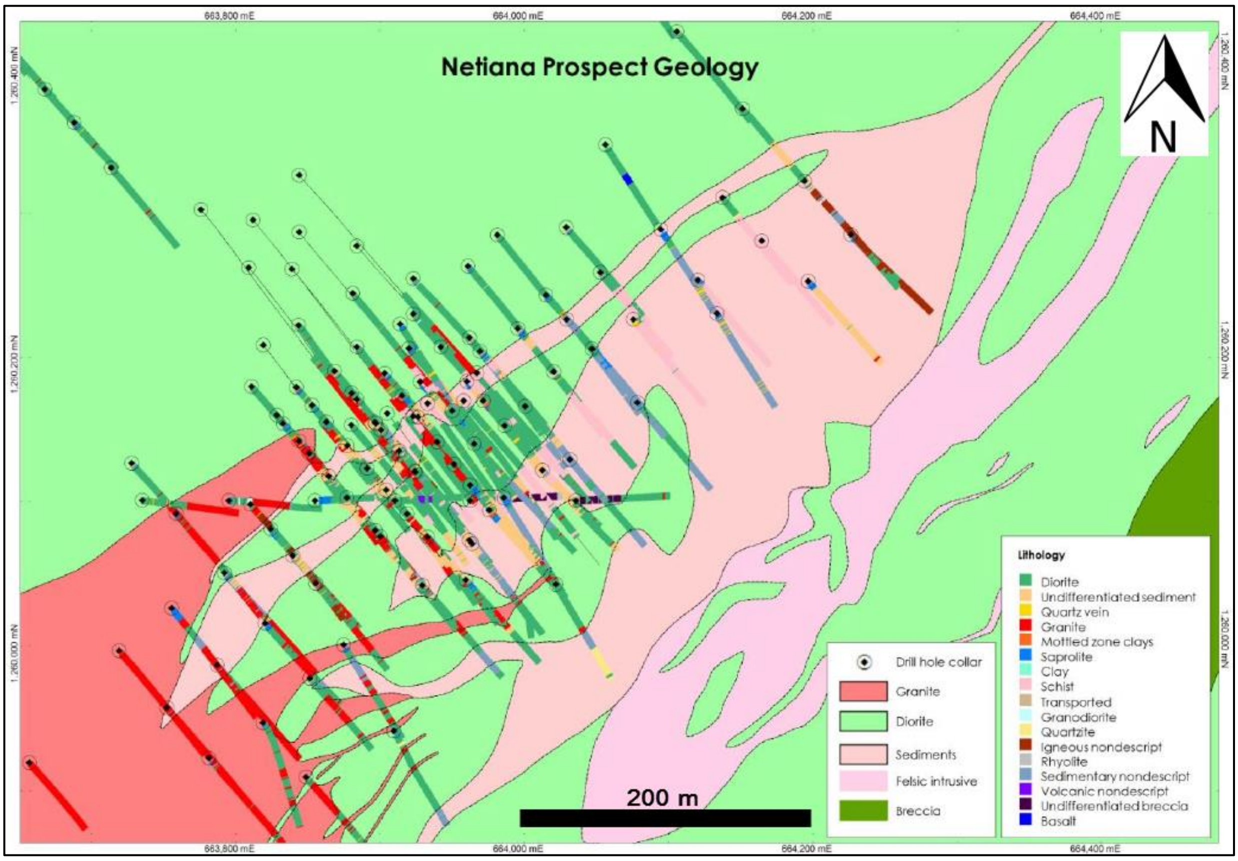


Figure 7-8: Geological map for the Netiana deposit

Source: GMR, 2015

7.5 Alteration

7.5.1 Regional Alteration

Regionally, rocks have been overprinted by amphibolite grade metamorphism, possibly related to contact metamorphism. The metamorphic minerals are typically aligned along a pervasive foliation fabric. A weak retrograde alteration (calcite+/-chlorite-muscovite) overprints most of the rocks.

7.5.2 Youga Property Alteration

The arkosic sequences are substantially modified by alteration, principally comprising; carbonate, sericite, haematite, chlorite, possibly albite and silica. Pervasive silicification and intense haematite developments are intimately associated with zones of quartz stockwork veining, intense fracturing, sulphide development and gold mineralisation.

The sulphide content is extremely low (generally <1%), comprised predominately of pyrite with trace amounts of arsenopyrite, chalcopyrite, pyrrhotite and galena. Fine euhedral pyrite is broadly disseminated throughout the arkosic lithologies, particularly within zones of mineralisation and intense silicification, where it also selectively replaces the detrital magnetite laminae. Pyrrhotite, arsenopyrite and galena are more intimately associated with higher-grade mineralisation, particularly within zones of more intense quartz veining and silicification.

7.5.3 Ouaré and Balogo Property Alteration

The lithologies are substantially modified by alteration, principally comprising carbonate, sericite, haematite, chlorite, possibly albite and silica. Pervasive silicification and quartz veining are intimately associated with gold mineralisation.

The sulphide content is moderate (generally 2% to 5%) and comprised predominately of pyrite with trace amounts of chalcopyrite, pyrrhotite and sphalerite. Fine euhedral pyrite is broadly disseminated throughout the lithologies, particularly within zones of mineralisation and intense silicification. Chalcopyrite and pyrrhotite are more selectively associated with higher-grade mineralisation, particularly within zones of more intense quartz veining and silicification.

7.6 Mineralisation Styles and Character

7.6.1 Youga Property Mineralisation

Within the **Youga deposit**, there are two distinct styles of mineralisation:

- Moderately to weakly silicified arkose with quartz stockwork veining and pyrite is the predominant sulphide which generally grades between 0.5 g/t and 2 g/t
- Intensely silicified arkose with abundant quartz veins and more diverse sulphides which generally grades >3 g/t.

Main Pit appears to represent a point at which a shear has refracted through a more competent arkosic sequence. The style of mineralisation is distinctly brittle in character, represented by irregular fracturing, quartz veining and occasional brecciation. The related A2 East mineralisation almost certainly reflects the same structure but is developed within a conformable (070/45°N) setting within thin arkose units sandwiched between more ductile chlorite schist (conglomerate) horizons. Dominantly ductile deformation within the chlorite schist units has created more brittle fracturing and quartz veining of the adjacent arkose.

West Pit 1 and 2 superficially appear to be relatively straight forward. The deposits are aligned along a northeast trending, steeply southeast dipping structure that marks the approximate north-western extent of the Tarkwaian inlier. This orientation is also consistent with the immediately adjacent north-western margin of the Upper Birimian Bole-Navrongo Belt at this point.

Mineralisation associated with the **West Pit 2 and 3** deposits appears to be broadly conformable with both the regional fabric and lithology, confined to one or more arkosic units sandwiched between conglomerate lenses (chlorite schist units) like the **East Pit** deposit. There is, however, some evidence that the mineralisation (and therefore possibly structure) mildly transgresses lithology, with sporadic mineralisation developed within the chlorite schists themselves.

NTV is a similar style of mineralisation **Main** and **East Pit** and strongly related to pervasive silicification, quartz veining and sulphidation (mainly pyrite) of the arkose host rock, although the mineralisation is not as developed within these deposits. The Nanga deposit is a well-defined zone, steeply dipping to the east. The Tail deposit is less well constrained, trends east-west and dips shallowly to the north, while the Village target dips even more shallowly.

Zergoré mineralisation occurs off the eastern flank of the Tarkwaian basin and is structurally complex. Gold is hosted within sericitic and chloritic schists with only minor intercalations of arkose which are tightly folded along a roughly north-south hinge with steeply dipping limbs. Gold mineralisation is associated with quartz-veining and sulphidation (mainly pyrite) along numerous zones.

A2N (East and Middle) mineralisation also occurs off the Tarkwaian basin, has similar host rocks with similar alteration but is much less structurally complex than Zergoré. The A2N East deposit consists of several steeply, north dipping zones along an east-west trend (Figure 7-6 and Figure 7-9). The A2N Middle deposit consists of five steeply, north-west dipping zones along a northeast-southwest trend.

Figure 7-9: Mineralised core at A2N East, core shown averaging 3.7 g/t, highest grade is in the first 3 m of the lower core tray including 21 g/t between 32.15 m and 32.5 m

Source: BMC

7.6.2 Ouaré Property Mineralisation

The Ouaré mineralisation is on the Bitou 2 Exploration Permit and has been delineated in three zones, along a strike length of 2 km.

At the **Ouaré** Main zone, mineralisation occurs as quartz veins within shear zones at the contacts between felsic and mafic volcanics. Orpailleur workings have been developed along mineralised structures in two orientations: 090° and 315°. The 090° portion of these workings have multiple parallel quartz veins along shears in an interpreted dilation zone. The 315° portion is interpreted as a 100 m wide deformation zone, terminating the 090° trend.

The gold mineralisation appears to preferentially follow the lithologic contacts between felsic volcanics and mafic volcanics, particularly within a shear zone of inter-layered quartz-feldspar porphyritic and intermediate to mafic volcanic rocks. Gold mineralisation appears to be confined to a major 090° trending deformation corridor of dextral strike slip. Figure 7-10 shows mineralised core from Ouaré.

Figure 7-10: Mineralised core from Ouaré, averaging at approximate 4.5 g/t, increasing in grade towards the lower core tray, including 8.4 g/t between 74 m and 78 m

Source: BMC

7.6.3 Balogo Property Mineralisation

At Balogo, there have been at least three distinct mineralisation styles recognised. These include:

- High-grade gold mineralisation (+/- Cu, Bi, Te) hosted in a sequence of diorites (as defined by drilling at the Netiana deposit over a length of approximately 500 m to a depth of approximately 250 m). Mineralisation is restricted to a single dioritic unit which has a structurally-controlled hangingwall contact with a distinct unit of chloritic metasediments. High gold grades are typically associated with quartz veining within the dioritic rocks. Figure 7-11 shows diamond drill core with this style of last lithology.
- Massive magnetite associated copper-gold mineralisation. This style of mineralisation outcrops near Cobra Hill and occurs as generally massive magnetite (+/- copper) gold mineralisation. Mineralisation is probably shear controlled and generally is hosted in metasediments immediately above the structural contact between metasediments and dioritic intrusives.
- Copper-gold mineralisation associated with disseminated cumulate magnetite in a porphyritic intrusive. Mineralisation consists of disseminated magnetite, pyrite +/ chalcopyrite in a moderately to strongly silicified porphyritic dyke. The dyke is around 40 m thick, strikes east-northeast and dips steeply west. Broad zones of low-grade copper/gold mineralisation are erratically distributed within the dyke unit.

Figure 7-11: Drill core from hole BDH188, Netiana lodes, Balogo property, 258.5 m to 262.4 m, showing thick quartz vein and possible high-grade mineralisation

Source: CSA Global, 2017

8 Deposit Types

8.1 Deposit Style

The gold deposits within the Youga, Ouaré and Balogo properties can be described as epigenetic, mesothermal ("lode") gold deposits, demonstrating a strong structural control and relationship to regional scale shear zones. Similar deposits can be found in other areas of the late Proterozoic Birimian terranes of West Africa.

At Youga and Ouaré, gold mineralisation is intimately associated with pervasive silicification, quartz veining and sulphidation (predominantly pyrite), although sulphide content is extremely low (generally <1%).

The majority of the Youga gold deposits are hosted within the Tarkwaian sandstones, while Ouaré is hosted along the sheared contact between mafic volcanics to the north and quartz-feldspar porphyritic rocks to the south.

At Balogo, gold mineralisation is typically associated with networks of quartz mineralisation or associated with disseminated sulphides within strongly deformed alteration zones.

8.2 Exploration Concept

CSA Global notes that surface geochemical data accompanied by geophysical surveys and followed by trenching and drill testing has been successful at identifying, evaluating and developing the Mineral Resources at Youga, Ouaré and Balogo (Netiana). There remain several exploration targets within the Youga, Ouaré and Balogo (and Dabinyan III) licences that appear to have significant potential. However, there also appears to be a general insufficiency of data (e.g. surface mapping, structural mapping, downhole structural data, sectional interpretations etc.) to constrain the structural and mineralisation models at a local scale. This inhibits the effective estimation of the Mineral Resource at these exploration targets.

9 Exploration

This section, in the context of Youga and Ouaré and relating to pre-MNG exploration, has been modified from Endeavour (2015). The Qualified Persons take responsibility for the content of this section and believe it is accurate and complete in all material aspects.

9.1 Overview

9.1.1 Youga and Ouaré Properties

Extensive exploration was undertaken during Endeavour's evaluation of the Youga and Ouaré property areas between 2003 and 2016 (known as Etruscan until 2010). MNG has conducted exploration since ownership of the properties were transferred to MNG in 2016.

Geochemical data, used in conjunction with the available geophysical survey and geological mapping, was used in the delineation of gold mineralisation targets within the mine area for advancement. The higher order geochemical anomalies were trenched and drilled by Endeavour, but potential exists to identify additional gold mineralisation either proximal to the currently defined deposits, by additional drilling of known mineralised structures both along strike and down dip/plunge, or by advancing lower order targets in the work carried out by Endeavour.

Consultants and contractors were engaged by Endeavour for various exploration activities including; geophysical surveys, structural mapping, drilling, and assaying. Table 9-1 summarises the contractors and consultants engaged by Endeavour in their managed exploration programs.

Sampling quality and methods and survey procedures appear to be appropriate and representative. There is intrinsic sample bias and/or potential for contamination associated with soil, grab and auger sampling; however, these datasets have not been used in the estimation of Mineral Resources and are for indicative and/or exploration purposes.

MNG undertook a ground magnetic survey at Youga, followed up by trenching and minor grab sampling. At Ouaré, 222 soil samples have been taken, an auger program drilled, and a ground magnetic survey completed by MNG.

Table 9-1: Summary of contractors and consultants engaged by Endeavour

Activity	Consultant(s)
Airborne geophysics	Fugro Airborne Surveys (Pty) Ltd Terrascan Airborne
Ground geophysics	Sagax Afrique S.A.
Geophysical interpretation	Bob Gillick
Structural mapping	EcoTerra NPA Fugro Ltd SRK Consulting (Canada) Inc.
Geology	D. R. Duncan & Associates Ltd Taiga Consultants Ltd
Petrography	P. M. Nude Panterra Geoservices Inc.
Analytical laboratories	ALS Bamako (formerly Abilab) SGS Ouagadougou
RC drilling	Boart Longyear Inc. West African Drilling Services Forages Technic-Eau Foraco Burkina Faso

Activity	Consultant(s)
Diamond drilling	Boart Longyear Inc. West African Drilling Services African Mining Services Foraco Burkina Faso
Downhole wireline logging	LIM Logging
Database review and Resource estimation	RSG Global (now Coffey) AMEC International
Geotechnical	Golder Associates Inc. SRK Consulting (South Africa) Inc.
Mineral Reserve estimation	MDM Ferroman SEMS Exploration MICON International Limited

9.1.2 Balogo Property

Regional exploration was largely undertaken by GMR between 2010 and 2014 and included:

- Reconnaissance mapping and grab sampling: Highlighted that quartz/sulphide magnetite mineralisation is hosted in a quartz diorite unit and striking northeast-southwest.
- Soil geochemical surveys (Figure 9-1 and Figure 9-2): Initial success was followed up with more soil sampling in 2011, which increased the size of the gold in soil anomaly to approximately 10 km long and between 500 m and 2,000 m in width.
- Auger drill programs (Figure 9-1): Samples were initially spaced on 100 m x 50 m grids. When there were anomalous results, the sample grid was infilled to 100 m x 25 m and in some cases 50 m x 25 m.
- Trench programs: A total of 27 trenches (3,488 m) were excavated across the Balogo property which allowed for direct observations of mineralisation at surface (alongside the artisanal workings). The best trench intercepts include: 12 m at 5.3 g/t, including 1 m at 60.4 g/t from BT27; 16 m at 0.6 g/t from BT31 and 3 m at 4.1 g/t, including 1 m at 10 g/t, and 10 m at 0.3 g/t from BT32.
- Geophysical surveys include:
  - Aeromagnetic survey (Figure 9-2 and Figure 9-3): outlined a major magnetic high anomaly that appeared to be associated with the Cobra Shear Zone. The anomaly extends for at least 5.4 km and appears to be locally folded or cross-faulted. The Cobra Shear Zone can be traced in outcrop for 1.1 km, with the remainder of the magnetic feature obscured by soil cover.
  - High-resolution ground magnetics and gradient array IP (Figure 9-1 and Figure 9-4): completed at a 50 m line-spacing and highlighted the prospectivity of the Cobra Shear Zone and confirmed a further 1.3 km of strike with strong anomalies not yet tested by drilling (MNG, 2016).
  - Ground gravity survey: a survey identified several features which may represent new exploration targets. The main feature highlighted by the survey was a distinct linear feature which links the Netiana lodes with the Cobra Shear Zone.
  - Ground magnetic survey: MNG completed a ground magnetic survey at a 50 m line spacing on north-south orientated lines. A total of 1,191 km line and 58.8 km^2 area was surveyed.

Sampling quality and methods and survey procedures appear to be appropriate and representative. There is intrinsic sample bias and/or potential for contamination associated with soil, grab and auger sampling, however these datasets have not been used in the estimation of Mineral Resources and are for indicative/exploration purposes.

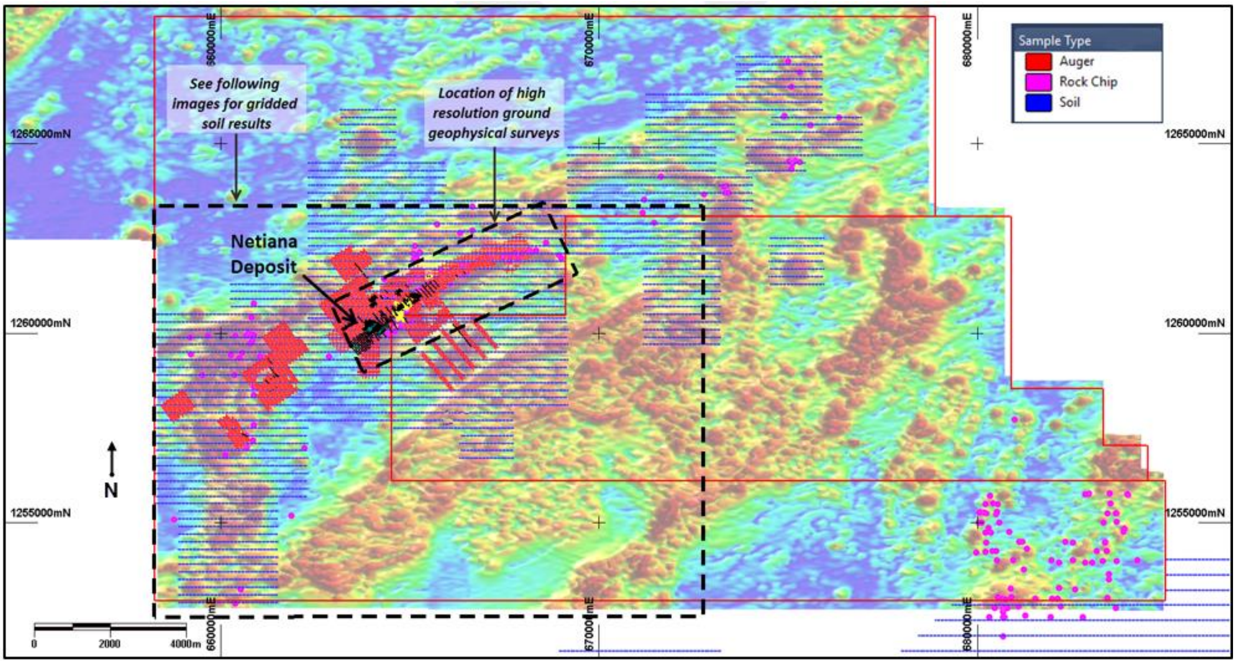


Figure 9-1: Location of rock chip, soil and auger drill programs

Note: Dashed outline shows location of high-resolution ground magnetic survey and gridded soil results in the following images. Drilling at Netiana annotated black and artisanal workings coloured with yellow dots.
Source: CSA Global, 2017

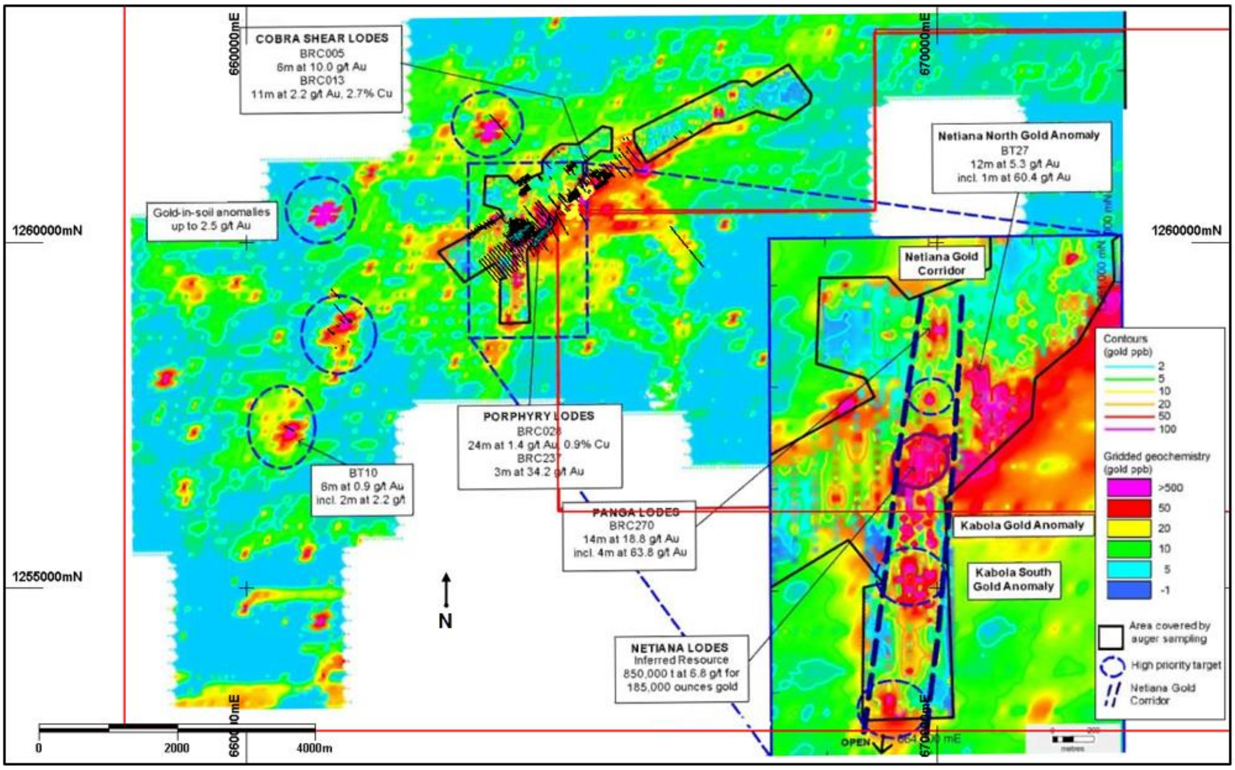


Figure 9-2: Gridded soil results (Au ppb) for focus area shown in Figure 9-1, showing along-strike anomalies

Note: Contamination of soils from artisanal workings to the south of the Netiana drill program.
Source: CSA Global, 2017

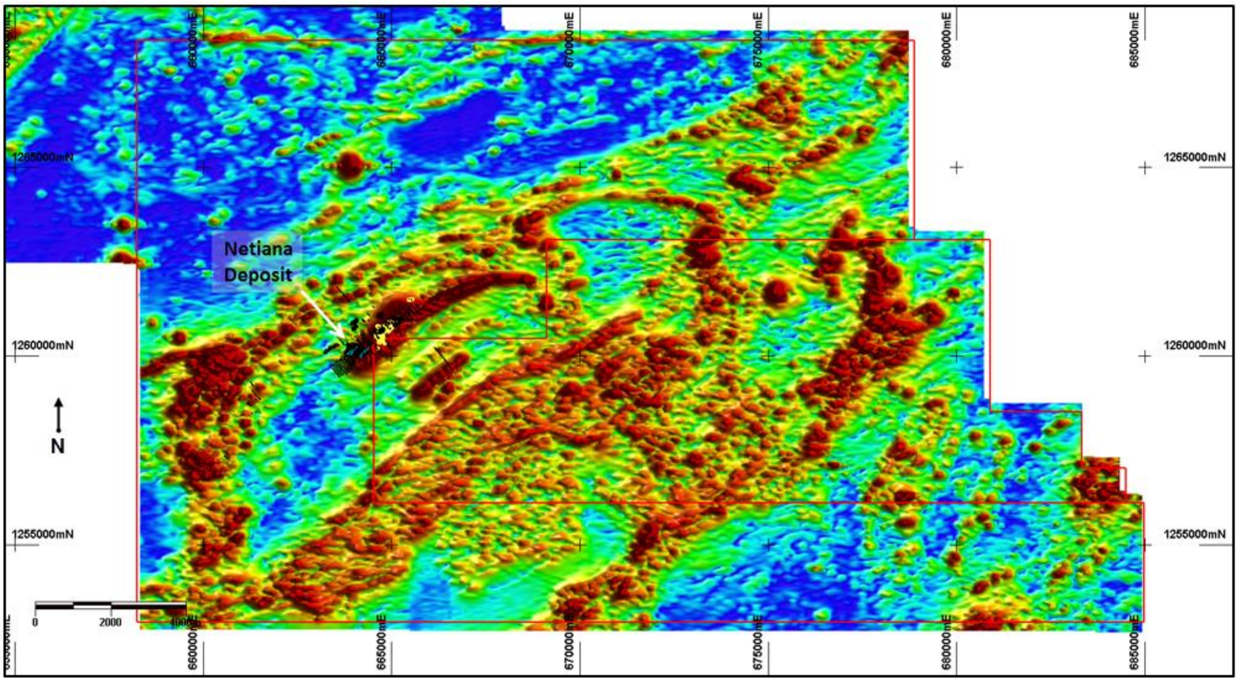


Figure 9-3: Regional aeromagnetic survey, with licence outlines in red (drilling at Netiana annotated where artisanal workings are coloured with yellow dots)

Source: CSA Global, 2017

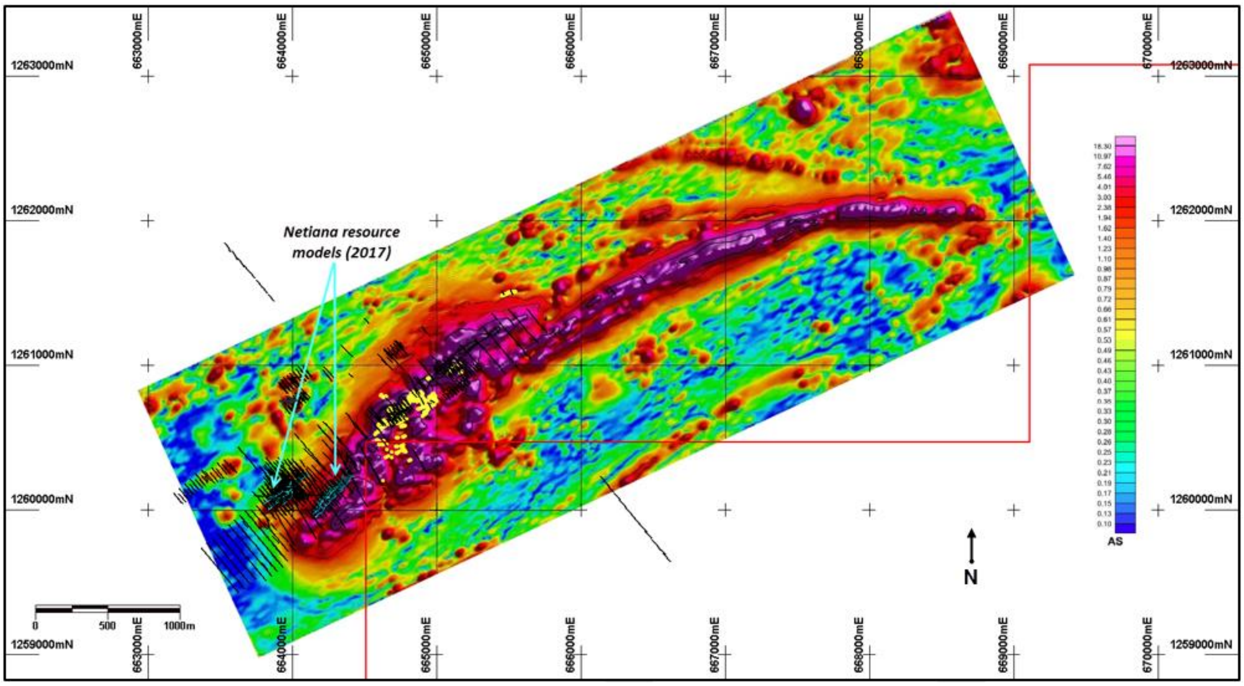


Figure 9-4: High-resolution (50 m line-spacing) ground magnetic results: analytical signal, for focus area shown in Figure 9-1

Note: The 2017 Netiana 3D resource models are annotated. Artisanal workings plotted in yellow.
Source: CSA Global, 2017

9.2 Geochemical Surveys

9.2.1 Reconnaissance Mapping and Rock Chip Sampling

Balogo Property

Reconnaissance mapping and geochemical sampling programs were carried out across the Balogo property area. To date, approximately 549 rock chip sample have been collected across the property area, with 84 sampled by MNG, the rest by GMR.

Geological mapping showed that quartz/sulphide magnetite mineralisation is hosted in a quartz diorite unit and strikes northeast-southwest. A zone of brecciated pegmatitic granite and a highly siliceous felsic intrusive unit run parallel to the trend of mineralisation. A discontinuous horizon of sulphidic magnetite occurs along the contact between the siliceous felsic unit and the brecciated pegmatite.

The geology is obscured to the southwest under residual cover sequences (MNG, 2016).

9.2.2 Soil Geochemistry

Youga and Ouaré Properties

Both Youga and Ouaré permits were extensively covered with soil geochemistry during Endeavour's management of the projects. Initially, the regional (800 m x 100 m) and semi-regional (200 m x 100 m) scale sampling was followed by detailed (100 m x 25 m) sampling over selected areas in Youga (Figure 9-5) and Ouaré (Figure 9-6). MNG completed a soil sampling program of 222 samples on the Bitou Sud Exploration Permit in June 2016.

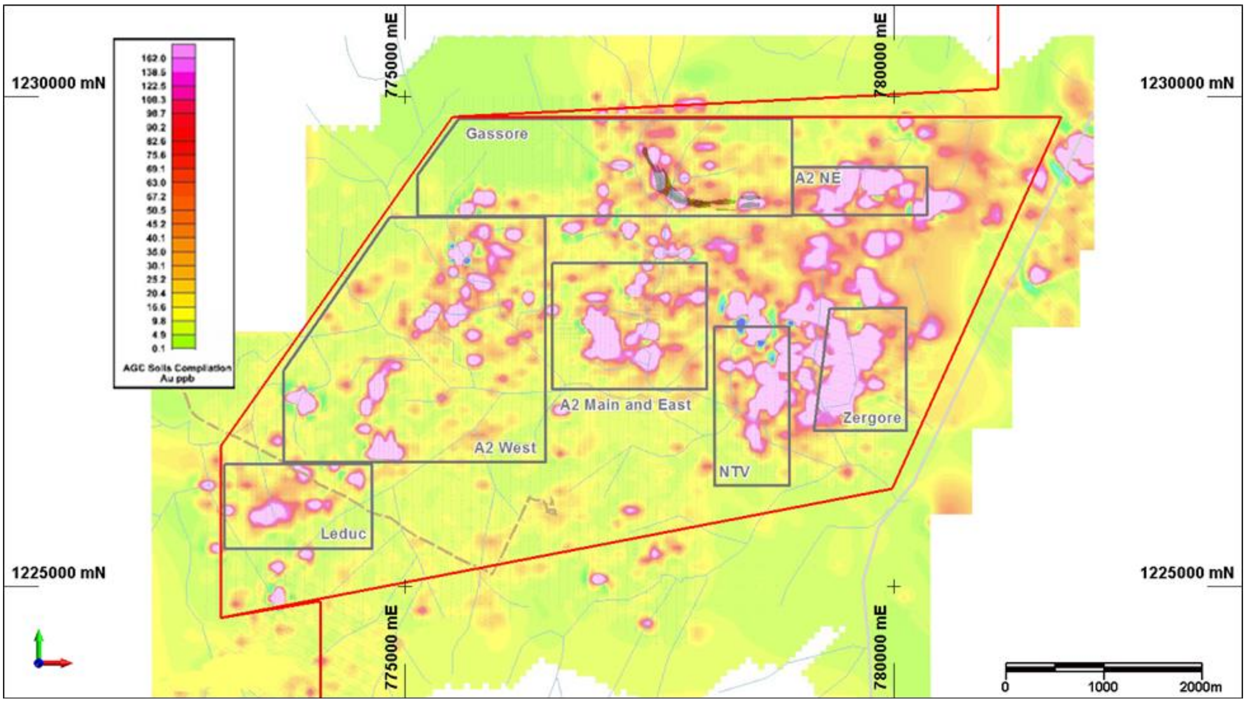


Figure 9-5: Regional soil geochemical survey over the Youga Exploitation Permit (Au in ppb)

Source: Endeavour, 2015

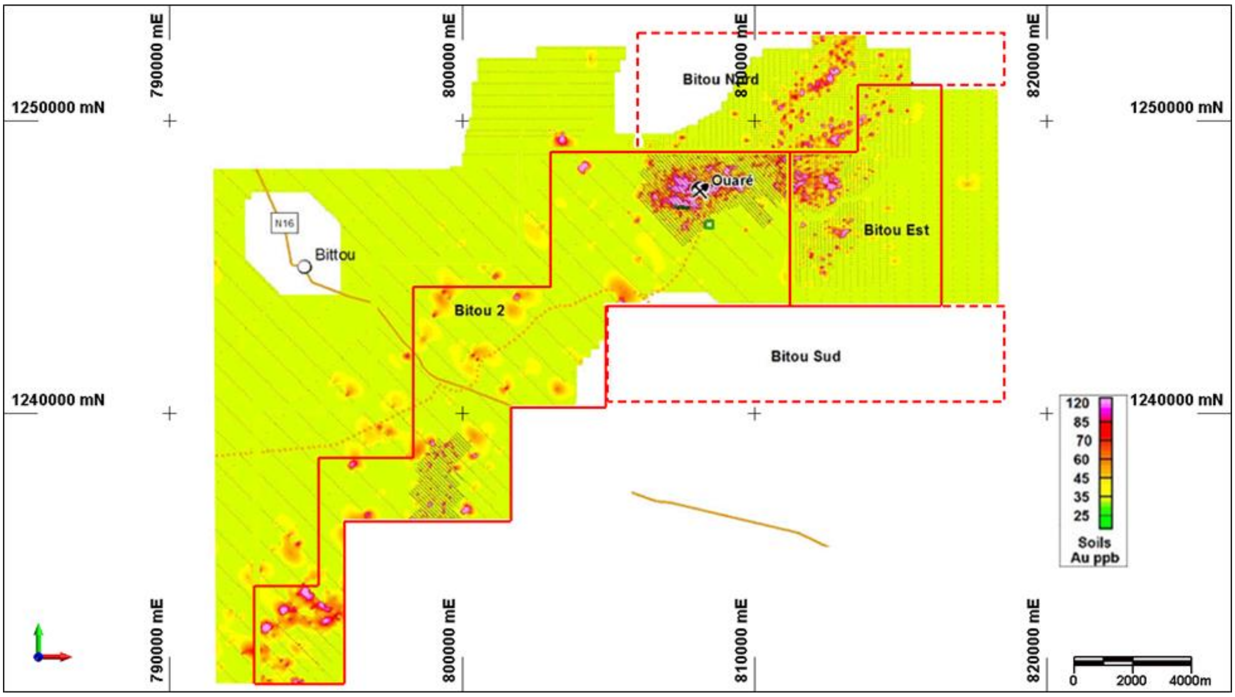


Figure 9-6: Regional soil geochemical survey over the Ouaré Exploration Permits (Au in ppb); permits shown with dashed red lines have been re-applied for

Source: MNG, 2015

Balogo Property

A program of wide spaced regional soil sampling was commenced in 2010. The initial grid was spaced at 50 m x 200 m, over an area of 4.2 km x 2.6 km. Results indicated the presence of a major gold-in-soil anomaly, striking northeast-southwest, and open along strike in both directions.

This initial success was followed up with more soil sampling during the first quarter of 2011, which increased the size of the gold-in soil-anomaly to approximately 10 km long and between 500 m and 2,000 m in width. A second parallel gold-in-soil anomaly was outlined 1 km to the northwest. This anomaly extends for approximately 6 km and is around 500 m in width.

A total of 17,979 soil samples were collected and analysed at BIGS Laboratory in Ouagadougou for gold analysis. MNG collected a total of 201 soil samples from north of Seven Hill and south of the Wattle prospects. Several batches of soil samples were also assayed for base metals (MNG, 2016).

9.2.3 Auger Geochemistry

Youga and Ouaré Properties

MNG completed an auger drill program on the Bitou Nord permit in June 2016. A total of 1,386 holes were augered, with an average depth of 2.4 m for a total of 3,386 m.

Balogo Property

An extensive program of auger geochemistry was conducted in areas where it was believed soil sampling was not effective due to the transported nature of the sediments.

A total of 4,390 auger samples have been collected over the Balogo property. Samples were initially spaced on 100 m x 50 m grids and infilled to 100 m x 25 m and in some cases 50 m x 25 m. A total of 2,405 of these auger samples were taken by MNG and the rest by the preceding owners of the property.

Several significant new auger gold anomalies exist adjacent to, and along strike of the Netiana lode anomaly, and are of greater magnitude. They provide new targets for satellite gold deposits (MNG, 2016).

9.2.4 Trenching

Youga and Ouaré Properties

A significant number of trenches have been excavated across the Youga and Ouaré properties. There are 871 trenches with a total of 59,574 m in the Youga database and 67 trenches (7,556 m) in the Ouaré database. Most of these trenches were excavated prior to MNG's ownership, with only MNG-T001 to MNG-T008 (711 m) being completed by MNG. Trenches were channel sampled at either 1 m or 2 m intervals.

MNG excavated trenches in WP3E (five trenches), Gassore East (eight trenches), Gassore West (four trenches) and Waste Dump East (four trenches) in 2017. The trench data were not included in the database handed to CSA Global and therefore their results are not included in this data review.

Balogo Property

To date, a total of 35 trenches, have been excavated across the Balogo property, with 1,693 samples (4,364.20 m) taken. These trenches were channel sampled at either 1 m or 2 m intervals. Three of these trenches have been excavated by MNG, and 32 by GMR.

Trenches BT01, BT02, BT03, BT13 and BT15 were excavated above the Netiana lodes and within the pit outline proposed in the Coffey 2013 Scoping Study.

The best trench intercepts above the Netiana lodes include:

- 16 m at 0.7 g/t gold, including 2 m at 3.8 g/t gold (BT01)
- 10 m at 0.3 g/t gold (BT03)
- 31 m at 1.9 g/t gold (BT13).

Trench BT10 was excavated 4.2 km southwest along strike from the Netiana lodes to test an area with a single anomalous soil result of 564 ppb gold. The trench returned 6 m at 0.9 g/t gold, including 2 m at 2.2 g/t gold. The mineralisation is open in all directions under the soil cover. Given the distance BT10 lies from the Netiana lodes, this trench intercept is considered significant.

Ten trenches were excavated to test the new soil and rock chip anomalies, including the Netiana North anomaly. Extensive quartz-hematite-stockwork veining in several of these new trenches was mapped and is typical of the high-grade gold mineralisation identified in the drilling across the Netiana lodes.

MNG excavated three trenches (260.2 m) and collected 159 samples from the Panga prospect.

The best trench intercepts include:

- 12 m at 5.3 g/t, including 1 m at 60.4 g/t from BT27
- 16 m at 0.6 g/t from BT31
- 3 m at 4.1 g/t, including 1 m at 10 g/t, and 10 m at 0.3 g/t from BT32 (MNG, 2016).

9.3 Geophysical Surveys

9.3.1 Magnetic and Radiometric Surveys

Youga and Ouaré Properties

In May 2004, Fugro Airborne Surveys (Pty) Ltd completed a detailed aeromagnetic and radiometric data survey for Endeavour, over the Youga permits along flight lines (145°) spaced at 50 m, with a tie-line spacing of 500 m (Figure 9-7). This survey was superseded in 2016, when MNG undertook a detailed ground magnetic survey, totalling 1,591 km and covering 87 km^2 (Figure 9-8).

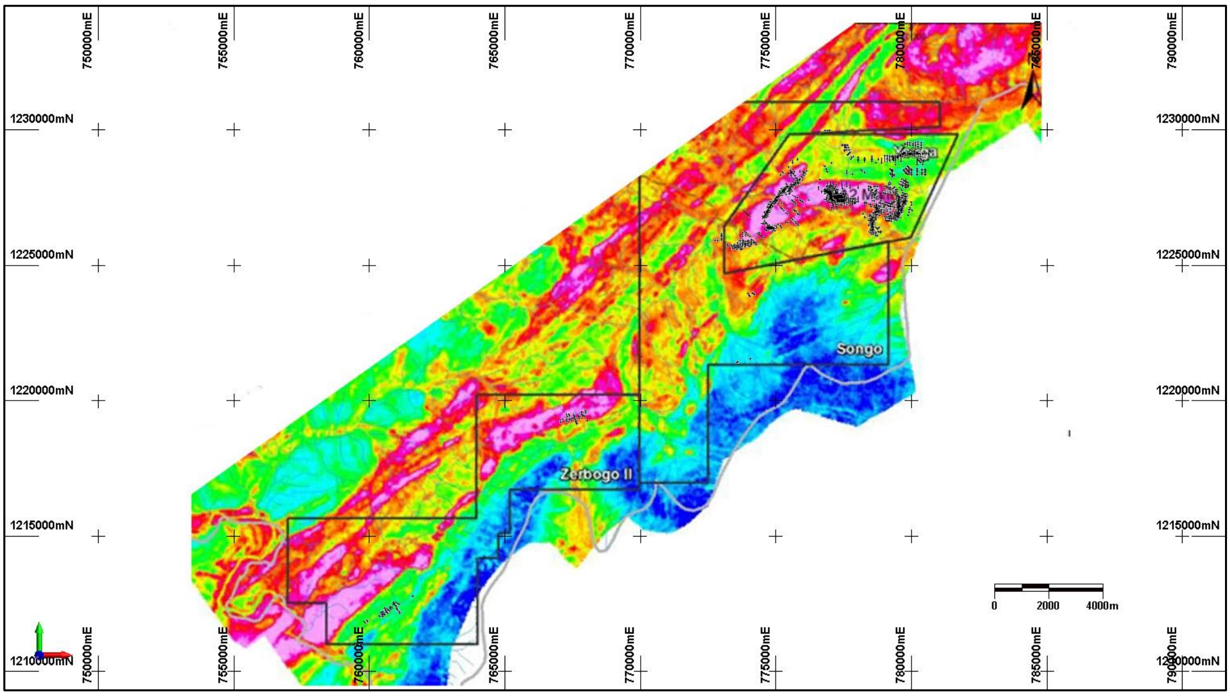


Figure 9-7: *Reduced to pole aeromagnetic survey at Youga (old licences are outlined in black)*

Source: Endeavour, 2015

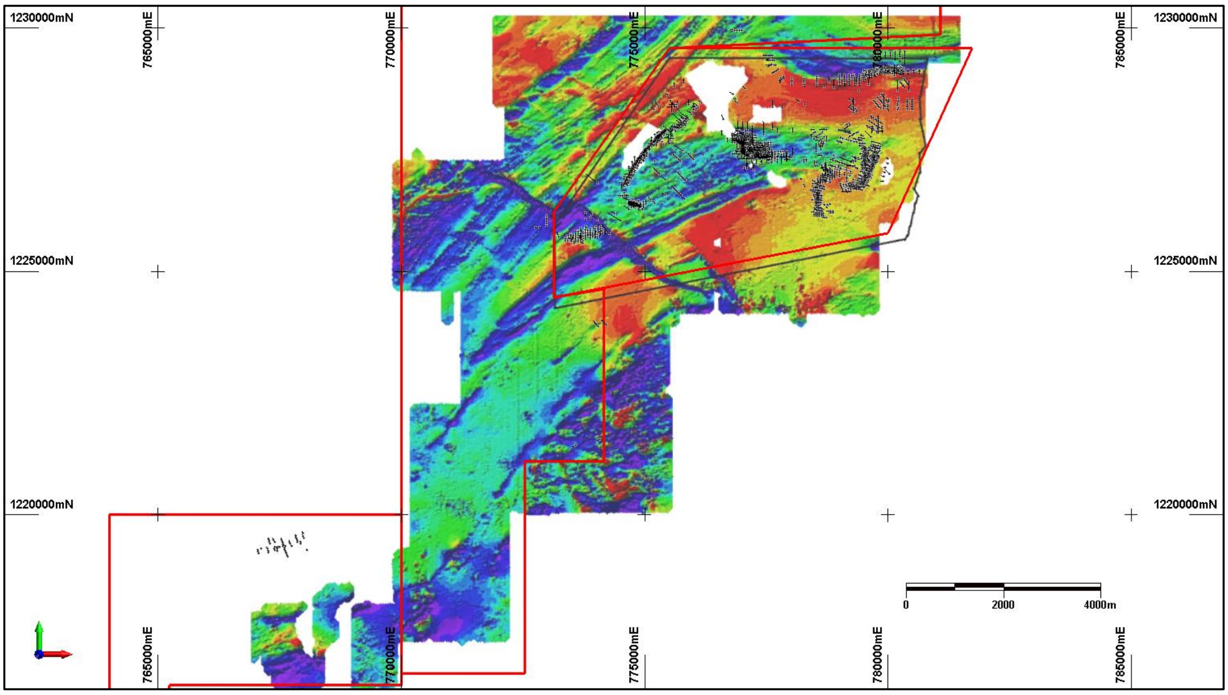


Figure 9-8: *2016 ground magnetic survey, reverse TMI (current licences outlined in red)*

Source: Endeavour, 2015

MNG finalized a ground magnetic survey over the Ouaré Project along north-south oriented lines spaced at 50m in February 2018 with total of 2,719km, covering 135.41 km^2.

Balogo Property

A major high-resolution aeromagnetic survey was conducted by Xcalibur Airborne Geophysics (Pty) Ltd, South Africa over the Balogo Project area. The survey comprised more than 3,000 line-km and was flown on north-south, 200 m spaced lines with a nominal ground clearance of 30 m. The high-resolution aeromagnetic data was used to develop detailed structural interpretations and determine more favourable structural settings for gold mineralisation (MNG, 2016).

9.3.2 Ground Geophysical Surveys

Youga and Ouaré Properties

During 2004 and 2005, Sagax Afrique S.A. completed a gradient IP survey on behalf of Endeavour, which covered a large part of the Youga Exploitation Permit (Figure 9-9) and the northern part of the Bitou 2 permit (Figure 9-10), over the area surrounding the Ouaré deposit. The survey was completed at a line spacing of 100 m, at various line orientations, and with sampling intervals of 25 m.

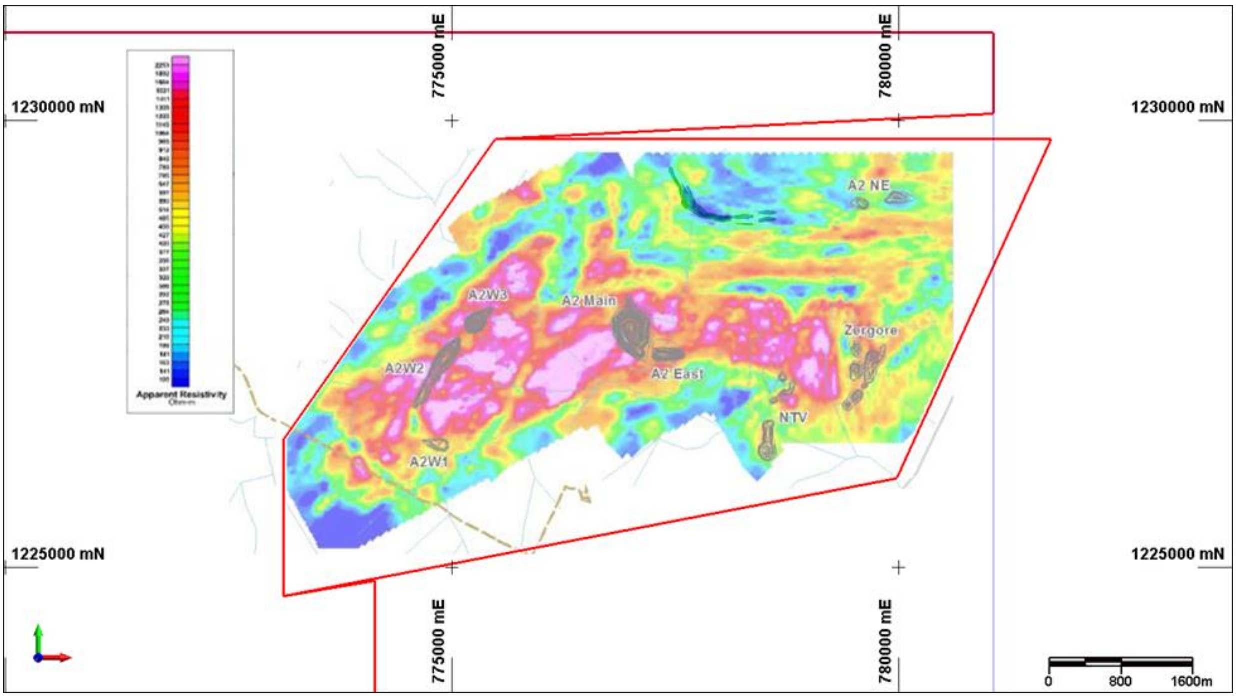


Figure 9-9: Apparent resistivity from the 2004–2005 gradient array IP survey at Youga

Source: Endeavour, 2015

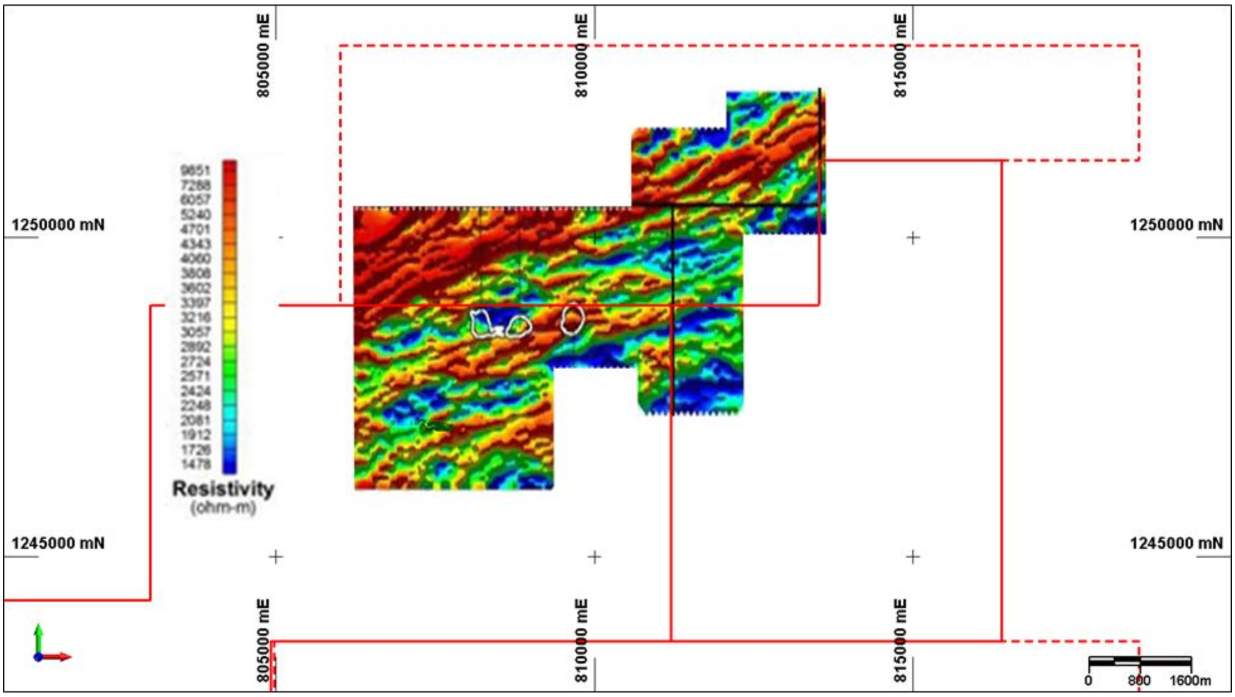


Figure 9-10: Apparent resistivity from the 2004–2005 gradient array IP survey at Ouaré; outdated licences outlined in black, current licences in red (dashed have been reapplied for)

Source: Endeavour, 2015

Balogo Property

Detailed ground geophysical surveys (gradient array IP and magnetics) were completed at Balogo in June 2011. The surveys were conducted by Terratec Geophysical Services from Germany over a 6 km x 1 km area. Both the magnetic and IP surveys were conducted on lines spaced at 50 m and orientated northwest, perpendicular to the trend of the Cobra Shear Zone. The detailed ground magnetics were highly successful in locating intensely magnetised parts of the Cobra Shear Zone and allowed the discrimination between the shear and the less prospective magnetic horizons in the adjacent diorite unit.

The ground magnetic data outlines a series of very strong magnetic high anomalies that are coincident with a series of strong copper-in-soil and gold-in-soil anomalies. The strongest portion of these anomalies lies along a 1.3 km long outcropping portion of the Cobra Shear Zone which consists of a low ridge of quartz-malachite-magnetite veining surrounded by a halo of strong disseminated pyrite and magnetite alteration.

The gradient array IP survey was completed to locate conductive units (potentially sulphide-bearing). A well constrained chargeability high/resistive low anomaly was identified over a strike length of approximately 2.8 km. Detailed ground geophysics surveys have highlighted the prospectivity of the Cobra Shear Zone and confirm a further 1.3 km of strike with strong anomalies not yet tested by drilling.

MNG conducted a ground magnetic survey on north-south orientated lines at a 50 m spacing. A total of 1,191 km line and 58.8 km^2 area was surveyed (MNG, 2016).

9.3.3 Gravity Survey

Balogo Property

In November 2012, a detailed GPS gravity survey was conducted at the Balogo property. The survey covered an area of 6 km x 1.8 km and included the Netiana, Porphyry and Cobra lodes. The survey was conducted by an Australian company, Haines Survey Pty Ltd. The original proposed survey comprised 975 stations in 50 northwest to southeast lines with a line spacing of 100 m and 200 m and station spacing of 50 m coincident with UTM Zone 30 North.

The survey identified several features which may represent new exploration targets. The main feature highlighted by the survey was a distinct linear feature which links the Netiana lodes with the Cobra Shear Zone (MNG, 2016).

10 Drilling

Data reported here is a compilation of drilling completed at the Youga, Ouaré and Balogo properties.

The Youga property has experienced several acquisitions, option agreements and joint ventures as detailed in Section 6 (History). In summary:

- 1991 to 1999: Exploration works were restricted to Youga and undertaken by Incanore, IGR and Echo Bay
- 1999 to 2003: Exploration works included Ouaré and were operated by Ashanti
- 2003 to 2016: Exploration works were undertaken by Endeavour (known as Etruscan until 2010) following their acquisition of both properties
- 2016 to 2017: MNG owned and operates the Youga and Ouaré properties
- 2017 to present: Avesoro owns and operates the Youga and Ouaré properties.

MNG finalised its acquisition of Youga and Ouaré from Endeavour in April 2016. Discussion and review of the data has for the purposes of clarity been presented separately under separate subheadings, chapters and tables.

In context to sections relating to the Balogo property, unless otherwise stated (i.e. reference to works completed by CSA Global) much of the content in these sections have been summarised from GMR's 2015 Exploration Summary report (GMR, 2015).

The Qualified Persons take responsibility for the content of this section and believe it is accurate and complete in all material aspects.

10.1 Drilling Summary

10.1.1 Youga Project Drilling Summary

Trenches (considered akin to drill holes for the purposes of downstream use), rotary air blast (RAB), RC and diamond (DD) drilling were completed during the various exploration stages carried out by IGR, Ashanti/Echo Bay, Etruscan and Endeavour.

Drill data collection procedures can be subdivided into four distinct periods of exploration:

- Pre-2000: Relates to data collected as part of Incanore's and IGR's exploration management and programs executed under the management of the Echo Bay and Ashanti joint venture
- 2003 to April 2016: Relates to data collected under work programs managed by Endeavour
- April 2016 to May 2017: Relates to data collected under MNG management for use in the previous 2017 MRE update
- May 2017 to present: Relates to additional data collected under Avesoro management for use in the 2018 MRE update.

Exploration activities and data collection methodologies applied during the initial period are based on information compiled in Ashanti's 1999 databases and discussed in the Ashanti FS completed in 1999 (Lycopodium, 1999). Activities during 2003 to April 2016 are based on information from the 2015 Endeavour Technical Report. Post April 2016 activities are based on information provided by MNG and on the Qualified Person's site visits.

Figure 10-1 below depicts the Exploration and Youga Exploitation Permit areas in red and the Project areas in blue. The Project areas are shown in more detail in Figure 10-1, Figure 10-2, Figure 10-3 and Figure 10.4. Additional drilling in 2017–2018 has been undertaken in the A2NE area, with the Resource model now split into Gassore, A2NE Middle and A2N East for the purposes of reporting them in the 2018 MRE update, see Section 14.

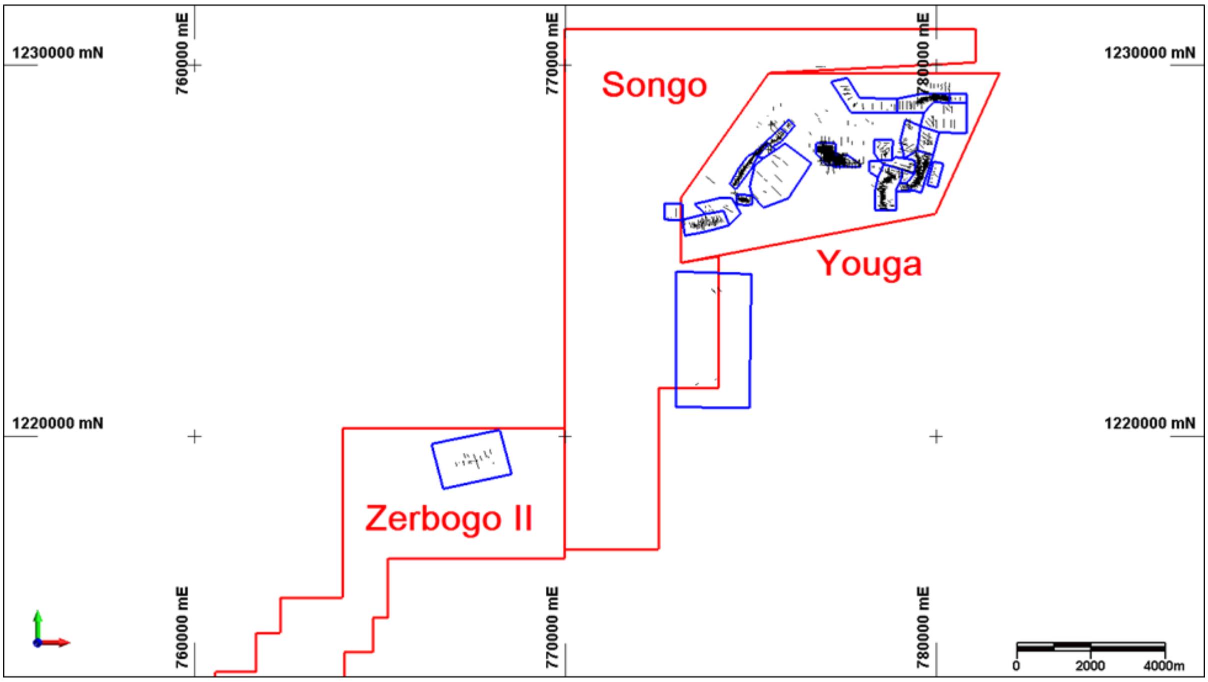


Figure 10-1: Permit areas (red) and Project areas in blue

Source: CSA Global, 2017

Table 10-1 summarises the drilling by exploration phase as at 31 December 2014 (excluding grade control drilling and RAB).

Table 10-1: Summary of Youga drilling statistics

Company	DD		RC		Trench	
	No. of holes	Metres	No. of holes	Metres	No.	Metres
Ashanti/Echo Bay	129	20,048	298	18,219	210	30,554
Endeavour	355	43,738	1,133	101,077	86	5,266
Total	**484**	**63,786**	**1,431**	**119,296**	**296**	**35,820**

Note: Drill totals include exploration/resource drilling only and do not include grade control holes.
Source: 2014 Endeavour Report

Table 10-2 lists the drilling completed by MNG to date, and available for use in the 2018 MRE update, per project area and hole type. A total of 80,776 m of drilling (excluding trenches) have been completed by MNG since April 2016.

Table 10-2: Summary of Youga drilling statistics by area

Project area	DD		RC	
	No. of holes	Metres	No. of holes	Metres
A2N Middle	73	5,429	105	8,222
A2N East	27	1631	126	9,512
WP5	34	2,789		
WP3	14	977		
Gassore	321	47,524	48	4,692
Total	**469**	**58,350**	**279**	**22,426**

Drillhole codes and descriptions are listed in Table 10-3 below.

Table 10-3: Youga drillhole types

Code	Hole type	Code	Hole type
BH	Blast hole	OTR	Other
BHGC	Blast hole (grade control)	RC	Reverse circulation
DD	Diamond drillhole	RCDD	RC pre-collar, diamond tail
GT	Geotechnical	RPL	Ripline
MET	Metallurgical	TR	Trench

Table 10-4 lists the drilling by project area and by hole type, including grade control drillholes. No date or company data were provided with the export and therefore this table has not been subdivided by exploration phase. RAB hole data were not included in the database. The drilling for A2N and Gassore has been broken down into those holes used for the recent MRE update, and those to the west and east of the updated resources which show further exploration targets. A significant amount of drilling has been completed across the projects:

- 854 DD holes for 112,599 m
- 11,185 RC drillholes for 381,676 m (includes grade control drilling up to May 2017)
- 857 trenches for 57,696 m.

In general, drillhole spacing varies between 18 m and 25 m x 25 m within resource areas.

Table 10-4: Summary of Youga drilling statistics by deposit

Project	DD		RC		TR		RCDD		BH		BHGC		GT/MET		OTR		RPL	
	Count	Total (m)	Count	Total (m)	Count	Total (m)	Count	Total (m)	Count	Total (m)	Count	Total (m)	Count	Total (m)	Count	Total (m)	Count	Total (m)
A2N Main, Middle, East	100	7,060	231	17,734	220	18,849	-	-	-	-	-	-	-	-	14	182	-	-
A2N Exploration	-	-	8	800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2VIL	-	-	23	1,709	11	1,006	-	-	-	-	-	-	-	-	-	-	-	-
Beaufort	-	-	76	4,677	1	230	-	-	-	-	-	-	-	-	-	-	-	-
Castel	-	-	24	2,400	5	975	-	-	-	-	-	-	-	-	-	-	-	-
EP	53	6,643	1,595	50,460	166	5,991	7	1,533	-	-	-	-	-	-	-	-	-	-
Gassore Main	321	47,524	48	4,692	5	376	-	-	-	-	-	-	-	-	-	-	-	-
Gassore Exploration	-	-	27	2,704	3	300	-	-	-	-	-	-	-	-	-	-	-	-
La Forge	-	-	22	1,844	1	196	-	-	-	-	-	-	-	-	-	-	-	-
Leduc	-	-	72	7,408	8	1,500	-	-	-	-	-	-	-	-	-	-	-	-
Leduc Nord	-	-	-	-	7	775	-	-	-	-	-	-	-	-	-	-	-	-
MP	157	29,760	4,855	130,146	186	8,609	8	2,287	-	-	-	-	1	379	-	-	-	-
NTV	45	4,582	397	22,157	39	3,052	-	-	-	-	-	-	-	-	-	-	-	-
Songo	-	-	9	769	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Songo Nord	-	-	5	407	2	80	-	-	-	-	-	-	-	-	-	-	-	-
Sprite	-	-	26	2,236	7	748	-	-	-	-	-	-	-	-	-	-	-	-
TLP Est	-	-	14	428	1	75	-	-	-	-	-	-	-	-	-	-	-	-
TLP Ouest	-	-	6	465	1	70	-	-	-	-	-	-	-	-	-	-	-	-
WNE	-	-	31	2,497	4	532	-	-	-	-	-	-	-	-	-	-	-	-
WP1	43	2,468	848	21,420	15	1,942	-	-	-	-	-	-	-	-	-	-	-	-
WP2	9	820	932	27,002	41	2,907	-	-	198	1,980	-	-	-	-	-	-	4	54
WP3	15	1,521	764	22,007	36	642	-	-	-	-	-	-	-	-	10	600	5	100
WP3 Est	2	259	6	745	2	26	-	-	-	-	-	-	-	-	4	850	-	-
WP4	-	-	99	5,096	15	1,342	-	-	-	-	-	-	-	-	2	524	-	-
WP4-NE	-	-	12	1,180	-	-	-	-	-	-	-	-	-	-	2	250	-	-
Zerbogo NE	-	-	10	765	7	157	-	-	-	-	-	-	-	-	-	-	-	-
Zerbogo SW	-	-	32	2,127	7	1,165	-	-	-	-	-	-	-	-	-	-	-	-
Zergoré EST	-	-	6	600	1	154	-	-	-	-	-	-	-	-	-	-	-	-
Zergoré NW	2	294	52	3,385	9	867	-	-	-	-	-	-	-	-	-	-	-	-
Zergoré (ZGP)	107	11,668	955	43,816	57	5,130	-	-	257	2,549	175	1,750	2	180	-	-	85	3,456
Total	**854**	**112,599**	**11,185**	**381,676**	**857**	**57,696**	**15**	**3,820**	**455**	**4,529**	**175**	**1,750**	**3**	**559**	**32**	**2,406**	**94**	**3,610**

Figure 10-2 shows a plan view of the drilling completed on the Youga Project area. Figure 10-3 and Figure 10-4 show the Youga project area in more detail (excluding Songo and Zerbogo).

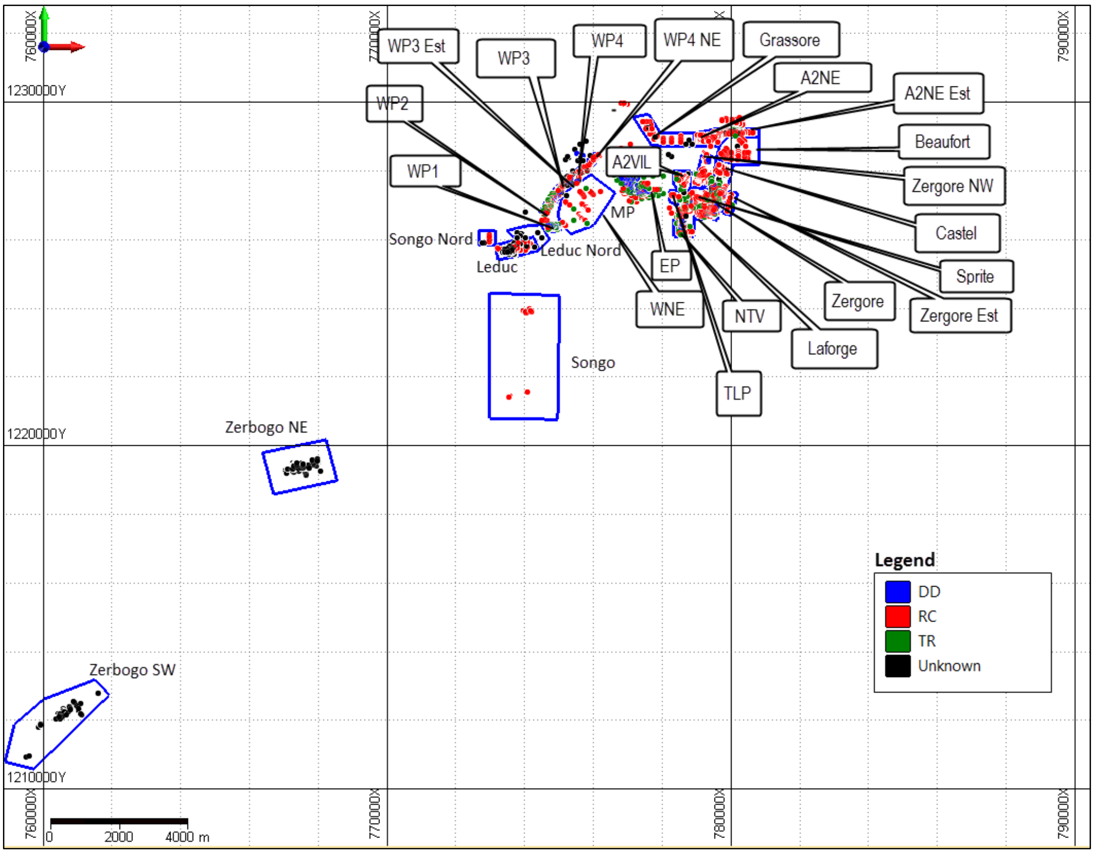


Figure 10-2: Youga drilling (project area and drill type)

Source: CSA Global, 2017

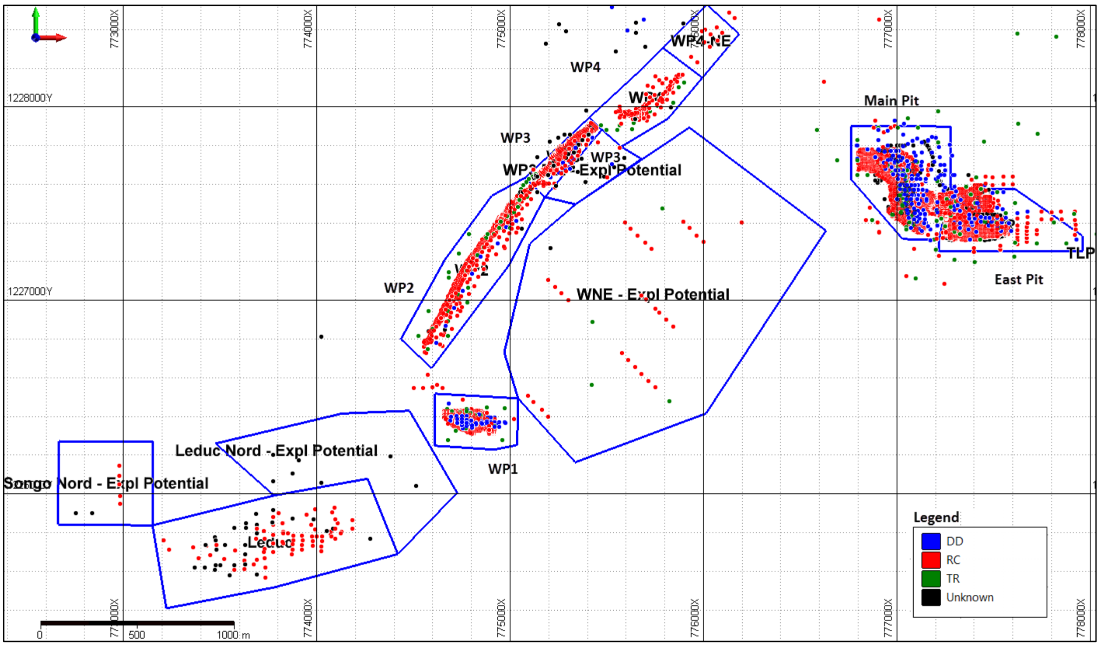


Figure 10-3: Youga drilling – project area and drill type (West pits, Leduc, Main Pit and East Pit)

Source: CSA Global, 2017

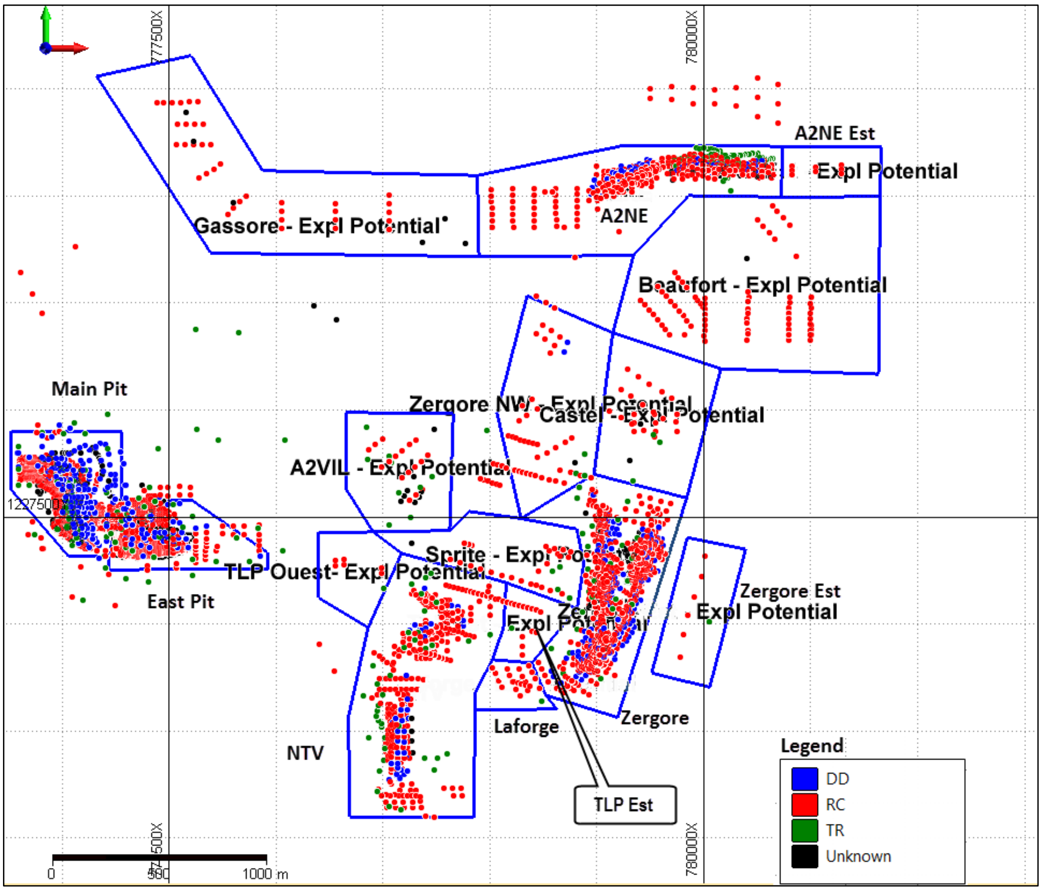


Figure 10-4: Youga drilling – deposit area and drill type (MP, EP, Zergoré, A2NE, TLP, NTV, Laforge, Castel, Sprite, Beaufort and Gassore)

Source: CSA Global, 2017

Figure 10-5 shows the current Gassore, A2NE Middle and A2N East project used in the 2018 MRE update.

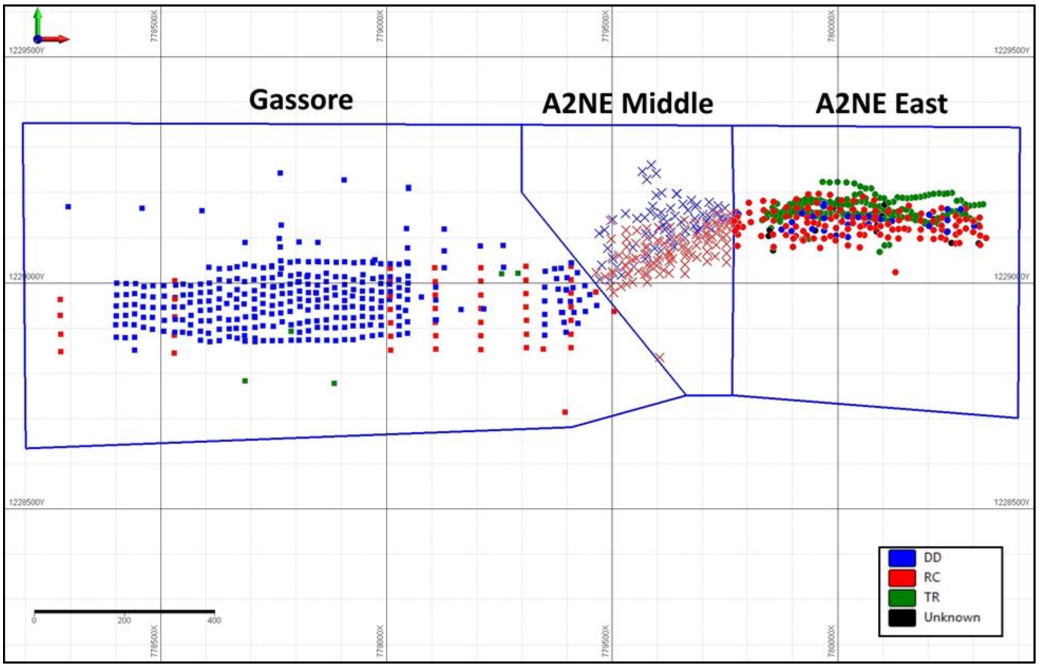


Figure 10-5: Updated drilling of the A2N and Gassore areas for use in the 2018 MRE update

Source: CSA Global, 2018

The drilling at Youga was targeted normal to the plane of the principal mineralised orientation ensuring the optimum angle of intersection (Table 10-5). Scissor holes, drilled back in the opposite sense, have also been completed on each deposit to ensure the proper orientation.

Table 10-5: Youga mineralisation and drilling orientation by zone

Domain	Mineralisation		Drilling	
	Strike	Dip	Azimuth	Dip
A2 Main	N-S	Moderate to steep E	270°	-45° to -50°
A2 East	E-W	Moderate to steep N	180°	-45° to -50°
A2 West Zone 1	E-W	Shallow to moderate N	Vertical, 180° and 270°	-40° to -50°
A2 West Zones 2 and 3	NNE-SSW	Steep SE	300° and 310°	-40° to -50°
Nanga	N-S	Steep E	270°	-50°
Tail	E-W	Shallow to moderate N	180°, 105° and 285°	-50°
A2N East	E-W	Steep N	180°	-50° to -55°
A2N Middle	NE-SW	Steep NW	180° and 155°	-50° to -55°
Gassore	E-W	Moderate to steep N	180°	-50° to -55°
Zergoré S and NE	NNE-SSW	Near vertical	280° and 300°	-45° to -55°
Zergoré NW	NNW-SSE	Near vertical	280° and 300°	-45° to -55°

Source: Endeavour 2015 Report, with A2N and Gassore updated in 2018

10.1.2 Ouaré Property Drilling Summary

Drilling on the Ouaré Exploration Permits can be separated into campaigns (by ownership) and by prospect area. Figure 10-6 below depicts the Exploration Permits in red and the prospect areas in blue. The dashed red lines show permits which have lapsed but have been reapplied for. Drillholes are depicted by black dots.

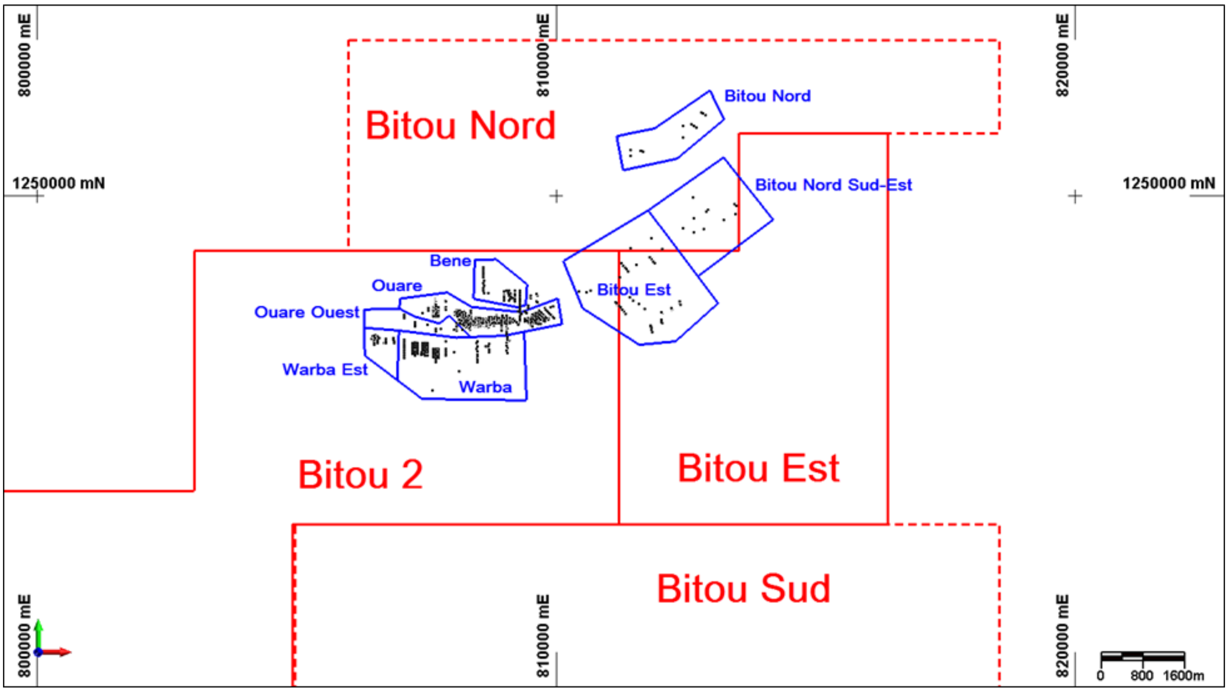


Figure 10-6: Ouaré licence areas (in red) and Project areas in blue (dashed red lines depict licences that have lapsed and have been reapplied for)

Source: CSA Global, 2017

Table 10-6 summarises the drilling completed on the Ouaré deposits by campaign, the upper records are those from the 2014 Endeavour report, the lowermost records are data not included in that report.

- Ashanti/Echo Bay and Endeavour/Etruscan. Only RC drilling was completed during the exploration stages carried out by Ashanti/Echo Bay, while Etruscan delineated an initial resource with RC drilling.
- Endeavour then undertook a resource definition drilling program which included RC and core drilling.
- MNG took over the project in April 2016 but have not undertaken any drilling to support MREs. MNG drilled 12 RC drillholes (1,098 m) targeting historical soil anomalies in Bitou Nord.

Exploration activities and data collection methodologies applied during the initial period are based on information compiled in Ashanti's 1999 databases and discussed in the Ashanti FS completed in 1999 (Lycopodium, 1999). Activities during the Endeavour-managed period are based on information from the 2014 Endeavour Technical Report.

Table 10-6: Summary of Ouaré drilling statistics

Company	Diamond		RC		Trench	
	No. of holes	Metres	No. of holes	Metres	No.	Metres
Ashanti/Echo	-	-	18	1,762	45	6,524
Etruscan	-	-	232	19,512	-	-
Endeavour	56	6,975	257	26,723	-	-
Subtotal (in 2014 report)	**56**	**6,975**	**507**	**47,997**	**45**	**6,524**
Unknown	-	-	-	-	3	350
Etruscan	-	-	34	1,127	19	682
Endeavour	-	-	26	2,644	-	-
TOTAL	**56**	**6,975**	**567**	**51,769**	**67**	**7,556**

Source: 2015 Endeavour Technical Report

Note that MNG drilled 12 RC drillholes in Bitou Nord which are not included in the above table. Table 10-7 lists the drilling by prospect area.

Table 10-7: Summary of Ouaré drilling statistics by deposit area

Project	DD		RC		TR	
	Count	Total (m)	Count	Total (m)	Count	Total (m)
BENE	-	-	45	3,798	2	357
Bitou Nord Sud Est	-	-	3	309	10	423
Bitou-Est	-	-	48	2,536	9	706
Bitou Nord	-	-	9	926	6	160
Ouaré	55	6,855	310	29,765	15	2,669
Ouaré Ouest	-	-	12	1,016	4	760
Ouaré Sud Ouest	-	-	-	-	10	851
Warba	1	120	116	11,133	7	1,120
Warba Est	-	-	24	2,287	4	511
Total	**56**	**6,975**	**567**	**51,769**	**67**	**7,556**

Figure 10-7 and Figure 10-8 (excludes Ouaré Sud Ouest) below depict the Ouaré prospect areas and drilling completed on them.

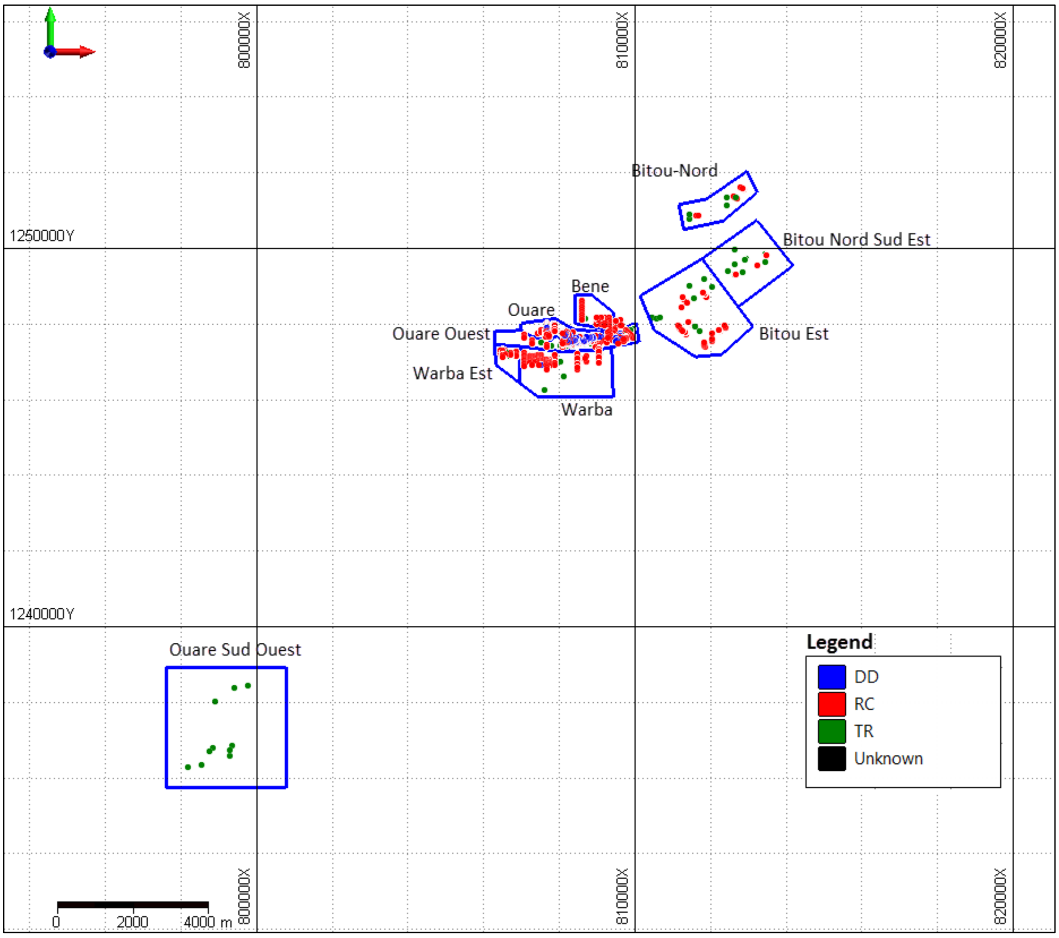


Figure 10-7: Ouaré drilling (deposit area and drill type)

Source: CSA Global, 2017

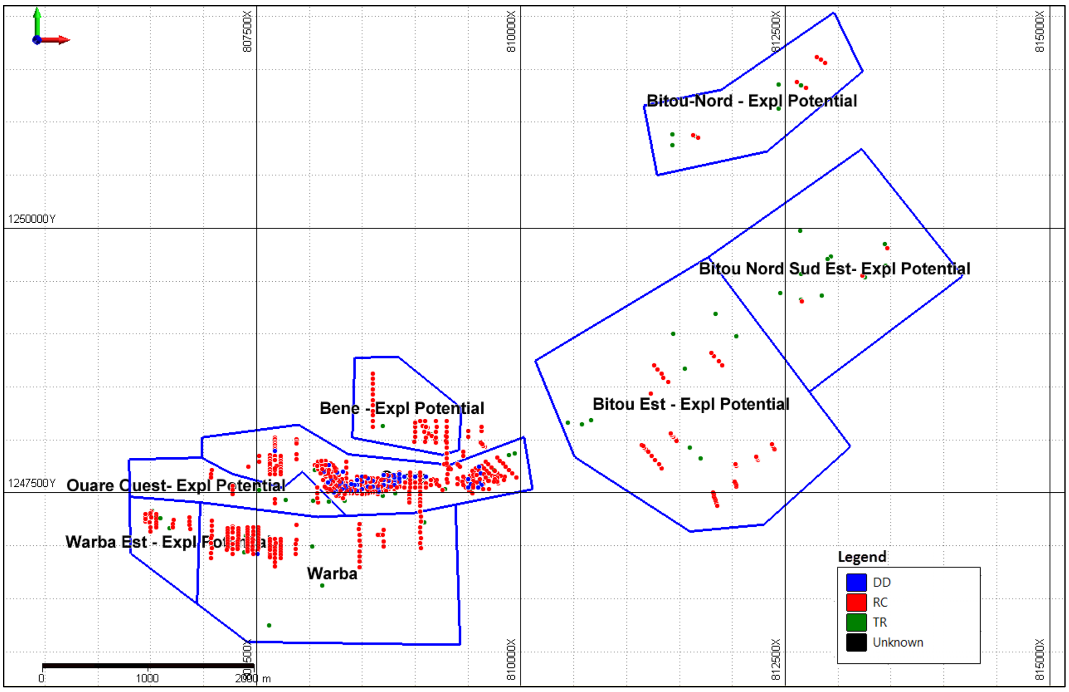


Figure 10-8: Ouaré drilling excluding Ouaré Sud Ouest (deposit area and drill type)

Source: CSA Global, 2017

The drilling at Ouaré was targeted normal to the plane of the principal, mineralised structures to ensure the optimum angle of intersection (Table 10-8). Scissor holes, drilled back in the opposite sense, have also been completed on each deposit to ensure that drilling was completed in the proper orientation.

Table 10-8: Ouaré mineralisation and drilling orientation by zone

Domain	Mineralisation		Drilling	
	Strike	Dip	Azimuth	Dip
Ouaré Central	E-W	Moderate to steep N	180°	-45° to -55°
Ouaré West	SE-NW	Moderate to steep N	220°	-45° to -55°
Ouaré East	E-W	Steeply N	0 and 315°	-45° to -55°

Source: Endeavour 2015 Report

The Mineral Resources defined at Ouaré are hosted within three zones (Central, West and East) along a structural corridor which runs roughly east-west; however, the orientation of the mineralisation does vary along the strike.

10.1.3 Balogo Property Drilling Summary

Between 2011 and 2014, GMR drilled approximately 65% of the holes and 27% of the metres as contained in the drill and trench database. From 2016 and 2017, all drilling was completed by MNG.

As per the 2016 Technical Report (MNG, 2016), procedures for all drilling completed at the property follow those employed by GMR. These procedures have been reported in GMR's 2015 Exploration Summary report (GMR, 2015).

Figure 10-9 below depicts the drilling completed at the Balogo property, whereas Table 10-9 summarises the drilling by exploration phase.

Core drilled by MNG were reviewed as part of the 2018 CSA Global site visit (see Section 12.2).

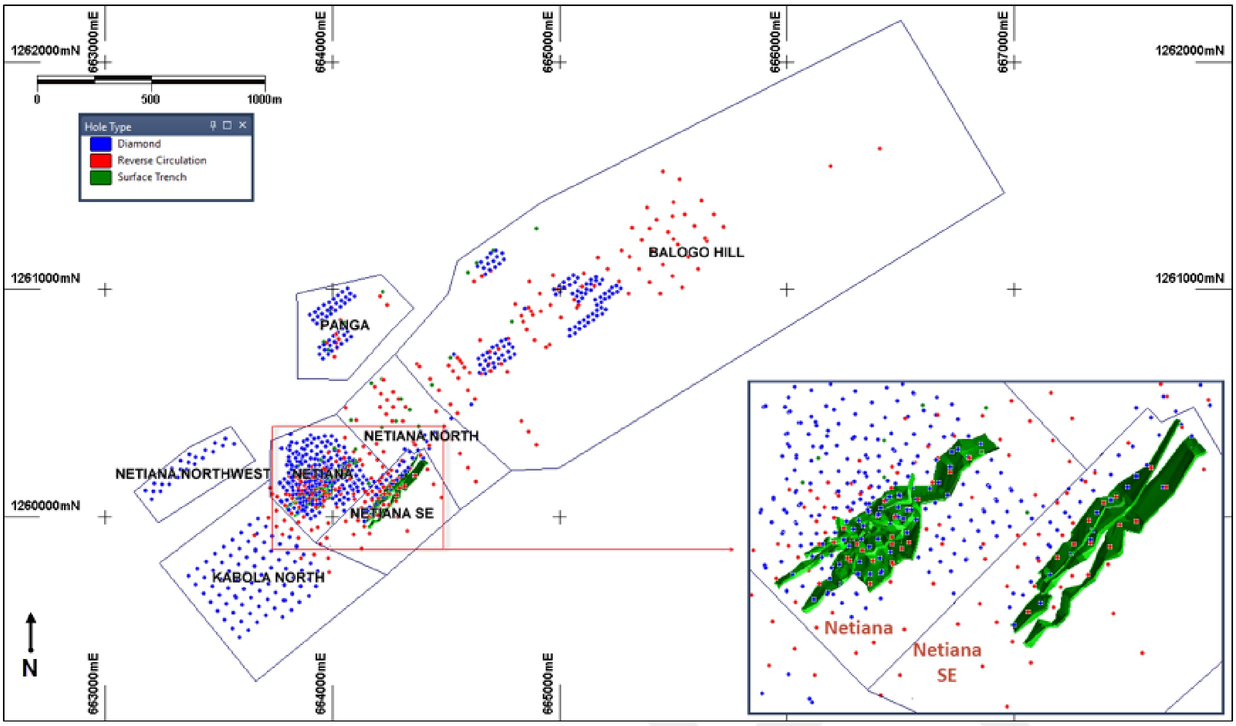


Figure 10-9: Drilling completed at the Balogo property outlined by general prospect areas

Source: CSA Global, 2017

Table 10-9: Balogo drillhole summary table

Phase	Company	Year(s)	Drilling type	No. of holes	Metres (sum)	Hole IDs	Drilling company
RC01	GMR	2011	RC	32	3,099.00	BRC001 to BRC032	Boart Longyear
RC02*			RC	35	4011.00	BRC033 to BRC067	Boart Longyear
RC03*			RC	195	23906.00	BRC068 to BRC250	Forages Technique-Eau
DD01		2012	DDH	11	2,268.65	BDH001 to BDH008	Major Drilling
DD02			DDH	22	5,285.94	BDH009 to BDH030	Major Drilling
DD03			RC	13	1,346.00	DRC001 to DRC011B	Forages Technique-Eau
RC04			RC	8	1,073.00	BRC251 to BRC258	PPI
TR1		2012–2013	TR	27	3,512.00	BT01 to BT32	
RC05		2013	RC	22	2,081.00	BRC259 to BRC280	PPI
RC06		2014	RC	6	726	BRC281 to BRC286	PPI
TR2		2014	TR	5	492	BT33 to BT37	
Subtotal – GMR				**376**	**47,800.59**		
DD04	MNG	2016	DDH	76	9,397.95	BDH031 to BDH101	PPI
DD06			DDH	3	184.5	BMH001 to BMH003	FDC
ST			DDH	33	3,290.30	BSH001 to BSH032	FDC
TR3			TR	3	260.2	BT38 to BT40	
DD05		2016–2017	DDH	94	13,742.10	BDH102 to BDH195	FDC
Subtotal – MNG				**209**	**26,875.05**		
TOTAL				**750**	**74,675.64**		

** Minor differences in total metres from the GMR Exploration Report.*
*** Grade control drilling not provided to CSA Global.*

Table 10-10: Balogo Property – drill summary by type and exploration Area

Project	DD		RC		TR	
	Count	Total (m)	Count	Total (m)	Count	Total (m)
Balogo Hill	106	11,179	92	10,266	7	985
Kabola North	-	-	12	1,466	-	-
Netiana	252	38,479	92	11,597	8	1,188
Netiana North	11	1,150	28	2,846	8	999
Netiana NW	25	3,133	-	-	-	-
Netiana SE	39	3,796	45	5,577	-	-
Panga	47	5,460	11	1,139	-	-
Unknown	7	540	31	3,351	1	165
Total	**487**	**63,736**	**311**	**36,242**	**24**	**3,337**

10.1.4 Significant Intercepts

Several exploration areas have been drilled and trench tested at the Youga, Ouaré and Balogo licences (drilling is tabulated in Table 10-4 for Youga, Table 10-7 for Ouaré and Table 10-15 for Balogo). Significant intercepts (1 g/t over 5 m) are tabulated in Table 10-11 for Youga, Table 10-12 for Ouaré and Table 10-13 for Balogo. The orientation of mineralisation relatively to the drill angle for these areas remains unconstrained and so their true thickness is undetermined.

The locations of the exploration areas are provided in Figure 10-3 and Figure 10-4 for Youga, and Figure 10-7 and Figure 10-8 for Ouaré.

Exploration Targets (potential/conceptual tonnage and grades, expressed as ranges, for further exploration as per Clause 2.3/2 Rules and Policies for NI 43-101) for Warba, Gassore and Zerbogo South West were generated and reported in Section 10.2. There has been insufficient exploration to define a

Mineral Resource in these areas and it remains uncertain if further exploration will result in the target being delineated as a Mineral Resource.

Table 10-11: Significant intercepts (1 g/t over 5 m) for exploration target areas at Youga

Prospect	Hole ID	Hole type	From (m)	To (m)	Interval width	Grade	Intercept description
A2VIL	A2-00-T129	TR	72	104	32	6.69	32.00 m at 6.69 ppm
	A2-00-T138	TR	10	16	6	2.55	6.00 m at 2.55 ppm
	RC-05-266	RC	41	53	12	1.2	12.00 m at 1.20 ppm
	YARC-100	RC	1	8	7	1.92	7.00 m at 1.92 ppm
Gassore	YGRC-015	RC	58	63	5	4.14	5.00 m at 4.14 ppm
	YGRC-018	RC	52	57	5	3.04	5.00 m at 3.04 ppm
	YGRC-033	RC	63	70	7	2.59	7.00 m at 2.59 ppm
	YGRC-033	RC	90	100	10	1.03	10.00 m at 1.03 ppm
La Forge	YLFRC-006	RC	41	46	5	2.46	5.00 m at 2.46 ppm
	YLFRC-014	RC	9	14	5	2.07	5.00 m at 2.07 ppm
LeDuc Nord	A2-98-T83B	TR	69.05	77.06	8.01	2.74	8.01 m at 2.74 ppm
Songo Nord	SONRC-12-009	RC	12	17	5	1.52	5.00 m at 1.52 ppm
Sprite	A2V-05-T197	TR	16	30	14	3.55	14.00 m at 3.55 ppm
	I-95-ZT11	TR	76	86	10	2.02	10.00 m at 2.02 ppm
	YSRC006	RC	39	44	5	2.46	5.00 m at 2.46 ppm
	YSRC013	RC	90	95	5	2.07	5.00 m at 2.07 ppm
TLP EST	RCY96-101	RC	0	6	6	2.84	6.00 m at 2.84 ppm
WP3 EST	A2-97-T52	OTR	94	106	12	2.26	12.00 m at 2.26 ppm
	A2-97-T53	OTR	96	106	10	2.31	10.00 m at 2.31 ppm
	A2-98-T64	OTR	236	242	6	1.01	6.00 m at 1.01 ppm
	A2-98-T65	OTR	156	164	8	2.35	8.00 m at 2.35 ppm
	A2W-04-62	DD	108.77	118	9.23	2.9	9.23 m at 2.90 ppm
	A2W-04-62	DD	122.45	131.8	9.35	1.31	9.35 m at 1.31 ppm
	WP3_ADGC_32	RC	109	115	6	1.55	6.00 m at 1.55 ppm
	WP3_ADGC_32	RC	119	126	7	1.13	7.00 m at 1.13 ppm
WP4-NE	A2-98-T73	OTR	86	94	8	1.82	8.00 m at 1.82 ppm
	RC-05-349	RC	13	20	7	1.18	7.00 m at 1.18 ppm
	RC-05-349	RC	24	29	5	1.2	5.00 m at 1.20 ppm
	RC-05-349	RC	44	49	5	1.01	5.00 m at 1.01 ppm
	RC-05-349	RC	74	81	7	1.98	7.00 m at 1.98 ppm
	YARC-036	RC	57	65	8	1.51	8.00 m at 1.51 ppm
Zerbogo NE	ZD-05-07		13	18	5	1.06	5.00 m at 1.06 ppm
	ZERBRC-12-043	RC	8	22	14	1.35	14.00 m at 1.35 ppm
Zerbogo SW	RCZ-96-04	RC	20	28	8	1.63	8.00 m at 1.63 ppm
	ZERBRC-12-045	RC	40	46	6	1.87	6.00 m at 1.87 ppm
Zergoré EST	ZGP_ST_03	RC	72	82	10	1.58	10.00 m at 1.58 ppm
Zergoré NW	I-94-ZT32A	TR	68.09	74	5.91	1.54	5.91 m at 1.54 ppm
	I-95-ZT32A	TR	68	74	6	1.54	6.00 m at 1.54 ppm
	I-95-ZT36	TR	138.08	148.16	10.08	2.54	10.08 m at 2.54 ppm
	I-95-ZT36	TR	186.46	202.59	16.13	2.6	16.13 m at 2.60 ppm
	YZ-12-96	DD	70	75	5	2.88	5.00 m at 2.88 ppm
	YZRC-230	RC	15	25	10	4.49	10.00 m at 4.49 ppm

Table 10-12: Significant intercepts (1 g/t over 5 m) for exploration target areas at Ouaré

Prospect	Hole ID	Hole type	From (m)	To (m)	Interval width	Grade	Intercept description
BENE	BITRC-08-085	RC	22	32	10	4.61	10.00 m at 4.61 ppm
	BITRC-12-449	RC	4	10	6	8.32	6.00 m at 8.32 ppm
	BITRC-12-459	RC	59	64	5	1.93	5.00 m at 1.93 ppm
	BITRC-12-483	RC	46	51	5	7.61	5.00 m at 7.61 ppm
Bitou-Nord	BNTR-08-017	TR	32	38	6	7.15	6.00 m at 7.15 ppm
Warba	BITRC-10-169	RC	22	30	8	1.48	8.00 m at 1.48 ppm
	BITRC-10-213	RC	26	32	6	3.73	6.00 m at 3.73 ppm
	BITRC-10-220	RC	78	84	6	7.48	6.00 m at 7.48 ppm
	BITRC-10-220	RC	88	96	8	1.42	8.00 m at 1.42 ppm
	BITRC-11-341	RC	5	10	5	1.18	5.00 m at 1.18 ppm
	BITRC-11-341	RC	65	70	5	3.02	5.00 m at 3.02 ppm
	BITRC-11-354	RC	51	64	13	1.38	13.00 m at 1.38 ppm
	BITRC-11-362	RC	31	37	6	3.67	6.00 m at 3.67 ppm
	BITRC-11-364	RC	22	28	6	4.66	6.00 m at 4.66 ppm
Warba EST	BITRC-10-151	RC	12	20	8	1.91	8.00 m at 1.91 ppm
	BITRC-10-301	RC	30	36	6	9.09	6.00 m at 9.09 ppm
	BITRC-10-302	RC	42	54	12	16.36	12.00 m at 16.36 ppm
	BITRC-12-406	RC	19	24	5	3.05	5.00 m at 3.05 ppm
	BITRC-12-406	RC	51	59	8	11.31	8.00 m at 11.31 ppm
	BITRC-12-408	RC	0	7	7	1.99	7.00 m at 1.99 ppm
	BITRC-12-408	RC	49	55	6	1.68	6.00 m at 1.68 ppm
	TR-42	TR	28.874	34.847	5.97	1.59	5.97 m at 1.59 ppm

Table 10-13: Significant intercepts (1 g/t over 5 m) for exploration target areas at Balogo

Prospect	Hole ID	Hole type	From (m)	To (m)	Interval width	Grade	Intercept description
Panga	BRC270	RC	34	39	5	50.89	5.00 m @ 50.89 ppm
Panga	BRC281	RC	34	44	10	8.4	10.00 m @ 8.40 ppm
Balogo Hill	BRC013	RC	29	36	7	3.02	7.00 m @ 3.02 ppm
Netiana NW	BDH111	DD	12.4	18.25	5.85	2.64	5.85 m @ 2.64 ppm
Netiana N	BT31	TR	16	24	8	1.11	8.00 m @ 1.11 ppm

10.2 Exploration Targets

Several exploration areas (other than those from which Mineral Resource have been reported) were drilled and trench tested at the Youga and Ouaré licences (see Table 6-2 and Figure 10-3 to Figure 10-4 for Youga and Table 10-7 and Figure 10-7 and Figure 10-8 for Ouaré).

At Warba, Gassore and Zerbogo South West, CSA Global believed there to be sufficient continuity of mineralisation between drill fences to generate “Exploration Targets”. Exploration Targets are defined as potential tonnage and grades, expressed as ranges, as per Clause 2.3/2 within the Rules and Policies for NI 43-101. CSA Global states that there has been insufficient exploration to define a Mineral Resource in these areas and highlights that it remains uncertain if further exploration will result in their being delineated as a Mineral Resource. Thus, the reported tonnages and grades below are entirely conceptual in nature.

Exploration Targets were determined by creating mineralisation envelopes around a combination of 0.25 g/t and 0.5 g/t intercepts following a similar strategy to the modelling undertaken for Mineral Resources. Wireframing was completed in Micromine with solids were cut to topography. Tonnages are reported as a range using a 2.4 t/m^3 and 2.74 t/m^3 (approximate Oxide and Fresh bulk densities used in the reporting of Mineral Resources in Section 14). Length-weighted mean grades were determined for each area by flagging assays within the models, applying top-cuts, and de-clustering using the nominal drill spacing. Results are provided in Table 10-14.

Table 10-14: Exploration Targets for Youga and Ouaré (CSA Global, 2017)

Exploration Target	Tonnage tange (kt)	Grade range (Au g/t)
Warba	1,500 to 2,300	1.0 to 1.5
Gassore	2,500 to 4,000	1.0 to 1.5
Zerbogo SW	800 to 1,500	1.2 to 1.8

Note: Grades and tonnes are rounded to reflect that they are estimates.

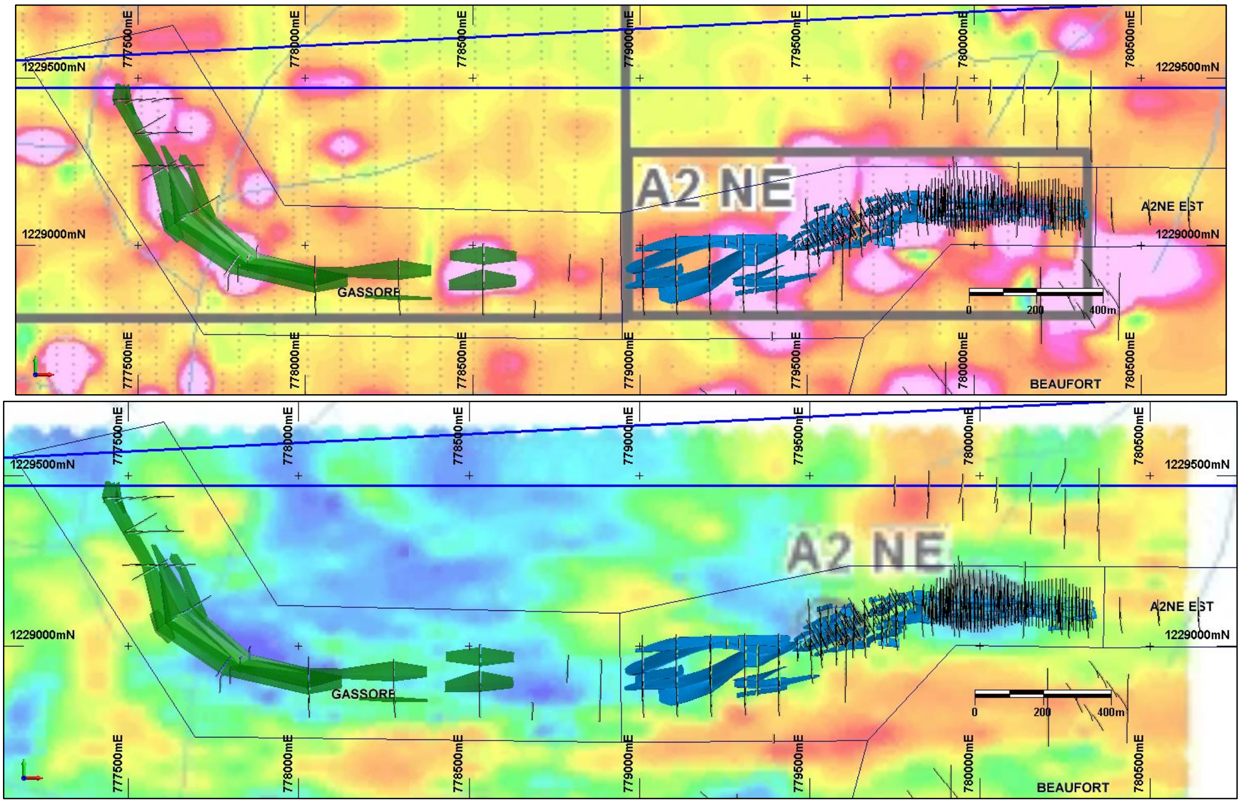


Figure 10-10: Example of Exploration Target 3D model at Gassore, overlain on (top) gold-in-soils and (bottom) IP survey results

Note: A2NE Mineral Resource models shown in blue, Gassore Exploration Target in green.

Several exploration areas have been drilled and trench tested in the Balogo and Dabinyan III licences and further exploration work on these targets is warranted. A summary for these the exploration areas is provided in Table 10-15.

Figure 10-11 for the locations of the exploration areas relative to the high-resolution ground magnetic survey. Figure 10-12 shows representative sections through the Netiana deposit.

Table 10-15: Balogo property – exploration area summary

Area	Prospect	Comment	Dimension (approx.)
Balogo	Netiana NW	Gold in soils anomaly. Subtle magnetic signature. Off strike relative to Netiana. One hole high grade.	400 m x 100 m
Balogo	Netiana North	Strong gold in soils (artisanals active). Strong magnetic signature. Along strike of Netiana in East and Balogo Hill in West. Very low-grade drill results.	230 m x 400 m
Balogo	Balogo Hill	Strong gold in soils (artisanals active). Strong magnetic signature. Along strike of Netiana in East and Balogo Hill in West. Very low-grade drill results.	1,500 m x 250 m
Balogo	Panga	Anomalous gold-in-soils with subtle magnetic signature (analytical signal).	230 m x 200 m
Balogo	Kabola North	Gold-in-soils. No magnetic signature. Along strike of Netiana. Drilling almost completely barren, except discrete intersections. Soil anomalism potentially from artisanal contamination.	400 m x 400 m

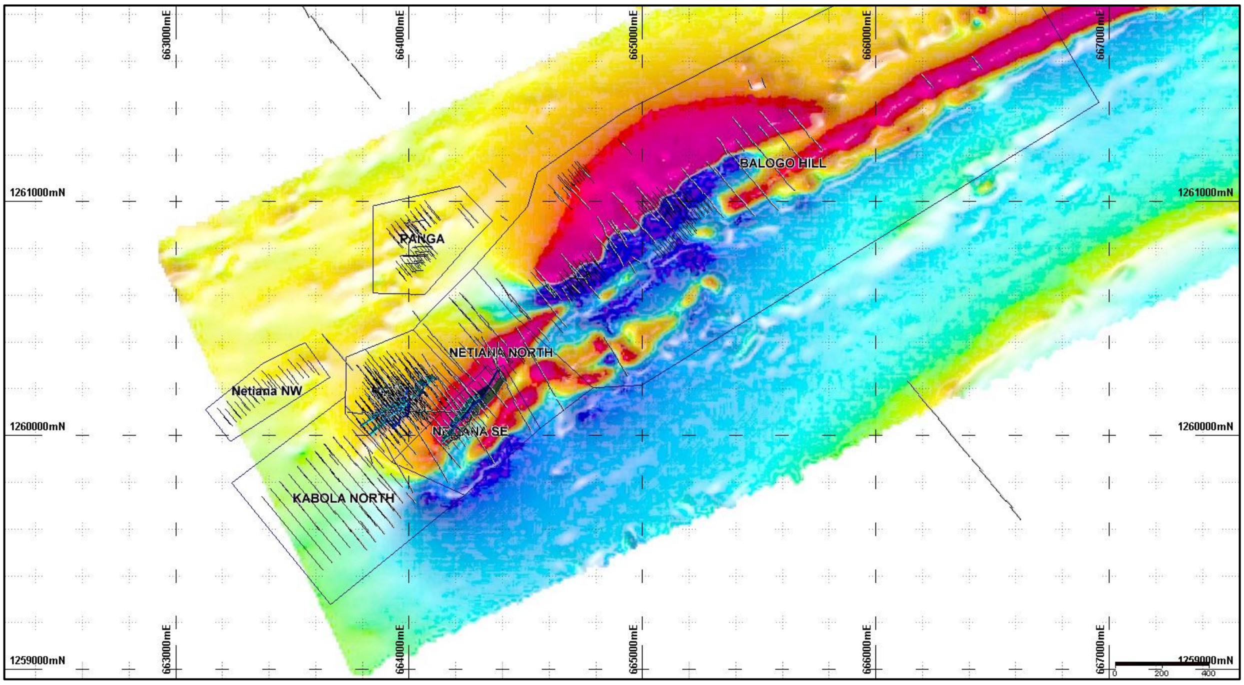


Figure 10-11: Exploration areas shown with drillholes for the Balogo and Dabinyan III licences against magnetic ground survey data

Note: Gold-in-soils not shown due to significant artisanal contamination locally.
Source: CSA Global, 2017

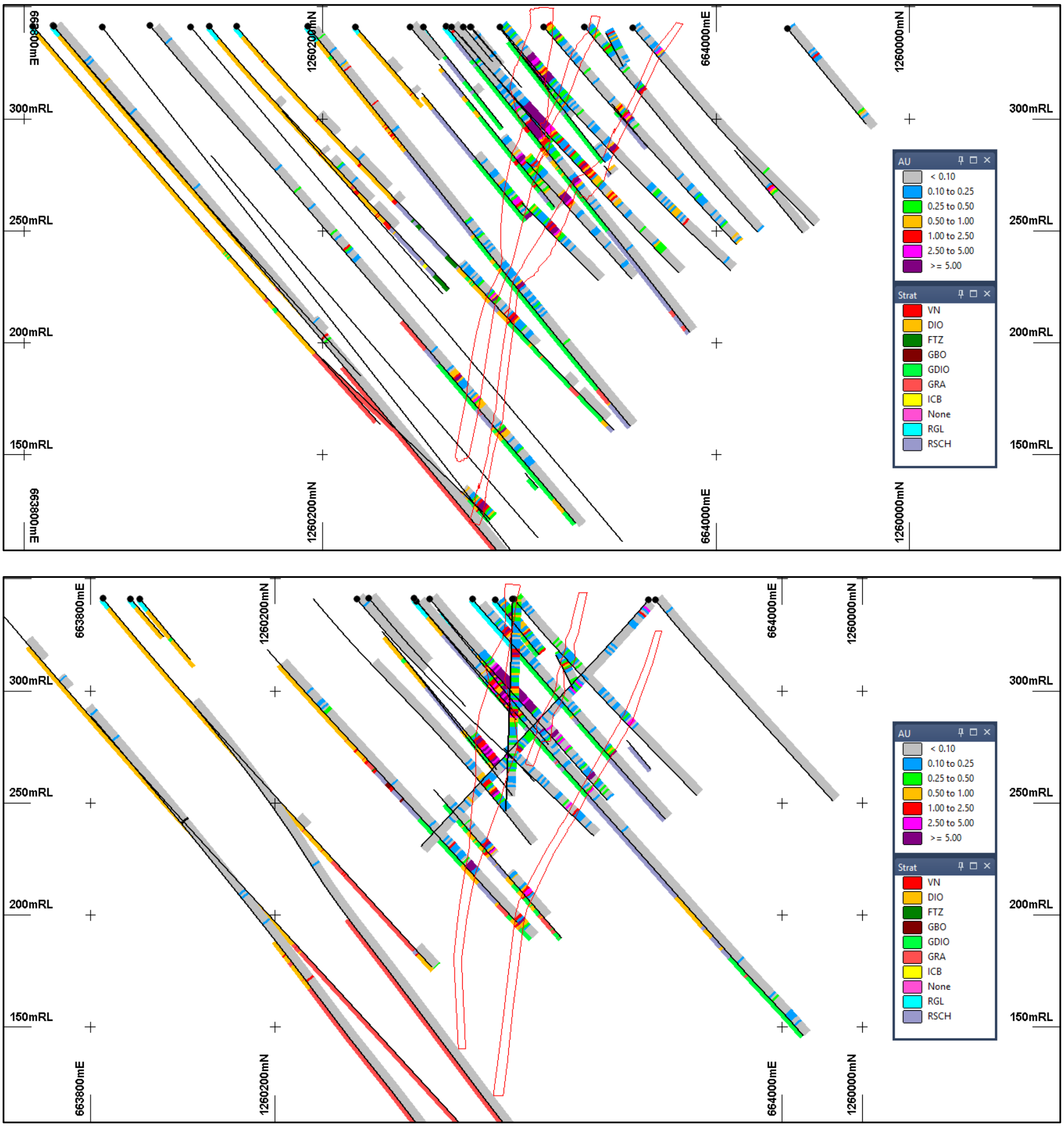


Figure 10-12: Representative sections through Netiana

Source: CSA Global, 2017

10.3 Drilling Procedure

10.3.1 Pre-Avesoro Drilling Procedures

Endeavour DD holes at the Youga and Ouaré properties were typically collared using HQ bits and reduced to NQ bits once competent rock was encountered, usually at depths less than 25 m downhole. Where ground was soft or loose, casing was inserted into the drillholes.

Endeavour RC drilling is usually done on 20 m bench heights at an angle of inclination of ≥50°. Drillhole diameters are below 5-1/8" and RC drilling and sampling are stopped during heavy rainfall to avoid wet samples.

Sampling of RC chips at the Balogo property was completed at 1 m sample intervals. The entire sample, typically weighing 40 kg, was collected from the drill rig cyclone and sealed rig-side before being transported under supervision to a central sample processing site. To ensure drill-site quality control (QC), a trained technician and/or a geologist was permanently on site during all RC drilling.

10.3.2 Avesoro Drilling Procedures

Avesoro drilling was undertaken by the Faso Drilling Company, using a PD500 drill rig (http://www.mbef.com.tr/urunler/pd500). Endeavour RC drilling procedures have been continued to be employed by Avesoro. Drilling is normally done on 20 m bench heights at an angle of inclination of ≥50°. Drillhole diameters are below 5-1/8" and RC drilling and sampling are stopped during heavy rainfall to avoid wet samples.

10.3.3 Limitations from the 2017 Mineral Resource Estimate

CSA Global did not receive details regarding the recoveries (mass %) and conditions (wet, damp or dry) of the RC samples which were used in the estimation of Mineral Resources. Whilst RC was the primary drill type at the start of exploration at Balogo, it was superseded by DD and the RC data represents approximately 20–25% of the Mineral Resource database.

Some twinning of the RC data was undertaken by MNG and was reviewed by MNG, alongside the QAQC results. This resulted in the exclusion of seven RC holes, and one diamond hole due to uncertainty over their results. CSA Global has reviewed these holes and agrees with their exclusion. Further detail is documented in Section 12.3.

CSA Global also completed a general statistical review of RC, DD drilling and trench (TR) data which is documented in Section 12.3, and the results support the use of the three datasets in the 2017 MRE, except for the eight excluded holes.

10.4 Logging

10.4.1 Pre-Avesoro Logging Procedures

The 2014 Endeavour Technical Report noted that the most important geological factors identified from the Youga and Ouaré deposits included; host rock, silicification, quartz-veining and pyrite content. Endeavour standardised geological logging of these features by implementing standardised coding. Logging was performed on paper log sheets and data entry and monitoring procedures were implemented to minimise data problems. All DD core was photographed, and the photos were maintained with the geological database.

All historical (i.e. pre-Endeavour) diamond drill core and RC chips (where possible) from Mineral Resource areas were re-logged by Endeavour using Endeavour coding.

Balogo drill core was collected daily and brought to the exploration camp where it was placed onto logging tables and logging completed on paper forms to be later transcribed to a computer in an XLS based logging form. Geologists logging the core also marked the intervals for sampling and filled out the sample tag book. Core sampling was generally at 1 m intervals, although sampling intervals were adjusted to fit geological boundaries. Once logging was completed, core was photographed two boxes at a time.

10.4.2 Avesoro Logging Procedures

Avesoro has continued to use Endeavour's lithological codes, with some modifications and additions. The logging team record lithology and mineralisation indicators such as silicification, alteration, quartz-veining, sulphide content, etc. Geologists use laptops to capture logging data in Microsoft Excel spreadsheets; no paper log sheets are used. All DD core was photographed, and the photos were maintained with the geological database.

10.5 Collar Surveying

10.5.1 Pre-Avesoro Collar Surveying Techniques

All drill collars at the Youga and Ouaré properties completed during the Ashanti/Echo Bay and Endeavour work programs were surveyed using a combination of total-station survey and differential GPS techniques by qualified surveyors and utilised control points.

Balogo drillhole collars were surveyed using a differential GPS method and was collected in WGS84, UTM Zone 30 North.

10.5.2 Avesoro Collar Surveying Techniques

The Avesoro procedure for drillhole collar surveying are summarised below:

- UTM projection, WGS84 datum UTM Zone 30 Northern Hemisphere is used for any readings undertaken in the field.
- Triangulation points were surveyed by an outside consultancy company at the beginning of the project. Additional triangulation points have been generated from the original control points by the project survey team using total station devices (Sokkia SET530 and Leica TS12+).
- Leica GS16 and GS10 differential GPS units are used to survey collars with an acceptable maximum difference of 5 cm for real-time mode and RTK mode. If the surveying team cannot get within a 5 cm accuracy threshold, the base station is moved. Differential GPS units retrieve data from GPS and GLONASS satellites.
- In flat terrain, data is collected from measuring points which are a maximum of 5 m apart. If the ground is undulating, measuring points are a maximum of 1 m apart.

10.6 Downhole Surveying

10.6.1 Pre-Avesoro Downhole Surveying Techniques

Ashanti/Echo Bay surveyed downhole deviation at the Youga and Ouaré properties using Sperry Sun single shot downhole cameras at intervals ranging from 20 m to 126 m and corrected for magnetic declination. Drilling completed by Endeavour were downhole surveyed using a Flexit© downhole instrument at a minimum of every 30 m and measured relative to magnetic north.

Downhole surveying at the Balogo project was undertaken using a digital Reflex Ez-shot camera. The downhole survey procedure is described below:

- The azimuth provided by the camera was referenced to Magnetic North and corrected using the magnetic declination for the area at the time of drilling (approximately -2.2°).
- For DD holes, surveys were carried out at depths of 6 m, 30 m and thereafter every 30 m down the hole. In RC holes, downhole surveys were carried out every 12 m.
- Survey results were reviewed by company’s representative at the drill rig who checked for unusual dip or azimuth changes. Downhole survey results were referenced against the planned survey and holes and re-surveyed if results anomalous.

10.6.2 Avesoro Downhole Surveying Techniques

Avesoro drillholes were downhole surveyed by the drilling company using a Reflex Ez-Trac downhole instrument, starting at a depth of 6 m and every 50 m thereafter. Readings are relative to magnetic north.

10.7 Reliability and Recovery

10.7.1 Pre-Avesoro Reliability and Recovery

The sample recovery of the drilling completed prior to Endeavour involvement for both Youga and Ouaré has not been recorded in the database, although Ashanti reported sample recovery for both the RC and diamond drilling to be high (Lycopodium, 1999).

As per the 2014 Endeavour technical report, for drilling that was managed by Endeavour, recovery was routinely calculated and captured in the database:

- Youga had an average core recovery near 95% and RC recoveries estimated near 79%. Acceptable recovery was achieved for all programs of drilling completed.
- Ouaré had an average core recovery near 95% and RC recoveries estimated near 80%. Acceptable recovery was achieved for all programs of drilling completed.

Balogo core recovery, rock quality designation (RQD) and solid core recovery (SCR) was logged in the exploration camp and loaded into the sample database. Average recovery was excellent, with a mean recovery of >92% within mineralisation. Any poor core recovery, which is very limited, is generally limited to the first 1 m to 3 m, due to highly weathered material and in and around shear zones. Figure 10-13 shows SCR as logged from drillholes at Netiana.

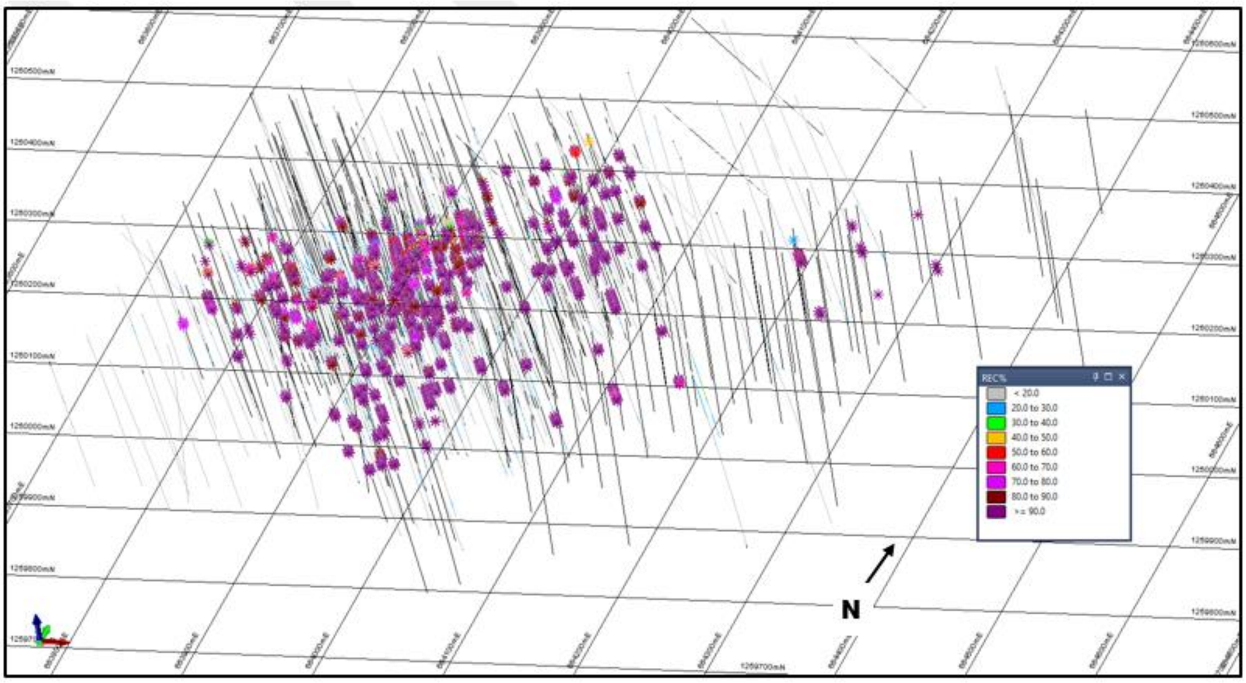


Figure 10-13: Recovery data within the Netiana mineralisation model, view towards northwest

Source: CSA Global, 2017

10.7.2 Avesoro Reliability and Recovery

Avesoro procedures state that Core Recovery, RQD and SCR are measured, included on the log sheet and captured in a Microsoft Excel file. RQD is defined as the sum of core greater than 10 cm divided by the drilling interval. SCR is defined as the sum of lengths of solid core (representing a complete cylinder) divided by the interval length.

10.7.3 Limitations from the 2017 Mineral Resource Estimate

The database provided by Avesoro only included 242 recovery records from pre MNG drilling (which averaged 88% recovery) and 3,261 MNG recovery records. Therefore, most of the drillholes did not have any recovery data, with all recovery data from the Youga property and none from the Ouaré property. Core recovery (based on 3,503 samples) averaged 94% for all samples. RQDs averaged 38% for all samples and SCR averaged 51% for all samples (Table 10-16).

Table 10-16: Youga – core recovery, RQD and SCR data

Project	Count	Mean recovery (%)	Mean RQD (%)	Mean SCR (%)
A2NE (MNG)	1,988	94	21	37
Kabola North (MNG)	1,273	94	65	72
NTV (pre-MNG)	242	88	42	56
Total	**3,503**	**94**	**38**	**51**

No sample weight data were captured in the database for Youga or Ouaré samples. Therefore, no review of recovery vs. grade could be made for any of the RC samples or for most of the diamond core samples.

10.8 Drill Site Security and Drill Core Handling

10.8.1 Pre-Avesoro Procedures

The Endeavour drilling procedures for the Youga, Ouaré and Balogo properties were as follows: All DD core from the Youga and Ouaré deposits was sampled by splitting/cutting the core and sampling half of the material. The remaining half was stored at the secured core yards at the Youga and Bitou exploration camps.

10.8.2 Avesoro Procedures

DD core is placed in core trays next to the drill rig during the drilling operation and collected twice a day by an Avesoro driver who transports them to the secured core shed at Youga mine. Core shed access is restricted to the exploration team, drill crew and mine geologists and there is 24/7 security at the gate and the core shed is surrounded by a fence.

11 Sample Preparation, Analysis and Security

11.1 Sampling

11.1.1 Pre-Avesoro Sampling

In context to sections relating to the Balogo property, unless otherwise stated, much of the content below has been summarised from the GMR's 2015 Exploration Summary report (GMR, 2015). The Qualified Persons take responsibility for the content of this section and believe it is accurate and complete in all material aspects.

Trench Sampling

The Endeavour trenching completed at Youga and Ouaré generally consisted of manually excavated trenches to bedrock (saprolite), usually less than 2 m in depth. Trenches were mapped in detail prior to sampling continuous channels at 1 m or 2 m intervals.

Reverse Circulation Drill Sampling

Procedures for Endeavour samples (Youga and Ouaré) were as follows:

- Samples were collected over 1 m intervals in a large plastic bag directly from the cyclone. The entire sample was weighed then split in a three-tier riffle splitter to reduce to approximately 2 kg. The splitter and boxes were cleaned with compressed air between samples. If the sample was wet, the entire sample was placed in a large rice bag and allowed to dry in the sun before the sample was weighed and split down.
- Procedures completed at the drill rig included:
  - The geotechnician recorded the sample number, the weight of the total sample and whether water was present
  - The geologist logged characteristics of the chips on a log sheet
  - Either an A3 size chip board was completed by gluing powder and washed chips from each sample interval, or a subsample of chips was placed in partitioned chip trays.
- The approximately 2 kg subsamples were placed in plastic bags and sealed with a numbered sample tag enclosed. A second 2 kg subsample was split off and retained on site as a reference sample.

GMR procedures were as follows:

- Samples (Balogo) were collected over 1 m intervals in sample bags from the rig (typically 40 kg). They were transported under supervision to a central sample processing site where they were weighed and split through a riffle splitter until a sub-sample of approximately 2–3 kg was obtained. Wet samples were collected at the drilling rig in their entirety and were sun-dried before being riffle-split.
- The 2–3 kg sample splits were collected into pre-labelled plastic sample bags and tags repeating the sample number were inserted into these bags. Every sample was sent to the laboratory for processing and assaying.
- The remaining portions of the split samples were retained in the Balogo Sample Logging, Preparation and Storage Facility as field duplicates. The rice sacks used to capture the samples from the base of the cyclone were used to store the remaining field duplicate split/rejects.

Diamond Drill Core Sampling

Endeavour procedures were as follows:

- Diamond core was placed into treated, wooden core boxes at the drill site by the contract drillers. The drillers also inserted wooden blocks, indicating the meterage, into the core boxes at the end of each run (normally every 3 m).
- Geologists and geotechnicians collected measurements of all geotechnical details, core recovery, geological logging as well as photographing the core. Where possible, samples were routinely collected over 1 m intervals, but ranged in length from 0.5 m to 1.5 m due to respecting geological contacts. Care was taken to consistently collect assay samples from one side of the core.
- Each core box was labelled with aluminium tape indicating the hole number, box number, and the hole length at the beginning and end of the core contained within the box. The labelled core boxes were stored under cover in steel racks in the core facility.

Balogo procedures were as follows:

- Core was cut with a diamond saw with the blade cooled by a stream of non-recirculated water.
- GMR geologists did not mark a cutting line on the core and the placement of the core on the saw is the responsibility of the trained core cutter. GMR sampled all drillholes from top to bottom, sampling the left-hand side of the core, retaining the right-hand side in the core tray for reference.
- During core cutting, in intersections with fractured zones, the core was reconstructed where possible by joining pieces of core. To prevent breakage or contamination, and to stop parts of the sample being washed away during core cutting, the reconstructed core was wrapped with tape prior to cutting. Broken or soft sections of the core (typically the upper few metres of the holes) were sampled by the geologists using a spatula and spoon method before being placed in labelled sample bags and dispatched for analysis. After cutting, both pieces of core are replaced in the core tray.

Split core samples were sampled by a technician who was also responsible for the insertion of the required QAQC control samples. Each sample was bagged and assigned a unique sample number (sample ID) and dispatched to the laboratory for analysis. The prepared samples were placed into empty rice-sacks for transport to the Laboratory in Ouagadougou.

11.1.2 Avesoro Sampling

Trench Sampling

Avesoro procedures are as follows:

- An excavator is used to open trenches in Youga. A field technician is tasked with supervising the trenching and ensuring that the excavator digs until bedrock is reached.
- The trench wall is logged by a geologist who uses the same logging criteria as used for drill core logging and records lithology, quartz veins, possible mineralised zones, level of oxidation, etc.
- Sampling intervals are marked by a geologist on one side of the trench in a continuous channel at 1 m or 2 m intervals. Experienced field technicians collect the samples under supervision of a geologist.
- The trenching team takes all the samples with them and stores them in the secured core shed at the Youga mine site until they are despatched to the laboratory.

Reverse Circulation Drill Sampling

Avesoro grade control samples are 2 m composite samples, riffle split in the field to provide samples of approximately 3–5 kg in weight for laboratory analysis. Wet samples are bagged in their entirety and air-dried before splitting.

Procedures completed at the drill rig included:

- Sampling is usually done under the supervision of one geologist, one geotechnician and three samplers.
- The weight of the entire sample is sometimes recorded.
- Samplers collect all material returned from the cyclone in a large (+25 kg) plastic bag or in rubber buckets.
- The sample is then split down using a riffle splitter until a sample weight between 3 kg and 5 kg is achieved.
- Sample number-tags are stapled at the opening of each sample bag.
- Field duplicates are made by simply spitting off an additional sample.
- All materials (splitter, containers, etc.) are cleaned thoroughly between samples with compressed air attached to the compressor of the drilling machine.
- Cyclones are also opened and cleaned before each new drillhole.
- RC cuttings are washed, and sample chips placed in chip boxes. RC cuttings are logged in appropriate detail including identification of lithology, structure, alteration and other notable characteristics by the grade control geologist.

Diamond Drill Core Sampling

Avesoro procedures are as follows:

- Diamond core was placed into plastic core boxes at the drill site by the contract drillers who also inserted plastic blocks, indicating the meterage, into the core boxes at the end of each run (normally every 3 m).
- Geologists and geotechnicians collected measurements of all geotechnical details, core recovery, geological logging as well as photographing the core.
- Samples were usually collected over 1 m intervals but ranged in length from 0.5 m to 1.5 m due to geological contacts. At least two hangingwall and footwall samples were collected before and after the possible mineralised zone.
- Care was taken to consistently collect assay samples from one side of the core.
- Each core box was labelled with permanent marker indicating the hole number, box number, and the hole length at the beginning and end of the core contained within the box. The labelled core boxes were stored at the secured core shed in Youga mine site.
- An MNG geologist marked a cutting line on the core for the technician to cut along. Avesoro geologists were required to supervise the technician sampling the drillhole.

Split core samples were sampled by a technician who was also responsible for the insertion of the required QAQC control samples. Each sample was bagged and assigned a unique sample number (sample ID) and dispatched to the laboratory for analysis. The prepared samples were placed into empty rice-sacks for transport to the Laboratory in Ouagadougou.

11.2 Sample Handling and Security

11.2.1 Pre-Avesoro Sample Handling and Security

Endeavour procedures for Youga and Ouaré were as follows:

- Trench and RC samples were collected in the field and diamond core samples collected in the core logging area, bagged immediately in plastic sample bags, labelled with the sample number on the outside of the bag and stapled shut with a sample tag inside.

- Samples were stored at the exploration camp until enough samples had been collected to send to the assay laboratory. Samples were delivered directly to the laboratory by Endeavour personnel or received directly by laboratory staff at the exploration camp.
- After the samples were received at the laboratory, all further sample preparation and analysis were conducted by laboratory personnel who were independent of Endeavour. No employee, officer, director or associate of Endeavour was involved in sample preparation or analysis after submission to the laboratory.

GMR procedures (Balogo project) were as follows:

- ALS Chemex organised sample pick-up from the Balogo camp where the samples for assaying were handed to an ALS Chemex staff member after checking the number of remitted sacks and duly signing an appropriate receipt.
- Sample submission sheets were completed for the laboratory, detailing the number of samples per batch which is crosschecked against the number of samples received by the laboratory to ensure no samples have been lost in transit.

11.2.2 Avesoro Sample Handling and Security

Avesoro procedures are similar to the Endeavour procedures and are as follows:

- Trench and RC samples were collected in the field and diamond core samples collected in the core logging area, bagged immediately in plastic sample bags, labelled with the sample number on the outside of the bag and stapled shut with a sample tag inside.
- Samples were stored at the secured core shed at Youga mine site until sufficient samples had been collected to send to the assay laboratory. Samples were delivered directly to the laboratory by the Avesoro driver.
- After the samples were received at the laboratory, all further sample preparation and analysis were conducted by laboratory personnel who were independent of Avesoro. No employee, officer, director or associate of MNG was involved in sample preparation or analysis after submission to the laboratory.

11.3 Dry Bulk Density Determinations

11.3.1 Pre-Avesoro Bulk Density Determination

The Endeavour 2014 Technical Report describes the bulk density (BD) determinations undertaken by Ashanti, Etruscan and Endeavour. Samples were collected from hangingwall, footwall and mineralised horizons and at depths greater than 10 m below the surface (predominantly in un-weathered rock).

The Ashanti bulk density ("SG") determinations (described as specific gravity) were reportedly undertaken by SGS in Ghana applying the "Archimedes" method (water displacement). The Ashanti SG determinations were completed on half drill core samples submitted to SGS for gold assay. Two measurements were made and averaged for each sample.

The Etruscan BD determinations were completed by SGS in Tarkwa using billets of half-core selected from reference material at Youga. The SGS determination methodology included weighing the core in air on receipt, drying billets for six hours at 100°C to 150°C, weighing the samples dry to record the moisture content, coating the samples in paraffin, weighing again to determine the weight of paraffin, weighing in water, then determining the BD, having allowed for the density of the paraffin.

Recent BD determinations for Endeavour were completed by SGS Ouagadougou, Burkina Faso. The only difference in the determination technique from that described above was the use of hairspray to seal samples, instead of wax.

GMR SG measurements were done on selected core samples by the hydrostatic immersion method. Solid pieces of core considered to represent the differing rock types and styles of mineralisation were selected. These were typically, solid pieces of core greater than 15 cm in length with no cavities. If the material was deemed to be porous or oxidised, the core was tightly wrapped with waterproof tape before measurements were done.

Dry core samples were weighed in air using a balance with accuracy to 0.5 g. The weight of a container filled with water was then measured. The core was then placed in the container of water and that weight was recorded. The SG was calculated by dividing the dry sample weight with the sample weight in water.

11.3.2 Avesoro Bulk Density Determinations

Avesoro BD measurements are taken using the "Archimedes" method (water displacement). Procedures state that one sample (5–15 cm in length) be taken every metre in mineralised zones and every 5 m outside of these zones. Samples are placed on aluminium foil on baking trays and dried for three hours at 200°C. Samples were weighed, wax coated, weighed again to account for the weight of the wax, weighed in water, and the BD determined. Water is changed every 50 samples, unless it becomes muddy, where it would be changed immediately.

Table 11-1 below lists the number of density measurements in the database for each deposit area.

Table 11-1: Count of density data for each project

Project	Deposit area	Density measurements (count)
Youga and Ouaré	A2NE	759
	Gassore	1,679
	Main Pit	136
	Ouaré	918
	Warba	29
	Subtotal	**3,521**
Balogo	Balogo Hill	191
	Netiana	4,065
	Subtotal	**4,256**

11.4 Sample Analysis

11.4.1 Pre-Avesoro Sample Analysis

Youga and Ouaré Properties

Ashanti utilised Inchcape Testing Services (ITS) Ouagadougou in Burkina Faso as the primary assay facility for processing samples. In addition, the SGS facility at Tarkwa in Ghana was utilised for assaying of selected diamond core and trench samples. Sample preparation was completed on the entire submitted sample, including crushing and pulverisation to a targeted 95% passing 75 µm. A 50 g subsample was analysed by fire assay (FA) with an atomic absorption spectroscopy (AAS) finish. The lower detection limit (LDL) was stated as 0.005 ppm Au.

Originally, Endeavour used SGS Tarkwa to complete sample preparation and FA analyses on all RC and core sampling as above, but with a reported LDL of 0.01 ppm Au. Abilab/ALS Ouagadougou was also used periodically for some earlier stage drill programs, with a reported LDL of 0.01 ppm Au. More recent sample preparation and FA analyses was completed by the SGS laboratory in Ouagadougou, Burkina Faso.

QAQC results were monitored on a batch-by-batch basis and any batch with more than two sample failures was re-assayed.

External check (umpire) assaying was undertaken at SGS Lakefield, Toronto (Canada) and ALS Johannesburg (South Africa) using a combination of 50 g FA with ICP-OES finish, and a gravimetric FA of samples above 2 ppm gold.

ITS, SGS, Abilab/ALS are all internationally recognised laboratories and the local laboratories are operated as subsidiaries of the parent company and are subject to internal QC programs and protocols in accordance with the operating practices of the parent laboratory.

Balogo Property

GMR used five laboratories (BIGS, SGS, ACTLABS, ALS Ouagadougou and ALS Johannesburg) to prepare and analyse drilling and geochemical samples.

Sample preparation at the laboratories involves the following steps:

- Samples receipt and primary weighing.
- Drying of the whole sample at 100°C to 110°C.
- The whole sample is crushed using jaw crushers >70% of the sample passing through a 2 mm sieve (checked at the start of a batch). The crusher is cleaned with compressed air between each sample and cleaned with sterile quartz between batches or more frequently if required.
- Sample split with a riffle splitter or directly from the crusher (using a Rocklabs crusher combined with a rotary splitter) to create a subsample of 250 g to 500 g.
- Pulverisation of the 250 g to 500 g subsample using "flying disc" or "ring and puck" style grinding mills to 85% of sample passing through a 75 µm (200 mesh) sieve or better (checked every 20th sample). The pulverisers are cleaned with compressed air between each sample and cleaned with sterile quartz between batches or more frequently if required.

Table 11-2 summarises the laboratories and analyses used for each sample type.

Table 11-2: Laboratories and methods summary (adapted from GMR technical report)

Company	Laboratory	BIGS (www.bigsglobal.com/)		SGS (www.sgs.com/)		ACTLABS (www.actlabs.com/)		ALS (Ou and Jhb) (www.alsglobal.com/)	
	Sample type	Element	Method and description	Element	Method and description	Element	Method and description	Element	Method and description
GMR	DD	Au Au Cu	FPF500 FGV500 ADF020.3					Au Au Cu Cu	Au-AA26 Au-GRA21 ME-ICP41 Cu-OG46
	RC	Au Au Cu	FPF500 FGV500 ADF020.3	Au Au Cu	FAA505 FAG505 ARA155				
	Auger	Au Cu	BLC105 ADF020.3						
	Trench	Au	FPF500	Au	FAA505	Au	1A2-50		
	Pit	Au	BLC105						
	Rock chip	Au	FPF500					Au	Au-AA26
	Soil	Au	BLC105			Au	1A6-Au	Au	Au-AA15b
MNG	DD							Au Au	Au-AA24 Au-Gra22

11.4.2 Avesoro Sample Analysis

Youga and Ouaré Properties

ALS Youga has been used as the primary laboratory for the grade control drilling since it was established in 2007. The assay method is a 50 g FA with over-limit results assayed using a gravimetric finish. The LDL is 0.01 ppm Au.

ALS Ouagadougou has been used to analyse drillhole samples. The preparation method is ALS's PREP31B which is to crush the sample to 70% less than 2 mm in size, riffle split off 1 kg, and pulverise the split to better than 85% passing 75 microns. The primary gold assay method is a 50 g FA with an AAS finish (LDL of 0.005 ppm Au). Over-limit results are assayed using a gravimetric finish.

Balogo Property

The diamond core samples were prepared and analysed at ALS Ouagadougou.

Samples have been analysed for gold using FA with an AAS finish with over-limit assays by FA with a gravimetric finish. The 2016 MNG diamond core samples were analysed with methods Au-AA24 and Au-GRA22. Details are in the tables below.

Table 11-3: ALS methods used for drillholes

Element	Method	Detection limits	Description
Au	Au-AA24	0.005–10 ppm	50 g Au by FA and AAS
Au	Au-Gra22	0.05–1,000 ppm	Over limit – 50 g Au by FA and gravimetric finish

Surface samples were also analysed at ALS Ouagadougou using a gold FA and a trace multi-element method for 53 elements. Details are in Table 11-4 below.

Table 11-4: ALS methods used for drillholes

Element	Method	Detection limits	Description
Au	Au-ICP22	0.001–10 ppm	50 g trace level Au by fire assay and ICP-AES
ME	ME-MS41L	Various	Aqua regia super trace level with ICP-MS finish (53 elements)
Au	Au-TL44	0.001–1 ppm	50 g trace level Au by aqua regia extraction and ICP-MS finish
ME	ME-ICP41	Various	Aqua regia trace level with ICP-AES finish (35 elements)

Internal QC samples included pulp duplicates, blanks and standards.

11.5 QAQC Procedures

11.5.1 Pre-Avesoro Procedures

To monitor the accuracy and precision of the analytical data received from the laboratories during the exploration programs, QAQC procedures were implemented by Endeavour at the Youga and Ouaré projects and by GMR at the Balogo project. In addition to the QAQC procedures put in place by the companies, the assay laboratories also included internal QC samples.

Certified Reference Material

Certified reference materials (CRM) are included with the primary samples to monitor assay accuracy and are homogenous pulp material with certified concentrations and expected standard deviations (SDs) of the elements of interest:

- For the Youga and Ouaré projects, Endeavour purchased commercially available CRM from Rocklabs, New Zealand and inserted one CRM in every batch of 20 samples.
- For the Balogo property, CRMs were sourced from Ore Research and Exploration Pty Ltd in Melbourne (Oreas) and Geostats Pty Ltd in Perth (Geostats). GMR inserted QC samples (blanks, CRMs, duplicates)

at a ratio of one to every 10 primary diamond core samples and at a ratio of one to every 30 RC primary samples.

Blanks

Coarse blanks are used to monitor potential contamination and undergo the same sample preparation process as the primary samples. Blanks should have negligible concentrations of the elements of interest.

- For the Youga and Ouaré properties, Endeavour inserted one blank sample (<5 ppb gold) in every batch of 20 samples. No detail is available regarding the blank material used prior to Avesoro taking over the projects and whether it is a coarse or pulp blank for either Youga or Ouaré.
- For the Balogo property, concrete was initially used as coarse blanks, but this was discontinued at the end of Phase 3 drilling, when it became apparent that some of the concrete samples contained assayable levels of copper. Three commercially available pulp blanks were obtained from Oreas. However, pulp blanks do not undergo the same sample preparation process as the primary samples as they do not pass through the crushers, and therefore the control on potential contamination is inadequate.

Duplicates

Duplicate samples are used to measure precision (i.e. repeatability of results).

Field Duplicates

Endeavour included a field duplicate per 20 primary samples. Duplicate RC samples, weighing 2 kg, were produced at the rig and core samples were randomly divided into two samples from one assay interval.

GMR routinely submitted RC field duplicate samples, comprising a second riffled sample split. No duplicate samples were submitted with the 2012 diamond drillholes.

External Check Samples

The Endeavour 2014 report references external (umpire) assaying undertaken at Lakefield Toronto, Canada and at ALS Johannesburg, South Africa, but no review has been undertaken.

QAQC Failures and Resolution

The Endeavour QAQC procedure for Youga and Ouaré was as follows:

- Results from the quality control samples were monitored as assay batches were received and where results were outside acceptable limits the entire batch was re-assayed.
- Pass/Fail thresholds for standards were derived directly from the statistical analysis for each standard provided by Rocklabs and were continually updated based on incoming results.
- A blank was deemed to have failed if they returned assay values greater than 0.05 ppm gold.
- The threshold for duplicate failures was determined based on two calculations:
  - The absolute difference between the original and duplicate assays exceeding 0.1 ppm Au.
  - The relative difference between the original and duplicate assays exceeding 35%. Relative difference is defined as the absolute difference between the two assays, divided by their arithmetic mean value.

As per the 2015 GMR report, the following checks at the Balogo property were undertaken upon receipt of assay data from the labs:

- CRM results were reviewed to see whether the assayed value falls within the ± SD range.
- Blanks were checked to confirm that the blank values fall within acceptable limits.
- Duplicate samples were checked to ensure that the values agree with the original value.

- Normal assay values were checked to ensure that the values fall within expected limits; any values outside expected limits were investigated and if there was no obvious reason for differences, the sample could be re-submitted for assay. Individual outliers were examined to determine why the assay value may have fallen outside the acceptable limits.
- If more that 10% of the standards in a single batch of samples fell outside the acceptable range, new CRMs were inserted, and re-assay of that batch was requested from the laboratory. These repeat results were again checked to ensure that the assayed value of newly inserted CRMs fell within the acceptable range. Also; if any CRM in a batch falls outside of its SD limits, samples from the last accurate CRM reading to next accurate CRM reading are re-assayed within the same batch.

11.5.2 Avesoro Procedures

Certified Reference Material

CRMs are included with the primary samples to monitor assay accuracy and are homogenous pulp material with certified concentrations and expected SDs of the elements of interest.

Avesoro insert four CRMs per batch of 100 samples in resource drilling and two CRMs per 100 samples for sterilisation drilling. CRMs are sourced from international providers; Geostats (Australia), Oreas (Australia) and Rocklabs (New Zealand). Table 11-5 and Table 11-6 below lists the CRMs used at Youga and at Balogo respectively.

Table 11-5: Youga CRMs with gold expected values and permitted minimum and maximum values

CRM	Unit	Expected value	Expected SD	Minimum (-3SD)	Maximum (+3SD)
G310-4	ppm	0.43	0.03	0.34	0.52
G311-5	ppm	1.32	0.06	1.14	1.5
G314-1	ppm	0.75	0.04	0.63	0.87
G314-2	ppm	0.99	0.04	0.87	1.11
G315-3	ppm	1.97	0.06	1.79	2.15
G316-2	ppm	1.04	0.04	0.92	1.16
G909-1	ppm	1.02	0.06	0.84	1.2

Table 11-6: Balogo CRMs with expected values and permitted minimum and maximum values

CRM	Unit	Expected value	Expected SD	Minimum (-3SD)	Maximum (+3SD)
G310-4	ppm	0.43	0.03	0.34	0.52
G311-5	ppm	1.32	0.06	1.14	1.5
G314-1	ppm	0.75	0.04	0.63	0.87
G315-3	ppm	1.97	0.06	1.79	2.15
G909-1	ppm	1.02	0.06	0.84	1.2
GLG312-1	ppm	0.021	0.003	0.01	0.03
GLG910-2	ppm	0.024	0.004	0.01	0.04
Oreas 15f	ppm	0.33	0.02	0.27	0.39
Oreas 502	ppm	0.49	0.02	0.43	0.55
SF85	ppm	0.848	0.018	0.794	0.902
SH82	ppm	1.333	0.027	1.252	1.414

Blanks

Coarse blanks are used to monitor potential contamination and undergo the same sample preparation process as the primary samples. Blanks should have negligible concentrations of the elements of interest.

Avesoro insert two blanks per batch of 100 samples for both resource development and sterilisation drilling. They are inserted as the last sample of every odd numbered RC hole drilled. The Youga assay

QAQC procedures state that blanks have been prepared on site from waste drilling which have been assayed to determine the grade.

Two commercially available pulp blanks were obtained from Oreas and are listed in Table 11-7 below. However, pulp blanks do not undergo the same sample preparation process as the primary samples as they do not pass through the crushers, and therefore the control on potential contamination is inadequate.

Table 11-7: Pulp blanks with expected values

Blank	Unit	Expected value
Oreas 22c	ppb	<2
Oreas 24c	ppb	<1

Duplicates

Duplicate samples are used to measure precision (i.e. repeatability of results). Precision error can be estimated by measuring the precision error at each stage of the sampling and assay process. Field duplicates contain all sources of error (sampling error, sample reduction error and analytical error), laboratory duplicates contain sample reduction error and analytical error, pulp duplicates contain analytical error only.

- Avesoro RC field duplicates are collected by riffle splitting the representative samples and are taken on every even numbered RC drillhole. They are inserted as the last sample taken on the RC hole.
- The Avesoro procedure states that a minimum of 4% of the samples will have duplicates (either quarter-core or rejects).
- The Avesoro procedures do not reference external check samples.

QAQC Failures and Resolution

The Youga assay QAQC procedures state that QC reports are produced monthly. Pass and failure criteria include the following:

- Duplicate samples with a relative difference of 50% or more
- Correlation coefficient of regression and between sample duplicate assay values should be R≥0.8
- Failure criteria for CRMs are based on values outside of three SD of the expected value or an absolute bias greater than 5%
- Blanks are expected to have gold values within three times the LDL.

11.6 QAQC Review – CSA Global

11.6.1 QAQC Review – March 2017 to February 2018

CSA Global reviewed the results of the QC material included with the samples assayed for the current Mineral Resource update. Cross contamination, assay accuracy and bias results were reviewed where data were available.

Cross Contamination

Coarse blanks undergo the same preparation process as the primary samples and are used to monitor cross contamination of samples during the preparation and analytical process. Pulp blanks are used to monitor analytical contamination, but as they do not require preparation, they do not measure cross contamination introduced during the sample preparation process. They are therefore not fit for purpose to monitor any potential cross contamination.

Two pulp blanks were included with the primary samples (Oreas 22c and Oreas 24c). A limit of 10 x the LDL was used as a failure limit and no blanks failed (all except one blank was within 3 x LDL). However, even though no failures were noted, pulp blanks are not suitable to monitor cross contamination. CSA Global recommends that a coarse blank is included with the samples to adequately monitor cross contamination.

Assay Accuracy

CRMs are included with primary samples to monitor assay accuracy (bias). CRM failures and biases were calculated and tabulated for Youga (Table 11-8) and Balogo (Table 11-9). Shewhart Control charts were plotted and any CRM that had an assayed value outside of three SDs of the expected value is deemed to have failed and any CRM with a mean grade outside 5% of the expected value has also exceeded permitted tolerances. Absolute biases greater than 5% have been highlighted in red in the tables below.

Instances of apparent misidentified CRM are still noted but show an improvement over the previous reporting period.

Table 11-8: Youga CRM results (absolute bias >5% highlighted in red)

Au standard(s)				No. of samples	Calculated values			
Standard code	Method	Expected value	Expected SD		Mean Au	SD	CV	Mean bias
G310-4	FA_AAS	0.43	0.029	379	0.42	0.02	0.042	-3%
G311-5	FA_AAS	1.32	0.06	259	1.30	0.05	0.035	-1%
G314-1	FA_AAS	0.75	0.04	211	0.77	0.03	0.045	2%
G314-2*	FA_AAS	0.99	0.04	1	0.73	0	0	-26%
G315-3	FA_AAS	1.97	0.06	17	1.97	0.04	0.023	0%
G316-2	FA_AAS	1.04	0.04	246	0.99	0.03	0.028	-4%
G909-1	FA_AAS	1.02	0.06	193	1.01	0.03	0.033	-1%

** Probable mislabelled CRM (G314-1)*

Youga CRM results are summarised below:

- Negative bias (under reporting) from -4 to -1% in four of six CRMs (example Figure 11-1) and positive bias of 2% in one. This not considered material.
- Four failures noted which are probably misidentified CRMs
- The highest-grade CRM used has a value of 1.97 ppm Au which is low compared to the grades in the Mineral Resource.

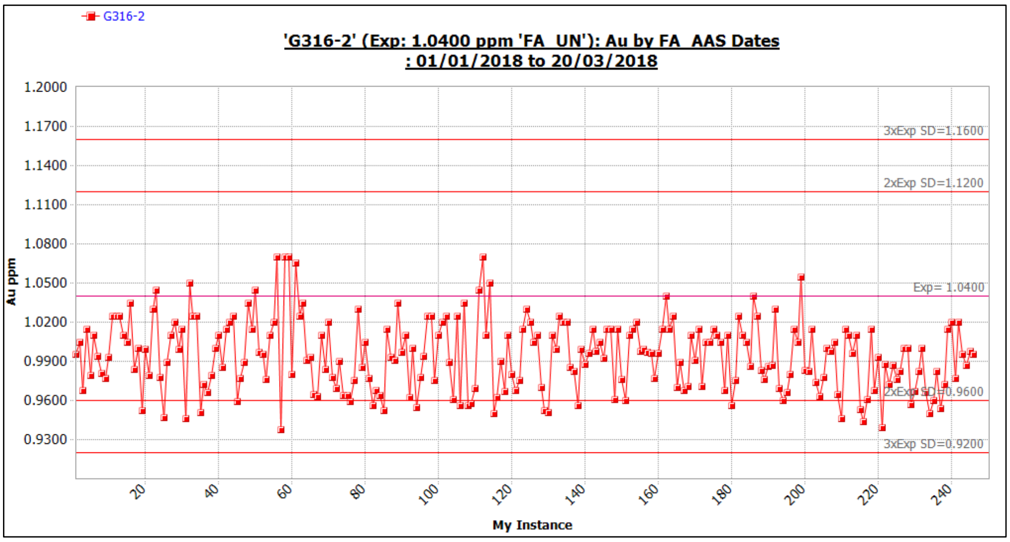


Figure 11-1: Youga CRM G316-2 showing a negative bias of 4%

Source: CSA Global, 2017

Table 11-9 below lists the Balogo CRM results where it can be noted that G314-1 over reports by 7%.

Table 11-9: Balogo CRM results (absolute bias >5% highlighted in red)

Au standard(s)				No. of samples	Calculated values			
Standard code	Method	Expected value	Expected SD		Mean Au	SD	CV	Mean bias
G310-4	FA_AAS	0.43	0.029	91	0.41	0.05	0.120	-4%
G311-5	FA_AAS	1.32	0.06	70	1.31	0.02	0.016	-1%
G314-1	FA_AAS	0.75	0.04	119	0.80	0.03	0.038	7%
G315-3	FA_AAS	1.97	0.06	82	1.99	0.06	0.029	1%
G909-1	FA_AAS	1.02	0.06	93	1.03	0.03	0.032	1%
GLG312-1**	FA_AAS	0.0206	0.0028	28	0.0190	0.005	0.270	-8%
GLG910-2**	FA_AAS	0.0243	0.0042	46	0.0196	0.008	0.413	-19%
Oreas 15f	FA_AAS	0.334	0.016	15	0.339	0.012	0.034	2%
Oreas 502	FA_AAS	0.491	0.02	14	0.498	0.025	0.050	1%
SF85	FA_AAS	0.848	0.018	67	0.837	0.024	0.028	-1%
SH82	FA_AAS	1.333	0.027	56	1.315	0.099	0.075	-1%

*** Low grade CRMs. Some results < LDL therefore negative bias.*

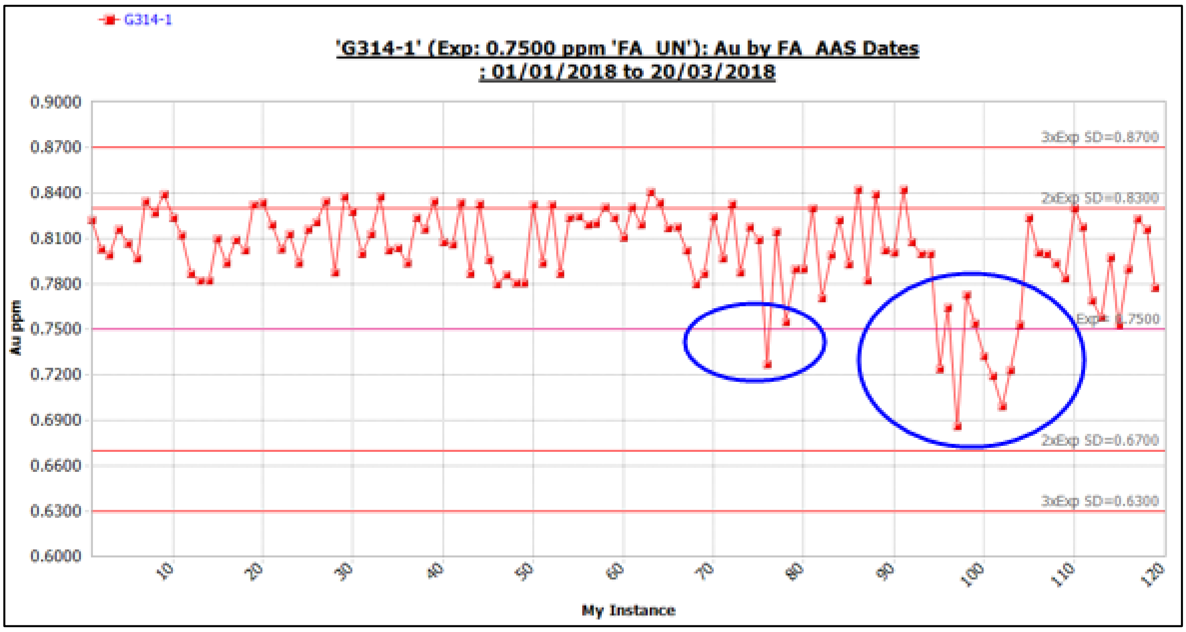


Figure 11-2: CRM G314-1 which over reports by 7% (circled points show where bias appears to have been corrected)

Source: CSA Global, 2017

Balogo CRM results are summarised below:

- CRM results are accurate. Apart from low grade (GLG) CRMs, seven of nine CRMs have biases between -1% and 2%.
- G314-1 over reports by 7% (Figure 11-2). The bias appears to have been corrected for a short period (circled in blue) before reverting back to over reporting.
- Seven failures noted, some of which could be misidentified CRMs.
- The highest-grade CRM used has a value of 1.97 ppm Au which is low compared to the grades in the Mineral Resource.

Precision

Data were assessed using coefficients of variation (CV = SD/average – also known as relative SD) calculated from individual duplicate pairs and averaged using the RMS (root mean squared) approach. CV_{AVR}(%) were calculated for duplicates with mean values ≥10 times the LDL and compared to acceptable and best practice limits (Abzalov, 2008). Mean grades for the original and duplicate populations were determined and relative bias calculated.

Field duplicate data were reviewed, but no laboratory duplicate results were included in the review. The proportion of field duplicates included with the samples is adequate, however most of the Youga pairs were too low grade to be included in the review (i.e. within 10 x LDL). Balogo field duplicate precision and bias was disproportionally affected by one high grade outlier pairs. Results of the duplicate review are summarised below:

Table 11-10: Youga gold field duplicate bias and precision errors (with acceptable limits)

Duplicate	$CV_{(AVR)}$% best practice	$CV_{(AVR)}$% acceptable practice	Pairs (total)	Count of pairs (>10 x DL)	$CV_{(AVR)}$ %	Mean Au Orig.	Mean Au Dup.	Bias
A2NE	20	40	269	50	44	0.18	0.21	20%
Gassore	20	40	1,578	255	51	0.23	0.23	2%

Results of the Youga gold duplicate pair comparison are summarised below:

- Most of the field duplicate pairs are low grade (within 10 x LDL) and therefore excluded from the comparison.
- Precision is poor and exceeds the recommended limits for a nuggety gold deposit.
- Significant biases observed in the A2NE pairs which could indicate a non-representative sampling.

Table 11-11: Balogo gold field duplicate bias and precision errors (with acceptable limits)

Duplicate	$CV_{(AVR)}$% best practice	$CV_{(AVR)}$% acceptable practice	Pairs (total)	Count of pairs (>10 x DL)	$CV_{(AVR)}$ %	Mean Au original	Mean Au duplicate	Bias
Balogo	20	40	434	231	27	4.18	2.52	-40%
Balogo (outlier removed)	20	40	433	230	26	2.26	2.35	4%

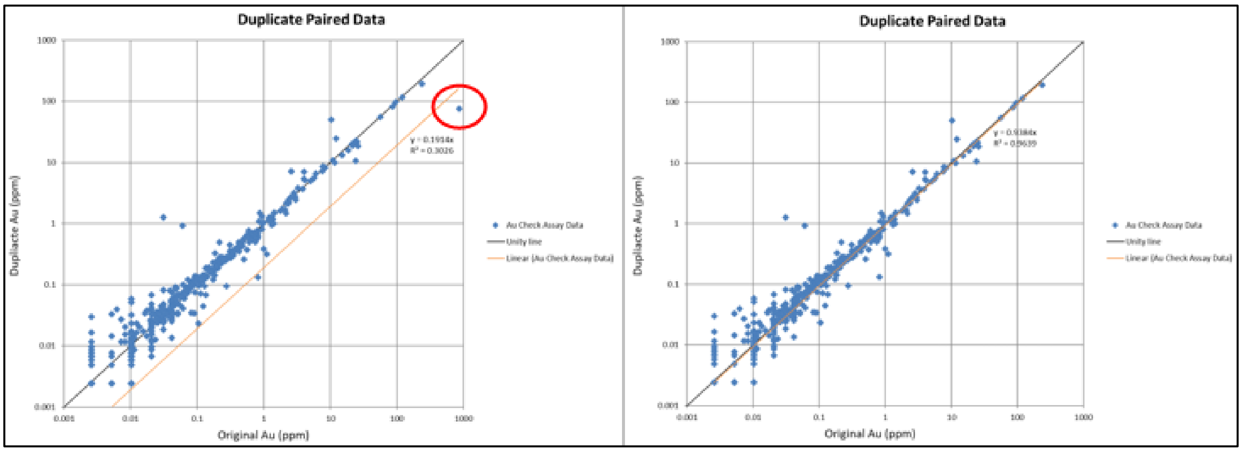


Figure 11-3: Balogo field duplicates; plot on right has one high grade outlier removed (circled)

Source: CSA Global, 2017

Results of the Balogo gold duplicate pair comparison are summarised below:

- Duplicate pairs have a $CV_{(AVR)}$% of 27%, i.e. within acceptable practice limits and a significant bias to the original samples. If one high grade outlier is removed, bias is 4% to the duplicate.
- Figure 11-3 shows scatterplots for the Balogo field duplicates. The left-hand side plot includes the outlier pair (circled) and the right-hand side plot has the outlier removed.

11.7 Adequacy of Sampling, QAQC and Data Management

QAQC procedures to monitor accuracy and precision are adequate, and whilst an improvement on the previous reporting period is noted, there are still issues with failures of CRMs as well as apparent misidentification of blank and CRM samples. CRM results were generally accurate without significant bias in most cases. Measures to control cross contamination are inadequate and urgently require the introduction of a preparation blank.

- No failures were noted in the pulp blanks, but these do not undergo preparation so do not monitor potential cross contamination in the sample preparation stage
- Assay accuracy was acceptable without significant bias in most instances
- Balogo samples had acceptable repeatability, but precision was poor with significant bias in the A2NE Youga samples which could indicate a sampling issue (i.e. non-representative sampling).

Data management requires improvement with instances of missing as well as duplicated data and apparent misidentified QC records noted. These issues potentially decrease confidence in the input data used for the Mineral Resource estimation work. Avesoro would benefit from implementing a comprehensive data management system including the use of a relational geological database such as acQuire or DataShed to ensure validation of data and to serve as a single point of truth for all the project data.

CSA Global recommends the following:

- Preparation blanks should be included to monitor potential contamination.
- A high-grade gold CRM should be included with the samples to monitor samples >2.0 ppm Au.
- Ongoing vigilance is required to reduce CRM and blank misidentification.
- Field duplicates should be biased towards mineralised samples.
- Investigation of the poor precision and bias noted in the field duplicate samples to determine whether sampling issues (sample size or non-representative sampling) are factors.
- Laboratory QC results should be routinely reviewed and captured in the database.
- External check samples (umpires) should be sent to an accredited laboratory. CRMs must be included with these samples.
- A centralised database should be implemented which can serve as a single point of truth for the project data. Currently, Microsoft Excel sheets are used which are inadequate to securely host the project data. CSA Global can advise if required.

12 Data Verification

12.1 Database Verification

Data were provided to CSA Global in Microsoft Excel spreadsheets which were loaded into an SQL relational database, which is an industry standard for exploration project databases. The database schema used was the Maxwell DataShed format; which contains validation constraints and triggers, ensuring that data loaded meets standard validation rules. Validation issues were noted and resolved where possible during the above process and a validated database provided for downstream work.

CSA Global had previously validated the data for the 2017 MRE. New validation issues and data gaps flagged for the MRE update data, where possible, were resolved in communication with the Avesoro data manager:

- 122 drillholes in the database with duplicated coordinates, dips and azimuths
- 114 drillholes with no samples
- 14,830 samples with no assay results
- 5,584 drillholes with no geology data.

Currently, Avesoro does not have an industry standard database and CSA Global recommend they implement a relational geological database such as acQuire or DataShed to host the project data, as is in place at other projects owned by Avesoro Holdings subsidiaries (e.g. New Liberty, Liberia).

Balogo data management history (as per the GMR 2015 technical report) is as follows:

- Prior to 2012, all field data were captured into a Microsoft Access database which included collar, assay, geology, survey, density, recovery, structure, QAQC and geochemical sampling tables. Data management was completed under the guidance of the Exploration Manager and the Database Administrator.
- In 2012, GMR migrated from the in-house database system to one managed by IoGlobal Consulting (name has now changed to REFLEX). As part of the migration to the new database structure a review of data capture, logging codes and importing routines was completed.
- A corporate decision was made to stop using the services of IoGlobal in early 2014 to reduce costs.

12.2 Site Visit Verification

CSA Global staff visited the Youga property from 19 to 21 April 2018 and the Balogo property on 22 April 2018.

These visits were required for the purposes of inspection, ground truthing, review of activities, procedural review and information data collection and collation and to satisfy NI 43-101 “personal inspection” requirements.

Dr Belinda van Lente and Dr Matthew Randall (CSA Global Qualified Person, Mineral Reserves) carried out the site inspections on behalf of CSA Global, as described in Section 2.4.

12.2.1 Geology and Mineral Resources

The following was completed as part of the data verification:

- Ground truthing the deposit locations and layouts for Youga and Balogo
- Verification of drillhole collar locations with survey coordinates in the drill database
- Inspection of drill core
- Discussion of drilling and sampling procedures

- Reviewing database management system for storage of drillhole data, and QAQC protocols.

CSA Global inspected the core yards at Youga and Balogo and viewed core for the Youga deposits from holes GASS-17-001, GASS-17-067, GASS-17-068, GASS-17-070 and GASS-17-072, and core from the Netiana deposit from holes BDH091, BDH093 and BDH188. Photographs for BDH093 and BDH188 (Youga) and BDH093 and BDH188 (Netiana) showing mineralisation styles and host lithologies are presented in Figure 12-1 to Figure 12-4.

Figure 12-1: Youga – drillhole GASS-17-067 (Gassore) high-grade Au (weighted average 14.74 g/t) 95.75–100.50 m

Source: CSA Global, 2018

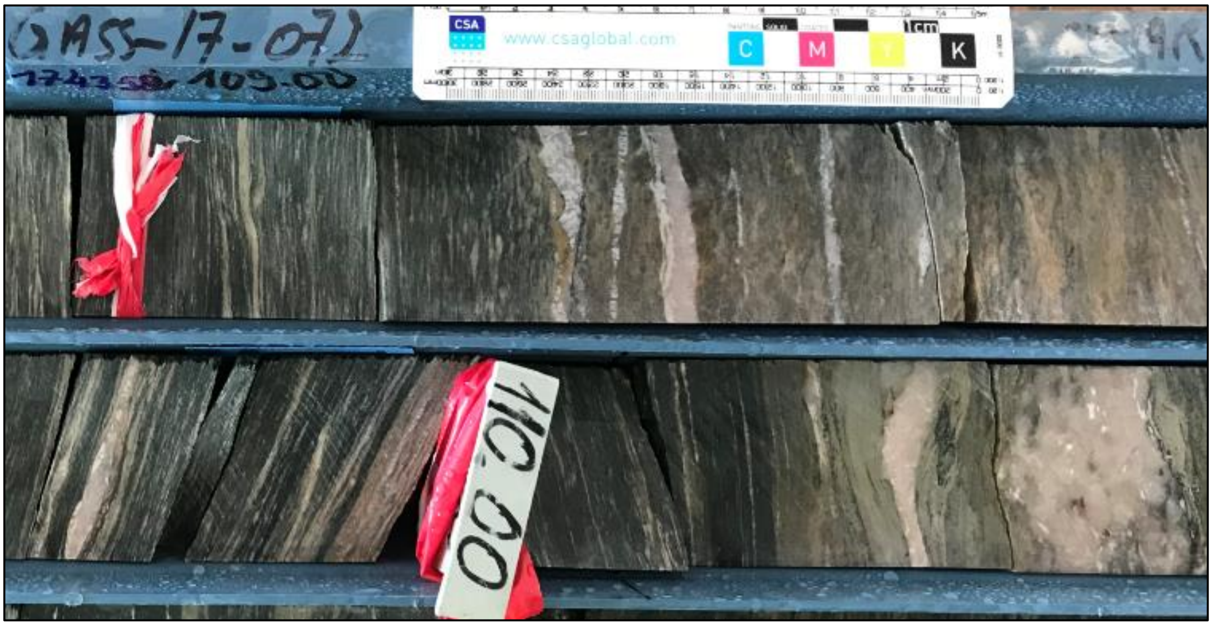


Figure 12-2: Youga – drillhole GASS-17-072 (Gassore) very high-grade Au (231.0 g/t) 110.0–110.75 m

Source: CSA Global, 2018

Figure 12-3: Balogo – drillhole BDH093 (Netiana) very high-grade Au (weighted average 209.96 g/t) 252.0–256.5 m

Source: CSA Global, 2018

Figure 12-4: Balogo – drillhole BDH188 (Netiana) very high-grade Au (weighted average 267.86 g/t) 257.9–260.6 m

Source: CSA Global, 2018

CSA Global verified the locations of seven collars at Youga and four collars at Balogo. The handheld GPS coordinates are presented with those recorded in the databases in Table 12-1.

Table 12-1: GPS and database collar surveys verified during the site visit (WGS1984, Zone 30N)

Project	BHID	Avesoro database			CSA Global GPS			Difference		
		Easting	Northing	Elevation	Easting	Northing	Elevation	Easting	Northing	Elevation
Youga	GASS-18-265	779,044.67	1,229,120.27	225.32	779,046	1,229,123	224.63	-1.33	-2.73	0.69
	GASS-18-272R	779,048.96	1,229,211.64	225.55	779,050	1,229,213	223.92	-1.04	-1.36	1.63
	GASS-18-282	779,162.47	1,228,887.23	224.14	779,163	1,228,888	224.23	-0.54	-0.77	-0.09
	GASS-18-285	779,254.97	1,228,886.83	225.62	779,255	1,228,891	225.44	-0.03	-4.17	0.17
	GASS-18-286	779,260.92	1,228,947.76	225.70	779,264	1,228,950	224.87	-3.08	-2.24	0.83
	GASS-18-288	778,360.52	1,228,970.86	225.47	778,361	1,228,973	224.04	-0.48	-2.14	1.43
	GASS-18-290	778,316.69	1,228,963.83	225.49	778,317	1,228,966	223.66	-0.31	-2.17	1.83
Balogo	BDH106	663,918.61	1,260,344.04	342.40	663,921	1,260,346	343.23	2.39	1.96	0.83
	BDH112	663,809.97	1,260,292.89	341.48	663,811	1,260,296	341.08	1.03	3.11	-0.40
	BDH113	663,774.57	1,260,300.99	341.43	663,773	1,260,303	341.03	-1.57	2.01	-0.41
	BDH261	663,809.49	1,260,264.70	341.40	663,811	1,260,268	342.62	1.51	3.30	1.22

CSA Global ground truthed the exploration target and mined deposits at Youga (Figure 12-5) and Balogo, inspecting open pits, drill collar locations (where preserved) and having geological discussions with the client representatives.

Figure 12-5: Location of Youga deposits (Google Earth image date April 2017)

Source: CSA Global, 2018

12.2.2 Mining and Mineral Reserves

The Mineral Reserve estimate is based on the Mineral Resource models created by CSA Global. Where possible, these were compared to previous estimates prepared by CSA Global (2017) to ensure that they were similar and to highlight and explain any significant differences.

12.3 Verification of RC Drilling

12.3.1 Twin Drillholes

Balogo Property

There are 23 RC and DD holes from which pairs are suitable for comparison, with the "twin" samples within 2.5 m of each other (Table 12-2). Of these, only 11 intersect mineralisation. An NMC review of these twin holes and RC QAQC resulted in the exclusion of several RC holes and one DD hole. CSA Global agrees with the exclusion of these holes.

Table 12-2: Balogo – twin drillholes

Twin ID	BHID 1 (DD)	BHID 2 (RC)	Comment
1	BDH064	BRC024	
2	BDH041	BRC042	Excluded RC
3	BDH040	BRC068	Excluded RC
4	BDH119	BRC068	Excluded RC
5	BDH031	BRC071	Excluded RC
6	BDH001R	BRC111	Excluded RC
7	BDH032	BRC112R	Excluded RC
8	BDH060	BRC113	Excluded RC
9	BDH010	BRC113	Excluded RC
10	BDH001R	BRC113	Excluded RC
11	BDH001	BRC113	Excluded RC
12	BDH053	BRC216	
13	BDH039	BRC217	Excluded RC
14	BDH037	BRC218	
15	BDH035	BRC219	
16	BDH036	BRC220	
17	BDH042	BRC221	
18	BDH048	BRC221	
19	BDH130	BRC245	
20	BDH044	BRC245	
21	BDH130	BRC245	
22	BDH140	BRC253	
23	BDH172	BRC254	

Figure 12-6 shows the cross sections of twinned pairs for the five sets of drillholes that intersect mineralisation and Figure 12-7 presents the log probability plot comparing the Au grades, with top-cuts applied to control the influence of outliers.

Despite what appears to be extensive twinning, because only some intersect mineralisation, it is not possible to draw conclusions from the statistical comparison of the twins, due to paucity of data, and nuggety style of the deposit.

Further analysis of the RC vs. DD comparison had to be conducted to ensure compatibility between the two datasets for use in the MRE. This work is outlined in Section 12.3.2.

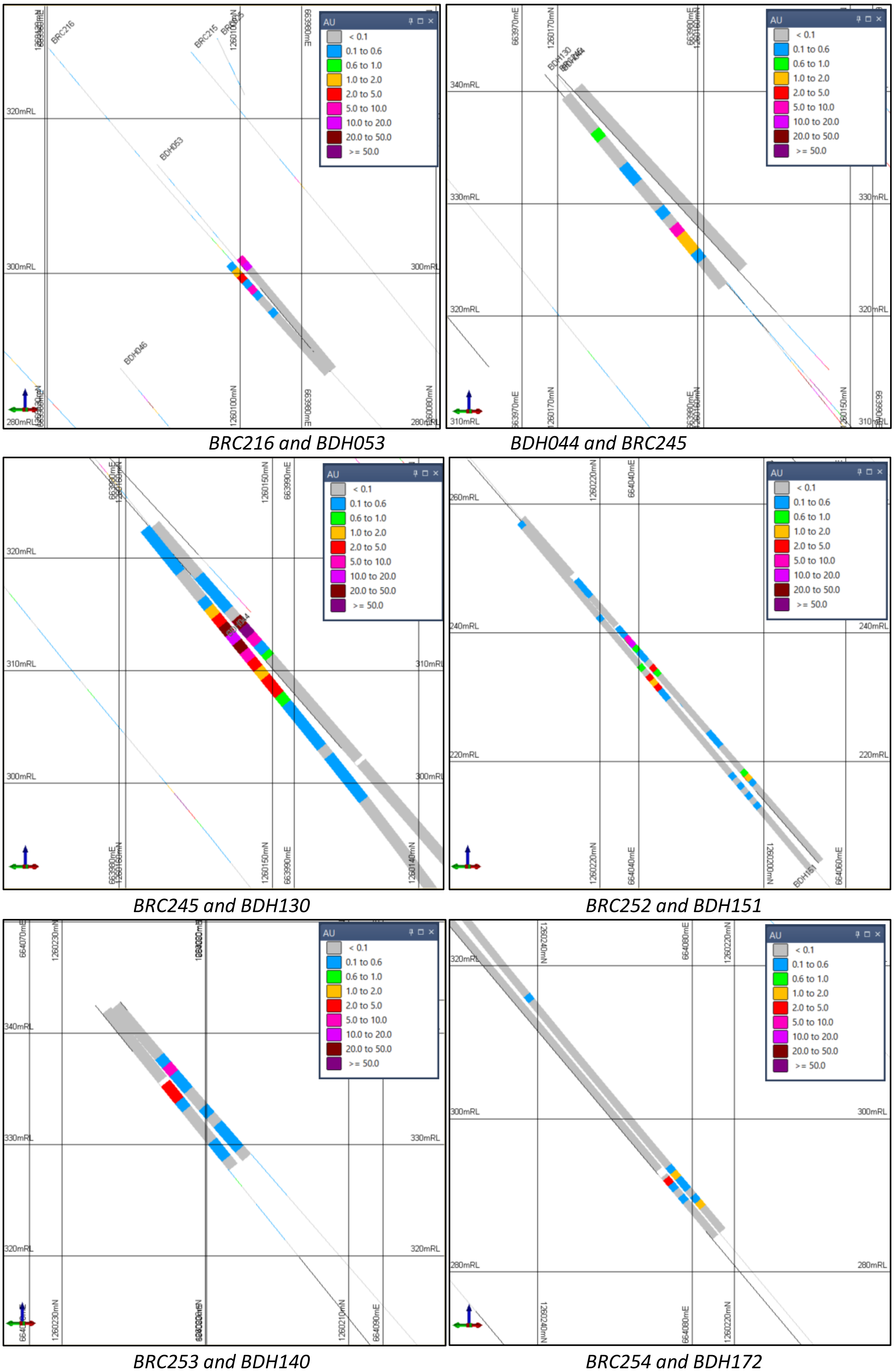


Figure 12-6: Balogo – cross sections showing twin pairs – DD vs. RC

Source: CSA Global, 2017

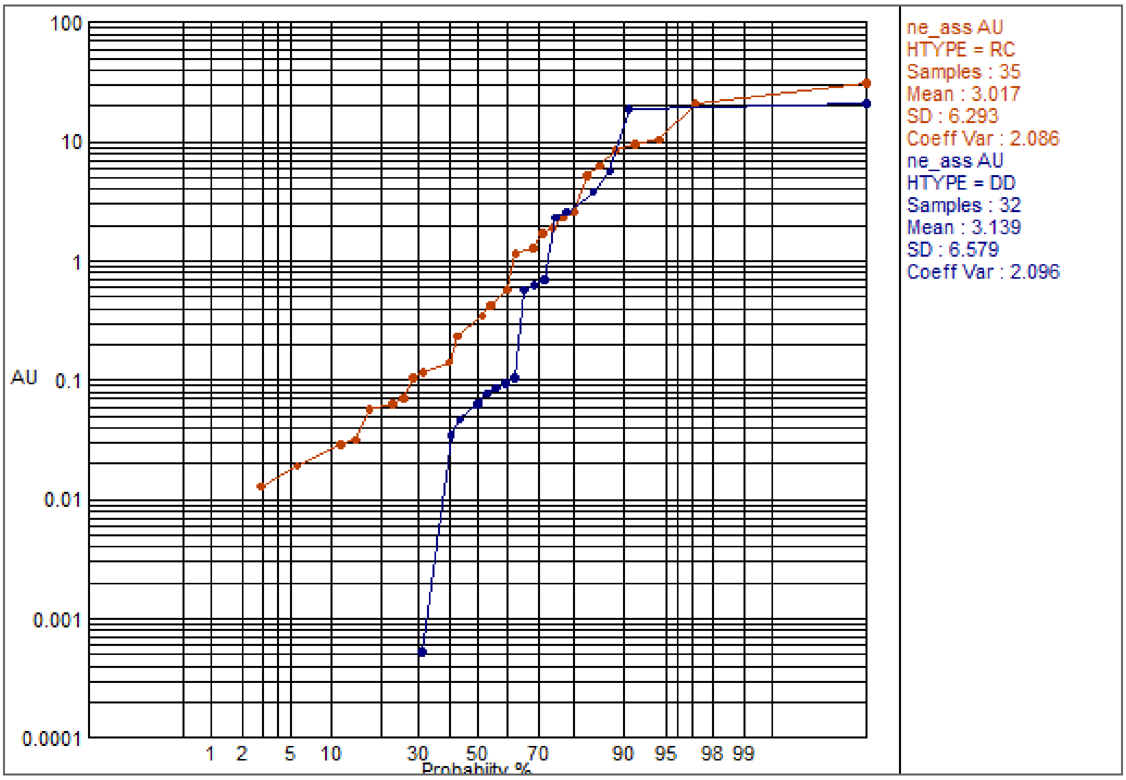


Figure 12-7: Balogo – probability plot of RC and DD twinned samples within mineralisation zone; top-cut to control influence of outliers

Source: CSA Global, 2017

12.3.2 RC vs. DD

Youga and Ouaré Properties

Drillhole samples flagged within the modelled mineralisation volumes (Section 14.4) at the Youga and Ouaré deposits, were used to compare Au (g/t) assays from RC and DD data. The results are shown in Figure 12-8 to Figure 12-10.

To ensure sample population are comparable, the drill data have been composited to the same sample length and top-cut, within each respective deposit.

Generally, the RC and DD mean assay values and grade distributions are comparable above the 0.25 g/t Au cut-off of interest. This was the cut-off used for mineralisation modelling. Both RC and DD datasets are acceptable for use in the MRE and there is no obvious bias.

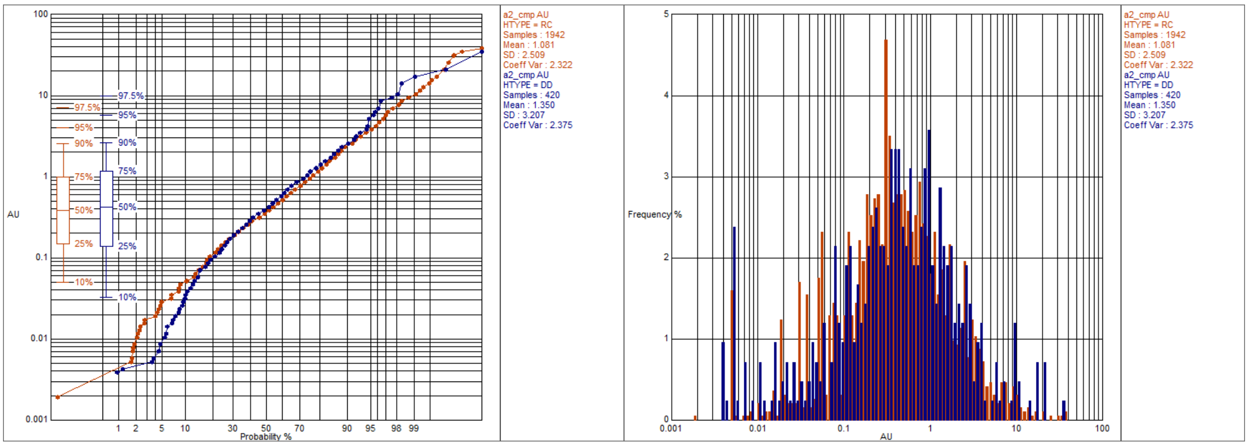


Figure 12-8: Youga – A2N East RC (red) vs. DD (blue) – log probability and log histogram plots

Source: CSA Global, 2018

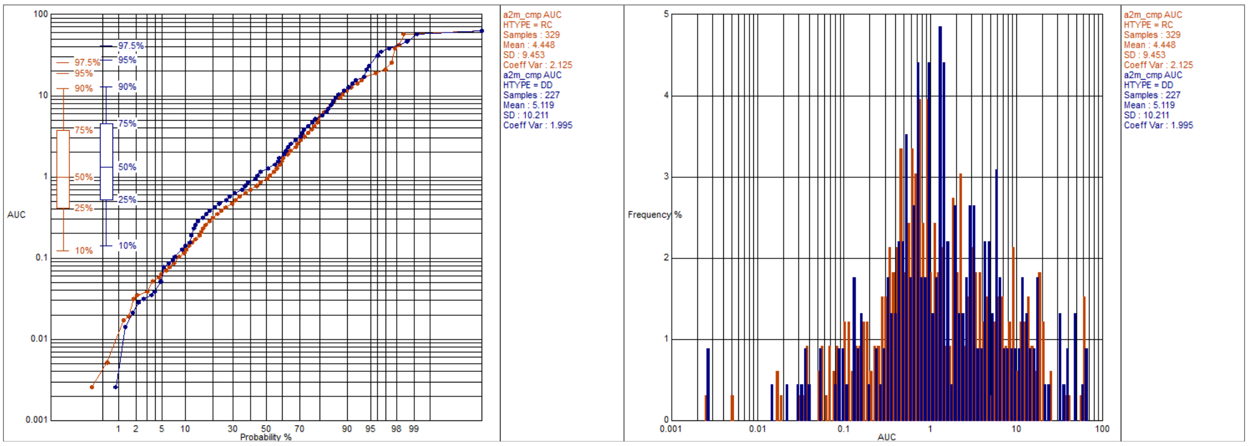


Figure 12-9: Youga – A2N Middle RC (red) vs. DD (blue) – log probability and log histogram plots

Source: CSA Global, 2018

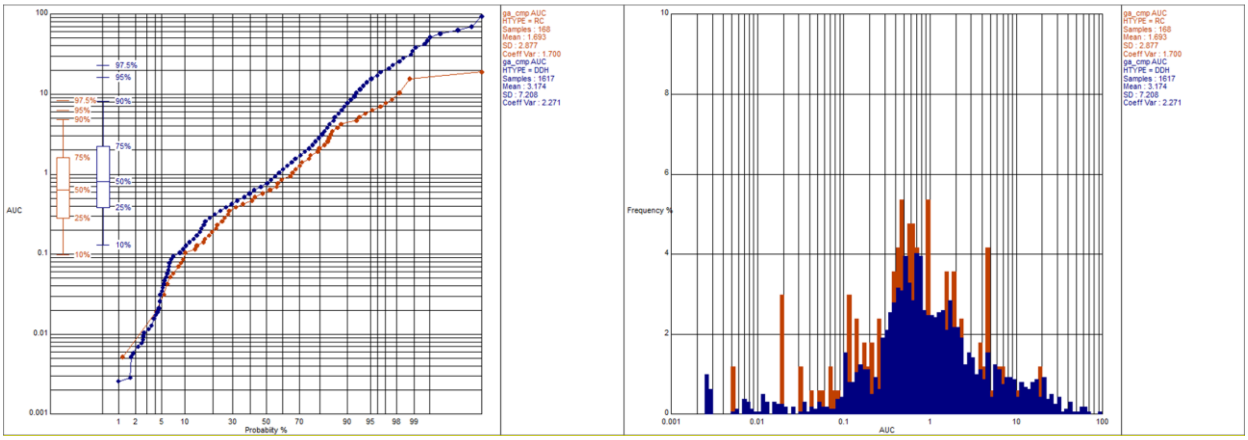


Figure 12-10: Youga – Gassore RC (red) vs. DD (blue) – log probability and log histogram plots

Source: CSA Global, 2018

Balogo Property

A significant portion of the data are RC, with approximately 30% at Netiana (Table 12-3). To assess the compatibility between the two datasets, procedures for both kinds of sample collection were reviewed and are considered appropriate.

Table 12-3: Balogo – drill type data by deposit and year

Deposit	Year	DD		RC		Trench		TOTAL	
		No.	Metres	No.	Metres	No.	Metres	No.	Metres
Netiana	2011	-	-	46	5,505	-	-	46	5,505
	2012	8	1,541	36	4,888	-	-	44	6,429
	2013	-	-	2	220	-	-	2	220
	2016	158	21,434	-	-	-	-	158	21,434
	2017	6	991	-	-	-	-	6	991
	-	24	5,595	8	1,073	10	1,538	42	8,206
	Subtotal	**196**	**29,561**	**92**	**11,686**	**10**	**1,538**	**298**	**42,785**
Netiana SE	2011	-	-	30	3,607	-	-	30	3,607
	2012	-	-	17	2,160	-	-	17	2,160
	2013	-	-	1	104	-	-	1	104
	2016	2	145	-	-	-	-	2	145
	2017	3	240	-	-	-	-	3	240
	-	1	83	-	-	-	-	1	83
	Subtotal	**6**	**468**	**48**	**5,871**	**-**	**-**	**54**	**6,339**
TOTAL		**202**	**30,028**	**140**	**17,557**	**10**	**1,538**	**352**	**49,123**

The drillhole data were run through a selective compositing process in Datamine Studio RM™ (CompSE) to generate minimum thickness and minimum grade intercepts at various Au cut-off grades to compare drillhole type datasets. The accumulated Au was compared at each cut-off for each drill type (Figure 12-11). RC tended to have slightly more accumulated Au at higher cut-offs than DD data but for the most part, the two datasets were found to be quite compatible at the cut-offs reviewed.

Trench data are very minor and while shows slightly lower grades, it reflects the lower grades found at surface, rather than bias in the dataset. Trenches tend to reflect the grade tenor of nearby holes.

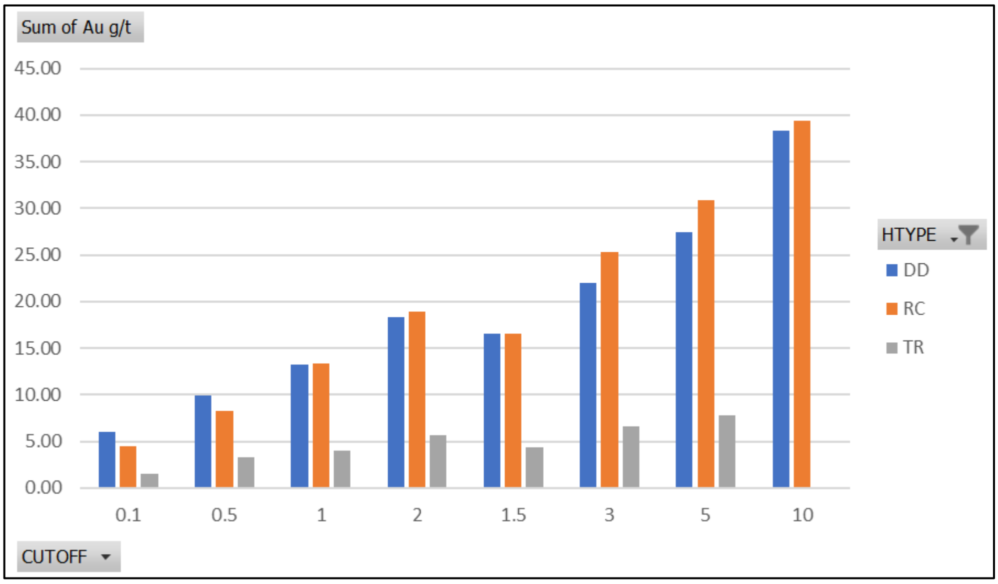


Figure 12-11: Balogo – comparison of hole types at a range of cut-offs

Source: CSA Global, 2017

In addition to the review of the data, a test estimate was run using only DD data, and using the combined dataset to assess any impact if any, of using the combined dataset. The result was within 1% on metal (2,500 oz Au) with the DD only scenario reporting a slightly lower tonnage, and higher grade than the combined dataset (Figure 12-12). This, alongside the data review, supported the decision to proceed using RC, DD and trench data in the MRE.

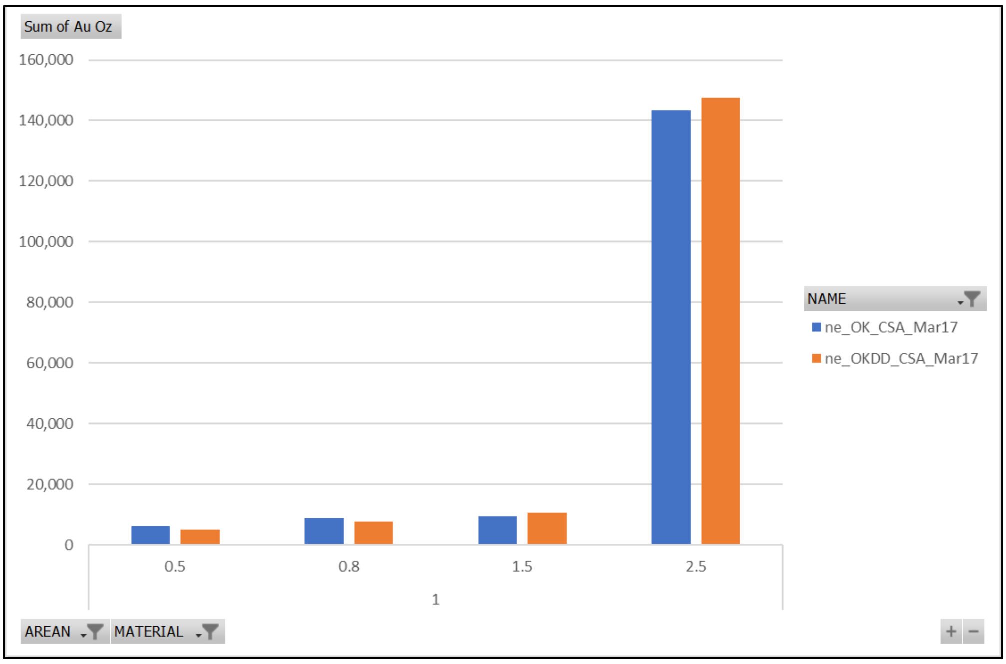


Figure 12-12: Balogo – comparison of estimation scenarios at a range of cut-offs; combined dataset (blue) and diamond only (orange)

Source: CSA Global, 2017

12.4 Drill Sample Recovery and Quality

12.4.1 Youga and Ouaré Properties

The sample recovery of the drilling completed prior to Endeavour involvement for both Youga and Ouaré has not been recorded in the database, although Ashanti reported sample recovery for both the RC and diamond drilling to be high (Lycopodium, 1999).

As per the 2014 Endeavour technical report, for drilling that was managed by Endeavour, recovery was routinely calculated and captured in the database:

- Youga had an average core recovery near 95% and RC recoveries estimated near 79%. Acceptable recovery was achieved for all programs of drilling completed.
- Ouaré had an average core recovery near 95% and RC recoveries estimated near 80%. Acceptable recovery was achieved for all programs of drilling completed.

The database provided only included recovery records from the Youga property, with no data from the Ouaré property.

There were 799 samples from A2N East (Figure 12-13), 1,472 samples from A2N Middle (Figure 12-14) and 580 samples from Gassore (Figure 12-15) available for review of the core sample recovery. Sample recoveries increase with rock competency/reduced weathering.

Within A2N East, core sample recovery in DD was very good in fresh rock averaging 97%. Core recovery from the moderate to highly weathered saprolite averaged 91%, with much lower core recovery in the overburden/laterite at 57%.

Within A2N Middle, core sample recovery in DD was very good in fresh rock averaging 98%. Core recovery from the moderate to highly weathered saprolite averaged 94%, with good core recovery in the overburden/laterite at 95%.

Within Gassore, core sample recovery in DD was very good in fresh rock averaging 99%. Core recovery from the moderate to highly weathered saprolite averaged 93%, with reasonable core recovery in the overburden/laterite at 82%.

The percentage DD core recovery against the Au grade was graphically reviewed for A2N East (Figure 12-16), A2N Middle (Figure 12-17) and Gassore (Figure 12-18) deposits. No relationship was evident.

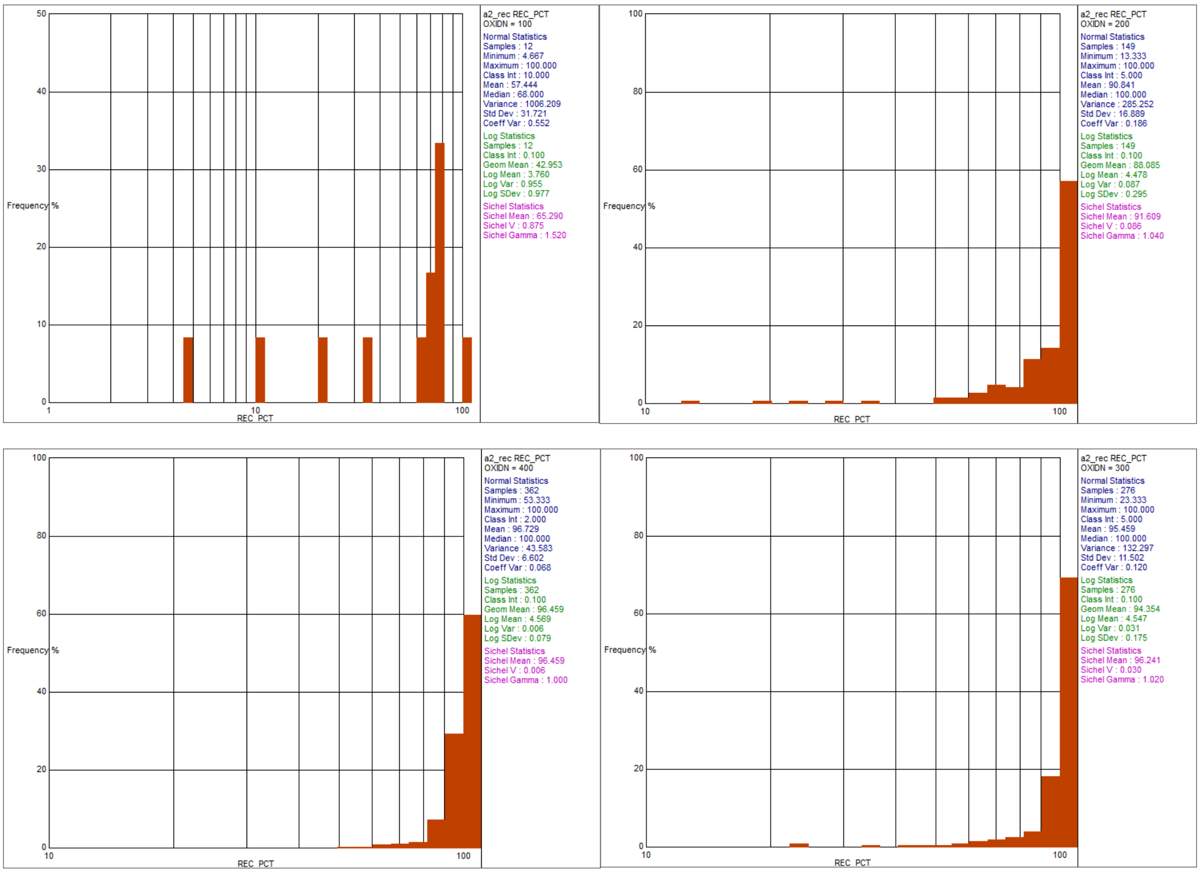


Figure 12-13: Youga – A2N East histogram plots – DD percentage core recovery

Clockwise from top left Overburden, Oxide Rock, Transitional Rock and Fresh Rock.
Source: CSA Global, 2018

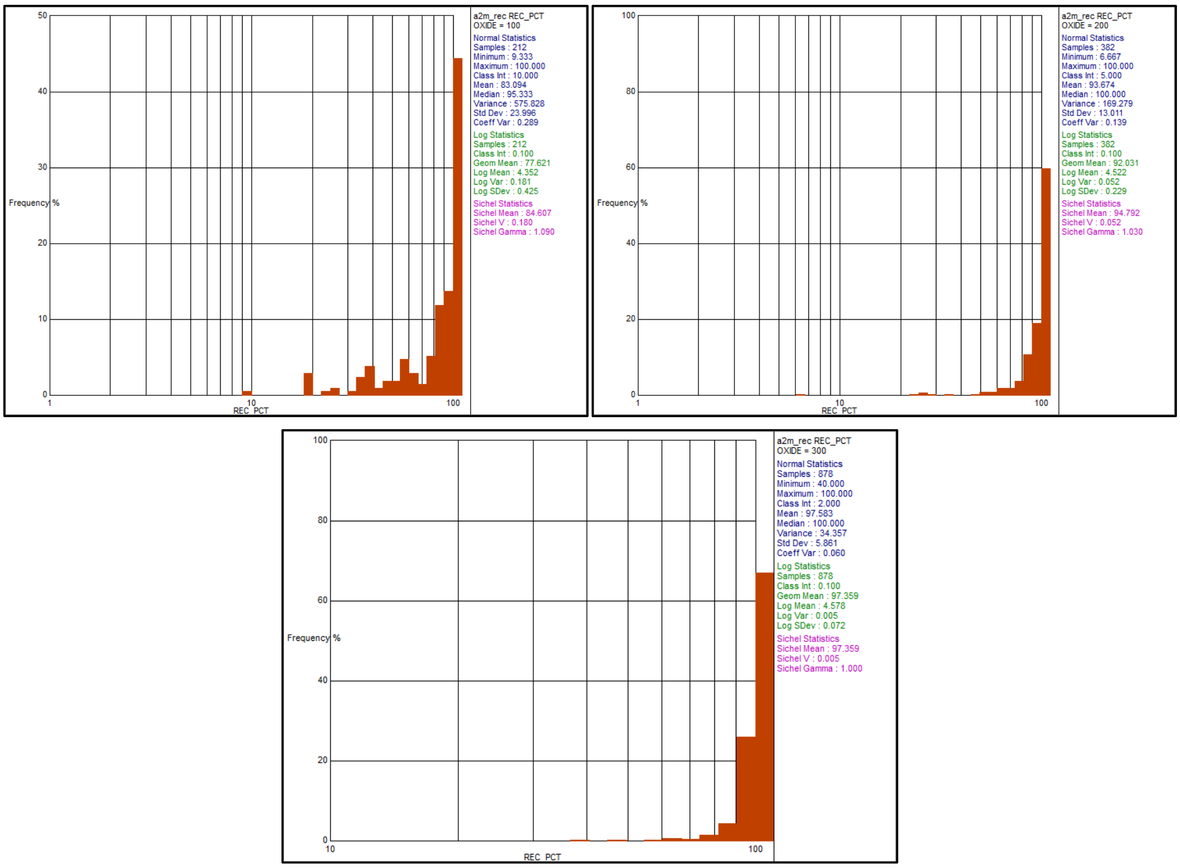


Figure 12-14: Youga – A2N Middle histogram plots – DD percentage core recovery

Clockwise from top left: Overburden/Oxide Rock, Transitional Rock and Fresh Rock.
Source: CSA Global, 2018

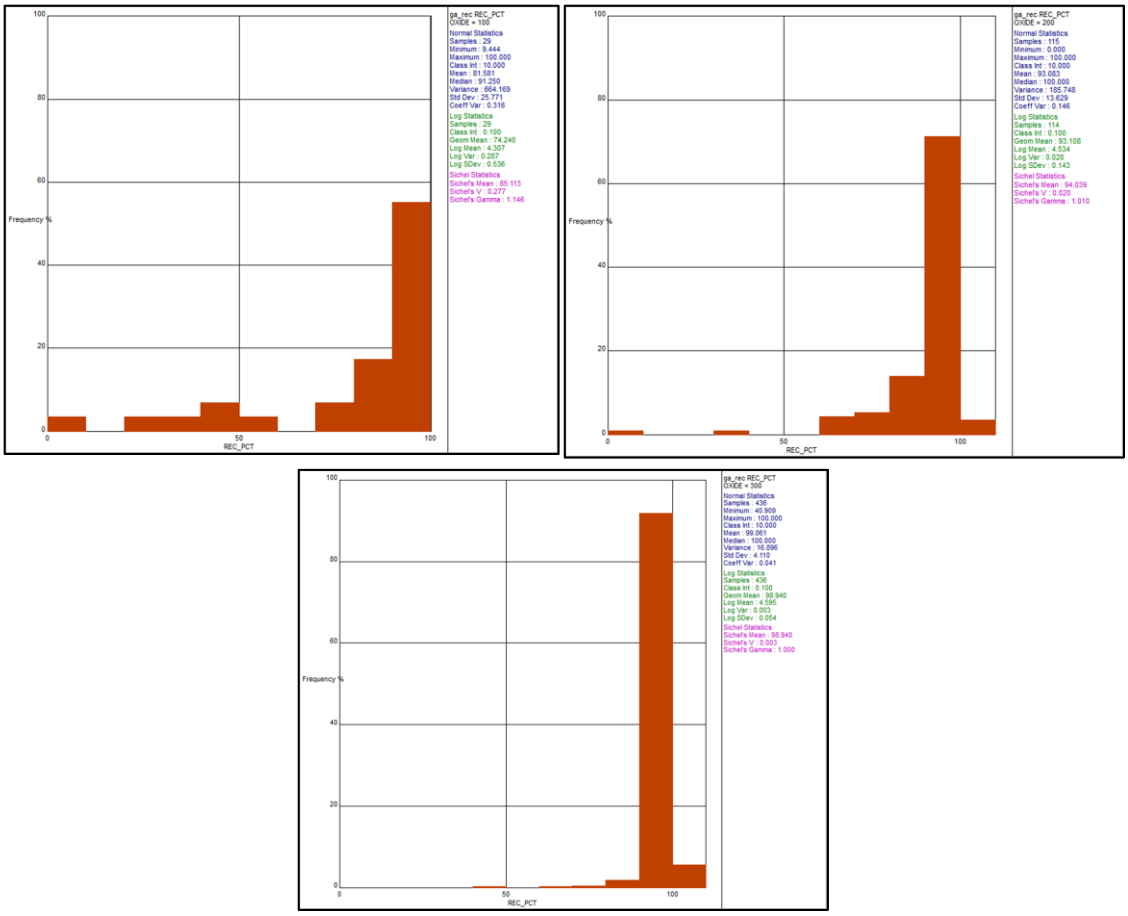


Figure 12-15: Youga – Gassore histogram plots – DD percentage core recovery

Clockwise from top left: Overburden/Oxide Rock, Transitional Rock and Fresh Rock.
Source: CSA Global, 2018

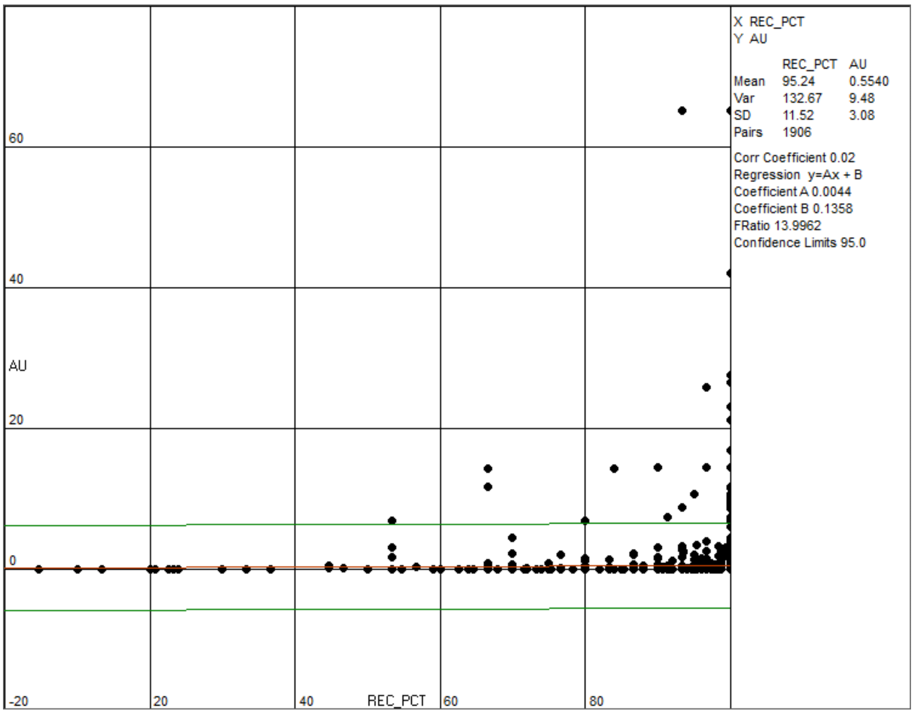


Figure 12-16: Youga – A2N East correlation plot – percentage core recovery vs. Au g/t

Source: CSA Global, 2018

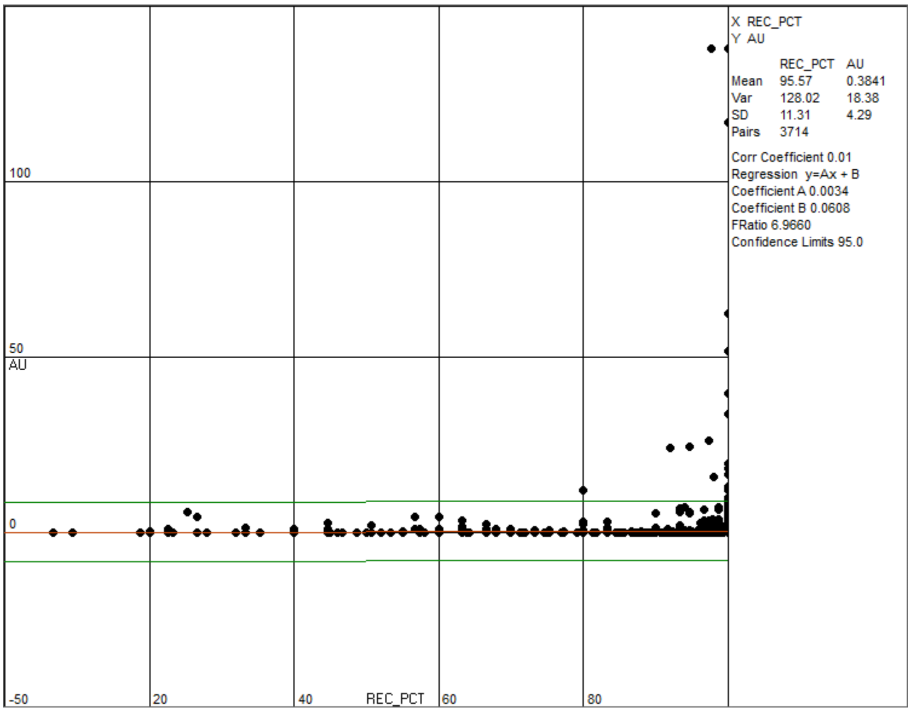


Figure 12-17: Youga – A2N Middle correlation plot – percentage core recovery vs. Au g/t

Source: CSA Global, 2018

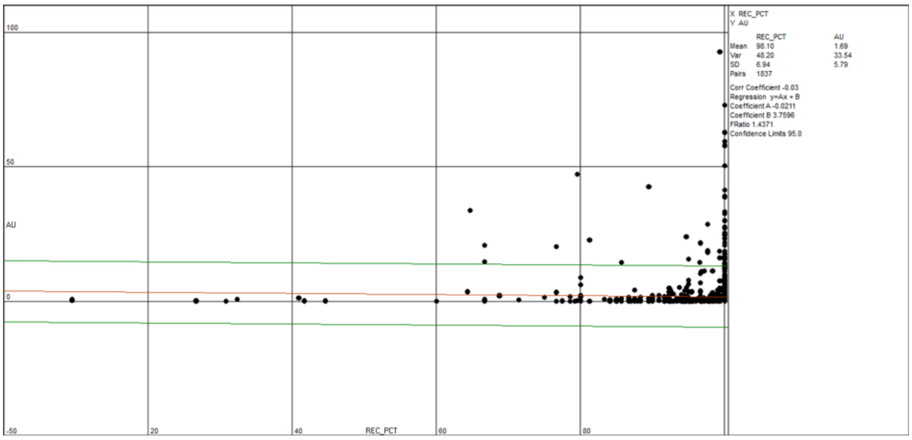


Figure 12-18: Youga – Gassore correlation plot – percentage core recovery vs. Au g/t

Source: CSA Global, 2018

12.5 Data Verification Limitations

Limitations noted include the following:

- A relational geological database is not in use, instead data were provided in various Microsoft Excel sheets. An industry standard database should be implemented which can serve as a single point of truth for the project data as well as being secure and have automated backups.
- ALS Youga gold assay results for the period 2010 to 2016 and SGS assay certificates for the 2012 Ouaré drilling were randomly verified against the database assay results. No other assay certificates were provided so no check of other results could be made.
- Numerous failures in the QAQC including apparent misidentified CRMs and blanks decreases confidence in the input data used for the Mineral Resource estimation work.

- No sample weight data were captured in the database for Youga or Ouaré samples. Therefore, no review of recovery vs. grade could be made for any of the RC samples.
- During the site visit, drill database tables were printed out and reviewed along with drill core for GASS-17-001, GASS-17-067, GASS-17-068, GASS-17-070 and GASS-17-072 at Youga, and BDH091, BDH093 and BDH188 at Balogo. The rest of the database was not reviewed during the site visit. Digital database tables were provided to CSA Global and underwent the data verification outlined in Section 12.1.
- No written procedures were available for review. Reports were reviewed to enable CSA Global to take an informed decision on the quality of data available.

12.6 Conclusions

Subject to the limitations listed above and based on the outcomes of the above data verification undertaken, as well as discussions with site geologists; CSA Global considers the drillhole data for the Youga, Ouaré and Balogo projects to be sufficiently reliable for Mineral Resource estimation and associated downstream work.

13 Mineral Processing and Metallurgical Testing

13.1 Introduction

The Project is planning to improve the diminishing ore grades at the current Youga operation by supplementing the feed material with material from nearby satellite deposits, the Ouaré deposit and higher-grade material from the Netiana deposit (Balogo). Ore from a new mining operation at Ouaré will be trucked 44 km, and 154 km from Balogo, and dumped on the Run of Mine (RoM) pad. The mill feed to the operation is scheduled to average 1.18 million tonnes per annum (Mt/a), of which material from Ouaré will comprise the proportions of 34% in 2018, 73% in 2019, and 53% in 2020. The Netiana material will comprise up to 50,000 t per quarter going forward, equivalent to a target blend proportion of 16% in 2018. It is expected that there will be an annual throughput of 1.18Mt/y over the scheduled mine life out to 2025.

13.2 Youga Processing Plant

13.2.1 Youga Ore Characteristics

Eight Youga core samples and three composite pit samples were tested at Mintek (1999 and 2004), and three core samples at Hazen Research at a previous date (Ref. HGC Cement and Mineral Processing Technologies – Section 15.4). These reported:

- An average Bond Ball Mill Work Index of 15.9kWh/t, with a range of 17.1 to 19.4 kWh/t
- Potential gravity recoverable gold (GRG) recoveries of 40–50%
- Leach extractions ranged from 88 to 96% on 10 samples of gravity tailing, after 24 hours and at low cyanide consumptions (<0.04 kg/t)
- The mineralogical report indicated the gold occurrence as both coarse and fine liberated particles between 40 microns and 100 microns in size, and as fine inclusions (1–12 microns) in pyrite.

This was the basis of design for the Youga process plant, which commenced operation in 2008. The flowsheet comprises of a three-stage crushing, and single-stage ball milling circuit; a gravity section recovering between 25% and 33% of the GRG present, from a portion of the current cyclone underflow recycle stream; the cyclone overflow reports to a single-stage cyanide leach and five-stage integral carbon-in-leach (CIL) circuit. Loaded carbon is removed from the first CIL tank and the gold recovered in a “Zadra” elution circuit with gold recovered by electrowinning and smelting to produce doré, while the leach tailings from the CIL circuit is pumped to the tailings management facility (TMF).

Production highlights for the operation since commencement of production in 2008 are shown in Table 13-1 below:

Year	Tonnes Milled	Head Grade, g/t	Au Recovery	Oz Produced
2008	663,334	2.37	92.79%	45,264
2009	871,740	2.64	91.57%	65,648
2010	891,202	3.10	93.62%	82,405
2011	940,168	3.18	93.77%	87,266
2012	1,012,829	2.92	93.61%	89,022
2013	1,005,876	2.99	92.36%	89,448
2014	990,852	2.57	90.63%	73,291
2015	1,060,983	2.20	89.85%	68,407
2016	1,119,197	1.39	88.54%	44,403
2017	1,199,577	3.34	89.90%	115,321

Table 13-1: Youga Mine operation – production history (Avesoro, 2018)

The operating performance since production start-up has confirmed the pre-production recovery assumptions (both gravity and leach extractions). The reduction in gold production in 2015/2016 was due to the significant decrease in milled head grade, which was partially offset by an increase in plant throughput. Higher recoveries obtained in 2017 are due in part to higher grade material processed from high-grade stockpiles.

13.2.2 Netiana Ore Characteristics

SGS Program, December 2012 (Coffey Mining, Netiana Scoping Study)

Gravity and leach tests were completed on a series of six samples. Two samples each of Oxide, Transition and Fresh ores were tested, with gold and tellurium head assays as outlined in Table 13-2.

Table 13-2: Netiana ore test results (December 2012)

Ore type	Sample number	Au grade (g/t)	Te (g/t)
Oxide	BRC - 217 03551	17	47
	BRC - 071 03554	186	663
Transition	BRC - 218 03552	155	461
	BRC - 112 03555	17	68
Sulphide	BRC - 220 03553	5.8	16
	BRC - 196 03556	2.5	11

In addition to a "gold occurrence" leach program on each of the samples, diagnostic mineralogy (Townend, Letter Report for SGS and Coffey Mining) identified the tellurium occurrence as substantially associated with bismuth minerals, containing only very fine (<10 micron) particles of gold.

Tellurium minerals are normally "refractory" (i.e. non-leachable in cyanide), with the corresponding reductions in recovery of most of the gold associated with these minerals. However, the identification that only minor proportions of the gold present in the feed are associated with the "tellurides" indicates their presence should not be detrimental to conventional leaching in cyanide.

Summary results of the program were:

- Standard comminution tests were completed on two lithological types (quartz and diorite), with the Bond Ball Mill Index being measured at 14.83 kWh/t and 14.69 kWh/t respectively. These work index values are below those of ore currently being treated at Youga.

- Gravity testing – each sample was ground to 850, 250 and 75 microns, and subjected to standard laboratory tests which showed recoveries (averaged for the six samples) of 34%, 21% and 50% for the three grind sizes respectively. While not optimised, these results confirm the requirement for the inclusion of a gravity recovery circuit in the flowsheet for these ore types.
- Leach testing carried out on the gravity tails resulted in gold extractions of greater than 90% after the standard 24 hours leach time in all samples. The leach curves also showed that extraction continued after the 24-hour period.
- One sample of the gravity concentrate was subjected to intensive cyanide leaching (ICN) resulting in >98% of the gold being leached after 72 hours.

13.3 Testwork on Ouaré and Satellite Samples, and Netiana Samples

Whole core drill samples (23), two each from Ouaré East, Ouaré Central and Ouaré West (designated CW); samples from six satellite zones, together with a Youga plant sample, were tested at SGS Vancouver to compare responses of each to the current operating Youga configuration.

13.3.1 Ouaré Ore Characteristics (AMEC 2012, Micon 2013)

Standard comminution tests were completed on the more competent (geologically described as “Fresh”) samples present, with both Bond Rod and Ball Mill work indexes being measured (Table 13-3).

Table 13-3: Ouaré samples – comminution test results (July 2012)

Ouaré sample number	Rod Mill Index (kWh/t)	Hardness percentile	Ball Mill Index (kWh/t)	Hardness percentile
East 1	19.1	88	18.4	93
East 2	18.2	83	22.2	97
Central 2	19.6	91	16.6	87
West 2	20.3	94	11.1	57
Youga Plant	16.8	73	15.7	84

While the results of the Rod Mill determinations are not generally used for single-stage ball milling circuits, they give an indication of the grinding characteristics at the coarser end of the size ranges (10–1 mm). Comparing the laboratory measurements to the actual plant sample at the time indicates that the Ouaré samples tested are significantly harder (with the exception of the Ball Mill Index of West 2) for both measurements, which is clearly confirmed with their relative positions in the “hardness” profile.

Standard gravity tests were completed on the samples ground to an 80% passing size (P_{80}) of 150 microns, and subsequent leach tests completed on the gravity tails. In addition, the gravity tails were ground to a P_{80} size of 75 microns to compare the effects of leaching at a finer grind size. The results summarised in Table 13-4 and Table 13-5.

Table 13-4: Ouaré samples – gravity test results, July 2012 (P_{80} of 150 microns)

Sample ID	Head grade (Au g/t)	Concentrate grade (Au, g/t)	Au recovery (%)
East 1	1.74	195	8.4
East 2	4.68	767	12.3
Central 1	4.38	832	8.1
Central 2	4.40	79	1.9
C W 1	1.67	501	36.6
C W 2	2.06	162	7.4
Youga Plant	4.68	849	16.8

Table 13-5: Ouaré samples – leach test results, July 2012 (P_{80} of 75 microns)

Sample ID	Au extraction (%)	CN consumption (kg/t)	Lime consumption (kg/t)
East 1	79.1	0.54	0.39
East 2	77.9	0.55	0.44
Central 1	81.5	0.30	0.7
Central 2	74.9	0.45	0.32
CW 1	90.1	0.22	0.35
CW 2	75.5	0.63	0.2
Youga Plant	84.8	0.30	0.24

The report made the comment that leaching was substantially complete for all the samples tested after 10 hours, with the exceptions of Central 2, which took 20 hours, and East where the extraction continued to increase slowly after the initial 10-hour period. The benefits of a finer primary grind (P_{80} of 75 microns) are also clear with the recommendation that this should be the target grind for the leach circuit.

The leach results were based on the original gravity grind size of 80% passing 150 microns. Additional work was performed on each of the samples at 80% passing 75 microns to compare the effects of leaching at a finer grind size. The effects are shown in Table 13-6 below.

Table 13-6: Ouaré Samples, Overall Au Recovery Projection. July 2012

Sample description	Calculated head (Au g/t)	Residue assays (Au, g/t)	Au Extraction (%)	
			P_{80} - 75µm	P_{80} - 150µm
East 1	1.74	0.18	89.7	82.5
East 2	4.68	0.39	91.7	82.4
Central 1	4.38	0.45	89.7	84.5
Central 2	4.40	0.61	86.1	77.0
CW 1	1.67	0.06	96.1	92.5
CW 2	2.06	0.27	86.9	70.6
Youga Plant	4.87	0.28	94.3	88.5

As can be seen the finer grind size significantly improves the leach performance, and the 75-micron grind size should be the target when treating the Ouaré ores in the future.

13.3.2 Satellite Deposits – Ore Characteristics (AMEC 2012, Micon 2013)

Standard comminution tests were completed on the more competent (geologically described as "Fresh") samples present, with both Bond Rod and Ball Mill indexes being measured (Table 13-7).

Table 13-7: Satellite samples – comminution test results (July 2012)

Satellite sample ID	Rod Mill Index (kWh/t)	Hardness percentile, %	Ball Mill Index (kWh/t)	Hardness percentile, %
A2N4	14.6	54	11.2	59
Nanga 2	16.1	67	12.3	69
Nanga 3	19.4	89	15.7	84
Tail 2	16.9	73	15.4	82
Tail 3	16.9	73	17.1	89
Zergoré N 3	15.2	59	10.8	56
Zergoré S 3	16.5	70	12.3	67
Youga Plant	16.8	73	15.7	84

While the results of the Rod Mill determinations are not generally used for single-stage ball milling circuits, they give an indication of the grinding characteristics at the coarser end of the size ranges (10–1 mm). Comparing the actual measurements to the those recorded for the plant sample at the time indicates that the Satellite deposit samples show generally lower, or equivalent numbers for both measurements, which is also confirmed with their relative positions in the "hardness" profile. One Ball Mill Index sample ("Tail 3"), was harder than the plant sample at the time. These results confirm that for the ores tested, there should be no bottlenecks in achieving the required mill throughput rates; at the target grind size P_{80} of 75 microns.

Standard gravity tests were completed on the samples ground to an 80% passing size (P_{80}) of 150 microns, and subsequent leach tests completed on the gravity tails. The gravity recovery results are summarised in Table 13-8 and Table 13-9. Note that no results are recorded for Zergoré S 1 due to sample contamination during the testing procedures.

Table 13-8: Satellite samples – gravity test results (July 2012)

Satellite sample ID	Calculated head grade (Au, g/t)	Concentrate grade (Au, g/t)	Au Recovery (%)
A2N_1	2.37	176	18.1
A2N_2	2.89	197	12.3
A2N_3	0.25	41.9	28.1
A2N_4	0.1	6.16	11.9
Nanga 1	1.68	314	18.8
Nanga 2	2.14	329	18.7
Nanga 3	1.47	192	16.6
Tail 1	0.79	163	13.9
Tail 2	0.51	100	20.3
Tail 3	0.69	155	27.1
Zergoré N 1	0.4	382	27.4
Zergoré N 2	3.63	1047	26.8
Zergoré N 3	2.24	943	32.2
Zergoré S 2	2.72	359	0.45
Zergoré S 3	0.61	102	0.26
Youga Plant	4.87	849	16.8

The results show reasonable GRG component for the ore types tested, with the exception for the samples recorded from Zergoré South. GRG values ranged from 11.9% to 32.2% for the samples tested.

Table 13-9: Satellite samples – leach test results on gravity tail (P_{80} – 150 microns), July 2012

Satellite sample ID	Au extraction (%)	CN Consumption (kg/t)	Lime Consumption (kg/t)
A2N_1	92.3	0.06	1.5
A2N_2	91.5	0.19	0.85
A2N_3	87.2	0.11	0.92
A2N_4	71.7	0.04	0.44
Nanga 1	90.5	0.2	0.58
Nanga 2	84.6	0.5	0.62
Nanga 3	62.5	0.36	0.59
Tail 1	95.6	0.3	0.89
Tail 2	83.6	0.35	0.47
Tail 3	85.3	0.27	0.39
Zergoré N 1	91.9	0.23	0.08
Zergoré N 2	85.4	0.46	0.32
Zergoré N 3	81.5	0.55	0.35
Zergoré S 2	75.6	0.3	0.45
Zergoré S 3	92.1	0.3	0.26

Satellite sample ID	Au extraction (%)	CN Consumption (kg/t)	Lime Consumption (kg/t)
Youga Plant	84.8	0.3	0.24

The leach results were based on the original gravity grind size of 80% passing 150 microns. Additional work was performed on three of the samples at 80% passing 75 microns to compare the effects of leaching at a finer grind size. The comparison is shown in Table 13-10 below.

Table 13-10: Satellite samples, overall Au recovery projection (July 2012)

Satellite sample ID	Calculated head (Au g/t)	Residue assays (Au, g/t)	Au extraction, % (P_{80} – 75 µm)	
Nanga N 3	1.47	0.12	91.8	63.3
Zergoré N 2	3.63	0.20	94.5	89.3
Zergoré S 2	2.72	0.28	89.7	80.5
Youga Plant	4.87	0.28	94.3	88.5

As can be seen the finer grind size improves the leach performance, hence the 75-micron grind size should be the target when treating the Satellite ores in the future.

13.3.3 Netiana – SGS Testing on 12 Samples – August 2014 (HGC Cement and Mineral Processing Technologies, pages 98–103)

The results of the leaching tests on “as received” samples undertaken on twelve Netiana core samples are summarised in Table 13-11. Gravity tests were not carried out for this series, however the relatively high leach extractions achieved after 24 hours do not indicate the presence of significant coarse gold. It is noted that leaching was not complete after 24 hours, with an additional 1% to 2% gold extraction achieved by extending the leach time to 48 hours.

Table 13-11: Netiana – SGS testing on 12 samples (August 2014)

Sample ID	Calculated head grades			Residue grades		Au extraction (%)	
	Au g/t	Te, g/t	S%	Te, g/t	S%	24h	48h
105452	4.06	27.6	3.18	21.1	3.39	84.8	85.6
105453	10.8	16.6	0.11	14.6	0.08	93.2	93.5
105454	8.73	13.4	1.24	11.9	0.08	97.1	97.5
105455	12.2	15.3	0.06	15.8	0.03	92.2	93.5
105456	1.25	9.81	0.64	9.52	0.06	86.4	89.1
105459	36.4	97.7	1.43	>100	1.35	93.3	93.8
105463	2.54	17.0	0.02	33.3	<0.01	91.1	92.7
105466	1.23	12.5	0.11	10.3	0.07	88.1	89.5
105468	3.69	15.4	2.7	15.5	2.29	87.1	89.2
105470	86.43	61.2	6.03	>100	5.38	75.2	82.8
105471	10.77	39.6	5.49	>101	5.13	91.6	92.2
105473	1.63	40.1	0.03	20.9	0.03	92.1	93.5
Average	**14.98**	**30.52**	**1.75**	**16.99**	**1.63**	**89.35**	**91.08**

Source: HGC Cement and Mineral Processing Technologies, pages 98–103

As shown in Table 13-12, the Netiana samples contain significant levels of tellurium (average of 30 g/t) and sulphur (average of 1.75% S) compared with <1 g/t and 0.23% S for the Youga ore samples respectively. As discussed in Section 13.2.2, gold leaching extractions from telluride and sulphide minerals can be relatively low, depending on the gold occurrence within the minerals. However, the measured gold leach extractions averaged ~89% after 24 hours (Table 13-12) and are only slightly below those obtained from the Youga samples.

Table 13-12: Netiana samples – extractions based on head grades

Sample ID	Au g/t	Average extraction (%)		
		Au g/t	24h	48h
105466	1.23			
105456	1.25			
105473	1.63	1.4	88.9	90.7
105463	2.54			
105468	3.69			
105452	4.06	3.4	87.7	89.2
105454	8.73			
105471	10.77			
105453	10.8			
105455	12.2			
105459	36.4	15.8	93.5	94.1

The extractions obtained on the various head grade ranges tested show an increase with the higher grades, and 94 % has been used in the production schedule.

The presence of Te and S (and the base metals Cu and Zn) are more significant in the Netiana samples tested than those recorded for Youga. Seven of the 12 samples tested had copper head grades between 0.10% Cu and 0.27% Cu (average of 0.16% Cu), and these resulted in greater than 100 ppm of copper in the leached solutions. Cyanide consumption were correspondingly high (2.7 kg/t) after 24 hours leaching. The five remaining samples with a head grade of 0.04% Cu consumed marginally less cyanide (1.8 kg/t) for the same leach time. Overall consumption tested to be considerably higher than that for the Youga samples and actual ore treated in 2016 (0.35–0.4 kg/t, Client Communication slide #8).

14 Mineral Resource Estimates

14.1 Introduction

The following section describes the methodology, parameters and key assumptions regarding the preparation of the updated MREs for the Youga and Balogo properties, prepared in 2018. This study was limited to updates to the A2N East, A2N Middle and Gassore deposits at Youga, as well as the Netiana deposit at Balogo, based on depletion through mining, additional infill or extensional drilling since the previous MREs.

The MRE work has been based on interpretations from assaying, and geological logging. Apart from the initial sample data preparation and intermediate spreadsheet processing, all the Mineral Resource interpretation, modelling, and estimation work was conducted using Micromine™, Datamine Studio^{RM} and Leapfrog™ software packages.

The deposits have been evaluated regarding the UTM grid (Zone 30 North in WGS84 datum), and all directional references in the MREs portions of this report are per this grid.

14.2 Drilling Database

14.2.1 Data Summary

CSA Global was initially provided with two Microsoft Access databases and various Microsoft Excel files for the Youga and Ouaré properties, and a series of Microsoft Excel files containing the Balogo project data. These data files contained, depending on deposit, variable degrees of collar, downhole survey, lithology, weathering, oxidation, recovery, SG and assay data. This information was exported in comma-separated values (CSV) format. A summary of the available drill data at Youga, per deposit, received as at 31 October 2017 is shown in Table 14-1. A summary of the Balogo drill data is shown in Table 14-2. The drill data was imported into SQL and Datamine StudioRM™ software for validation.

Table 14-1: Youga database – summary of data entries as at 31 October 2017

Deposit	Collars	Assays	Surveys	Lithology	Weathering	Oxidation	Recovery	SG
A2N East	370	21,500	1,100	8,103	8,095	7,544	799	50
A2N Middle	178	11,679	914	8,082	8,062	7,080	1,472	709
Gassore	374	40,290	1,885	9,148	8,799	7,964	17,292	1,670

Table 14-2: Balogo database – summary of data entries as at 31 October 2017

Deposit	Collars	Assays	Surveys	Lithology	Weathering	Oxidation	Recovery	SG
Netiana	277	24,857	2,597	7,651	789	7,498	13,037	4,091
Netiana SE	83	8,439	1,070	1,056	395	1,003	1,350	287

Since the February 2017 MRE update at Youga, infill and extension drilling have made it possible to better define the A2NE mineralisation trends. As a result, A2NE has been re-interpreted, extended and subdivided into three areas for the December 2017 MRE update. These are A2N East, A2N Middle and Gassore (Figure 14-1).

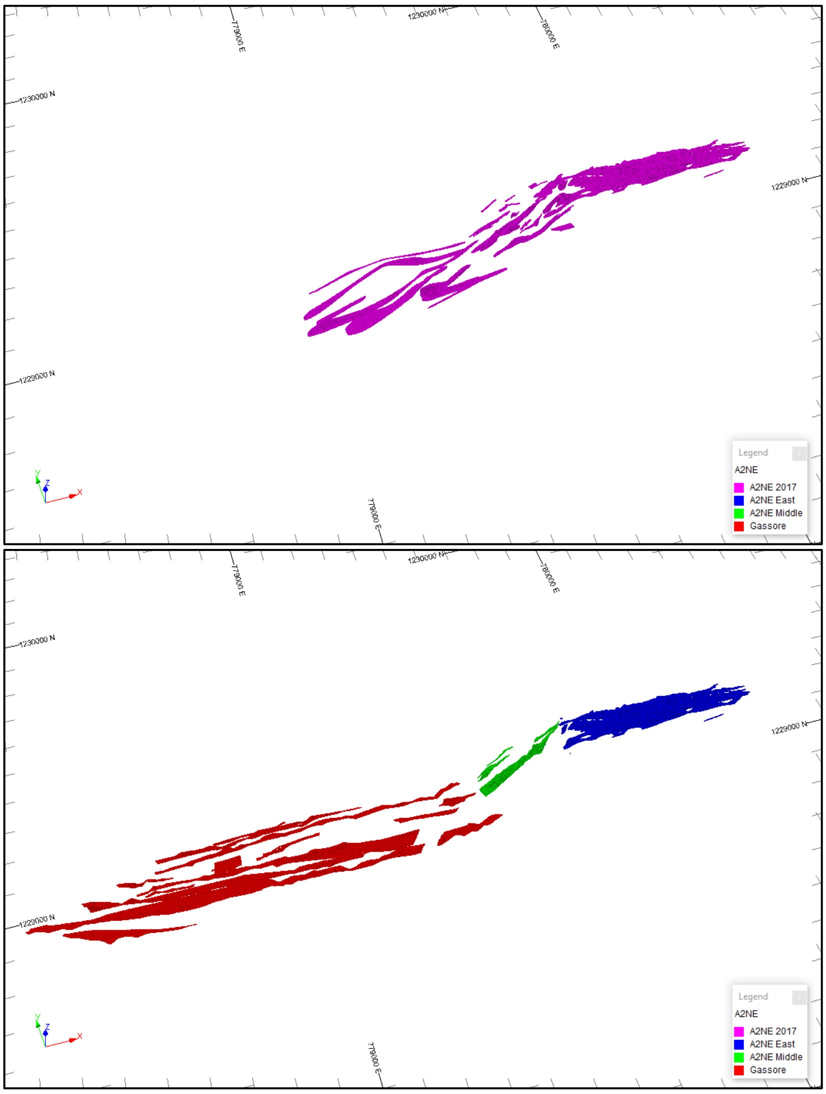


Figure 14-1: A2NE MRE February 2017 (top) vs. A2N East, A2N Middle and Gassore MREs December 2017 (bottom)

Source: CSA Global, 2018

The A2N East December 2017 MRE consists of the A2NE February 2017 MRE, cut back to the boundary (Easting>779,775) of what has been defined as the A2N Middle MRE.

A summary of the drilling data as used for estimation within each deposit at Youga is shown in Table 14-3.

Table 14-3: Youga database – summary of drilling as used for estimation as at 31 October 2017

Deposit		RC	RCDD	DD	TR	GT	Absent	Total
A2N East	Number of holes	123	-	27	-	-	-	**150**
	Metres	9,237	-	1,631	-	-	-	**10,868**
A2N Middle	Number of holes	105	-	70	-	-	-	**175**
	Metres	8,222	-	5,390	-	-	-	**13,612**
Gassore	Number of holes	48	-	313	-	-	-	**361**
	Metres	4,692	-	46,124	-	-	-	**50,816**

Note: RC – reverse circulation hole; RCDD – reverse circulation with diamond drill tail hole; DD – diamond drillhole; TR – trench; GT – geotechnical hole; Absent – based on review these are RC exploration holes

A summary of the drilling data as used for estimation within each deposit at Balogo is shown in Table 14-4.

Table 14-4: Balogo database – summary of drilling as used for estimation as at 31 October 2017

Deposit		RC	RC-DD	DD	TR	GT	Absent	Total
Netiana	Number of holes	73	-	197	7	-	-	**277**
	Metres	9,478	-	31,812	1,073	-	-	**42,363**
Netiana SE	Number of holes	51	-	31	1	-	-	**83**
	Metres	6,339	-	3,200	115	-	-	**9,654**

Note: RC – reverse circulation hole; RCDD – reverse circulation with diamond drill tail hole; DD – diamond drillhole; TR – trench; GT – geotechnical hole; Absent – based on review these are RC exploration holes

14.2.2 Location of Mineral Resource Estimate Data Points

All drill collars completed during the Ashanti/Echo Bay and Endeavour work programs were surveyed using a combination of total-station survey and differential GPS techniques by qualified surveyors and utilised control points.

Ashanti/Echo Bay surveyed downhole deviation using Sperry Sun single shot downhole cameras at intervals ranging from 20 m to 126 m and corrected for magnetic declination. Drilling completed by Endeavour were downhole surveyed using a Flexit© downhole instrument at a minimum of every 30 m and measured relative to magnetic north.

Location plans for drillholes used in the MRE, coloured by drillhole type ("HTYPE") are presented in Figure 14-2 to Figure 14-5.

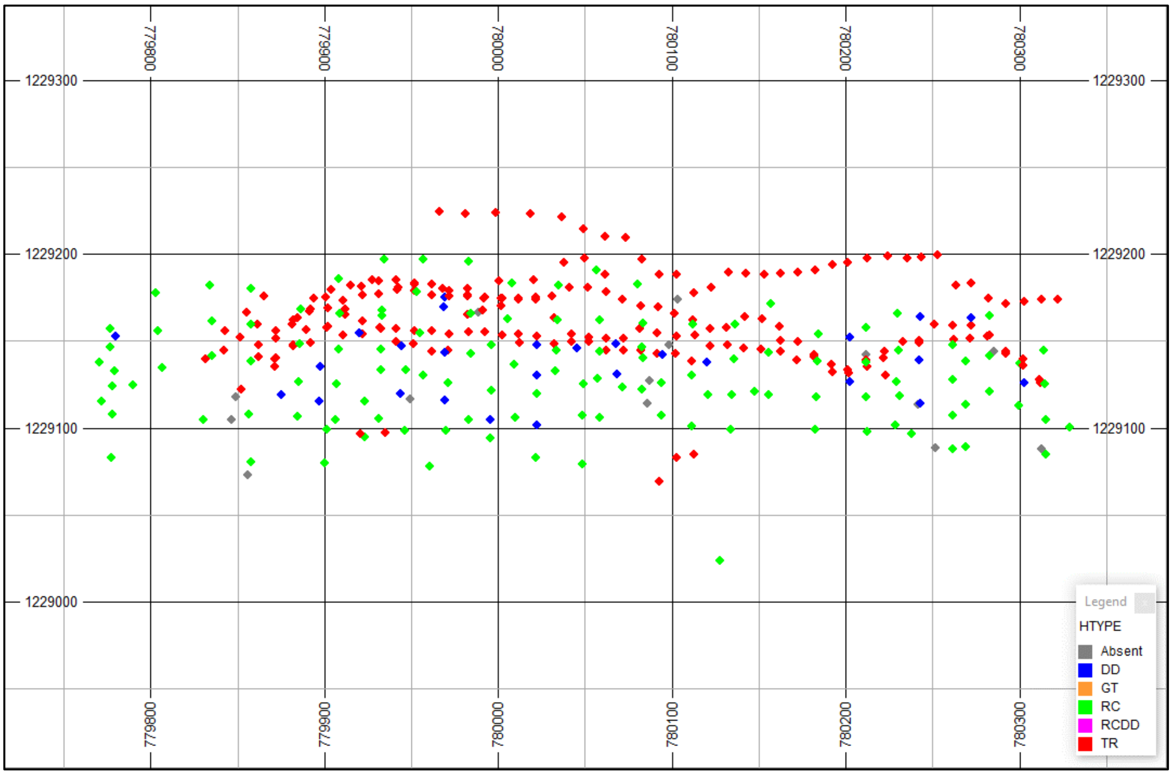


Figure 14-2: Plan view – Youga A2N East MRE drillhole locations

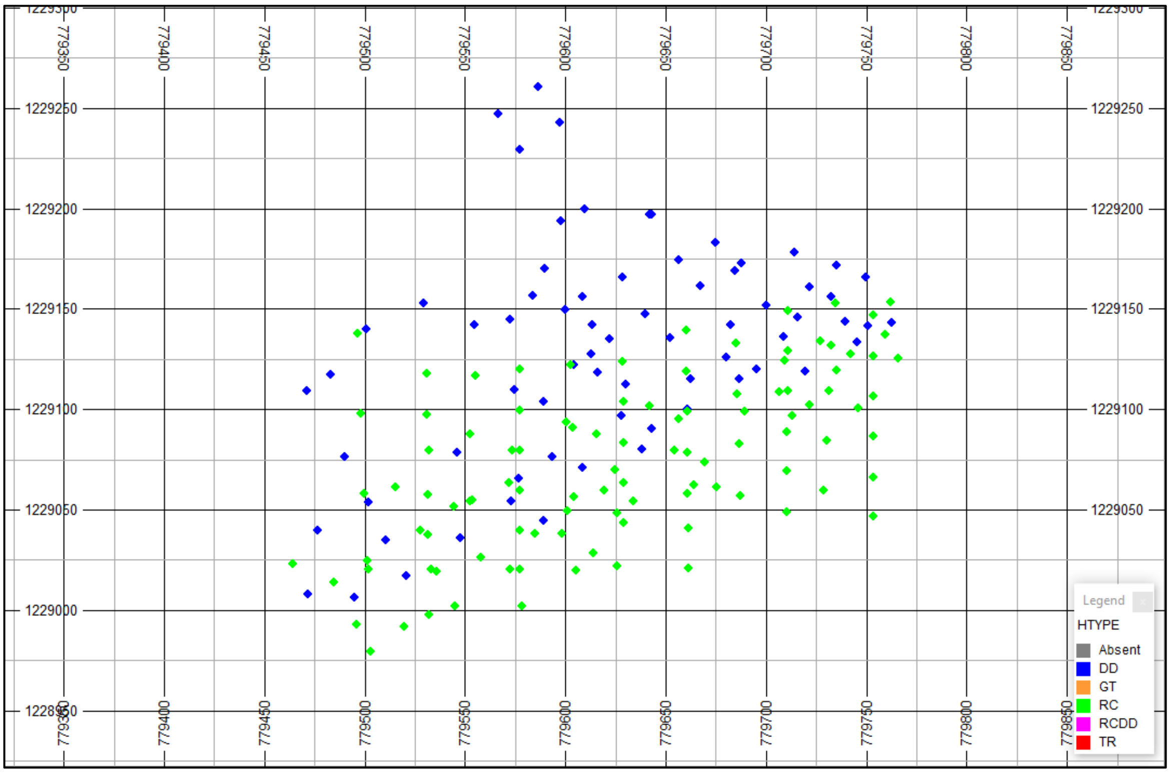


Figure 14-3: Plan view – Youga A2N Middle MRE drillhole locations

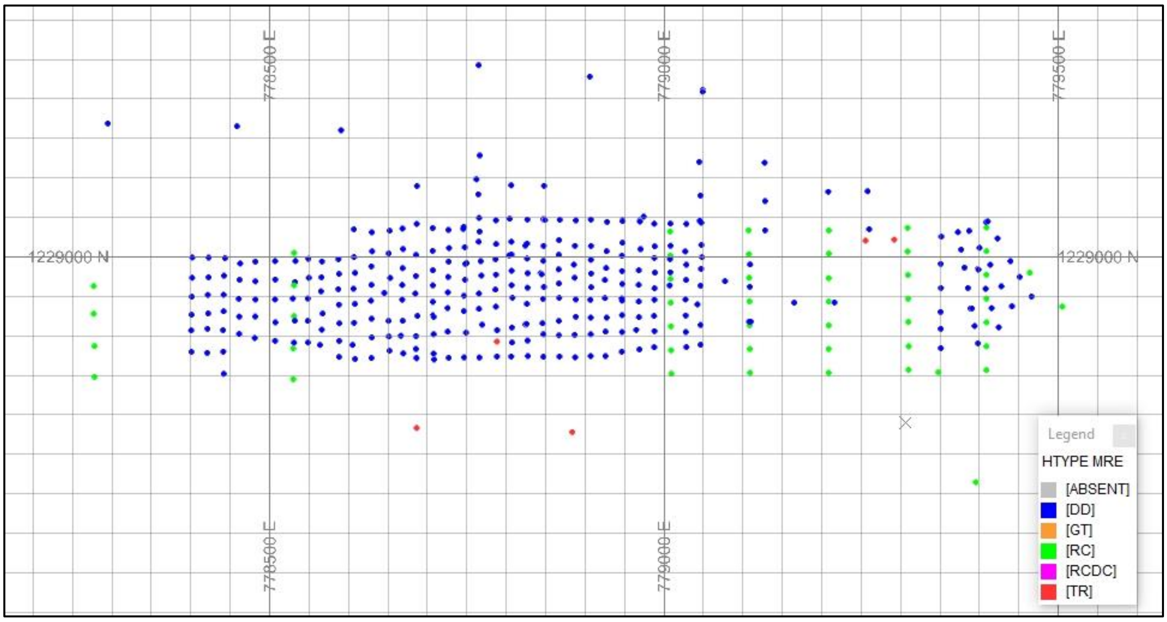


Figure 14-4: Plan view – Youga Gassore MRE drillhole locations

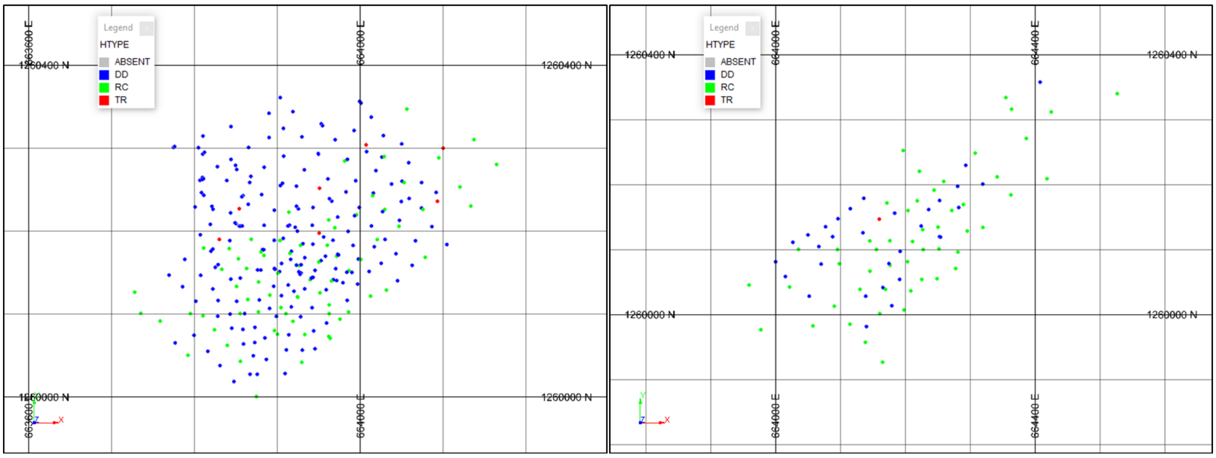


Figure 14-5: Plan view – Netiana and Netiana SE drillhole locations

14.2.3 Data Spacing and Orientation in Relation of Geological Structure

Drilling within resource areas have been completed on sections which are generally between 18 m and 25 m x 25 m apart. The drilling at Youga was targeted normal to the plane of the principal mineralised orientation ensuring the optimum angle of intersection. Scissor holes, drilled back in the opposite sense, have also been completed on each deposit to ensure the proper orientation.

14.2.4 Data Load and Data Excluded

A relational geological database is not in use by Avesoro, instead data were provided in various Microsoft Access databases and Microsoft Excel sheets. The drilling database used for the current MRE was closed on 31 October 2017.

Data was loaded into an SQL database which has constraints and triggers, ensuring that only validated data was included in the database. During the validation process issues were highlighted and corrected where possible. Exports of the clean, verified data were provided to the resource geologists in CSV format for the MRE.

The list below includes the validation and checks completed:

- Collar table: Incorrect coordinates (not within known range), duplicate holes.
- Survey table: Duplicate entries, survey intervals past the specified maximum depth in the collar table, overlapping intervals, abnormal dips and azimuths.
- Geotechnical table: Overlapping intervals, missing collar data, negative widths, geotechnical results past the specified maximum depth in the collar table.
- Geology, sample and assay tables: Duplicate entries, lithological intervals past the specified maximum depth in the collar table, overlapping intervals, negative widths, missing collar data, missing intervals, correct logging codes, duplicated sample IDs, missing samples (assay results received, but no samples in database), missing analyses (incomplete or missing assay results).
- QAQC material: A QAQC report is generated in which results of the standards (CRMs), blanks and duplicates are reviewed (includes client QAQC material and lab checks where applicable).

The absent assay values were left as absent during the data load, as these are lost or missing samples (as communicated by BMC and NMC). The negative Au values were set to half the detection limit to a value of 0.0025 g/t Au.

Following de-surveying, missing intervals were identified in the assays, as summarised in Table 14-5. These gaps were also set to half the detection limit to a value of 0.0025 g/t Au.

Table 14-5: Youga and Balogo databases – summary of missing intervals

Deposit	No. of missing intervals	Total missing interval length (m)
A2N East	91	322.81
A2N Middle	191	1,550.84
Gassore	997	5,981.6
Netiana	690	15,586.69
Netiana SE	32	1,125.55

The CSA Global data load validations for Balogo showed the following:

- 21 completed collars with no assays
- 316 collars with no logged lithology
- One duplicated density measurement
- 32 overlapping density records – all of which were repeat samples which were subsequently removed
- 278 downhole surveys with no corresponding collar file – all of which were from planned holes not yet drilled.

The appropriateness of data to be used in the MRE were reviewed per deposit. A summary of drill data removed prior to estimation is shown in Table 14-6 below.

At Balogo, 19 holes were excluded from the dataset due to either uncertainty over their reliability, highlighted during a twin drilling program undertaken by NMC, or through poor QAQC results. These holes are presented in Table 14-7.

Three holes were removed from the database that were drilled after the date cut-off. These holes are provided in Table 14-8.

Table 14-6: Youga deposit – summary of drill data removed prior to estimation

<table>
<tr><th rowspan="2">Deposit</th><th rowspan="2">Phase</th><th colspan="8">HTYPE</th><th rowspan="2">Total</th></tr>
<tr><th>RC</th><th>DD</th><th>TR</th><th>GT</th><th>BH</th><th>MET</th><th>RPL</th><th>Absent</th></tr>
<tr><td rowspan="3">A2N East</td><td>Exploration</td><td>3</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td rowspan="3">220</td></tr>
<tr><td>Grade control</td><td>-</td><td>-</td><td>203</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Face mapping sample</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>14</td></tr>
<tr><td rowspan="3">A2N Middle</td><td>Exploration</td><td>-</td><td>3</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td rowspan="3">3</td></tr>
<tr><td>Grade control</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Face mapping sampling</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Gassore</td><td>Exploration</td><td>-</td><td>8</td><td>5</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>13</td></tr>
</table>

Note: RC – reverse circulation hole; DD – diamond drillhole; TR – trench; GT – geotechnical hole; BH – blast hole; MET – metallurgical hole; RPL – rip line.

Table 14-7: Balogo – excluded drillholes due to QAQC concerns

BHID
BDH001R, BRC071, BRC113, BRC112R, BRC111, BRC042, BRC022, BRC023, BRC217, BRC068, BRC091, BRC092, BRC223, BRC244, BRC245, BRC252, BRC253, BRC254, BRC255

Table 14-8: Balogo – excluded drillholes drilled after the cut off data

BHID
BDH269, BDH270, BDH271

Drillholes have been excluded from the MRE where there is potential bias in sample data, e.g. the high-grade bias in face mapping (FM) chip samples relative to RC and DD samples. Drillholes have also been rejected where they have been drilled down the orebody, do not contain any assays, or contain spurious survey records.

Sometimes, drillholes were coded grade control (GC), but in fact were resource development holes. These were identified by stepping through sections and identifying those holes that were drilled at a coarser drill spacing than the main GC programs, generally coinciding with depths >45 m.

Trench (TR) sample data, rip line (RPL) sample data and blast hole (BH) samples were mostly excluded from the MRE due to the lack of validation of the sampling technique. Further exclusions include all GC holes with a grid spacing of 5 m x 5 m, geotechnical (GT) holes and metallurgical (MET) holes.

Some diamond drillholes were excluded in A2N Middle (three drillholes) and Gassore (eight drillholes) based on either proximity to twin holes, or feedback from client with respect to bias of data. The repeat/twin drillhole is generally selected unless it is a poor reflection of the surrounding geology (as observed from other nearby drillholes).

In cases where trenches have been included in the MRE, these have been reviewed for any potential bias when compared against the other drillhole types, whereby no bias was found.

All subsequent data analysis, statistics and estimation are limited to the validated and selected datasets as used in the MRE.

14.3 Density

14.3.1 Youga Property

The in-situ dry BD determinations undertaken by Ashanti, Etruscan and Endeavour are described the 2015 Technical Report (Endeavour, 2015). Samples were collected at depths greater than 10 m below the surface (predominantly in un-weathered rock) from hangingwall, footwall and mineralised horizons.

The Ashanti BD determinations, described as SG, were reportedly undertaken by SGS in Ghana applying the “Archimedes” method (water displacement). The density is calculated with the following formula:

$$\text{Density} = \frac{\text{Weight in air}}{\text{Weight in air} - \text{Weight in water}}$$

The Ashanti SG determinations were completed on half drill core samples submitted to SGS for Au assay. Two measurements were made and averaged for each sample. Recent BD determinations for Endeavour were completed by SGS Ouagadougou, Burkina Faso.

Table 14-9: In-situ dry bulk densities as per Endeavour (2015)

Deposit	In-situ dry BD determinations					
	Ashanti	Average SG	Endeavour	Average SG	Total	Average SG
A2NE			427	2.68	427	2.68

Since the previous A2NE MRE, no additional density data for A2N Middle was available for review. As such, the in-situ dry BD as previously applied to the A2N East MRE, was applied to the A2N Middle MRE.

Since the completion of the previous MRE in 2017, additional infill drilling has occurred at Gassore with the inclusion of subsequent density data. The total dataset included 1,670 measurements taken from across 67 holes with an average SG of 2.70. This data was reviewed by CSA Global along with the existing datasets below.

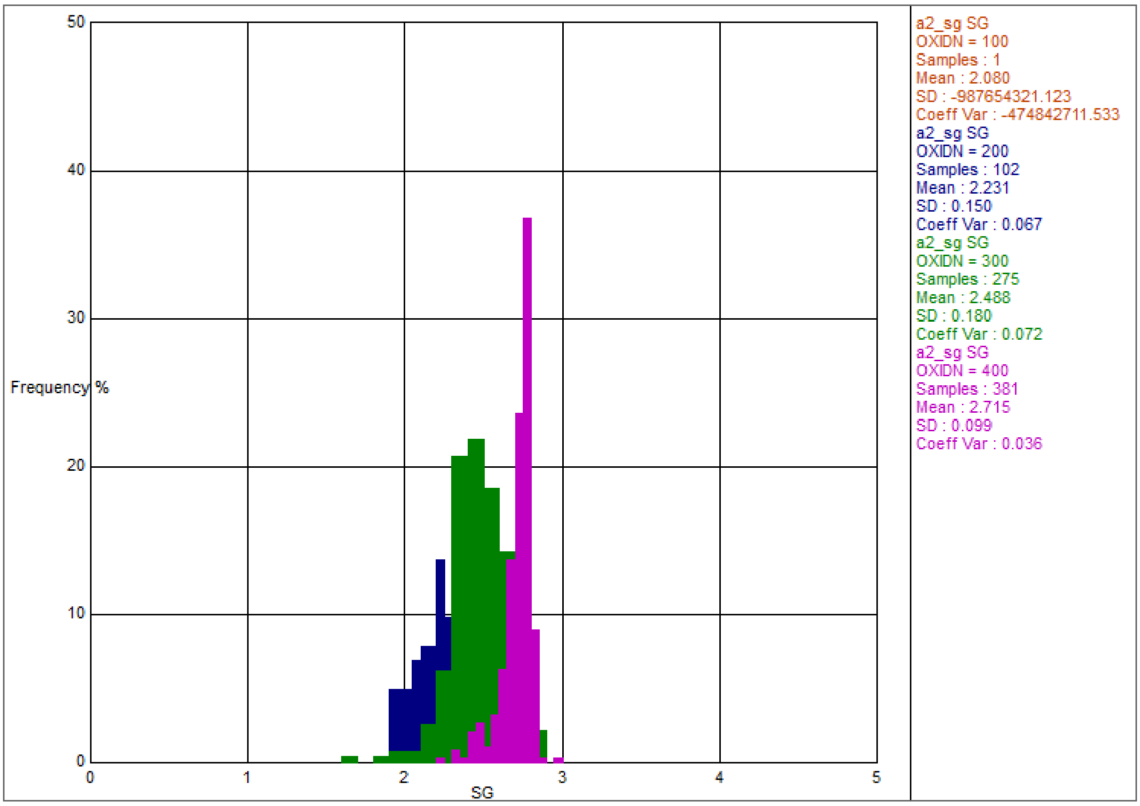


Figure 14-6: Youga A2NE 2017 – histogram plot of uncut in-situ dry BD per weathering profile (OXIDN100 = Overburden; OXIDN200 = Oxide; OXIDN300 = Transitional; OXIDN400 = Fresh)

Note: Dataset comprised of A2N East and A2N Middle.

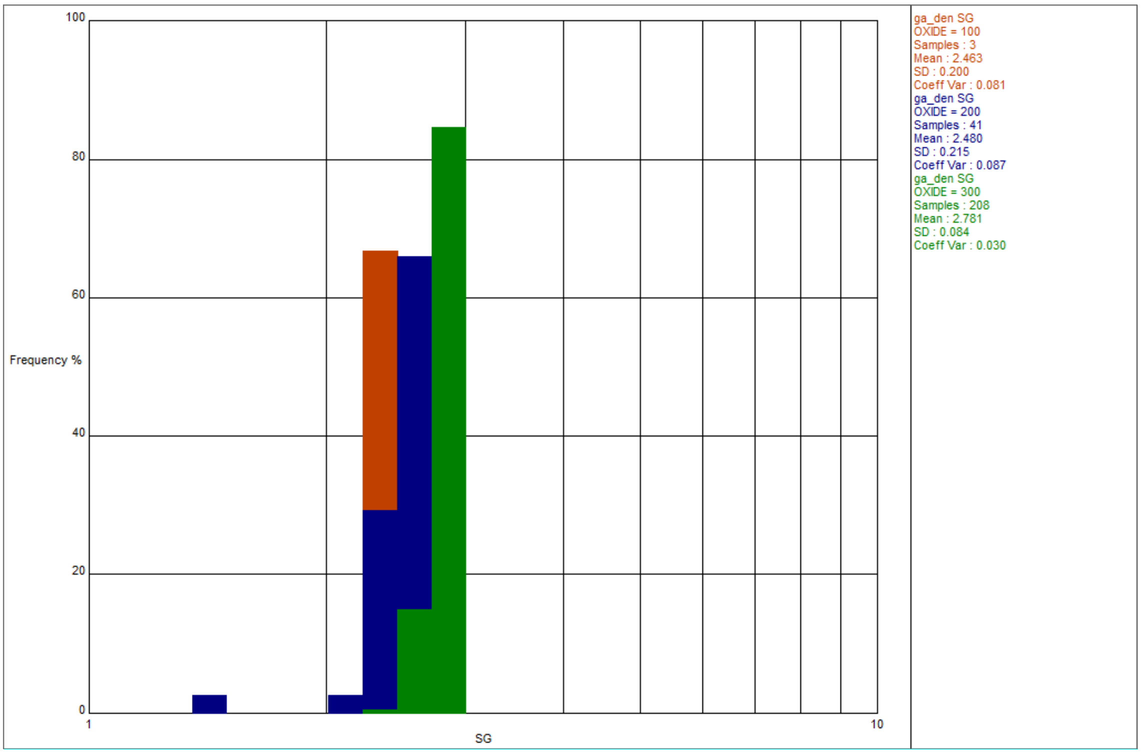


Figure 14-7: Youga Gassore December 2017 – histogram plot of uncut in-situ dry BD per weathering profile (OXIDN100 = Oxide; OXIDN200 = Transitional; OXIDN300 = Fresh)

Note: Dataset restricted to mineralised wireframes.

Following statistical analysis, identified outliers were removed and the average BD applied per weathering profile within the A2N East, A2N Middle and Gassore MREs (Table 14-10). The values used for non-fresh material have been informed by experience of other deposits in the region, given that samples measured in these materials are generally competent and tend to be overstated in the density measurements provided.

Due to the proximity of A2N East along strike, which is in production, and the close alignment of the Gassore density values with the A2N values, it was deemed appropriate to assign the A2N East densities to the Gassore model.

Table 14-10: Youga Property – MRE in-situ dry bulk densities applied following CSA Global review

Deposit	Weathering profile	In-situ dry BD (t/m³)
A2N East, A2N Middle	Overburden	2.08
	Oxide	2.23
	Transitional	2.46
	Fresh	2.74
Gassore	Overburden	-
	Oxide	2.23
	Transitional	2.46
	Fresh	2.74

Additional dry BD data should be collected routinely during grade control and/or mine production and reviewed to build up a useful BD database of values that can be used to improve the confidence of the tonnage factors for the MRE. The methodology and measurements should be verified and standardised.

14.3.2 Balogo Property

Dry in-situ BD measurements for the Netiana deposit were estimated using the water immersion method.

Table 14-11 summarises the BD statistics for samples measured within mineralisation zones, with an outlier where BD was greater than 4 t/m^3 were excluded (one sample). The high BD for fresh material is characteristic of the mineralisation host which is diorite. The BD for oxide and transitional were considered very high for these material types. Core photos were reviewed to assess what type of material had been measured for BD. It was clear that the samples tend to be very competent pieces of core, and are not necessarily representative of the softer, less dense parts of these zones. Therefore, to apply these values to non-fresh material would likely overestimate tonnages of the resource. Through inspection of the drill core, CSA Global verified that in-situ dry BD measurements are taken in competent pieces of core within oxide material (Figure 14-8). This has led to the conclusion that the measured BD is likely to be overstated in oxide and transitional zones.

Figure 14-8: Drillhole BDH046 (Netiana lode, Balogo property) showing weathering profile and billets chosen for BD measurement

Source: CSA Global, 2017

To mitigate this, CSA Global reviewed the codes assigned to the OXIDE field in the geological logging. These are numeric codes used to characterise intensity of weathering within what is defined as oxide. Codes of one represents a low intensity of weathering, two is moderate and three is high. These codes were verified through the review of core photos for several holes.

Table 14-11: Balogo project – in-situ dry bulk densities

OXIDN	No. of samples	In-situ dry BD (t/m³)			
		Minimum	Maximum	Mean	Median
Laterite/Overburden					
Oxide	116	1.96	3.10	2.60	2.60
Transitional	151	2.06	3.20	2.77	2.82
Fresh	530	2.36	3.38	2.88	2.91

The geological logging was flagged with the oxidation surfaces and mineralisation wireframes and the proportion of weathering intensity was used to derive a length weighted BD for oxide. Table 14-12 summarises the BD derived for use in the MRE.

Table 14-12: Balogo – length weighted in-situ dry bulk densities used in Netiana MRE

OXIDN	In-situ dry BD (t/m³)
Laterite/Overburden	2.00
Oxide	2.14
Transitional	2.35
Fresh	2.86

Additional dry BD data should be collected routinely during grade control and/or mine production and reviewed to build up a useful BD database of values that can be used to improve the confidence of the tonnage factors for the oxide/transitional portions of the Netiana deposit. The methodology and measurements should be verified and standardised in the MRE.

14.4 Geological and Mineralisation Modelling

Geotechnical logging has recorded lithology, weathering and oxidation.

CSA Global and Avesoro geologists created weathering and mineralisation surfaces and volumes for the Youga and Balogo deposits through cross-sectional interpretations using Datamine StudioRM™, Micromine™ and Leapfrog™ software. These interpretations were based on logged weathering state and chemical Au assays. The weathering codes used for the construction of the weathering surfaces are shown in Table 14-13. NMC provided three oxidation surfaces representing base of regolith ("regolite"), base of oxidation ("oxide") and top of fresh rock ("trans"), which CSA Global verified matched the oxidation logging. No lithological surfaces or volumes were modelled.

Table 14-13: Youga and Balogo databases – logged weathering codes

Weathering	Description
OVBD/SOIL	Overburden/Soil
LATR	Laterite
SAPR/SAP	Saprolite
TRAN	Transitional
SPRK/SRK	Saprock
BDRK/BRK	Bedrock

A numeric weathering/oxidation code was applied to the drillhole data and MRE blocks, depending on the weathering profile, as defined in Table 14-14 to Table 14-16.

Table 14-14: Youga property – MRE weathering/oxidation codes

OXIDN	Description
100	Overburden/Regolith
200	Oxide
300	Transitional
400	Fresh/Sulphide

Table 14-15: A2N Middle and Gassore deposits – MRE weathering/oxidation codes

OXIDN	Description
100	Oxide
200	Transitional
300	Fresh/Sulphide

Table 14-16: Netiana and Netiana SE deposits – MRE weathering/oxidation codes

OXIDE	Description
50	Overburden/Regolith
100	Oxide
200	Transitional
300	Fresh/Sulphide

Depending on the deposit, the modelled weathering profiles comprise a bottom of overburden ("bovb") surface, a bottom of oxidation ("boco") surface and a top of fresh ("tofr") surface. Example vertical sections of the weathering profiles per deposit are shown in Figure 14-9 to Figure 14-12.

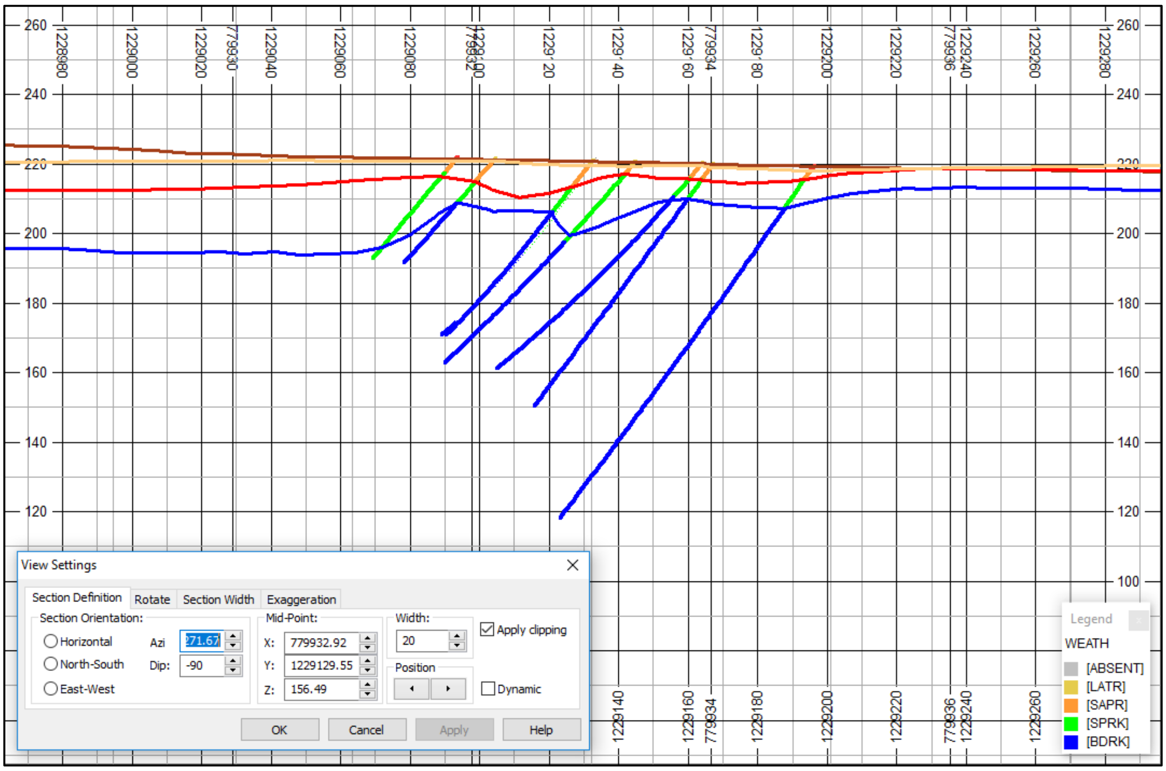


Figure 14-9: Youga A2N East – section view of the weathering profiles and drillholes

Section lines: Topography (brown); BOVB (orange); BOCO (red); TOFR (blue).

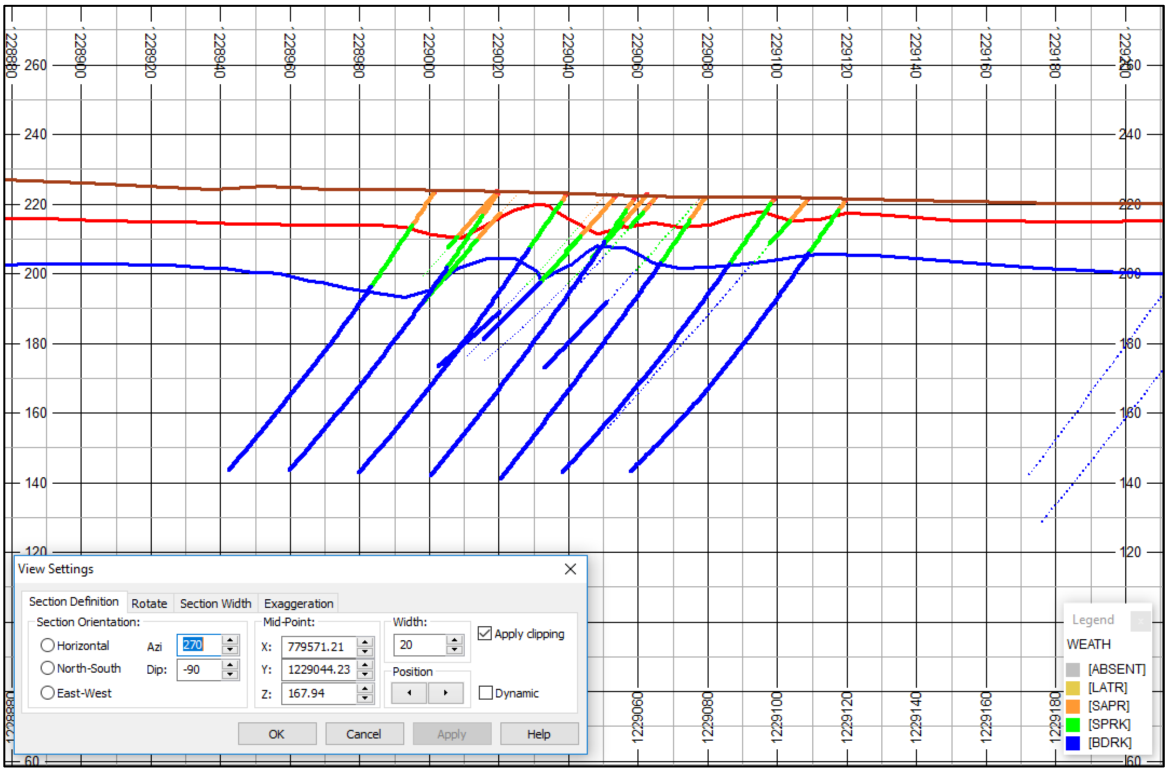


Figure 14-10: Youga A2N Middle – section view of the weathering profiles and drillholes

Section lines: Topography (brown); BOCO (red); TOFR (blue).

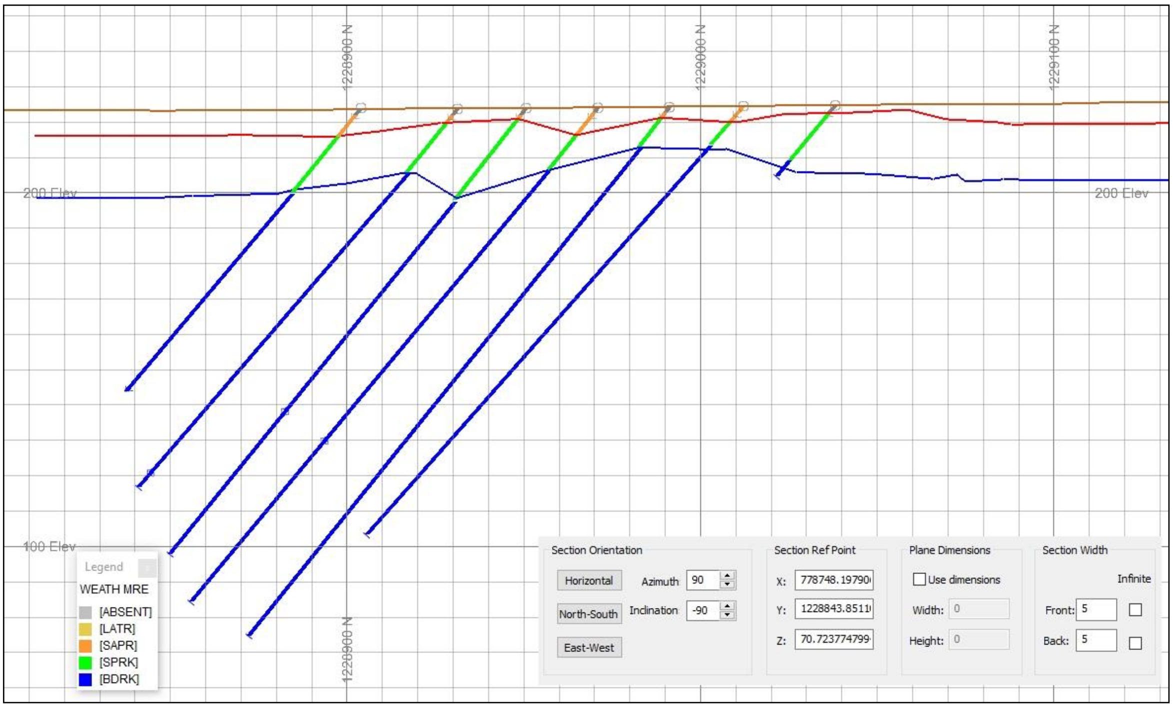


Figure 14-11: Youga Gassore – section view of the weathering profiles and drillholes

Section lines: Topography (brown); BOCO (red); TOFR (blue).

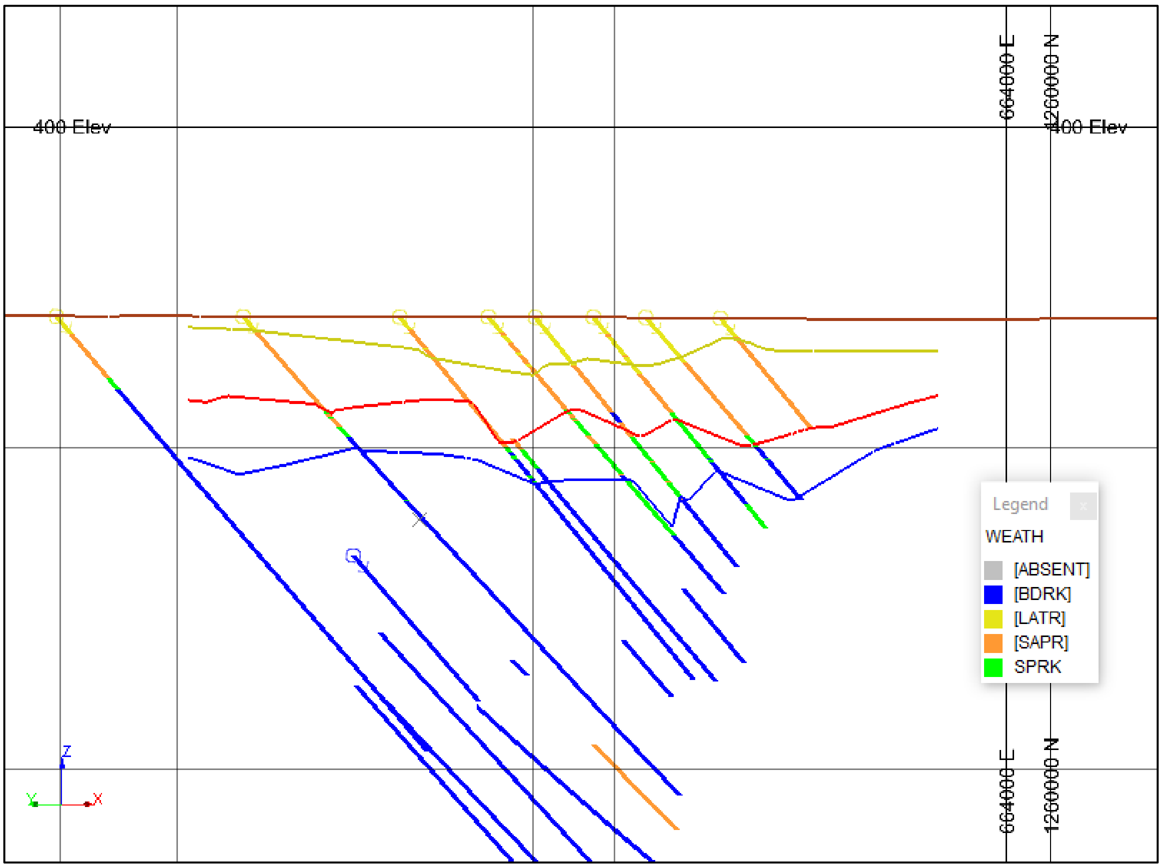


Figure 14-12: Balogo – section view of the weathering profiles and drillholes

Section lines: Topography (brown); BOVB (orange); BOCO (red); TOFR (blue).

CSA Global reviewed the grade continuity at various cut-offs by creating mineable intercepts, generated using Datamine's CompSE grade compositing function. This generates grade composites on the basis of a minimum grade (0.1, 0.2, 0.25, 0.3, 0.5, 1.0 and 2.0 g/t Au) and a minimum true thickness (2 m). This is useful in assessing the reasonableness of blocks above cut-offs. The results show good grade continuity at a cut-off of 0.25 g/t with a minimum true thickness of 2 m for A2NE. Gassore shows reasonable grade continuity at a cut-off of 0.3 g/t, down to 0.1 g/t in some instances, with a minimum true thickness of 2 m.

All available drillhole and sampling data was used to inform the grade modelling (DD, RC, TR, FM), with close spaced GC data used for rough trend visualisation only.

Figure 14-13 to Figure 14-15 show examples of cross sections with interpreted mineralisation for the Youga deposits. The current mined surfaces are shown for A2N East and A2N Middle. A small portion of Gassore has been mined as part of the A2N East mining operations.

The mineralisation at the Netiana deposit (Balogo) is hosted within strongly silicified, strongly sheared zones with pyrite. In the absence of silica or pyrite, grades are elevated (e.g. 1 g/t to 5 g/t). Massive quartz veins with visible gold are also mineralisation hosts. A cross-section view of the Netiana and Netiana SE mineralisation domains is shown in Figure 14-16 and Figure 14-17.

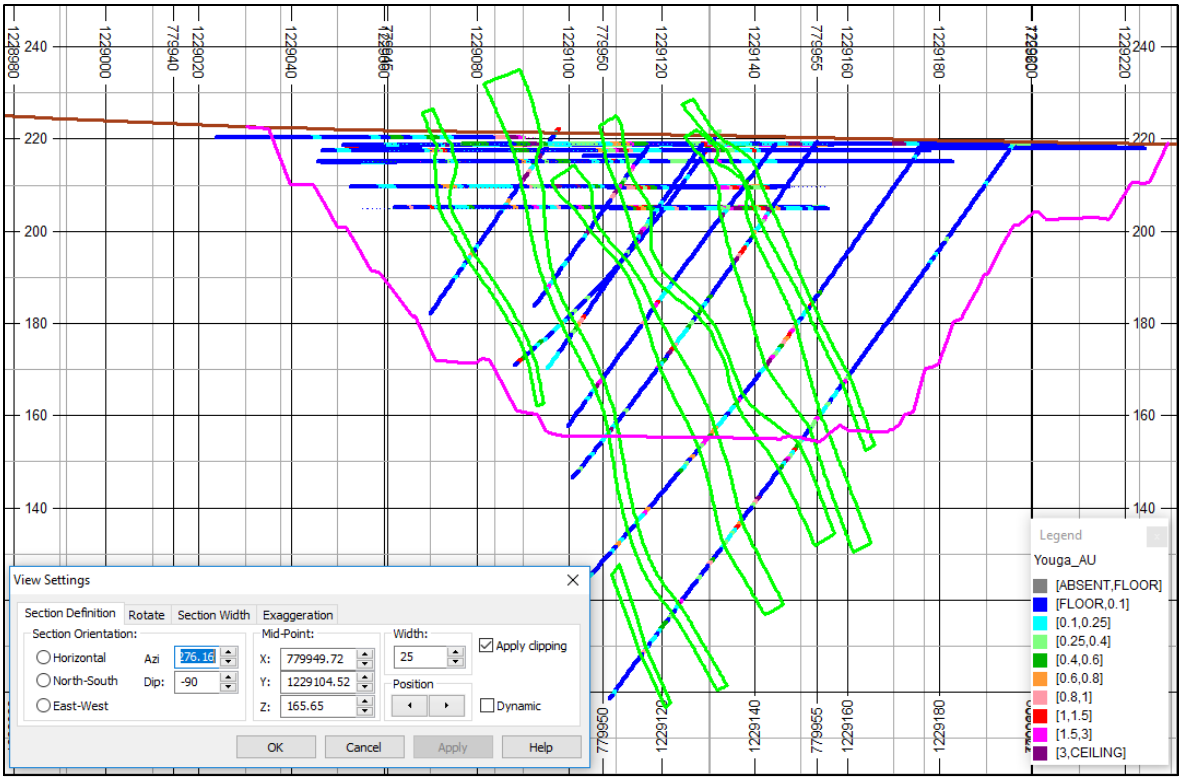


Figure 14-13: Youga – section view of the A2N East mineralisation and drillholes

Section lines: Topography (brown); Mineralisation (green); Mined surface December 2017 (pink).

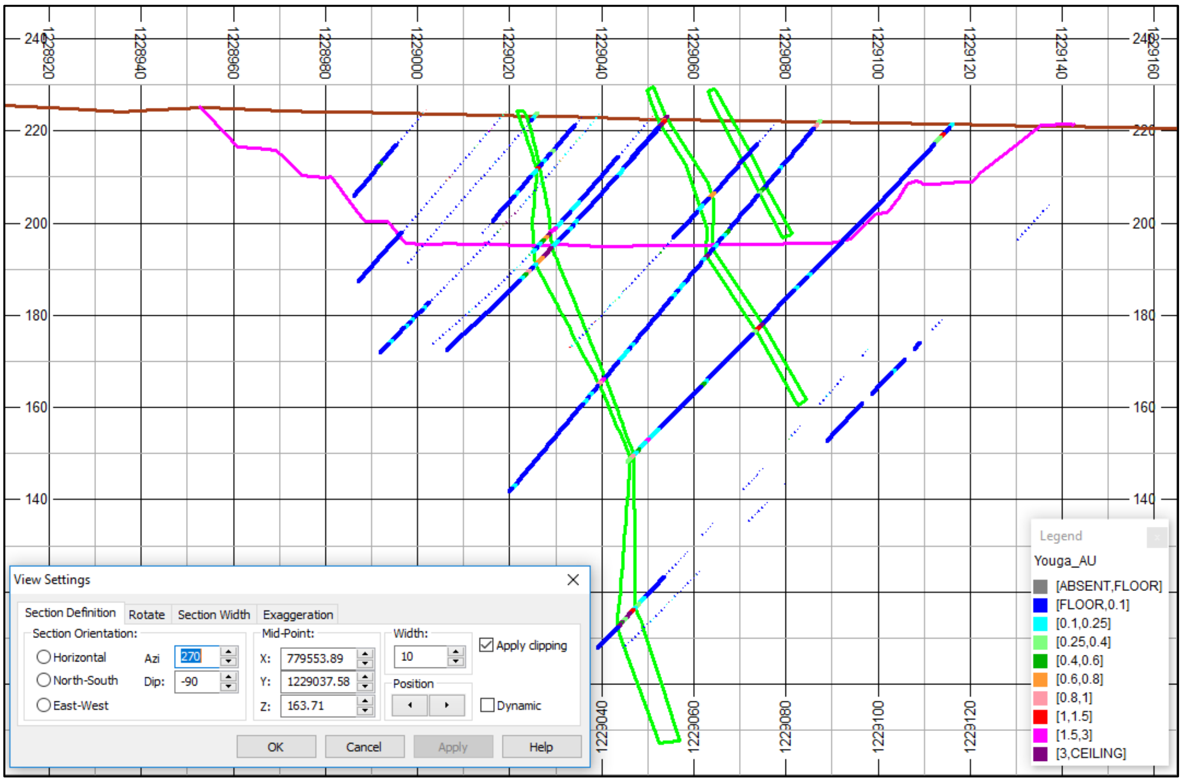


Figure 14-14: Youga – section view of the A2N Middle mineralisation and drillholes

Section lines: Topography (brown); Mineralisation (green); Mined surface December 2017 (pink).

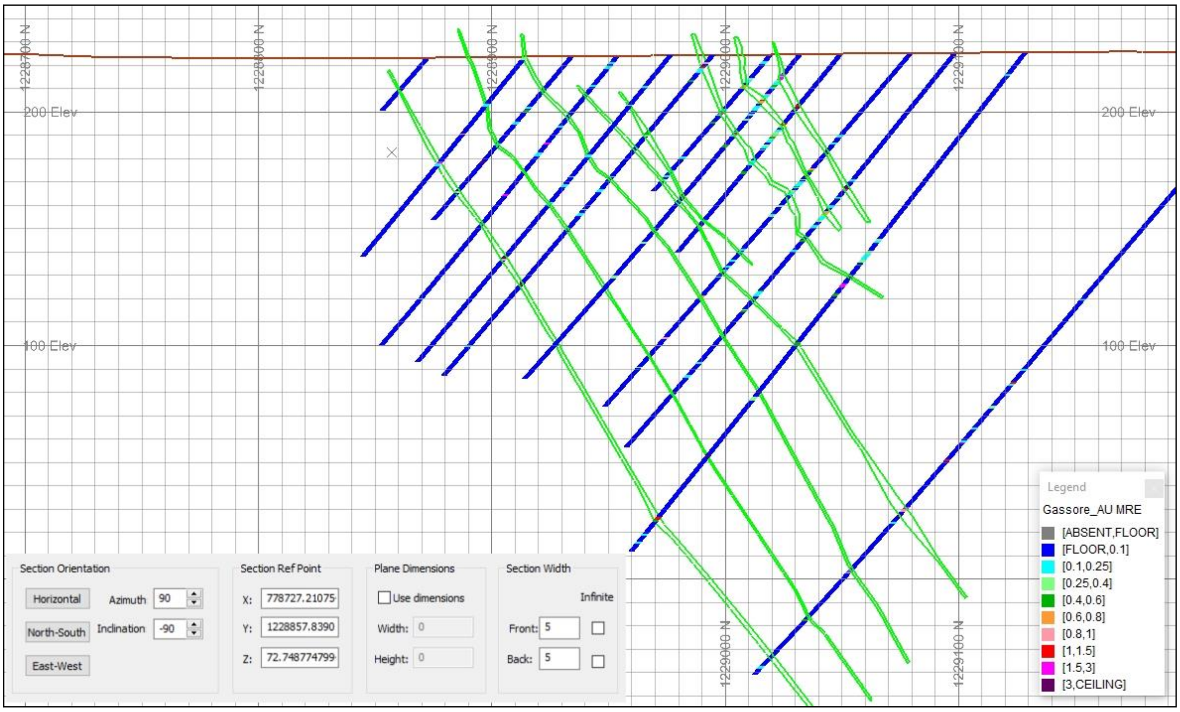


Figure 14-15: Youga – section view of the Gassore mineralisation and drillholes

Section lines: Topography (brown); Mineralisation (green); No mining to date.

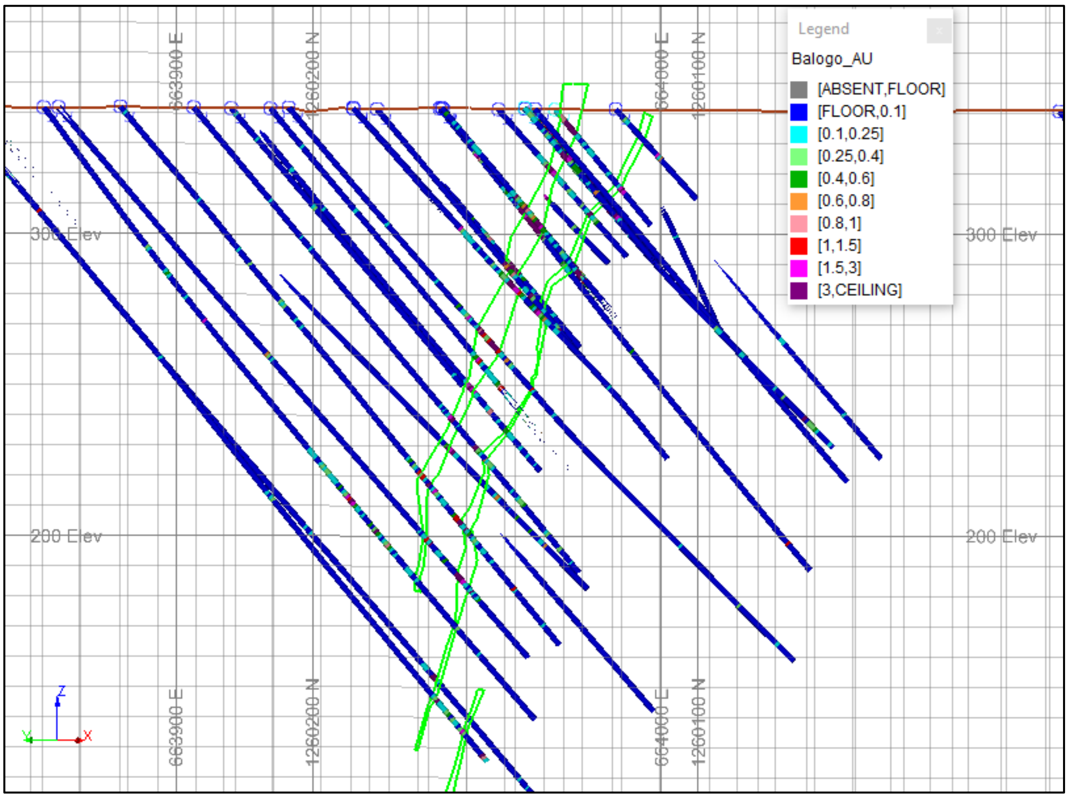


Figure 14-16: Balogo – section view of the Netiana mineralisation and drillholes (local grid)

Section lines: Topography (brown); Mineralisation (green).

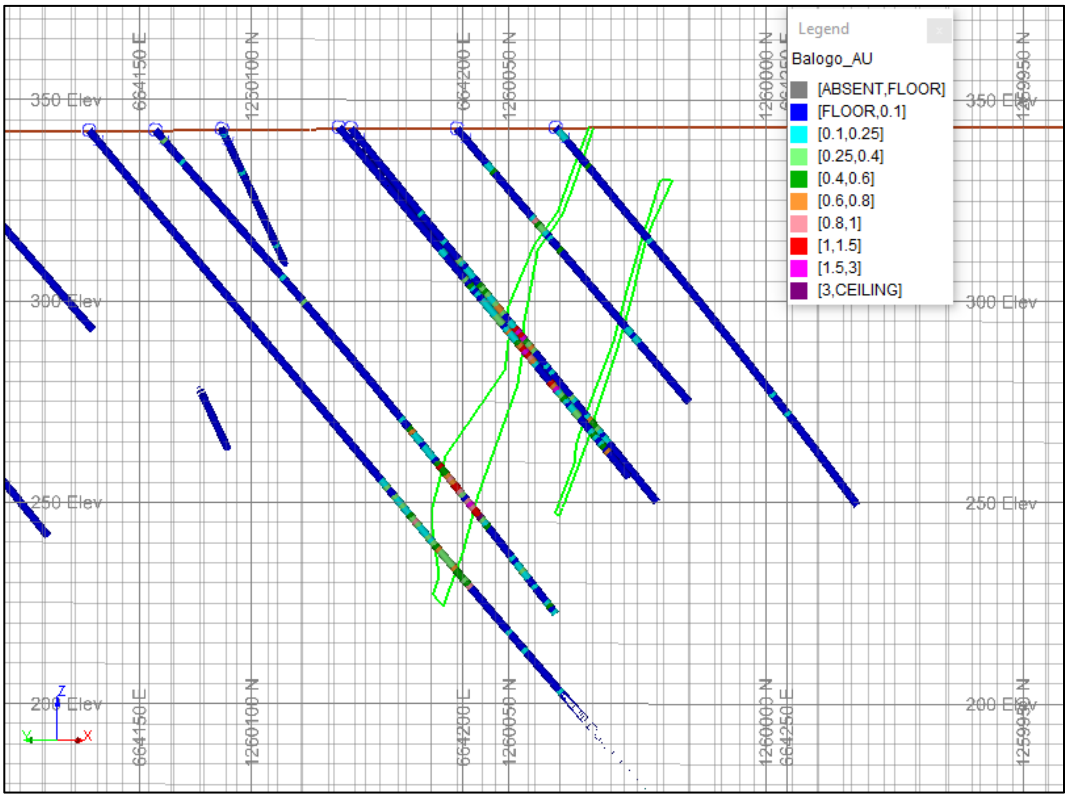


Figure 14-17: Balogo – section view of the Netiana SE mineralisation and drillholes (local grid)

14.5 Statistical Analysis

Before undertaking the estimate, the data was first analysed to understand how the estimate should be accomplished. Drillhole samples were statistically reviewed, and variograms were calculated to determine spatial continuity for Au.

The statistical analysis was carried out by CSA Global using Datamine StudioRM™, Supervisor v8.4™ and GeoAccess Professional™ software packages.

14.5.1 Boundary Analysis

Boundaries are either classified as “hard” or “soft”. Where hard boundaries are abrupt, they generally represent a sharp geological contact such as the edge of a quartz vein on its host rocks and where the boundary marks the margin of metal grade. A soft boundary is a gradational one and represents a gradual reduction in grade (e.g. as one would find in the alteration zone of a copper porphyry system).

It is important to understand the nature of the boundaries between domains. If domain boundaries are gradational, then data from the adjacent domains should be used during estimation (soft boundary). If there are distinct grade boundaries, then estimation should be restricted to only use the data within that domain (hard boundary).

Contact analysis for Au g/t between the modelled mineralisation and waste were carried out to assess the nature of the domain boundaries by graphing the average grade with increasing distance from the domain boundary. The average grades can be calculated by incrementally expanding the wireframes or manually by coding the samples based on distance from the domain contact, as was done in this instance. The contact analysis results for the Youga, Ouaré and Balogo deposits are shown in Figure 14-18 to Figure 14-20. Based on the results of the boundary analysis between mineralisation and waste, the boundary was interpreted to be hard for all the deposits.

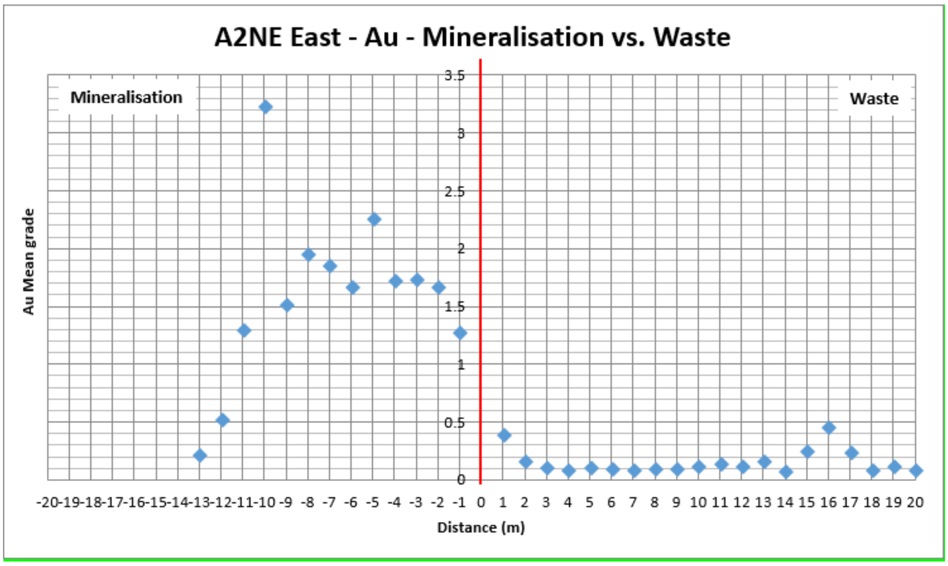


Figure 14-18: Mineralised boundary test graph for A2N East – Au g/t mineralisation vs. waste

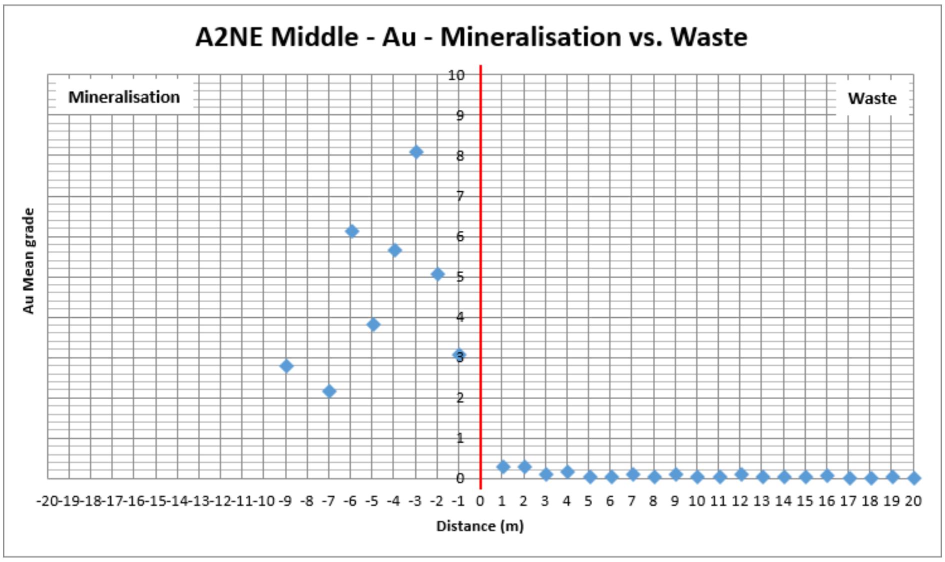


Figure 14-19: Mineralised boundary test graph for A2N Middle – Au g/t mineralisation vs. waste

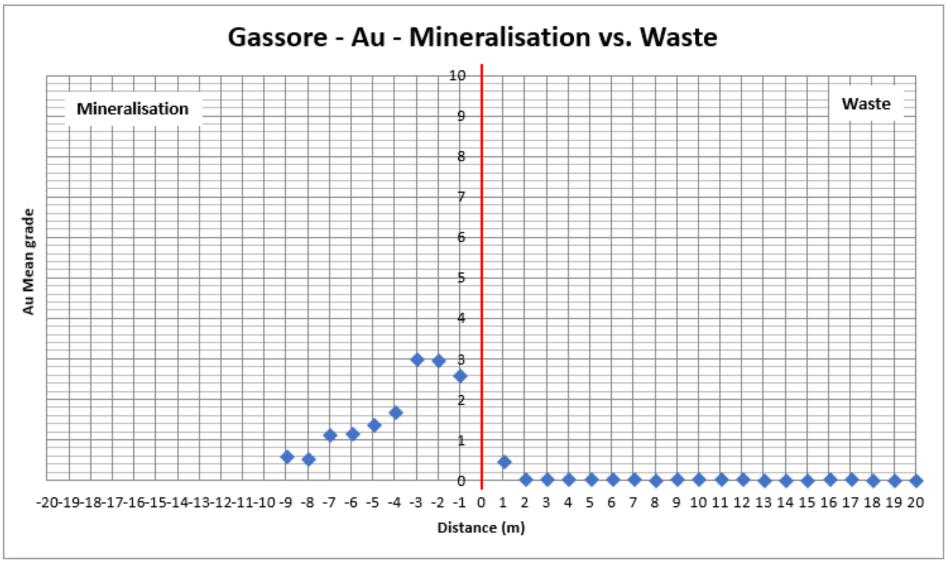


Figure 14-20: Mineralised boundary test graph for Gassore – Au g/t mineralisation vs. waste

Additional contact analysis was carried out to assess the nature of the domain boundaries within the mineralised volumes between the weathering profiles. Based on the results of the boundary analysis for these profiles, the boundaries were interpreted to be soft. The boundary analysis between oxidation zones within Netiana is shown in Figure 14-21.

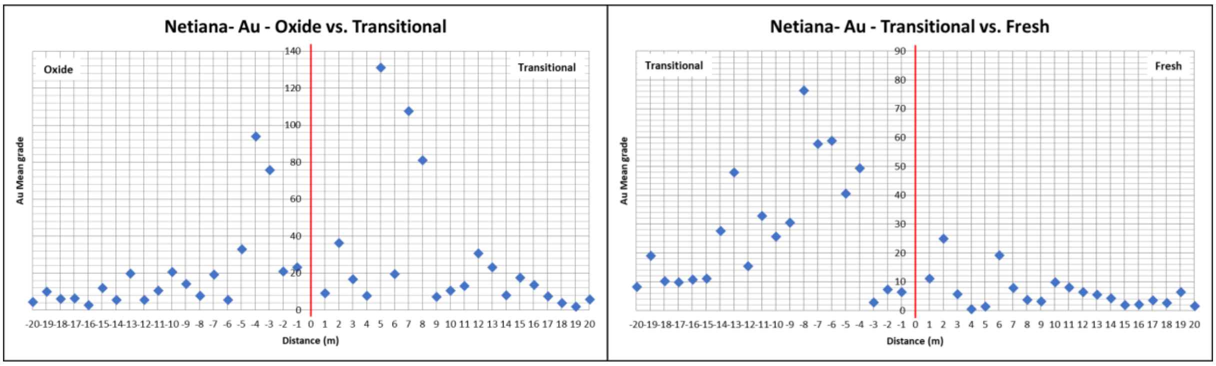


Figure 14-21: Oxidation boundary test graphs for Netiana – Au g/t oxide vs. transitional, transitional vs. fresh

14.5.2 *Naïve Statistics*

Drillhole coding is a standard procedure which ensures that the correct samples are used in statistical and geostatistical analyses, and grade interpolation. Within each of the Youga and Ouaré deposits, the mineralised envelopes were used to select drillhole samples. The samples were coded by geological domain and oxidation state.

A summary of the domain codes, used to distinguish the data during geostatistical analysis and estimation, is shown in Table 14-17 and Table 14-18 below. Within the A2N Middle MRE, the SEARCH field is synonymous to MINZON.

Table 14-17: Youga deposits – data field flagging and description

Field	Code	Description
OXIDN (A2N East)	100 200 300 400	Overburden/Regolith Oxide Transitional Fresh
OXIDE (A2N Middle, Gassore)	100 200 300	Oxide Transitional Fresh
MINZON	A2N East: 10 to 15, 17, 21, 28, 43 to 44 A2N Middle: 2.1 to 2.5 Gassore: 1 to 15	Mineralised
	99 – A2N East, A2N Middle, Gassore	Waste

Table 14-18: Netiana deposit – data field flagging and description

Field	Code	Description
OXIDE	1 2 3 4	Overburden/Regolith Oxide Transitional Fresh
DOMAIN	1 to 4 5 to 6	Mineralisation in Netiana Mineralisation in Netiana SE
	99	Waste

The mineralised domains for the Youga and Balogo deposits were combined into a single domain per deposit and compared to the associated waste domains, as shown in Figure 14-22 to Figure 14-26. There are some isolated high values within the waste domains; however, the sample populations are clearly distinct from the mineralised domains.

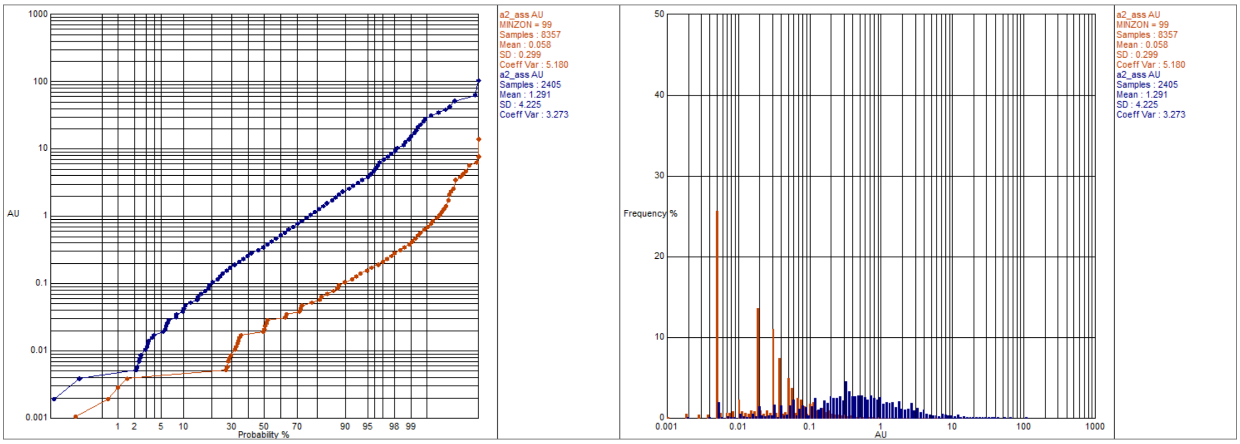


Figure 14-22: Youga A2N East – log probability (left) and log histogram (right) overlays of mineralisation (blue) vs. waste (red)

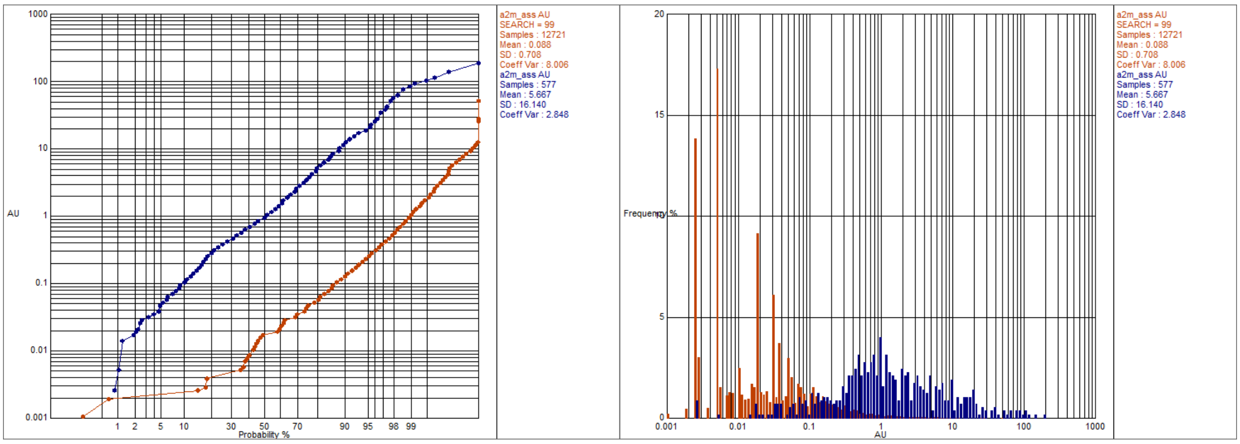


Figure 14-23: Youga A2N Middle – log probability (left) and log histogram (right) overlays of mineralisation (blue) vs. waste (red)

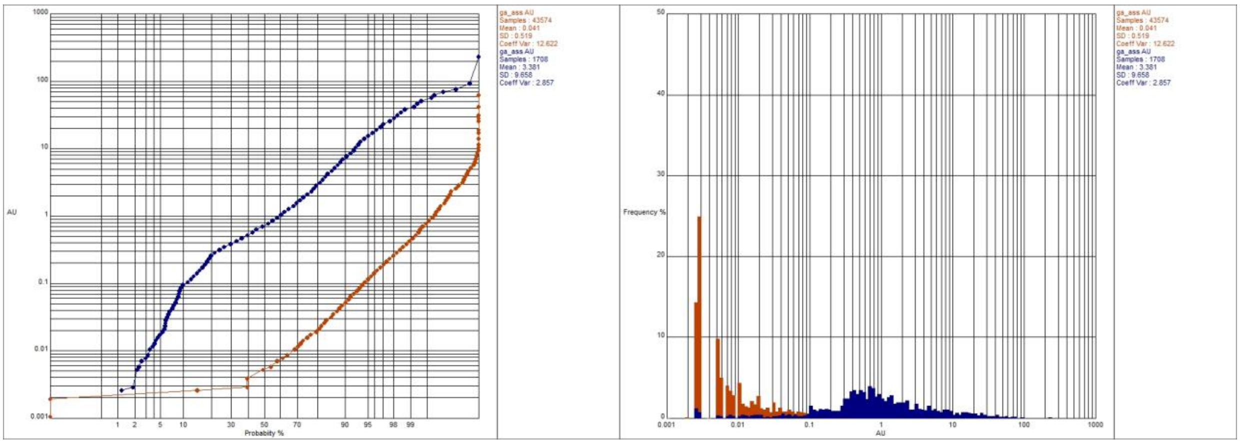


Figure 14-24: Youga Gassore – log probability (left) and log histogram (right) overlays of mineralisation (blue) vs. waste (red)

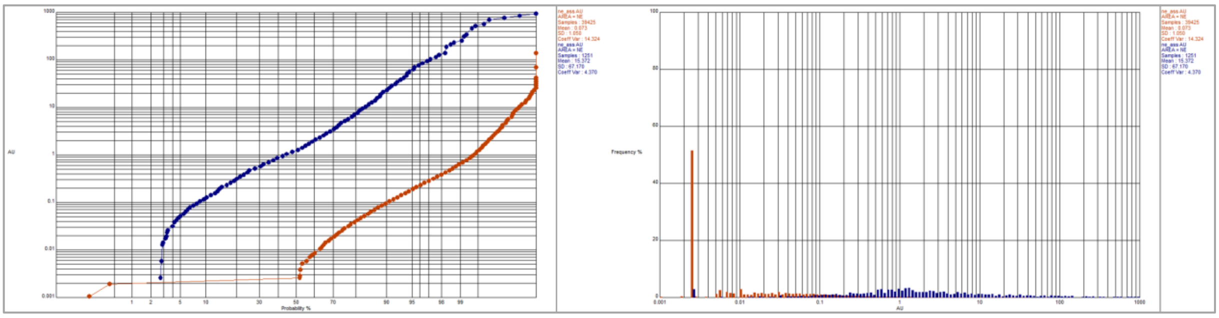


Figure 14-25: Balogo Netiana – log probability (left) and log histogram (right)

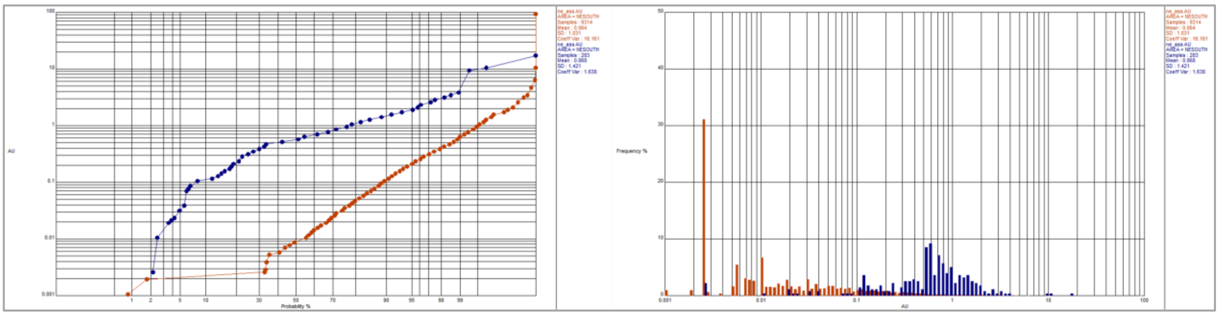


Figure 14-26: Balogo Netiana SE – log probability (left) and log histogram (right)

The Youga and Balogo deposits naïve statistics, per MINZON, are given in Table 14-19. Based on visual review and geostatistical analysis, each individual MINZON per deposit show different grade populations and was estimated with hard boundaries against one another.

Table 14-19: Youga and Balogo deposits – naïve statistics per MINZON

Deposit	MINZON	No. of samples	Minimum	Maximum	Mean	SD	CV
A2N East	10	457	0.01	65.10	1.69	5.39	3.19
	11	187	0.01	13.40	0.75	1.45	1.94
	12	447	0.01	104.00	2.31	6.81	2.95
	13	376	0.00	13.00	0.77	1.55	2.01
	14	373	0.00	30.50	0.96	2.54	2.64
	15	177	0.01	8.01	0.58	1.17	2.02
	17	359	0.01	37.40	1.08	3.42	3.15
	21	4	0.01	3.15	1.59	1.40	0.88
	28	15	0.04	1.28	0.43	0.38	0.89
	43	6	0.02	0.96	0.37	0.44	1.21
	44	4	0.51	2.59	1.49	0.96	0.64
	99	8,357	0.00	14.44	0.06	0.30	5.18
A2N Middle	2.1	436	0.00	192.00	6.06	17.48	2.89
	2.2	72	0.06	81.00	5.31	11.42	2.15
	2.3	42	0.00	50.60	3.82	9.22	2.41
	2.5	12	0.02	64.70	6.01	18.50	3.08
	2.4	15	0.01	4.22	0.97	1.24	1.28
	99	12,721	0.00	49.60	0.09	0.71	8.01
Gassore	1	546	0.00	231.00	4.29	12.69	2.96
	2	244	0.00	92.70	3.99	10.42	2.61
	3	298	0.00	59.50	3.44	7.59	2.20
	4	196	0.00	35.10	1.42	3.79	2.67
	5	32	0.00	15.40	1.99	3.23	1.63
	6	73	0.02	15.90	1.26	2.21	1.76

Deposit	MINZON	No. of samples	Minimum	Maximum	Mean	SD	CV
	7	36	0.00	40.80	4.54	9.21	2.03
	8	79	0.00	38.20	2.53	6.26	2.48
	9	34	0.00	23.40	3.62	5.86	1.62
	10	16	0.05	59.00	8.23	15.08	1.83
	11	30	0.00	5.97	0.64	1.07	1.69
	12	48	0.00	25.80	2.16	4.04	1.87
	13	17	0.01	17.35	2.31	4.78	2.07
	14	29	0.00	73.90	6.88	18.62	2.71
	15	30	0.00	2.78	0.60	0.61	1.02
	99	43,470	0.00	65.60	0.04	0.52	12.67
Netiana	1	725	0.00	783.00	16.78	63.20	3.76
	2	99	0.00	64.21	2.56	7.38	2.88
	3	311	0.00	981.00	16.94	80.43	4.75
	4	116	0.00	231.00	5.38	24.75	4.60
	5	189	0.01	3.93	0.75	0.61	0.80
	6	94	0.00	17.90	1.13	2.38	2.10

14.5.3 Compositing

Sampling was undertaken at varying sampling lengths within the Youga and Balogo deposits. CSA Global reviewed all sample lengths within the modelled mineralisation envelopes per deposit. The dominant as well as the mean sample length within these mineralisation envelopes per deposit was selected for compositing.

Within A2N East, A2N Middle, Gassore, Netiana and Netiana SE, compositing to 1 m was selected as the most appropriate for use in estimation (Figure 14-27 to Figure 14-31).

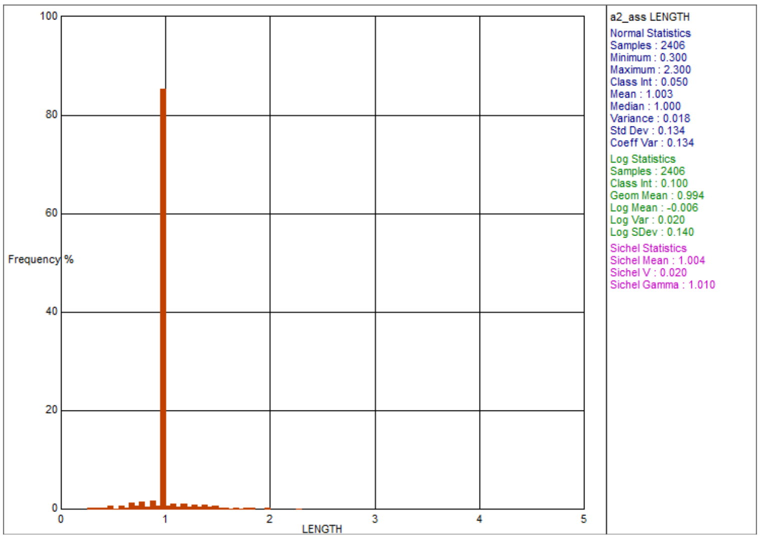


Figure 14-27: Youga A2N East – histogram sample lengths for mineralised domains

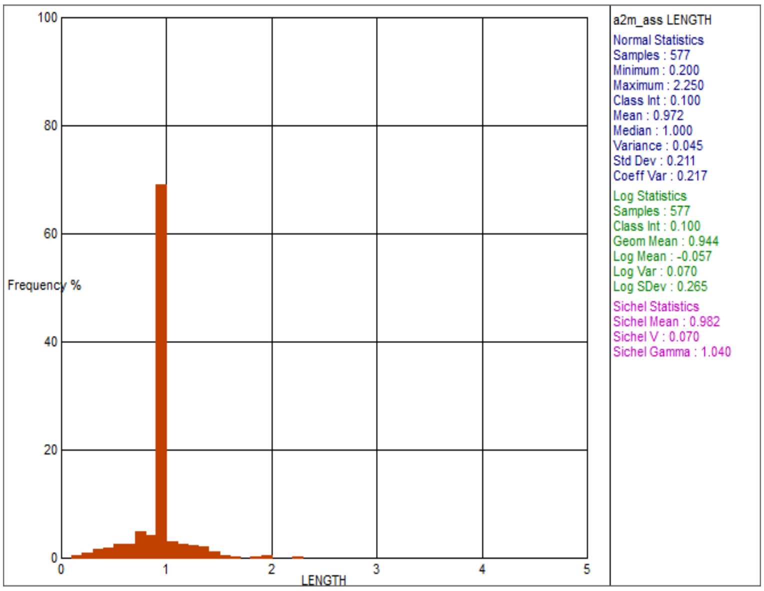


Figure 14-28: Youga A2N Middle – histogram sample lengths for mineralised domains

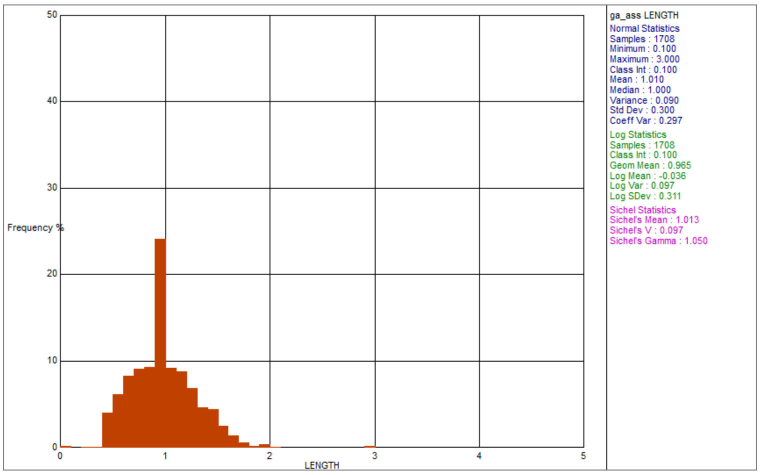


Figure 14-29: Youga Gassore – histogram sample lengths for mineralised domains

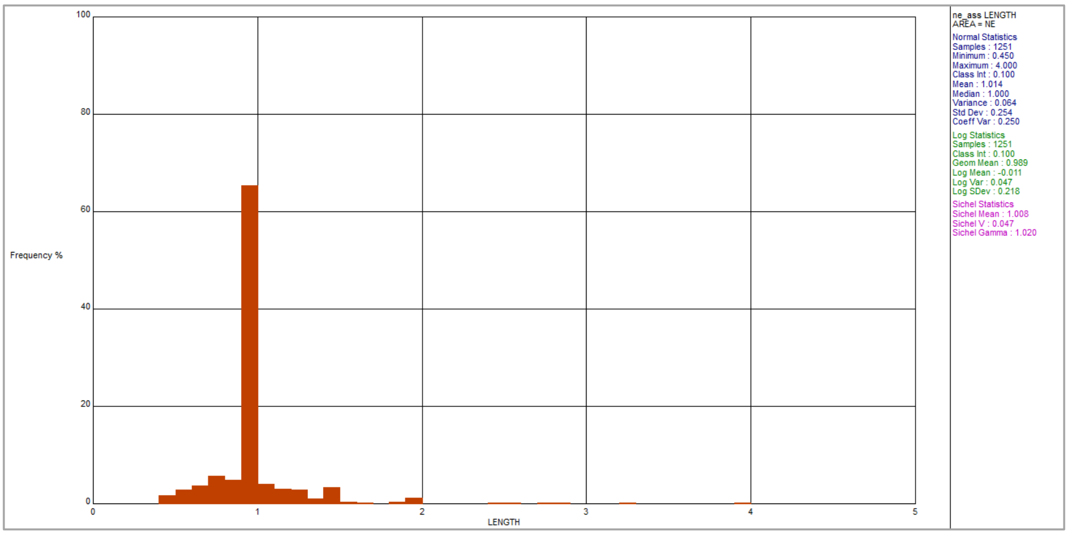


Figure 14-30: Balogo Netiana – histogram sample lengths for mineralised domains

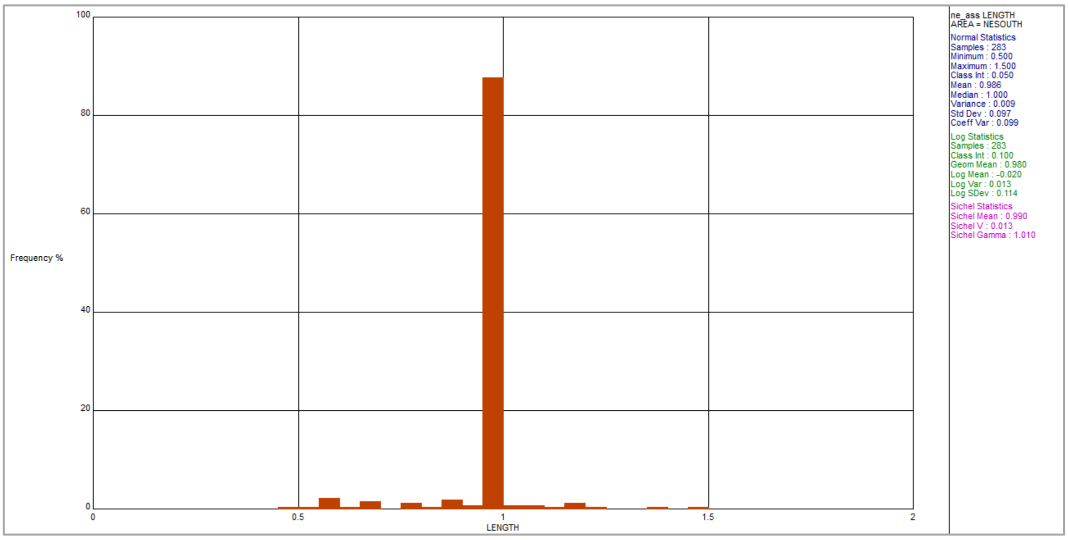


Figure 14-31: Balogo Netiana SE – histogram sample lengths for mineralised domains

During the compositing process in Datamine™, the MODE parameter was set to either 0 or 1, depending on the deposit style. For Zergoré, East Pit and West Pit 4 the default setting of MODE = 0 was applied. The maximum composite length was defined by the set INTERVAL parameter (1 m) and the minimum composite length by the MINCOMP parameter (0.5 m). It is thus possible for part or all of one or more samples to be excluded from the composite. Following compositing, the proportion of residuals for Zergoré, East Pit and West Pit 4 were found to be <1%. These residuals were excluded from the geostatistical analysis and the estimate. This will limit any potential bias in the sample support during kriging.

For A2N East, A2N Middle and Gassore, MODE = 1 was used. This allows the process to force all samples to be included in one of the composites by adjusting the composite length, while keeping it as close as possible to the INTERVAL (1 m or 2 m). The maximum possible composite length will then be 1.5*INTERVAL (1.5 m or 3 m). The MODE = 1 setting was used for these deposits due to the narrow nature of the grade envelopes with depth. It thus reduces the proportion of residual samples that would have been excluded from the estimate if forced to a single rigid interval composite length.

For Netiana, residuals less than 0.50 m were excluded to limit any potential bias in the sample support during kriging. Seventy samples were removed, from an original total of 1,411.

Assays that fall within the modelled mineralisation envelopes were downhole composited, either to 1 m or 2 m depending on the deposit, prior to statistical review, top-cutting, variography and grade estimation.

The descriptive analyses for the estimation domains, per deposit, is shown in Table 14-20. The composite statistics for Netiana, per DOMAIN, are given in Figure 14-32 to Figure 14-34.

Table 14-20: Youga and Balogo deposits – composite statistics per MINZON

Deposit	MINZON	No. of samples	Minimum	Maximum	Mean	SD	CV
A2N East	10	452	0.01	63.50	1.57	4.41	2.81
	11	188	0.01	13.40	0.74	1.44	1.94
	12	438	0.01	102.48	2.24	6.52	2.91
	13	366	0.00	13.00	0.75	1.43	1.92
	14	366	0.00	30.50	0.96	2.57	2.67
	15	174	0.01	8.01	0.59	1.18	2.01
	17	349	0.01	37.08	1.04	3.21	3.08
	21	4	0.01	3.15	1.59	1.40	0.88
	28	15	0.04	1.28	0.43	0.38	0.89
	43	6	0.05	0.96	0.42	0.41	0.99
	44	4	0.51	2.59	1.49	0.96	0.64
A2N Middle	2.1	418	0.00	107.00	5.52	13.29	2.41
	2.2	73	0.06	81.00	5.65	11.61	2.05
	2.3	42	0.00	28.80	3.06	5.96	1.95
	2.4	15	0.01	3.16	0.72	0.82	1.14
	2.5	11	0.02	10.08	2.22	3.58	1.61
Gassore	1	554	0.00	176.29	4.11	10.34	2.52
	2	258	0.00	90.74	4.04	10.65	2.64
	3	311	0.00	57.80	3.25	6.80	2.09
	4	206	0.00	35.10	1.55	4.32	2.78
	5	32	0.00	11.13	1.78	2.31	1.30
	6	77	0.02	11.11	1.10	1.61	1.46
	7	39	0.00	40.80	4.26	8.90	2.09
	8	82	0.00	38.20	2.44	6.03	2.47
	9	37	0.00	20.60	3.54	5.05	1.43
	10	18	0.05	59.00	8.59	14.72	1.72
	11	30	0.00	5.97	0.63	1.08	1.72
	12	52	0.00	25.80	2.12	3.91	1.84
	13	20	0.01	17.35	2.05	4.44	2.17
	14	35	0.00	72.90	5.63	16.37	2.91
	15	34	0.00	2.78	0.59	0.57	0.98
Netiana	1	585	0.00	783.00	16.28	59.83	3.68
	2	92	0.00	64.51	2.75	7.63	2.77
	3	285	0.00	710.01	18.00	73.66	4.09
	4	98	0.00	231.00	5.98	26.56	4.45
	5	188	0.01	3.93	0.76	0.61	0.81
	6	93	0.00	17.90	1.13	2.31	2.05

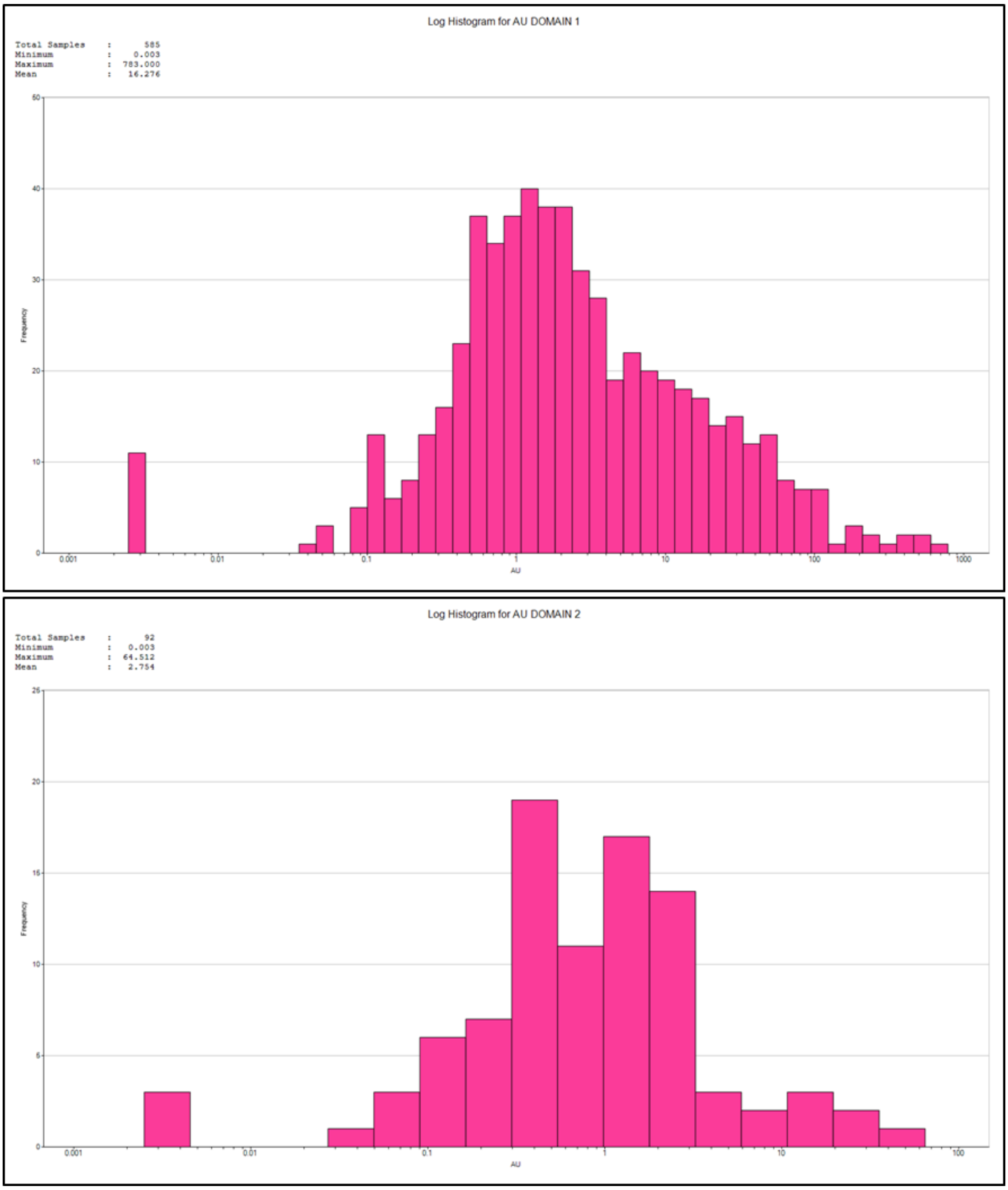


Figure 14-32: Balogo Netiana – log histograms for mineralisation domains 1 to 2

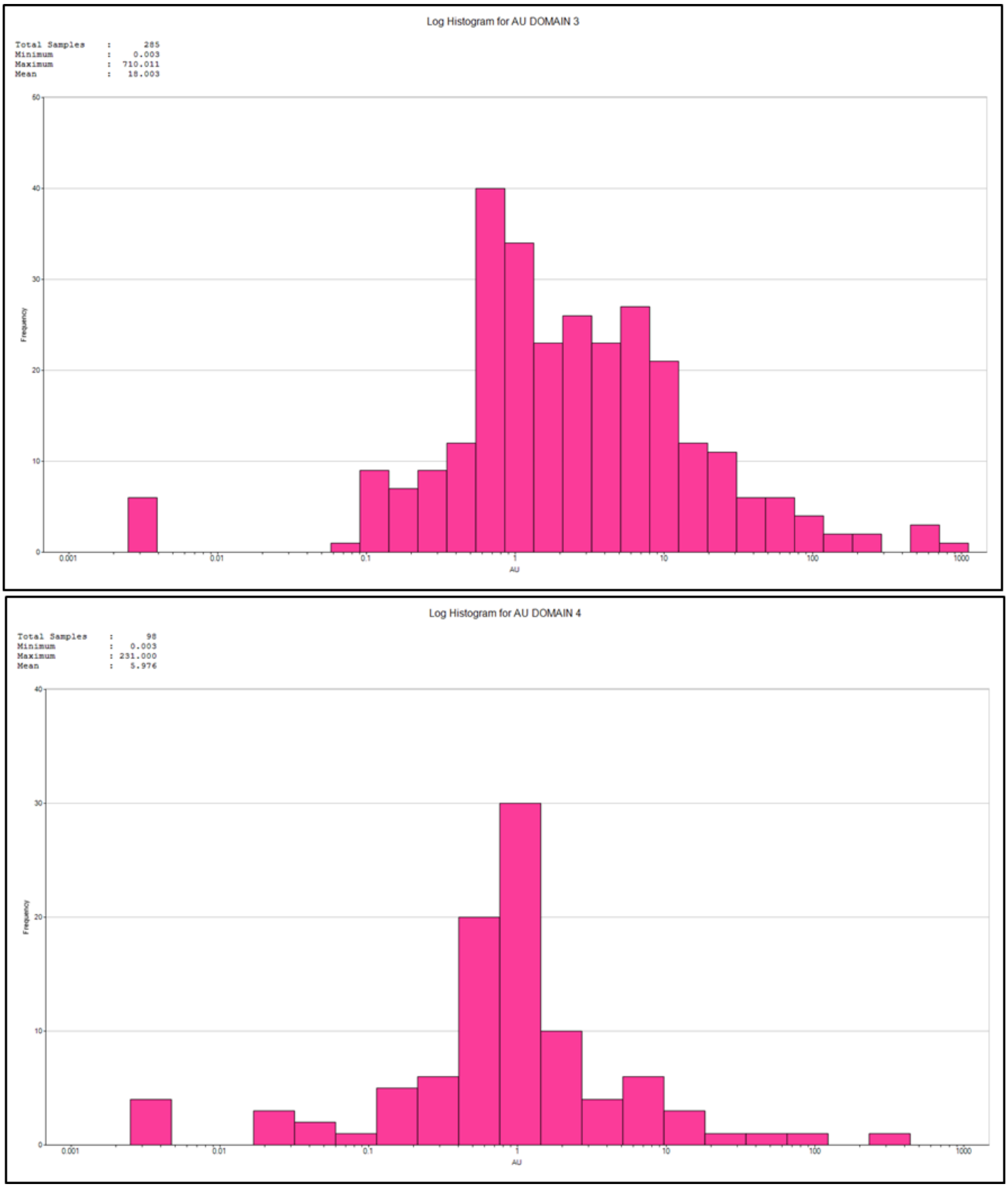


Figure 14-33: Balogo Netiana – log histograms for mineralisation domains 3 to 4

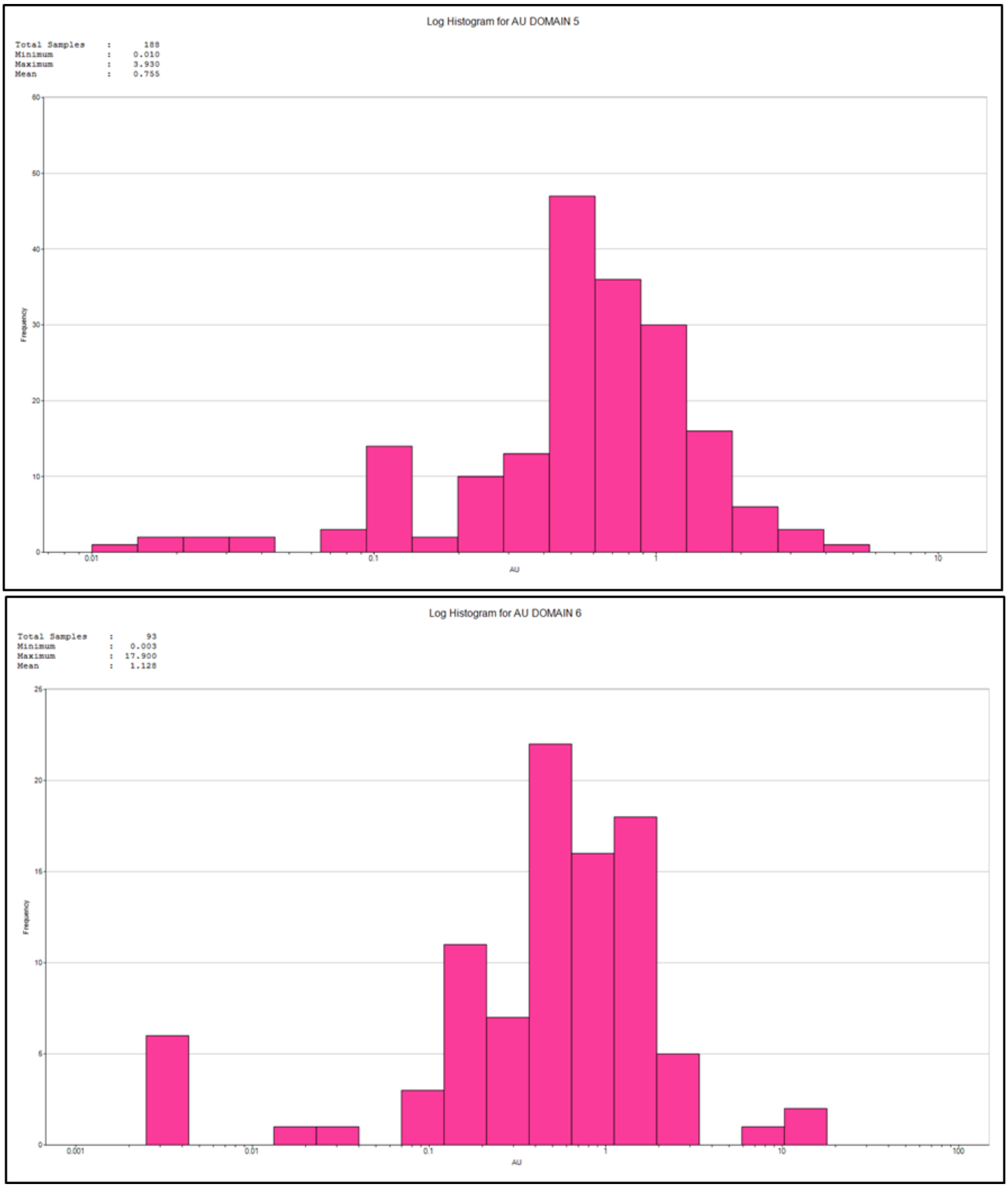


Figure 14-34: Balogo Netiana – log histograms for mineralisation domains 5 to 6

14.5.4 Top-Cut Analysis

Grade-cutting (top-cutting) is generally applied to data used for grade estimation in order to reduce the local high grading effect of anomalous high-grade samples in the grade estimate. In cases where individual samples would unduly influence the values of surrounding model cells, without the support of other high-grade samples, top-cuts are applied. These top-cuts are quantified according to the statistical distribution of the sample population.

Cutting strategy was applied based on the following:

- Skewness of the data
- Probability plots
- Spatial position of extreme grades.

Histograms and probability plots were reviewed for Au per deposit within each individual estimation domain, where there were sufficient numbers of samples to draw meaningful conclusions, to determine the top-cut. For smaller domains, these were combined, and a global top-cut was applied. The uncut and top-cut statistics are shown in Table 14-21.

Table 14-21: Youga and Balogo deposits – top-cut statistics per MINZON

Deposit	MINZON	Top cut	No. of samples	No. of samples cut	Uncut mean	Cut mean	% metal cut	Uncut SD	Cut SD	Uncut CV	Cut CV
A2N East	10	20	452	4	1.57	1.42	-9%	4.41	3.03	2.81	2.13
	11	5	188	2	0.74	0.67	-9%	1.44	1.00	1.94	1.49
	12	40	438	2	2.24	2.08	-7%	6.52	4.58	2.91	2.21
	13	-	366	-	0.75	0.75	0%	1.43	1.43	1.92	1.92
	14	9	366	5	0.96	0.83	-14%	2.57	1.48	2.67	1.78
	15	8	174	1	0.59	0.59	0%	1.18	1.18	2.01	2.007
	17	10	349	4	1.04	0.83	-21%	3.21	1.33	3.08	1.61
	21	10	4	-	1.59	1.59	0%	1.40	1.40	0.88	0.878
	28	-	15	-	0.43	0.43	0%	0.38	0.38	0.89	0.887
	43	-	6	-	0.42	0.42	0%	0.41	0.41	0.99	0.99
	44	-	4	-	1.49	1.49	0%	0.96	0.96	0.64	0.641
A2N Middle	2.1	60	415	7	5.51	5.05	-9%	13.33	10.50	2.42	2.08
	2.2	45	73	1	5.65	5.16	-9%	11.61	8.79	2.05	1.70
	2.3	20	42	1	3.06	2.85	-7%	5.96	5.13	1.95	1.80
	2.4	-	15	-	0.72	-	-	0.82	-	1.14	-
	2.5	-	11	-	2.22	-	-	3.58	-	1.61	-
Gassore	1	60	554	3	4.11	3.89	-5%	10.34	7.64	2.52	1.96
	2	-	258	-	4.04	4.04	0%	10.65	10.65	2.64	2.64
	3	-	311	-	3.25	3.25	0%	6.80	6.80	2.09	2.09
	4	15	206	4	1.55	1.26	-19%	4.32	2.31	2.78	1.83
	5	-	32	-	1.78	1.78	0%	2.31	2.31	1.30	1.30
	6	6	77	2	1.10	1.00	-9%	1.61	1.09	1.46	1.09
	7	20	39	2	4.26	3.24	-24%	8.90	4.90	2.09	1.51
	8	20	82	2	2.44	2.08	-15%	6.03	4.20	2.47	2.02
	9	-	37	-	3.54	3.54	0%	5.05	5.05	1.43	1.43
	10	30	18	1	8.59	6.97	-19%	14.72	9.56	1.72	1.37
	11	-	30	-	0.63	0.63	0%	1.08	1.08	1.72	1.72
	12	10	52	1	2.12	1.82	-14%	3.91	2.32	1.84	1.28
	13	-	20	-	2.05	2.05	0%	4.44	4.44	2.17	2.17
	14	15	35	2	5.63	2.47	-56%	16.37	3.96	2.91	1.61
	15	-	34	-	0.59	0.59	0%	0.57	0.57	0.98	0.98
Netiana	1	200	585	9	16.28	12.87	-21%	59.83	31.66	3.68	2.46
	2	15	92	3	2.75	2.06	-25%	7.63	3.49	2.77	1.70
	3	75	285	12	18.00	9.24	-49%	73.66	17.79	4.09	1.93
	4	15	98	4	5.98	2.23	-63%	26.56	3.56	4.45	1.60
	5	-	188	-	0.76	0.76	0%	0.61	0.61	0.81	0.81
	6	10	93	2	1.13	1.03	-9%	2.31	1.71	2.05	1.65

14.5.5 Variography

The variograms were modelled for Au on 1 m composites within the A2N East, A2N Middle, Gassore and Netiana estimation domains. Variography was completed on the largest estimation domains per deposit. The resultant variograms were assigned to the minor domains based on spatial location and orientation of the minor domains relative to the main domains.

Nugget were obtained from the downhole variogram where the lag was set equal to the composite length of 1 m or 2 m. Normal scores transform was used for modelling the variograms.

The semi-variograms were well structured, with moderate to high nuggets and moderate to long ranges. The variograms were back-transformed prior to estimation and examples are presented in Figure 14-35 to Figure 14-40. The variogram parameters are detailed in Table 14-22.

Variograms were modelled on the largest domain in Netiana (MINZON 11) and the largest domain in Netiana SE (MINZON 22). The variogram from MINZON 11 was applied to all domains within Netiana, while the variogram modelled for MINZON 22 was applied to all domains within Netiana SE.

Outliers were removed from the dataset to prevent their undue influence on the variogram model. For MINZON 11, composites with a gold grade exceeding 150 g/t Au were excluded, while in MINZON 22, composites with a gold grade exceeding 5 g/t Au were excluded.

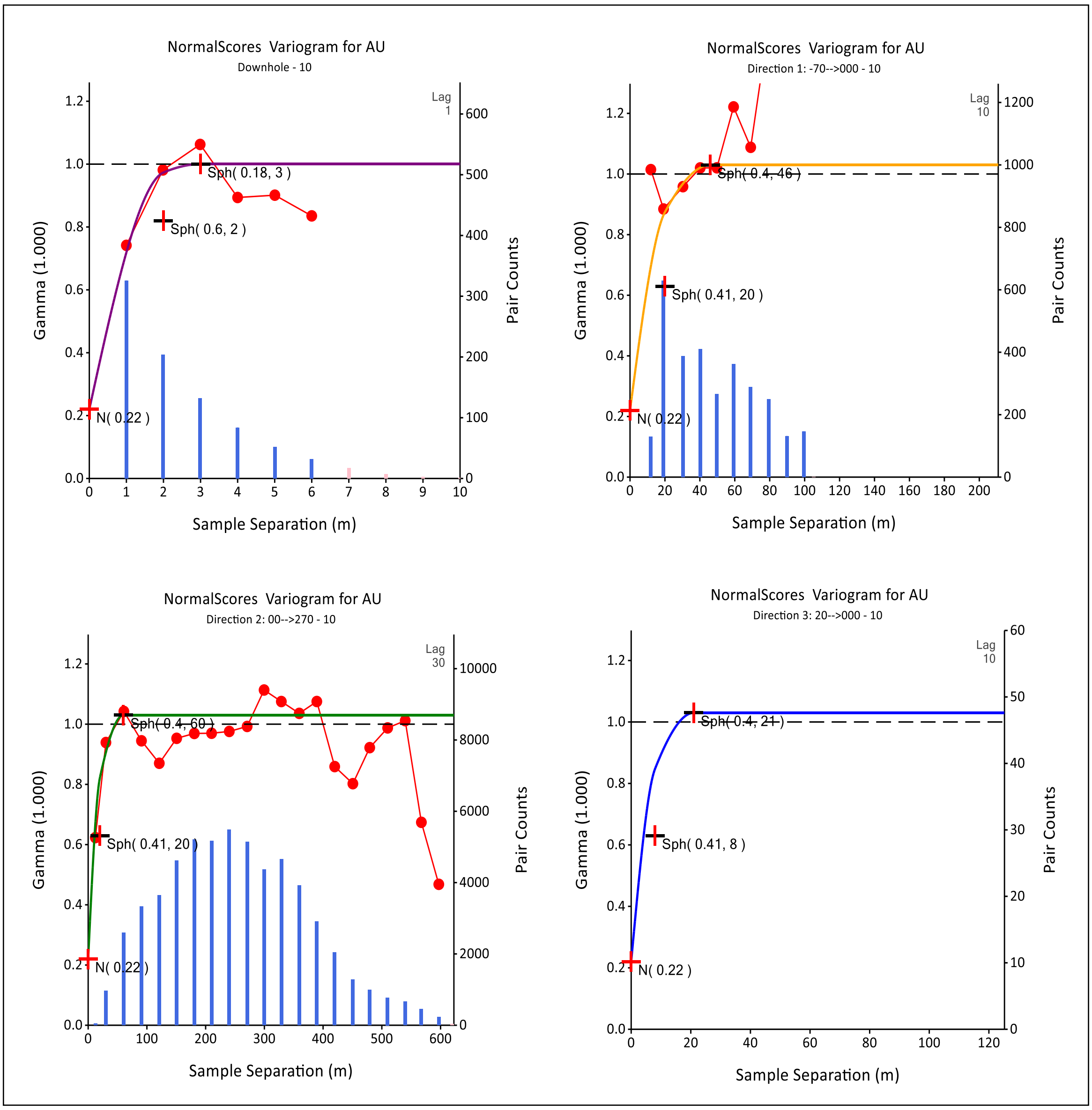


Figure 14-35: Youga A2N East – variogram (VREFNUM=1) modelled on MINZON=10

Note: Used for Au g/t estimation within all MINZONs (10-44).

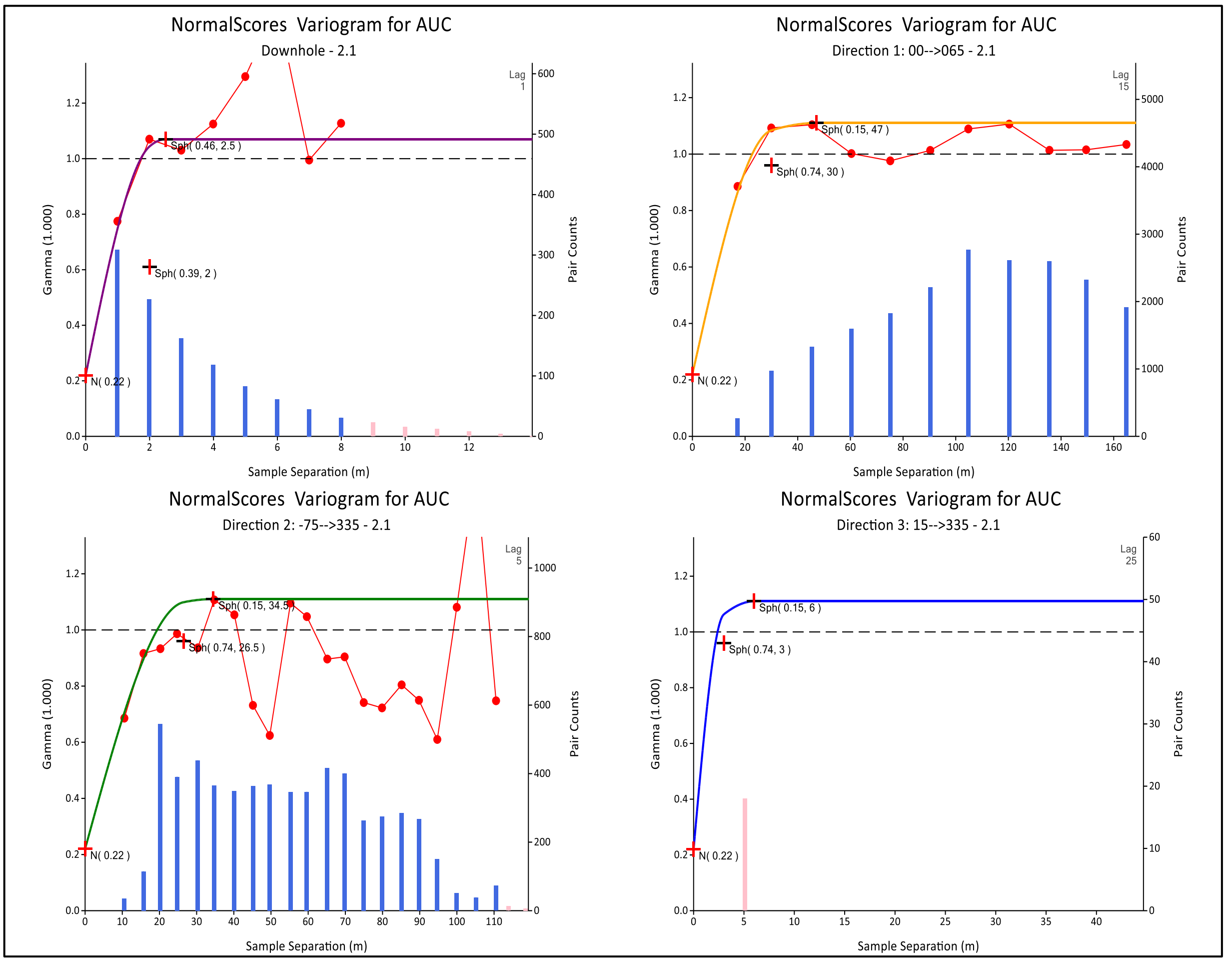


Figure 14-36: Youga A2N Middle – variogram (VREFNUM=1) modelled on SEARCH=2.1

Note: Used for Au g/t estimation within all MINZONs (2.1 to 2.5).

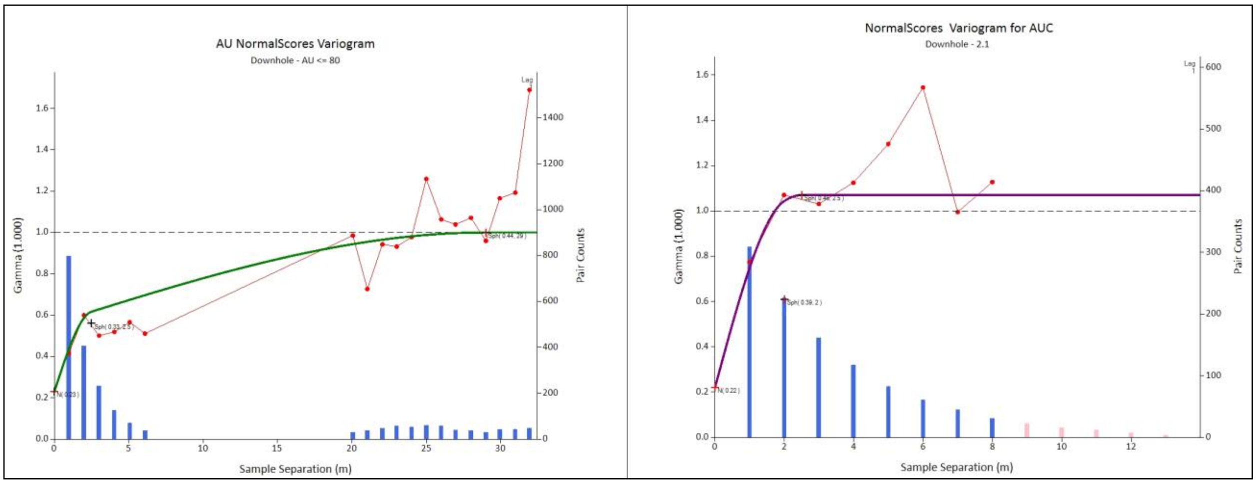


Figure 14-37: Youga Gassore – downhole variogram (all domains) modelled in green (left), and A2N Middle downhole variogram for comparison, modelled in purple (right)

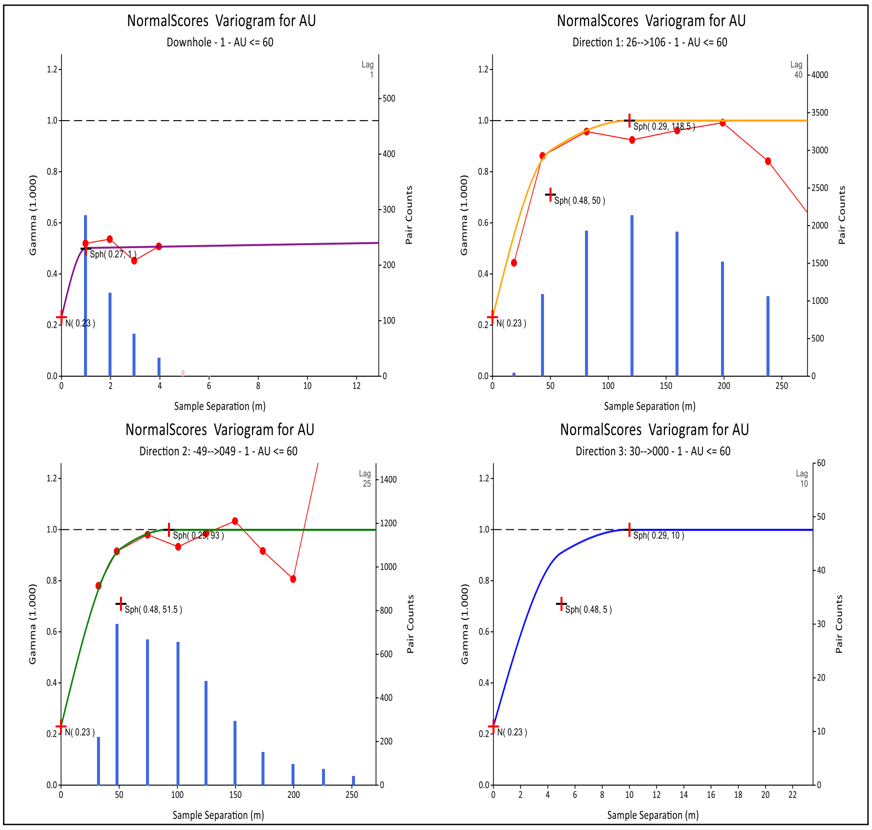


Figure 14-38: Youga Gassore – variogram (VREFNUM=1) modelled on MINZON=1

Note: Used for Au g/t estimation within all MINZONs (1-15).

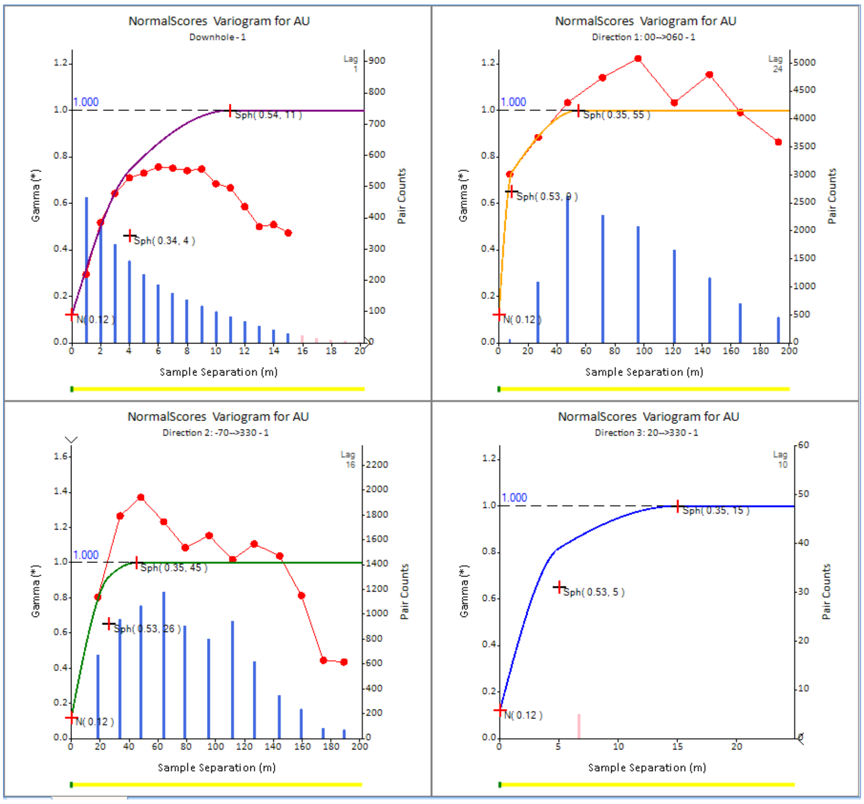


Figure 14-39: Balogo Netiana – normal score variogram (VREFNUM=1) modelled on DOMAIN=1

Note: Used for Au g/t estimation within DOMAINS 1 and 2.

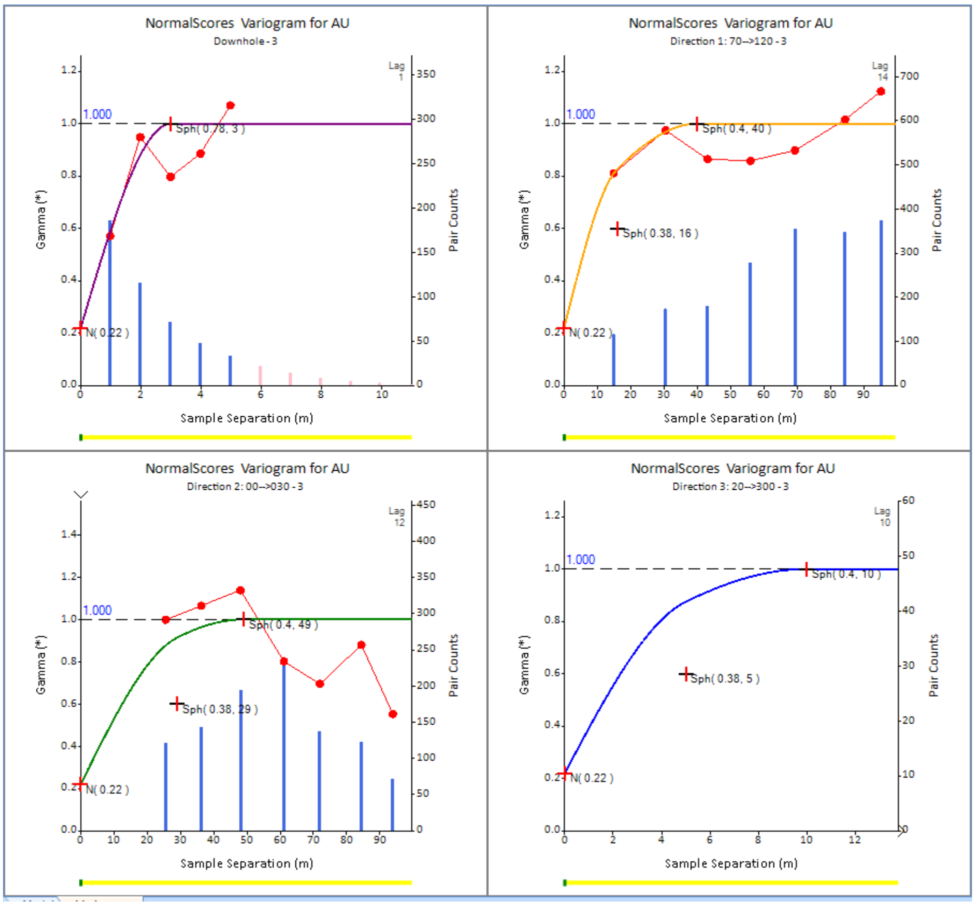


Figure 14-40: Balogo Netiana – normal score variogram (VREFNUM=2) modelled on DOMAIN=3

Note: Used for Au g/t estimation within DOMAINS 3 and 4

Table 14-22: Youga and Balogo deposits – variogram parameters

Deposit	VREFNUM (MINZON)	Datamine rotation	Datamine axis	Nugget	Structure 1		Structure 2		Structure 3	
					Partial sill	Range	Partial sill	Range	Partial sill	Range
A2N East	1 (10-44)	0	3	0.36	0.44	20	0.21	46	-	-
		70	1			20		60		-
		-90	3			8		21		-
A2N Middle	1 (2.1 to 2.5)	-25	3	0.35	0.58	30	0.08	47	-	-
		75	1			26.5		34.5		-
		0	3			3		6		-
Gassore	1 (1-15)	0	3	0.33	0.5	50	0.17	118.5	-	-
		60	1			51.5		93		-
		30	3			5		10		-
Netiana	1	-30	3	0.26	0.61	9	0.13	55	-	-
		70	1			26		45		-
		0	3			5		15		-
Netiana	2	-60	3	0.45	0.43	16	0.12	40	-	-
		70	1			29		49		-
		90	3			5		10		-

14.6 Block Model and Grade Estimation

14.6.1 Summary

Estimation of Au grade was carried out using ordinary kriging (OK) into parent cell panels. Grade was estimated into all mineralisation blocks, using available data within the mineralisation domain. The MRE was completed by CSA Global using the Datamine StudioRM™ software package.

14.6.2 Block Modelling

The models were cut to below the topographic surface. A model prototype with parent cells and sub-celling was created. The model prototypes parameters, including cell dimensions and model extents, are shown in Table 14-23.

Panel sizes for grade estimation were based on the following:

- Results of kriging neighbourhood analysis (KNA)
- The density of the drilling grids
- The geometry of the mineralisation
- The mining parameters.

Table 14-23: Block model dimensions

Deposit	Easting		Northing		RL		Block X (m)	Block Y (m)	Block Z (m)
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum			
A2N East	778300	780800	1228300	1229800	0	250	5	5	5
A2N Middle	779265	780065	1228550	1229500	0	250	5	5	5
Gassore	778100	779600	1228700	1229200	-100	300	5	5	5
Netiana	663750	664500	1259950	1260350	30	390	10	10	10

14.6.3 Kriging Neighbourhood Analysis

KNA on the composites (1 m or 2 m, depending on the deposit) was used to optimise the parent cell sizes and to determine the optimal theoretical estimation and search parameters during kriging.

The following was reviewed for each of the variables per selected domain:

- Slope and kriging efficiency (KE) statistics for a well-informed block for different block sizes.
- On choosing a block size, optimum minimum and maximum samples were chosen. The maximum was set at the lowest number of samples from which consistently good slopes and KE could be derived. The minimum was defined as the lowest minimum from which moderate to good statistics could be derived.
- On choosing the minimum/maximum samples, search ellipse ranges were defined. The quality of the statistics was least sensitive to this parameter. The ranges chosen approximated the ranges of the first structure of the variogram (two thirds of the total range for Gassore).
- Negative weights were reviewed at each stage to ensure the parameters chosen were not leading to excessive negative weights.
- Discretisation was defined at:
    - 3 x 3 x 3 (X x Y x Z) for Netiana
    - 5 x 5 x 5 (X x Y x Z) for A2N East, A2N Middle and Gassore.
- Maximum number of samples allowed per each individual drillhole, per estimate, was set to three.

The KNA results show that the search parameters and block size selected are suitable for use in the MREs and adequately take drill spacing, geology and practicality into account. The plots with examples of the selected estimation parameters, per deposit, are shown in Figure 14-41 to Figure 14-45.

The number of composites used for the Au grade estimations per deposit are presented in Table 14-24. The modelled variogram parameters together with the selected estimation panel size and number of samples was used to determine the appropriate search ellipse for the primary search pass. These are also presented in Table 14-24.

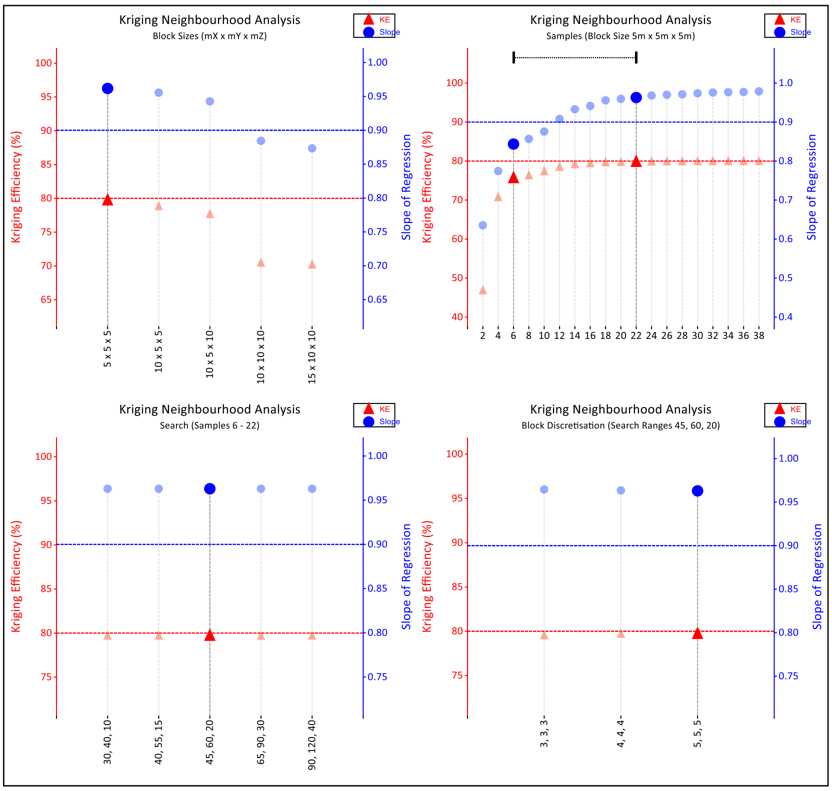


Figure 14-41: Youga A2N East – KNA parameters (SREFNUM=1) modelled on MINZON=10

From top left, clockwise: Block size, samples, discretisation and search results. Used for Au g/t estimation within all MINZONs (10-44).

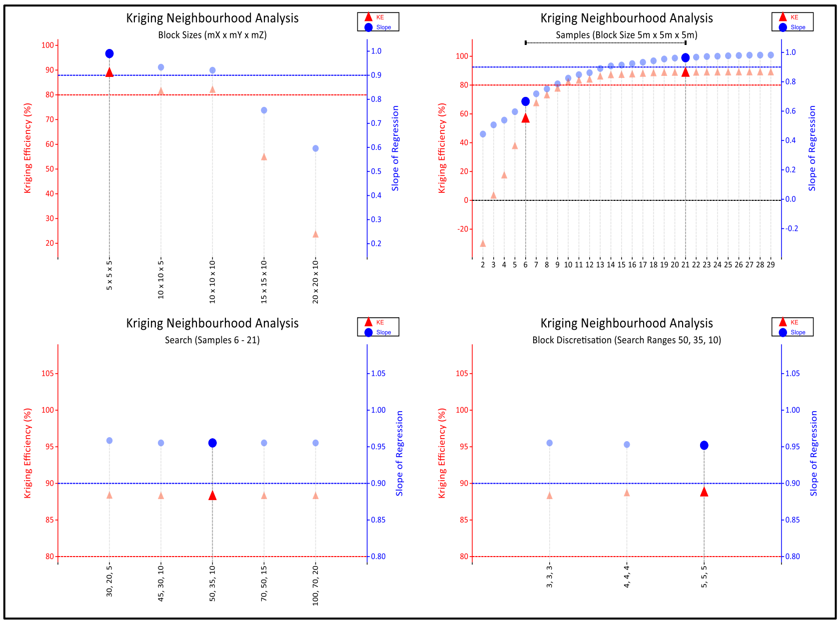


Figure 14-42: Youga A2N Middle – KNA parameters (SREFNUM=1) modelled on SEARCH=2.1

From top left, clockwise: Block size, samples, discretisation and search results. Used for Au g/t estimation within all MINZONs (2.1 to 2.5).

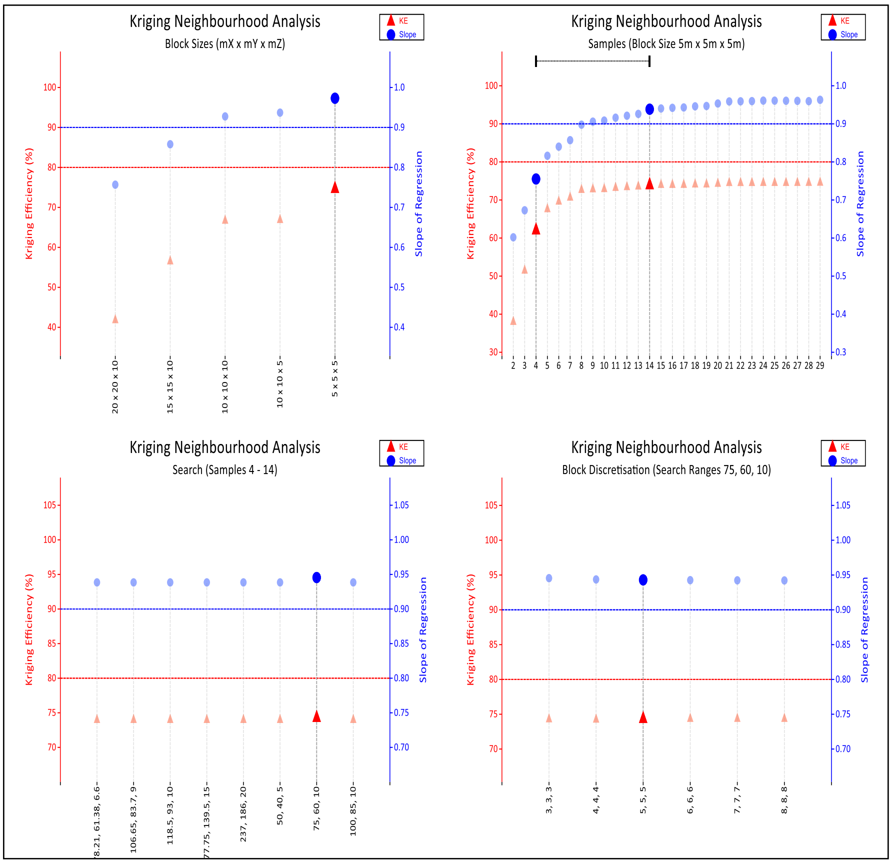


Figure 14-43: Youga Gassore – KNA parameters (SREFNUM=1) modelled on MINZON=1

From top left, clockwise: Block size, samples, discretisation and search results. Used for Au g/t estimation within all MINZONs (1-15).

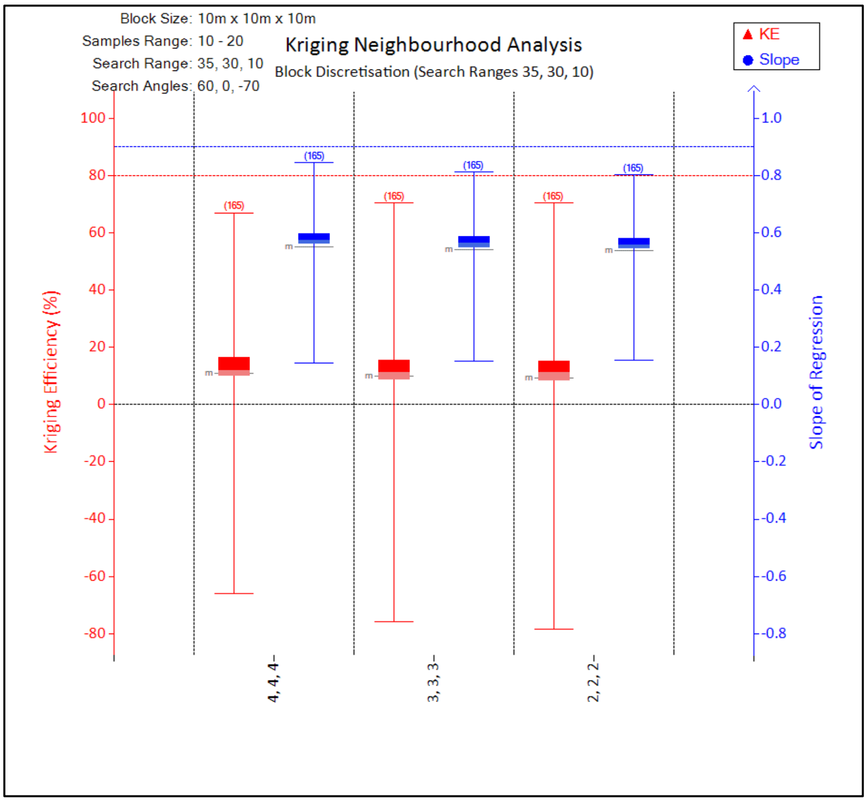


Figure 14-44: Netiana – KNA parameters modelled on DOMAIN=1

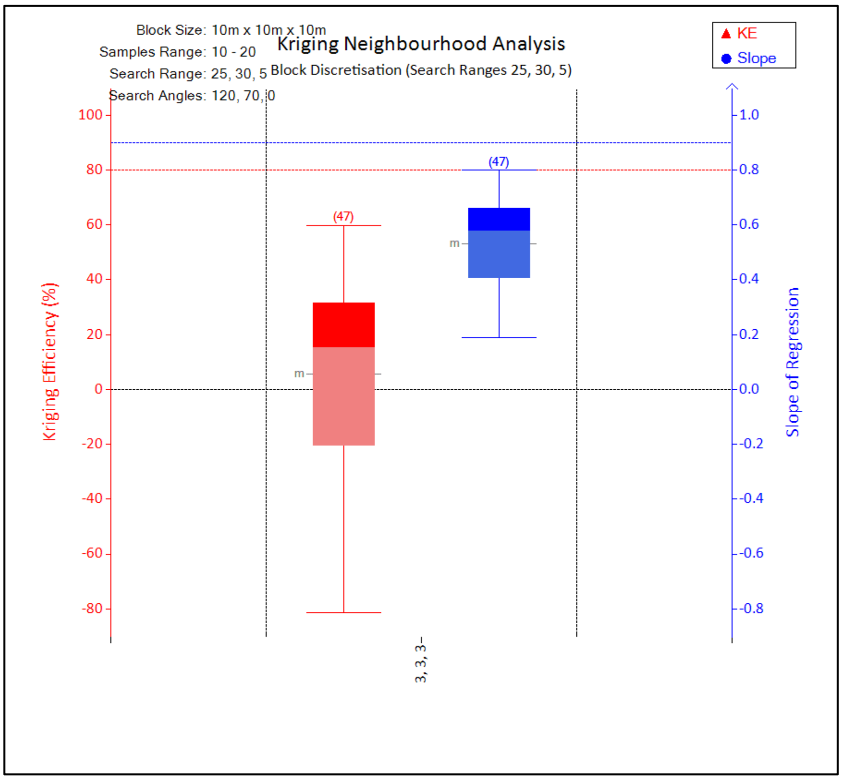


Figure 14-45: Netiana – KNA parameters modelled on DOMAIN=3

Table 14-24: Youga and Balogo deposits – search neighbourhood parameters for Au

Deposit	SREFNUM (MINZON)	Search volume 1 Ranges	Search volume 1 Composites Min.	Search volume 1 Composites Max.	Search volume 2 Range	Search volume 2 Composites Min.	Search volume 2 Composites Max.	Search volume 3 Range	Search volume 3 Composites Min.	Search volume 3 Composites Max.	MAXKEY
A2N East	1 (10-15, 17, 28, 43-43)	45	6	21	90	6	21	135	3	12	3
		60			120			180			
		10			20			30			
	21 (21)	45	10	20	90	10	20	135	5	10	5
		60			120			180			
		10			20			30			
A2N Middle	1 (2.1 to 2.5)	50	6	21	100	6	21	150	3	12	3
		35			70			105			
		10			20			30			
Gassore	1 (1-15)	75	4	14	150	4	14	300	3	8	3
		60			120			240			
		10			20			40			
Netiana	1 (1)	35	10	20	52.5	10	20	105	6	16	4
		30			45			90			
		10			15			30			
	2 (3 and 4)	25	10	20	37.5	10	20	75	6	16	4
		30			45			90			
		5			7.5			15			
	4 (2)	25	10	20	37.5	10	20	75	6	16	4
		25			37.5			75			
		10			15			30			
Netiana SE	3 (5 and 6)	20	10	20	30	10	20	60	6	16	4
		40			60			120			
		5			7.5			15			

14.6.4 Grade Estimation

At Youga, estimation of Au grade was carried out using OK into parent cell panels. Zonal control with a hard boundary between mineralisation domains was used during the grade estimation. MINZON was used as the estimation domain for each deposit. At Balogo, estimation of Au grade was carried out using OK for domains 1 to 4 (Netiana lodes), and inverse distance squared for domains 5 and 6 (Netiana SE lodes). It was felt that due to the extreme differences in grade profiles at Netiana compared to Netiana SE, it was inappropriate to assign variogram parameters derived from Netiana, to the Netiana SE lodes. There were insufficient samples at Netiana SE to inform a variogram that was reasonable to use in the estimation process – and so inverse distance squared was used in its place.

A three-phased search pass was applied, and the orientation of the search ellipsoid was aligned to the modelled variography. This process involves the estimation being performed three times, where two expansion factors are used. During each individual estimation run this factor increases the size of the search ellipse used to select samples. This method ensures that blocks which are not estimated and populated with a grade value in the first run, are populated during one of the subsequent runs.

Upon review of the estimation parameters in domain 3 at Netiana, it was felt that the top-cut applied to the composites was removing metal that was likely to be real, and that there was a small high grade sub-domain within domain 3. It was decided that a four phased search be used in this particular domain, with a very small search ran using the high-grade composites prior to the main estimation run. This small search utilised an ellipse of 5 m x 5 m x 5 m, with a minimum number of three samples, and a maximum number of five samples. The input composites were selected based on intercepts that contained a sample of at least 100 g/t Au – this is the grade cut-off that best represents the high grade sub-domain. A top-cut of 300 g/t Au was applied to the selected composites prior to the estimation. Once this subdomain was estimated, the remaining three search passes were run as per for the other domains.

The mineralised areas were estimated using dynamic anisotropy. This process allows the rotation angles for the search ellipsoid to be defined individually for each cell in the models, so that the search ellipsoid is aligned with the axes of mineralisation. This therefore requires the rotation angles to be estimated into the model cells, which in turn requires a set of angles as the input data file for interpolation. The dip and dip direction of the major axis of anisotropy were defined by digitising strings in section perpendicular to the strike of the mineralisation for A2N East, A2N Middle and Netiana, digital terrain model (DTM) surfaces were created honouring the dip and dip direction of the various units for the remaining deposits. These strings/triangle files were converted to points that contained the true dip and dip direction of the mineralisation and stratigraphy (fields SANGLE1_F and SANGLE2_F in the search parameter files).

The rotations of the modelled variograms aligned with the dominant orientation of the mineralisation for each deposit. Therefore, the variogram also used dynamic anisotropy.

Discretisation was used and is summarised in Table 14-25.

Table 14-25: Discretisation cell sizes

Deposit	X	Y	Z
A2N East	5	5	5
A2N Middle	5	5	5
Gassore	5	5	5
Netiana	3	3	3

Validation of the block model was completed by comparing input and output means. Several techniques were used for the validation. These included visual validation of block grades, global grade comparisons and swath plots.

14.6.5 Visual Validation

The block models were visually reviewed section by section and in 3D to ensure that the grade tenor of the input data was reflected in the block models (examples shown in Figure 14-46 to Figure 14-49). Generally, the estimates compare well with the input data. The grades in the composites align with the corresponding grades in the block models.

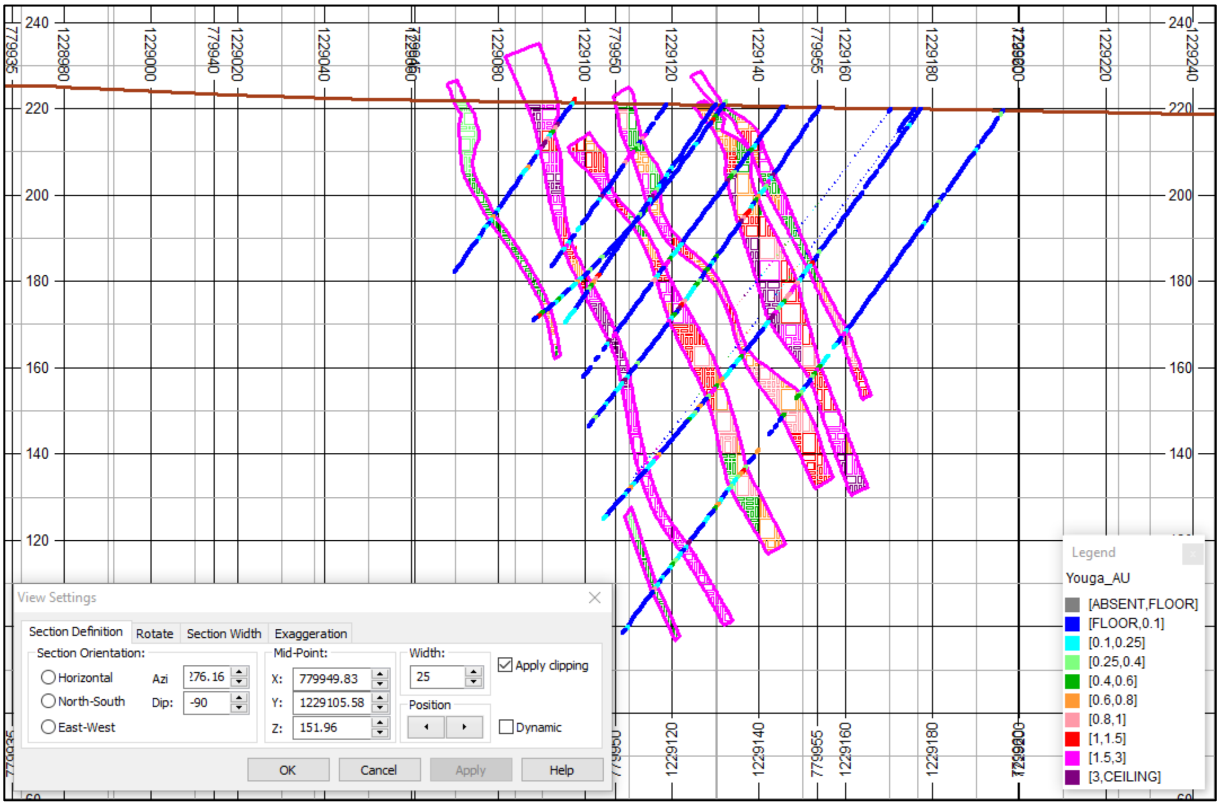


Figure 14-46: Section view – Youga A2N East grade model and composites

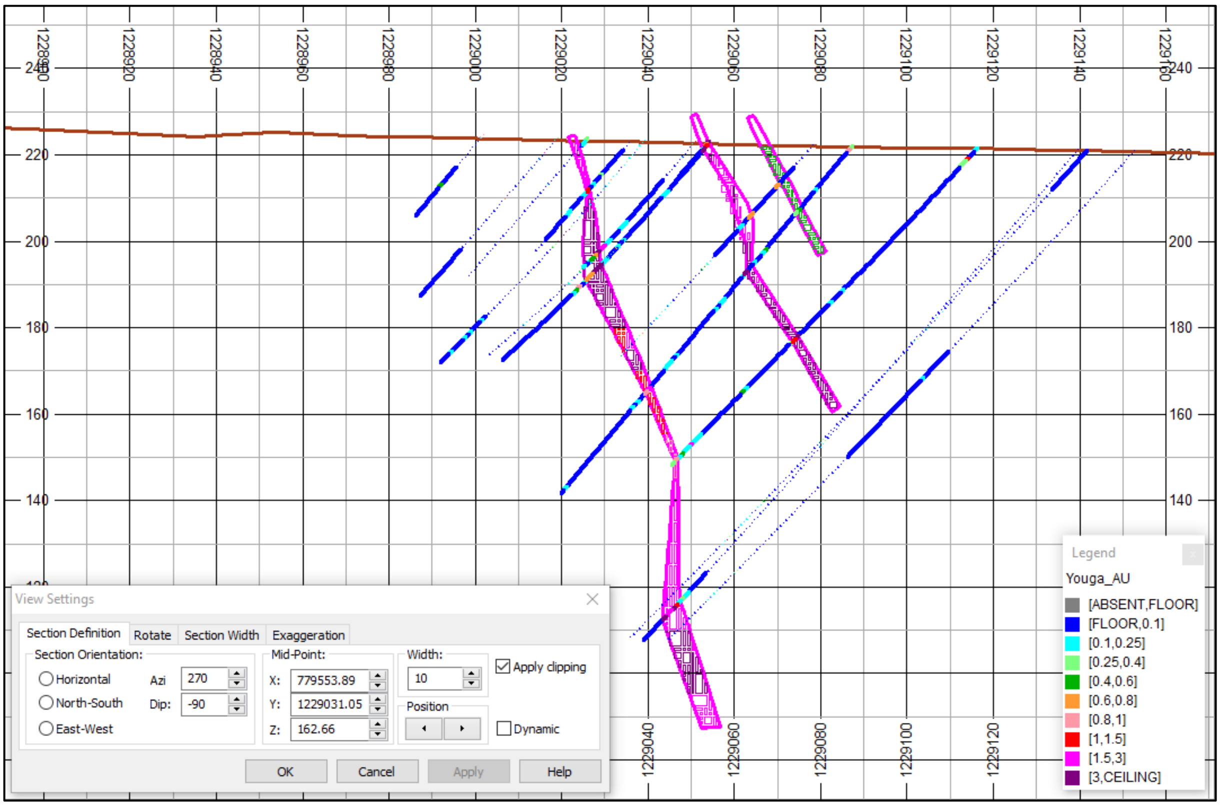


Figure 14-47: Section view – Youga A2N Middle grade model and composites

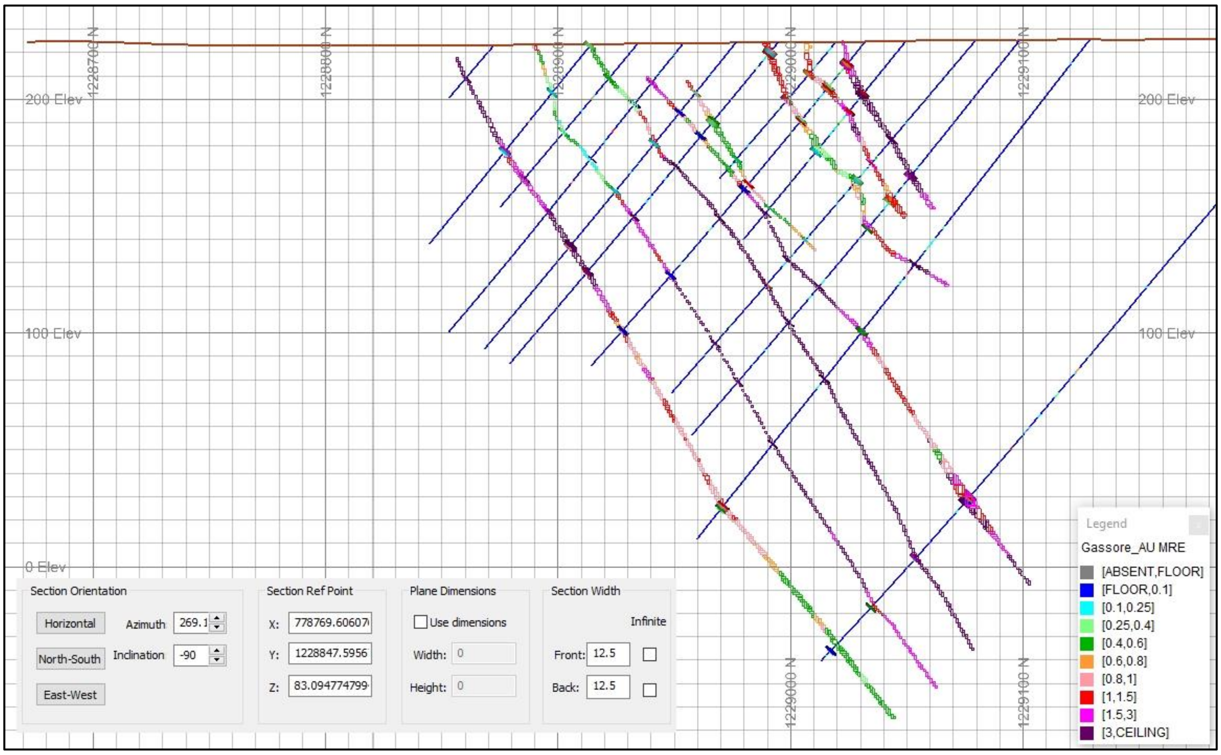


Figure 14-48: Section view – Youga Gassore grade model and composites

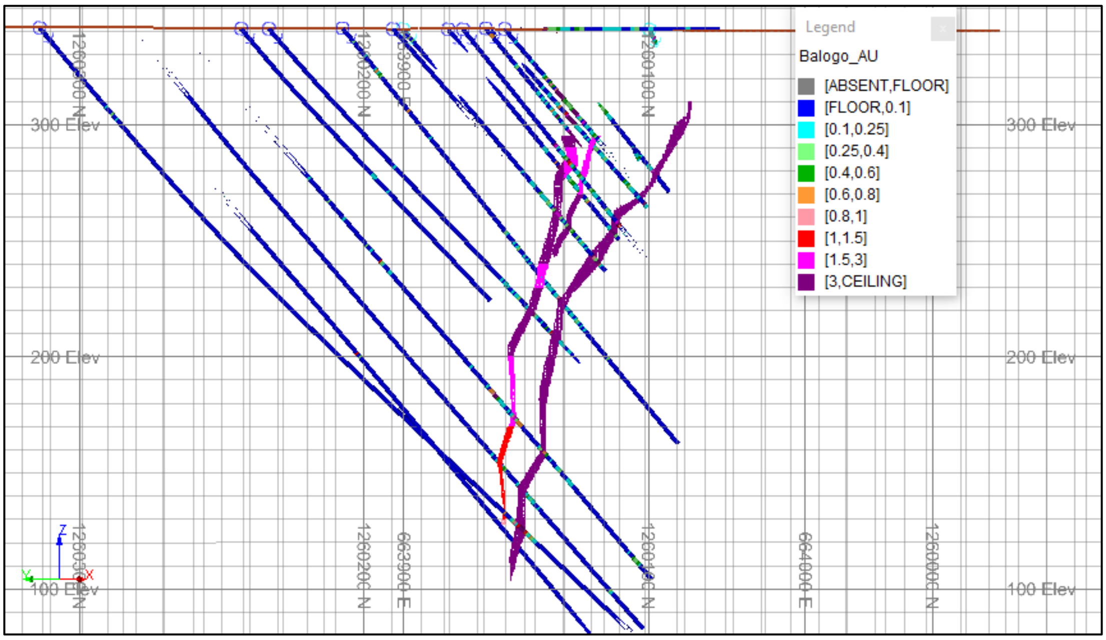


Figure 14-49: Section view – Netiana grade model and composites

14.6.6 Statistical Validation

De-clustering

Irregular sampling of a deposit, most commonly through infill drilling or drilling in multiple orientations, causes clustering. Clustering results in a disproportionate distribution grades (usually high grades from the infill drilling) in the dataset used for statistical analysis. Mixed populations in the histogram can create a bias when comparing the drillhole sample distribution with the block model distribution (which is de-clustered) and distort the calculated mean grades and variance.

Different ways of de-clustering data each give different results. These include interactive filtering, polygonal de-clustering, nearest neighbour de-clustering and cell-weighted de-clustering.

The method used for geostatistical analysis and validation for the Youga and Balogo MRE updates is cell-weighted de-clustering, since all samples are considered when determining the average. This method involves placing a grid of cells over the data. Each cell that contains at least one sample is assigned a weight of one. That weight of one is distributed evenly between the samples within each cell.

No de-clustering was required for Gassore since the drilling is regularly spaced.

The OK grade estimation process is a very efficient way of data clustering, therefore de-clustering before grade estimation is not necessary. De-clustering of the input data does give a good indication of the global mean. It is used in the validation of the estimate (comparison of the means). De-clustering was applied to remove any bias due to drill spacing prior to validation. The de-clustering parameters as used for Youga, and Netiana are presented in Table 14-26.

Table 14-26: De-clustering parameters

Deposit	Cell size (m)			Anchor point		
	X	Y	Z	X	Y	Z
A2N East	5	5	5	778300	1228300	0
A2N Middle	5	5	5	779265	1228550	0
Gassore	Regular spaced drilling, no de-clustering required					
Netiana	10	10	10	663750	1259950	30

Results

The global statistics of Au g/t were reviewed, and the results are reported below in Table 14-27. For Netiana, domains were reviewed individually. Domains with the largest number of samples are presented in Table 14-28.

All estimated block grades are included. The mean grades in the estimated model block parent cells were compared to the raw, as well as the de-clustered, top-cut composite data.

Generally, the models validate well, showing <10% difference between the de-clustered composites and the block estimates. This is within expected parameters.

*Table 14-27: Youga deposits – de-clustered mean grade comparison for Au g/t (*Gassore and Ouaré are raw mean grades)*

Deposit	Block (Au g/t)	De-clustered composite (Au g/t)	% difference
A2N East	1.11	1.09	+2%
A2N Middle	4.59	4.34	+6%
Gassore*	3.79	3.69	3%

Table 14-28: Netiana deposit – de-clustered mean grade comparison for Au g/t

Domain	Block Au g/t)	De-clustered composite (Au g/t)	% difference
1	10.04	9.49	6%
3	11.35	10.97	3%

14.6.7 Swath Plots

Swath plots were created as part of the validation process, by comparing the model parent block grades and input composites (de-clustered and top-cut) in spatial increments. These plots display northing, easting and elevation slices throughout the deposit (Figure 14-50 to Figure 14-53).

The plots show that the distribution of block grades honours the distribution of input composite grades. There is a minor degree of smoothing evident, which is to be expected from the estimation method used, with block grades showing lower overall variance. The general trend of the composite grades is reflected in the block model.

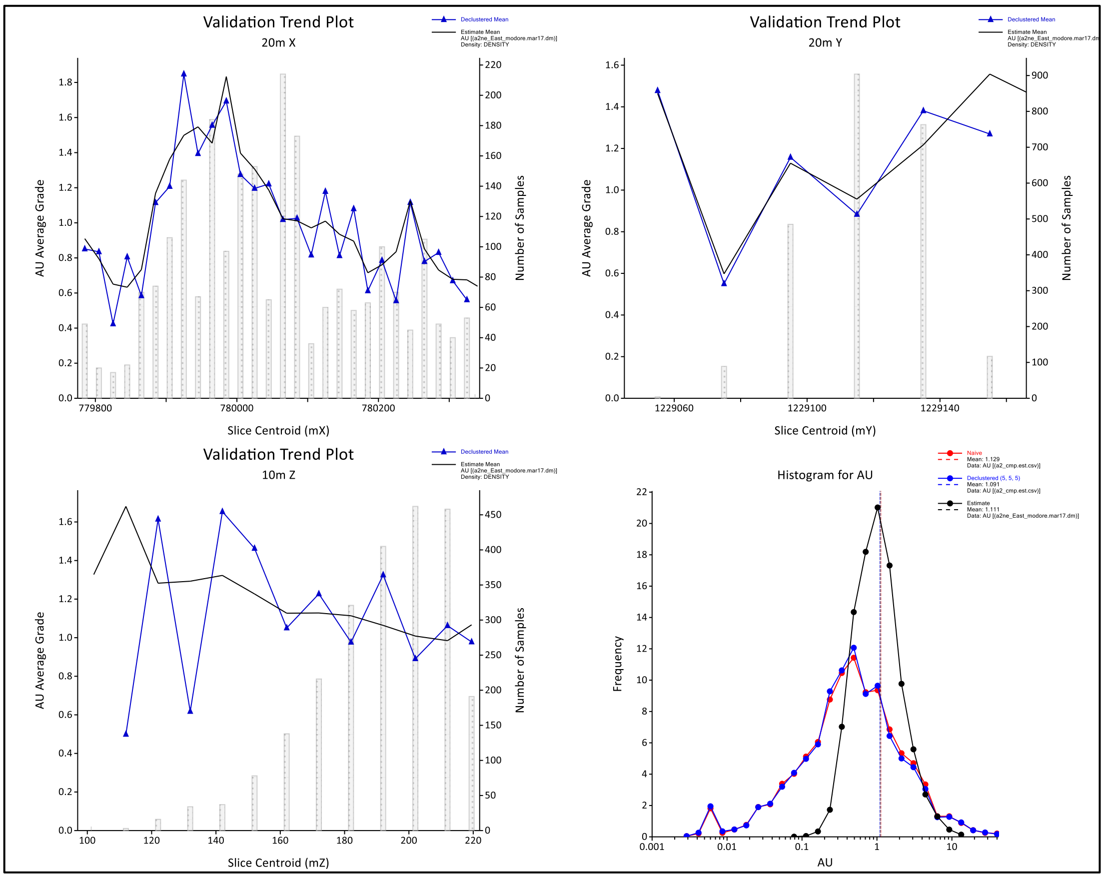


Figure 14-50: Youga – swath plot A2N East

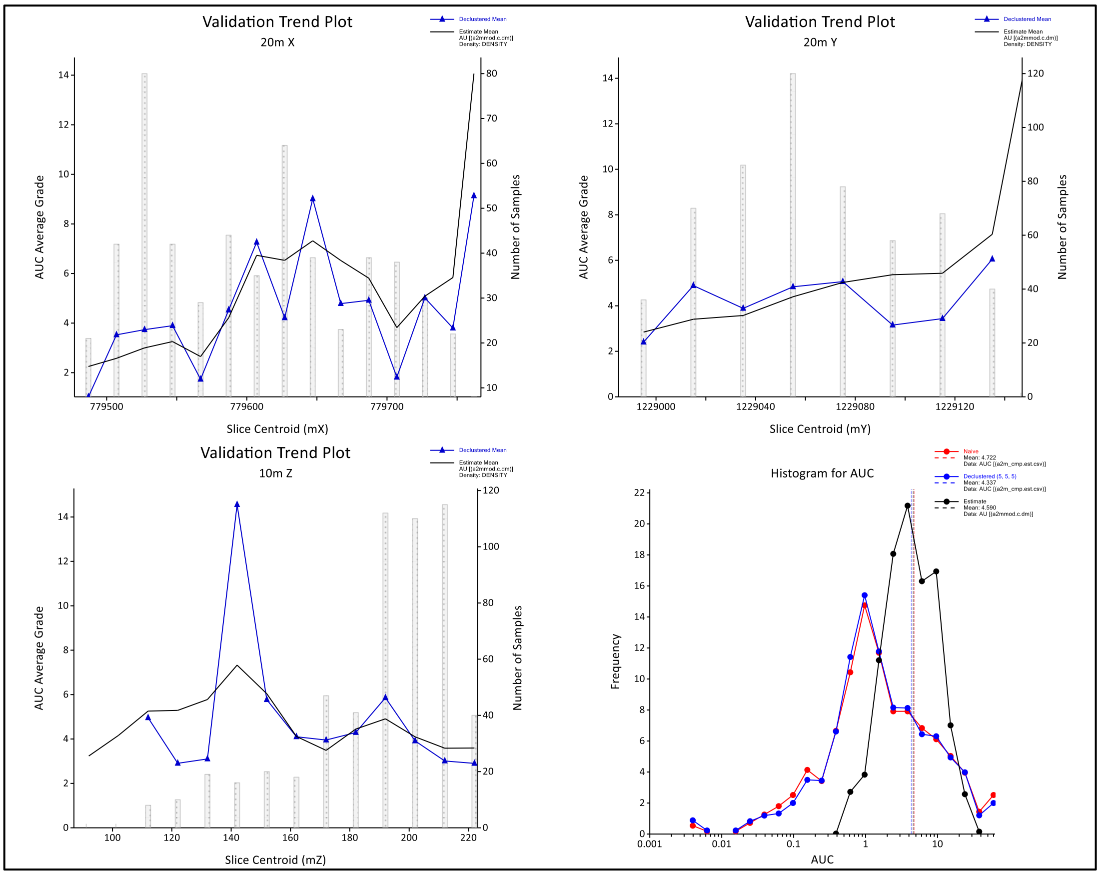


Figure 14-51: Youga – swath plot A2N Middle

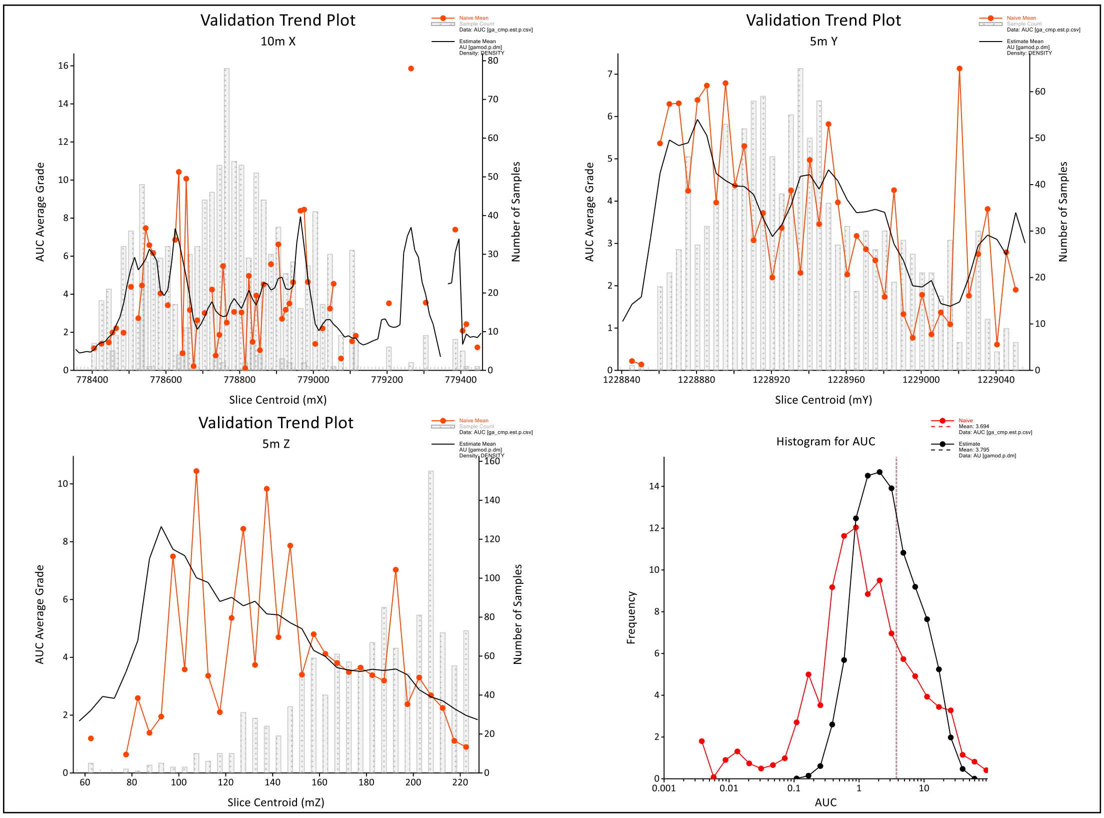


Figure 14-52: Youga – swath plot Gassore

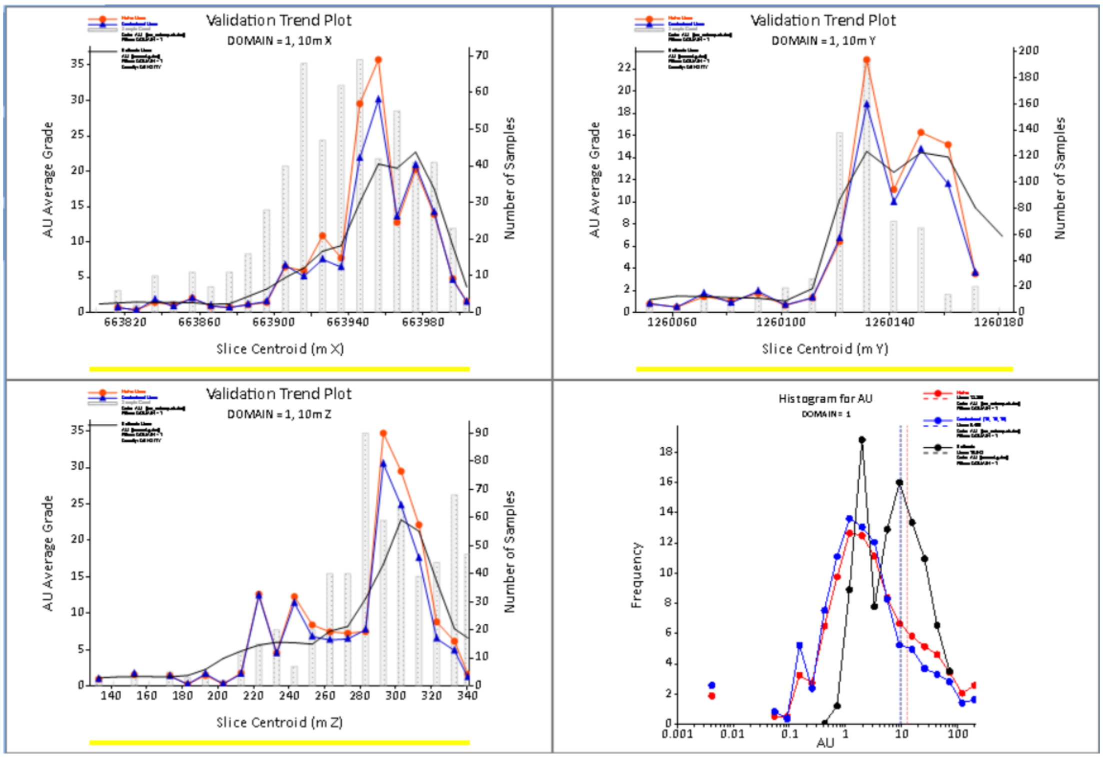


Figure 14-53: Swath plot Netiana

14.7 Classification

The Mineral Resource has been classified as Measured Mineral Resources, Indicated Mineral Resources and Inferred Mineral Resources under the guidelines of the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council, and procedures for classifying the reported Mineral Resources were undertaken within the context of the Canadian Securities Administrators NI 43-101.

The classification level is based upon an assessment of geological understanding of the deposit, geological and mineralisation continuity, drillhole spacing, quality control results, search and estimation parameters and an analysis of available density information.

The criteria reviewed for classification applied to all deposits was as follows:

- Review of potential for eventual economic extraction
- Review of geological continuity
- Review of data quality
- Review of QAQC
- Review of drill spacing and estimation quality statistics such as search pass, number of samples used to estimate, slope of regression.

For all deposits, a resource shell was run in NPV Scheduler (NPVS) using input parameters outlined in Table 14-29 and Table 14-30 to constrain and classify Mineral Resources for each deposit. This was completed to provide support that each Mineral Resource has the potential for eventual economic extraction, a key criterion for the classification of Mineral Resources under CIM guidelines. Any material outside the resource shell remains unclassified and does not contribute to the Mineral Resource inventory.

Table 14-29: Youga – input parameters for resource shell (NPVS)

Parameter	Units	Value
Price	US$/Troy Oz	1,500
Selling cost	%	4.0
Mining cost	US$/t mined	2.2
Process cost	US$/t ore	17
G&A	US$/t ore	5.0
Transport cost	US$/t ore	0.56
Pit slope angle	°	45
Mining recovery	%	95
Mining dilution	%	5
Process recovery	%	91

Table 14-30: Netiana – input parameters for resource shell (NPVS)

Parameter	Units	Value
Price	US$/Troy Oz	1,500
Selling cost	%	4.0
Mining cost	US$/t mined	2.2
Process cost	US$/t ore	17
G&A	US$/t ore	5.0
Transport cost	US$/t ore	2.0
Pit slope angle	°	45
Mining recovery	%	95
Mining dilution	%	5
Process recovery	%	91

While Netiana is located more than 100 km from the Youga Plant, the assumptions around transport costs assume a closer plant location, to support the criteria that a Mineral Resource must have the potential for eventual economic extraction. No part of Netiana SE was within the constraining resource shell, and therefore, no part of it can be considered having the potential for eventual economic extraction. Netiana SE has no Mineral Resources.

For all deposits, the drill spacing is sufficient to allow the geology and mineralisation zones to be modelled into coherent wireframes for each domain. Reasonable consistency is evident in the orientations, thickness and grades of the mineralised zone.

Validation of the historical drillholes, particularly in relation to the exact collar locations and assay results, and the availability of QAQC information, has allowed for the classification of Measured and Indicated Mineral Resources. A summary of the classification codes applied in the models are shown in Table 14-31.

Table 14-31: CLASS field and description

Class	Description
1	Measured Mineral Resource
2	Indicated Mineral Resource
3	Inferred Mineral Resource
9	Unclassified – estimated material outside a Whittle $1,500 gold price and assumptions regarding operating costs and recoveries pit shell, as well as all waste material not estimated

For Measured and Indicated Mineral Resources, the specific criteria for each deposit is summarised in Table 14-32.

Table 14-32: Additional specific criteria for the classification of Measured and Indicated Mineral Resources

Deposit	Criteria				Domain	Comment
	Search pass	No. of samples	Slope of regression	Drill spacing		
A2N East	1	6	0.7		10, 11, 12, 13, 14, 15, 17	
A2N Middle	1	6	0.5 to 0.7		2.1, 2.2, 2.3, 2.4, 2.5	Measured Mineral Resources restricted to Domains 2.1 and 2.2 and Slope of Regression >0.7.
Gassore	1	4	0.8	20 m x 20 m	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	Indicated Mineral Resources defined using a wireframe created around blocks where SLOPE>0.8 and blocks estimated in first search pass. Remainder Inferred within resource shell.
Netiana	1	10	0.5 to 0.7		1, 2, 3, 4	Measured Mineral Resources restricted to Domains 1, 2 and 3, with a slope of regression greater than 0.6. Measured Mineral Resources have also been defined 10m below the current pit surface, representing two mining benches.

Figure 14-54 to Figure 14-57 shows the classified block models in 3D view, alongside the constraining resource shells.

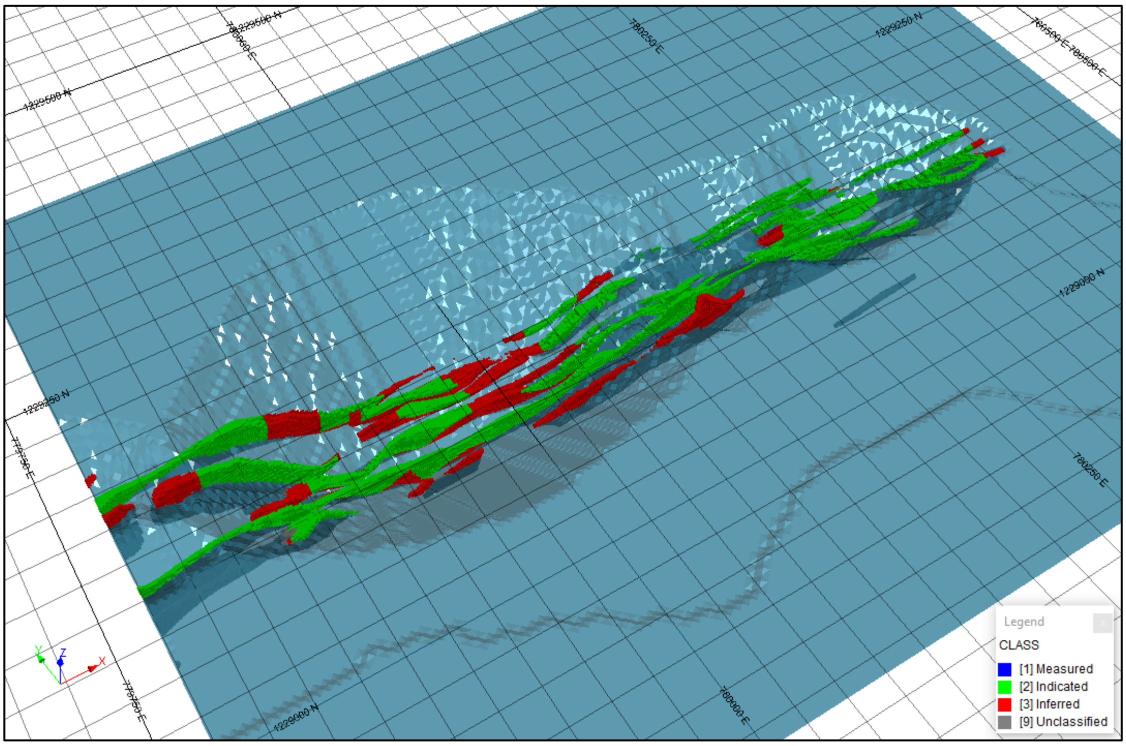


Figure 14-54: Youga A2N East – 3D view of the classified Mineral Resource and constraining US$1,500 resource shell

Note: Unclassified material in grey (falls outside resource shell). View towards northeast.

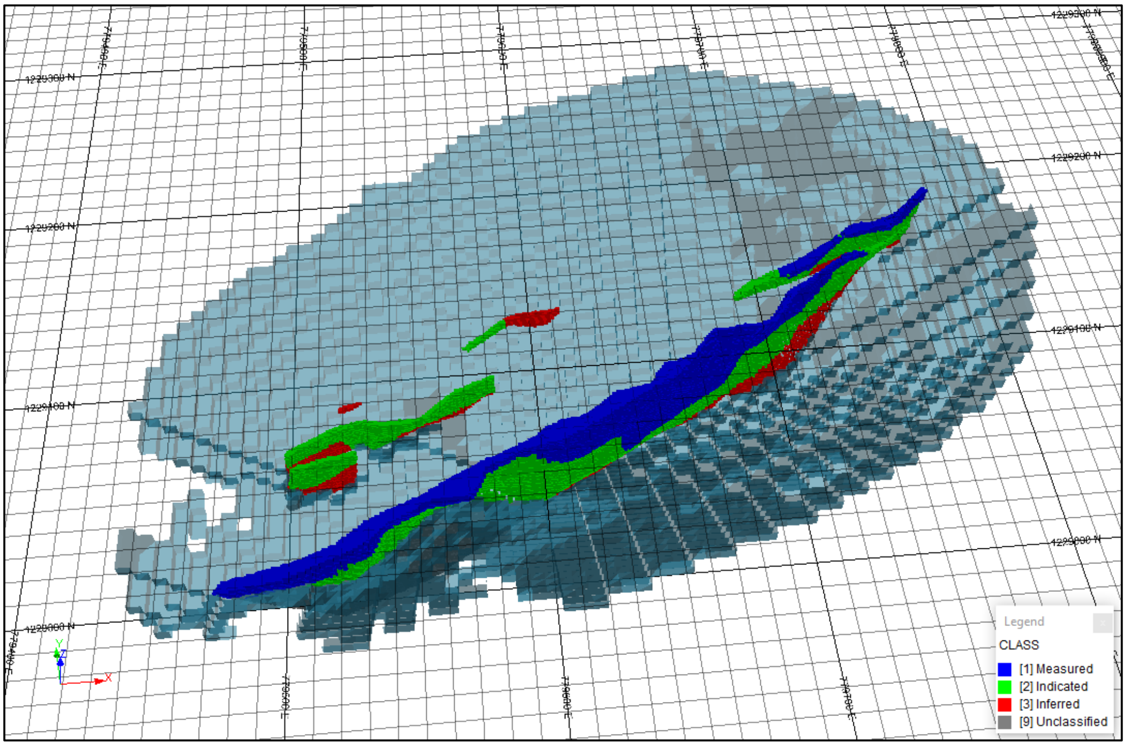


Figure 14-55: Youga A2N Middle – 3D view of the classified Mineral Resource and constraining US$1,500 resource shell

Note: Unclassified material in grey (falls outside resource shell). View towards northeast.

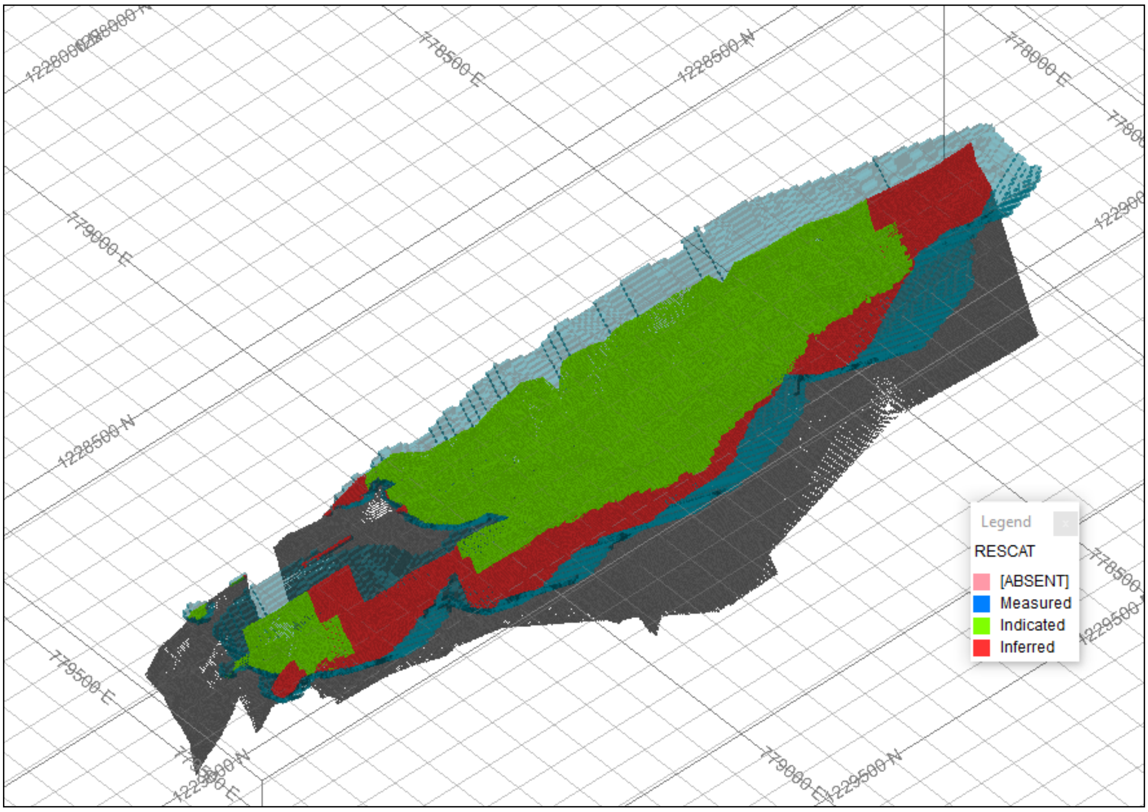


Figure 14-56: Youga Gassore – 3D view of the classified Mineral Resource and constraining US$1,500 resource shell

Note: Unclassified material in grey (falls outside resource shell). View towards northeast.

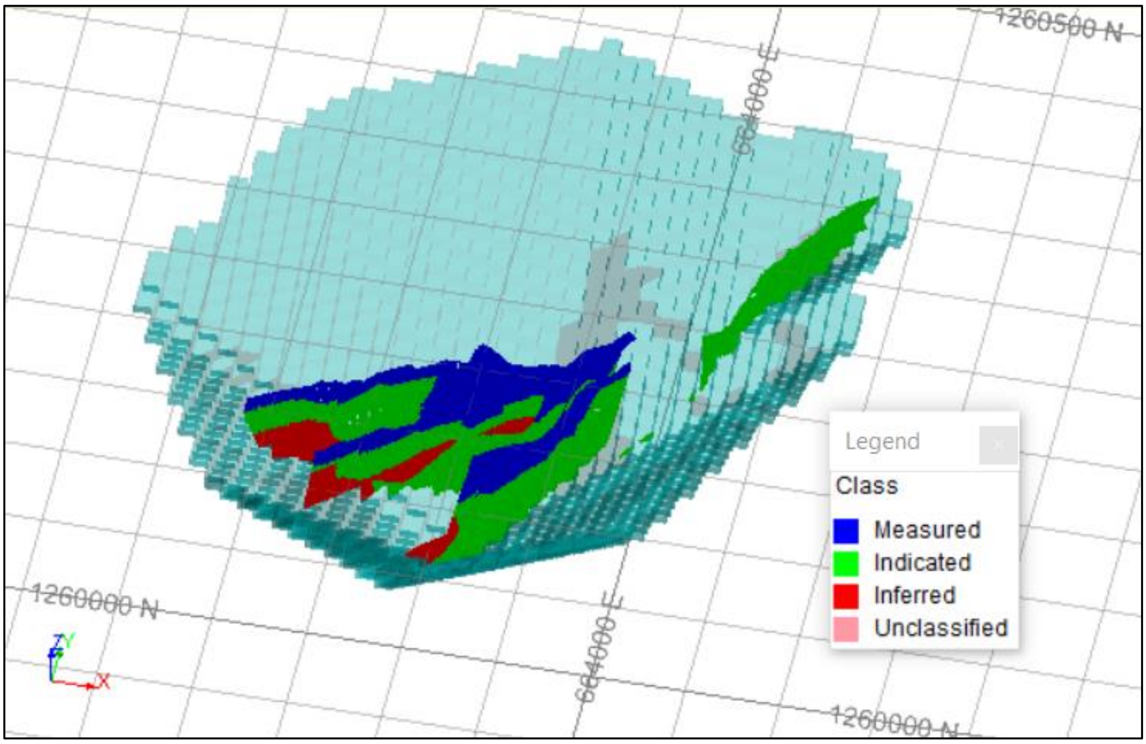


Figure 14-57: Netiana – 3D view of the classified Mineral Resource and constraining US$1,500 resource shell

14.8 Mineral Resource Statement

The MRE is shown in Table 14-33 as at 31 December 2017. The MRE compiled by CSA Global has been classified and is reported as Measured Mineral Resources, Indicated Mineral Resources and Inferred Mineral Resources under the guidelines of the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council, and procedures for classifying the reported Mineral Resources were undertaken within the context of the Canadian Securities Administrators NI 43-101.

Table 14-33: Youga, Ouaré and Balogo Gold Deposits – MRE, reported at a 0.55 g/t Au cut-off, 31 December 2017

Deposit	Measured			Indicated			Measured and Indicated			Inferred		
	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)	Tonnes (Mt)	Au grade (g/t)	Au metal (koz)
Main Pit	-	-	-	2.96	1.53	145.6	2.96	1.53	145.6	0.8	1.4	36
Zergoré	-	-	-	2.57	1.2	99.1	2.57	1.20	99.1	1	1.2	39
NTV	-	-	-	1.88	1.1	66.6	1.88	1.10	66.6	1.5	1.3	61
A2N East	-	-	-	0.21	1.38	9.2	0.21	1.38	9.2	0.1	1.6	6
A2N Middle	0.08	5.52	14	0.09	5.6	16.6	0.17	5.56	30.6	0	6	5
Gassore	-	-	-	1.2	3.89	150.3	1.2	3.89	150.3	0.5	4	62
East Pit	-	-	-	0.68	1.55	33.8	0.68	1.55	33.8	0	1.2	2
West Pit 3	-	-	-	0.64	1.53	31.5	0.64	1.53	31.5	0.2	1.2	7
West Pit 2	-	-	-	0.57	1.46	26.8	0.57	1.46	26.8	0.2	1.5	8
West Pit 4	-	-	-	0.34	1.53	16.6	0.34	1.53	16.6	0.4	0.9	13
West Pit 1	-	-	-	-	-	-				0.1	1.6	5
LeDuc	-	-	-	-	-	-				1	1	34
Ouaré	-	-	-	5.1	1.39	228.3	5.1	1.39	228.3	7.2	1.8	406
Netiana (Balogo pit)	0.16	9.81	49	0.16	6.98	36.8	0.32	8.40	85.8	0	2.2	2
Total	**0.24**	**8.2**	**63**	**16.4**	**1.63**	**861.1**	**16.64**	**1.73**	**924.2**	**13**	**1.7**	**685**

Notes:

- *Reporting cut-off is 0.55 g/t Au for all deposits.*
- *The MRE has been depleted for mining up to 31 December 2017. The effective date of the Mineral Resource is December 2017.*
- *Figures have been rounded to the appropriate level of precision for the reporting of Resources.*
- *Due to rounding, some columns or rows may not compute exactly as shown.*
- *The Mineral Resources are stated as in situ dry tonnes. All figures are in metric tonnes.*
- *The Mineral Resource has been classified under the guidelines of the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council, and procedures for classifying the reported Mineral Resources were undertaken within the context of the Canadian Securities Administrators NI 43-101.*
- *The model is reported above a surface based on the NPVS shell from a US$1,500 gold price pit optimisation run to support assumptions relating to reasonable prospects of eventual economic extraction.*
- *Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. The estimate of Mineral Resources may be materially affected by environmental, permitting, legal, title, taxation, socio-political, marketing, or other relevant issues.*
- *Mineral Resources have been reported inclusive of Mineral Reserves, where applicable.*
- *No Mineral Reserves have been estimated for the Ouaré, West Pit 1 and LeDuc deposits.*
- *Those deposits shown in **bold** are those updated as part of this study. All other areas remain current from 2017.*

The grade vs. tonnage curves for the Measured Mineral Resources, Indicated Mineral Resources and Inferred Mineral Resource categories of each deposit are shown in Figure 14-58 to Figure 14-61.

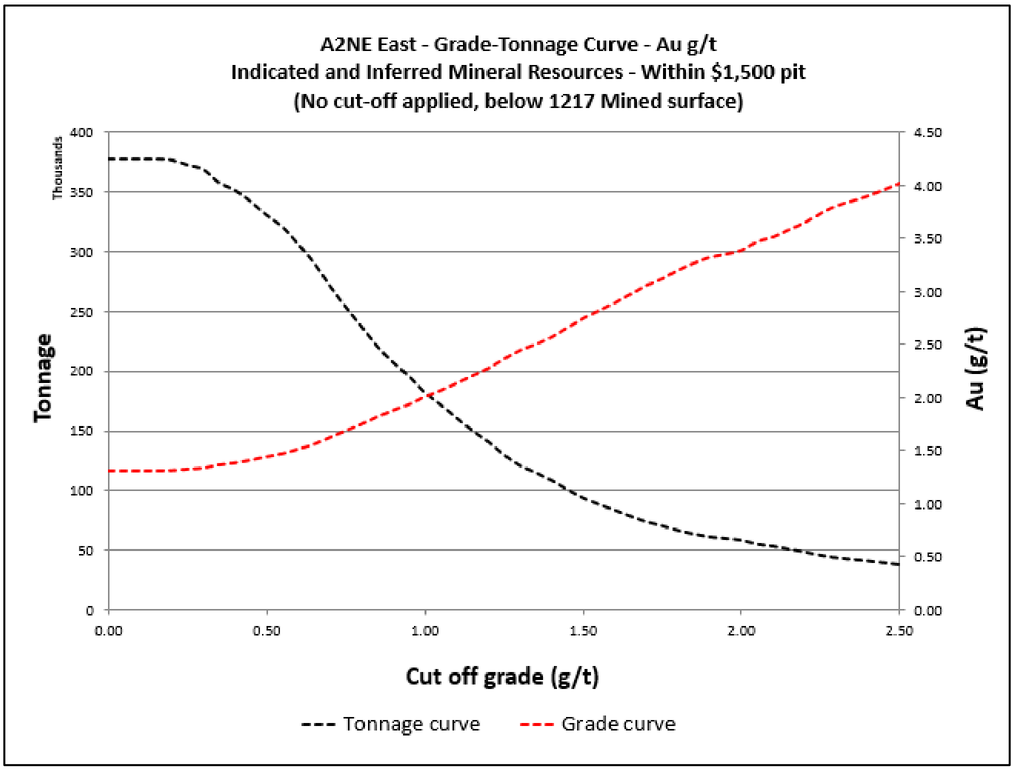


Figure 14-58: Youga A2N East grade-tonnage curve

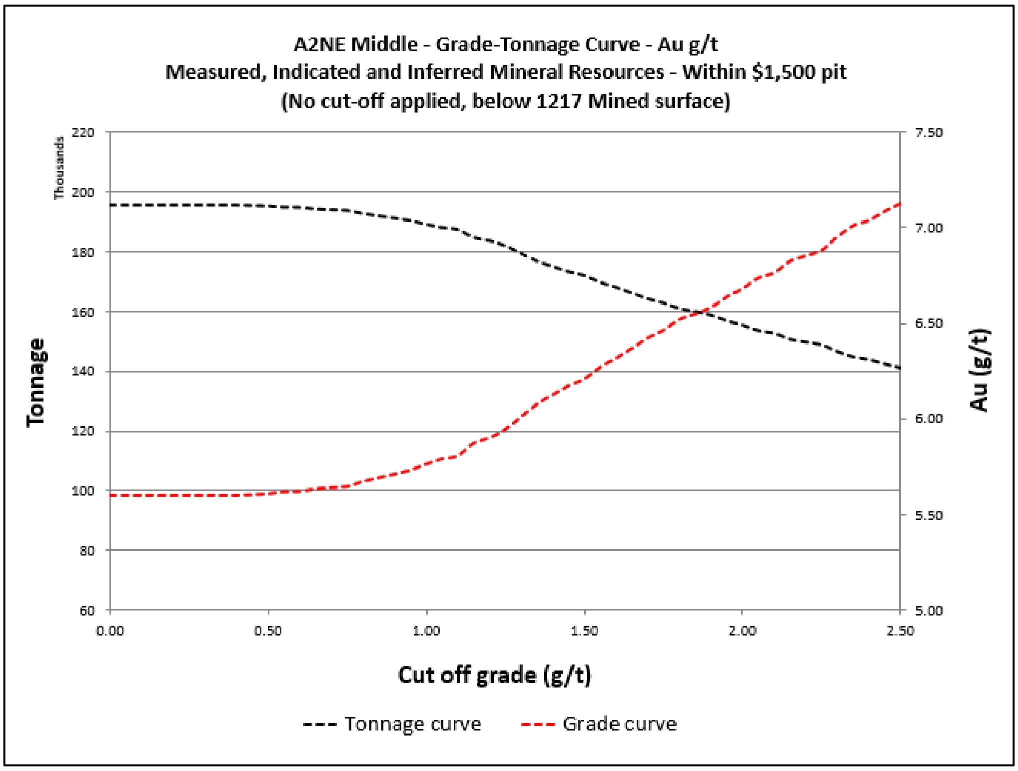


Figure 14-59: Youga A2N Middle grade-tonnage curve

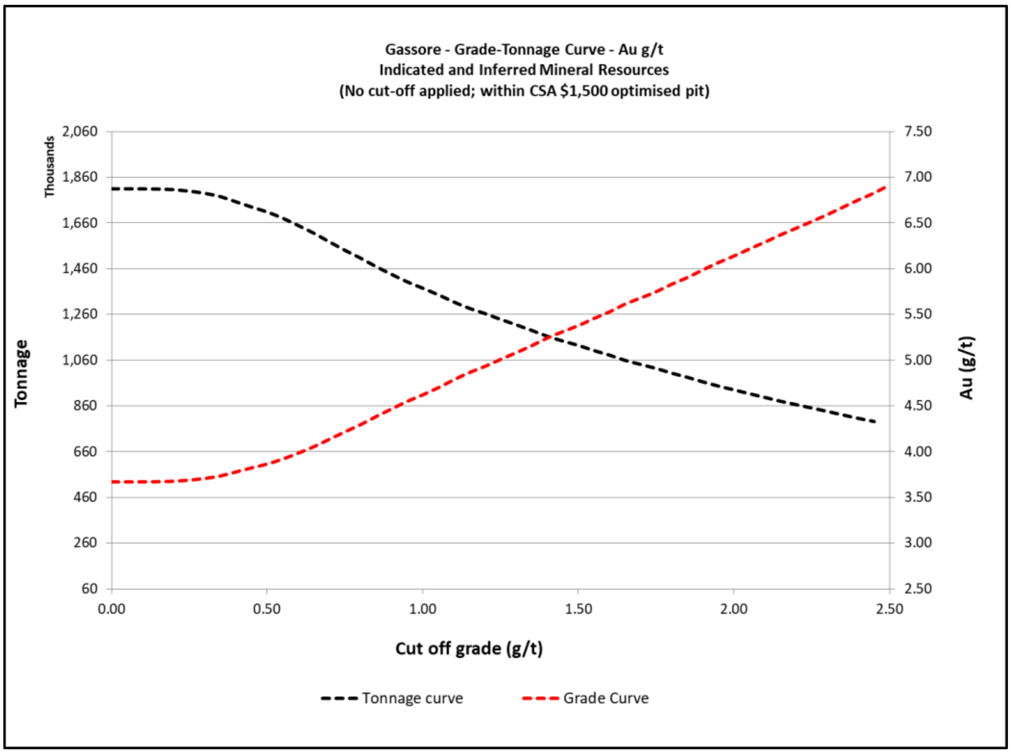


Figure 14-60: Youga Gassore grade-tonnage curve

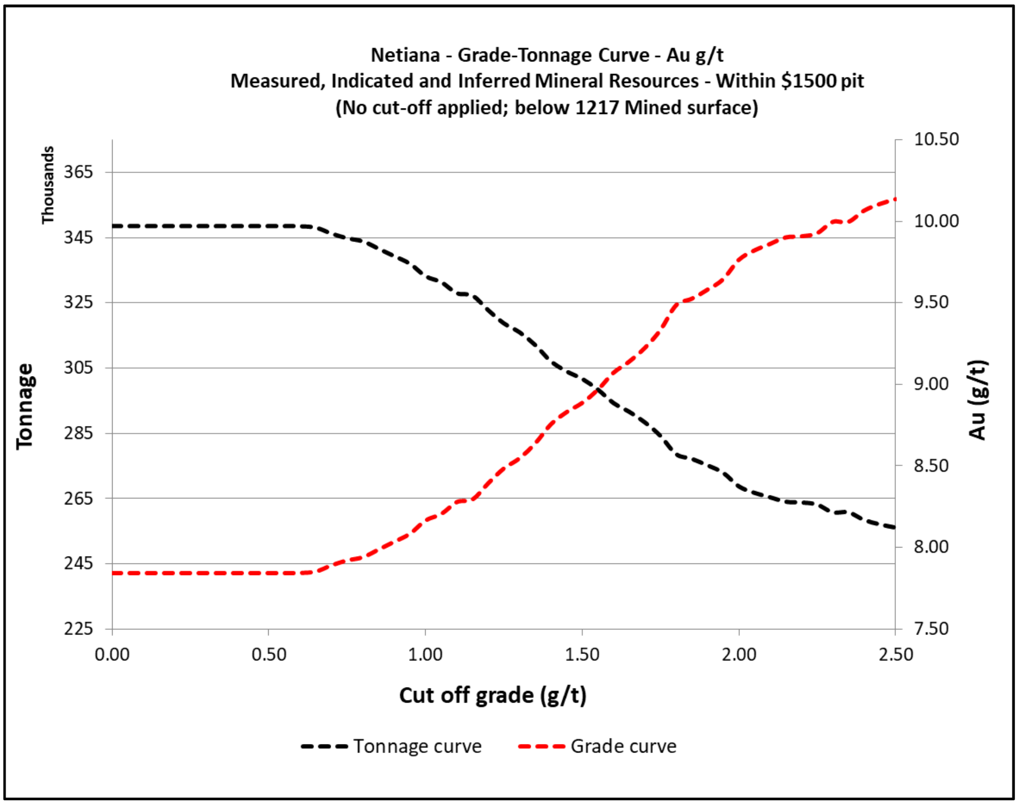


Figure 14-61: Netiana grade-tonnage curve

14.9 Comparison with Previous Estimates

The previous Mineral Resource estimation for the Youga and Balogo deposits was completed by CSA Global, effective 28 February 2017. The Mineral Resource statement from February 2017, December 2017 and percentage differences between the respective deposits updated in this study, are presented in Table 14-34.

Measured Mineral Resources for the December 2017 MRE have been classified at A2N Middle, which is a departure from the February 2017 MRE for Youga and Ouaré where no Measured Mineral Resources were classified.

Increases in the Mineral Resource inventory is due to infill drilling completed since the February 2017 MRE.

Table 14-34: Youga MRE comparison – 28 February 2017 vs. 31 December 2017

Deposit	Model	Measured			Indicated			M&I			Inferred			TOTAL		
		kt	Au g/t	koz	kt	Au g/t	koz	kt	Au g/t	koz	kt	Au g/t	koz	kt	Au g/t	koz
A2N East, A2N Middle and Gassore	MRE Feb 2017				858	1.98	55	858	1.98	55	507	1.75	29	1,365	1.9	83
	MRE Dec 2017	79	5.52	14	1,501	3.65	176	1,580	3.74	190	616	3.6	72	2,197	3.71	262
	% Difference				75%	84%	220%	84%	89%	245%	21%	106%	148%	61%	95%	216%
Balogo	MRE Feb 2017				450	6.75	99	450	6.75	99	100	4.0	15	550	6.45	114
	MRE Dec 2017	156	9.81	49	164	6.98	37	320	8.36	86	29	2.18	2	349	7.84	88
	% Difference				-64%	3%	-63%	-29%	24%	-13%	-71%	-46%	-87%	-37%	22%	-23%
TOTAL	**MRE Feb 2017**				**16,045**	**1.55**	**802**	**16,045**	**1.55**	**802**	**13,018**	**1.56**	**654**	**29,063**	**1.56**	**1,456**
	MRE Dec 2017	**235**	**8.2**	**63**	**16,401**	**1.63**	**861**	**16,636**	**1.73**	**924**	**13,057**	**1.70**	**685**	**29,694**	**1.71**	**1,611**
	% Difference				**2%**	**5%**	**8%**	**4%**	**11%**	**15%**	**0%**	**9%**	**5%**	**2%**	**10%**	**11%**

Note: Reported at 0.55 g/t Au, A2NE February 2017 MRE has been compared to a total value for the 2018 updated A2N East, A2N Middle and Gassore Mineral Resources. Totals may not add directly in table due to rounding errors.

15 Mineral Reserves

15.1 Key Assumptions

The Mineral Reserves for Youga, Ouaré and Balogo-Netiana (which includes unchanged Mineral Reserves disclosed in 2017 as well as updated Mineral Reserves over those deposits with updated Mineral Resources (see Section 14), are supported by an updated LOM plan, which was developed using the following key parameters.

15.1.1 Pit Slopes

The overall slope angle (OSA) for the Youga, Ouaré and Netiana open pit was set to 38° for the weathered material (Regolith and Oxide) and 45° for the Transition and Fresh material. These material types were coded into the block model.

15.1.2 Metal Price and Selling Cost

The pit limit design and Reserve estimate are based on a metal price of US$1,300/Troy oz. A deduction of 4% was made to account for royalty payments. An additional refining cost of US$4.82/oz has been allowed for in the pit optimisation.

15.1.3 Operating Costs

The waste and ore-based costs applied for the Youga pit optimisation and mine planning were based on a combination of a Mine Cost model developed by CSA Global and the 2018 Budget costs supplied by Avesoro Holdings. The mining cost (exclusive of ore control, geology, lab services, and inclusive of a mining equipment-sustaining capital allowance) was US$1.76/t. The total ore-based costs (including processing and G&A) are US$24.84/t ore.

Ouaré ore-based costs include an additional US$4.0/t overland ore haulage cost from Ouaré to the processing plant at Youga.

For Netiana, the waste and ore-based costs applied for pit optimisation and mine planning were based on a combination of a Mine Cost model developed by CSA Global and the 2018 Budget costs supplied by Burkina Mining Company S.A, and Avesoro Resources Inc. (Avesoro). The mining cost (exclusive of ore control, geology, lab services, and inclusive of a mining equipment-sustaining capital allowance) was US$1.48/t. The total ore-based costs (including processing and G&A) are US$22.93/t ore. Netiana ore-based costs include an additional US$13.87/t overland ore haulage cost from Netiana to the processing plant at Youga.

15.1.4 Pit Optimisation and Phase Design

The standard Lerch-Grossman pit optimisation was run to determine the economic limits for the deposit. The block value for ore was estimated from the revenue and costs discussed above and Inferred Resources were treated as waste.

The resource models for Netiana, Gassore, A2N Middle pit (formerly called A2NE) and A2NW were all depleted to 31 December 2017.

A series of pit shells were determined by varying the Price Factor in equal incremental steps. The pit limit was selected at a Price Factor of 100% (US$1,300/oz) to maximise the Reserve and a set of pushbacks were constructed based on the shells. Suitable minimum mining widths and practical ramp access constraints were applied in the selection of the pushbacks.

15.1.5 Mining Recovery and Dilution

Modifying factors for the Gassore, A2N East and A2N Middle Pit included a 95% mining recovery (i.e. 5% ore loss) and 10% at 0 g/t Au waste dilution in the estimate of the Mineral Reserves. The Ore Reserves at the Zergoré, West Pit 2, West Pit 3, West Pit 4, Main Pit, East Pit, NTV and Ouaré were unchanged from the 2017 Ore Reserve statement and utilised a 90% mining recovery (i.e. 10% ore loss) and 10% at 0 g/t Au waste dilution.

The modifying factors were based on relevant mining experience at Youga and the typical configuration of the mineralised zones. It is assumed that the mining method chosen for Ouaré supports the assumptions regarding selective mining to minimise ore loss and waste dilution.

At Netiana, modifying factors of 95% mining recovery and 5% waste dilution were included in the estimate of the Mineral Reserves. These were based on relevant mining experience at Youga and the geological recommendation of the expected skin dilution and ore loss from the discretisation of the 1 m x 1 m x 1 m resource block model. It is assumed that the mining method chosen for Netiana supports the assumptions regarding selective mining to minimise ore loss and waste dilution.

15.1.6 Metallurgical Recovery

A metallurgical recovery of 91% was used in the pit optimisation process.

15.1.7 Other Costs

An additional 1% of gold price (equivalent to US$13.0/oz discount) has been allowed for the provision of Community and Social Responsibility (CSR) commitments.

15.1.8 Conversion Factors from Mineral Resource to Mineral Reserve

Mineral Reserves have been modified from Mineral Resources by considering geological, mining, processing, and economic parameters and permitting requirements, and are therefore classified in accordance with the CIM Definition Standards for Mineral Resources and Mineral Reserves.

15.2 Mineral Reserve Statement

The Mineral Reserve for Youga and Ouaré (Table 15-1) and the Mineral Reserves for Netiana (Table 15-2) were converted from the Mineral Resource using the modifying factors discussed in Section 16. Mineral Reserves are classified as Proved based on a resource classification of Measured Mineral Resources, and Probable based on a resource classification of Indicated Mineral Resources. Inferred and Unclassified Mineral Resources have been excluded from the conversion of Resources to Reserves.

Table 15-1: Youga and Ouaré converted Mineral Reserves

Ore Reserve estimated for the Youga and Ouaré gold projects, Burkina Faso, as at 31 December 2017										
Deposit	**Cut-off grade (g/t)**	**Proved**			**Probable**			**Total Ore Reserve**		
		Tonnes (Mt)	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**
A2N East	0.70	-	-	-	0.0	2.12	1.6	0.0	2.12	1.6
A2N Middle	0.70	0.1	5.02	13.3	0.1	5.04	12.4	0.2	5.03	25.7
Gassore	0.70	-	-	-	1.0	3.99	125.0	1.0	3.99	125.0
Zergoré	0.70	-	-	-	1.5	1.22	57.1	1.5	1.22	57.1
West Pit 2	0.70	-	-	-	0.4	1.34	15.8	0.4	1.34	15.8
West Pit 3	0.70	-	-	-	0.4	1.61	20.2	0.4	1.61	20.2
West Pit 4	0.70	-	-	-	0.3	1.53	12.9	0.3	1.53	12.9
Main Pit	0.70	-	-	-	1.3	1.63	66.6	1.3	1.63	66.6
East Pit	0.70	-	-	-	0.5	1.47	22.4	0.5	1.47	22.4
NTV	0.70	-	-	-	1.2	1.07	41.6	1.2	1.07	41.6
Ouaré	0.82	-	-	-	2.6	1.67	141.4	2.6	1.67	141.4
Total (exc. stockpiles)		**0.1**	**5.02**	**13.3**	**9.1**	**1.76**	**517.0**	**9.2**	**1.79**	**530.3**
ROM LG stockpiles		-	-	-	0.2	1.14	6.3	0.2	1.14	6.3
ROM LLG stockpiles		-	-	-	1.4	0.73	32.8	1.4	0.73	32.8
Total (inc. stockpiles)		**0.1**	**5.02**	**13.3**	**10.7**	**1.61**	**556.2**	**10.8**	**1.64**	**569.5**

Notes:

- *The Ore Reserve has been depleted for mining up to 31 December 2017.*
- *Figures have been rounded to the appropriate level of precision for reporting.*
- *Due to rounding, some columns or rows may not compute exactly as shown.*
- *The Ore Reserves are stated as in-situ dry metric tonnes.*
- *The Ore Reserves were prepared under the guidelines of the CIM, for reporting under NI 43-101.*
- *The Ore Reserve is reported at a US$1,300/oz gold price.*
- *Modifying factors of 95% mining recovery and 10% at 0 g/t Au waste dilution have been applied to A2N East, Gassore and A2N Middle.*
- *Modifying factors of 95% mining recovery and 5% at 0 g/t Au waste dilution have been applied to all other pits,*
- *An Ore Reserve cut-ff of 0.7 g/t has been used for all pits except at Ouaré where the cut-off is 0.82 g/t due to additional ore transportation costs,*
- *Proved Ore Reserves were derived from Measured Mineral Resources, and Probable Ore Reserves were derived from Indicated Mineral Resources.*
- *Ore Reserves are inclusive of Mineral Resources.*
- *There are no known legal, political, environmental, or other risks that could materially affect the potential Ore Reserves.*
- *Additional marginal grade surface stocks of 6.7 kt at 0.62 g/t Au not included in ROM stockpile stated in tabulation.*

Table 15-2: Netiana converted Mineral Reserves

Ore Reserve estimated for the Youga and Ouaré gold projects, Burkina Faso, as at 31 December 2017										
Deposit	**Cut-off grade (g/t)**	**Proved**			**Probable**			**Total Ore Reserve**		
		Tonnes (Mt)	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**
Netiana	1.10	0.2	8.88	45.9	0.2	5.91	31.8	0.3	7.36	77.7
Total (exc. stockpiles)		0.2	8.88	45.9	0.2	5.91	31.8	0.3	7.36	77.7
ROM stockpiles (LG, MG, HG)		-	-	-	0.1	7.12	13.0	0.1	7.12	13.0
Total (inc. stockpiles)		**0.2**	**8.88**	**45.9**	**0.2**	**6.21**	**44.8**	**0.4**	**7.32**	**90.6**

Notes:

- *The Ore Reserve has been depleted for mining up to 31 December 2017.*
- *Figures have been rounded to the appropriate level of precision for reporting.*
- *Due to rounding, some columns or rows may not compute exactly as shown.*
- *The Ore Reserves are stated as in-situ dry metric tonnes.*
- *The Ore Reserves were prepared under the guidelines of the CIM, for reporting under NI 43-101.*
- *The Ore Reserve is reported at a US$1,300/oz gold price.*
- *Modifying factors for mining recovery of 95% and waste dilution of 5% at 0g/t Au have been applied.*
- *An Ore Reserve cut-off grade of 1.1 g/t has been used for Netiana.*
- *Proved Ore Reserves were derived from Measured Mineral Resources, and Probable Ore Reserves were derived from Indicated Mineral Resources.*
- *Ore Reserves are inclusive of Mineral Resources.*
- *There are no known legal, political, environmental, or other risks that could materially affect the potential Ore Reserves.*

Table 15-3: Total combined Mineral Reserve inventory, prepared in accordance with CIM guidelines, as at 31 December 2017

Mineral Reserve estimated for the Youga Gold Mine, Burkina Faso, as at 31 December 2017										
Deposit	**Cut-off grade (g/t)**	**Proved**			**Probable**			**Total Mineral Reserve**		
		Tonnes (Mt)	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**	**Tonnes (Mt)**	**Au grade (g/t)**	**Au metal (koz)**
Balogo	1.10	0.2	8.88	45.9	0.2	5.91	31.8	0.3	7.36	77.7
A2NE	0.70	-	-	-	0.0	2.12	1.6	0.0	2.12	1.6
Mid Pit (A2NW)	0.70	0.1	5.02	13.3	0.1	5.04	12.4	0.2	5.03	25.7
Gassore	0.70	-	-	-	1.0	3.99	125.0	1.0	3.99	125.0
Zergoré	0.70	-	-	-	1.5	1.22	57.1	1.5	1.22	57.1
West Pit 2	0.70	-	-	-	0.4	1.34	15.8	0.4	1.34	15.8
West Pit 3	0.70	-	-	-	0.4	1.61	20.2	0.4	1.61	20.2
West Pit 4	0.70	-	-	-	0.3	1.53	12.9	0.3	1.53	12.9
Main Pit	0.70	-	-	-	1.3	1.63	66.6	1.3	1.63	66.6
East Pit	0.70	-	-	-	0.5	1.47	22.4	0.5	1.47	22.4
NTV	0.70	-	-	-	1.2	1.07	41.6	1.2	1.07	41.6
Ouaré	0.82	-	-	-	2.6	1.67	141.4	2.6	1.67	141.4
Total (exc. stockpiles)		**0.3**	**7.59**	**59.2**	**9.3**	**1.83**	**548.8**	**9.7**	**1.97**	**608.0**
ROM stockpiles (LG, MG, HG) – Balogo		-	-	-	0.1	7.12	13.0	0.1	7.12	13.0
ROM LG stockpiles – Youga		-	-	-	0.2	1.14	6.3	0.2	1.14	6.3
ROM LLG stockpiles – Youga		-	-	-	1.4	0.73	32.8	1.4	0.73	32.8
Total (inc. stockpiles)		**0.3**	**7.59**	**59.2**	**10.9**	**1.71**	**600.9**	**11.2**	**1.84**	**660.1**

Notes:

- *The Mineral Reserves have been depleted for mining up to 31 December 2017.*
- *Figures have been rounded to the appropriate level of precision for reporting.*
- *Due to rounding, some columns or rows may not compute exactly as shown.*
- *The Mineral Reserves are stated as dry metric tonnes.*
- *The Mineral Reserves were prepared under the guidelines of the CIM, for reporting under NI 43-101.*
- *The Mineral Reserve is reported at a US$ 1,300/oz gold price.*

- *A cut-off grade of 0.70 g/t Au was applied to all the Youga deposits.*
- *A cut-off grade of 0.82 g/t Au was applied to the Ouaré deposit.*
- *A cut-off grade of 1.10 g/t Au was applied to Netiana.*
- *Modifying factors for mining recovery of 95% and waste dilution of 10% at 0 g/t Au have been applied to A2NE, A2N Middle Pit and Gassore.*
- *Modifying factors for mining recovery of 95% and waste dilution of 5% at 0 g/t Au have been applied to Balogo.*
- *Modifying factors for mining recovery of 90% and waste dilution of 10% at 0 g/t Au have been applied to all other deposits*
- *Probable Mineral Reserves were derived from Indicated Mineral Resources.*
- *Mineral Reserves are inclusive of Mineral Resources.*
- *There are no known legal, political, environmental, or other risks that could materially affect the Mineral Reserves.*
- *An additional marginal grade ROM stockpile of 6.7 kt at 0.62 g/t Au was not included.*

15.3 Factors Affecting the Mineral Reserve Estimate

Factors that may affect the Mineral Reserve estimates include dilution; metal prices; refining, and shipping terms; metallurgical recoveries and geotechnical characteristics of the rock mass; capital and operating cost estimates; and effectiveness of surface and groundwater management.

The Qualified Persons are of the opinion that these potential modifying factors have been adequately accounted for using the assumptions in this report, and therefore the Mineral Resources within the mine plan can be converted to Mineral Reserves. Factors that may affect the assumptions in this report are:

- Commodity price and exchange rate assumptions are important factors that affect revenue and costs.
- Changes in process cost, mining cost or slope angle (±10%) generally have a relatively small impact (less than 5%) on the estimate of contained metal and confirm that the pit limits are not as sensitive to these parameters as they are to price. This is evident when you look at the plot of cumulative rock tonnes vs. price, which shows an almost linear relationship in the range US$750 to US$1,300/oz.
- The mine plan has initially been limited by an assumed annual mill throughput of 1.2 Mt/a, with an uplift of 8% in 2018 with the addition of the oxygen plant. Mill throughput may prove to be higher or lower than this depending on the ore type. This is particularly relevant to the new deposits such as Netiana and Ouaré, as bulk metallurgical tests have not been carried out yet.
- If certain rock types or blends of rock types, have lower throughputs than currently modelled, this would increase the processing cost, which would in turn increase the mill cut-off grade. If all other things held constant, this would tend to reduce the tonnage of the Mineral Reserve and the amount of contained metal. If throughput reductions are significant, this could reduce the size of the economic pit limits, further reducing the Mineral Reserve. Furthermore, a reduction in throughput would delay cash flow, resulting in a negative impact on Project economics.
- Effective surface and groundwater management is important to the safety and productivity of the mining operation. Although this is only really an issue during the rainy season, if the currently planned water management methods prove to be inadequate, additional sumps and pump systems may be required. This would add to the capital and operating costs, resulting in a negative impact on Project economics and a potential reduction in the Mineral Reserves.
- Transport of ore between the Ouaré and Balogo projects and the process plant at Youga is a key part of the plan and relies on the efficient planning of the transport route, good road maintenance and proactive management of community relations. The 44 km route from Ouaré will potentially pass near to existing villages, and 154 km route from Balogo passes through many villages, and there is a high risk of road traffic accidents. Major public unrest due to injury or fatality could disrupt the transport of ore to Youga. Additional comment regarding this risk is highlighted in Section 20.7.

16 Mining Methods

16.1 Mining Method

The proposed method of mining for Youga, Ouaré and Netiana (Balogo) is a conventional open pit method using drilling and blasting, loading with excavators, and hauling with articulated dump trucks. The ore will be extracted by small hydraulic excavator (30–40 t) to maximise selectivity where the orebody is narrow, and the waste will be loaded by slightly larger hydraulic excavators (70–80 t) to allow for higher productivity.

There is potential for additional Mineral Resources to be exploited by open pit mining methods, although this is dependent on improved project economics and/or reclassification of the Inferred Resources through additional drilling. Consideration of underground mining has not been necessary at this stage of the Project, although if mineralisation were found to continue at depths beyond economic open pit limits then this could be considered in the future.

The evaluation of Youga, Ouaré and Netiana assumes that the ore will be transported to the main processing facility at Youga. The optimal production rate is therefore constrained by the capacity of this plant, which is nominally set at 1.2 Mt/a. However, provision is made for the addition of an oxygen plant in January 2018, which will increase the plant throughput by 8% to 1.2 Mt/a.

At Netiana, consideration also has to be given to the maximum vertical advance rate as the pit limit at surface is relatively small in area and the pit extends to a depth of more than 100 m below topographic surface. The mining rate for Netiana was therefore constrained by a vertical advance rate of 90 m/stage.

The mining rate varies over the life of the mine, depending on the stripping ratio for the individual deposits or pits. Twelve independent mining areas have been identified at Youga, Ouaré and Balogo, namely:

- A2N East
- A2N Middle Pit (previously A2NW)
- Gassore
- Main and East Pit
- West Pit 2, 3 and 4
- Zergoré
- NTV
- Ouaré
- Netiana.

Note that the cut-off grade applied to each pit depends mainly on the location and transport cost. Other costs (processing, G&A etc.) were constant across all deposits.

16.2 Pit Optimisations

The open pits have been optimised using the geological models and MREs completed by CSA Global, as well as industry standard methods (pit shell selection, mine design, mine layout) that are based on criteria discussed in the following sections.

16.2.1 Optimisation Parameters and Inputs

Most of the pit limits for Youga and Ouaré were determined by using Datamine® NPVS (Datamine's pit "optimisation" software) except for Gassore and A2NE Middle West pit limits that were determined by using Whittle™ (Geovia) as well as Netiana. Both these software packages use the industry standard Lerchs-Grossman algorithm and have been shown to give near identical results.

The input values used in the determination of the pit limits and the development of the mine designs are presented in Table 16-1 for Youga and Ouaré, and Table 16-2 for Netiana. The outputs from NPVS and Whittle are used to select the pit limit for each deposit so that subsequent detailed design can be completed, as well as identifying options for subdivision of the pit into stages or pushbacks.

Table 16-1: Youga and Ouaré – open pit optimisation parameters

Parameter	Unit	Gassore	A2N Middle Pit
Start date		1 January 2018	1 January 2018
Overall slope angle – Weathered	OSA °	38	38
Overall slope angle – Transition/Fresh	OSA °	45	45
LOM metal price	US$/Troy oz	1,300	1,300
Royalty/Selling cost	%	4.0	4.0
Mining cost	US$/t mined	1.76	1.76
Processing cost	US$/t ore	17.42	17.42
Ore haulage to the plant	US$/t ore	0.15	0.15
G&A	US$/t ore	7.42	7.42
CSR cost	%	1	1
Refining charge	US$/oz	4.82	4.82
Process recovery	%	91	91
Mining recovery	%	95	95
Mining dilution	%	10	10
Bench height	m	10	10
Discount rate	%	5	5

Table 16-2: Netiana – open pit optimisation parameters

Parameter	Unit	Value
Start date		1 March 2018
Weathered	OSA °	38
Transition/Fresh	OSA °	45
LOM metal price	US$/tr Oz	1,300
Royalty/Selling cost	% of Au price	4.0
Mining cost	US$/t mined	1.48
Additional ore transport cost	US$/t ore	13.87
Processing cost	US$/t ore	17.42
G&A	US$/t ore	5.51
Refining cost	US$/oz refined	4.82
Process recovery	%	91
CSR	% of Au price	1
Discount rate	%	5
Mining recovery	%	95
Mining dilution	%	5
Bench height	m	10
Discount rate	%	5

At Youga and Ouaré, there is limited opportunity to create pushbacks or stages within a final pit limit and it has generally only been possible to divide the individual deposits into sub-pits that may or may not be contiguous. The A2N East pit is close to final depletion and the redesign consisted of final bench design and reporting. No optimisation was required for the A2N East pit.

In the case of Netiana, pushbacks or stages within the final pit limit was restricted by the practicalities of access space on a bench and it was only possible to subdivide the pit into two intermediate stages. The smaller starter pit allows the mining sequence to target high grade, low strip ratio material in the first year of production.

It should be noted that the discount rate used in the Lerchs-Grossman algorithm has no impact on the evaluation of the pit limit or internal pit shells, as the algorithm does not account for the time value of money.

16.2.2 Selling Price

The LOM metal price is based on the expected forecast of gold price in relation to the one, two and three-year trailing averages of daily historical gold prices for the period 2012 to 2018 (Figure 16-1). The price used in this study was US$1,300/Troy oz, which was agreed with Avesoro and CSA Global as an appropriate price to be used for determining the Mineral Reserves.

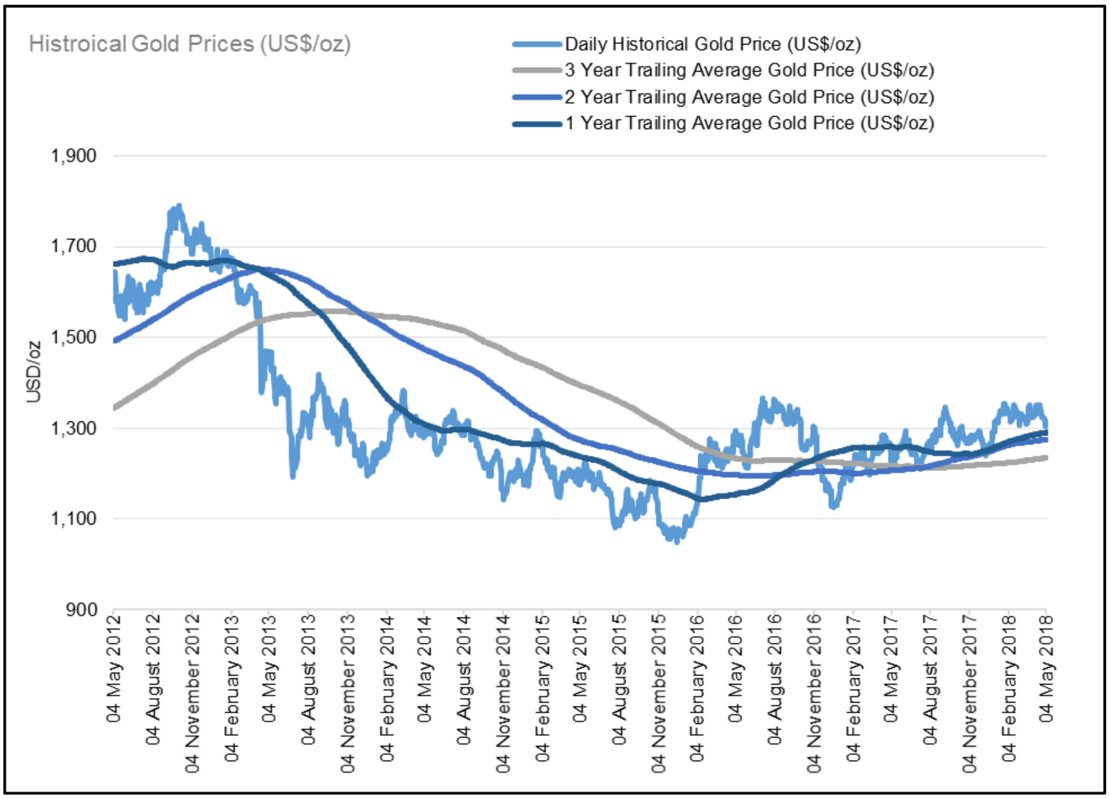


Figure 16-1: Gold spot price (2012 to 2018)

16.2.3 Pit Shell Selection

Using the parameters listed in Table 16-1 and Table 16-2, the optimal pit limit was selected at US$1,300/Troy oz (Price Factor of 1.0) in order to maximise the Mineral Reserve. Whilst there may be an opportunity to reduce the pit limits for individual deposits, it was generally found that the near linear relationship between contained metal and price meant that the optimal pit limit coincided with the pit limit at a Price or Revenue Factor of 1.0.

The results from the pit optimisation of the A2N Middle, Gassore and Netiana deposits are shown below in Figure 16-2 to Figure 16-4.

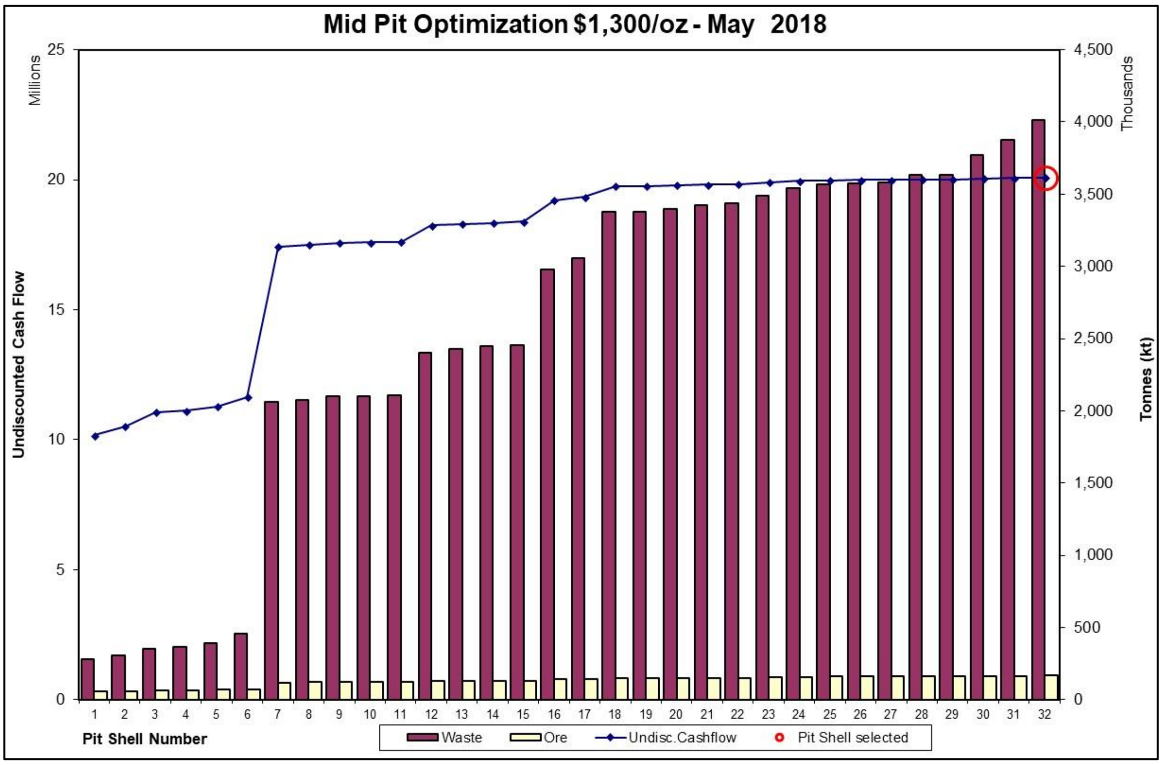


Figure 16-2: Pit optimisation results for A2N Middle pit (base case parameters)

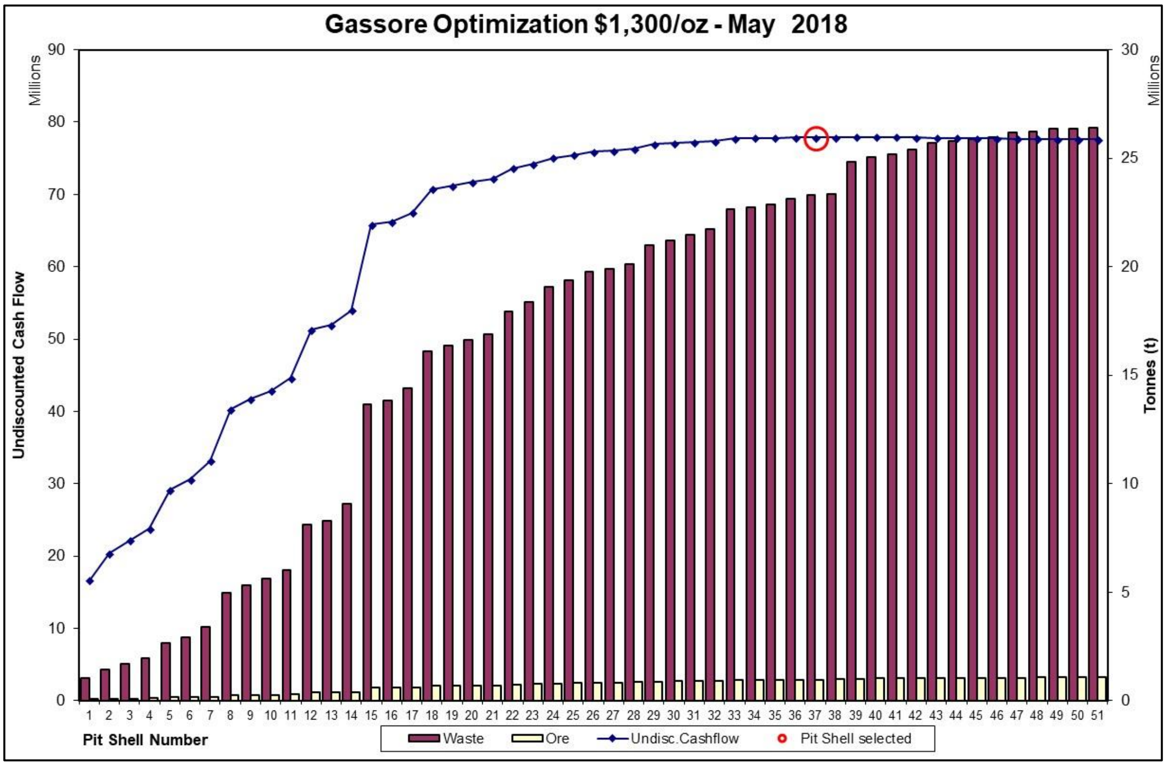


Figure 16-3: Pit optimisation results for Gassore pit (base case parameters)

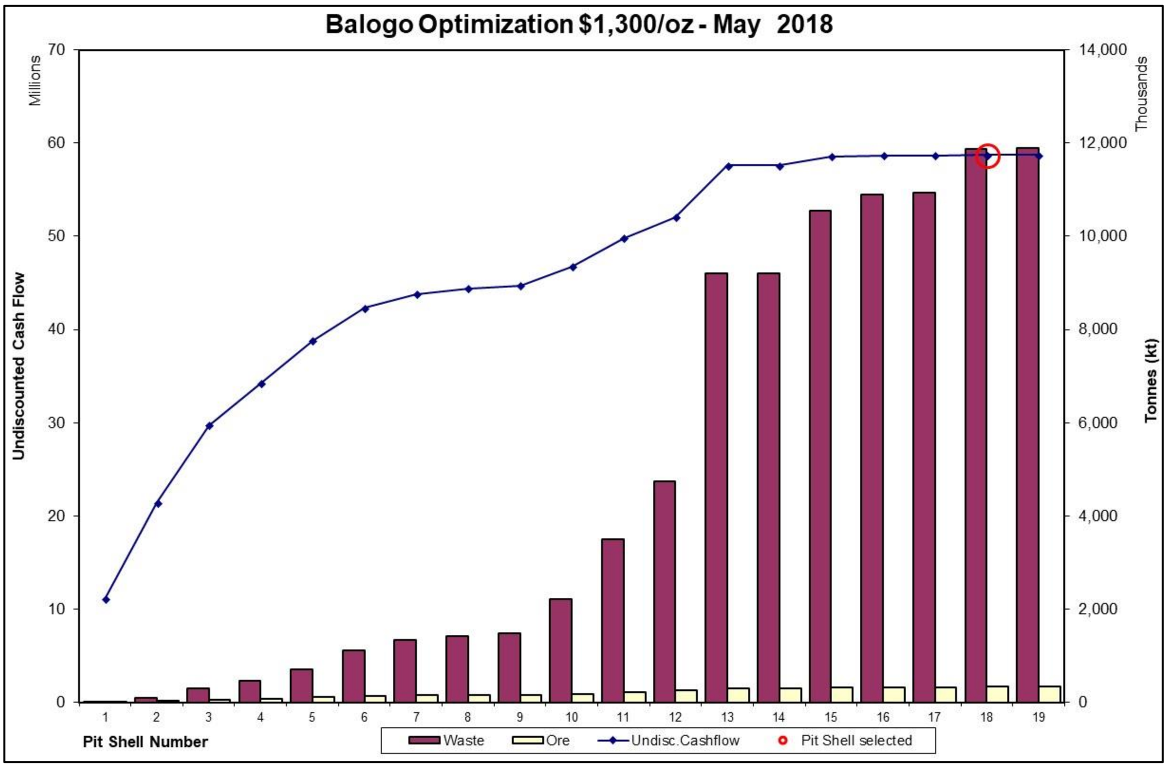


Figure 16-4: Graph of cumulative ore, waste and contained metal for Netiana (Balogo)

A reduction in the Netiana pit limit would have also limited the opportunity to create a starter pit, which would have meant that it would not have been possible to high grade in the early months. This was regarded as a key strategy in the development of Netiana.

Pit optimisations results for the remaining pits at Youga are presented below in Figure 16-5 to Figure 16-12 and have not materially change since the Q2 2017 optimisations.

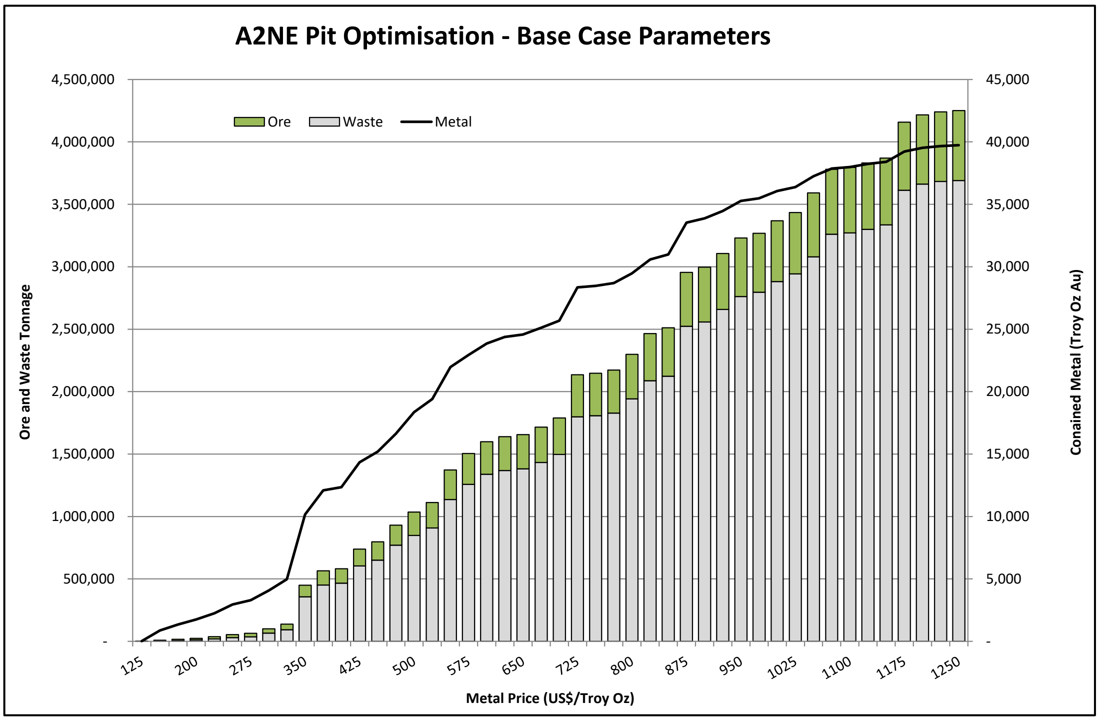


Figure 16-5: Graph of cumulative ore, waste and contained metal for A2N East

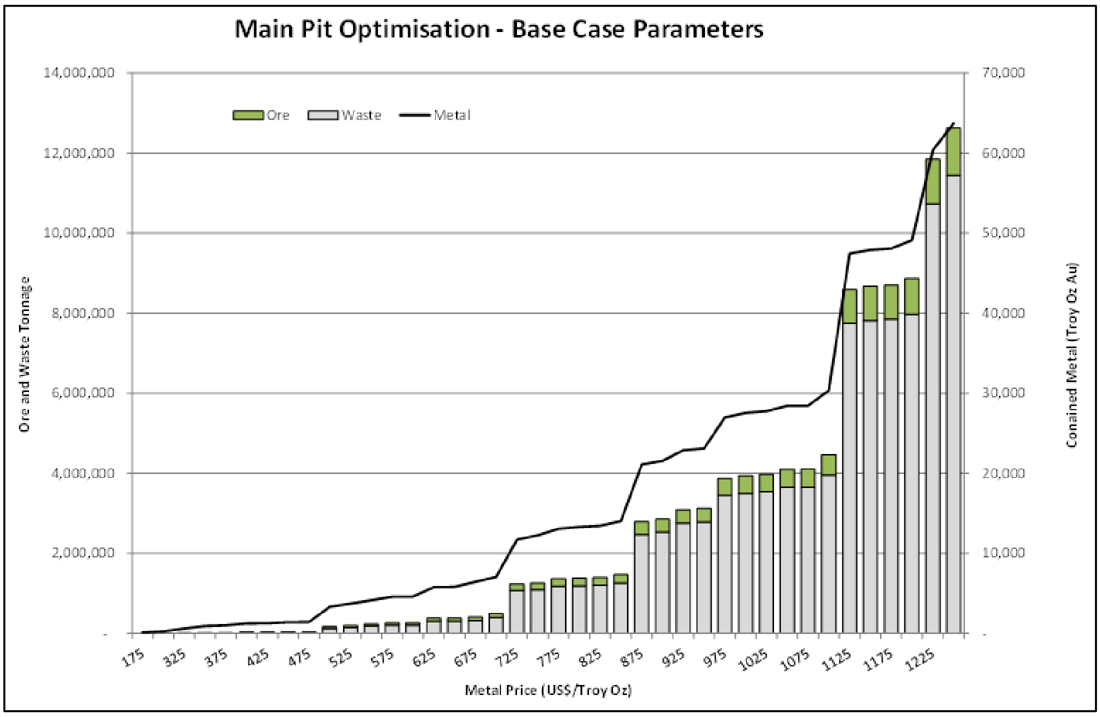


Figure 16-6: Graph of cumulative ore, waste and contained metal for Main Pit

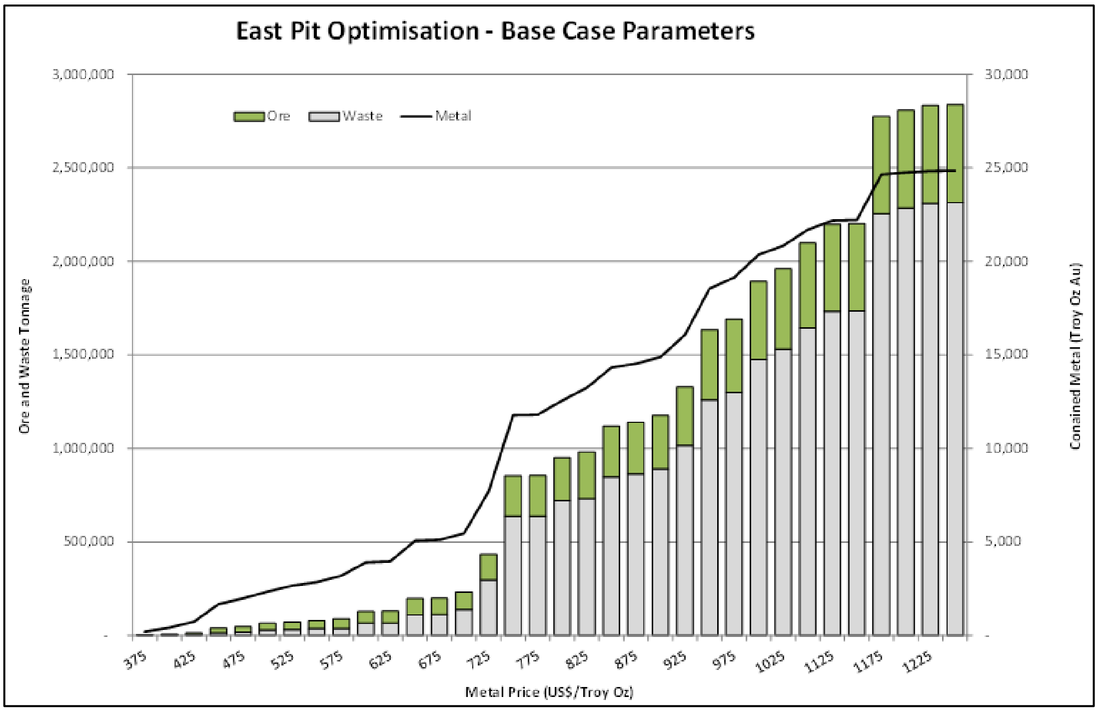


Figure 16-7: Graph of cumulative ore, waste and contained metal for East Pit

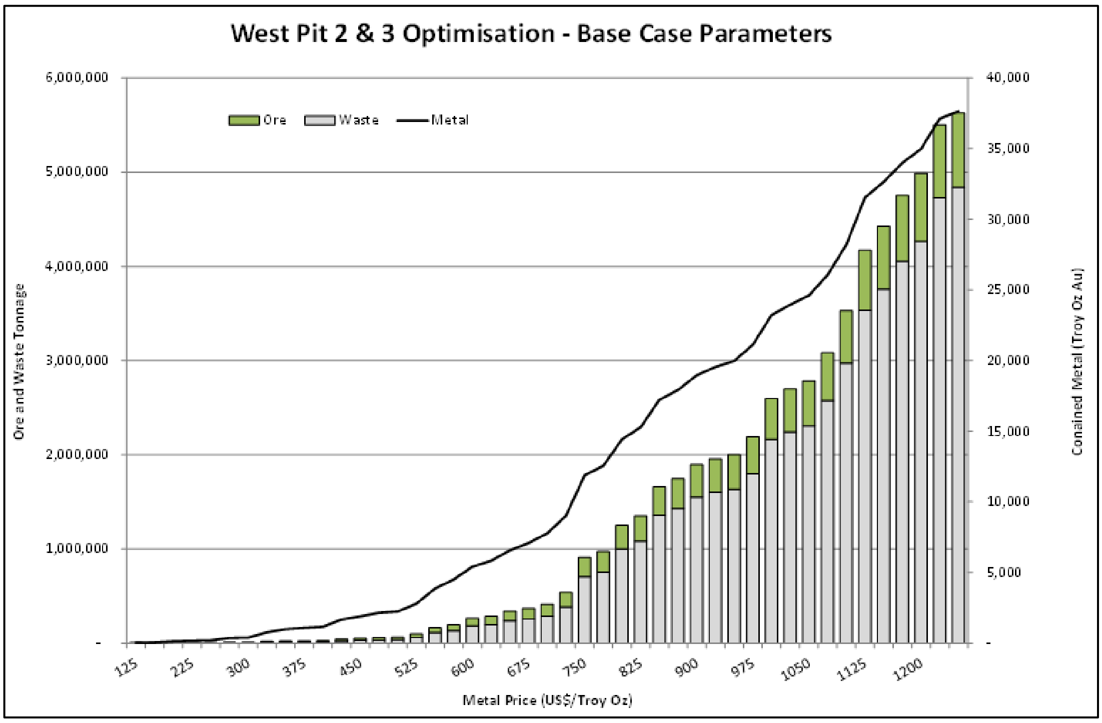


Figure 16-8: Graph of cumulative ore, waste and contained metal for West Pit 2 and 3

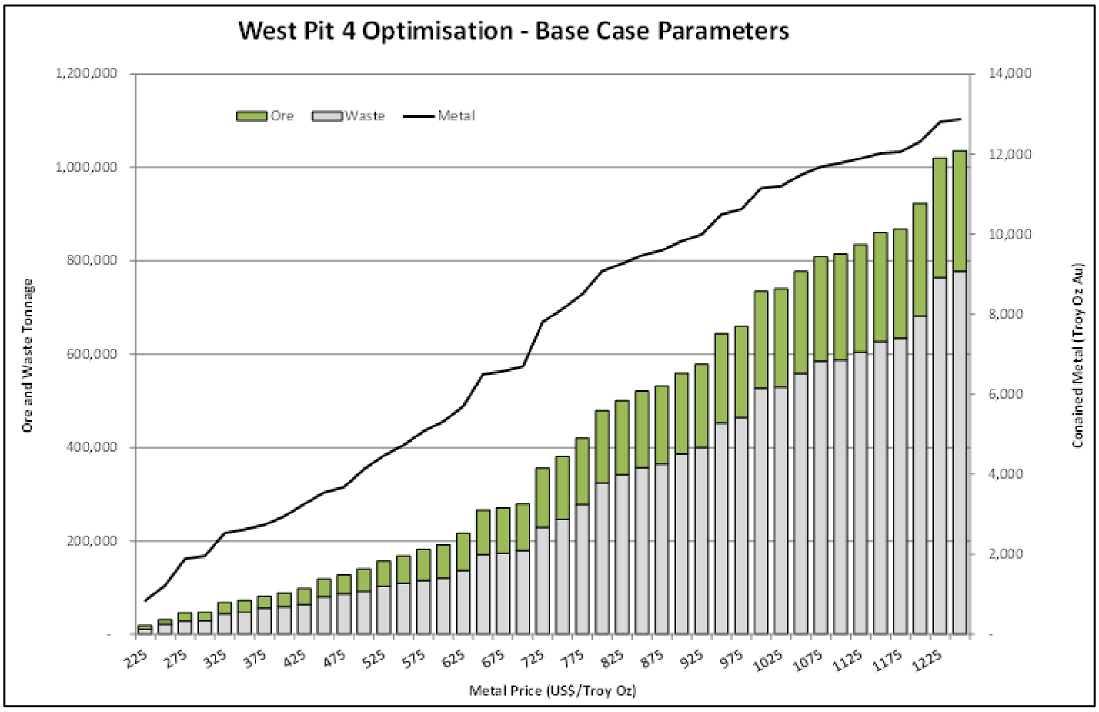


Figure 16-9: Graph of cumulative ore, waste and contained metal for West Pit 4

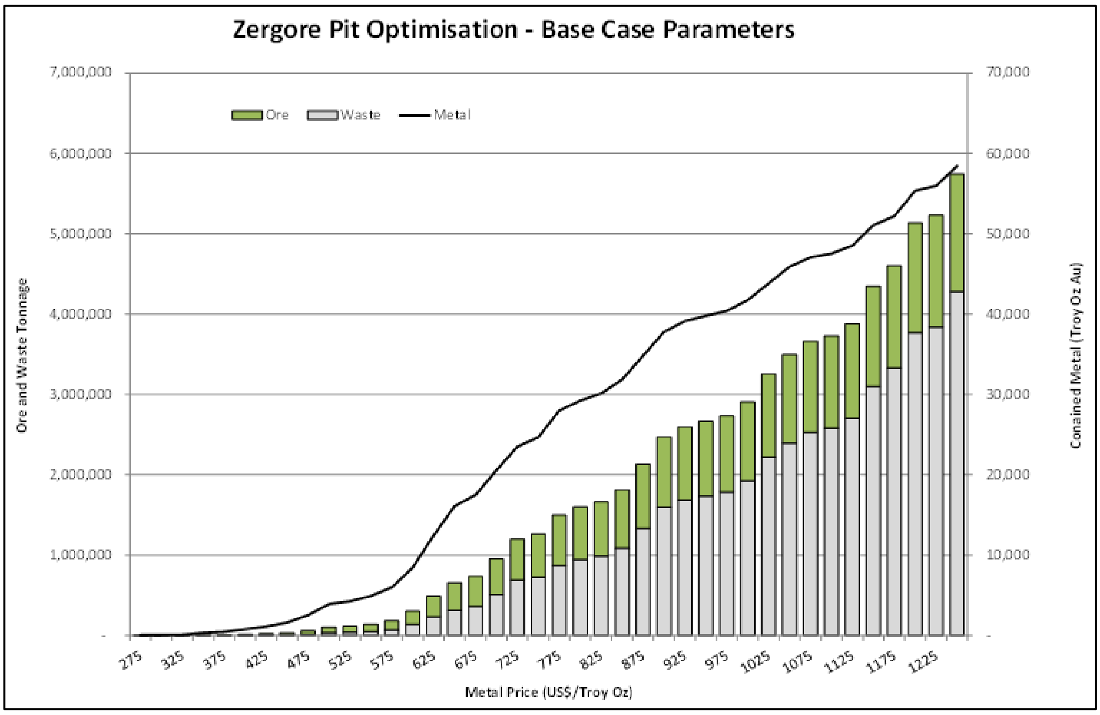


Figure 16-10: Graph of cumulative ore, waste and contained metal for Zergoré

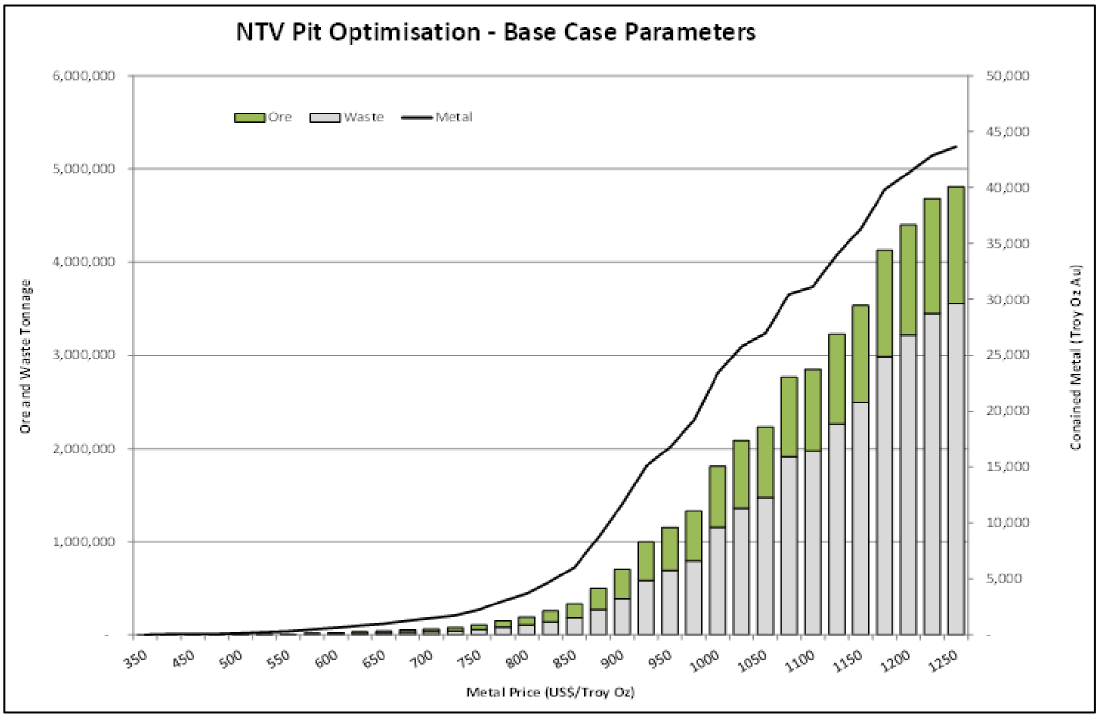


Figure 16-11: Graph of cumulative ore, waste and contained metal for NTV

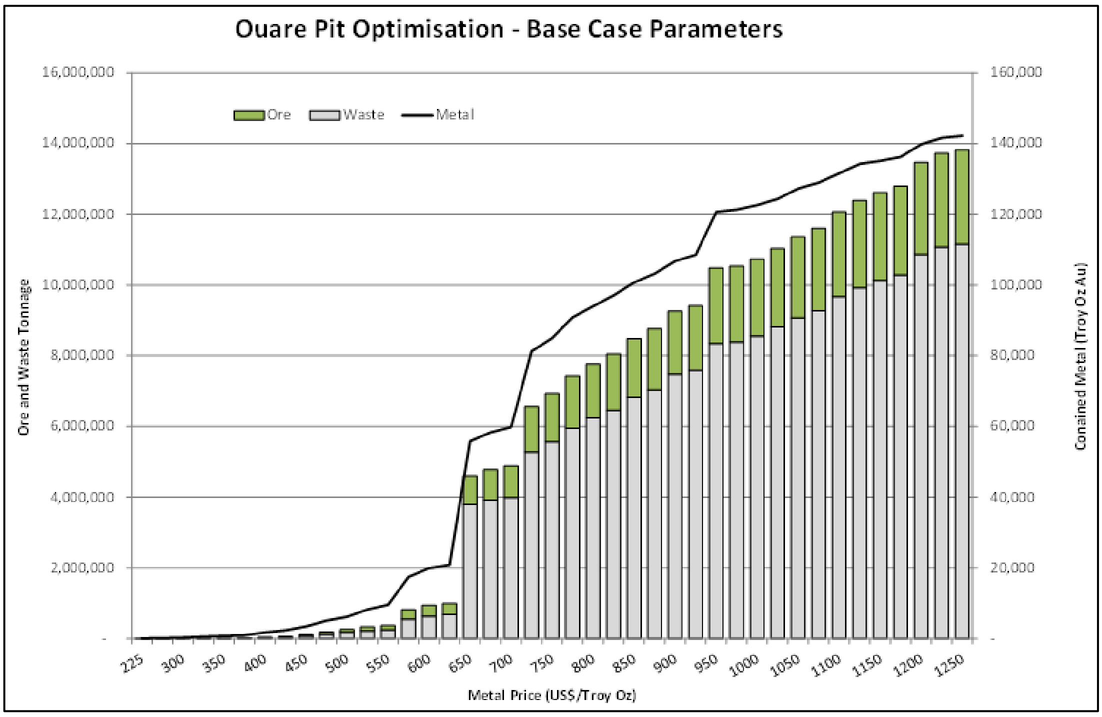


Figure 16-12: Graph of cumulative ore, waste and contained metal for Ouaré

16.2.4 Cut-Off Grade

Using the parameters in Table 16-1 and Table 16-3, the cut-off grade was calculated for each deposit. It was found that the cut-off grade for most of the deposits could be set to 0.7 g/t Au. The exceptions were Ouaré and Netiana. At Ouaré, the cut-off was set to 0.82 g/t Au, due to the additional cost of transporting the ore to the ROM pad. At Netiana, the cut-off grade at the reference bench was calculated to be 1.075 g/t Au. This was rounded up to 1.10 g/t Au to account for the additional cost of rehandling material during transport to Youga, and the incremental haulage cost as the pit deepens.

The transportation cost between Ouaré and Youga was estimated to be US$4/t hauled for a haul distance of 44 km. The actual route to be taken has not been designed as yet and it may be possible to reduce this distance, which could reduce the cut-off grade.

As at Ouaré, a significant factor in determining the cut-off grade for Netiana is the inclusion of the transportation cost between Netiana and Youga. This has been estimated at US$13.87/t hauled, for a haul distance of approximately 154 km.

16.2.5 Stockpiling Strategy

It is assumed that all material above the cut-off grade will be transported to the ROM pad at Youga. This material is then loaded by a front-end loader (FEL) and dumped in the crusher feed bin. The blend is determined by the number of FEL loads from each ROM stockpile (HG, MG, LG and LLG).

At Youga, marginal material between 0.5 g/t Au and the cut-off is stockpiled separately as a Resource that could be converted to a Reserve in the future, should it become economic to process.

The cut-off grade for Ouaré is slightly raised compared to the deposits at Youga, which means that material classified as Low-Low Grade (LLG) has a grade range of between 0.82 g/t and 1.2 g/t Au.

Marginal material at Ouaré (between 0.5 g/t and 0.82 g/t Au) is stockpiled separately near to the pits. This material is not economic at this time but is a potential Resource should the economics improve. It would be advisable to segregate this stockpile into a high and a low-grade portion.

Due to the raised cut-off grade for Netiana, the material that is normally classified as Low Grade (grade range of between 0.7 g/t Au and 1.1 g/t Au) is stockpiled at Netiana as a potential ore source in the future. The LLG material is not included in the Ore Reserve as it is uneconomic at this time. Similarly, Marginal material (grade range between 0.5 g/t Au and 0.7 g/t Au) is also stockpiled separately at Netiana.

Material at Netiana with a grade ≥1.1 g/t Au is mined and stockpiled on a temporary ROM stockpile close to the pit exit. This material is split into Low, Medium and High-Grade piles with cut-off grades of 1.1 g/t Au, 1.8 g/t Au and 2.5 g/t Au respectively.

By segregating the ROM pad into several stockpiles, it is possible to prioritise transport of the higher-grade material in the early periods. It also provides the opportunity to blend the feed to the plant by controlling the mix of ore from the satellite deposits such as Ouaré and Netiana.

16.3 Geotechnical Investigations

16.3.1 Review of Previous Studies

Youga Property

The mine has been in operation for some time and slopes have been established. The slope angles used in the original mine design were specified by Golder Associates (Golder) in a geotechnical report compiled at the onset of the mining operation.

The Golder report describes some limited geotechnical parameters but stops short of detailing rock mass classification values or mechanical properties of the rock types. Golder performed kinematic analyses, based on the quantification of discontinuity orientations, obtained from orientated core. Slope angles were provided for mine design and slope optimisation purposes, based on this information.

A number of site visits were subsequently conducted by SRK, and reports, detailing the observations, conclusions and recommendations, were studied. From these reports, it could be established that some slope instability has been observed since the onset of mining, using the slope angles provided by Golder.

Revised slope angles, described as “preliminary”, are provided by SRK. Although the reports state that the slope angles were obtained from empirical charts, input data used in the design is not described. Furthermore, the report does not reference the empirical design charts that were used to obtain the recommended preliminary slope angles.

It is concluded that additional modelling is required to improve the accuracy of the estimate of the geotechnical parameters so as to improve the reliability of the mine design criteria. The geotechnical parameters also need to be updated with data from ongoing exploration drilling and face mapping.

Although the level of geotechnical data in the design is limited, some experience has been gained, through the mining that has been done to date, which does allow for a basic understanding of the risk associated with the slope design.

Balogo Property

The initial geotechnical parameters, described in the HCG 2016 FS report, were subsequently updated with a more detailed geotechnical investigation in 2016. This work, detailed in a report dated November 2016, was performed by the Dokuz Eylül University, Faculty of Engineering. The report was compiled in Turkish and had to be translated to gain some insight into the detail.

It could be established that rock mass classification data and mechanical properties of the rocks, to be encountered in the slopes, were effectively quantified. Data and samples were collected from core, recovered from purpose-drilled exploration drillholes. The parameters used to describe the competency of the rocks are of international standard and are believed to be sufficiently comprehensive for the purposes of reporting the Ore Reserves.

The report details the stable slope angle design and describes numerical modelling that was conducted to obtain the optimal slope angles, through the quantification of the factor of safety. The methodology followed is sufficiently detailed for the report to be considered at Bankable Feasibility Study level of reliability.

Subsequent experience at Balogo has required that the slope angles and bench configuration be adjusted to account for localised actual slope performance.

16.3.2 Recommendations

Youga Property

Based on the information provided (Golder and SRK reports), it is concluded that mining operations should be planned on the available slope angle specification, recommended by SRK and detailed in Table 16-3.

Table 16-3: Youga – preliminary slope angles provided by SRK

Design elements	Initial SRK design slope parameters	Final SRK design slope parameters
Bench height (m)	10	10
Batter angle (°)	70	70
Berm width (m)	7	7 m to -70 m depth, then 5 m
Stack height (m)	50	50
Stack angle (°)	46	51° (49° over upper 70 m)
Number of stacks	4	4
Overall angle	39	41

In order to improve the reliability of the mine design criteria, additional geotechnical parameters will have to be collated from exploration drilling and face mapping. These parameters must then be used in a logical methodology to establish stable slope angles.

Balogo Property

From the recommendations contained in the HCG 2016 FS report, slope design angles for each of the identified geotechnical domains are detailed in Table 16-4 to Table 16-6.

Table 16-4: Netiana – slope design angle for Regolith

Parameter	Units	Value
Material type		Regolith
Bench height (maximum)	m	10
Batter angle	°	50
Berm width	m	5
Inter-ramp angle	°	36.75
OSA	°	34.8

Table 16-5: Netiana – slope design angles for Magmatic rocks

Parameter	Units	Value
Material type		Magmatics
Bench height	m	10
Batter angle	°	70
Berm width	m	5
Inter-ramp angle	°	49.2
OSA	°	46.5

Table 16-6: Netiana – slope design angles for Metamorphic rocks

Parameter	Units	Value
Material type		Metamorphics
Bench height	m	10
Batter angle	°	60
Berm width	m	5
Inter-ramp angle	°	42.9
OSA	°	40.3

As the HCG 2016 FS report does not specifically specify an Inter-ramp angle (IRA), it may be assumed that the pit shells should be designed with an IRA as specified. Following which, the inclusion of the ramp will yield an OSA that will be shallower than the specified IRA.

16.4 Mine Design Parameters

16.4.1 Design Criteria

The parameters for Youga and Ouaré proposed by CSA Global (Table 16-7) are considered reasonable at this level of study for the reporting of Reserves. However, CSA Global recommends reviewing these parameters prior to mining.

Table 16-7: Youga – pit design parameters (2018 design pits)

Parameter		Gassore	A2N Middle Pit	A2N East
Batter angle	Weathered	50 / 55	50 / 55	55
	Rest	70 / 75	70 / 75	75
Berm height	Weathered	10	10	10
	Rest	10	10	10
Berm width	Weathered	5	5	5
	Rest	5	5	5
IRA	Weathered	36.75 / 39.80	36.75 / 39.80	36.75 / 39.80
	Rest	48.17 / 49.17	48.17 / 49.17	48.17 / 49.17
Ramp width	Weathered	16	16	10*
	Rest	16	16	10*
Overall angle	Range	~40	~40	~40

** The last four benches to the end of pit.*

For Netiana, having established the pit extent from the optimised pit limit; the ramps, batter and berms were included in the final pit design. The pit parameters were split into weathered/oxidised and magmatic/metamorphic for transitional and fresh rock. The design parameters are shown in Table 16-8.

Table 16-8: Netiana – pit design parameters (2018 design pit)

Material type		Batter angle	Bench height	Berm width	IRA	Overall (considering 1 ramp per wall and rock type)	Ramp width
Weathered		50	10	5	36.75	33	15
Transition/Fresh	Magmatics	70	10	4	/52	42/45	15
	Metamorphics	65	10	4	/49	42/45	15

16.4.2 Geotechnical and Safety Berms

With respect to the design of the overall pit slope, it was assumed that no additional geotechnical berms will be required. At Netiana, the maximum pit depth is 100 m and the pit slopes are only open for a limited period (<2 years).

In order to provide substantial width for the safety berm it is proposed that the final pit wall is double benched to 10 m. This will provide a wide catch bench every 10 m that will have sufficient capacity to contain localised failures.

The ramp also acts as a catch bench that can be regularly cleaned. The configuration of this ramp system means that the maximum inter-ramp stack height is mostly less than 50 m. This is an important factor when considering the potential for failure of the rock mass.

16.4.3 Primary Mining Equipment

The Ouaré and Balogo properties will be managed alongside the existing project at Youga. These properties will share a lot of the same infrastructure and therefore it makes sense to standardise the fleet across all operations. The mining fleet has therefore been standardised on a mix of medium size hydraulic excavators (30–80 t), loading 45-t articulated trucks.

The smaller 30–40 t excavators are well suited to selective mining of the ore on 2.5 m flitches, whilst the larger 70–80 t hydraulic excavators are predominately used for waste due to their higher productivity.

The combined mining rate for Youga, Ouaré and Balogo has been limited to 1,800 kt/month, which can be accommodated by a total of up to seven excavators and 21 trucks. The exact split between Youga, Ouaré and Balogo will vary with time.

Due to the size of the Netiana pit the mining rate has been limited to less than 800 t/h, which can be accommodated by two excavators. A FEL is used at the ROM pad to load the ore into the trucks for transport of ore from Netiana to Youga.

The mining rate at Youga has been increased to 1,400 t/h in order to advance the stripping in Gassore and A2N Mid pit, both of which have relatively high stripping ratios of 22:1 and 34:1 respectively. On completion of the Netiana mining, the mining fleet will be moved to Ouaré.

Backup loading capacity is provided by a FEL that can load the 45 t trucks. The FEL is also used to load the ore into the trucks for transport of ore from Ouaré to Youga.

16.4.4 Benches

A bench height of 5 m has been selected in order to ensure selective mining of the ore. The bench will be blasted on 5 m intervals and loaded on two flitches of 2.5 m. This is the current practice at Youga and it can be demonstrated that this works well for the given rock types and distribution of ore.

This bench height is well suited to the selected size of hydraulic excavators, each having a maximum reach between 5 m and 6 m (Figure 16-13).

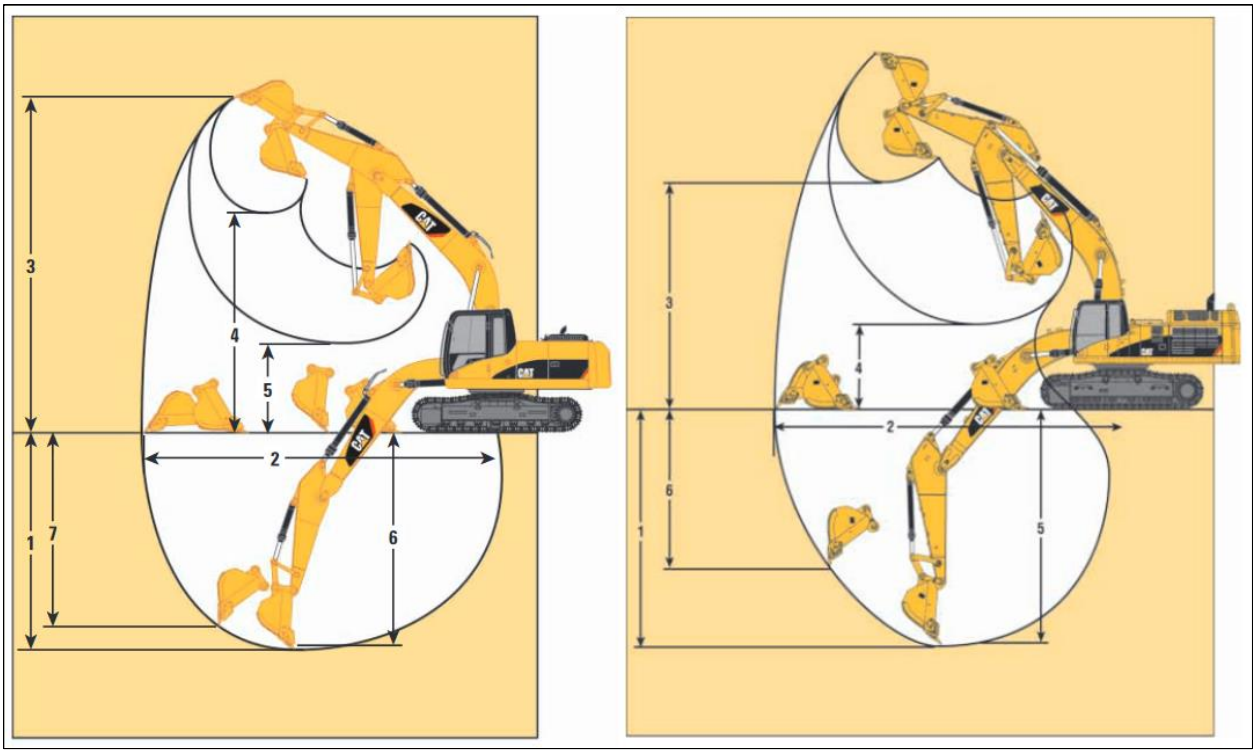


Figure 16-13: Maximum mining reach for a Cat 336 (35-t) and a Cat 374 (75-t) excavator

16.4.5 Minimum Mining Width

The minimum mining floor width has been designed at 35 m to allow turning of the trucks (SAE turning radius of 8.7 m). This also allows sufficient clearance during normal operations for the minimum distance from the highwall and allowance for safety berms at the crest.

16.4.6 Pit Dewatering

Burkina Faso has a relatively dry climate with a total rainfall of less than 800 mm per year. The majority of the rainfall is between June and October (Figure 16-14).

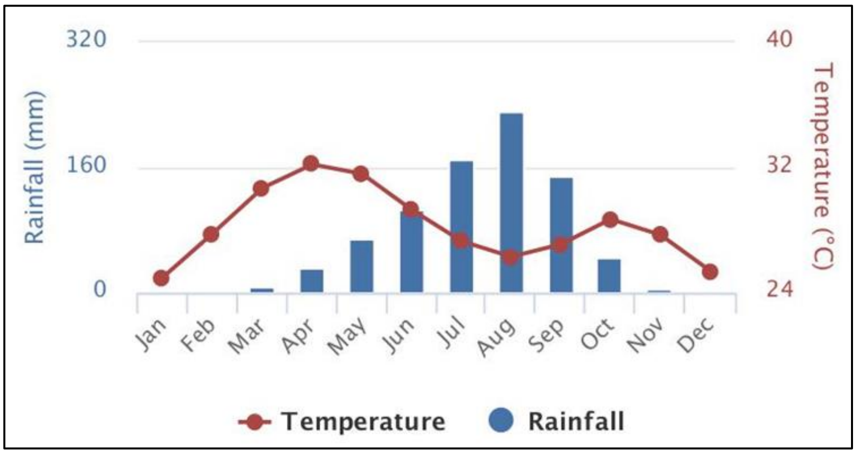


Figure 16-14: Average monthly temperature and rainfall for Burkina Faso (1991 to 2015)

Source: Climate Change Knowledge Portal (http://sdwebx.worldbank.org/climateportal)

The stream beds are typically dry for most of the year but there is a need to provide for water diversion to avoid inflow into the pit. Surface runoff that is captured by the pit is collected in a sump and provision has been made for pumping as required.

16.4.7 Haul Roads and Ramps

To meet the production targets and to match the selected loading machines, a 45-t articulated haul truck has been selected. This truck has an overall operating width of 4.16 m, which means that the minimum ramp width at 2.5 x truck width is 10.4 m. Ideally, the ramp width should be at least 3.5 x truck width (14.6 m) to allow passing on the ramp. However, it is accepted that 12 m will be sufficient for the shallower pits if passing places are provided for, and a lower operational efficiency is accepted.

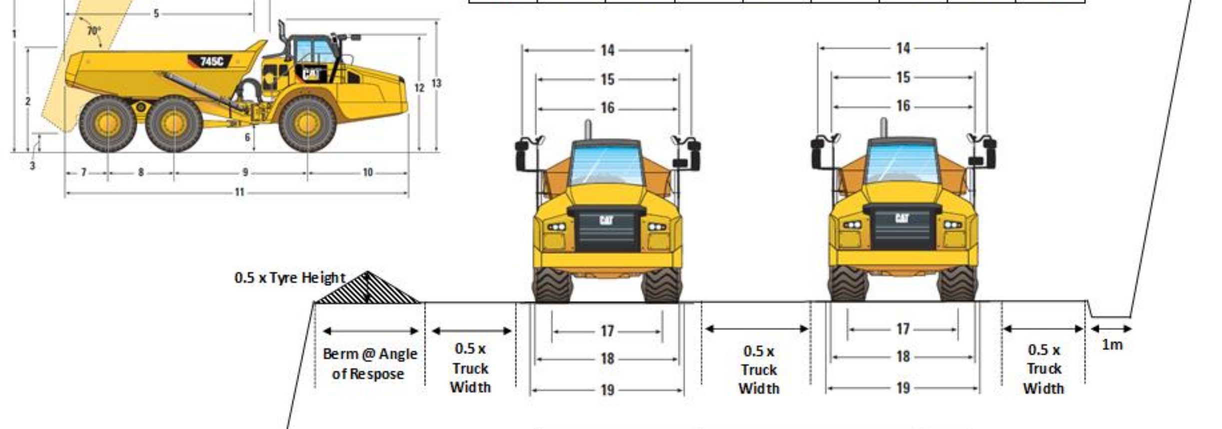
On the lower benches the ramp width has been reduced to 10 m on the assumption of a single lane. This helps to maximise the ore recovery and minimise the waste stripping.

Ramps will be established at a maximum gradient of 10% (1:10). To facilitate drainage of the roadway, a 2% cross slope on the ramp should be included.

It is necessary to have a safety bund equivalent to at least half the tyre height on the low-wall side and preferably an allowance for a drainage ditch on the high wall side of the ramp. With this configuration, it is possible to attain a road width of 16 m (~4 x truck width), which is an acceptable compromise.

The proposed haul road dimensions for a Cat 745 truck is shown in Figure 16-15.

CAT 745C	Max Truck Width (m) Dim 14	Lane Width (m) Dim 19	Drain Width (m)	Shoulder (m)	Meridian (m)	Tyre Height (m)	Tyre Berm (m)	Road Width (m)
Single	4.1	3.5	1	3.5		1.61	2.1	10.0
Dual	4.1	7.1	1.5	3.5	2.1	1.62	2.1	16.0



	mm	ft/in		mm	ft/in
1	7302	22'11"	11 *	11 429	37'5"
2	3165	10'4"	**	11 555	37'10"
3	772	2'6"	12	3746	12'3"
4	6447	21'1"	13	4041	13'3"
5	5889	19'3"	14	4166	13'8"
6	579	1'10"	15 ***	3422	11'2"
7	1458	4'9"	16 ****	3774	12'4"
8	1966	6'5"	17 †	2687	8'9"
9	4590	15'0"	18 ††	3370	11'0"
10	3415	11'2"	19 †††	3530	11'6"

Figure 16-15: Proposed haul road dimensions for a Cat 745 (40-t) truck

16.4.8 Mining Recovery and Waste Dilution

For Youga and Ouaré, the mining recovery and waste dilution have been set at 95% and 10% at 0 g/t respectively. For Netiana, the mining recovery and waste dilution have been set to 95% and 5% at 0 g/t Au respectively. The modifying factors take into account that ore mining will be with the smaller hydraulic excavator (1.6 m^3 to 2.5 m^3 bucket) on 2.5 m flitches. Considerable care needs to be taken with the blasting to minimise movement and, therefore, the blast design assumes choke blasting with a relatively low powder factor of 0.29 kg/m^3.

These factors are reasonable for the conditions. However, on a local scale the mining recovery and dilution factors are likely to vary considerably, depending on the width of the veins and the amount of internal waste.

16.4.9 Pit Limit

The pit limits for each deposit were selected at a Price Factor of 1.0 so as to maximise the Ore Reserve. The wireframe for the pit limit was exported from NPVS and Whittle and then used as a guide to design the final pit. As discussed below this includes the provision for the ramps and access to benches.

It should be noted that the pit limit generated by the pit optimisation software is based on an OSA that includes the provision for safety berms and ramps. However, the exact location of the ramps is unknown at the time of optimisation and consequently there will be minor differences between the pit limit generated by NPVS and the subsequent engineered pit designs. Ideally, this variance will be minimised to maximise ore recovery and minimise waste stripping.

Figure 16-16 illustrates the development of the practical pit limits at Netiana, which include the pushbacks that target the high-grade core of the deposit. The vertical section (Figure 16-17) shows the distribution of mineralised blocks (>0.7 g/t Au) with respect to the pit limit. The width of the orebody varies considerably across the deposit, but typically exceeds 5 m.

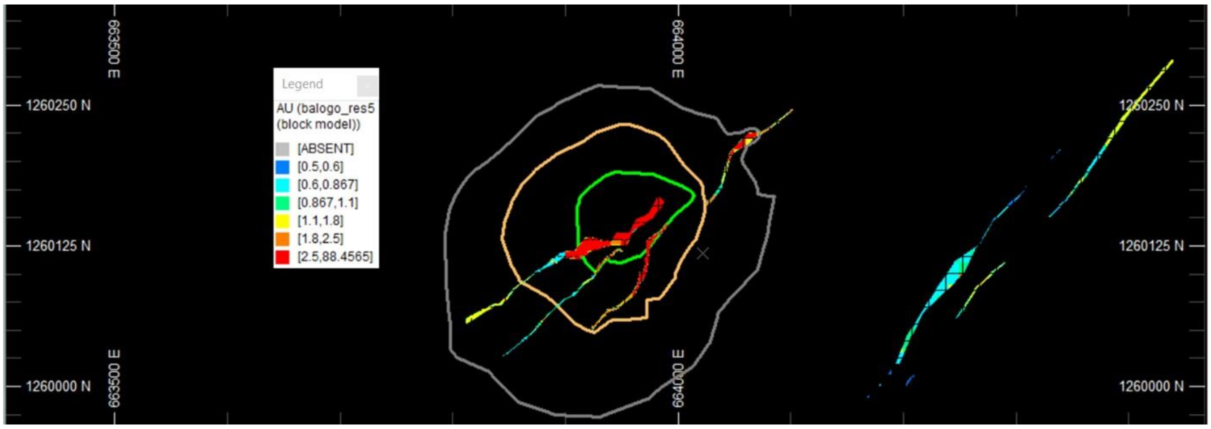


Figure 16-16: Netiana – plan view showing the pushbacks and final pit

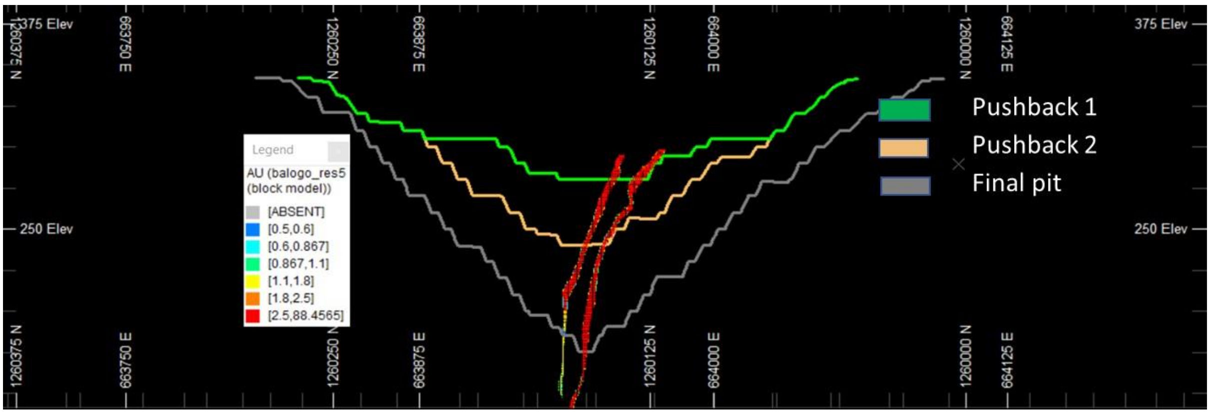


Figure 16-17: Netiana – section A-A showing mineralised blocks (>0.7 g/t Au) within the pushbacks and the pit limit

16.4.10 Topsoil

There is a thin layer of topsoil (<0.5 m) covering the mining areas, which will be stripped off and stored separately for reuse and rehabilitation at a later date.

16.5 Mine Design

16.5.1 *Phases/Pushbacks*

The 2018 optimisations for A2N Middle Pit and Gassore indicated that two interim pushbacks would be required at A2N Middle and three interim pushbacks were required at Gassore.

At Netiana, the pit was divided into a starter pit and a pushback to the final pit limit (Figure 16-18).

The initial Netiana starter pit was selected using the pit shells generated by the pit optimisation software as a starting point. The selected shell was chosen so that it included at least 43,000 ore tonnes behind cut-off grade (1.1 g/t Au) within which there are 32,000 t of high-grade ore.

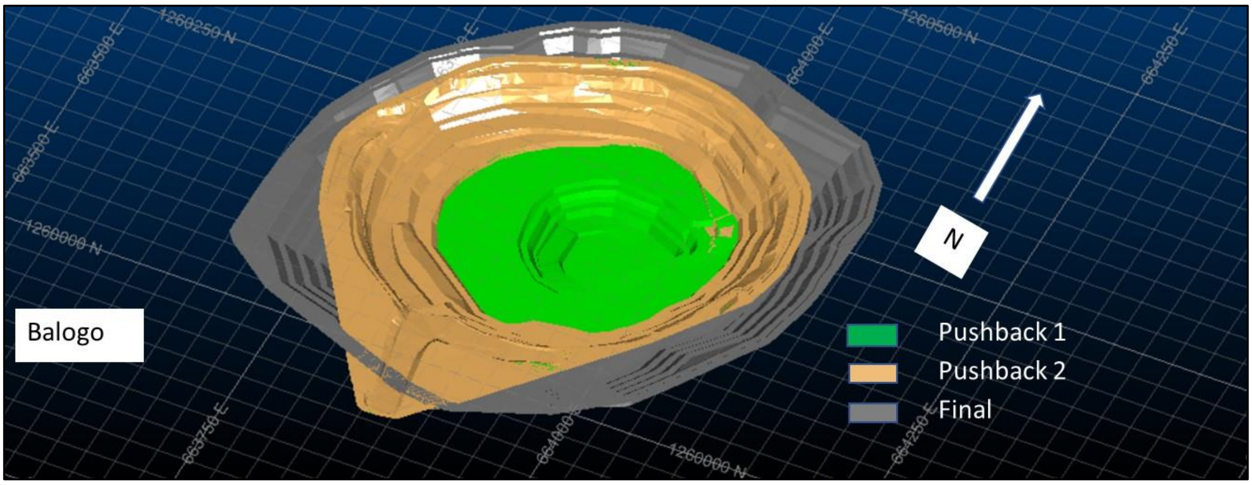


Figure 16-18: Netiana Starter pit, second pit and final pushback

The topographic surface at Netiana is at an RL of 345 m. The first pushback and last pit reach RLs of 280 m and 240 m above sea level (ASL) respectively. In the final pushback, the road width changes from 15 m to 10 m in the last four benches.

16.5.2 *Pit Design Quantities*

The Reserves were calculated using the block model values and the engineered pit design surface for Youga, Ouaré and Netiana. The quantities shown for Youga and Ouaré are after applying the modifying factors of 95% mining recovery and 10% at 0 g/t Au mining dilution. The quantities shown for Netiana are after applying the modifying factors of 95% mining recovery and 5% mining dilution.

Table 16-9 to Table 16-12 show the 2018 pit design quantities for A2N East, A2N Middle Pit, Gassore and Netiana.

Table 16-9: Youga – 2018 A2N East design results

A2N East	**Cut 1**			**TOTAL**		
	Tonnes	**Ounces**	**g/t Au**	**Tonnes**	**Ounces**	**g/t Au**
High Grade	8,305	1,067	3.99	8,305	1,067	3.99
Medium Grade	2,448	153	1.95	2,448	153	1.95
Low Grade	4,285	188	1.37	4,285	188	1.37
LLG Ore	9,045	232	0.80	9,045	232	0.80
Total Ore	**24,083**	**1,639**	**2.03**	**24,083**	**1,639**	**2.03**
Marginal Ore	3,282	61	0.58	3,282	61	0.58
Total Stockpile	**3,282**	**61**	**0.58**	**3,282**	**61**	**0.58**
Waste	133,379	892	0.21	133,379	892	0.21
GRAND TOTAL	**160,744**	**2,592**	**0.50**	**160,744**	**2,592**	**0.50**

Note: Waste is back calculated from the grand total, assuming waste is diluting material and receiving ore loss.

Table 16-10: Youga – 2018 A2N Middle Pit design results

A2N Middle Pit	Cut 1			Cut 2			Cut 3			TOTAL		
	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au
High Grade	45,551	8,860	6.05	23,183	4,280	5.74	40,908	10,220	7.77	109,642	23,361	6.63
Medium Grade	8,709	551	1.97	7,683	481	1.95	2,079	128	1.91	18,471	1,159	1.95
Low Grade	9,543	415	1.35	9,315	405	1.35	3,101	138	1.38	21,959	958	1.36
LLG Ore	63,804	9,826	4.79	40,181	5,166	4.00	46,088	10,486	7.08	150,072	25,478	5.28
Total Ore	**2,483**	**78**	**0.98**	**5,960**	**168**	**0.88**	**607**	**19**	**0.95**	**9,050**	**265**	**0.91**
Marginal Ore	6	0	0.56	1,268	22	0.55	0	0	0.00	1,274	23	0.55
Total Stockpile	6	0	0.56	1,268	22	0.55	0	0	0.00	1,274	23	0.55
Waste	525,794	0	0.00	3,148,207	0	0.00	829,434	0	0.00	4,503,435	0	0.00
GRAND TOTAL	**592,086**	**0**	**0.00**	**3,195,617**	**0**	**0.00**	**876,129**	**0**	**0.00**	**4,663,831**	**0**	**0.00**

Table 16-11: Youga – 2018 Gassore design results

Gassore	Cut 0			Cut 1			Cut 2			Cut 3			Cut 4			TOTAL		
	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au
High Grade	2,977	463	4.83	89,138	19,939	6.96	141,253	25,937	5.71	244,781	56,641	7.20	8,969	62	6.88	487,118	104,965	4.83
Medium Grade	1,134	72	1.97	20,699	1,264	1.90	38,813	2,414	1.93	61,422	3,847	1.95	4,759	9	1.91	126,828	7,891	1.97
Low Grade	1,665	70	1.30	27,962	1,217	1.35	36,704	1,594	1.35	82,578	3,566	1.34	4,322	6	1.34	153,231	6,632	1.30
LLG Ore	2,597	70	0.84	45,561	1,230	0.84	54,777	1,456	0.83	101,783	2,784	0.85	3,210	3	0.94	207,928	5,638	0.84
Total Ore	**8,373**	**674**	**2.51**	**183,361**	**23,651**	**4.01**	**271,547**	**31,401**	**3.60**	**490,564**	**66,838**	**4.24**	**21,260**	**80**	**3.75**	**975,105**	**125,126**	**3.06**
Marginal Ore	1,383	24	0.55	17,272	310	0.56	31,559	557	0.55	42,650	750	0.55	21	0	0.61	92,885	1,642	0.55
Total Stockpile	**1,383**	**24**	**0.55**	**17,272**	**310**	**0.56**	**31,559**	**557**	**0.55**	**42,650**	**750**	**0.55**	21	0	0.61	92,885	1,642	0.55
Waste	628,515	86	0.00	4,646,752	1,480	0.01	5,987,836	2,359	0.01	10,090,147	5,537	0.02	454,005	2,739	0.19	21,807,256	9,720	0.01
GRAND TOTAL	**638,271**	**785**	**0.00**	**4,847,385**	**25,441**	**0.03**	**6,290,942**	**34,317**	**0.05**	**10,623,361**	**73,125**	**0.10**	**475,286**	**2,819**	**0.00**	**22,875,246**	**136,487**	**0.19**

Table 16-12: Balogo – 2018 Netiana design results

Balogo	Cut 1			Cut 2			Cut 3			TOTAL		
	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au	Tonnes	Ounces	g/t Au
High Grade	31,974	17,802	17.32	95,633	25,423	8.27	126,999	30,585	7.49	254,606	73,810	9.02
Medium Grade	4,038	275	2.12	8,765	568	2.01	15,441	999	2.01	28,245	1,842	2.03
Low Grade	7,207	325	1.40	14,008	628	1.39	24,089	1,053	1.36	45,304	2,006	1.38
Total Ore	**43,219**	**18,402**	**13.24**	**118,406**	**26,619**	**6.99**	**166,530**	**32,637**	**6.10**	**328,155**	**77,658**	**7.36**
LLG Ore	6,229	171	0.85	9,945	269	0.84	19,754	551	0.87	35,928	991	0.86
Marginal Ore	1,879	35	0.57	5,644	107	0.59	8,421	157	0.58	15,944	298	0.58
Total Stockpile	**8,108**	**206**	**0.79**	**15,589**	**376**	**0.75**	**28,175**	**708**	**0.78**	**51,872**	**1,290**	**0.77**
Waste	1,343,588	0	0.00	1,961,682	0	0.00	12,050,826	0	0.00	15,356,096	0	0.00
GRAND TOTAL	**1,394,915**	**0**	**0.00**	**2,095,677**	**0**	**0.00**	**12,245,530**	**0**	**0.00**	**15,736,122**	**0**	**0.00**

The 2017 pit design for the remaining ore source at Youga and Ouaré are detailed in Table 16-13 to Table 16-15 below.

Table 16-13: Pit design quantities for Youga Main, Youga East and A2NE

	Youga Main			Youga East			A2NE		
	Tonnes	troy oz	g/t	Tonnes	troy oz	g/t	Tonnes	troy oz	g/t
High Grade	235,952	27,018	3.56	32,585	3,001	2.86	235,952	27,018	3.56
Medium Grade	214,369	14,721	2.14	118,013	7,900	2.08	82,289	5,355	2.02
Low Grade	431,894	20,236	1.46	211,349	10,143	1.49	128,576	6,065	1.47
Total Ore	**882,215**	**61,975**	**2.18**	**361,947**	**21,044**	**1.81**	**446,816**	**38,438**	**2.68**
LLG	400,370	12,000	0.93	116,259	3,844	1.03	182,051	5,762	0.98
Marginal	203,811	3,936	0.60	11,885	220	0.58	89,280	1,562	0.54
Total Stockpile	**604,181**	**15,937**	**0.82**	**128,144**	**4,064**	**0.99**	**271,331**	**7,324**	**0.84**
Waste	20,549,686			3,518,860			4,371,189		
GRAND TOTAL	**21,431,901**			**3,880,807**			**4,818,005**		

Table 16-14: Pit design quantities for West Pit 2, West Pit 3 and West Pit 4

	West Pit 2			West Pit 3			West Pit 4		
	Tonnes	troy oz	g/t	Tonnes	troy oz	g/t	Tonnes	troy oz	g/t
High Grade	22,093	2,234	3.15	73,537	7,298	3.09	32,338	4,100	3.94
Medium Grade	55,927	3,722	2.07	97,162	6,635	2.12	43,633	2,993	2.13
Low Grade	147,324	7,046	1.49	102,536	4,915	1.49	91,390	4,286	1.46
Total Ore	**225,344**	**13,001**	**1.79**	**273,235**	**18,847**	**2.15**	**167,360**	**11,379**	**2.11**
Low-Low Grade	145,828	4,566	0.97	120,719	3,627	0.93	97,259	2,900	0.93
Marginal	25,921	506	0.61	35,149	690	0.61	29,630	605	0.64
Total Stockpile	**171,749**	**5,072**	**0.92**	**155,868**	**4,318**	**0.86**	**126,889**	**3,505**	**0.86**
Waste	3,591,877			4,365,432			1,356,538		
GRAND TOTAL	**3,817,221**			**4,638,667**			**1,523,898**		

Table 16-15: Pit design quantities for NTV, Zergoré and Ouaré

	NTV			Zergoré			Ouaré		
	Tonnes	troy oz	g/t	Tonnes	troy oz	g/t	Tonnes	troy oz	g/t
High Grade	9,497	951	3.11	62,982	6,207	3.07	410,318	48,096	2.00
Medium Grade	48,090	3,199	2.07	192,033	12,875	2.09	556,332	37,407	1.48
Low Grade	399,593	18,115	1.41	467,669	21,869	1.45	948,973	45,187	0.87
Total Ore	**457,180**	**22,265**	**1.51**	**722,683**	**40,951**	**1.76**	**1,915,623**	**130,689**	**2.12**
Low-Low Grade	763,197	23,917	0.97	750,251	22,517	0.93	750,954	26,409	1.09
Marginal	97,861	1,968	0.63	376,602	7,246	0.60	734,637	13,410	1.12
Total Stockpile	**861,059**	**25,885**	**0.94**	**1,126,852**	**29,763**	**0.82**	**1,485,590**	**39,819**	**0.83**
Waste	5,717,533			5,677,401			13,448,352		
GRAND TOTAL	**6,174,713**			**6,400,085**			**15,363,976**		

Figure 16-19 to Figure 16-22 show Youga pit designs and Figure 16-23 shows the Ouaré pit designs.

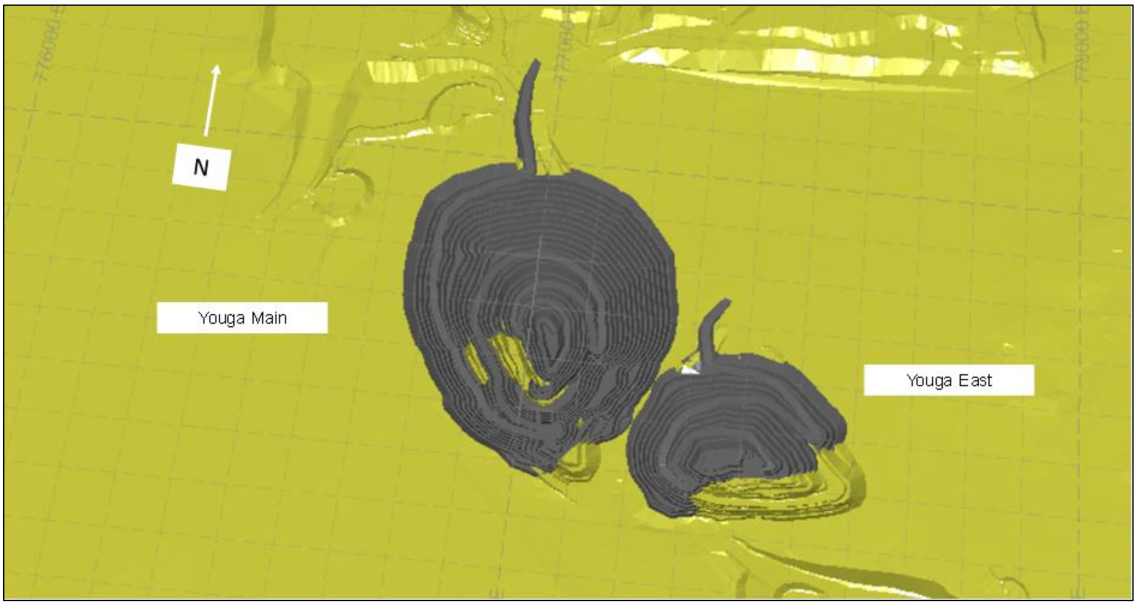


Figure 16-19: Youga Main and Youga East pit designs (2017)

Youga Main has a depth of 215 m and the ramp width of 15 m width is designed from the surface to the last 55 m. Youga East has been designed with a depth of 115 m.

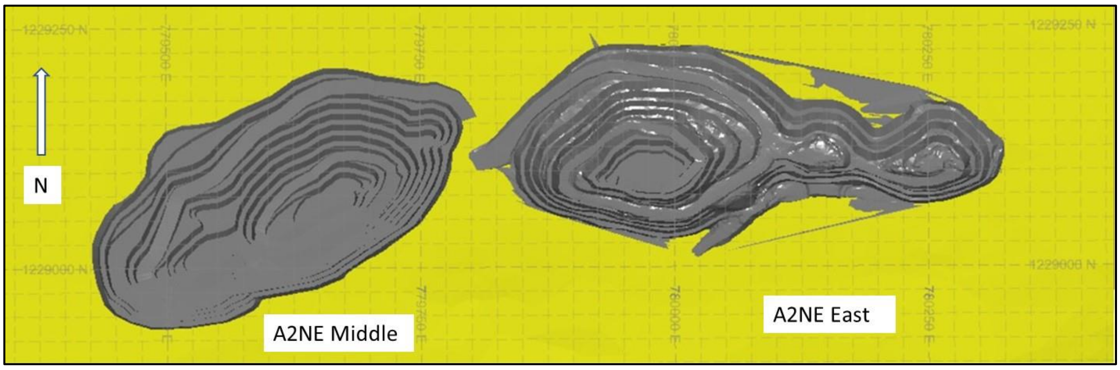


Figure 16-20: Youga – A2N pit designs (January 2018)

In both the A2N Middle West and A2N East pits, the road width changes from 12 m to 7 m for the last 25 m depth and 45 m respectively in the pits. Topography surface is at an RL of 225 m and the bottom of the pit is located at a RL of 135 m in A2N East and 130 m in A2N Middle West.

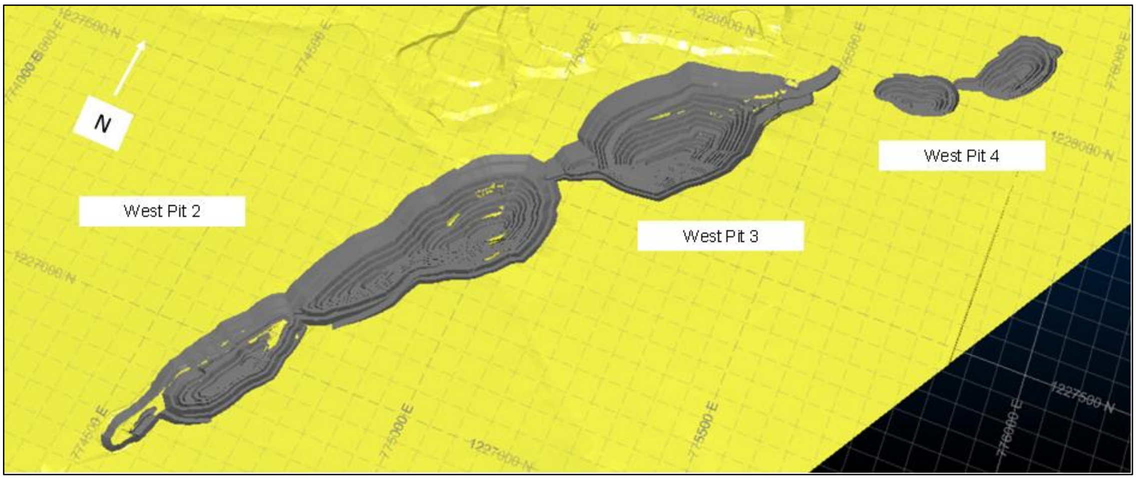


Figure 16-21: Youga – West Pit 2, 3 and 4 pit designs (2017)

West Pit 2A (North) and 2B (South) reach a depth of 52 m and 89 m respectively. West Pit 3 is located to the northeast of West Pit 2B and is 52 m deep. West Pit 4 is located to the northeast of West Pit 3 and reaches a depth of 52 m.

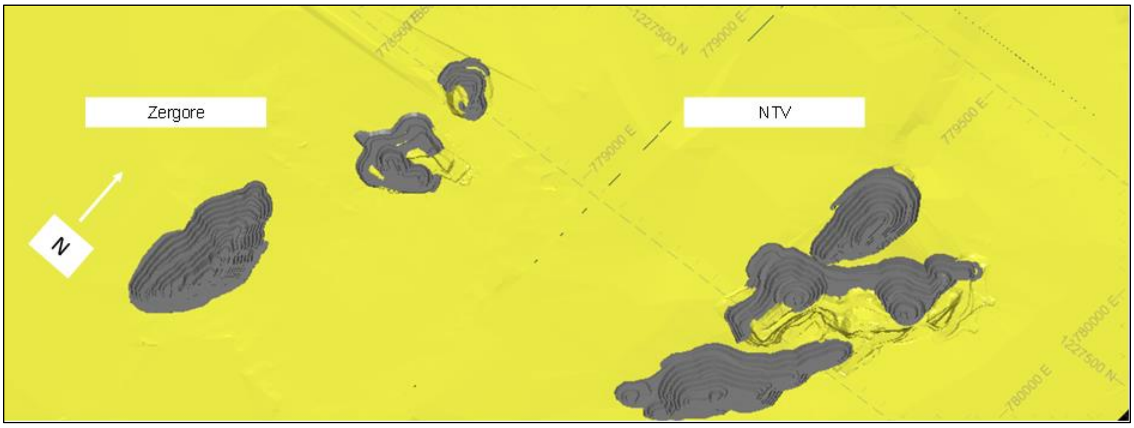


Figure 16-22: Youga – Zergoré and NTV pit designs (2017)

Zergoré comprises three main pits (North, Mid and South). Zergoré North reaches a deep of 67 m, whilst Zergoré Mid is formed by two pits, each 59 m in depth, and Zergoré South is 69 m deep.

NTV comprises three pits, NTV North (31 m deep), NTV Mid (41 m deep) and NTV South (90 m deep).

Ouaré comprised three pits; (West, Mid and East). Ouaré East is the deepest pit (98 m) and Ouaré West and Ouaré Mid which reach depths of 69 m and 65 m respectively.

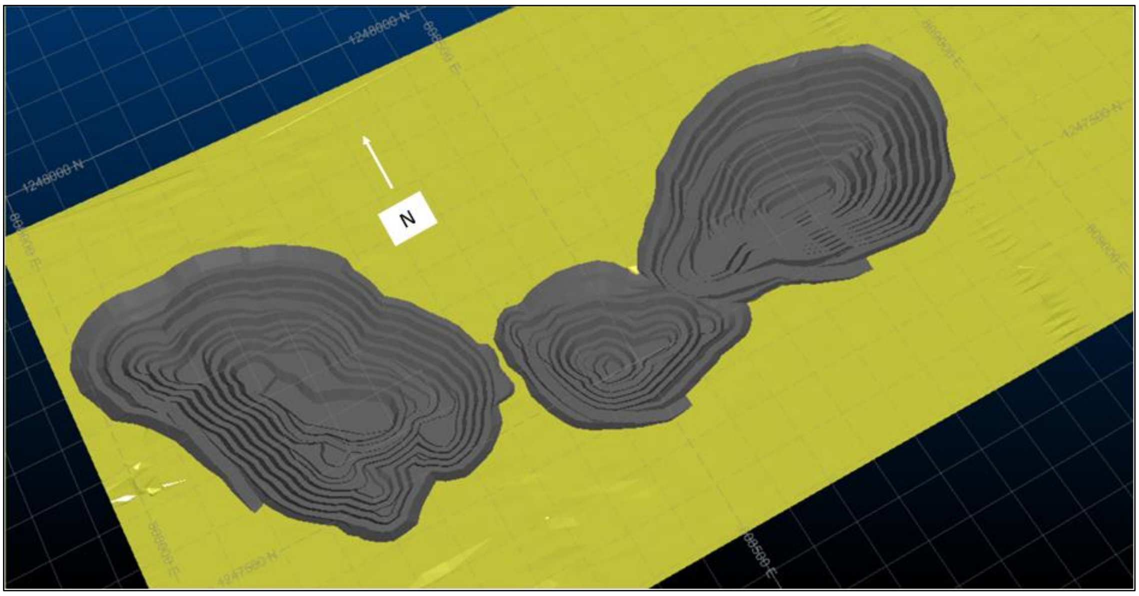


Figure 16-23: Ouaré pit designs (2017)

Gassore which comprises three pushbacks is located in Youga North. The final pit which contains different areas, has a depth of 137 m from the top (220 mRL) and the ramp width varies between 10 m and 15 m depending of the area.

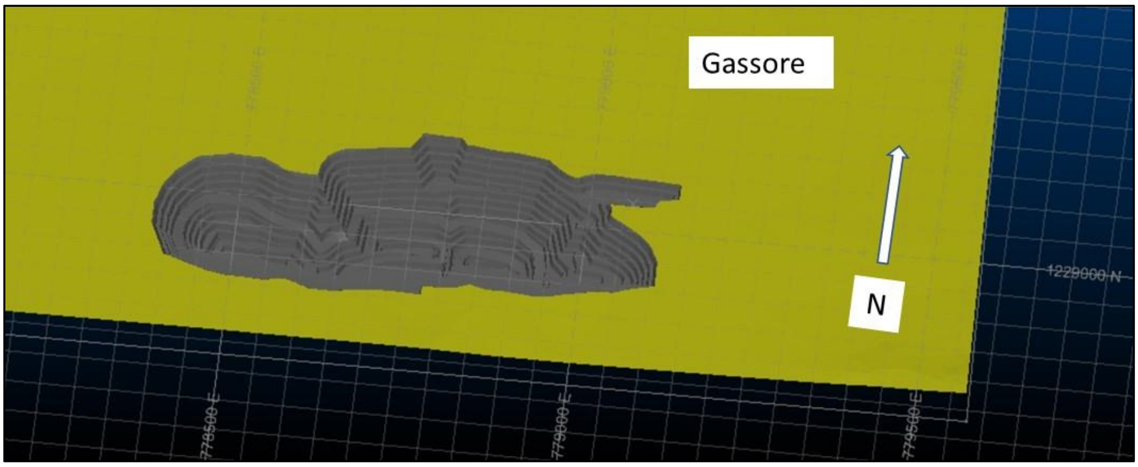


Figure 16-24: Gassore pit design (2018)

16.6 Waste Dumps and Stockpiles

Waste dump capacities have been based on a swell factor of 30% and no allowance has been made for backfilling of the pits. Swell factor has been modified to 25% in 2018 for A2NE East, A2NE Middle West, Gassore and Balogo. At Youga and Ouaré, the new waste dump positions have been selected based on the locations of the old waste dumps, with most of the new waste dumps intersecting, surrounding or covering the old waste dumps (except for at Ouaré, A2N Middle West and Gassore).

At Balogo, the waste dump position has been selected based on the Report "Balogo Mine Planning, AMC 2016" and the current waste dump to target barren areas.

In addition, the following factors have also been considered when positioning the waste dumps:

- Avoiding geologically prospective ground
- Including sterilisation drilling as required
- Allowing for existing or proposed infrastructure
- Within Mining Exploitation licence areas
- Stockpiles have been designed adjacent to the waste dumps.

16.6.1 Design Parameters

The design parameters for waste dumps are based on recommendations from the Wardell-Armstrong report, "Review of mine Closure, Youga mine Burkina Faso. November 2016".

A 25 m wide ramp has been selected for the waste dump designs to permit truck double lanes together with simultaneous works such as maintenance, drainage and rehabilitation (topsoiling); for the stockpiles the ramp width has been reduced to 12 m wide.

Table 16-16 shows the design parameters used for waste dumps and stockpiles at Youga, Ouaré and Balogo.

Table 16-16: Design parameters for Youga, Ouaré and Balogo waste dumps and stockpiles

Design parameters	Units	Waste dumps	Stockpiles low grade and marginal
Batter angle	grade	20	35
Swell factor	%	30; reduced to 25% in 2018	30; reduced to 25% in 2018
Bench height	m	15; increased to 20 m in 2018	15
Berm width	m	30; reduced to 10m in 2018	30
OSA	grade	From 11.3 in 2017 to 17 in 2018	24/35
Road width	m	25	12

16.6.2 Waste Dump and Stockpile Capacity

The capacities and projected area for waste dumps and stockpiles at Youga, Ouaré and Balogo are summarised below in Table 16-17 and Table 16-18. Note that this table indicates the waste dump estimated in A2NE in 2017 and A2NE estimated in January 2018. Also, Table 16-18 shows the 2018 marginal designed for Gassore, A2NE and A2NW Middle pit.

Table 16-17: Youga and Ouaré – waste dump/stockpile capacities and projected areas

	Capacity (m^3)	Projected area (m^2)	Maximum height (m)	Stockpile	Capacity (m^3)	Projected area (m^2)	Maximum height (m)	Grade
Youga Main	10,192,794	637,200	37	Marginal	97,781	12,974	17	0.5 to 0.7
Youga East	4,831,874	360,658	37	Marginal	5,694	3,485	3	0.5 to 0.7
NTV	4,831,874	360,658	37	Marginal	47,183	10,073	6	0.5 to 0.7
A2NE (2017)	2,253,439	139,372	32	Marginal	43,231	14,808	4	0.5 to 0.7
A2NE (January 2018)	57,407	14,505	11	See Gassore marginal				
A2NE Middle West (January 2018)	2,193,083	169,719	22	See Gassore marginal				
Zergoré	2,877,963	268,281	34	Marginal	189,342	29,614	8	0.5 to 0.7
West34	2,828,847	254,658	20	Marginal	31,895	8,072	6	0.5 to 0.7
West2	1,782,805	209,226	22	Marginal	12,437	6,624	3	0.5 to 0.7
Ouaré	6,945,744	640,631	46	Marginal	380,961	36,312	19	0.5 to 0.7
Gassore	8,015,160	408,141	42	Marginal	46,638	7,874	11	0.5 to 0.7

Table 16-18: Balogo – waste dump/stockpile capacities and projected areas

Balogo		Capacity (m^3)	Maximum height (m)	Projected area (ha)	Grade (g/t)
Waste dump		9,651,991	38.5	41.69	To 0.5
Stockpile	Marginal	100,553	9	1.19	0.5 to 1.1
Stockpile	Rom pad	26,349	9	0.56	From 1.1

Figure 16-25 to Figure 16-35 show the waste dumps and stockpiles. In some cases, pit designs have been included in order to show the waste dump positions relative to the pits.

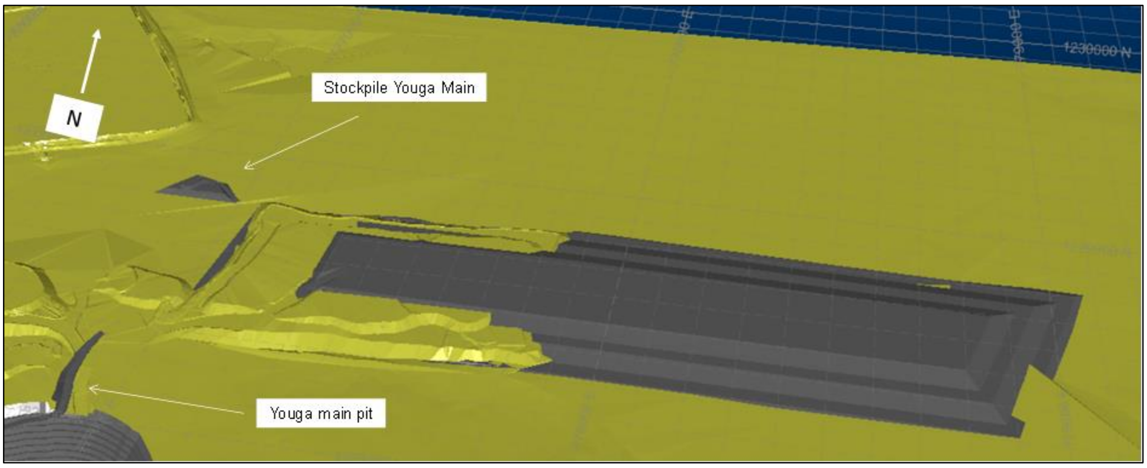


Figure 16-25: Youga Main waste dump and stockpile designs (2017)

The average distance between Youga Main and its waste dump is 1.4 km.

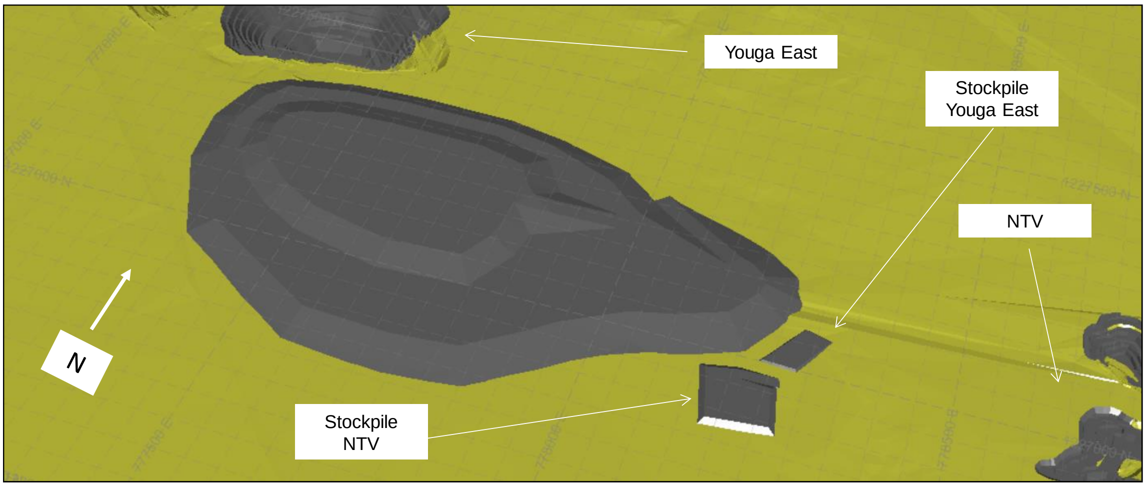


Figure 16-26: Youga East/NTV waste dump and stockpile designs (2017)

Although the new waste dump design covers the position of the old waste dump at Youga East, it will be used as the dump for both Youga East and NTV due to its position between the deposits. The average distances from the waste dump to Youga East and NTV are 1.5 km and 1.7 km respectively.

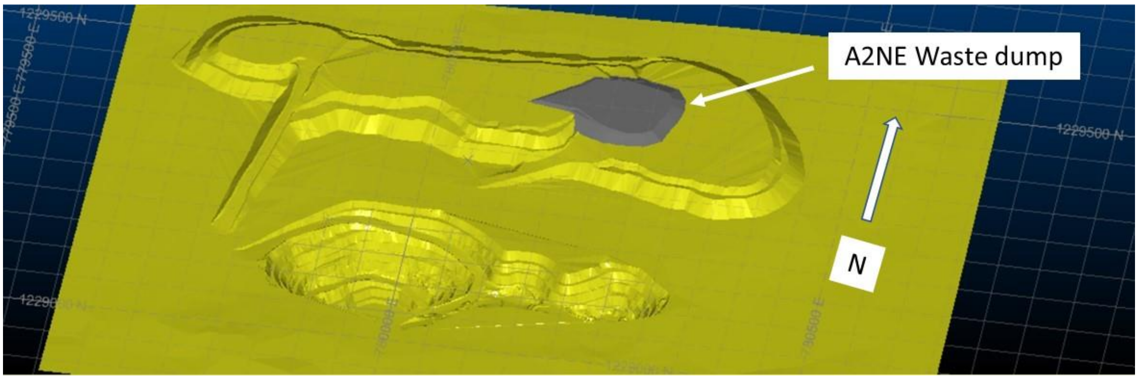


Figure 16-27: A2NE East waste dump

The A2NE East waste dump of has been designed on the current waste dump. The average distance from the pits to the new waste dump is 1.1 km.

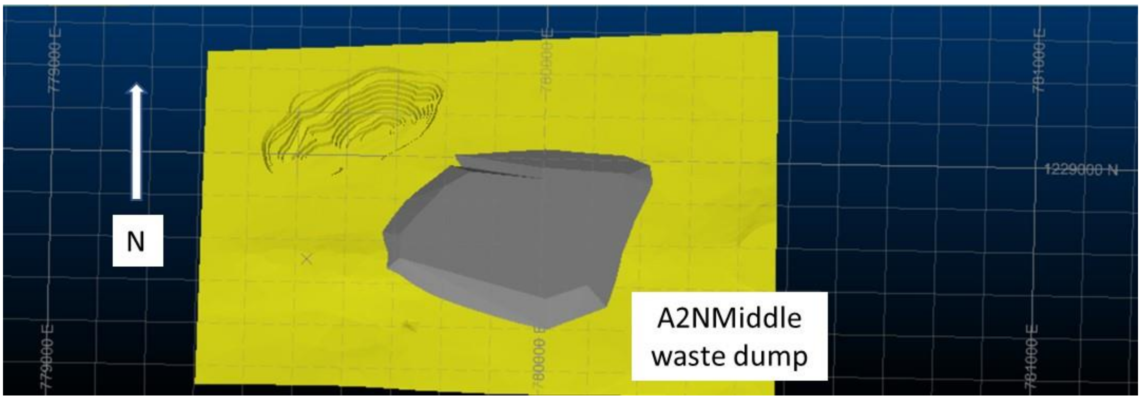


Figure 16-28: A2NE Middle West waste dump

A2N Middle Wet waste dump is located in the southeast of the final pit (0.6 km). This location has been selected to reduce the overloading of the A2NE East waste dump.

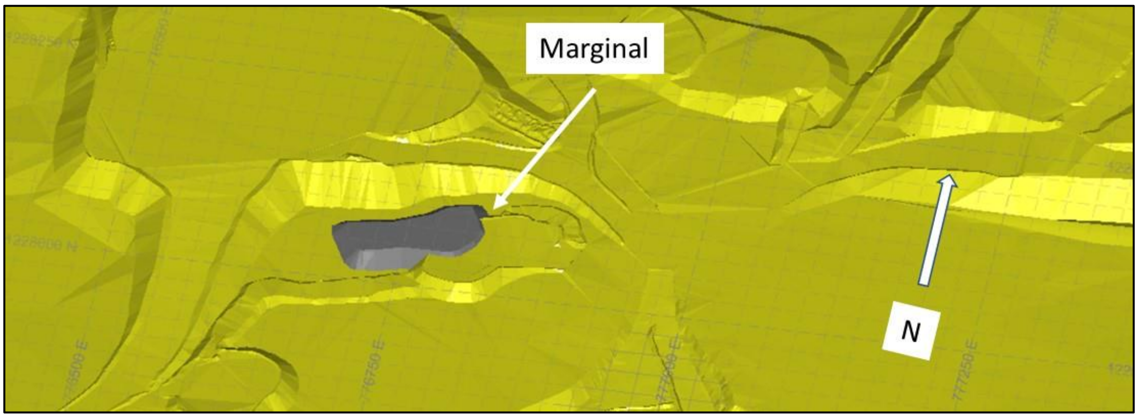


Figure 16-29: Marginal stockpile

Marginal stockpiles for Youga were designed close of the current stockpiles in the north of the Main Pit. The tonnage come from Gassore, A2NE East and A2NE Middle West.

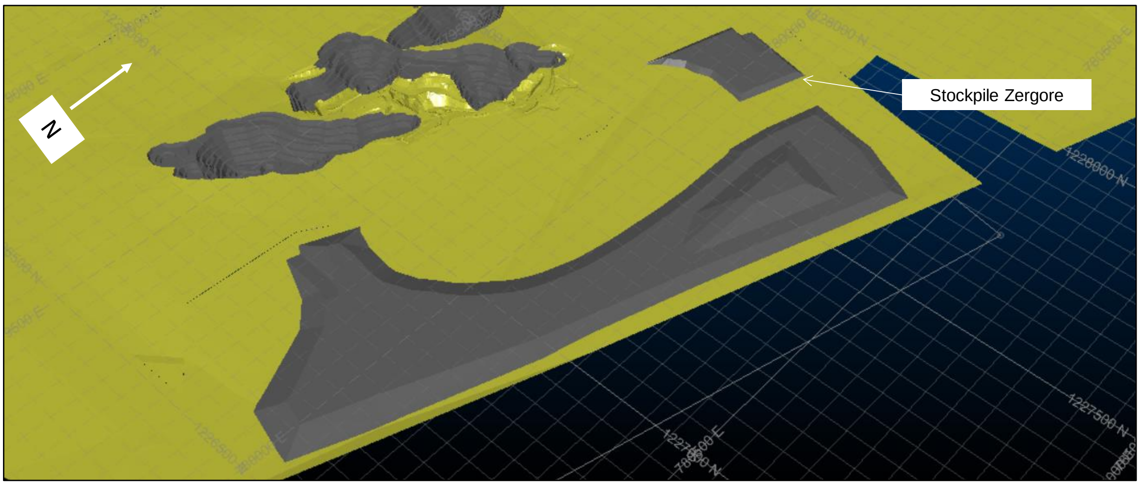


Figure 16-30: Youga-Zergoré waste dump and stockpile designs (2017)

The waste dump design at Zergoré surrounds the existing waste dump. The average distance between the pits and the new waste dump is 1.3 km.

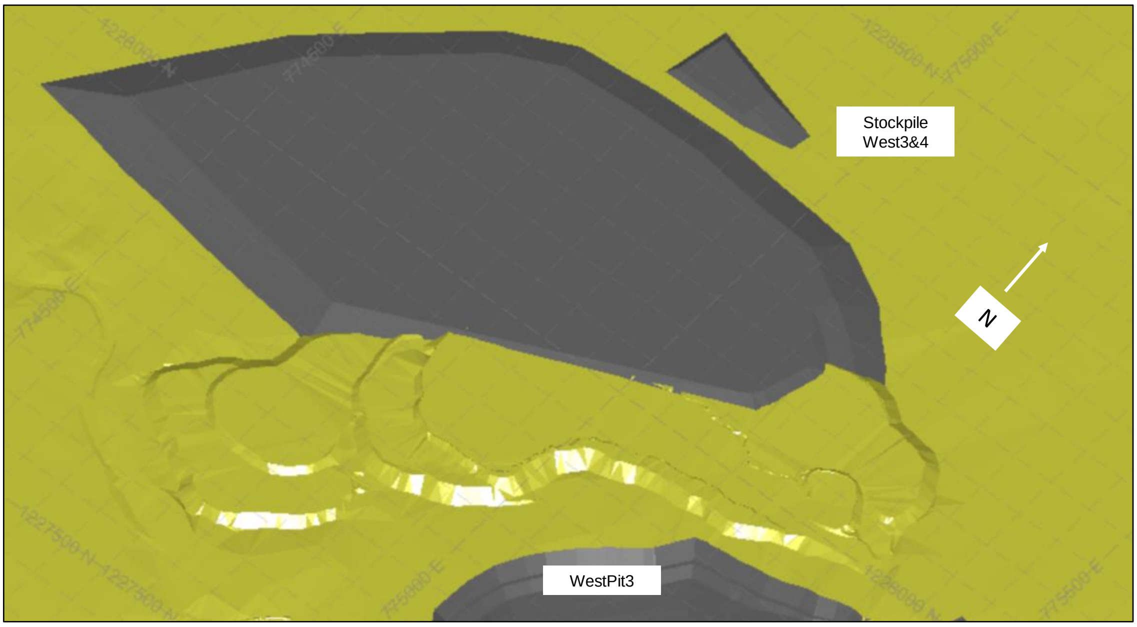


Figure 16-31: Youga – West Pit 3 and West Pit 4 waste dump and stockpile designs (2017)

The old waste dump at West Pit 3 has been expanded to the north to create the new waste dump for both deposits, West Pit 3 and West Pit 4 with an average distance from the pits to the waste dump of 778 m.

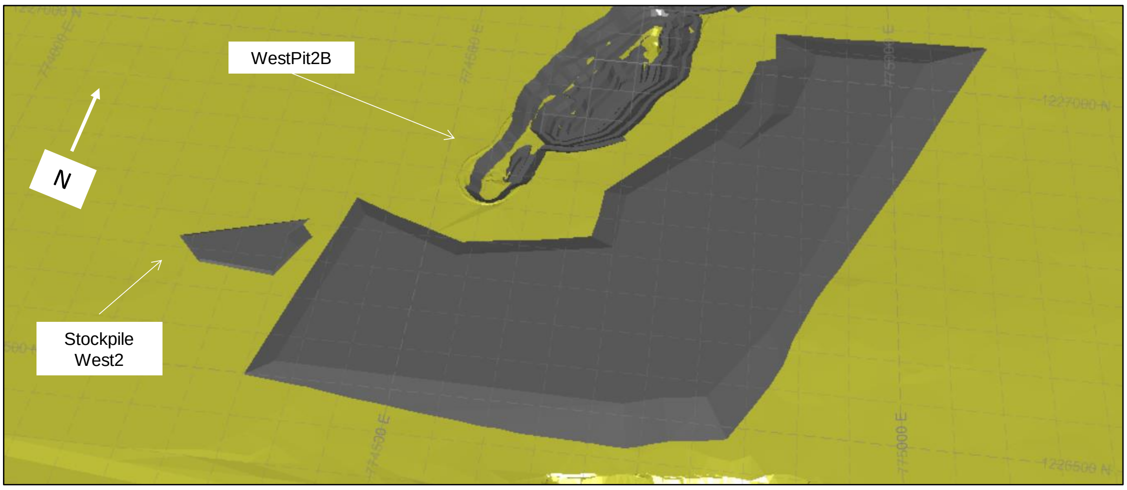


Figure 16-32: Youga – West Pit 2 waste dump and stockpile designs (2017)

The new waste dump design covers the existing waste dump and the average distance from the waste dump to the pit is 0.7 km.

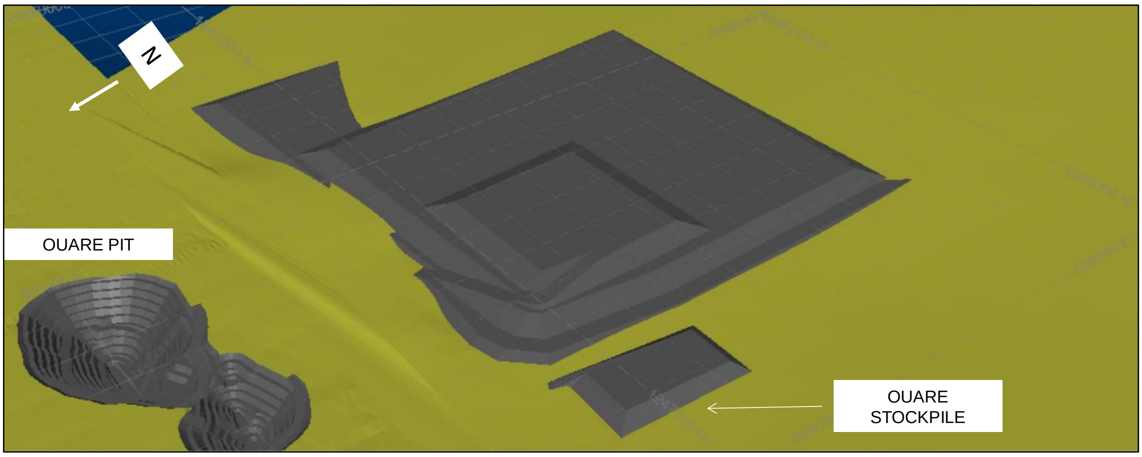


Figure 16-33: Ouaré waste dump and stockpile design (2017)

The average distance between the Ouaré pit and the waste dump is 0.9 km.

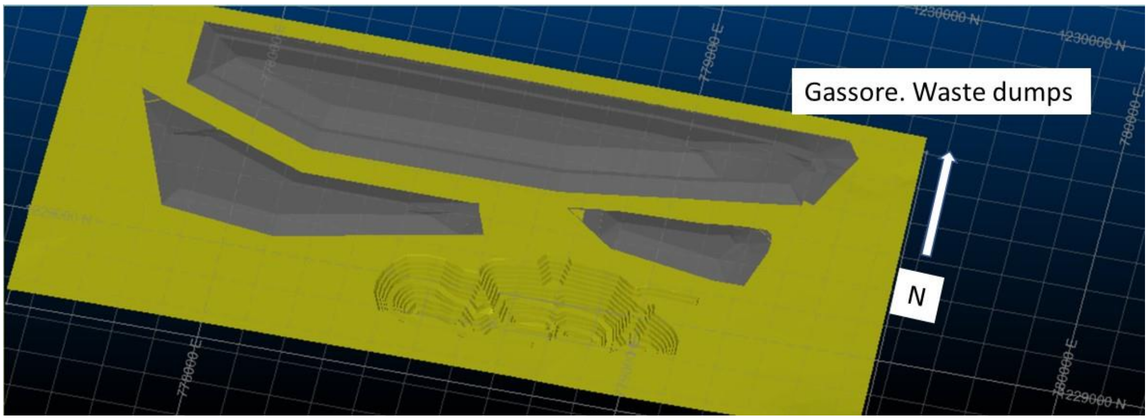


Figure 16-34: Gassore waste dumps

Gassore waste dump comprises three dumps around the north of the pit. The maximum distance between the pit and the largest dump is 1.4 km.

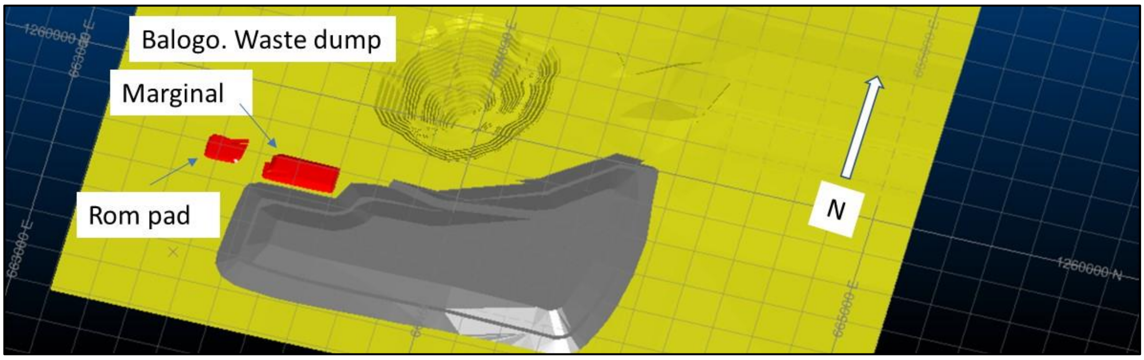


Figure 16-35: Balogo (Netiana) waste dump and stockpiles relative to the pit

The new Balogo waste dump (2018) design was located on the south of the mine by covering part of the current waste dump and it has been expanded to the north of the mine. The marginal and ROM pad was designed close to the mine and the waste dump.

16.7 Mine Layout

The layouts are depicted below in Figure 16-36, to Figure 16-38 for Ouaré, Youga and Balogo respectively and include the following:

- Waste dump new designs (indicated as "WD").
- Current stockpiles.
- Pits.
- Plant.
- Tailings dam.

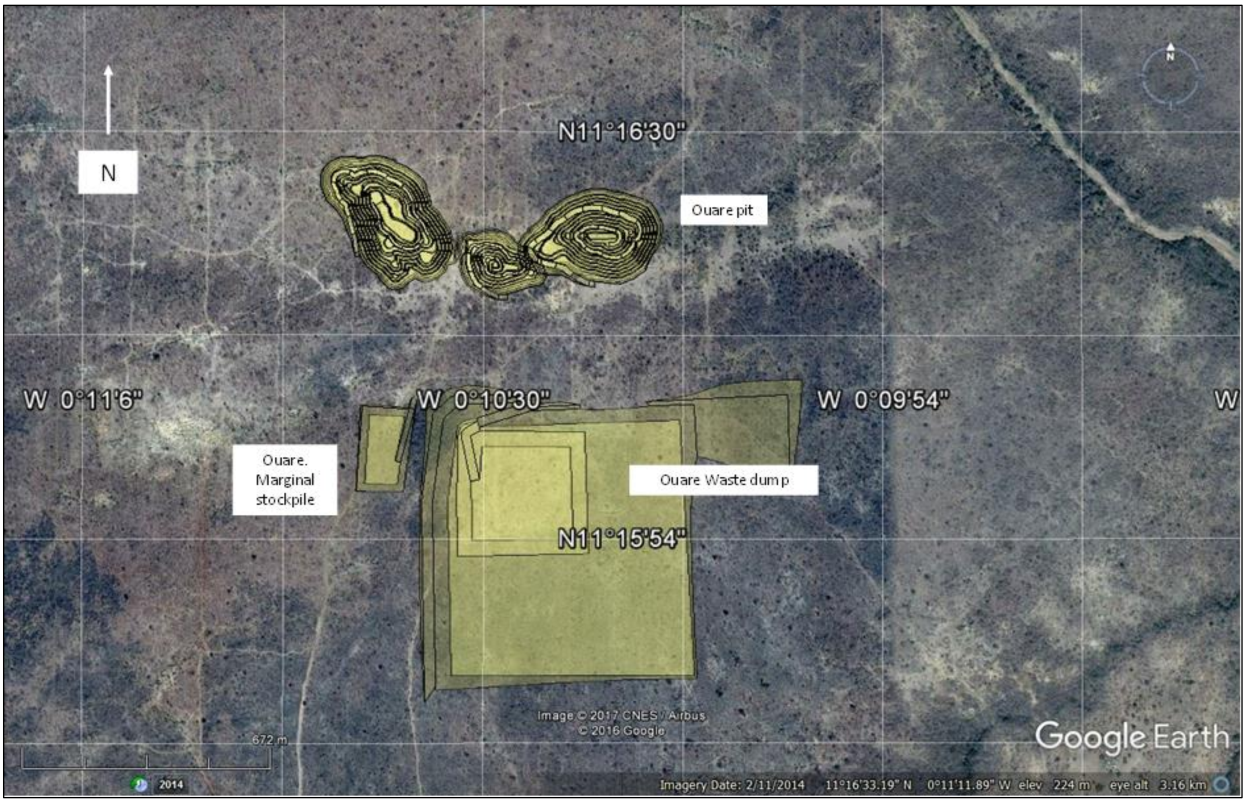


Figure 16-36: Ouaré mine layout (2017)

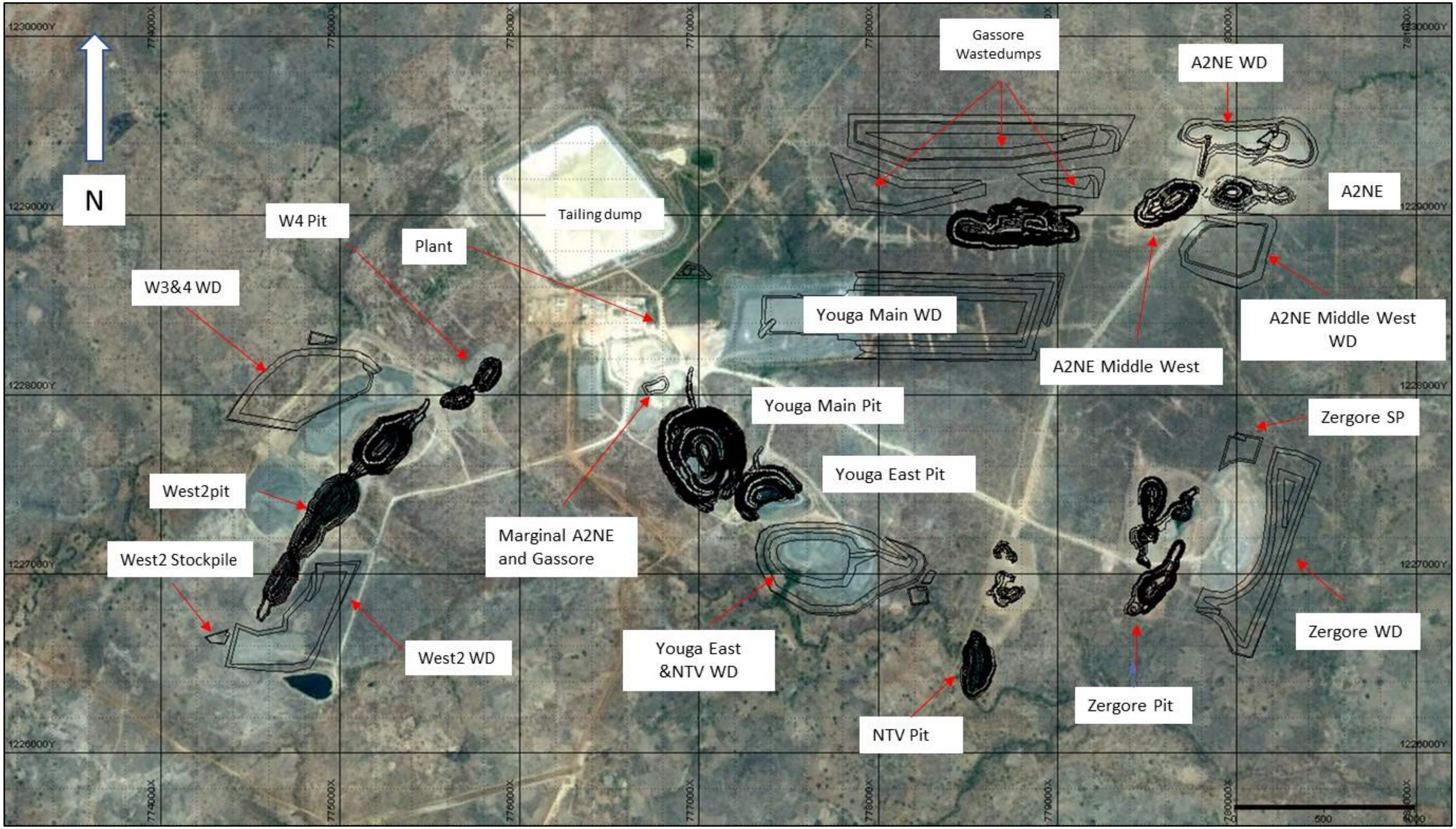


Figure 16-37: Youga mine layout

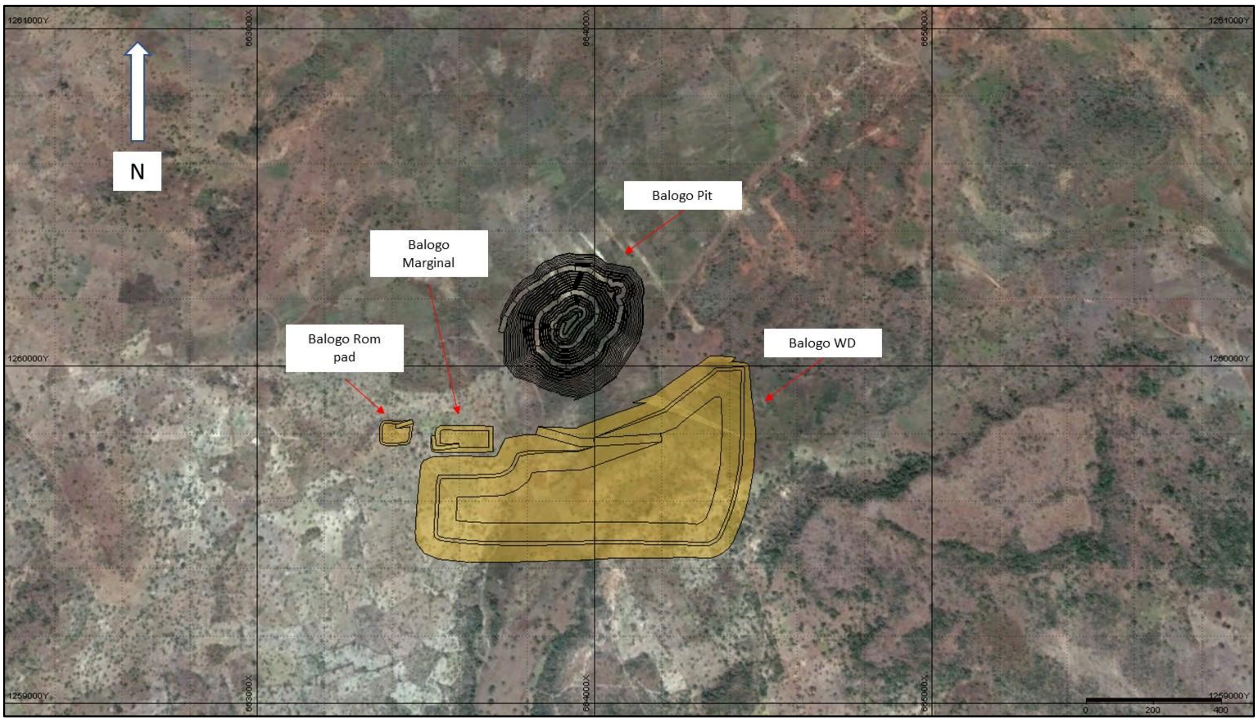


Figure 16-38: Balogo mine layout showing pit, waste dump, ROM pad and marginal ore stockpiles

16.8 Mining Sequence

The pits at Balogo, Youga and the satellite deposit of Ouaré are essentially sequenced in order of profitability so as to maximise early cash flow. However, there are a number of practical considerations that need to be applied when sequencing, namely:

- The earliest production from Ouaré has been set to October 2020 due to the need to develop this project and complete Netiana. This includes building a 44 km access road and constructing a bridge over the Nakambe River.
- Production rates from the individual pits are constrained by access space and bench sinking rate. Typically, the bench sinking rate is limited to less than one bench per month.
- No more than three active pits should be operational at any one time. This is a function of the available equipment and limits on logistics of running multiple pits.
- If possible, a deposit is mined out before moving to the next one. This allows the pit to be closed and rehabilitation to proceed as the Project continues.
- Where two pits of a single deposit are joined then some pre-stripping may have to be done to develop a common access ramp. For example, this occurs with Main Pit and East Pit.

The overall mining sequence is depicted as a bar chart in Figure 16-39 and the mining sequence includes material sourced from the Balogo project (see Section 16.11 for further information). The Reserve tonnes and average grade are shown in the figure below to illustrate the logic behind the sequencing of the deposits.

It should be noted that the LOM schedule incorporates the actuals for Q1 2018 and that the remaining reserves for Netiana, A2N Mid and Gassore were re-estimated by depleting the pit designs to 31 March 2018. In the case of A2NE, as this pit was mined out by May 2018, the actuals for 2018 have been used to define the Reserves.

As a consequence, the quantities in the Mine Schedule and the Financial Model will differ marginally from the Reserve Statement as at 31 December due to the inclusion of the actuals for the first quarter 2018.

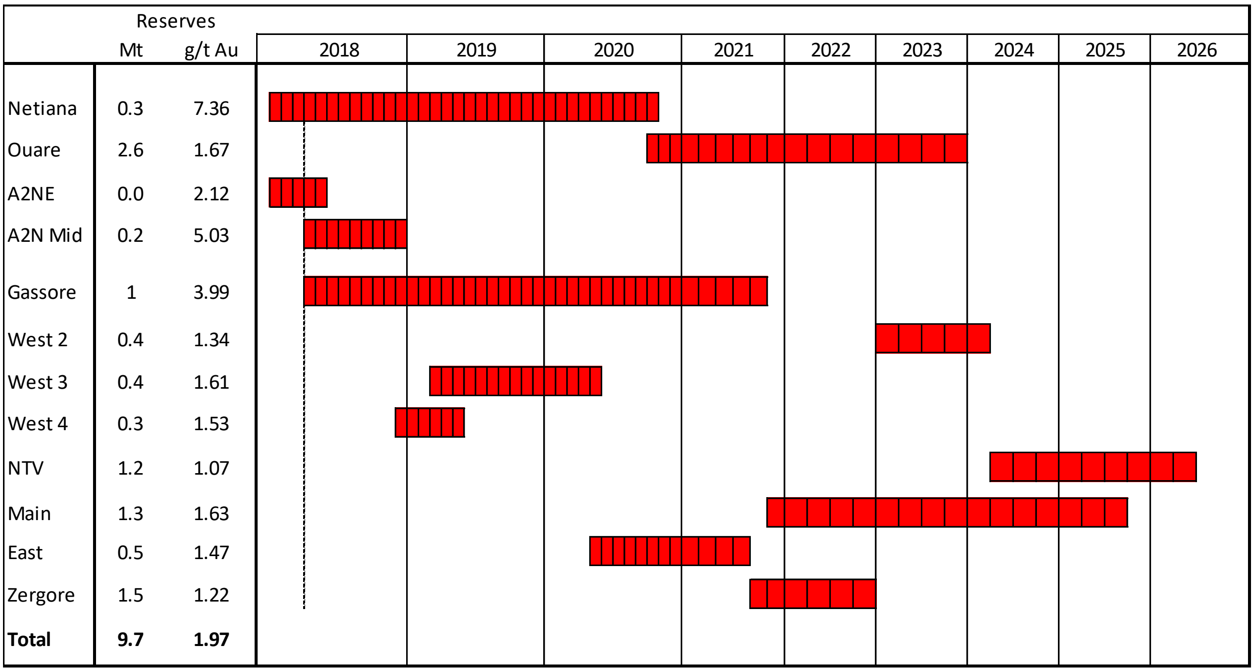


Figure 16-39: Mining sequence for the Youga, Balogo and Ouaré projects

Mining extends until the second quarter of 2026, when the remains of the stockpiles are fed to the plant over the next 12 months.

16.9 Mining Equipment

16.9.1 Drill and Blast

Drilling is with an Atlas Copco D60 rig that drills a 105 mm diameter hole on 5 m benches with a 0.3 m sub-drill. The design parameters for the production shots are shown in Table 16-19.

Table 16-19: Drill and blast parameters – production shots

Project Assumptions	Units	Oxide Ore Dry	Fresh Ore Dry	Oxide Waste Dry	Fresh Waste Dry
Production Patterns					
Input Parameters					
Drill	-	Primary Drill	Primary Drill	Primary Drill	Primary Drill
Proportion of material	(%)	100.0	100.0	100.0	100.0
Bench Height	(m)	5.0	5.0	5.0	5.0
Hole Diameter	(mm)	105.0	105.0	105.0	105.0
Subdrill	(m)	0.3	0.30	0.30	0.30
Spacing	(m)	3.2	3.20	3.20	3.20
Burden	(m)	3.6	3.60	3.60	3.60
Stemming Height	(m)	3.2	3.20	3.20	3.20
Re-drill	(%)	10.0	10.0	10.0	10.0
Rod Length	(m)	7.50	7.50	7.50	7.50
Hoisting Rate	(m/min)	27.70	27.70	27.70	27.70
Cleaninng, retract, tramming, etc	(min.)	3.25	3.25	3.25	3.25
Add/remove rods	(min.)	2.50	2.50	2.50	2.50
Sampling	(%)	100.0	20.0	20.0	20.0
Samples per Hole	(#)				
Primers per Hole	(#)	1	1	1	1
Explosive Product		ANFO	ANFO	ANFO	ANFO
Checks					
Bench Height : Hole Diameter	(m:m)	48	48	48	48
Subdrill to Hole Diameter	(m:m)	2.9	2.9	2.9	2.9
Stemming to Burden	(m:m)	0.89	0.89	0.89	0.89
Drilling					
Hole Depth	(m)	5.3	5.3	5.3	5.3
Volume Rock per Hole	(m3)	57.6	57.6	57.6	57.6
Quantity Rock per Hole	(t)	121.0	150.9	121.0	150.9
Yield of Rock	(m3 rock/m drilled)	10.9	10.9	10.9	10.9
Yield of Rock	(t rock/m drilled)	22.8	28.5	22.8	28.5
Penetration Rate	(m/hr)	33.5	33.5	33.5	33.5
Drill time per Hole	(min.)	12.9	12.9	12.9	12.9
Productivity per meter	(m/doh)	24.6	24.6	24.6	24.6
Productivity per tonne	(t/doh)	561	700	561	700
Blasting					
Stemming Volume	(m3)	0.03	0.03	0.03	0.03
Volume of Charge	(m3)	0.02	0.02	0.02	0.02
Charge Height	(m)	2.1	2.1	2.1	2.1
Charge per Hole	(kg)	14.5	14.5	14.5	14.5
Powder Factor	**(kg/m3)**	**0.25**	**0.25**	**0.25**	**0.25**
Powder Factor	**(kg/t)**	**0.12**	**0.10**	**0.12**	**0.10**

The explosive selected is a heavy ANFO product (Emunex 7000), which has a density of 1.2 t/m3 and Velocity of Detonation (VoD) of 4,600 m/s. This product is mixed on site by the contractor (Maxam).

The drill pattern for wall control (trim blasting) is also drilled with a 105 mm diameter hole and assumes a three-row shot with no sub-drill. The parameters are shown in Table 16-20.

Table 16-20: Drill and blast parameters – wall control

Project Assumptions	Units	Oxide Ore Dry	Fresh Ore Dry	Oxide Waste Dry	Fresh Waste Dry
Trim Patterns					
Wall Control					
Drill Patern		1.8 x 2.0	1.8 x 2.0	1.8 x 2.0	1.8 x 2.0
Drill	-	Primary Drill	Primary Drill	Primary Drill	Primary Drill
Bench Height	(m)	5.0	5.0	5.0	5.0
Hole Diameter	(mm)	105.0	105.0	105.0	105.0
Spacing	(m)	1.8	1.8	1.8	1.8
Burden	(m)	2.0	2.0	2.0	2.0
Stemming Height	(m)	3.5	3.5	3.5	3.5
Subdrill	(m)	0.0	0.0	0.0	0.0
Charge Height	(m)	1.5	1.5	1.5	1.5
Re-drill/Drilling Overlap Factor	(%)	10.0	10.0	10.0	10.0
Rod Length	(m)	7.50	7.50	7.50	7.50
Hoisting Rate	(m/min)	27.70	27.70	27.70	27.70
Cleaninng, retract, tramming, etc	(min.)	3.25	3.25	3.25	3.25
Add/remove rods	(min.)	2.50	2.50	2.50	2.50
Sampling	(%)	0.0	0.0	0.0	0.0
Samples per Hole	(#)				
Primers per Hole	(#)	1	1	1	1
Explosive Product		ANFO	ANFO	ANFO	ANFO
Drilling					
Hole Depth	(m)	5.00	5.00	5.00	5.00
Volume Rock per Hole	(m3)	18.0	18.0	18.0	18.0
Quantity Rock per Hole	(t)	37.8	47.2	37.8	47.2
Yield of Rock	(m3 rock/m drilled)	3.6	3.6	3.6	3.6
Yield of Rock	(t rock/m drilled)	7.6	9.4	7.6	9.4
Penetration Rate	(m/hr)	33.5	33.5	33.5	33.5
Drill time per Hole	(min.)	12.4	12.4	12.4	12.4
Blasting					
Stemming Volume	(m3)	0.03	0.03	0.03	0.03
Volume of Charge	(m3)	0.01	0.01	0.01	0.01
Charge Height	(m)	1.5	1.5	1.5	1.5
Charge per Hole	(kg)	10.4	10.4	10.4	10.4
Productivity per meter	**(m/doh)**	**24.22**	**24.22**	**24.22**	**24.22**
Productivity per tonne	**(t/doh)**	**183.11**	**228.46**	**183.11**	**228.46**

16.9.2 Loading and Hauling

The primary loaders for Youga, Ouaré and Balogo are assumed to be with a mix of hydraulic excavators (30–80 t), which will load 45-t articulated trucks. This combination has been tried and tested previously at Youga since October 2016 and has been shown to provide a good compromise between productivity and selectivity.

Based on a loader utilisation of 74%, it can be shown that the theoretical loader productivity ranges for the mid-size exactor (3.5 m^3 bucket) is between 480 t per Direct Operating Hour (doh) for weathered material (Regolith or Oxide) to 600 t/doh for Transition or Fresh material (Table 16-21).

The haul truck productivity is primarily based on the cycle and travel time, which in the case of Youga varies considerably between deposits depending on:

- Distance from pit exit to ROM pad
- Distance from pit exit to waste dump
- Depth of the pit.

The ex-pit travel time for Ouaré and Netiana is relatively short as the ore is dumped at the pit exit onto the temporary ROM pad for future rehandling into the trucks used to transport ore from Ouaré and Netiana, respectively, to the ROM pad at Youga.

The number of trucks required has been calculated for each schedule period (months or quarters) by estimating the truck hours for each pit included in the mining sequence. This takes into account the loading time, dumping time, queue and spot time, bench haul distance, pit depth and travel time to the destination. Average speeds are allocated to the haul profile to allow for speed loaded and empty on the flat and on ramps.

Based on an average of 5,840 operating hours per year and an average cycle time of 15 minutes, it is expected that eight trucks will be required at the outset at Balogo.

Table 16-21: Loader productivity parameters

	Units					
Material Type	-	Fresh Waste	Fresh Ore	Oxide Waste	Oxide Ore	RoM Rehandle
Loading						
Loading Unit		Primary Excavator	Primary Excavator	Primary Excavator	Primary Excavator	Primary Excavator
Bucket Size	(m3)	3.5	3.5	3.5	3.5	3.5
Loading Spot Time	(min.)	0.50	0.50	0.50	0.50	0.50
Loading Cycle Time	(min.)	0.50	0.50	0.50	0.50	0.50
First Bucket Dump	(min.)	0.05	0.05	0.05	0.05	0.05
Haulage						
Truck		Primary Truck	Primary Truck	Primary Truck	Primary Truck	
Capacity	(t)	40.00	40.00	40.00	40.00	
Capacity	(m3)	14.00	14.00	14.00	14.00	
Dump & Spot Time	(min.)	1.20	1.20	1.20	1.20	
FEL Travel Time	(min)					1.00
Bucket Fill Factor	(%)	90	90	90	90	95
In-Situ Density	(t/bcm)	2.62	2.62	2.10	2.10	2.00
Swell Factor	(lcm/bcm)	1.40	1.40	1.40	1.40	1.40
Loose Density	(t/lcm)	1.87	1.87	1.50	1.50	1.43
Moisture Factor	(%)	5.0	5.0	5.0	5.0	5.0
Passes	(#)	4.4	4.4	4.4	4.4	
Passes (Rounded)	(#)	4	4	4	4	
Passes (Override)	(#)					
Loaded Quantity	(t)	26.2	26.2	21.0	21.0	5.0
Loaded Volume	(m3)	14.0	14.0	14.0	14.0	3.5
Loading Productivity						
Total Loading Cycle Time	(min.)	2.05	2.05	2.05	2.05	1.05
Loader Operator Efficiency	(%)	83	83	83	83	83
Loader Productivity	**(t/doh)**	**606**	**606**	**486**	**486**	**226**
Loader Productivity	(lcm/doh)	324	324	324	324	158
Loading Unit Utilisation	(%)	73.7	73.7	73.7	73.7	73.7
Loading Productivity	**(Mtpa)**	**3.9**	**3.9**	**3.1**	**3.1**	**1.5**

16.9.3 Ancillary Equipment

The ancillary equipment consists of drills, dozers, graders and FELs. The proposed equipment list is shown in Table 16-22. The number of units is kept constant over the life of the mine and will only be reduced once the pit is mined out. At this time, reclaiming of any remaining stocks will continue with a reduced fleet of a FEL, two trucks, one grader and one track-dozer.

Table 16-22: Support equipment

Equipment	Model/Size	Current	Maximum number
Drill rigs	Atlas Copco D60/T40	2	6
Dozer	Cat D6-D8	4	4
FEL	Cat 966H/988	2	2
Grader	Cat 14M	1	1
TLB	-	1	1
Compactor	-	1	1
Lighting plant	-	6	6
On-highway truck	Merc 3340	5	5
Tractor truck	-	1	6
Dewatering pump	Cat 14M	1	2

16.9.4 Service Equipment

The proposed service equipment lists for Youga, Ouaré and Balogo are shown in Table 16-23 and Table 16-24.

Table 16-23: Service equipment for Youga and Ouaré

Equipment	Model/Size	Units
Backhoe	Cat 330	1
Service truck		1
Fuel truck	Man	1
Tyre handler		1
Large crane		1
Low bed	Man	1
Light vehicles		10
Personnel carrier		1

Table 16-24: Service equipment for Balogo

Equipment	Model/Size	Units
Service truck	Man	1
Fuel truck	Man	1
Light vehicles	Toyota	3
Personnel carrier	Toyota	1

The equipment lists for machines currently on site may differ slightly from the above, due to a mix of equipment with different states of mechanical availability and condition. The lists shown above are used to estimate the mining costs and are representative of the minimum list of equipment needed to support the selected major pieces of equipment.

16.10 Operational Considerations

16.10.1 Blasting

For the production shots, it is assumed that 105 mm diameter holes are drilled on 5 m benches with a 0.3 m sub-drill. The stemming length has been adjusted to account for the air gap that is typically left in the column so that the total explosive per hole is approximately 14 kg.

The normal practice is to “paddock” blast ore and waste together with no free face. This minimises the movement during blasting and limits the mixing of ore and waste at the contacts.

It was observed at Youga that with a relatively low powder factor the heave is typically less than 1 m. This helps with the grade control as the bench preparation for loading is fairly minimal, which helps to avoid contamination of the ore during dozing.

The blast pattern for wall control uses close-spaced holes with a reduced charge per hole. These shots are typically taken in advance of the production shots so as to limit the damage to the final wall.

16.10.2 Grade Control

The grade control process is based on a combination of interpretation of ore composites from the block model, infill drilling with RC holes and trench sampling of the working bench. By applying a range of cut-off grades the mineralised material is split into the following categories at Youga and Ouaré (Table 16-25) and Balogo (Table 16-26).

Table 16-25: Youga and Ouaré – material categories for grade control

Category	Material code	Grade range	
		g/t Au	g/t Au
High-High Grade	HHG	≥15.0	
High Grade	HG	≥10.0	<15.0
Low-High Grade	LHG	≥5.0	<10.0
Medium	MG	≥1.8	<5.0
Low Grade	LG	≥1.2	<1.8
Low-Low Grade	LLG	≥0.7	<1.2
Marginal	Marginal	≥0.5	<0.7

At Youga the cut-off grade has been set to 0.7 g/t Au. Marginal material below cut-off grade and above 0.5 g/t Au is stockpiled as a Resource for future use. Material with a grade less than 0.5 g/t Au is sent to the waste dump.

The same grade control procedure is applied to Ouaré, except the cut-off grade for LLG has been adjusted to 0.82 g/t Au to allow for the additional cost of transportation of ore from Ouaré to Youga.

Table 16-26: Balogo – material categories for grade control

Category	Material code	Grade range	
		g/t Au	g/t Au
High High Grade	HHG	≥15.0	
High Grade	HG	≥10.0	<15.0
Low High Grade	LHG	≥5.0	<10.0
Medium	MG	≥1.8	<5.0
Low Grade	LG	≥1.1	<1.8
Low Low Grade	LLG	≥0.7	<1.1
Marginal	Marginal	≥0.5	<0.7

At Netiana, the cut-off grade was estimated as 1.1 g/t Au. Therefore, Low Grade material and above are fed to the plant whilst LLG and Marginal are stockpiled at site as a Resource. Material with a grade less than 0.5 g/t Au is sent to the waste dump.

16.11 Production Schedule

16.11.1 Methodology

The production schedule was created in Microsoft Excel by first importing the bench reserves for each pushback. The bench reserves are split into the following material categories at Youga and Ouaré (Table 16-27) and Balogo (Table 16-28).

Table 16-27: Youga and Ouaré – material categories and destinations for scheduling

Category	Material code	Grade range		Destination
		(g/t Au)	(g/t Au)	
High Grade	HG	≥2.5		ROM
Medium	MG	≥1.8	<2.5	ROM
Low Grade	LG	≥1.2	<1.8	ROM
Low-Low Grade	LLG	≥0.7	<1.2	LLG stocks
Marginal	Marginal	≥0.5	<0.7	Marginal stocks
Waste	Waste		<0.5	Waste dump

Table 16-28: Netiana – material categories and destinations for scheduling

Category	Material code	Grade range		Destination
		(g/t Au)	(g/t Au)	
High Grade	HG	≥2.5		ROM
Medium	MG	≥1.8	<2.5	ROM
Low Grade	LG	≥1.1	<1.8	ROM
Low-Low Grade	LLG	≥0.7	<1.1	LLG stocks
Marginal	Marginal	≥0.5	<0.7	Marginal stocks
Waste	Waste		<0.5	Waste dump

The schedule is driven by the specified mining rate (t/hour) in a scheduling period. For Youga and Netiana, the scheduling periods were months and the first period of mining was January 2018.

The Microsoft Excel scheduler automatically selects material from the bench reserves to match the specified production for a scheduling period. This means that the mining progresses bench-by-bench and that a proportion of a bench can be mined in a scheduling period.

Based on the total rock moved, the quantities of each material type that are sent to each destination (ROM pad, stockpile or waste dump) are computed and the cumulative quantities recorded. The reclaim from the ROM stockpile is then automated such that the highest-grade material is reclaimed first.

The main constraints on the mine schedule are:

- Maximum bench sinking rate
- Limit of three active pits at any one time in any one mining area
- Maximum ore transport rate from Ouaré and Netiana to Youga.

The maximum annual vertical sinking rate has been set at 90 m per pushback. On the uppermost benches, it may be possible to exceed this rate by using temporary ramps but as the pushback deepens the access constraint to a bench becomes the limiting factor. This is particularly true of the bottom benches where single lane ramps are used, and the area of each bench diminishes with depth.

The constraint on ore transport from Ouaré and Netiana to the ROM pad at Youga is dependent on:

- Number of trucks
- Truck availability
- Truck size
- Shifts per day
- Cycle time.

16.11.2 Stockpiling

The ore grade material from the Youga pits will be transported to the ROM pad next to the crusher. The ore will be segregated into separate stockpiles based on grade so that they can be loaded by a FEL to achieve the required blend.

The ore grade material from Ouaré and Netiana will be stockpiled near to the respective pit exits on a temporary ROM pad. This material will then be loaded into the Volvo trucks and transported to the main ROM pad at Youga. Final blending of the crusher feed is performed at the Youga ROM pad, as there are multiple ore sources from the Youga, Balogo and Ouaré.

Sub-economic mineralised material (Marginal) will be stockpiled at Youga or Ouaré, whereas LLG and Marginal material will be stockpiled at Netiana, as a potential Resource should the price increase or a buyer is found for the raw material. The Low Grade and Marginal material, respectively, should ideally be split into separate stockpiles in order to provide flexibility.

16.11.3 Production

The production profiles for Youga and Balogo commences in January 2018 with the A2NE, A2N Mid, Gassore and Netiana forming the primary ore sources in 2018. The A2NE pit has been in production since October 2016 and has been stripped down to the ore benches so that it is actively producing ore. Low-grade material from A2NE, and other pits has been stockpiled and this Reserve is included in the schedule.

At Netiana, the starter pit is nearing completion and stripping of the second stage has commenced. The transport rate between Netiana and Youga varies considerably over time and is used as a means of controlling the average feed grade to the plant.

The monthly production profile for the Youga and the Ouaré pits for the period January 2018 to December 2020 are shown in Figure 16-40. The production for 2021 to 2025 was scheduled in quarters and is shown in Figure 16-41. The mine production for the Netiana is shown in Figure 16-42.

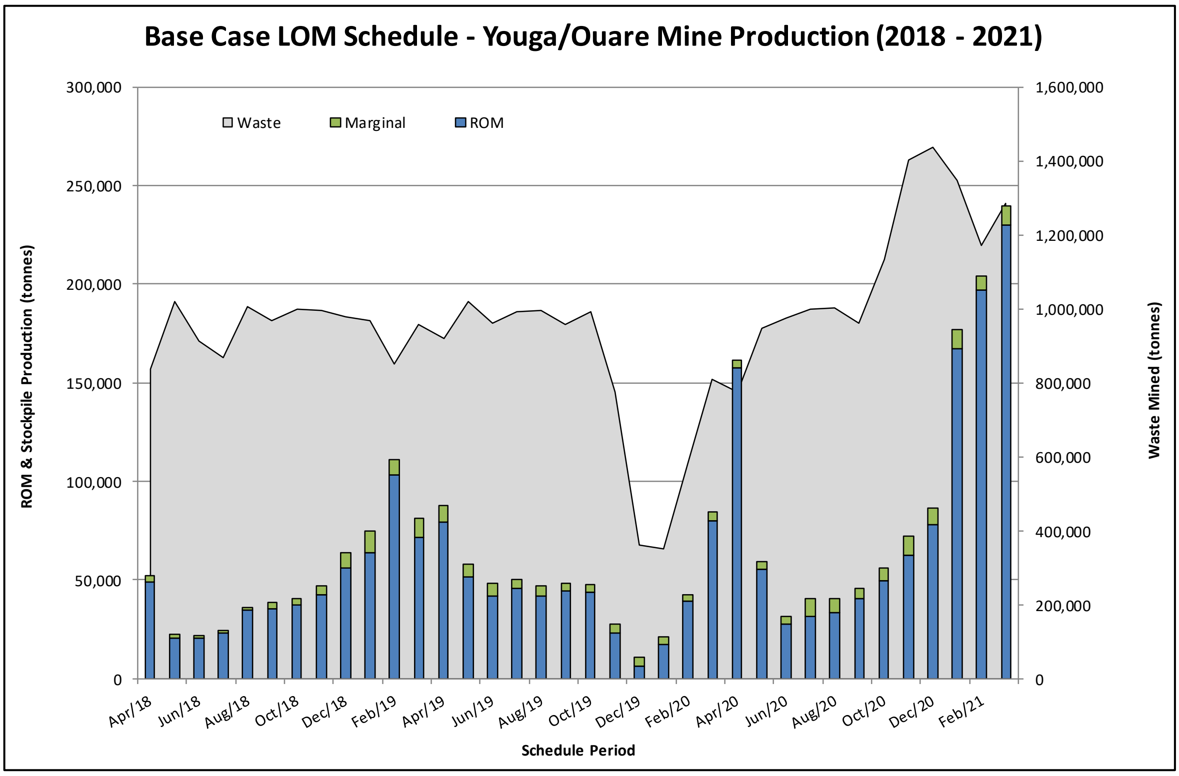


Figure 16-40: Production profile for Youga/Ouaré (2018 to 2021)

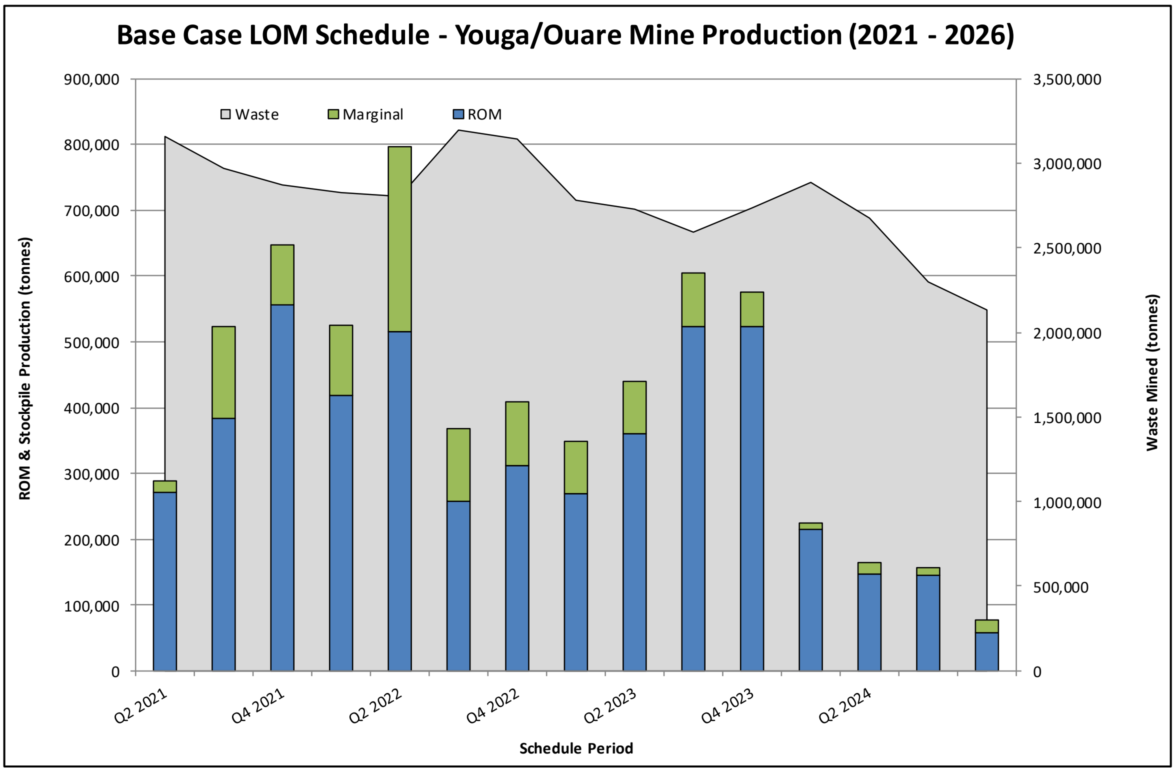


Figure 16-41: Production profile for Youga and Ouaré (2021 to 2026)

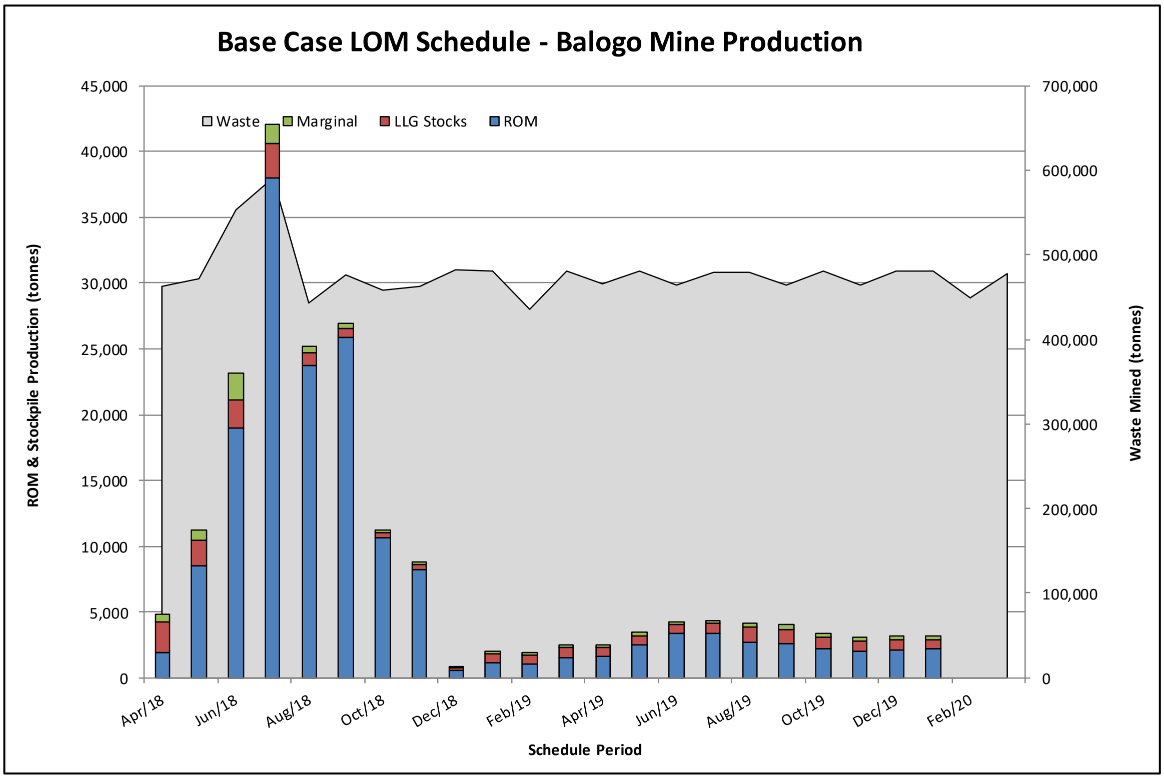


Figure 16-42: Production profile for Netiana

The corresponding stockpile levels for Youga and Ouaré are shown in Figure 16-43 and Figure 16-44, and for Balogo in Figure 16-45. Note that at Balogo, the LLG stocks are not reclaimed as they are not economic at this time.

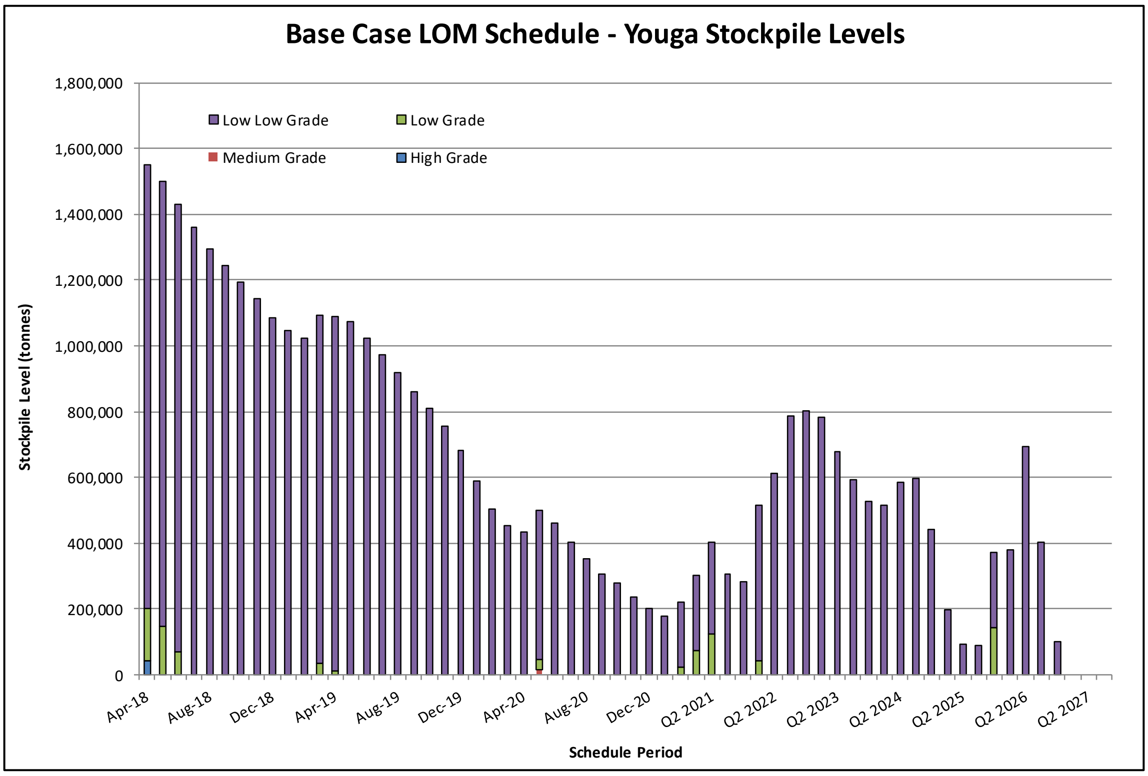


Figure 16-43: Stockpile levels for Youga

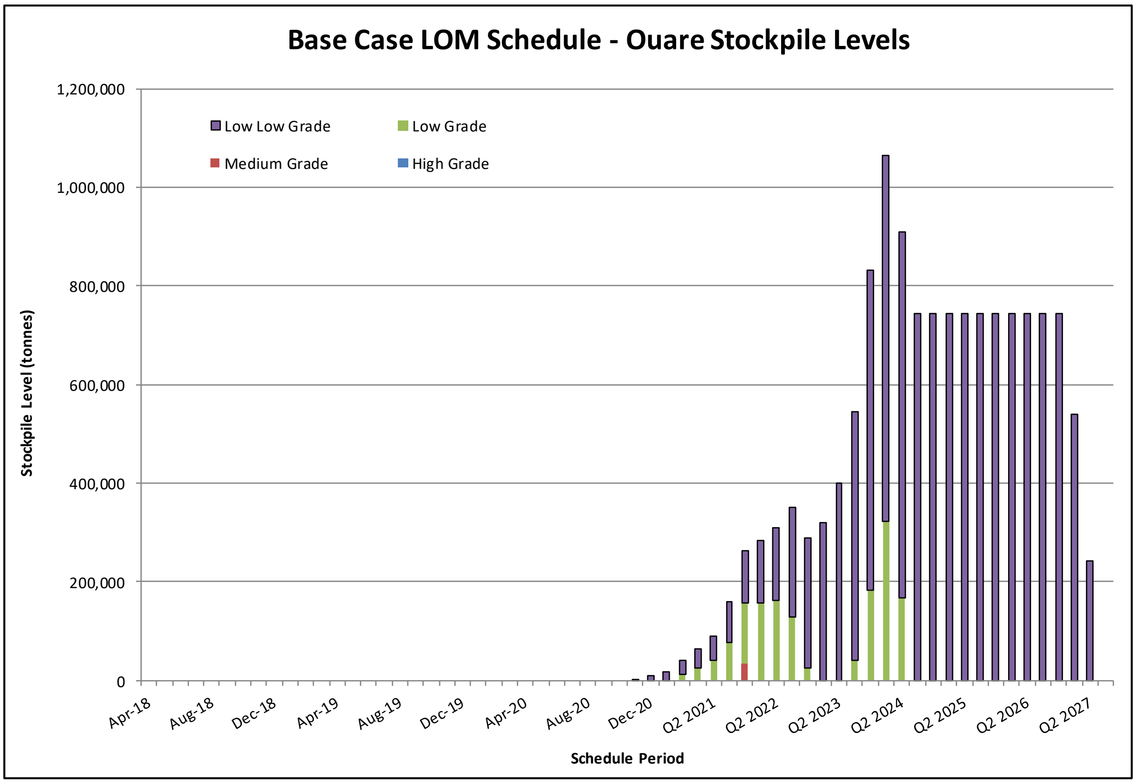


Figure 16-44: Stockpile levels for Ouaré

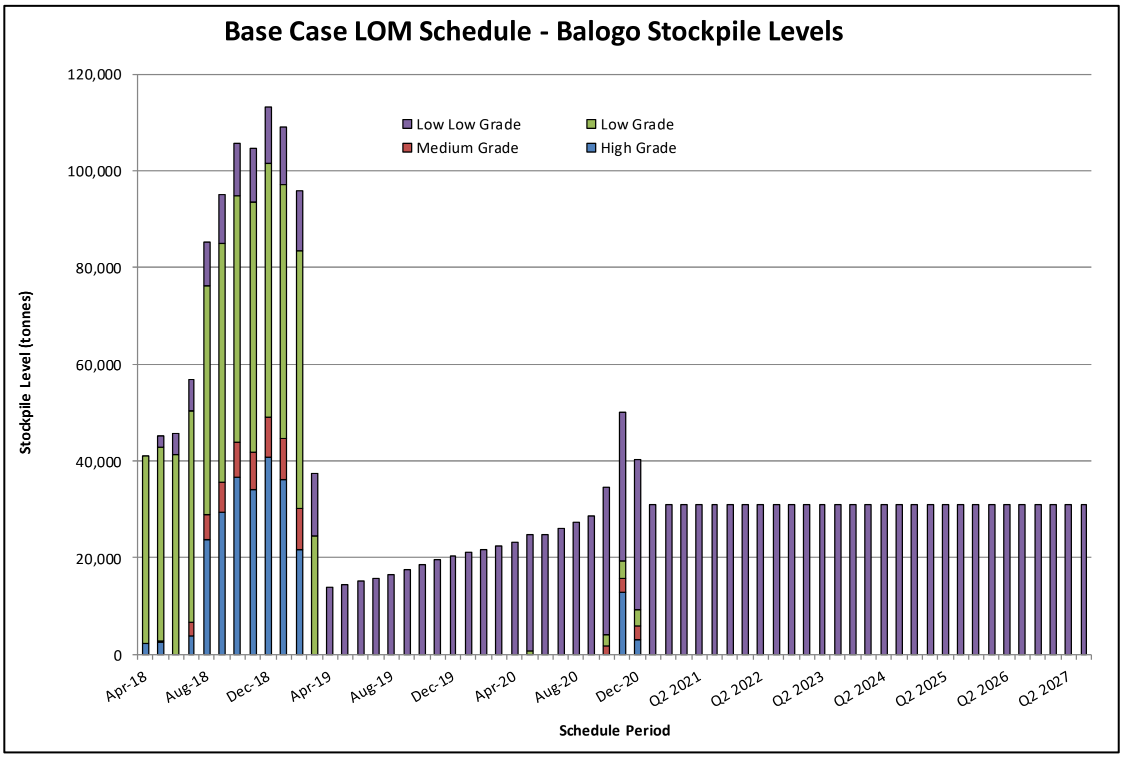


Figure 16-45: Stockpile levels for Balogo

The combined stockpile levels for Youga, Ouaré and Balogo are shown in Figure 16-46.

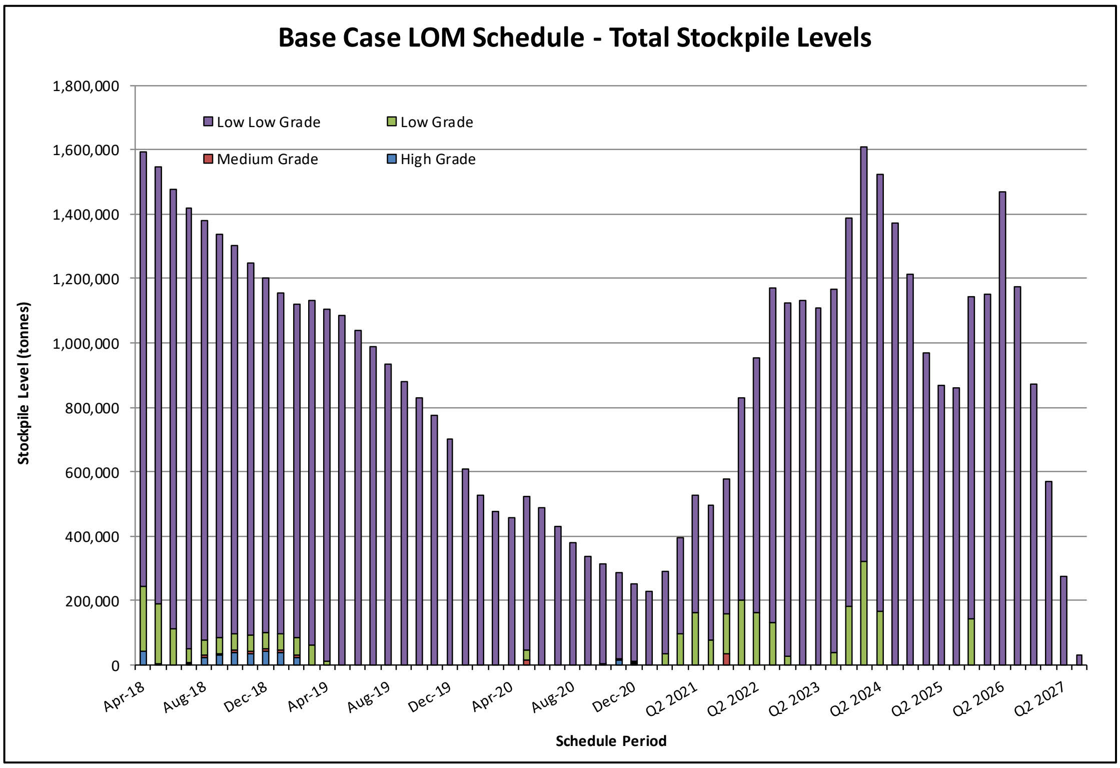


Figure 16-46: Combined stockpile levels (Youga, Ouaré and Balogo)

It can be seen in Figure 16-46 that the combined stockpile level is relatively large due to the deferment of Low Grade and LLG order in order to maximise plant feed grade in the early years. Whilst this provides a buffer between the mine production and plant production it highlights the issue of grade control and the desire to high grade as much as possible.

Over the period 2018 to 2020, there is a general decline in stockpile levels as the stockpiled LLG material is fed to the plant whilst Gassore and A2N Mid are developed and there is a limit on the mine capacity due to the high stripping ratio for these pits.

From 2021 onwards, the level of LLG stockpiles starts to grow again. This is primarily due to the fact that lower grade pits are coming into production and higher-grade material is fed preferentially where possible. It is possible that the level of this stockpile could be significantly reduced by reducing the mining rate. However, this would mean that the average grade in these periods would drop due to the reclamation of the LLG stocks.

With a fleet of 20 to 30 trucks to transport ore from Balogo to Youga there is sufficient for the planned transport rates. The constraint on feed to the plant at Youga therefore comes down to the mining rate, which is primarily controlled by the maximum bench sinking rate. It is believed that the assumed maximum mining rate for Netiana is reasonable and there is limited opportunity to optimise the schedule beyond that shown.

The ore feed from Netiana to the plant at Youga will be combined with the ore feed from other deposits at Youga and Ouaré.

The feed to the plant is shown in Figure 16-47 and Figure 16-48.

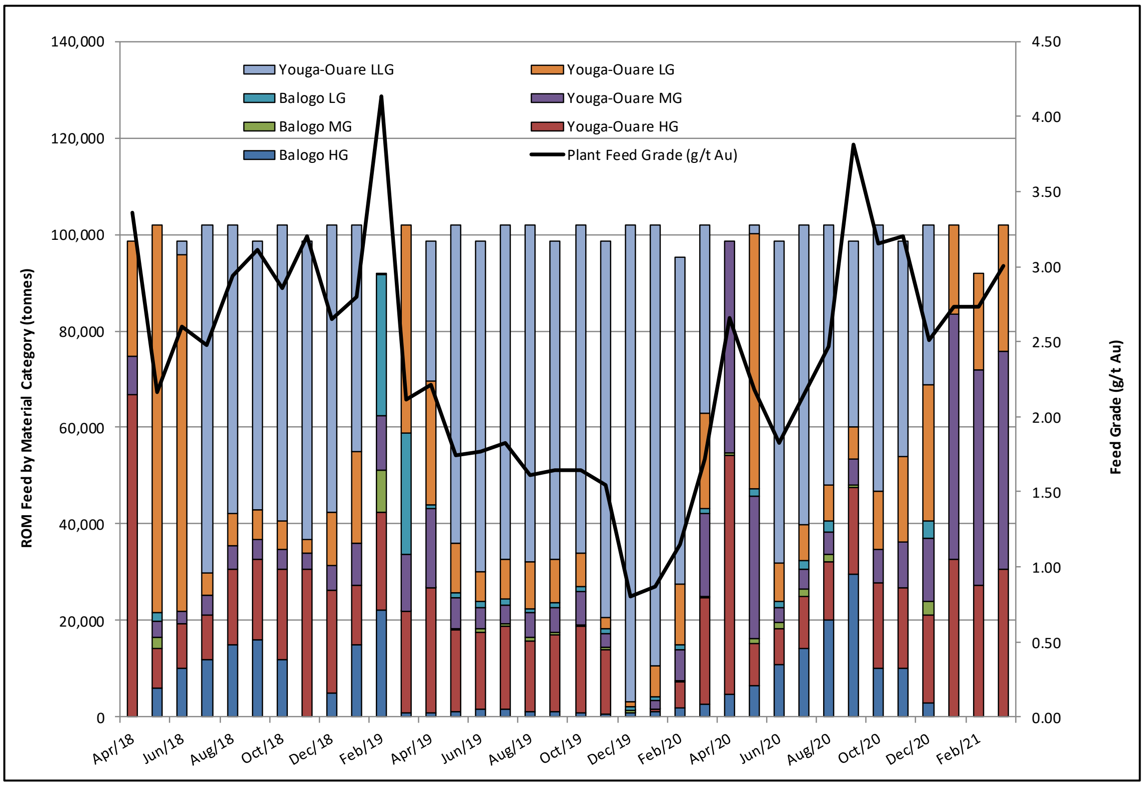


Figure 16-47: Overall plant feed (2018 to 2021)

It can be seen that the production from Balogo has a significant impact on the overall feed grade to the plant due to the high grade of the starter pit. As a consequence, the average feed grade exceeds 3 g/t Au in 2018 then gradually declines in 2019, until it starts to pick up again in 2020.

By Q2 2026 the pits are depleted, and the plant feed solely comes from reclaiming the LLG stockpile over the next 12 months.

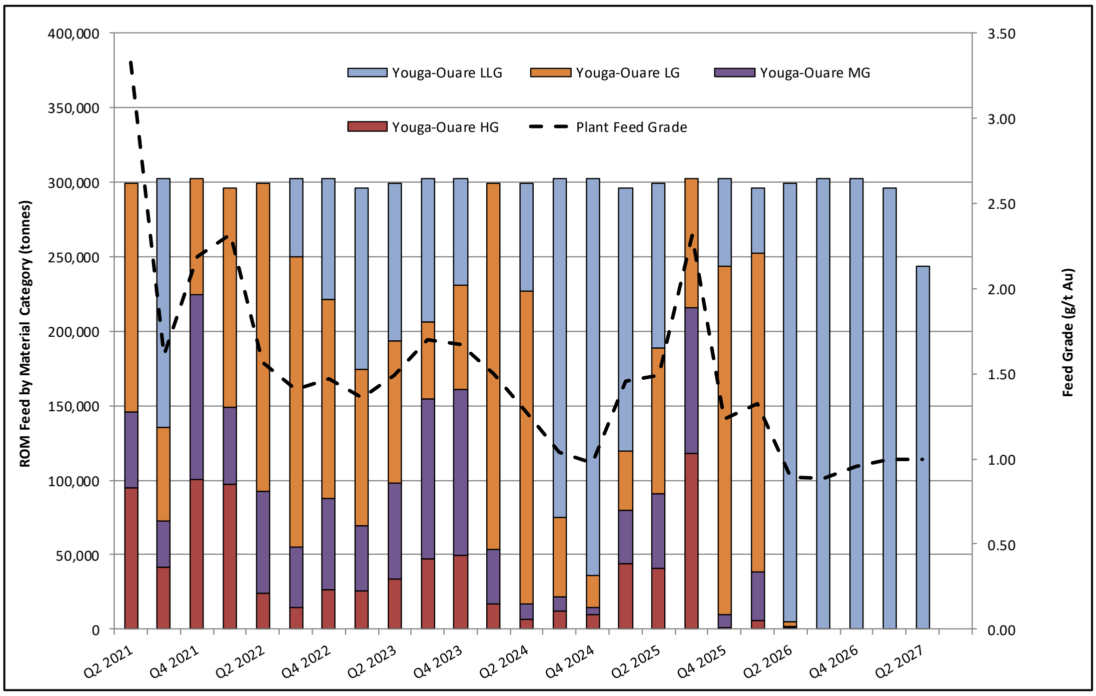


Figure 16-48: Plant feed (2021 to 2027)

16.11.4 Equipment Requirements

The major items of equipment are summarised in Table 16-29 and Table 16-30.

Table 16-29: Equipment list – Youga and Ouaré

Equipment type	Model/Size	Current	Maximum number
Excavator	Mix of 30 t to 80 t	8	7
Haul trucks	45 t	18	21
Drill	Atlas Copco D60	2	6
FEL	Cat 988	2	2

Table 16-30: Equipment list – Balogo

Equipment type	Model/Size	Units
Excavator	Cat 374	3
Excavator	Cat 345	1
Haul trucks	Cat 745	8/10
Drill	Atlas Copco D60	3
FEL	Cat 988	1
Track dozer	Cat D8	2
Grader	Cat 14M	1
Service truck		1
Fuel truck		1
Light vehicles		3
Personnel carrier		1

Note that the explosives truck is supplied by the contractor and has not been included in these lists as it is provided as part of a fixed price contract for a down the hole service. It should also be noted that although the haul truck requirements at Youga and Ouaré increase from five in 2018 to 21 in 2020, this increase is offset by transferring equipment from Balogo to Ouaré. The transfer of equipment from Balogo to Youga requires that only two additional drill rigs will be required during the LOM to sustain the production requirements based on the LOM scheduling.

Similarly, the support equipment from Balogo will be transferred to Ouaré so that Youga and Ouaré can for all intents and purposes be treated as two different operations with their own fleets. This greatly simplified matters as it is not practical to transfer equipment between Youga and Ouaré on a short-term basis (daily or weekly). On a longer-term basis, it is feasible to move loading equipment between sites using the low bed.

16.11.5 Consumables

Fuel and lube were estimated from first principles from the industry standard consumption figures for each equipment type. Provision is also made for wear parts.

The blasting consumables (ANFO, primers, detonators and cord) were also calculated from first principles using the yield per hole (t/m drilled) and the power factor. These were split into production shots and wall control.

16.11.6 Labour

The labour requirements were estimated as follows:

- Managerial staff
- Supervisors
- Engineer/Geologist
- Operators.

For non-shift pattern workers, a six and two rotation is assumed and there is no additional coverage during leave. Sufficient managerial or supervisory staff has been allowed for to cover operations for 365 days per year.

For shift workers, the number of full-time-employees was estimated on the basis of two shifts per day and a three-crew roster. Provision is also made for coverage for leave and absenteeism.

Table 16-31: Youga and Ouaré – labour requirements (Mine Operations)

Labour group – Mine Operations	**Expat or local**	**Full-time employees**	
		2017	**2018**
Mine Manager	Expat	1	1
Mine Operations Supervisors	Expat	2	2
Production Engineers	Local	2	2
Trainers	Local	4	4
Mine Admin Assistant	Local	1	1
Excavator Operators	Local	9	15
FEL Operators	Local	3	3
Truck Operators	Local	24	48
Dozer Operators	Local	9	9
Grader Operators	Local	6	6
Backhoe Operators	Local	3	3
Other Equipment	Local	51	51
Blast Crew	Local	1	1
Mine Operations Coverage	Local	6	6
Drillers	Local	9	15
D&B Supervisors	Local	4	4
D&B Engineers	Local	2	2
Total		**137**	**173**

Table 16-32: Youga and Ouaré – labour requirements (Maintenance)

Labour group – Maintenance	**Expat or local**	**Full-time employees**	
		2017	**2018**
Maintenance Manager	Expat	1	1
Maintenance Supervisor	Expat	1	1
Maintenance Admin Assistants	Local	3	3
Maintenance Coverage	Local	3	3
Total		**8**	**8**

Table 16-33: Youga and Ouaré – labour requirements (Technical Services)

Labour group – Technical Services	**Expat or Local**	**Full-time employees**	
		2017	**2018**
Chief Mining Engineer	Expat	1	1
Planning Engineers	Expat	4	4
Senior Surveyor	Expat	1	1
Mine Surveyors	Local	2	2
Senior Mine Geologist	Expat	1	1
Mine Geologists	Local	3	3
Grade Control	Local	8	8
Samplers	Local	4	4
Technical Admin Assistant	Local	1	1
Total		**25**	**25**

The total Youga and Ouaré workforce for 2018 is therefore 206.

Table 16-34: Balogo – labour requirements

Labour group	**Expat or Local**	**Full-time employees**	
		2017	2018
Mine Operations Supervisor	Expat	1	1
Production Engineers	Local	2	2
Trainers	Local	2	2
Mine Admin Assistant	Local	1	1
Excavator Operators	Local	3	3
Truck Operators	Local	12	9
Dozer Operators	Local	3	3
Grader Operators	Local	3	3
Other Equipment	Local	18	18
Blast Crew	Local	1	1
Drillers	Local	3	3
Maintenance Supervisor	Expat	1	1
Maintenance Admin Assistants	Local	3	3
Mine Maintenance	Local	3	3
Planning Engineer	Local	1	1
Mine Surveyors	Local	2	2
Mine Geologists	Local	2	2
Grade Control	Local	4	4
Samplers	Local	2	2
Tech Admin Assistant	Local	1	1

17 Recovery Methods

The following section is reproduced from the September 2016 FS report (HGC, 2016). The subsections below summarise aspects of the processing plant, and recent and current plant performance.

The Qualified Person does not disclaim responsibility for the information contained in this section.

17.1 General Description of the Process Plant

The Youga processing plant uses the conventional gravity/CIL gold recovery process, similar to various facilities in operation in West Africa. This consists of a three-stage crushing operation, ball milling, gravity concentration and cyanidation by CIL. Pressure Zadra elution is utilised for recovery of gold from loaded carbon. Gold stripped from the loaded carbon is then electrowon and cathodes smelted to produce doré.

17.1.1 Crushing Circuit

ROM ore is delivered to the primary crusher feed bin by FEL. Ore is withdrawn by a variable speed apron feeder to the primary (jaw) crusher. The crushed ore is conveyed to the secondary (cone) crusher, which operates in open circuit. The secondary crushed product is fed to a single deck screen (14 mm openings to produce a nominal -12.5 mm crushed product), with the screen oversize reporting to the tertiary crusher section (two cone crushers in parallel) feed bins, while the screen undersize reports to the fine ore stockpile feed conveyor. The tertiary crushed product report back to the single deck screen, in closed circuit.

17.1.2 Milling Circuit

The crushing circuit product reports to the fine ore stockpile, from which feed to the grinding circuit is withdrawn by one of three vibrating feeders onto the mill feed conveyor. Hydrated lime is added via a rotary valve onto the conveyor to ensure the ground ore is fed to the leaching circuit at the correct pH (>10.5). The ball mill discharge is pumped to a “cluster” of hydro-cyclones, the overflow product from which forms the feed to leach circuit. The underflow product returns to the mill feed after a portion (approximately 20%) is diverted to the gravity circuit.

17.1.3 Gravity Circuit

The cyclone underflow bleed stream is passed over a vibrating scalping screen to remove coarse (+2 mm) particles, which gravitate back to the mill inlet chute. The screen underflow feeds the centrifugal bowl type concentrator for recovery of the coarse free gold and other particles of sufficiently high SG. Concentrator tails gravitate to the mill feed inlet, while the concentrate is periodically discharged from the concentrator and flows into a storage tank located in the gold room for upgrading by further gravity devices.

17.1.4 Leaching Circuit

The cyclone overflow slurry flows onto a linear trash screen for removal of natural and mining debris such as woodchips, cloth, plastic and wire which can cause operating issues in the downstream stages. The slurry gravitates through a sampler and into the first leach tank (mechanically agitated) where cyanide solution is added. From there it overflows and gravitates through five subsequent, mechanically agitated, CIL tanks to enable maximum possible dissolution of gold as a cyanide complex and subsequent adsorption onto activated carbon. Each CIL tank is equipped with an inter-stage screen mechanism, with a cylindrical basket-type stainless steel wedge-wire screen surface for retention of activated carbon in the tank. Air blowers installed on the top of the CIL tank platform provide air in the slurry through the agitator shaft in order to improve oxygenation of the slurry and enhance the dissolution process.

By the end of the year, this will be supplemented by the addition of an oxygen plant, which should further increase oxygen transfer into the process, thereby increasing dissolved oxygen levels, and increasing leach kinetics.

17.1.5 Tailings

The leach tails from the last CIL tank gravitates to a vibrating screen (Carbon Safety Screen) prior to a sampler, and then to the tailings pumping station from where it is pumped to the tailings dam. Any carbon recovered from the screen will be recirculated as required.

17.1.6 Carbon Treatment

Barren carbon is added to the last of the CIL tanks and advanced through to the first where the loaded carbon is routinely removed from the circuit, washed in acid, and the adsorbed gold is stripped from the carbon by eluting with a cyanide/caustic solution under pressure and temperature. The desorbed gold is electrowon onto steel wool. The cathodes are routinely "harvested", and, combined with the separately collected gravity concentrate, converted to bullion by smelting.

17.1.7 Supplementary Systems

Raw Water

This is taken from the Nakambé River, stored in a desanding holding tank from where it is pumped over 11 km to the site raw water pond. Distribution points include: elution – for making up acid wash and carbon desorption solutions, gland water, reagent preparation, and the fire water head tank.

Process Water

Decanted excess settled water from the tailings dam gravitates to the return water decant tower. A return water pump at the dam recycles water to the plant process water tank. Process water is reticulated throughout the plant where required, servicing specific process requirements, as well as general hose points.

Potable Water Supply

Raw water is treated through a filtration and sterilisation system before being stored in a dedicated tank. Potable water is reticulated to the various drinking water and ablution facilities throughout the plant and offices, and all safety showers on site.

Fire Water Supply

The fire system consists of a main fire pump, an electric jockey (pressure booster) pump, a diesel driven pump, a fire pipe manifold and hydrants in chosen locations throughout the plant.

Compressed Air

Standard air compressed air systems are supplied for a plant of this type, including leach air compressors, high pressure and instrument air. Later in 2017, the operation proposes to install an oxygen separation plant to supplement the air supply to the leach circuit.

17.2 Historical Process Plant Performance

Processing operations commenced in 2008, ramping up to a throughput of 1 Mt in 2012, and 1.12 Mt in 2016. Figure 17-1 shows how the plant throughput has steadily increased over the period, while gold production peaked in 2013 at 89,000 oz, and thereafter steadily declining due to falling head grades as the current ore sources moved into lower grade zones.

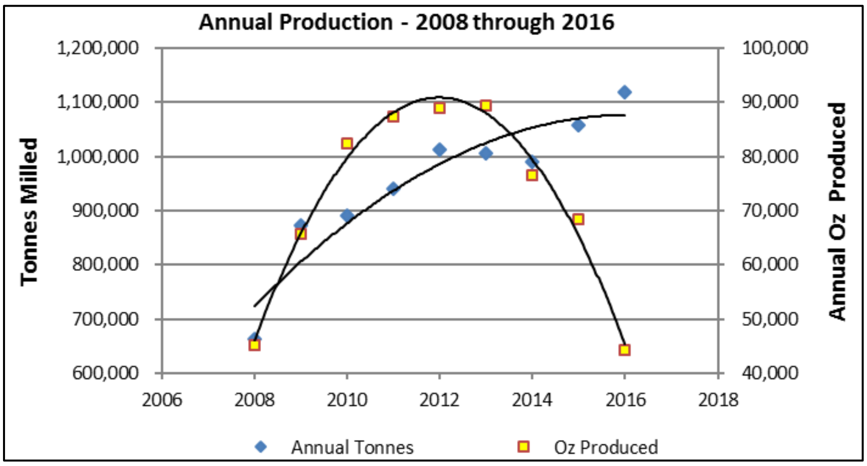


Figure 17-1: Annual tonnes processed and gold produced

The decrease in production is principally due to the decrease in plant feed grades during the latter years. The relative effect of decreasing head grades on overall recovery is shown in Figure 17-2 below. The decrease in production was only partially offset by an increase in tonnes milled (+10% in 2016 over 2012).

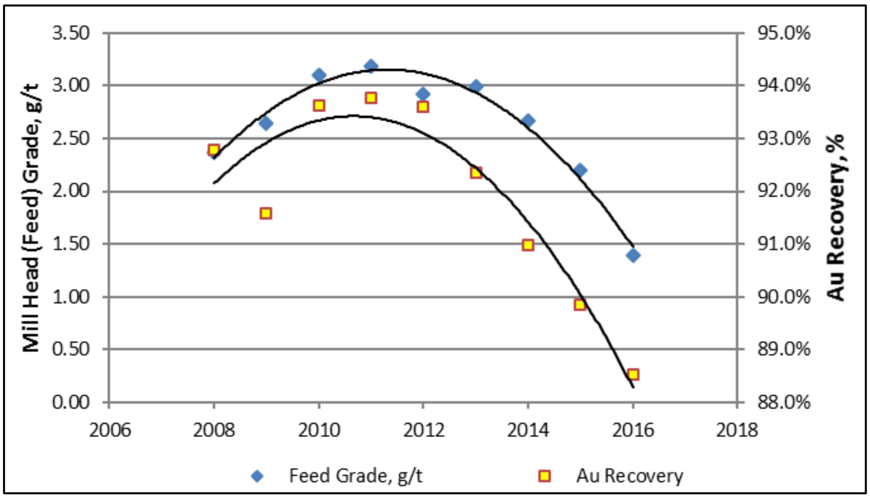


Figure 17-2: Youga operation – annual mill feed grade and gold recovery

Examination of the tailings grades recorded over the same period (Figure 17-3) shows a gradual increase as the feed grades have decreased while circuit throughput has increased.

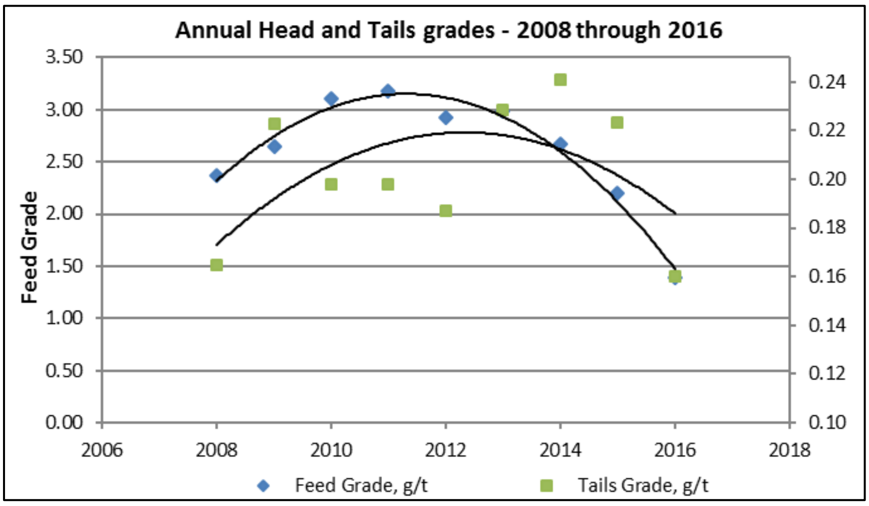


Figure 17-3: Youga operation – annual mill feed grades and residue grades (2008–2016)

17.3 2008 - 2017 Process Plant Performance

Process plant performance to 2017 is set out in the table below. Recoveries increased in 2017 largely due to higher grade material treated from high-grade stockpiles.

Table 17-1: Youga Plant operation – overall production (2008 – 2017)

Year	*Tonnes Milled*	*Head Grade, g/t*	*Au Recovery*	*Oz Produced*
2008	*663,334*	*2.37*	*92.79%*	*45,264*
2009	*871,740*	*2.64*	*91.57%*	*65,648*
2010	*891,202*	*3.10*	*93.62%*	*82,405*
2011	*940,168*	*3.18*	*93.77%*	*87,266*
2012	*1,012,829*	*2.92*	*93.61%*	*89,022*
2013	*1,005,876*	*2.99*	*92.36%*	*89,448*
2014	*990,852*	*2.57*	*90.63%*	*73,291*
2015	*1,060,983*	*2.20*	*89.85%*	*68,407*
2016	*1,119,197*	*1.39*	*88.54%*	*44,403*
2017	*1,199,577*	*3.34*	*89.90%*	*115,321*

Source: Avesoro, 2018

17.4 Predicted Plant Throughput

The current mine plan (Figure 16-47) is projecting the material from Youga, Netiana and Ouaré deposits to be processed over the remainder of the LOM in the proportions of 73.2%, 3.5% and 23.3% respectively, of the proposed mill annual throughput of 1.18 Mt. In 2020, it is projected that material mined from Balogo will be depleted and Youga/Netiana material will be mined in the ratio of 57% to 43%. Given that harder material from Ouaré deposit constitutes a significant proportion of the feed, the average weighted LOM Bond work index is 16 kWh/t.

The mill feed to the operation is scheduled to average 1.18 Mt/a. At the design utilisation of availability of 95% (8,330 operating hours), the average plant throughput required is 143 t/operating hour.

17.5 Predicted Metallurgical Recoveries

Given lower head grade material is being mined and processed from the Youga, Netiana and Ouaré deposits, predicted gold recoveries are 91%, 89% and 91% respectively. In order to achieve the gold recoveries a grind size P_{80} of 75 microns is required, and a minimum leach residence time of 24 hours.

18 Project Infrastructure

18.1 Youga and Ouaré Properties

18.1.1 Introduction

Details of the infrastructure for Youga have been taken from Endeavour's Technical Report of 2015. The mine has been operating since 2008 and was taken over by MNG (a subsidiary of Avesoro Holdings) in February 2016, and by Avesoro Resources in 2017. MNG subsequently restarted the mining operation in October 2016, following a period of operations where ore was processed from existing stockpiles.

Under the management of Endeavour, the mine operations were run by a mining contractor, PW Mining International Ltd, but since the takeover by MNG in 2016 the mine has been run by the owner. This has not substantially changed the operation other than to introduce new mining equipment.

The one area of change is that the Ouaré deposit has been included in the Reserves for Youga and is treated as a satellite deposit that will be run from Youga. Consequently, the facilities at Ouaré will be kept to a minimum. These are discussed below in the relevant sections.

18.1.2 Water

Water at Youga is taken from the Nakambé River using a submersible pump anchored on the riverbank including stand-by to ensure that there is an uninterrupted water supply to the plant. Power to the pumps will be via an overhead line running from the plant to the water extraction point at the river.

The raw water from the Nakambé River is pumped to a raw water storage pond located close to the plant. The pond supplies water to the plant raw water tank as well as supplying raw water to the process water tank to supplement the tailings dam water supply when the process water dam runs low.

Potable is produced at the plant from river raw water. This water is passed through a filtering and sterilization system to clarify and kill off biological organisms before it is stored for distribution to the camp and plant.

The tailings dam incorporates a return water decant system linked to a return water pond. Reclaim water is pumped to the process water tank within the plant area for re-use in the process.

Potable water will be produced at Ouaré by pumping raw water from the Ouaré River. This water will be passed through a filtering and sterilisation system to clarify and kill off biological organisms before it is stored for distribution to the camp and other mine buildings.

18.1.3 Electricity

Burkina Faso has no infrastructure close enough to supply power to the Youga plant. The option of generating power on site with diesel-powered generators has been implemented as a back-up solution while main power is supplied from the Ghanaian grid. A powerline running between Zebila and the Youga site has been installed, as well as the associated transformers and switchgear to supply power to the plant grid.

The 34 kV/11kV switchyard consists of a pole mounted fused isolator, a 34 kV outdoor circuit breaker and a 34 kV/11kV 10 MVA power transformer. The indoor 11 kV switchgear panel consists of an incomer with protection and power metering, power factor correction, ball mill contactor/circuit breaker, five transformer feeders and overhead line/mini sub-feeders.

The motor control centres (MCCs) are of the fully detachable plug-in type for ease of maintenance. The MCCs have been designed to service specific areas of the plant, and the drives, including the variable speed drives, requiring emergency standby power have been equipped with auto changeover incomers. Grounding networks is looped around substations and shared by both high-voltage and low-voltage units.

Electrical power required for the camping area and the mine buildings will be sourced from two diesel generators of 100 kVA and 150 kVA.

18.1.4 Access

Plant access roads to Youga were constructed on laterite base and are maintained and upgraded on an "as required" basis. The haul roads are constructed on a similar base but are wider and covered by waste rock. The construction of the haul roads and ROM pad was completed by the mining contractor.

At Youga a substantial bridge has been built across the Zéra River, which divides the mine camp and the mine operating infrastructure, in order to avoid isolation of the sites during periods of heavy downpour.

An airstrip for light aircraft is currently being constructed along the East Pit mine haul road to provide an alternative emergency medical evacuation option for personnel.

A new 44 km access road will be constructed to connect Youga to Ouaré. This will include the construction of a substantial bridge to cross the Nakambe river. It is noted that Avesoro will only be required to construct a road of 11–14 km (including bridge construction), with the government currently constructing the remainder.

18.1.5 Buildings

The administration office block at Youga consist of 500 m^2 of prefabricated building and accommodates financial, purchasing, human resources (HR), and health, safety and environment (HSE) staff. Adjacent to it is the infirmary and another office for the geologists, surveyors and mining team. Other offices within the processing area are used by the maintenance and process plant supervisors.

There is also a workshop and reagent store at Youga, which are located within the plant high security area. A smaller workshop will be located at Ouaré to deal with minor repairs. This workshop will be constructed from containers and will be relocated from Balogo.

The mine buildings at Ouaré will be very limited and will be mainly be constructed from container-style buildings that can be relocated from Balogo.

18.1.6 Laboratory

A comprehensively equipped analytical laboratory is provided at Youga to cater for the process control, metallurgical accounting, mine assay and environmental monitoring. Equipment was supplied and is maintained by ALS, the contractor managing the laboratory.

There is no provision for a laboratory at Ouaré. All the samples from Ouaré will be sent back to the laboratory at Youga.

18.1.7 Fuel Storage

Fuel and oil storage is supplied under contract from TOTAL, facilities include two 200 m^3 horizontal tanks, fuel service area for both light and heavy vehicles (including high capacity filling pumps) a covered area for storage of lubricant and offices for the contractor staff.

A smaller fuel and oil storage facility will be located at Ouaré to deal with the mine equipment used at this site. This facility can be relocated from Balogo.

18.1.8 Fire Protection

Portable fire extinguishers are placed outside of the offices, sleeping quarters, kitchens, workshops and stores and distributed around the plant site for fighting small fires.

The MCC rooms are equipped with incomer cut-offs to trip the power feeding to the MCC room should a fire break out.

18.1.9 Waste and Sewage

Solid wastes are buried in dedicated facilities within the mine lease areas. This site consists of a series of pits (cells) which will be filled with waste materials and sealed once filled to design capacity.

Sewage is collected in septic tanks and drains away through French drains. The camp at Youga is located on a hilltop, and French drains run away from the accommodation units. A similar arrangement will be constructed for Ouaré.

18.1.10 Communications

The area is under coverage of more than one cell phone company and a standalone VSAT (very small aperture terminal) system allows internet and voice transmissions that are carried on the same signal using VOIP (voice over internet protocol).

Mine mobile communications are done via handheld mobile radio sets, with a base station located near the centre of operations.

18.1.11 Transport

The site vehicle fleet of pick-ups is used for the transport of materials and personnel to and from Ouagadougou and between the mine sites and camps. Contracted buses provide transportation to work for personnel living in the nearby villages and Ouagadougou.

18.1.12 Security

The main entrance security office is located on Youga's Main Plant access road. All visitors to the mine complex report to this security gate for authorisation prior to entry. If required, personal protection equipment (PPE) is available for issue from this point. A separate security gate will be constructed at Ouaré to deal with traffic to and from the camp at Ouaré and also traffic coming from Youga.

Monitoring systems are installed in the plant overseeing the mill, cyclones, concentrator and gold room to monitor activities. This system uses smart camera technology to provide improved image quality, coverage of operations and image storage and review capacity.

18.1.13 Accommodation

The accommodation camp at Youga is located on a hilltop approximately 3.5 km south of the plant and is approximately 1.5 km south of the A2 main pit. All services have been provided to the camp and plant since there was no existing water or power infrastructure in the region at the time of construction of the mine.

There are five stand-alone two-bedroom houses with a separate bathroom, separate toilet, living room and a small kitchenette for senior management. Managers and supervisors housing consists of a 30 m^2 single room with its own shower, toilet and basin and sufficient space for a desk and a living area with provision for a television connection point. All enclosed rooms are air-conditioned.

The camp can accommodate 100 persons.

The laundry, a prefabricated structure 42 m^2 in size, is equipped with eight industrial washing machines. The room includes a washbasin and worktop for ironing and folding clothes.

The kitchen and dining facility is fully equipped to prepare and serve food as required by the mine shift roster.

Television signals are received from satellite television systems. The camp recreation area consists of a bar, games area, open veranda, swimming pool and a gym.

A smaller camp will be built at Ouaré to accommodate key members of the mine operations personnel. Where possible the main camp at Youga will be used for personnel that are not working on shift.

18.1.14 Personnel

Although nationals from Burkina Faso are filling most operational and management positions within the company, some selected posts requiring specific skills or experience not available within Burkina Faso, have been filled by expatriates. In addition to performing their job function, expatriate personnel are expected to transfer knowledge and expertise to develop the capabilities of their national staff.

18.1.15 Tailings Disposal

The TSF for the project was originally designed by Digby Wells and Associates (DWA) (Digby Wells and Associates, 2006). The facility construction commenced in November 2006 and was scheduled to be completed by the end of July 2007. However, due to significant delays in construction it was not completed until March 2008, when production began.

DWA was not involved in the construction or has had no involvement since the design. Knight Piésold (KP) assisted BMC in the construction supervision and was asked to conduct regular audits on the facility from 2010 onwards.

The existing TSF is a paddock style impoundment and is located approximately 200 m north of the Youga processing plant. In April 2017, KP reported that the existing TSF covers an area of approximately 540,000 m^2 and contains just over 5 Mt of tailings. It was noted that the TSF has been constructed up to its initial intended DWA design height of 242 mRL.

At the time, it was recognised by KP that the LOM plan requires further storage to handle an expected tonnage of up to 7.0 Mt of added storage capacity, above the 5 Mt capacity in April 2016.

KP concluded that there were two main expansion options to consider:

- Raise the existing TSF beyond the current proposed design height of 242 to 249 m ASL
- Extend the TSF by creating new starter walls on available ground to the west and north of the existing TSF.

A third option of raising the existing facility to 252 m ASL was also considered by KP by adding another phase (249–252 m ASL).

KP assumed that the method delivery of the tailings, the tailings deposition and the water reclaim all remain unchanged from the existing philosophy. It is assumed that no additional pumping equipment will be necessary to transfer the tailings to the TSF. In addition, BMC indicated that no changes to the nature or character of the tailings are expected over the LOM.

On this basis, KP concluded that:

- The lowest net present cost option is Option 1, whereby the existing TSF is raised to 249 m ASL. However, this option only provides sufficient storage for 5.1 Mt and assumes that the existing tailings conditions.
- The decant arrangements would not affect future construction or operation.

- A detailed investigation of the geotechnical conditions of the existing tailings (using cone penetration testing/boreholes) and analysis of the decant arrangements would need to be made to increase the confidence in this design and the stability thereof.
- It is especially important to determine the settled tailings density in order to increase accuracy of calculations to determine the future storage capacity requirements.
- Further expansion beyond 249 m ASL might be possible but the tailings strength and decant arrangements would become critical and investigation would need to be repeated more regularly to confirm that the stability of the TSF is not compromised.
- The option to raise the existing TSF has the added benefit of not affecting any further land take and reducing environmental impact.

If additional storage is required above 5.1 Mt and the further raising of the existing TSF is considered too risky, or the site investigation proves it to be impractical, then it is considered that the extended option (Option 2) provides a suitable alternative.

With Option 2, based upon the stage storage curves, a starter wall to 239 m ASL, followed by taking the extended facility upstream to 242 m ASL, in conjunction with the existing facility being raised to 249 m ASL, would provide sufficient storage for 7.0 Mt of tailings.

However, construction material availability and suitability of the ground conditions is uncertain. Consequently, to verify that the design is viable a full site investigation of the TSF expansion area and the existing tailings using boreholes will be required. This option would also require careful management of the tailings deposition in order to reduce the rate of rise and provide suitable foundations for the subsequent upstream raise.

Based upon the above, KP recommended that a detailed investigation of Option 1 is carried out to:

- Establish the geotechnical conditions of the existing tailings
- Analyse the decant arrangements to confirm that raising the TSF to 249 m ASL can be carried out safely
- Determine whether it is possible for further raise the facility to 252 m ASL.

At the time, KP considered that raising the existing TSF to be more cost effective than creating an extension, and that the costs for the investigations are small compared with the additional costs for preparing the expanded TSF, with or without the need for an HDPE liner.

However, the updated LOM schedule presented in this report demonstrates that the total storage requirements as of 1 March 2017 are now 9 Mt and it will be necessary to reconsider the option of extending the current facility as it is unlikely that Option 1 by itself will provide sufficient capacity.

For the purposes of this study the incremental cost of expanding the TSF by 5 Mt to 7 Mt have been used to arrive at a cost of expanding the facility to 9 Mt.

18.2 Balogo Property Infrastructure

Since Netiana is well advanced and came in to production (pre-stripping) in May 2017 the estimate of mine infrastructure is essentially unchanged from that of the FS published in March 2016.

The infrastructure for mining includes open pit, waste rock stockpile, ore stockpile and related facilities. These facilities include prefabricated office buildings and change house. The infrastructure on site is designed to support an efficient mining operation. Electrical power for office building, change house and lighting is sourced from a 150kVA diesel generator.

There will be no camp facilities on site. The camping area is located at 6.3 km east of the Balogo project area. The camping area consists of prefabricated and containerised buildings for the following:

- Accommodation of mine staff
- Accommodation and office space for the engineers
- Laundry
- Kitchen
- Bathroom
- Dining hall.

Provision for a total of up to 40 mine staff and 10 engineers is accommodated in the camping area. Electrical power required for the camping area is sourced from two diesel generators of 100kVA and 150kVA.

The mine fleet at Netiana consists of two hydraulic excavators, four to six haul trucks, one FEL, one dozer, one grader, service truck, water truck, fuel truck, explosives truck, light vehicles and other support equipment. Routine servicing will need to be done at site and this can be done with a simple setup with containers joined together and covered with a metal roof.

There is a fuel and lube station at site as well as a simple tyre bay. This is constructed from containers so that it can be relocated after 18 months.

The ore from Netiana is transported back to the processing plant at Youga. It is assumed that this fleet of trucks will be based at Youga and will utilise the facilities, including the workshops, at Youga. There should be no need to include additional facilities at Netiana.

Equally as all the processing and refining of the ore is done at Youga there will be no requirement for these facilities at Netiana.

Other administrative functions, including HSE, will be sourced from Youga and there will be minimal need to accommodate additional staff at Netiana except for routine visits of inspection.

19 Market Studies and Contracts

19.1 Market Studies

Gold is a freely traded commodity and as such there has been no market study made and nor is one proposed.

Ore from Ouaré and Netiana is trucked to the Youga plant where the plant currently produces Dore bars that are sold to independent refineries under normal commercial conditions. The gold is collected from site and is transported to Ouagadougou, from where it is flown to Europe for further refining. The funds flow back into Burkina Faso.

As soon as the gold is collected from the gold room at Youga, all risks are transferred to the security company/refinery.

The gold price dynamics (Figure 19-1) suggests that the base case scenario gold price of US$1,250/oz is within the current market trends.

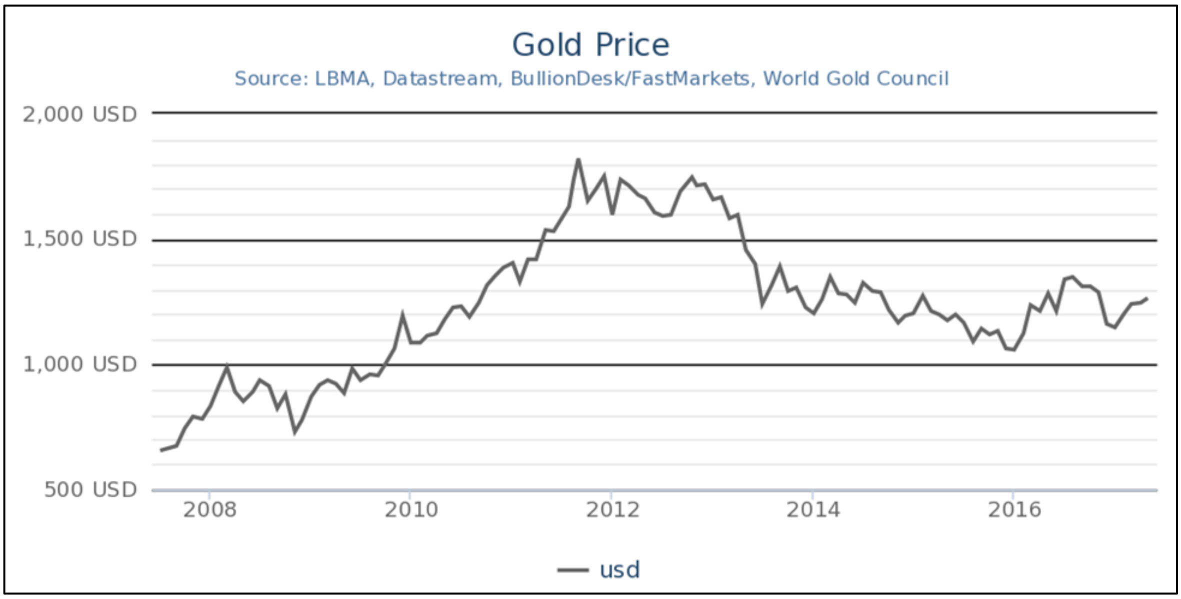


Figure 19-1: Gold price in US$ for the past 10 years

Source: World Gold Council website (http://www.gold.org/investment/interactive-gold-price-chart), accessed on 1 June 2017

19.2 Contracts

Currently there are no long-term contracts in place for the Projects.

20 Environmental Studies, Permitting and Social or Community Impact

20.1 Overview

Youga is an operational mine with several open pits and a conventional gravity CIL processing plant, which was due to be closed when Avesoro acquired it from the previous owner. Netiana (Balogo) is a gold deposit some 130 km west of Youga, which will produce ore to feed into the Youga processing plant. There is also a further gold deposit, Ouaré, approximately 50 km east of Youga, which could potentially also feed ore to the Youga plant. This report comments on the level of environmental permitting and study work completed, to inform the Reserve reporting, sufficient to meet or exceed prefeasibility study standard work.

The review is based on the following main documents:

- Youga EIA Report, SGS Environmental (Ghana), February 2005
- Youga EMP (version 1), date unclear but pre-2012
- Review of Mine Closure, Youga Mine, Wardell Armstrong, January 2017
- Balogo EIA, Socrege, August 2016
- Balogo RAP, Socrege, August 2016
- EIES on Balogo-Youga Ore Transport Route, Socrege, April 2017
- Ouaré Project FS Report, HCG Turkey, May 2017
- Ouaré Preliminary E&S Assessment Report, Socrege, November 2012.

Other relevant documents also sighted:

- Copy of Youga Mining Permit, 2003
- Signed Company Environmental Policy, January 2017
- Youga EMP, 2016
- Youga 'Respect to Commitments' (Social Mitigations), 2015
- Youga Environmental Program Organisation, 2016
- Balogo Environmental Permit, September 2016.

20.2 Area Context

The Youga, Ouaré and Balogo properties are located within the Sudanese climatic type of southern Burkina Faso but influenced by the south Sudano-Sahelian zone, where annual evaporation exceeds rainfall. The wet season runs from May to October, bringing around 900 mm rainfall on south and south-westerly winds, while the dry season from November to March, is associated with dusty north and northeast "Harmattan" winds. Annual evaporation is around 2,870 mm. Highest temperatures occur at the end of the dry season with mean monthly maxima exceeding 39°C. Surface water is largely ephemeral and rain-fed groundwater fluctuates seasonally, giving rise to water supply issues for people, livestock and wildlife.

The property areas are entirely rural with savannah woodland cover but with rapidly expanding agricultural cultivation and pastoralist activities, as well as artisanal mining and felling for firewood and charcoal, causing significant deforestation. Population density is low and scattered with severely limited infrastructure, social structures and services.

20.3 Youga Property

20.3.1 Current Condition and Status

The Project is composed of several open pits and responding waste rock dumps; a ROM stockpile; processing plant and mine offices; paddock-style TSF; and a mine camp. Operations at the site are ongoing but currently no mining is taking place, with the process plant being fed from the ROM stockpile which has sufficient material to sustain the plant through 2017. Mining operations at Youga are expected to recommence and further feed is to be provided from the Balogo mining operation.

As no site visit was undertaken as part of this review, the current condition and status of the Youga property site is derived from the Wardell Armstrong (WA) site visit, undertaken at the end of 2016, whose visual assessment of the various Youga Project components was as follows:

Open Pits

- **Main Pit** – Mining terminated in early 2016. Pumping continues to maintain dry workings to allow further mining should this prove viable.
- **East Pit** – Mining terminated in early 2016. Water has been allowed to accumulate in the excavation before being pumped to the process plant as a source of technical water. Depth of water in the pit is c. 80.
- **West Pit 1** – Mining completed in 2011 with rehabilitation undertaken. The pit was flooded via diversion of a local watercourse, with controlled outflow returning water to the same river. The remaining visible pit rim appears in generally sound condition with significant vegetation regrowth.
- **West Pits 2a and 2b** – Both pits no longer operational. Pit 2b is flooded to within 5 m of the pit rim from a water course, with intention to cut a channel between the pits to flood Pit 2a.
- **West Pit 3** – Mining terminated in early 2016. Some surface runoff has been allowed to accumulate with long-term intention to channel through to West Pits 2a and 2b to create three consecutive ponds as part of a local watercourse with natural inflow/outflow.
- **West Pit 4** – Planned for development in late-2016/early-2017.
- **NTV 1, 2 and 3** – Small excavations mined during 2016, subsequently backfilled with waste rock, covered with replacement top soil and fertiliser to maintain land for future use.
- **NTV 4** – Excavated to completion and flooded to form a lake as part of a local water course. The pit is to be backfilled to keep crocodiles from posing a risk to villagers.
- **Zergoré A** – Shallow excavation (≈30 m) currently in operation. To be completely backfilled with waste rock following completion of mining.
- **Zergoré B** – Mining completed, and pit backfilled to surface with replacement of topsoil.
- **Zergoré C** – Mining completed and backfilling with waste rock underway.
- **A2 North-east** – Mining commenced.

Open pit closure and rehabilitation will continue to comprise either backfilling with waste rock or flooding. Backfilled pits are to be returned to farming or cultivation land use, while flooded pits may be used as water storage facilities with offtake for irrigation and farming. Water quality samples have been recently tested though this data has not been seen.

Waste Rock Dumps

The Youga waste rock dumps are spread out across the site, with each pit area having dedicated waste rock dumps. All dumps are below 45 m in height and are constructed with 45° to 50° slope angles, are generally in good condition with no apparent stability concerns and some vegetation regrowth:

- **Main Dump** – The largest waste rock dump at the site, covers ≈39 ha and has a maximum height of 43 m in two lifts. Small amounts (<100 kg) material removed from top of the dump by artisanal miners (issue of access control). A watercourse runs under the dump. A topsoil bund surrounds approximately 75% of the dump, for covering slopes during rehabilitation.
- **East WRD** – Covers ≈31 ha, maximum height 23 m with two lifts. Slopes have significant vegetation regrowth covering at least 50% of slopes on which topsoil has been replaced, but there is some slippage of this topsoil. There is similar perimeter topsoil bund for later rehabilitation.
- **West 1 WRD** – Covers 4 ha with a maximum height of 15 m.
- **West Dumps 2 and 3** – Adjoining waste dumps separated from the open pits by some 30 m of flat ground. The dumps cover a combined area of 30 ha and vary in height from 8 m to 14 m. Waste rock is likely to be used for open pit abandonment bunding system.
- **Zergoré Dump** – Used to backfill Zergoré pits, with Zergoré C pit backfilling currently taking place. Remaining material covers 17 ha to a maximum height of 10 m but will be significantly reduced with backfill completion. The terrain at Zergoré is more undulating than the rest of the site and the waste rock dump is to be re-profiled to limit the visual impact.

Tailings Storage Facility

The TSF, 500 m from the processing plant, covers around 64 ha and contains tailing slurry, domestic wastewater and surface runoff. The base of the structure is apparently made of impervious materials and the paddock area is contained within a system of bunds covered by geomembrane. The embankment was constructed in a single lift to ≈8 m with slope angles of 40° to 45° and is apparently in good condition with vegetation regrowth at the base. A decant tower takes supernatant water from the TSF to a settling pond for reuse in the processing plant, with no discharge to the environment except for accidental ruptures in the tailings pipeline, the return-water pipeline or failure of the decant tower. The TSF appears to be reaching maximum capacity with <1 m freeboard. The mine plans to construct an additional 3 m lift to increase the capacity of the TSF for continued operations.

Water Management System

The water management system on the Youga site comprises the following components:

- Water tower located on the bank of the Nakambé River
- Pumping station at the Nakambé River
- An 11.2 km pipeline to take water from the river to the process plant
- 7 km of pipe to take water from pits to the plant
- A sump facility at the receiving point of the pipeline.

Mine Infrastructure

The mine infrastructure includes process plant and mine offices; stores and warehouse, garage, contractor workshops, fuel farm (owned/operated by TOTAL), and generator sets. The main mining camp comprises eight blocks of residential buildings, each containing 10 bedrooms, serviced by a restaurant/canteen, a bar, social facility and three concrete buildings. There are also three junior camps at Youga Village.

The Project is served by approximately 10 km of roads which vary in width from 15 m to 20 m. The majority are in good condition and suitable for both mine and civilian traffic. A number of small roads forming part of the national road network also traverse the site but are in significantly worse condition than the mine roads. As a result, many local people use those mine roads outside the restricted areas.

20.3.2 Environmental and Social Impact Assessment

The original Youga Environmental Impact Assessment (EIA) report was prepared in partnership with local consultancy SOCREGE, who was responsible for both local coordination and collection of baseline data and information. Initial baseline data collection started in 1999 and the submitted EIA resulted in the granting of an Exploitation Permit by the Government of Burkina Faso in April 2003. The 2005 SGS updated EIA study for the Youga Project was undertaken as the proposed development had changed from that described in the original mining plan and associated EIA upon which the permit was granted.

Socrege and SGS appear to have a good understanding of the Burkina Faso legislative framework for the Project and all the environmental studies and reviews (for all components – Youga and Ouaré) have given comprehensive details of the laws and regulations that apply to the Project, including listing of the different permits, authorisations and licenses required. The legal components of the EIAs and reviews have all included reference to international standards, guidelines, treaties and commitments, including the International Finance Corporation (IFC) Performance Standards and Equator Principles.

The Youga EIA Project description was detailed and based on the updated mine plan. The site infrastructure locations, including for the waste rock dumps, process plant and offices, TSF and camp were all selected based on suitable criteria of topography, geotechnical considerations, access and proximity as well as environmental impacts and health and safety issues. Water balance calculations indicated average climatic conditions would cause a shortage of process water and that water would need to be pumped from the Nakambé River to meet process plant requirement. This also meant that discharge from the TSF was not necessary except in emergency flood conditions. Typical reagents required for operation of the process plant were identified as sodium cyanide, lime, caustic, hydrochloric acid, activated carbon and flocculant. Project waste streams, including waste rock and tailings, industrial and domestic garbage, sewage and liquid wastes were identified, and disposal routes proposed.

The geology and mineralogy of the deposits are well understood, and a preliminary geochemical study was undertaken on 24 waste rock samples representing the main lithologies to be extracted in the open pits, to determine the potential for acid rock drainage (ARD). All the samples gave neutral or alkaline slurry pH values and acid-base account (ABA) testing showed that they were all non-acid forming (NAF). This indicated that there should be no ARD risk and it would be permissible to discharge runoff and percolation from the waste dump directly into the local waterways, via settlement ponds, without chemical treatment. However, there was no testing of ore material or process tailings and no metal leaching tests undertaken. This review has not seen any evidence of further geochemical study or operational water monitoring data to confirm the absence of ARD or metal leaching since mining and disposal of waste rock started in 2006.

The Youga environmental baseline studies assessed the climate, air quality, surface and groundwater hydrology, ecological, land (soils and land use) and socio-economic characteristics of the Youga Gold Project area and immediate surrounds. Much of this information was obtained as part of the original baseline survey carried out in 1999, updated in 2004/2005 to reflect current conditions and assess potential costs of compensation for farmers and resettlement of some isolated hamlets.

Description of rainfall and other climate parameters were based on data obtained from the closest national meteorological stations (40 km to 75 km distance from the Project site) covering over 40 years and was sufficient to determine likely site conditions for planning and impact mitigation. No site data was collected, but the Environmental Management Plan (EMP) proposed establishment of a Project site met station. It is not clear if this was accomplished and review has not seen any updated operational site met data. The water resources of the area are described and although flow measurement was limited, the ephemeral nature of most surface water and important springs identified. Groundwater resources are the main sources of water supply for domestic and agricultural use, and the local water-table levels recorded. A limited sampling program for water quality assessment was undertaken in 1999, which suggested surface and groundwater water is little affected by mineral leaching, but microbiological contamination is common, together with turbidity and sediment loading in the rainy season. No further operational monitoring results have been seen.

Detailed soil and vegetation studies reflect the strengths of the study team and Project area flora diversity is considered relatively rich but with increasing anthropogenic degradation from agriculture and pressure of population demands. Fauna surveys are less well detailed, but the importance of riparian forest areas was identified include sacred and protected areas and forest pockets in the Project area that are important to local communities and critical habitats for birds, medium and small mammals, insects, reptiles and amphibians, particularly during the dry season. Human activity including agriculture, grazing livestock, gold washing and hunting has impacted the area ecology.

The main agricultural and other land uses were surveyed and include cultivated annual crops; fallow land; animal husbandry and pasture; savannah woodland; artisanal gold washing; mine exploration areas, access roads and accommodation camp; and villages and scattered small hamlets. The total Project footprint was estimated at ≈1.75 km^2 in an area where there was limited settlement and agricultural activities, 70% of which is covered by marginal soils unsuitable for agricultural purposes.

In 2005 the population of the area was estimated at 6,200 with Youga and Zergoré having a combined population of less than 2,000. Socio-political relations between the various communities are still largely administered by traditional authorities, particularly when it comes to land management and acquisition. The economy of the district is dominated by agriculture followed by livestock, and since 1993, artisanal mining. Farming is usually on a small scale and designed to meet local food needs. Cultural and economical relations have been maintained with the neighbouring and related population based in Ghana. In-migration is limited to neighbouring villages and particularly from Ghana during the rainy season for farming, with people returning to their villages after harvest. There is strong emigration of young people away from the area in search of employment and other opportunities. Prior to mining the economic development of the area was severely hampered by restricted road networks, poor spatial distribution of very limited social infrastructure (education, health and local government) and the lack of skilled workforce.

20.3.3 Impact Assessment and Mitigations

The Youga EIA identified impacts for both construction and operational phases of the Project. Potential negative impacts of the project assessed included to air quality; noise; pollution and depletion of water resources; to soils, vegetation and wildlife, and on local communities. Impacts of enforced relocation and loss of land and crops were identified as significant, with preliminary surveys showing up to four hamlets needing resettlement and approximately 100 ha of farms requiring compensation. As the majority of local residents depend on farming for their livelihood, appropriate compensation was acknowledged as critical to mitigate local socio-economic risk and confrontation. The EIA also identified a number of potential positive impacts of the project relating to employment, economic opportunities and social/infrastructure benefits for local communities and to national and regional government through payments of royalties and taxes.

Proposed impact mitigation included conventional and Best Practice measures recommended for avoiding, reducing, mitigating or compensating impacts. A precautionary approach was proposed to relocate or restrict access to a 500 m buffer zone around the main Project infrastructure. A Project liaison consultation committee was to be established to address issues associated with employment, social and livelihood impacts, as well as effects of in-migration attracted to the Project, especially across borders. However, no details were provided on a formal Project Grievance Mechanism.

The EIA incorporated a preliminary EMP which included: waste management; community relations and compensation; a basic monitoring program; Reclamation Closure and Decommissioning Plan; Emergency Response Plan; and provisions for environmental and social auditing and review. The preliminary EMP gave estimates for the environmental and social budget for the Project to be financed from the annual budget and operating costs. An annual operational budget of approximately US$30,000 was allowed for the implementation of the EMP, excluding ongoing rehabilitation costs or environmental auditing (every two years at US$20,000). In addition, there was also to be an allocation of a minimum fund of US$20,000 per year over the mine life of the Project for community relation expenses. Resettlement costs and compensation payments for buildings and farms were additional to this, but not provided as a separate budget.

According to the 2017 WA report, actual Project expenditure for obligatory and voluntary social commitments has included construction of educational facilities and other social infrastructure and roads. Total social expenditure for the years 2013 to 2015 was US$1,134,635, considerably more than the projected annual budget in the 2005 EIA EMP.

20.3.4 Environmental and Social Management Plan

The operational working Environmental and Social Management Plan (ESMP), c. 2011, is a 23-page document that covers the general requirements for Project environmental and social management, including targets; key procedures, roles and responsibilities; monitoring and reporting requirements; and performance indicators. It describes management activities for waste; equipment, chemicals and hazardous materials management; control of wildlife; land disturbance and erosion control; management of in-migration; and more detailed actions for water, air quality, noise and vibration, and hydrocarbon management. The plan monitoring programs do not include either ecological or social monitoring. The plan also covers consultation and communication; training; investigation and reporting of incidents and complaints; and emergency preparedness and response.

Most of these management activities are also contained in the more recent 2015/2016 environmental management system, plans and program organisation developed subsequent to Project acquisition. Social/community management measures for ongoing stakeholder consultation, compensation and influx issues are also recorded in the 2015 "Respect to Commitment" document.

No budget is given for these current management plans, but CSA Global believe that for a project of this size, a minimum of US$100,000 per annum should be allowed for ESMP implementation, with community assistance and ongoing compensation and resettlement costs additional to this.

This review has seen no operational monitoring results, or monthly/annual reports of environmental and community relations activities; accident reports; or records of grievances and resolutions – to be able to comment on implementation of the ESMP and Project environmental and social performance over the last nine years since operations started.

20.3.5 Stakeholder Engagement

As part of the EIA studies, stakeholder engagement included meetings with local representatives (governmental and traditional) for project disclosure and to gain information about the views of local communities. No major objections to the proposed development were received from any of the government officials, chiefs or villagers interviewed. According to the WA Youga closure review, the Project has a track record of conducting public consultation and stakeholder engagement with community representatives and traditional authorities. Project stakeholders are identified but the Project Public Consultation and Information Disclosure Plan was lacking at the mine at the time of the WA review in 2016.

Some documented meeting minutes from February and March 2015 made available to WA, show residents expressed concerns about the following:

- Lack of water and need for a new water well (to reduce trespass on Project land)
- Proper security measures to prevent theft of livestock
- The lack of jobs
- A local farmer claimed his land was larger than what he was compensated for
- Other local residents claim that compensation was not given for land on or around the Project site.

These suggest that despite identifying compensation issues as a significant social risk, this remains the main area of contention at the Project. In 2006, Socrege conducted an inventory of the Project area for resettlement and displaced farmland and developed pricing for compensation payments based on land size and agricultural products grown, but post start-up demands for compensation are particularly difficult to address – to verify who should receive compensation payments; and to avoid creation of precedent. However, continuing activities at site will impact more people and further compensation issues are likely to arise.

20.3.6 Closure and Rehabilitation

The 2005 EIA included a preliminary Closure Plan for the Project. This included site end-use and proposed flooding of the pit excavations; capping and revegetation of the TSF and WRDs; dismantling of buildings not required by the communities; rehabilitation of roads not needed by the local people; and post-closure monitoring and maintenance for two years. Costing for closure and rehabilitation was calculated in some detail, giving a total of US$1,495,733, including post-closure monitoring. According to the National Mining Code, any holder of a mining licence must open an account at the Central Bank of West African States or in a commercial bank in Burkina Faso and make deposits in a fiduciary account to cover the costs of rehabilitation. The EIA Closure Plan proposed accrual of the estimated cost for reclamation and decommissioning on a yearly basis to reflect the mining schedule.

The Closure Plan has subsequently been revised and updated during operations, and the WA review had access to the Youga Rehabilitation and Closure Plan, 2013; and the Mine Closure Strategy, Version 2, 2015. It was also stated that as part of the recent approval stage of the Youga EIA in 2016, a number of additional social aspects were incorporated into the official mine closure objectives.

The 2016 WA review of Youga closure included visual assessments of the open pits, WRDs, TSF and site infrastructure which suggest that closure activities so far have been effective. However, the review also recommends significantly more investment in social and community capacity building in preparation for post-closure. The report provides an updated estimate of scheduling and costs for proposed future rehabilitation works, with total costs given as US$3,768,000 – more than double the 2005 EIA estimate. CSA Global believe this updated rehabilitation and closure budget is realistic.

20.4 Ouaré Property Summary

The Ouaré property is located in the commune of Bittou, province of Boulgou in the Center-East Region. Ore is to be excavated and hauled to the Youga processing plant.

Socrege was contracted to undertake an initial environmental and social review of the project area in 2012 as a precursor to developing an ESIA study. The review was to undertake scoping baseline physical, biological and social studies to identify issues prior to any development; and recommend appropriate communication and consultations for stakeholder engagement.

The area is part of the Nouhao valley where an agro-pastoral development project was implemented by the government in 1986 and is dominated by these activities. Much of the review was desktop-based research, using available data from nearby meteorological stations and government records for water resources, land use and demographics and social information. Several field trips were also undertaken for water quality sample collection; soil studies; vegetation surveys; field observations for mammals and birds; interviews with locals; and socio-economic surveys of the villages in the Project area. Statistics were collected from municipal sources, regional authorities and from local communities on social, political and land organisation; education, health and other social service provisions. There is much detail on the rural activities in the area and land-use conflicts between agricultural, pastoral and artisanal mining activities. The area is heavily impacted by 15 years of intense artisanal mining, with rapid deforestation along the river banks, multiple excavations (some to considerable depth) and significant siltation and contamination of local rivers and streams, particularly the Ouaré River.

The report also provides recommendations for stakeholder engagement, additional studies and Project impact assessment and provides a good basis for ESIA scoping studies.

A preliminary feasibility study was undertaken on the proposed Ouaré project in early 2017 by Turkey based HCG Cement and Mineral Processing Technologies. This cursory report, of only 68 pages, has no specific environmental content, but refers to the previous Socrege scoping baseline. It describes the geology and mineral exploration and defines an open pit operation to extract approximately 2.6 Mt of ore and 13.5 Mt of waste from three small pits, over 26 months. No details are provided on the planned waste rock dump. The ore is to be stockpiled at site and hauled to Youga for processing. This will require construction of a new 44 km road, including a new 100 m bridge crossing the Nouaho River. The haul road and bridge required a separate ESIA study with investigation of ambient conditions, consultation with route communities and impact assessment.

CSA have been able to briefly review the ESIA (June, 2018) which appears to be reasonably comprehensive but lacking in detail.

There were some gaps and deficiencies noted in 2017 relating to investigations, impact assessments and mitigation and management measures, which are highlighted below, along with comment from Avesoro as to the current status. The most significant gap was the apparent lack of environmental and social work on the haul routes from Ouaré to Youga. This required urgent work to describe ambient conditions, identify potential impacts and engage with affected communities – together with completion of the Ouaré ESIA – to develop suitable environmental and social management plans prior to start-up of haulage. An ESIA study was completed and submitted to the Ministry of Environment in June 2018, and that the RAP (Resettlement Action Plan) studies are ongoing. CSA has cited the ESIA document, and whilst progress has been made addressing many of the gaps, additional works are required and are ongoing.

20.5 Balogo Property

An Environmental Permit was granted to the Project in September 2016 following submission and approval of the Project ESIA and RAP, both conducted by Socrege. The ESIA report is a comprehensive study of the baseline conditions at the site, identification and assessment of potential Project impacts, and proposed mitigations to address these. The ESIA also includes risk analysis, an ESMP and preliminary Rehabilitation and Closure Plan (RCP).

20.5.1 Environmental and Social Impact Assessment

Baseline Studies

Baseline studies are detailed. The climate study was based on 34 years of data from three government met stations, all within 47 km of the Project area. This data shows the effects of climate change, with weather becoming more erratic over the last decade, with unexpected and spasmodic heavy rain events. Five measuring stations were established for air quality and noise, located based on source and receptors, and two campaigns of measurement were undertaken and showed ambient conditions are within standards.

There is a good understanding of the water resources in the area, with documented research into the hydrogeology and aquifers together with data from wells and boreholes, and surface flow data from existing flow gauges and stations in the area. There are no perennial rivers or major reservoirs, but ephemeral streams exist with small riverbed ponds persisting into the dry season. Several small reservoirs have been created for wildlife in the Nazinga Hunting Reserve and Tambi Park and there are three agro-pastoral water dams, the Boala dam being the main reservoir near the Project area.

Groundwater is recharged through rainfall and the water table is relatively shallow. A water quality sampling campaign was undertaken in June 2016 at 10 sites including surface water, wells and boreholes. The pH varied from 6 to 7.5, surface water had high turbidity and all samples had faecal bacterial pollution. Water usage in the area is collated but mine water requirements are not calculated, or Project supply source identified. Three options are considered: using the existing Boala dam; raising the Boala dam wall; or construction of a new site dam.

The geology and mineralogy of the deposit is described but no geochemical studies were undertaken for the ESIA study despite recognised abundance of pyrite and chalcopyrite. Soils and land-use studies are detailed with characterisation and mapping. Vegetation surveys were undertaken from August 2013 to March 2014 and inventories made of gallery forests, wooded savannahs, shrubby savannahs, grassy savannahs, cultivated fields and forest plantations and protected flora species. Forest resources and different uses are described and listed, with almost all species occurring in the Project area. Seven protected and conservation areas are recognised: pastoral, energy services access, development project, seven village hunting zones, the National Park (10 km from the Project site), the Nazinga Game Ranch (11 km) and Elephant Migration Corridor No. 1 (23 km).

The fauna studies are relatively detailed provide an initial status of the wildlife populations and biodiversity in the study area. Only three small mammal species were observed in the Project area during field surveys in 2015: red patas monkeys, hare and rat. However, the nearby Game Ranch have a reasonable diversity of large mammals, including elephant, hippos, various antelope species, warthog, monkeys and several predators including lion, leopard, caracal and hyena. A total of 25 bird species were identified in the study area, but the Park and Ranch are known to have abundant birdlife, with over 300 recognised species. The Boala dam has three species of fish and a crocodile population (44 and 63 recorded at two different survey periods). Three traps were set at 14 sites to survey insects and snakes, catching and identifying 29 species.

The social study involved research and interviews and captured the demographics, ethnic, religious, and population dynamics; the social, administrative and political frameworks; traditional and social organisation in the study area.

The rural population of the wider area is around 20,000 in 19 villages, plus ≈56,000 in the main town of Sapouy. The Project area has between 5,500 and 6,000. Basic services and facilities for education and literacy, health, planning, use of land and resources, and infrastructures are given together with description of the economic sectors (agriculture, livestock, other primary production, crafts, tourism, artisanal mining and trade). Land issues are complex, but ownership is well defined with access to land via inheritance, gifting or borrowing. Access to pasture is free but any damage to farm land requires compensation. There are some issues over these land transfers, but most conflict is between farmers and breeders. Traditional and modern systems are employed for conflict resolution. The cultural heritage and archaeology study identified 19 iron reduction workshop sites as well as cemeteries and sacred sites.

Impact Assessment

Potential impacts generated by Project activities are identified and assessed across the Project timeline from site preparation and construction, operations and decommissioning, closure and rehabilitation.

Major challenges are anticipated to be resettlement, compensation for loss of land and access to grazing, water and natural forest resources. Relocation of three traditional households and the economic displacement of 39 other households are required, together with expropriation of 71 fields covering an area of 101.59 ha, as well as loss of grazing for livestock where right-of-way is restricted. The EIA proposed minimum exclusion from other project areas to reduce socio-economic impacts on livelihoods and the exploitation of natural flora resources. Apart from displacements, other impacts from Project construction are identified as:

- Air quality from dust and exhaust emissions
- Noise
- Soil erosion and contamination of soils
- Sedimentation and turbidity in water resources
- Deforestation and clearance of vegetation cover (including 11,376 feet of tree removal of major significance)
- Disturbance of wildlife and deterioration of habitats.

Many of these impacts are continued or exacerbated during operations, as well as landscape changes from pit excavation and WRD construction. Potential contamination of water resources and soils from AMD and metal leaching from the open pit and WRD is identified but has not be evaluated with testwork and is a significant gap in the ESIA.

Other impacts include lowering of water table through pit dewatering drawdown affecting local wells and boreholes; and health and safety issues associated with road traffic accidents and access to mine infrastructure. Haulage of ore from Netiana to the Youga plant requires the passing through of at least five villages between Balongo and Pô and may pose a significant safety hazard to the locals. There is likely to be opposition to hauling through the night and hence restricting haulage to daylight hours seems reasonable.

There is little evaluation of the potential Project social impacts from the expected influx of people, or of impacts on and from artisanal mining in the area.

Positive impacts from the operation will include creation of 100 jobs; new business opportunities for local populations (trade, catering etc.); and economic benefits to the State and local authority from tax gains.

The main additional impacts from the rehabilitation and closure phase include the loss of direct and indirect jobs and business opportunities for local populations.

The ESIA risk analysis identifies social disorder from conflicts over compensation; conflicts with farmers and pastoralists; and traffic accidents as significant issues. It also includes evaluation of geotechnical risks from the pit and WRD; fire, explosion and flooding; chemical/hydrocarbon spills; drawdown depletion of groundwater resources; and health issues from microbial contamination.

CSA Global is of the opinion that the ESIA proposes suitable measures to prevent, eliminate, mitigate or compensate for adverse impacts, as well as measures to increase the positive impacts of the project. These relate to protection against air, water and soil pollution as well as management measures for solid and liquid waste from the mine and for combating the risks of fires and other accidents. Measures to strengthen the capacity of stakeholders are also proposed.

However, given the lack of geochemical testing, the potential impacts from ARD and/or metal leaching has not been assessed; impacts from- and to the artisanal miners in the area are not addressed; and the effects of in-migration due to Project development are not evaluated nor mitigations described.

Environmental and Social Management Plan

The preliminary ESMP provides for the implementation of environmental and social mitigation measures, as well as for monitoring and supervision, and capacity-building. The overall budget for the implementation of the ESMP for the Project is estimated at US$1,454,514, including nearly US$750K for mitigation and compensation plans; US$560K for resettlement; US$120K for monitoring; and US$33K for capacity building.

The participation and public consultation section of the ESIA identifies Project stakeholders and describes the methodology, protocols and means of communication for stakeholder engagement, including the required consultation for scoping terms of reference, ESIA and Project disclosure. The main concerns raised by initial meetings with local communities included relocation of families; destruction of vegetation and loss of fields; nuisance/disturbance from the Project and risk of accidents; impacts to sacred sites and places of worship; loss of income from artisanal gold mining on the Project site; access to drinking water; and employment, development of income-generating activities and training of young people in skilled trades.

The preliminary RCP in the ESIA gives closure objectives and the progressive rehabilitation options and closure activities to achieve these. The plan details actions for the pit and WRD and post-closure monitoring, at an estimated cost of US$1,444,803, but does not include any social interventions or community preparation for closure.

20.5.2 Balogo Resettlement Action Plan

Experience of compensation issues at Youga has informed and guided the approach to stakeholder engagement and compensation at Balogo and a detailed RAP was developed for the Balogo Project by Socrege in 2016. The proposed duration of the RAP is five months for all the resettlement and compensations, at an estimated cost of just over US$560K. In addition to the Project, environmental and social descriptions, the RAP includes detailed inventories of the footprint areas, with land take; number of fields; number and type of trees; number of buildings, huts and sheds, sheepfolds and henhouses; and number of people displaced by the pit, WRD, ROM, offices and roads of the Project. The plan looked at alternatives to reduce the affected area and minimise the required relocations. The policy and legal framework for displacement and compensation are described together with details of eligibility, cut-off dates, evaluation methods and compensation rates. The RAP covers resettlement measures and selection of sites; integration with host communities; public involvement; gender and vulnerable people issues. It also identifies responsibilities and describes litigation management.

20.6 Balogo–Youga Haul Route ESIA

In 2016/2017, Socrege undertook an ESIA study on the proposed Netiana-Youga haul route, issuing the EIES report in April 2017. The Socrege work on this ESIA has again been thorough and detailed, with the 217-page report covering the main aspects of baseline data collection, impact assessment and proposed mitigation.

Two alternative routes for the ore haulage were evaluated with the chosen route being shorter; crossed less populated areas and so impacted fewer communities; and was economically more feasible. The ore mined at the Netiana deposit will be transported by truck along a 154 km long route to the Youga mine for processing. Of this route, 150 km are on the existing national highway RN25 (from Koumbili to Youga), but the dirt road from the project site to the RN25 which has been rebuilt. The road will be used by a range of vehicles aside from the haul trucks, including heavy equipment and fuel delivery, light vehicles and buses for personnel movements and is critical to the development of the Balogo project.

The study area for the ESIA was appropriately set for each of the component studies, varying from 30 m to 400 m either side of the road central axis. Extensive desktop studies have been augmented by a field study undertaken in October 2016 for dust and noise measurement along the route; observations on the surface water intersected by the 14 km rebuild section of the route; vegetation and fauna surveys; and stakeholder engagement. Relevant baseline data from the Balogo studies were collated for the portion of road close to the mining area.

Impact assessment includes identification of sources and receptors through construction and operations. Potential impacts ongoing maintenance of the route include:

- Air quality, primarily from dust
- Construction noise and vibration
- Soil erosion from deforestation and increased runoff
- Accidental hydrocarbon spills; siltation and increased turbidity of water resources
- Temporary water shortages due to construction water use
- Wildlife in close proximity to the works.

Haulage operations are expected to transport around 18,000 t/month in 30-t trucks, with an average of 20 round trips per day. There will be two convoys per day, supported by police escort and safety trucks. These will pass each haul route village four times in 24 hours, assuming haulage continues on both dayshift and nightshift. Operational impacts from ore haulage along the 154 km of the route will affect six main settlements, with a total population of nearly 240,000 people. These include:

- Noise
- Vibration
- Light pollution at night
- Dust and other air quality particulates
- Deterioration of the road
- Road safety/traffic accidents involving people, property and loss of livestock (provoking conflicts/compensation), as well as to wildlife.

The ESIA study risk analysis identified several potential risks from developing the ore transport route for the Balogo-Youga Project, but the two main issues were:

- Road traffic accidents.
- Risk of social disorder from:
  - Economic displacement and compensation disputes
  - Nuisance and disruption from convoy traffic through towns and villages and resulting from traffic incidents.

Positive outcomes of rehabilitating the road and ore haulage on the RN25 include:

- Improved access and connectivity for rural populations
- Economic and employment benefits from allowing development of the mining project
- Possible business, catering and trade opportunities for communities along the haul route.

Appropriate mitigation measures are proposed for the construction and operational phases that relate to protection against air-, water- and soil pollution as well as road safety awareness and accident risk management measures and capacity building amongst the impacted communities.

Stakeholder engagement has included public consultations to provide information on the project together with gathering opinions, concerns and to identify suggestions and recommendations from the public. Socrege identified the direct and indirect project stakeholders and undertook individual and group meetings with various level authorities and animal resources and educational services; public meetings in all the villages crossed by the route; targeted meetings with women and youth groups; and visits to various hamlets and settlements in the area of influence of the project. The main concerns were associated with road safety and dust.

The report includes an ESMP for the implementation of environmental and social mitigation, compensation, monitoring and capacity-building measures. This framework includes a table of specific measures, as well as details for both internal monitoring and surveillance and external verification and project transparency monitoring, and of the capacity building program (mainly focused on road safety). The overall budget for the implementation of the haul road ESMP has been estimated at CFA 245,361,130 (approximately US$420,750), of which US$41K is for the monitoring plan, and US$17K is allocated for the capacity building program, in addition to the amount already committed for the original Balogo CSR budget.

20.7 CSA Global Conclusions

Generally, there has been a considerable amount of environmental and social work undertaken on the Youga and Balogo properties and EIA reports are of reasonable content and quality. Baseline data collection has been detailed and comprehensive and impact assessment and mitigations appropriate. While not to Standard Operating Procedure detail, the ESMPs are at an adequate level for implementation.

The ESIA submission for the original Youga project was obviously sufficient for National Burkina Faso requirements as the Youga operation received environmental permitting and exploitation mining license and has been active for over 10 years. While this review cannot comment on operational environmental and social performance, given that no operational or monitoring reports have been seen, the current condition and status of the Youga site; apparent lack of environmental penalties or social conflict; and proposed continuation of activities imply that there have not been any significant non-compliance or grievance issues.

However, ongoing community complaints about compensation and water resources suggest that there is room for improvements on some issues, and the current operation can address these with increased SE, community consultation and demonstrated transparency.

Inclusion of the Ouaré deposit in the Youga project has a good (if now five years old) scoping baseline data resource, but considerably more work is required to build on the Ouaré ESIA and ESMP for the mine (June, 2018) and additionally for the proposed new haul road and bridge. However, much can be learnt from experiences gained at Youga and effort therefore focussed on identified issues.

CSA sets out the following comments with respect to the June, 2018 ESIA document for Ouaré;

- The ESIA includes an explanation of the legal and regulatory context in Burkina Faso and the legislation applicable to the project. There is an overview of the Project description, including mining, processing and employment and economic implications, but this at a relatively high level.
- There are no details of the waste rock management and design, or project water balance and proposed management.
- Baseline studies are generally extensive and cover all the required areas of investigation, although, as in previous studies, the level of detail demonstrates the strengths and weaknesses of the study team, with a strong coverage of vegetation, soils, agriculture and landuse, but cursory fauna or geochemical studies.
- Evaluation of Project alternatives is very superficial, looking only at mining and processing methods and waste rock locations, with little reference to relative impacts.
- Impact identification and assessment appears to be reasonably thorough, given the limited Project detail, and covers construction, operations and closure phases. It is not clear how much coverage of the proposed haul road is included in the assessment or stakeholder engagement. Suitable, though high level, mitigations are proposed, and these are incorporated into evaluation and addressing of Project risks and a framework ESMP, which includes implementation of measures, monitoring and

capacity building. There is a 4 page conceptual Closure and Rehabilitation plan and an even shorter proposal for public consultation.

- There does not appear to be a specific Relocation Action Plan for the removal and resettling of people in the project footprint, or a functional grievance mechanism in-place for the Project.
- The ESIA report gives total costs for implementation of the ESMP, including for monitoring, as FCFA 755,480,000 or under US$1.5M which may be underestimated, especially as it is unclear if this includes provision for the RAP for relocation of people within the mine areas.
- Closure costs are estimated based on US$0.05/t of ore and waste extracted, which corresponds to approximately US$800,000. This is to be paid in instalments over the life of the project but completed at least 12 months before the end of the project. While this estimate is understood to be preliminary and subject to revision, CSA believe this will need to be significantly increased to include social preparations and livelihood restoration.

For the Balogo property, both the ESIA and RAP have apparently been approved and an environmental permit has been granted.

However, CSA Global raises the following concerns with regards to the Balogo property:

- CSA Global believe that there is some additional work required to properly assess and address the geochemical-, artisanal mining- and in-migration risks.
- CSA Global believe that the indicated monitoring frequency is believed to be insufficient, especially for surface and groundwater quality and quantity; ecology and biodiversity; and social monitoring. The overall budget for the implementation of the ESMP for the Project is also believed to be underestimated, given the experience from Youga.
- CSA Global believe that additional social considerations should take the total closure costs closer to US$2 million. A financial guarantee for the RCP is to be paid by instalment over the Project lifetime (four years), but the total amount must be paid at least one year before the end of the Project.

20.8 CSA Global Recommendations

There are some gaps and deficiencies in investigations, impact assessments and mitigation and management measures, which are highlighted below. Required work to address gaps in the Project environmental and social work:

- Undertake more detailed follow-on study on the haul route from Ouaré to Youga, including baseline data collection, stakeholder consultation, impact assessment and mitigations.
- Establish site meteorological stations at Youga and Ouaré (as required)
- Install permanent flow gauges at Project streams and depth rods at ponds/dams
- Undertake more detailed faunal biodiversity studies at Youga to determine the most appropriate measures to avoid and/or offset for Project impacts
- Implement and publicise a formal grievance mechanism for Youga and Ouaré
- Undertake geochemical testing, including metal leaching tests on ore material and tailings from Youga; representative WRD material and ore from Netiana; and from Ouaré as required.
- Define and implement ecological and social monitoring at Youga
- Develop and disclose an appropriate procedure for evaluating post start-up demands for compensation at Youga (for expanding Project area)
- Assess impacts on- and from- artisanal mining in the Youga area (and Ouaré in particular) and establish dialogue to reduce environmental impacts and conflicts.
- Calculate Netiana Mine water requirements and identify supply source

- Evaluate potential social impacts from influx of people to the Balogo area and develop measures to alleviate these
- Increase frequency of surface and groundwater quality and quantity; ecology and biodiversity; and social monitoring at Balogo
- Develop measures for social interventions and community preparation for closure in the Balogo RCP.

21 Capital and Operating Costs

21.1 Capital Expenditure

21.1.1 Youga and Ouaré Properties

The existing load and haul fleet at Youga consists of a mix of three hydraulic excavators and eight haul trucks. These were located at A2NE and A2NW and are then to be used to develop West 3, Ouaré and other deposits at Youga. It is assumed that there is no need for additional capital spend on the mining fleet at Youga.

By July 2018 the mining rate at Youga is significantly increased as Netiana is mined out and the focus of the operation moves to Youga and Ouaré. This means that the load and haul fleet is increased to five hydraulic excavators and 17 haul trucks. There is also a similar increase in the drill requirements and the ancillary equipment to support the load and haul fleet.

A large part of the is increase in equipment requirements comes from transferring the fleet from the Balogo property at Netiana to Ouaré. This means that the capital spend is limited to US$5.28 million in 2018 and there is a sustaining capital is US$1.12 million for the remaining life of the mine.

Other capital costs included in the financial analysis are:

- To accommodate the increase in the Reserves to 9.3 Mt the TSF needs to be extended. The capital expenditure is expected to be US$2 million, there is also an expenditure of US$4.8 million to extend the dumps, which is spread over the life of the mine and can be treated as either a capital or an operating cost.
- The capitalised environmental and social expenditures are estimated at US$9.66 million and are spread across the mine life.
- There is also a capital allowance of US$1.7 million in 2018 to build the road from Ouaré to Youga so that ore can be transported from Ouaré to the plant at Youga. This capital includes provision for the construction of a bridge over the Nakambe River.

21.1.2 Balogo Property

The proposed capital expenditure for Netiana has been limited to the purchase of the initial mining equipment which is detailed in the mine costs model for Netiana and totals US$5,863K. The main items are:

- One excavator
- Four haul trucks
- One drill
- One track dozer
- One grader.

Allowance is also made for service equipment and light vehicles and additional equipment will be transferred from Youga as the mining rate at Netiana is gradually increased.

It is assumed that the existing exploration camp facilities will be repurposed for day-to-day operation of Netiana. This includes:

- Mine office buildings
- Canteen and lunch room
- Accommodation block
- Fuel station.

It is assumed that major overhauls will be carried out at the Youga workshops if required and that routine maintenance can be done with the existing facilities. Given that the equipment is new, and the mine life is short (12 months), this should be minimal.

21.2 Operating Costs

The mine operating costs were estimated from first principles from the required mine equipment to support the schedule. A breakdown of the Youga and Ouaré property costs for 2017 and 2024 is shown in Table 21-1, whereas a breakdown of the Balogo Project costs for 2017 and 2018 is shown in Table 21-3.

Table 21-1: Summary of mine operating costs for the Youga and Ouaré properties

	Units	Total	2017	2018	2019	2020	2021	2022	2023	2024
Operating costs – category	**US$/t**	**1.62**	**1.79**	**1.23**	**1.20**	**1.58**	**2.05**	**2.11**	**1.72**	**1.72**
Labour	US$/t	**0.30**	0.41	0.22	0.21	0.34	0.54	0.56	0.21	0.21
Overhaul	US$/t	**0.08**	0.08	0.07	0.07	0.08	0.09	0.10	0.09	0.09
Maintenance	US$/t	**0.12**	0.12	0.10	0.10	0.11	0.14	0.14	0.14	0.14
Fuel	US$/t	**0.70**	0.69	0.51	0.50	0.64	0.83	0.85	0.84	0.84
Lubricants	US$/t	**0.08**	0.08	0.06	0.06	0.07	0.09	0.09	0.09	0.09
Tyres	US$/t	**0.03**	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Wear parts	US$/t	**0.08**	0.08	0.06	0.06	0.08	0.10	0.10	0.10	0.10
Explosives	US$/t	**0.22**	0.30	0.18	0.19	0.22	0.23	0.24	0.22	0.22
Miscellaneous	US$/t	**0.01**	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01

Table 21-2: Summary of mine operating costs for the Balogo property

	Units	Total	Mar 2017	Jan 2018
Operating costs – category	**US$/t**	**1.59**	**1.46**	**1.67**
Labour	US$/t	**0.38**	0.31	0.39
Overhaul	US$/t	**0.08**	0.07	0.08
Maintenance	US$/t	**0.11**	0.11	0.12
Fuel	US$/t	**0.64**	0.59	0.69
Lubricants	US$/t	**0.07**	0.07	0.08
Tyres	US$/t	**0.03**	0.03	0.03
Wear parts	US$/t	**0.08**	0.07	0.08
Explosives	US$/t	**0.19**	0.20	0.18
Miscellaneous	US$/t	**0.02**	0.02	0.02

The Miscellaneous category includes the annual fixed costs for provision of contract services to supply fuel and explosives.

A summary of the operating costs for the Youga and Ouaré properties is given in Table 21-3, and for the Balogo property in Table 21-4.

Table 21-3: Summary of operating costs for the Youga and Ouaré properties

Cost area	Units	2017	LOM
Mining cost	US$/t mined	1.79	1.61
Ore transport	US$/t ore	Varies	Varies
Processing (variable)	US$/t ore	17.58	17.58
G&A	KUS$/annum	6,908	6,908

Note: The ore transport cost is from the pit exit (or ROM pad in the case of Ouaré) to the ROM pad at Youga. For Ouaré, the transport cost over the 44 km route is US$4.05/t ore. For Youga, the transport cost varies between US$0.06/t ore and US$0.56/t ore, depending on haul distance to the ROM pad.

Table 21-4: Summary of operating costs for the Balogo property

Cost area	Units	2017	2018
Mining cost	US$/t mined	1.46	1.67
Ore transport	US$/t ore	14.06	14.06
Processing (variable)	US$/t ore	17.60	17.60
Processing (fixed)	KUS$/annum	4,040	4,040
G&A	KUS$/annum	2,209	2,209

Note that open pit mining of Netiana ceases in mid-2018 and reclaiming of the ROM stockpiles continues until the first quarter of 2019. The annual fixed costs have been adjusted accordingly.

22 Economic Analysis

This 2018 Economic Analysis of the Project is based on the Mineral Reserves presented in Section 15. The analysis is based on discounted cash flow (DCF) approach. Results are expressed as pre-tax and after-tax basis, and pre-financing terms. The analysis takes into account the 4% royalty paid on revenue and 1.8% royalty on revenue paid to Endeavour. No inflation or escalation of revenue or costs has been incorporated into the base case economic model. Project expenditures prior to January 2018 are considered as sunk costs and are excluded from the cash flow model.

The model is developed in US$ at current prices and does not include considerations for exchange rate fluctuations.

22.1 Inputs and Assumptions

Inputs to the cash flow model include:

- No processing facilities on Ouaré or Balogo site, the ore from Ouaré and Netiana is transported to Youga processing plant.
- The cost of ore transportation from Ouaré to Youga is at US$4.05/t, and from Balogo to Youga at US$14/t, based on the information provided by Avesoro.
- No additional capex is provisioned for the ore transportation from Balogo or Ouaré to Youga.
- Processing recovery at 91% for Youga ores, 89% for Ouaré ores and 91% for Netiana ore.
- Revenue based on a gold price of US$1,300/oz.
- Sales cost of US$7/oz.
- Mineral royalty of 4% of revenue, applied to Youga and Ouaré.
- Tailing dam expansion capex of US$4,383K. No cost is allocated to the Netiana project with regards to tailing dams on the processing facility in Youga.
- Contingency on mining opex of 10% has been provisioned for Netiana to factor in risk of salaries increase.
- Mining operations for eight years until 2025, with ore rehandling operations spanning into 2027.
- Total LOM production of 9,030 kt with average grade of 1.86 g/t containing 21.1 t of gold.
- Total expenditures related to environmental and social impact of US$6.6 million over the 10 years.
- Royalty to Endeavour of 1.8% of revenue.
- Profit tax rates used are as below:
  - Youga pits – 17.5%
  - Ouaré pits – 22.5%
  - Netiana pits – 22.5%.
- Mining capex of US$3,645 k.
- Net present value (NPV) assessment at 5% discount rate.

22.2 Cash Flow Model and Economic Result

The cash flow model inputs for Youga/Ouaré and Netiana are shown in Table 22-1.

Table 22-1: Youga and Ouaré cash flow model

	Units	Total	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Ore mined	kt	**9,030**	645	644	811	1,803	1,504	1,677	563	1,382	-	-
ROM rehandle	kt	**7,735**	1,210	1,200	1,200	746	798	500	881	1,200	-	-
Waste	kt	**101,385**	15,699	16,484	15,747	13,084	12,568	11,137	10,044	6,621	-	-
Stripping ratio	t/t	**11.2**	24.3	25.6	19.4	7.3	8.4	6.6	17.8	4.8	-	-
Ore to Plant	kt	**11,356**	1,210	1,200	1,203	1,200	1,200	1,200	1,203	1,200	1,200	539
Head grade	g/t	**1.86**	3.25	1.97	2.31	2.48	1.69	1.56	1.19	1.62	1.01	0.99
Gold content	kg	**21,082**	3,929	2,365	2,776	2,982	2,025	1,867	1,436	1,949	1,217	536
Gold recovered	koz	**614.0**	114.9	69.2	81.2	86.8	58.5	53.7	41.7	57.0	35.5	15.3

The key economic indicators such as cash flow and NPV on pre-tax and after-tax basis and comparable 2017 estimate at 5% discount rate and US$1,300/oz gold price are shown in Table 22-2.

Table 22-2: Key economic indicators for Youga/Balogo and Netiana

	Youga and Ouaré	Balogo	Total	2017 estimate
Gold recovered (koz)	522	92	**614**	464
Undiscounted cash flow (US$M, pre-tax)	166,100	59,410	**225,510**	
Undiscounted cash flow (US$M, after tax)	135,670	46,040	**181,720**	
NPV US$M (5% discount rate, pre-tax)	133,050	55,270	**188,320**	132,700
NPV US$M (5% discount rate, after tax)	108,750	42,840	**151,580**	
Cash cost (US$/oz)	910	550	**860**	886
All-in cost (US$/oz)	980	600	**920**	937

Internal rate of return (IRR) and payback period assessments are not applicable to the projects as they are cash flow positive from year one.

22.3 Sensitivity Analysis

The base case results shown in Table 22-1 for Youga/Ouaré and were tested for sensitivities to:

- Gold price fluctuations in the range from US$1,100/oz to US$1,450/oz and mining cost variation from the base case to an increase of 20% (the base case includes the contingency on mining cost for Netiana). See Table 22-3 for the results.
- Gold price fluctuations in the range from US$1,100/oz to US$1,450/oz and processing recoveries change from -4% to +2% from the current base case. See Table 22-4 the results.

Table 22-3: Youga/Ouaré and Netiana NPV (at 5%) sensitivity to mining cost increase and gold price fluctuations (NPV in US$1,000)

Mining cost increase	Gold price (per ounce)							
	$1,100	$1,150	$1,200	$1,250	$1,300	$1,350	$1,400	$1,450
20%	$67,620	$91,040	$114,450	$137,870	$161,280	$184,700	$208,120	$231,530
15%	$74,380	$97,800	$121,210	$144,630	$168,040	$191,460	$214,880	$238,290
10%	$81,140	$104,560	$127,970	$151,390	$174,800	$198,220	$221,640	$245,050
5%	$87,900	$111,320	$134,730	$158,150	$181,560	$204,980	$228,400	$251,810
0%	$94,660	$118,070	$141,490	$164,910	$188,320	$211,740	$235,150	$258,570

Table 22-4: Youga/Ouaré and Netiana NPV (at 5%) sensitivity to processing recovery rate change and gold price fluctuations (NPV in US$1,000)

Processing recovery variations	Gold price (per ounce)							
	$1,100	$1,150	$1,200	$1,250	$1,300	$1,350	$1,400	$1,450
-4%	$72,440	$94,820	$117,200	$139,580	$161,970	$184,350	$206,730	$229,110
-2%	$83,550	$106,450	$129,350	$152,250	$175,150	$198,050	$220,940	$243,840
0%	$94,660	$118,070	$141,490	$164,910	$188,320	$211,740	$235,150	$258,570
1%	$100,210	$123,890	$147,560	$171,230	$194,910	$218,580	$242,260	$265,930
2%	$105,760	$129,700	$153,630	$177,560	$201,490	$225,430	$249,360	$273,290

Project NPV shows strong resilience to both gold price fluctuations within the limits tested and cost and recovery fluctuations. In stress scenario where mining cost is 20% higher than the base case and gold price is at US$1,100/oz the projects still return US$67.6 million pre-tax NPV at 5% discount rate.

23 Adjacent Properties

There are no relevant adjacent properties (pers. comm. Gökhan Kellecioglu).

24 Other Relevant Data and Information

24.1 Hydrology

24.1.1 Overview

CSA Global undertook a review of the available hydrological and hydrogeological aspects of the Project. The aim of the review was to evaluate the level of understanding of the hydrology and hydrogeology at each of the sites and to identify any potential mine water management issues and risks at each site. To complete the review, the available hydrological and hydrogeological data were compiled and is summarised in this report.

The scope of work for the review includes the following tasks:

- Review all hydrological and hydrogeological information currently available relating to the Youga, Ouaré and Balogo properties
- Identify any gaps in the data currently available and put forward recommendations to address these data gaps
- Prepare a technical memorandum detailing the findings of the above.

The data available for review included the following:

- Ouaré ESIA study (2018), cited.
- Endeavour (2015); Technical Report Mineral Resource and Mineral Reserve Update for the Youga Gold Mine Burkina Faso West Africa, Endeavour Mining Corporation, March 2015
- SGS (2005); Youga Gold Project Updated Environmental Impact Assessment, SGS Environment, 2005
- Youga Gold Mine, Burkina Faso: Mining Geotechnics Site Visit – 19 to 25 August 2010
- Youga Gold Mine, Burkina Faso: Technical Site Visit Report – 27 to 30 August 2013
- Review of Mine Closure, Youga Mine, Burkina Faso 2016
- Youga Mine Environmental Management Plan
- Water Management System, BMC YOUGA MINE
- HCG Cement & Mineral Processing Technologies, 2017; Ouaré Project Feasibility Study, Prepared for Etruscan Resources Inc., 5 May 2017
- MNG, 2016; FS for the Balogo Project in Burkina Faso, HCG Cement & Mineral Processing Technologies, March 2016
- Socrege, 2016; Environmental and Social Impact Study of the Netiana Gold Project, produced for MNG Gold, August 2016.

24.1.2 Conceptual Hydrological and Hydrogeological Model

Climate

A climatological assessment for the Youga, Ouaré and Balogo properties is presented in Section 5.2.

Hydrology and Physiography

A hydrology and physiography assessment for the Youga and Ouaré property areas is presented in Section 5.3.

The MNG (2016) FS on the Balogo project contains a short section on hydrology; however, the report refers to proposed monitoring measures rather than providing actual field results. The ESIA details literature review data and limited site-specific data. Per the FS, the Balogo project area is located within the sub-catchment areas of three small ephemeral streams, which drain the site to the south, eventually feeding in to the larger Sissili and Nazinon Rivers. These sub-basins are reported as the West Koumbili, East Koumbili and Koro.

Primary hydrometric data are provided in the ESIA from the following gauging stations:

- Nazinon station in Nobéré
- Sissili station in Nebbou
- Sissili station in Kounou.

A review of the Direction Générale des Resources (DGRE) inventory identifies 14 surface water reservoirs in the rural commune (department) of Guiaro. These are listed in Table 12-2 of the FS (MNG, 2016) and may provide local hydrometric data. They are tabulated below.

Table 24-1: List of surface water reservoirs of the rural commune of Guiaro (MNG, 2016)

Region	Province	Municipality	Village	Name of work	Type	Dyke length	Volume (m^3)	Real year	Main purpose	Sustainability	National basin
Centre-Sud	Nahouri	Guiaro	Boala	Santuoge	Barrage	887	-	2007	Agricole	Permanent	Nakanbe
			Oualem	Akalon	Barrage	256	87,000	1986	Faunique	Permanent	
			Oualem	Akawazena	Barrage	225	-	1977	Faunique	Permanent	
			Oualem	Barka	Barrage	140	-	1983	Faunique	Permanent	
			Oualem	Boudjero	Barrage	60	-	1985	Faunique	NPE	
			Oualem	Centrale	Barrage	437	169,000	1987	Faunique	Temporaire	
			Oualem	Kadro	Bouli		-	2009	Agricole	Permanent	
			Oualem	Kaliéboulou	Barrage	405	1,465,000	1987	Faunique	Permanent	
			Oualem	Kouzougou	Barrage	80	-	1981	Faunique	Permanent	
			Oualem	Mare Des Phacocheres	Mare					Permanent	
			Oualem	Naggio	Barrage	160	-		Faunique	Permanent	
			Oualem	Nakuru	Barrage	30	-	1981	Faunique	Permanent	
			Oualem	Poupanga	Barrage	310	-	1986	Faunique	Permanent	
			Oualem	Talanga	Barrage	100	-	1984	Faunique	Permanent	

Hydrogeology

Aquifers

An assessment of the hydrogeological setting of the Youga mine area is provided in Section 3.3.2 of the "Youga Gold Project Updated Environmental Impact Assessment (2005)". According to the report, there are likely to be two main aquifer units within the mine area:

- Shallow weathered aquifer. The Youga Mine area is characterised by a shallow weathered zone with a maximum thickness of 10 mbgl. The shallow aquifer is recharged by rainfall during the wet season, feeding several springs, including the Gossé Stream which flows all year round. Porosity is estimated at being between 30% and 40% and permeability is estimated to range from 1 to 10-3 (no units given).
- Fractured bedrock aquifer. The Youga Mine area is highly fractured. The bedrock aquifer has a low permeability ranging from 10-5 to 10-10 (no units given) and porosity is estimated to be less than 5%.

In general, the rocks are low yielding and not ideally suited to exploitation using boreholes. The above hydraulic information is provided in "Youga Gold Project Updated Environmental Impact Assessment, SGS Environment, 2005"; however, no information is provided regarding the hydraulic testing methodology and no empirical units are provided for permeability.

The Ouaré project FS indicates that there is limited groundwater use within the Ouaré project area. The FS report contains a short section on potential aquifers in the area. No site-specific hydrogeological investigation data was provided, except for limited groundwater quality data. No information on potential groundwater levels or aquifer parameters was provided.

Within the Balogo project area, a significant number of exploration boreholes have been drilled using a combination of RC and DD drilling. Investigations to date have focused on the geotechnical properties of the subsurface rather than hydrogeological parameters. The hydrogeological information available for the Balogo project area relies on literature values and limited site-specific data.

The literature data used in the MNG (2016) FS includes six piezometers in the Nazinon and Sissili sub-basins, an inventory of water access points in the municipality of Guiero and 19 water access points visited by the Socrege mission. Tables 12-4 to 12-6 of MNG (2016) provide a listing of potential groundwater data sources. No site-specific water level measurements or borehole hydraulic testing results are provided, and limited site-specific water level measurements are available.

The FS and ESIA reports for the Balogo project contain a short section on aquifer properties. The section is poorly referenced, and the data sources used in the interpretation are unclear. Per the report, the three sub-basins that the Balogo project area intersects have low interstitial porosity, although it is identified that there is potential for enhanced groundwater flow in fracture zones.

The west and east Koumbili sub basins are cited as poorly productive, with water yields during drilling reported as being 3–7 m^3/second. These yields do not seem reasonable for the hydrogeological environment as this flow rate corresponds to a maximum yield exceeding 700,000 m^3/day. Therefore, the quoted yields are considered questionable and there is likely to be some unit or calculation error.

The Koro sub-basin is classified as having good potential for extensive exploitation with a yield rate of 3–9 m^3/second (again the quoted yields are considered questionable and there is likely to be some unit or calculation error). No information was provided regarding how the yield rate was calculated i.e. via pumping test, or whether the provided rates relate to the weathered zone or competent bedrock.

Groundwater Levels and Flow Direction

For the Youga project, four groundwater monitoring wells (BH1 to BH4) are referenced in the EIA (2005); however, no groundwater level data are provided.

According to the report, "Youga Gold Mine, Burkina Faso: Mining Geotechnics Site Visit – 19 to 25 August 2010", three additional piezometers were installed in the vicinity of the main pit. The exact location of these piezometers is uncertain. A monthly time-series of water levels from GPBH-01, GPBH-02 and GPBH-03 is illustrated in Figure 4-6 of the report, "Youga Gold Mine, Burkina Faso: Technical Site Visit Report – 27 to 30 August 2013".

In the absence of water level data for monitoring wells BH1-BH4 and location data for the on-site piezometers (GPBH-01 to GPBH-03), it is not currently possible to infer groundwater flow direction at the Youga mine site.

According to the Technical Report (2015), the hydrogeology, hydrology and surface water aspects at the Youga mine were originally assessed by KP in 1999. Their findings are summarised in the report, "Youga Mine Project Feasibility Study – Tailings Facility, Plant Site, Pit Slopes and Storm Water Management". This report did not appear to be available for this review but may provide additional hydrogeological insight.

Groundwater in the Ouaré project area is reported to be calcium magnesium bicarbonate type with low conductivity and low turbidity. Microbial contamination of groundwater is reported in the project area.

At the Balogo project, except for the 19 Socrege data points, all referenced groundwater data points lack spatial information. One monitoring point is located on the periphery of the Balogo project area, while there appear to be two surface water monitoring points on watercourses which are hydrologically connected to the mine site.

Of the 19 Socrege points, piezometric water levels are provided for three of the points which range from 0 to 24.7mbgl (note: assumed to be mbgl, units given as m). Given the lack of spatial or topographical information, it is not possible to infer groundwater flow direction.

24.1.3 Water Management and Supply

Water Supply

The Ouaré and Balogo mines water supply requirements will depend upon the operation of the mines and may include requirements for dust suppression, ablution and potable water. As the ore will be transported to the Youga mine for processing, the processing water requirements for the Ouaré and Balogo sites are likely to be minimal.

A water supply strategy for the Ouaré project, including water supply options and their potential yields, quality and long-term sustainability have not been provided for review.

Water supply options for the Balogo project are provided in the ESIA; however, a water supply strategy for the Balogo project, including potential yields, quality and long-term sustainability of the water supply sources has not been provided for review.

Pit Stability

In technical site visit reports (2010) and (2013), potential issues were raised concerning water management and pit stability, as detailed in the following excerpts from those reports:

- Technical site visit (2010): Mining of the Main Pit has been temporarily halted due to flooding following heavy rains. This notwithstanding, areas of concern in the Main Pit include a recent wedge failure in the northeast corner of the pit.
- Technical site visit (2013): Taken in conjunction, the observations on site, together with the interpretation of available piezometer data, suggests that, to date, the influence of water on the development of the tension cracks and contribution towards the instability of the west wall of the East Pit is serious.

While measures to counteract these concerns were detailed in both reports, it is not clear if these measures were successful in effectively managing the effect of surface water and groundwater ingress on pit stability.

Pit Status (Post-2016 Cessation of Active Mining)

The current pit statuses are:

- Main Pit: Pumping continued to maintain dry workings.
- East Pit: Water has been allowed to accumulate to a depth of up to approximately 80 m in the pit before being pumped to the process plant as a source of water. No major instabilities were identified at an inter-ramp or wall scale for the east pit in the decommissioning report, suggesting that the issues identified in the technical site visit in 2013 (Section 4.5.1) may have been rectified.
- West Pit: West Pit 2b is flooded while it is intended to flood West Pit 2a and West Pit 3 by creating adjoining channels between the pits. West Pit 4 is planned for development.
- The status of smaller on-site excavations is provided in “Review of Mine Closure, Youga Mine, Burkina Faso, 2016”.

Pit Dewatering

Pit dewatering is achieved utilising in-pit sumps. It is reported that the quantity of water pumped from the pits is recorded on a daily basis and that water quality is monitored daily and monthly. Pit dewatering was initially predicted (KP, 1999) to be of the order 5 L/s to 15 L/s (400 m^3/day to 1,300 m^3/day) but no actual dewatering rates were available for review.

Potable Supply

Raw water is pumped from the Nakambé River, is stored in a de-sanding holding tank, from where it is then pumped over 11 km to the raw water pond. Potable water is supplied from the raw water pond and is treated through a filtration and sterilisation system before being stored in a dedicated 20 m^3 potable water tank. According to the mine closure review (2016), the water tower, pumping station and pipeline could provide a long term agricultural water supply for the local community assuming the following maintenance actions are undertaken:

- Periodic inspections to evaluate the state of the remaining structures
- Continuation of monitoring of surface water and undergroundwater channels.

Water Quality

At the Youga project, surface water quality is measured at upstream and downstream points on the Zera River and at the Gossé Stream. Surface water on site was found to be unsuitable for human consumption owing to extensive microbial contamination. Water quality is monitored at four borehole locations (BH1 to BH4). The concentration of iron in well CSPS (BH3) and the school borehole (BH4) was reported to be twice the level allowed for potable consumption. The concentration of manganese in BH4 was more than three times the World Health Organization (WHO) drinking water standard (0.05 ppm).

Three open pits, with depths up to 130 m, are proposed for the Ouaré mine. A specific water management plan, including both groundwater and surface water management, is not provided for the Ouaré site.

Groundwater and surface water quality measurements were collected near the Balogo project area from the 19 Socrege monitoring points.

Water quality samples were collected from four boreholes, three wells and three surface water locations in the vicinity of the Project area. Of the available water quality parameters, the dissolved oxygen concentrations represent a potential concern. Dissolved oxygen concentrations detected in groundwater wells and drilling water ranged from 1.15 mg/l to 2.96 mg/l (mean 2.06 mg/l) and 1.49 mg/l to 3.58 mg/l (mean 2.18 mg/l) respectively. Dissolved oxygen concentrations less than 2 mg/l are considered anaerobic. In anaerobic groundwater, reducing conditions increase the solubility of naturally occurring metals. Anaerobic groundwater can therefore exhibit elevated concentrations of reduced iron, manganese and hydrogen sulphide. Water treatment may be required if this water is to be used as a water supply for the proposed Netiana mine.

Water Management

A detailed EMP is provided in “Youga Mine Environmental Management Plan”. The plan sets out actions, reporting procedures and corrective actions to achieve the following:

- Minimise or prevent potential negative impacts on water quality
- Minimise disturbance to drainage through erosion or deposition, beyond natural fluctuations
- Contain potential AMD on site and prevent impact on local waterways.

Three open pits, with depths up to 130 m, are proposed for the Ouaré mine. A specific water management plan, including both groundwater and surface water management, is not provided for the Ouaré project.

A specific water management plan is not provided for the Balogo project. The proposed Socrege monitoring program does not contain either on-site boreholes or a targeted surface water monitoring regime (i.e. upstream and downstream of on-site activities).

24.1.4 CSA Global Conclusions

Youga Property Conclusions

In summary, and based on the information provided for review, there appears to be a good understanding of most operational water management issues at the mine site. However, additional assessments and site-specific investigations would improve future operational water management including:

- Long-term prediction of dewatering and depressurisation requirements
- Long term water supply security
- Optimisation of overall site water management
- Assessment of potential impacts from mine water management on the environment.

Additional observations include:

- Uncertainty also remains as to whether there is an understanding of the hydrogeological regime at the site. It is reported that a preliminary assessment of dewatering requirements was completed as part of the FS.
- Surface water management issues have been identified at several of the open pits, including aspects such as the erosion of the pit crest and enhanced pit inflows resulting in pit wall instability. A water course has also been identified as being present beneath the main waste dump. Again; hydrogeological assessments have been completed for the Youga mine site.
- Although hydrological assessments have been completed for the Youga gold mine, there appears to be limited site specific meteorological data and limited quantitative surface water flow monitoring data available for the site. Thus, there remains some uncertainty as to whether surface water management strategies are appropriately designed for conditions at the site. An overall surface water management plan for the Youga mine site has not been sighted.
- No issues regarding pit dewatering have been reported.
- It is reported that depressurisation was identified as a potential requirement to ensure pit wall stability, although there is uncertainty whether depressurisation strategies have been developed for the site. Pit wall stability issues have been identified in a number of the open pits.
- In site visit reports, pit instabilities related to groundwater and surface water ingress have been highlighted. While we understand that corrective actions were implemented, no follow up was provided in the available documentation regarding the success or failure of these mitigation measures. In addition, the consequences of pit flooding following the decommissioning of the mine do not appear to have been assessed from a hydrogeological perspective.
- Water supply for the Youga mine site is reported to be provided by a number of sources, including TSF return, the Nakambé River, pit dewatering and boreholes. A water tower currently exists at the Nakambé River and there is also an on-site water treatment facility. A water balance for the site has not been sighted. However, no water supply issues were reported in the documentation available for review.
- An EIA, EMP and Water Management System have been completed for the Youga mine site. While no issues with respect to the impact of water management at the site on the surrounding environment have been reported, a risk of potential impact on the environment (from the mine operation) remains due to the uncertainties regarding the hydrological and hydrogeological understanding at the site.

- The Youga site has an existing water monitoring network, including both upstream and downstream groundwater and surface water monitoring locations. The EMP which is in place details compliance criteria, sampling and reporting procedures and corrective actions required to achieve water quality objectives.
- While a monitoring network is in place, additional work is recommended to collate spatial data from the monitoring points outlined in the EIA and the on-site boreholes described in the technical site visit reports. The current hydrogeological interpretation lacks specific information on the location of test boreholes and the hydraulic testing method used. No information has been provided regarding groundwater flow direction at the site.

Ouaré Project Conclusions

Limited hydrological and hydrogeological assessments have been completed for the FS for the Ouaré project, although additional information has been collated in to the recent ESIA study submitted to the Ministry in June 2018. Some uncertainty remains with respect to water management for the project. Additional site-specific assessments are recommended in order to ensure that the water management aspects of the project are fully understood, and appropriate surface water and groundwater management strategies are developed and costed.

Balogo Property Conclusions

In summary; while hydrological and hydrogeological assessments have been completed for the FS, significant uncertainty remains with respect to water management for the Balogo project. Additional site-specific assessments are recommended to ensure that the water management aspects of the project are fully understood, and appropriate surface water and groundwater management strategies are developed and costed.

Additional observations include:

- The assessment of the hydrology and hydrogeology for the Balogo project area appears to be based predominantly on literature values and limited site-specific data. Significant uncertainty remains regarding the hydrological and hydrogeological understanding of the Balogo project area due to the lack of site specific data.
- An assessment of design rainfall events, design flood events, derivation of peak flow rates and peak flood heights is not included in the MNG (2016) FS and a surface water management plan for the Balogo project is not included in the FS.
- An assessment of potential pit inflows (derived from both rainfall runoff/surface water and groundwater) is not included in MNG (2016) and a dewatering strategy for the proposed open pit is not included in the FS.
- The water demands for the Balogo project are not detailed in the FS, although it is identified that water for dust suppression will be required. In addition, it is likely that there will be a water demand associated with the administration and mine camp. The camp is proposed to accommodate a total of 40 mine staff and 10 engineers. Water supply options for the project are not detailed in MNG (2016). A water balance for the Netiana mine has not been provided for review.
- The potential impact of mine water management on the water environment was included in the ESIA.
- Capital and operating costs for the Netiana mine have been developed. However, the costs are not presented in sufficient detail to determine whether they include an adequate provision for water management for the project.
- A water monitoring program for the Balogo project has been proposed, although uncertainty remains as to whether water monitoring is being completed in accordance with the proposed program. The

proposed monitoring program does not include on-site boreholes or targeted surface water monitoring (i.e. upstream and downstream of on-site activities).

24.1.5 CSA Global Recommendations

Youga Property Recommendations

Additional studies are recommended to improve the level of understanding relating to the hydrology and hydrogeology at Youga. This additional information would also increase the confidence with regards predictions for mine water management at Youga. More specifically, CSA Global recommends the following:

- Additional site investigations to improve the hydrological and hydrogeological understanding for the site, including:
  - Installation of an on-site rain gauge to record site specific rainfall data relating to both individual storm events and daily rainfall totals.
  - Monitoring of flows in surface water features in the immediate project area.
  - Mapping of the depth to bedrock across the project area to identify the depth of the weathered zone and position of the weathered rock/fresh rock contact (transition zone) which often represents a zone of enhanced permeability and preferential groundwater flow and is important in terms of managing pit inflows.
  - A review of the hydrogeological monitoring infrastructure and collation of all available data relating to groundwater levels, well-head elevation, hydraulic testing and geochemical analysis. Once the data is organised, it may be necessary to carry out additional hydraulic testing.
- An integrated surface water management plan should be developed for the Youga mine site to optimise surface water management systems, minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.
- Operational groundwater management strategies for the entire Youga mine site should be reviewed and where possible integrated to optimise water use and management across the mine.

Ouaré Property Recommendations

Specifically, CSA Global recommends the following:

- Hydrological and hydrogeological site investigations should be completed to improve the hydrological and hydrogeological understanding for the site, including:
  - Installation of an on-site rain gauge to record site specific rainfall data relating to both individual storm events and daily rainfall totals.
  - Monitoring of flows and water quality associated with surface water features in the immediate project area.
  - Mapping of the depth to bedrock across the project area in order to identify the depth of the weathered zone and the position of the weathered rock/fresh rock contact (transition zone) which often represents a zone of enhanced permeability and preferential groundwater flow and is important in terms of managing pit inflows and as a target depth for potential water supply bores.
  - A site-specific hydrogeological field investigation program, including:
    - installation of site-specific monitoring boreholes upstream and downstream of mine activity
    - site-specific aquifer parameters for the various lithologies across the project site
    - investigate the hydraulic connection between different units

  - groundwater levels and groundwater flow direction
  - groundwater quality.
- A water monitoring program should be developed in order to ensure that the program enables the water management issues for the entire site to be fully evaluated.
- An assessment of pit inflows and dewatering requirements should be completed, and an appropriate dewatering and depressurisation strategy developed.
- A surface water management plan should be developed for the proposed Ouaré mine site in order to minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.
- An assessment of potential water supply options and their long-term water supply security should be completed to ensure a sustainable water supply is available to meet local requirements for the life of the mine.
- An assessment of the potential impacts of mine water management on the environment should be completed.

Balogo Property Recommendations

Additional studies are recommended to improve the level of understanding relating to the hydrology and hydrogeology at Balogo. This additional information would also increase the confidence with regards predictions for mine water management at Balogo. More specifically; CSA Global recommends the following:

- Additional site investigations to improve the hydrological and hydrogeological understanding for the site, including:
  - Installation of an on-site rain gauge to record site specific rainfall data relating to both individual storm events and daily rainfall totals.
  - Monitoring of flows and water quality associated with surface water features in the immediate project area.
  - Mapping of the depth to bedrock across the project area in order to identify the depth of the weathered zone and the position of the weathered rock/fresh rock contact (transition zone) which often represents a zone of enhanced permeability and preferential groundwater flow and is important in terms of managing pit inflows and as a target depth for potential water supply bores.
  - A site-specific hydrogeological field investigation program, including:
    - installation of site-specific monitoring boreholes upstream and downstream of mine activity
    - site-specific aquifer parameters for the various lithologies across the project site
    - investigate the hydraulic connection between different units
    - groundwater levels and groundwater flow direction
    - groundwater quality.
- The current water monitoring program should be reviewed in order to ensure that the program enables the water management issues for the entire site to be fully evaluated.
- An assessment of pit inflows and dewatering requirements should be completed, and an appropriate dewatering and depressurisation strategy developed.
- A surface water management plan should be developed for the proposed Netiana mine site to minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.

- An assessment of the long-term water supply security of potential water supply options should be completed to ensure a sustainable water supply is available to meet local requirements for the life of the mine.

25 Interpretations and Conclusions

The following conclusions are relevant to this study:

25.1 General

QAQC procedures to monitor accuracy and precision are adequate, and whilst an improvement on the previous reporting period is noted, there are still issues with failures of CRMs as well as apparent misidentification of blank and CRM samples. The following conclusions apply to all the projects reviewed.

- Measures to control cross contamination are inadequate and urgently require the introduction of a preparation blank.
- No failures were noted in the pulp blanks, but these do not undergo preparation so do not monitor potential cross contamination in the sample preparation stage.
- CRM results were generally accurate without significant bias in most instances.
- Balogo samples had acceptable repeatability, but precision was poor with significant bias in the A2NE Youga samples which could indicate a sampling issue (i.e. non-representative sampling).
- Data management requires improvement with instances of missing as well as duplicated data and apparent misidentified QC records noted. These issues decrease confidence in the input data used for the Mineral Resource estimation work. Avesoro would benefit from implementing a comprehensive data management system including the use of a relational geological database such as acQuire or DataShed to ensure validation of data and to serve as a single point of truth for all the project data.

The following conclusions apply to the Balogo property:

- As there is intrinsic sample bias and/or potential for contamination associated with soil, grab and auger sampling, these datasets have not been used in the estimation of resources and are for indicative/exploration purposes only.

25.2 Mineral Processing and Metallurgical Testing

25.2.1 Youga and Ouaré Properties

- The results show the potential of good recovery by gravity for the ore types tested, with the exception for the samples recorded from Zergoré South.
- Testwork on Ouaré and Satellite samples has demonstrated that a P_{80} grind size of 75 microns should be the target when treating the future Ouaré ores.
- The historical and 2017 YTD comminution circuit data has been incorporated into a mill model, which has been used to predict the milling capacity of the Youga plant for the future ores. This has shown that the Youga milling circuit has the capacity to treat the future Ouaré ores as specified in the mine production schedule.
- Satellite deposit samples show generally lower or equal numbers for hardness tests which confirm that for these ores tested, there should be no bottlenecks in achieving the required mill throughputs.

25.2.2 Balogo Property

- Netiana samples contain significant levels of tellurium (average of 30 g/t) and sulphur (average of 1.75% S) compared with <1 g/t and 0.23% S for the Youga ore samples respectively. Gold leaching extractions from telluride and sulphide minerals can be relatively low, depending on the gold occurrence within the minerals. However, the measured gold leach extractions for the 12 samples tested averaged ~89% after 24 hours and 91% after 48 hours respectively. Extractions from the five samples of above 4 g/t were 94%, and this level has been used for the production schedule and economic analysis.

- Seven of the 12 samples tested had higher copper head grades (average of 0.16% Cu), which resulted in greater than 100 ppm of copper in the leached solutions and higher cyanide consumption (2.7 kg/t) after 24 hours leaching. The five remaining samples (average head grade of 0.04% Cu) consumed marginally less cyanide (1.8 kg/t) for the same leach time. Overall consumption tested to be considerably higher than that for the Youga samples and actual ore treated in 2016.

25.3 Geology and Mineral Resources

CSA Global considers that data collection techniques are consistent with industry good practice and suitable for use in the preparation of an MRE to be reported in accordance with NI 43-101. QC data supports the integrity of the analytical data which has been utilised.

25.3.1 Youga and Ouaré Properties

- During February 2017, Mineral Resources were estimated for 10 deposits at Youga – Main Pit, Zergoré, NTV, A2NE, East Pit, West Pit 1, West Pit 2, West Pit 3, West Pit 4, Leduc – and one deposit at Ouaré (Ouaré). West Pit 2 and 3 represent a contiguous zone of mineralisation and were estimated together into a single block model. Since the February 2017 MREs, infill and extension drilling have made it possible to better define the A2NE mineralisation trends. As a result, A2NE has been re-interpreted, extended and subdivided into three areas for the December 2017 MRE update. These are A2N East, A2N Middle and Gassore.
- Within the Youga deposit, there are two distinct styles of mineralisation; the moderately to weakly silicified arkose with quartz stockwork veining and pyrite is the predominant sulphide which generally grades between 0.5 g/t and 2 g/t and the intensely silicified arkose with abundant quartz veins and more diverse sulphides which generally grades >3 g/t. At Ouaré, gold mineralisation is associated with shear zones at the contacts between felsic and mafic volcanics.
- A 3D block model representing the mineralisation and oxidation was created by CSA Global and Avesoro geologists using Micromine™, Leapfrog and Datamine Studio RM software. High-quality RC, DD and in some cases trench samples were used to estimate grades into blocks using OK. The block model was validated visually and statistically. Grade control data, where it exists, was excluded from the estimation dataset except for West Pit 1, which has very little exploration data below the existing pit surface.
- The total drilling used for the MRE update was 3,320 holes and trenches for 145,635 m. The previous owners, Endeavour, filed a Technical Report in 2015 which documented that 1,808 drillholes for 190,672 m were used in that MRE. West Pit 4 is reported for the first time here as a Mineral Resource.
- 52,179 samples were flagged within the mineralised volume and composited downhole into 1 m lengths. The resultant 42,985 composite samples were used in the estimate. Composite length was dependent on dominant sampling length and proportion of lengths greater than the dominant sampling length. One metre was chosen for most deposits, with 2 m chosen for Main Pit, West Pit 1 and Ouaré.
- Additional in-situ dry BD analysis is required. The only density data available for review by CSA Global was for Main Pit, A2N East, A2N Middle, Gassore, West Pit 4 and Ouaré. The BD values applied to the Youga project MREs were informed by review of the Youga technical reports (AMEC, 2013a and 2013b; Endeavour, 2015), inspection of DD core photos, communication with site and considering Main Pit, A2N East, A2N Middle, Gassore and West Pit 4 density review results. The values used for non-fresh material have been informed by experience of other deposits in the region, given that samples measured in these materials are generally competent and tend to be overstated in the density measurements provided.

- Hard boundaries were used between mineralisation and waste zones, and between different mineralisation domains. Following contact analysis, oxidation boundaries were soft. Variograms were modelled for larger domains using the composites, with outliers top-cut or excluded to prevent biasing the resultant model.
- Grade was estimated into parent blocks using OK, controlled by dynamic anisotropy.
- Grade estimates were validated against drill data. There is good correlation between the input composites and output model for the estimated Au grade. Generally, the model grade trends follow the pattern of the drill samples grades, with reasonable levels of smoothing of the higher and lower grades.
- The Youga and Ouaré MRE satisfies the requirements for Measured, Indicated and Inferred Mineral Resource categories as embodied in the NI 43-101 Canadian National Instrument for the reporting of Mineral Resources and Reserves.
- The MRE indicates reasonable prospects for economic extraction, as supported by the generation of a constraining pit shell using NPVS using a gold price of US$1,500 and a cut-off of 0.55 g/t Au.
- At a comparable 0.5 g/t Au cut-off, changes in the total Measured and Indicated Mineral Resources are a decrease of 875 kt, a 5% decrease in tonnage. Mining has occurred in various pits since the 2015 Technical Report, resulting in the decrease in Measured and Indicated in these areas. No Measured Mineral Resource material was classified in the 2017 MRE.
- Global Measured and Indicated Au grade decreased from 1.48 g/t to 1.37 g/t Au (-7%). This is likely attributed to higher grades closer to surface that have been depleted since the last MRE.
- Inferred Mineral Resources have substantially increased (threefold) by 508 kt due to a combination of reasons – resource shells have changed, and a maiden Mineral Resource for West Pit 4 has been reported in 2017 and remodelling of the mineralisation volumes.

25.3.2 Balogo Property

- A twinning program and QAQC review completed by NMC resulted in the exclusion of eight drillholes global (seven RC, and one DD) from use in the MRE. A comparison of RC vs. DD data completed by CSA Global concluded that a combined drill type dataset was suitable for use in the estimation of Mineral Resources.
- Data verification included spot checks on four drillhole collars during a site visit, verification of core, review of core photos for several drillholes and review of core recovery. These checks support the use of the data for Mineral Resource and Mineral Reserve work.
- A 3D block model representing the mineralisation has been created by CSA Global, in collaboration with NMC geologists, using Datamine™ software. High-quality RC and DD samples were used to estimate grades into blocks using OK. The block model was validated visually and statistically.
- The total drilling available for the geological model and MRE update was 352 holes and trenches for 49,123 m.
- 2,981 samples in 12 domains were flagged within the mineralised volume and composited downhole to 1 m lengths. The resultant 3,004 composite samples were used in the estimate.
- A review of 798 in-situ dry BD measurements in mineralisation resulted in a BD of 2.86 t/m^3 being assigned to fresh material, which aligns with the mineralisation hosted in diorite. A review of core photos indicated that the BD for oxide and transitional material based on measurements was likely to be too high, since competent pieces of core (often quartz vein) were used for the measurements, but these are not considered representative of the mixed nature of these zones. Geological logging of intensity of weathering was used to derive a length weighted average for oxide and transitional. Highly weathered material was assigned 2.00 t/m^3; 2.14 t/m^3 for oxide and 2.35 t/m^3 for transitional.

- Following contact analysis, a decision was made to use hard boundaries between mineralisation domains and soft boundaries across weathering zones for all geostatistical analysis and estimation. A variogram was modelled for the largest domains in Netiana and Netiana SE for Au using 1 m top-cut composites, with outliers excluded where appropriate.
- Grade was estimated into parent blocks of 5 m x 5 m x 5 m (X x Y x Z) using OK, controlled by dynamic anisotropy.
- Grade estimates were validated against drill data. There is good correlation between the input composites and output model for the estimated Au grade. Generally, the model grade trends follow the pattern of the drill samples grades, with acceptable levels of smoothing of the higher and lower grades.
- The Netiana MRE satisfies the requirements for Indicated and Inferred Mineral Resource categories as embodied in the NI 43-101 Canadian National Instrument for the reporting of Mineral Resources and Reserve.
- The MRE indicates reasonable prospects for economic extraction, supported by a resource shell produced in NPVS using a US$1,500 Au price and basic assumptions regarding costs

25.4 Mineral Reserves

Mineral Reserves are classified as Proved based on a resource classification of Measured Mineral Resources, and Probable based on a resource classification of Indicated Mineral Resources. Inferred Mineral Resources and Unclassified Mineral Resources have been excluded from the conversion of Resources to Reserves. The Qualified Persons are of the opinion that potential modifying factors have been adequately accounted for using the assumptions in this report, and therefore the Mineral Resources within the mine plan can be converted to Mineral Reserves. Factors that may affect the assumptions in this report are:

25.4.1 Youga and Ouaré Properties

- Changes in Process cost, Mining cost or slope angle (±2°) generally have a relatively small impact (<5%) on the estimate of contained metal and confirm that the pit limits are not as sensitive to these parameters as they are to price.
- Effective surface and groundwater management is important to the safety and productivity of the mining operation. Although this is only really an issue during the rainy season, if the currently planned water management methods prove to be inadequate, additional sumps and pump systems may be required.
- Transport of ore between the Ouaré property and the process plant at Youga is a key part of the plan and relies on the efficient planning of the transport route, good road maintenance and proactive management of community relations.

25.4.2 Balogo Property

- Commodity price and exchange rate assumptions are important factors that affect revenue and costs. It has been shown that Price is a significant driver to the project economics and that a 10% change in price could result in at least a 10% change in the Reserve.
- The mine plan has been limited by an assumed annual mill throughput of 1.2 Mt/a. However, mill throughput may prove to be higher or lower than this depending on the ore type. This is particularly relevant to the new deposits such as Netiana and Ouaré where there is limited metallurgical tests.
- If certain rock types or delivered blends of rock types have lower throughputs than currently modelled, this would increase the processing cost, which would in turn increase the mill cut-off grade. If all other things held constant, this would tend to reduce the tonnage of the Mineral Reserve and

the amount of contained metal. If throughput reductions are significant, this could reduce the size of the economic pit limits, further reducing the Mineral Reserve. Furthermore, a reduction in throughput would delay cash flow, resulting in a negative impact on Project economics.

- Effective surface and groundwater management is important to the safety and productivity of the mining operation. Although this is only really an issue during the rainy season, if the currently planned water management methods prove to be inadequate, additional sumps and pump systems may be required. This would add to the capital and operating costs, resulting in a negative impact on Project economics and a potential reduction in the Mineral Reserves.
- Transport of ore between Netiana and the process plant at Youga is a key part of the plan and relies on the efficient planning of the transport route, good road maintenance and proactive management of community relations. The 154 km route passes through many villages and there is a high risk of road traffic accidents. Major public unrest because of injury or fatality could easily disrupt the transport of ore to Youga.

25.5 Mining Methods

The proposed method of mining for Youga, Ouaré and Balogo is a conventional open pit method using drilling and blasting, loading with hydraulic excavators, and hauling with articulated dump trucks. Consideration of underground mining has not been necessary at this stage of the Project.

25.5.1 Youga and Ouaré Properties

- The optimal production rate is constrained by the capacity limit of the ore transport fleet and the capacity of the plant at Youga.
- The cut-off grade applied to each pit depends mainly on the location and transport cost, other costs (Processing, G&A etc.) were constant across all deposits.
- It was noted that a 10% change in process or mining cost, or a 2° change in the OSA, all have a similar impact on the contained metal and it was therefore concluded that the Ore Reserve was not particularly sensitive to these parameters.
- Price is the main driver for most of the deposits and a 10% change in price resulted in a 13% change in contained metal. This is consistent with the charts of cumulative contained metal vs. price where there is a near-linear relationship for most deposits which supports the notion of selecting the pit at a Price Factor of 1.0.
- The cut-off grade for the majority of the deposits could be set to 0.7 g/t Au, the exception being Ouaré where the cut-off was set to 0.82 g/t Au due to the additional cost of transporting the ore to the ROM pad.
- No proper quantification of the rock mass properties could be found in the documentation provided and therefore, it must be concluded that the limited data that could be studied comprises the bulk of the knowledge at this time. The methodology that was followed to quantify the slope design parameters could not be established and therefore it must be concluded that the reliability of this design is limited.
- Production from Balogo has a significant impact on the overall feed grade to the plant due to the high grade of the starter pit.
- On completion of Balogo equipment will be transferred from Balogo to Ouaré.

25.5.2 Balogo Property

- Mining of the starter pit commences in May 2017 at a rate of 400 t/h and mining of the second pushback commences in August 2017. The mining rate has gradually been increased to 800 t/h, but this is regarded as a maximum given the limited access and the constraints on vertical advance rate. The Final Pit is mined out over the next 30 months.

- The evaluation of Netiana assumes that the ore will be transported to the processing facility at Youga. The optimal production rate is therefore constrained by the capacity limit of the transport fleet and the capacity of the plant at Youga.
- Consideration has been given to the maximum vertical advance rate as the pit limit at surface is relatively small in area and the pit extends to a depth of > 100 m below topographic surface.
- A significant factor in determining the cut-off grade is the inclusion of the transportation cost between Balogo and Youga. This has been estimated at US$13.87/t hauled, for a haul distance of approximately 154 km. This means that the cut-off grade for Netiana (1.1 g/t) is significantly higher than that seen at Youga, where the cut-off grade averages 0.7 g/t Au.
- A consequence of the raised cut-off grade for Netiana, is that the material that is normally classified as Low-Low Grade (LLG) is stockpiled as a potential ore source in the future. The LLG material is not included in the Ore Reserve as it is uneconomic at this time. Similarly, Marginal material (grade range between 0.5 g/t Au and 0.7 g/t Au) is also stockpiled separately at Netiana.
- By segregating the ROM material into several stockpiles, it is possible to prioritise higher-grade material in the early periods. It also provides the opportunity to blend the feed to the Youga plant to control the mix of ore from Netiana and other deposits.
- The geotechnical parameters used to describe the competency of the rocks are of international standard and are believed to be sufficiently comprehensive for the purposes of reporting the Ore Reserves.

25.6 Recovery Methods

Preliminary circuit simulations with a simple mill model (calibrated to actual mill performance results) show that the Ouaré material should on average be able to be processed at the required average throughput (148 t/h) at the required grind size P_{80} of 75 microns to achieve the predicted recoveries for Ouaré ores. A range of 89% to 91% is predicted, subject to consistently achieving the required grind size (80% passing 75 microns).

The current mine plan projects the material from Netiana to be processed in 2017 and 2018 at the proportion of 10% and 16% respectively of the proposed mill annual throughput. The 2012 test program, which measured the Bond Ball Mill index for the Netiana samples tested, are significantly lower than those currently being treated from the existing Youga ores. The new ore types should proceed through the existing Youga comminution circuit at a generally finer grind than currently being achieved, and at higher throughput rates. The extractions projected for the higher-grade material are expected to be ~94%.

25.7 Project Infrastructure

25.7.1 Balogo Property

Since the Balogo property is well advanced, the estimate of mine infrastructure is essentially unchanged from that of the FS published in March 2016.

- The ore from Netiana will be transported back to the processing plant at Youga. It is assumed that this fleet of trucks will be based at Youga and will utilise the facilities, including the workshops, at Youga. There should be no need to include additional facilities at Netiana.
- As all the processing and refining of the ore is done at Youga there will be no requirement for these facilities at Netiana.
- Other administrative functions, including HSE, will be sourced from Youga and there will be minimal need to accommodate additional staff at Netiana except for routine visits of inspection.

25.8 Environmental Studies, Permitting and Social or Community Impact

There has been a considerable amount of environmental and social work undertaken on the Youga and Balogo projects and EIA reports are of reasonable content and quality. Baseline data collection has been detailed and comprehensive and impact assessment and mitigations appropriate. While not to Standard Operating Procedure detail, the ESMPs are at an adequate level for implementation.

- The Youga operation received environmental permitting and an exploitation mining licence and has been active for over 10 years. While this review cannot comment on operational environmental and social performance, the current condition and status of the Youga site; apparent lack of environmental penalties or social conflict; and proposed continuation of activities imply that there have not been any significant non-compliance or grievance issues.
- However, ongoing community complaints about compensation and water resources suggest that there is room for improvements on some issues, and the current operation can address these with increased SE, community consultation and demonstrated transparency.
- Inclusion of the Ouaré deposit in the Youga project has a good (if now five years old) scoping baseline data resource and a recently complete ESIA study and can learn from experiences at Youga.

For the Balogo property, both the ESIA and RAP have apparently been approved and an Environmental Permit has been granted. However, CSA Global raises the following concerns:

- CSA Global believe that there is some additional work required to properly assess and address the geochemical, artisanal mining and in-migration risks.
- CSA Global believe that the indicated monitoring frequency is believed to be insufficient, especially for surface and groundwater quality and quantity; ecology and biodiversity; and social monitoring. The overall budget for the implementation of the ESMP for the Project is also believed to be underestimated, given the experience from Youga.
- CSA Global believe that additional social considerations should take the total closure costs closer to US$2 million. A financial guarantee for the RCP is to be paid by instalment over the Project lifetime (four years), but the total amount must be paid at least one year before the end of the Project.

25.9 Economic Analysis

The base case (US$1,300 gold price) results were tested for sensitivities to:

- Gold price fluctuations in the range from US$1,100/oz to US$1,450/oz and mining cost variation from base case to an increase of 20% from the base case
- Gold price fluctuations in the range from US$1,100/oz to US$1,450/oz and processing recoveries change from -4% to +2% from the current base case.

Due to lower grades, the projects show high sensitivity to gold price and cost and recovery variations in stress scenarios:

- NPV at 5% discount rate with project mining costs 20% higher than the base case and gold price at US$1,100/oz is at US$67.6 million for Youga/Ouaré and Netiana projects
- NPV at 5% discount rate with processing recoveries for Youga/Ouaré and Netiana ores at 4% lower than the base case and gold price at US$1,100/oz is at US$72.4 million.

For Youga/Ouaré and Netiana projects, the following pre-tax economic indicators were calculated:

- Net cash flow before tax of US$225.5 million
- Pre-tax NPV at 5% discount rate of US$188.3 million
- After tax NPV at 5% discount rate of US$151.6 million.

25.10 Hydrology

25.10.1 Youga Property

Based on the information provided for review, there appears to be a good understanding of most operational water management issues at the mine site. However, additional assessments and site-specific investigations would improve future operational water management including:

- Long term prediction of dewatering and depressurisation requirements
- Long term water supply security
- Optimisation of overall site water management
- Assessment of potential impacts from mine water management on the environment.

Additional observations include:

- Uncertainty also remains as to whether there is an understanding of the hydrogeological regime at the site. It is reported that a preliminary assessment of dewatering requirements was completed as part of the FS.
- Surface water management issues have been identified at several of the open pits, including aspects such as the erosion of the pit crest and enhanced pit inflows resulting in pit wall instability. A water course has also been identified as being present beneath the main waste dump.
- Although hydrological assessments have been completed for the Youga gold mine, there appears to be limited site specific meteorological data and limited quantitative surface water flow monitoring data available for the site. Thus, there remains some uncertainty as to whether surface water management strategies are appropriately designed for conditions at the site. An overall surface water management plan for the Youga mine site has not been sighted.
- No issues regarding pit dewatering have been reported.
- It is reported that depressurisation was identified as a potential requirement to ensure pit wall stability, although there is uncertainty whether depressurisation strategies have been developed for the site. Pit wall stability issues have been identified in a number of the open pits.
- In site visit reports, pit instabilities related to groundwater and surface water ingress have been highlighted. While we understand that corrective actions were implemented, no follow up was provided in the available documentation regarding the success or failure of these mitigation measures. In addition, the consequences of pit flooding following the decommissioning of the mine do not appear to have been assessed from a hydrogeological perspective.
- Water supply for the Youga mine site is reported to be provided by a number of sources, including TSF return, the Nakambé River, pit dewatering and boreholes. A water tower currently exists at the Nakambé River and there is also an on-site water treatment facility. A water balance for the site has not been sighted. However, no water supply issues were reported in the documentation available for review.
- An EIS, EMP and Water Management System have been completed for the Youga mine site. While no issues with respect to the impact of water management at the site on the surrounding environment have been reported, a risk of potential impact on the environment (from the mine operation) remains due to the uncertainties regarding the hydrological and hydrogeological understanding at the site.
- The Youga site has an existing water monitoring network, including both upstream and downstream groundwater and surface water monitoring locations. The EMP which is in place details compliance criteria, sampling and reporting procedures and corrective actions required to achieve water quality objectives.
- While a monitoring network is in place, additional work is recommended to collate spatial data from the monitoring points outlined in the EIA and the on-site boreholes described in the technical site

visit reports. The current hydrogeological interpretation lacks specific information on the location of test boreholes and the hydraulic testing method used. No information has been provided regarding groundwater flow direction at the site.

25.10.2 Ouaré Property

Extremely limited hydrological and hydrogeological assessments were completed for the FS for the Ouaré project, and whilst additional information has been gathered during the recent ESIA study, some uncertainty remains with respect to water management for the project. Additional site-specific assessments are recommended in order to ensure that the water management aspects of the project are fully understood, and appropriate surface water and groundwater management strategies are developed and costed. Observations include the following:

- The proposed infrastructure for the Ouaré mine includes three open pits, a waste rock stockpile, an ore stockpile and related administration facilities. It is proposed that there will be no processing plant at Ouaré and that the ore extracted from Ouaré will be transported to the Youga mine for processing.
- The assessment of the hydrology and hydrogeology for the Ouaré project area, completed as part of the FS, is extremely limited. A site specific hydrological and hydrogeological field investigation does not appear to have been completed for the Ouaré project, except for limited water quality sampling. Significant uncertainty remains regarding the hydrological and hydrogeological understanding of the Ouaré project area due to the lack of site specific data.
- An assessment of design rainfall events, design flood events, derivation of peak flow rates and peak flood heights is not included in the FS and a surface water management plan for the Ouaré project is not included in the FS.
- An assessment of potential pit inflows (derived from both rainfall runoff/surface water and groundwater) is not included in the FS and a dewatering strategy for the proposed open pits is not included in the FS.
- The water demands for the Ouaré project are not detailed in the FS. It is likely that there will be a water demand associated with dust suppression and for the administration and mine camp. Water supply options for the project are not detailed in the FS. A water balance for the Ouaré mine has not been provided for review.
- The potential impact of mine water management on the water environment is not included in the FS. Potential impacts may include:
    - Local groundwater table drawdown as a result of pit dewatering/depressurisation
    - Impact on surface water bodies from site discharges (water quality and flow regime)
    - Reduction of surface water flows due to surface water interception/harvesting
    - Pit void remaining at mine closure.
- A water monitoring program for the Ouaré project has not been provided.
- Capital and operating costs for the Ouaré mine have been developed. However, the costs are not presented in sufficient detail to determine whether they include an adequate provision for water management for the project.

25.10.3 Balogo Property

Whilst hydrological and hydrogeological assessments have been completed for the FS, significant uncertainty remains with respect to water management for the Balogo project. Additional site-specific assessments are recommended to ensure that the water management aspects of the project are fully understood, and appropriate surface water and groundwater management strategies are developed and costed.

Additional observations include:

- The assessment of the hydrology and hydrogeology for the Balogo project area, completed as part of the FS, appears to be based solely on literature values. A site-specific hydrological and hydrogeological field investigation does not appear to have been completed for the Balogo project. Significant uncertainty remains regarding the hydrological and hydrogeological understanding of the Balogo project area due to the lack of site specific data.
- An assessment of design rainfall events, design flood events, derivation of peak flow rates and peak flood heights is not included in the MNG (2016) FS and a surface water management plan for the Balogo project is not included in the FS.
- An assessment of potential pit inflows (derived from both rainfall runoff/surface water and groundwater) is not included in MNG (2016) and a dewatering strategy for the proposed open pit is not included in the FS.
- The water demands for the Balogo project are not detailed in the FS, although it is identified that water for dust suppression will be required. In addition, it is likely that there will be a water demand associated with the administration and mine camp. The camp is proposed to accommodate a total of 40 mine staff and 10 engineers. Water supply options for the project are not detailed in MNG (2016). A water balance for the Netiana mine has not been provided for review.
- The potential impact of mine water management on the water environment is not included in the FS. Potential impacts may include:
    - Local groundwater table drawdown because of pit dewatering and depressurisation
    - Impact on surface water bodies from site discharges (water quality and flow regime)
    - Reduction of surface water flows due to surface water interception/harvesting
    - Pit void remaining at mine closure.
- Capital and operating costs for the Netiana mine have been developed. However, the costs are not presented in sufficient detail to determine whether they include an adequate provision for water management for the project.
- A water monitoring program for the Balogo project has been proposed, although uncertainty remains as to whether water monitoring is being completed in accordance with the proposed program. The proposed monitoring program does not include on-site boreholes or targeted surface water monitoring (i.e. upstream and downstream of on-site activities).

25.11 Project Risks

Table 25-1 lists the risk categories used and the project risks have been summarised in Table 25-2 and are categorised from insignificant to fatal flaw. No fatal flaws were observed, with the majority of risks noted being either low or moderate with potential upside or opportunity also noted in many categories.

Table 25-1: Risk categories used

Risk category	Definition
(red)	Fatal Flaw (significant material risk to metal)
(orange)	Moderate (metal may be at risk)
(yellow)	Low (unlikely to have material effect on metal)
(green)	Insignificant (errors detected, but immaterial)
(blue)	Potential upside or opportunity

Table 25-2: Risk table for Youga, Ouaré and Balogo (coloured by risk category)

Project	Youga	Ouaré	Balogo
Data management system	Opportunity to improve on Microsoft Excel and passport-based data capture and storage, with a move towards more secure relational database structure to improve integrity and more efficiencies in data management, storage and security.	Opportunity to improve on Microsoft Excel and passport-based data capture and storage, with a move towards more secure relational database structure to improve integrity and more efficiencies in data management, storage and security.	Opportunity to improve on Microsoft Excel and passport-based data capture and storage, with a move towards more secure relational database structure to improve integrity and more efficiencies in data management, storage and security.
Geology	No digital geology data provided.	No digital geology data provided.	No digital geology data provided.
QAQC	No preparation blanks used therefore no control on cross-contamination. Bias noted in A2NE field duplicates which could indicate non-representative sampling. Multiple instances of apparent misidentification of CRMs.	No preparation blanks used therefore no control on cross-contamination.	Past QAQC failures has led to the exclusion of eight drillholes from the MRE database. No preparation blanks used therefore no control on cross-contamination. Acceptable precision.
Artisanal workings		Significant artisanal activity has been documented but no pits have been surveyed. Surface metal may be at risk.	No survey data for artisanal workings. Surface metal may be at risk.
Nature of gold mineralisation	High degree of complexity of gold mineralisation and variability exists at Zergoré	Grade variability is high both in terms of intra and inter-composite variability and so Indicated category is as high as is likely to be achieved here, and even that may be open to question in places.	Visible Au and extremely high-grade Au mineralisation may be discontinuous. Close spaced grade control required
Dry in-situ BD	Measured in-situ BD not available for most deposits at Youga.	Oxide and transitional density is not based on actual measured values, due to likely oversampling of competent material in core. This leads to uncertainty in the density values used for approx. 30% of the mineralisation, but based on CSA Global's experience, these values are unlikely to be too high.	Oxide and transitional density is not based on actual measured values, due to likely oversampling of competent material in core. This leads to uncertainty in the density values used for approx. 30% of the mineralisation, but based on CSA Global's experience, these values are unlikely to be too high.
Topography			Topography based on drillhole collars. Has had to be expanded for mine planning work. May place some oxide mineralisation at risk.
Haul road ESIA		No baseline data collection, impact assessment or stakeholder engagement along the proposed haul road from Ouaré to Youga.	
Geochemistry	Geochemical testing of ore material and tailings from Youga, Balogo and Ouaré required to identify any potential metal leaching impacts from Youga TSF.	Geochemical testing of representative waste rock material required to avoid unforeseen metal leaching from WRD.	Geochemical testing of representative waste rock material required to avoid unforeseen metal leaching from WRD.
Water supply source	Mine water supply requirements and source needed and potential impacts on other users identified.	Mine water supply requirements and source needed and potential impacts on other users identified.	Balogo mine water requirements not calculated. Water supply source and potential impacts to other users not identified.

Project	Youga	Ouaré	Balogo
Artisanal mining	Potential conflicts and environmental damage from artisanal mining. Requires assessment of impacts on- and from- artisanal mining and dialogue.	Assessment of impacts on- and from- artisanal mining required with dialogue to reduce environmental impacts and potential conflicts.	Potential conflicts and environmental damage from artisanal mining. Requires assessment of impacts on- and from- artisanal mining and dialogue.
Compensation	Potential for conflict over unresolved compensation grievances. Need to strengthen and disclose formal and transparent compensation procedure and grievance mechanism.	Potential for conflict over compensation grievances. Need to develop and disclose formal and transparent compensation procedure and grievance mechanism.	Potential for conflict over compensation grievances. Need to develop and disclose formal and transparent compensation procedure and grievance mechanism.
Closure	Opportunity to provide infrastructure, improved land-use conditions, regenerated forest resources and water supplies to communities' post closure. Positive legacy.	Opportunity to provide infrastructure, improved land-use conditions, regenerated forest resources and water supplies to communities' post closure. Positive legacy.	Opportunity for providing infrastructure, improved land-use conditions, regenerated forest resources and water supplies to communities, post closure. Positive legacy.
Mining recovery and dilution	The historical information on the modifying factors for Youga is not entirely relevant as previously the Mining Contractor used much larger equipment. The style of mineralisation also varies considerably between deposits and factors should be developed by simulation for each deposit rather than use global factors.		The modifying factors for mining recovery and dilution need to be regularly checked, particularly once mining starts in Ouaré. The current estimates are based on experience at Youga.
Slope stability	Although there has been extensive mining of the deposits at Youga over the last nine years with no evidence of major slope failures the development of these deposits in depth raises the risk of slope failure. Stability analysis should be undertaken.		The geotechnical assessment in the Golden Rim FS and the subsequent 2016 Stability Analysis by the Dokuz University provide recommendations on slope angles. These did not to take into account the hydrogeological conditions and need to be extended to allow for the possibility of depressurisation of the walls.
Metallurgical recovery	Samples tested are not necessarily representative of the actual ores, but recovery to date has been in line with predicted rates. Future testwork of new ore types could assist with mitigation of risk.	Samples tested are not necessarily representative of the actual ores, but recovery to date has been in line with predicted rates. Future testwork of new ore types could assist with mitigation of risk.	The characteristics of the ore at Netiana are different to Youga, principally in the lack of free gold and the presence of tellurides. Testwork on core samples indicates there should not be a problem provide the blend is controlled. Without bulk tests, there is a risk that the recovery rate or cyanide consumption rate will be higher than expected for Netiana.
Ore transport	The transport route between the various deposits at Youga has crossing points with the national highways. These are being manned to control traffic flow but there is always a risk to the public where there is interaction with mine traffic.	The 44 km route between Ouaré and Youga should be designed to avoid passing close to settlements. There will however be a residual risk of traffic accidents when crossing the national highway or other routes used by the public.	The 154 km route between Balogo and Youga passes through many villages. There is a high risk of injury or fatality to the public from fast moving traffic. There is also the potential issue of disturbance if hauling is a 24 hour operation.

26 Recommendations

26.1 Mineral Processing and Metallurgical Testing

A finer primary grind significantly improves the leach performance, and CSA Global recommends that the 75-micron grind should be the target grind for the leach circuit.

26.2 Geology and Mineral Resources

CSA Global recommends the following actions are completed prior to completing MRE updates in the future and to assist with current and future operations:

26.2.1 Data Management and QAQC

- An industry standard SQL database solution is recommended to host the data. Currently, Microsoft Excel sheets are used which are inadequate to securely host the project data and carry risks in terms of data security, verification and document control. CSA Global can advise if required.
- QAQC data should be continually collected and assessed during drilling, so that issues can be addressed as they arise. QAQC recommendations are as follows:
  - Preparation blanks should be included to monitor potential contamination.
  - A high-grade gold CRM should be included with the samples to monitor samples >2.0 ppm Au.
  - Ongoing vigilance is required to reduce CRM and blank misidentification.
  - The Youga field duplicates should be biased towards mineralised samples (i.e. try to select samples with mineralisation, not waste samples).
  - Laboratory QC results should be routinely reviewed and captured in the database.
  - External check samples (umpires) should be sent to an accredited laboratory. CRMs must be included with these samples.
  - Investigation of the poor precision and bias noted in the field duplicate samples to determine whether sampling issues (sample size or non-representative sampling) are factors.

26.2.2 Youga and Ouaré Properties

- A sound geological and structural model should form the basis of any future MRE, so that faulting and other mineralisation controls are integrated in the model.
- Additional dry BD should be collected routinely during grade control and/or mine production and reviewed to build up a useful BD database of values that can be used to improve the confidence of the tonnage factors for the MRE. The methodology and measurements should be verified and standardised.
- The current level of understanding of the Au distribution and geological controls are sufficient for mine planning purposes. CSA Global recommends that instead of additional infill drilling to upgrade Indicated Mineral Resources to Measured Mineral Resources, grade control drilling should be sufficient to delineated blast and dig lines during open cast mining.
- The resource is open down dip. CSA Global recommends additional drilling for resource delineation with depth to allow Inferred Mineral Resources to be considered for an Indicated Mineral Resources classification level. A drill spacing of about 25 mZ (down dip) is recommended to allow the classification of Inferred Mineral Resources.

26.2.3 Balogo Property

- Create a geological model to support and constrain the mineralisation model, to ensure that continuity and grade variability are well understood by correctly interpreting the structural and geological controls on high grades.
- Conduct a grade control program and estimate a grade control model to assist with short-term planning.
- Create a set of procedures that allow for accurate end of month reconciliation and compare this with the long-term model.
- Additional BD data should be collected in oxide and transitional material during open pit production and reviewed regularly to build up a useful BD database of values that can be used to determine the tonnage factors for the Netiana deposit. Methodology and measurements should be verified and standardised in the resource model.
- The current level of understanding of the Au distribution and geological controls are sufficient for mine planning purposes. CSA Global recommends that instead of additional infill drilling to upgrade Indicated Mineral Resources to Measured Mineral Resources, grade control drilling should be sufficient to delineated blast and dig lines during open cast mining.

26.3 Mineral Reserves

The mill throughput process is dependent on the ore type. This is particularly relevant to the new deposits such as Netiana and Ouaré, as bulk metallurgical tests have not been carried out yet. It is recommended that bulk metallurgical tests are undertaken on the various ore types.

26.4 Mining Methods

CSA Global recommends the following:

- To improve the reliability of the mine design criteria, additional geotechnical parameters will have to be collated from exploration drilling and face mapping. These parameters must then be used in a logical methodology to establish stable slope angles.
- CSA Global consider the pit design parameters a reasonable assumption at this stage. However, these parameters should be reviewed prior to mining.
- Considerable care needs to be taken with the blasting to minimise movement and as a consequence the blast design assumes choke blasting with a relatively low powder factor of 0.29 kg/m^3.
- No more than three active pits should be operational at any one time in a mining area. This is a function of the available equipment and limits on logistics of running multiple pits.
- If possible, a deposit should be mined out before moving to the next one. This allows the pit to be closed and rehabilitation to proceed as the project continues.

26.5 Environmental Studies, Permitting and Social or Community Impact

There are some gaps and deficiencies in investigations, impact assessments and mitigation and management measures, which are highlighted below. The most significant gap is the apparent lack of environmental and social work on the haul routes from Ouaré to Youga. This requires urgent work to describe ambient conditions, identify potential impacts and engage with affected communities – together with completion of the Ouaré ESIA – to develop suitable ESMPs prior to start-up of haulage.

Required work to address gaps in the Project environmental and social work includes:

- Establish site meteorological stations at Youga, Ouaré and Balogo (as required)
- Install permanent flow gauges at Project streams and depth rods at ponds/dams

- Implement and publicise a formal grievance mechanism for Youga, Ouaré and Balogo
- Undertake geochemical testing, including metal leaching tests on ore material and tailings from Youga; representative ore material from Balogo; and from Ouaré as required
- Define and implement ecological and social monitoring at Youga
- Undertake follow-on study on the haul route from Ouaré to Youga, including baseline data collection, stakeholder consultation, impact assessment and mitigations
- Undertake more detailed faunal biodiversity studies at Youga to determine the most appropriate measures to avoid and/or offset for Project impacts.
- Develop and disclose an appropriate procedure for evaluating post start-up demands for compensation at Youga (for expanding Project area)
- Assess impacts on- and from- artisanal mining in the Youga, Ouaré and Balogo areas and establish dialogue to reduce environmental impacts and conflicts
- Calculate Netiana mine water requirements and identify supply source
- Evaluate potential social impacts from influx of people to the Balogo area and develop measures to alleviate these
- Increase frequency of surface and groundwater quality and quantity; ecology and biodiversity; and social monitoring at Balogo
- Develop measures for social interventions and community preparation for closure in the Balogo RCP.

26.6 Hydrology

26.6.1 Youga Property

Additional studies are recommended to improve the level of understanding relating to the hydrology and hydrogeology at Youga. This additional information would also increase the confidence with regards predictions for mine water management at Youga. More specifically; CSA Global recommends the following:

- Additional site investigations to improve the hydrological and hydrogeological understanding for the site, including:
  - Installation of an on-site rain gauge to record site specific rainfall data relating to both individual storm events and daily rainfall totals
  - Monitoring of flows in surface water features in the immediate project area
  - Mapping of the depth to bedrock across the project area to identify the depth of the weathered zone and position of the weathered rock/fresh rock contact (transition zone) which often represents a zone of enhanced permeability and preferential groundwater flow and is important in terms of managing pit inflows
  - A review of the hydrogeological monitoring infrastructure and collation of all available data relating to groundwater levels, well-head elevation, hydraulic testing and geochemical analysis. Once the data is organised, it may be necessary to carry out additional hydraulic testing.
- An integrated surface water management plan should be developed for the Youga mine site to optimise surface water management systems, minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.
- Operational groundwater management strategies for the entire Youga mine site should be reviewed and where possible integrated to optimise water use and management across the mine.

26.6.2 Ouaré and Balogo Properties

- Hydrological and hydrogeological site investigations should be completed to improve the hydrological and hydrogeological understanding for the site, including:
  - Installation of an on-site rain gauge to record site specific rainfall data relating to both individual storm events and daily rainfall totals.
  - Monitoring of flows and water quality associated with surface water features in the immediate project area.
  - Mapping of the depth to bedrock across the project area in order to identify the depth of the weathered zone and the position of the weathered rock/fresh rock contact (transition zone) which often represents a zone of enhanced permeability and preferential groundwater flow and is important in terms of managing pit inflows and as a target depth for potential water supply bores.
  - A site-specific hydrogeological field investigation program, including:
    - Installation of site-specific monitoring boreholes upstream and downstream of mine activity
    - Site-specific aquifer parameters for the various lithologies across the project site
    - Investigate the hydraulic connection between different units
    - Groundwater levels and groundwater flow direction
    - Groundwater quality.
- A water monitoring program should be developed at Ouaré and reviewed and Balogo in order to ensure that the program enables the water management issues for the entire site to be fully evaluated.
- An assessment of pit inflows and dewatering requirements should be completed, and an appropriate dewatering and depressurisation strategy developed.
- A surface water management plan should be developed for the proposed Ouaré mine site to minimise pit dewatering pumping requirements, enhance pit wall stability, maintain safe working conditions and minimise potential surface water related impacts on the environment.
- An assessment of potential water supply options and their long-term water supply security should be completed to ensure a sustainable water supply is available to meet local requirements for the life of the mine.
- An assessment of the potential impacts of mine water management on the environment should be completed.

26.7 Future Work Programs

The following sets out planned exploration and resource development work programs being planned by Avesoro, which CSA Global considers to be appropriate activity;

- The 2018 exploration and resource development budget focuses on four areas; Balogo, Youga, Ouaré and Zerboga/Songo.
- At Balogo, 29,000 metres of diamond drilling has been budgeted, to test 8 near mine targets. regional soil sampling has been planned to cover 360sq km of licence area to identify potential additional mineralised zones. Total budget for these works is set at US$3.4 million.
- At Ouaré , 65,000 metres of diamond drilling has been budgeted to infill drill parts of the existing Mineral Resources to potentially upgrade currently defined Inferred Mineral Resources to higher resource categories (higher confidence) and to potentially define additional Inferred Mineral Resources. An additional 20,000 metres of trenching is planned, to test 9 different targets which

exhibit gold-in-soil anomalism. Soil sampling is planned to test mineralisation targets identified from a review of structural framework. Total budget for these works is set at US$6.8 million.

- At Youga Project 30,000 metres of diamond drilling has been budgeted to test 9 targets where Gassore West target is the western continuation of Gassore East zone which has been signed off in this report. 21,000 metres of trenching has been planned to test 21 targets within Youga exploitation permit to generate new drill targets for 2019. Allocated budget is US$4.5 million.

- At Zerbogo/Songo Project 16,000 metres of diamond drilling has been budgeted to drill test 5 targets @ Zerbogo and 30,000 metres of trenching to test 11 targets @ Zerbogo and 18 targets @ Songo. Allocated budget is US$3 million.“

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