MILLENNIUM
MINERALS LIMITED

ASX Code: MOY

Corporate Details

Ordinary Shares:
791,747,847

Market Capitalisation:
~$185 million

Cash and bullion at 31 December 2017:
~$22.4 million

Debt:
NIL

ASX Code: MOY

Board of Directors

Greg Bittar
Non-Executive Chairman

Michael Chye
Non-Executive Director

Tim Kennedy
Non-Executive Director

Peter Lester
Non-Executive Director

Management

Peter Cash
Chief Executive Officer

Dean Will
Chief Operating Officer

Ray Parry
Chief Financial Officer and Company Secretary

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5 April, 2018

Sulphide Resource Expansion Feasibility Study Update

Key component of Feasibility Study confirms viable expansion pathway for Nullagine Gold Project based on extensive sulphide mineralisation

Selection of processing flowsheet moves Millennium closer to its strategic production target of +100,000ozpa

- **Processing Study on the extensive sulphide Mineral Resource at the Nullagine Gold Project demonstrates sustainable financial and operating benefits using the new processing method outlined in recent releases**
- **The installation of a gravity sulphide scavenging circuit on the CIL tails stream together with an ultrafine grind and intense cyanidation, delivers superior cash flows and increases in gold production to all other options considered**
- **Increased production augments baseline oxide gold production, where guidance for CY2018 is 75,000 – 80,000oz at AISC A$1,280 – A$1,350**
- **Direct capital cost of the expansion estimated to be A$15M with vendor quotes now received for all major components**
- **Incremental processing costs are estimated to be $3.60 per tonne in addition to the current CIL processing cost (currently $18.40 per tonne)**
- **Overall recoveries on a blended feed of oxide and sulphide ores to average 85%. This is based on metallurgical test work on sulphide mineralisation from the Golden Eagle deposit (>75%), combined with incremental recoveries expected to be realised from oxide ores (current recoveries running at >90%)**
- **Metallurgical test work is continuing to further optimise leach conditions which is expected to further improve forecast recoveries**
- **Millennium will commence procurement for long-lead process equipment during the June 2018 Quarter and target commissioning of the plant expansion during the first quarter of CY2019**
- **Finalisation of the Feasibility Study will pave the way for a major re-optimisation of the Nullagine Resource and Reserve inventory**
- **This is expected to provide the foundations for Millennium to achieve its strategy of +100,000ozpa of gold production with a minimum 5-year mine life**

Millennium Minerals Limited (**Millennium** or **the Company** – ASX: MOY) is pleased to announce that it has completed a key component of the Sulphide Resource Expansion Feasibility Study ("Study") for its 100%-owned Nullagine Gold Project in Western Australia, with the results indicating that the selected flowsheet design will deliver significant financial and operational benefits for the Company.

The strong findings are pivotal for Millennium to achieve its broader strategy of an annualised gold production target rate of 100,000oz for at least five years. Considering these results, Millennium will commence procurement activities for long-lead items for the plant expansion in line with its target of commissioning the upgrade in the March quarter of 2019.

The selected processing configuration (as outlined in the ASX release of 5 February 2018) is simple and has been selected due to the relatively low operating risk profile. It involves scavenging un-leached sulphide concentrates from the existing CIL tailings and subjecting them to ultra-fine grinding and intense cyanidation to achieve an improvement in the overall leach recovery. Details of the process flow sheet are shown in ***Figure 2 and Figure 3***.

This is a well understood processing configuration similar to that which has been successfully used for many years to process sulphide ore at the world-class Granny Smith mine in WA and the fine grinding of sulphide concentrates for improved leach recovery as used at KCGM's Super Pit operations in Kalgoorlie.

Millennium Chief Executive Peter Cash said the locking down of this key component of the Study has marked a major milestone in the Company's growth strategy.

"This is a game changer for Millennium for a number of reasons," Mr Cash said.

"The ability to process our extensive Sulphide Mineral Resource inventory (ASX Release 26/02/18) will help ensure we can achieve a targeted production level of ~100,000ozpa from December quarter 2018. Resource-to-reserve conversion later this year is expected to provide an uplift in our Reserve base, with our ongoing commitment to exploration expected to deliver further mine life increases to support a plus 5-year mine life.

"To be able to achieve this result with such attractive capital and operating costs is an outstanding outcome which paves the way for our next chapter of growth at Nullagine.

"It is also highly significant to our longer-term growth prospects because it means we can now pursue the immense exploration upside which exists for sulphide mineralisation at Nullagine, knowing that we have an economic processing route.

"We will undertake a re-optimisation of the Resource and Reserve inventory at Nullagine over the coming months, which we expect will cement our expansion plans as we move forward with the procurement of long-lead items."

ENDS

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Appendix 1 – MineScope Services Executive Summary-Sulphide Expansion Study

Ore Processing

The existing 1.5 Mtpa nameplate ore processing facility (currently operating at 1.9 Mtpa) and infrastructure consists principally of a primary crusher, SAG mill, gravity circuit and carbon-in-leach (CIL) tankage and is utilised for the processing of the existing free milling Ore Reserves. The current Mineral Resource Inventory at Nullagine Gold Operations includes significant quantities of Sulphide Resources. Processing of the Sulphide Resource inventory through the CIL plant alone does not deliver economic recoveries.

The Sulphide Resource Expansion Feasibility Study ("Study") was initiated to identify the most economic outcome for processing the Sulphide Resources.

The trade-off component of the Study has allowed the Company to select the optimal processing flowsheet. This involves the installation of a gravity sulphide scavenging circuit on the CIL tails stream, coupled with an ultrafine grind and intense cyanidation ("plant expansion"). This expansion pathway demonstrates that the average overall gold recovery for Golden Eagle sulphide ore can be increased from the existing CIL plant to an average 75%.

Metallurgical recoveries are based on extensive metallurgical tests and actual plant recovery reconciliation factors. Recovery ranges from 70% to 95% depending on the mineralogy of various Ore types within the Golden Eagle deposit.

Metallurgy

The Golden Eagle metallurgical test works had identified an overall average gold recovery of 50% if the existing CIL plant was used without modification.

The following reports were also used by MineScope Services for determining metallurgical amenability and reasonable prospects for eventual economic extraction with respect to the reported Mineral Resources if processed through the proposed plant expansion:

BUREAU VERITAS MINERALS PTY LTD (report ID - BV3754Refractory Ore Testwork Report - JN 3754 Testwork Report Jan 2015)

This report covered the whole of ore leaching and flotation performance of the selected fresh ore material. For this program, PQ diamond core was provided from six (6) drill holes across Stage 1 and Stage 2 of the Golden Eagle pit. The identified ore zones were all combined into a master composite totalling ~ 480kg. The table below is extracted from the report (Table 2.1). GEDDMET1-3 are from Stage 1 of Golden Eagle and GEDDMET4-6 are from Stage 2.

Description	Gross Sample Mass (kg)
MM LTD GEDDMET 01	113.25
MM LTD GEDDMET 02	42.05
MM LTD GEDDMET 03	57.50
MM LTD GEDDMET 04	31.30
MM LTD GEDDMET 05	138.15
MM LTD GEDDMET 06	101.25

Subsamples of this composite were subject to a series of whole of ore leach, gravity concentration, flotation, flotation concentrate leaching and flotation tails leaching to assist in determining potential processing routes and parameters.

From this data, it was found that a combination of gravity concentration, flotation and fine grinding and leach of the flotation concentrate and leaching of the flotation tail yielded an overall recovery of 63.2%. This result is presented in table 3.10 of the report, which is copied below:

Flotation Conc. Grind Size (P80, µm)	Gravity Recoverable (Amalgam)		Float Concentrate					Float Tail					Gold Recovery (G+L) (%)	Calc. Head Assay (Au, ppm)
	Au Grade (ppm)	Au Dist. (%)	Mass (%)	Leached		Un-Leached		Mass (%)	Leached		Un-Leached			
				Au Grade (ppm)	Au Dist. (%)	Au Grade (ppm)	Au Dist. (%)		Au Grade (ppm)	Au Dist. (%)	Au Grade (ppm)	Au Dist. (%)		
75	0.085	6.6	7.5	4.16	24.1	7.89	45.8	92.5	0.138	9.9	0.190	13.6	40.6	1.29
20	0.085	6.2	7.5	5.15	28.4	7.81	43.1	92.5	0.138	9.4	0.190	12.9	44.0	1.36
10	0.085	6.5	7.5	7.22	41.1	5.15	29.3	92.5	0.138	9.7	0.190	13.4	57.3	1.32
7	0.085	6.5	7.5	8.19	46.9	4.09	23.4	92.5	0.138	9.7	0.190	13.4	63.2	1.31

Millennium Minerals Ltd, Gold Sulphide Project Scoping Study, CP1230-GN-RP-001 B, 16th September 2017 by DRA Pacific Pty Ltd.

The metallurgical information contained in the DRA report was also supported by work completed by Process Plant International and contained in their report "Process Plants International Report – PPI-003-PR-RWEP-02_Deeper Ore Concept Study" dated 13th March 2017 (PPI report).

The metallurgical test work (cyanide leach and flotation response) for this report was carried out by ALS and the subject of ALS report numbers A17366 and A17524. The composite samples for the test program were derived from RC and blast-hole samples from Stage 1 (Fresh) and Stage 2 (Transition) areas of the Golden Eagle pit. The methodology of composite selection was based on variations in sample lithology and multi-element analysis with a summary of this process provided in the PPI report, Sections 4.3.2 and 4.3.4. A table summarising the composites and drill holes for this program is provided below as an extract of the PPI report:

Deposit	No of Holes	From m	To m	Predominant Oxidisation class from Lithology	No of Composites created
Golden Eagle Stage 1 **GERCMET004 - 07**	4	54	99	Fresh	13 RC
Golden Eagle Stage 2 **GERCMET001 - 03**	3	2	40	Transition	20 RC

The results from the PPI test program indicate a range of recoveries for the composites of Stage 1 and Stage 2 samples with recovery upgrades of approximately 12% on average being achieved with fine grinding the ore to a p80 of 20 microns from the initial p80 of 106 um.

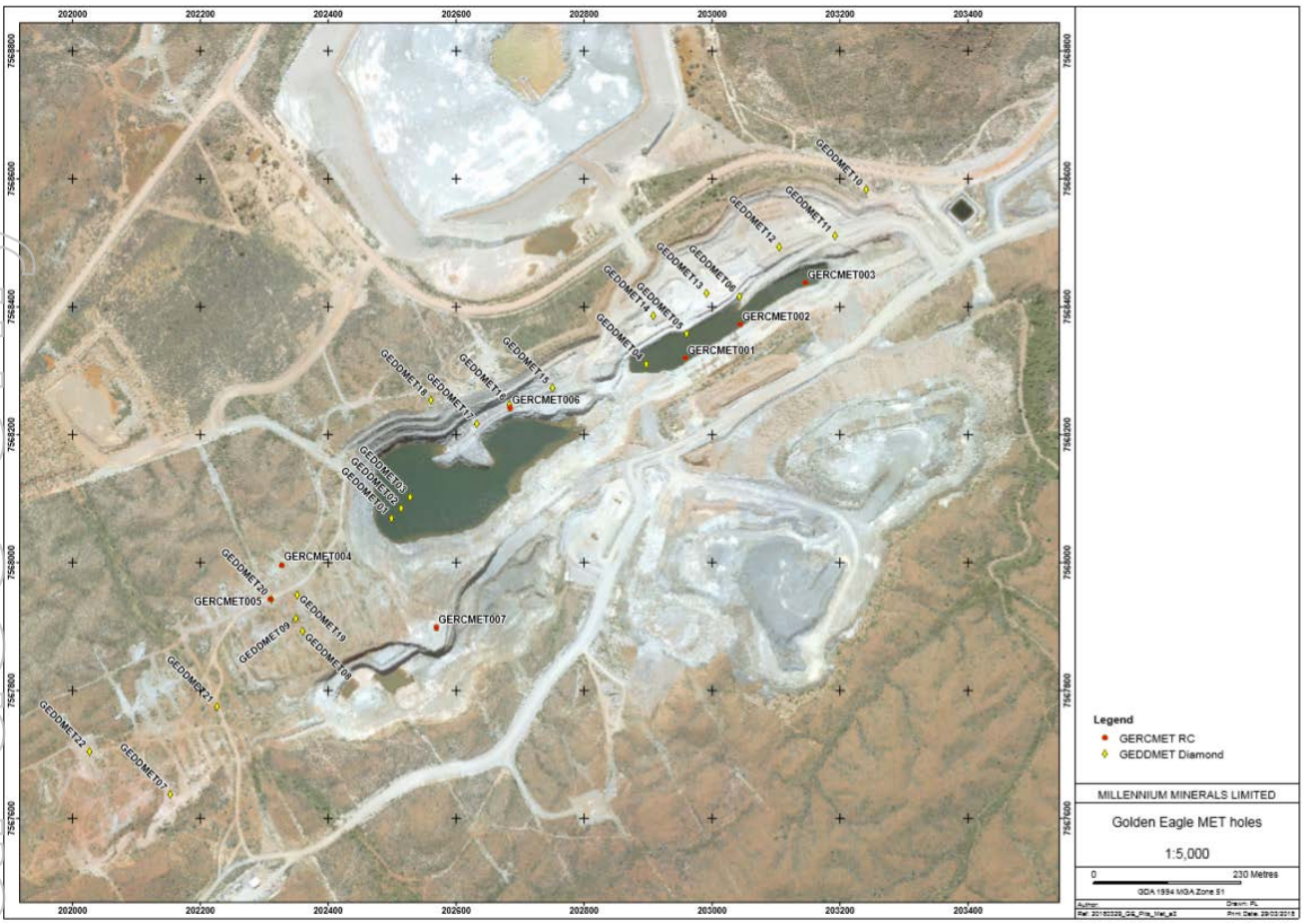


***Figure 1**: Drill hole location – Golden Eagle Deposit*

<u>Processing Study</u>

To allow the completion of the process selection for the Feasibility Study, a 'Trade Off' study was completed to assess several processing options with the potential to improve the gold recovery from the sulphide Resources. The outcomes from the Study facilitated a decision on the processing flowsheet for Golden Eagle Mineral resources.

The most economic option is determined to be a Modular concentrating circuit on the tail end of existing CIL plant and that the spiral concentrating circuit, fine grind and intense cyanidation circuit.

The flowsheet was designed for progressing the plant design and development of a preliminary site layout for the proposed plant upgrade (refer to Figure 2 – Plant Expansion Flowsheet and Figure 3 – Plant Expansion Layout).

Following the completion of the flowsheet design, the key long-lead components were identified. These items are:

Ultra-fine grinding mill	$2.5M
Spiral concentrating plant	$2.2M
PSA oxygen plant	$1.25m

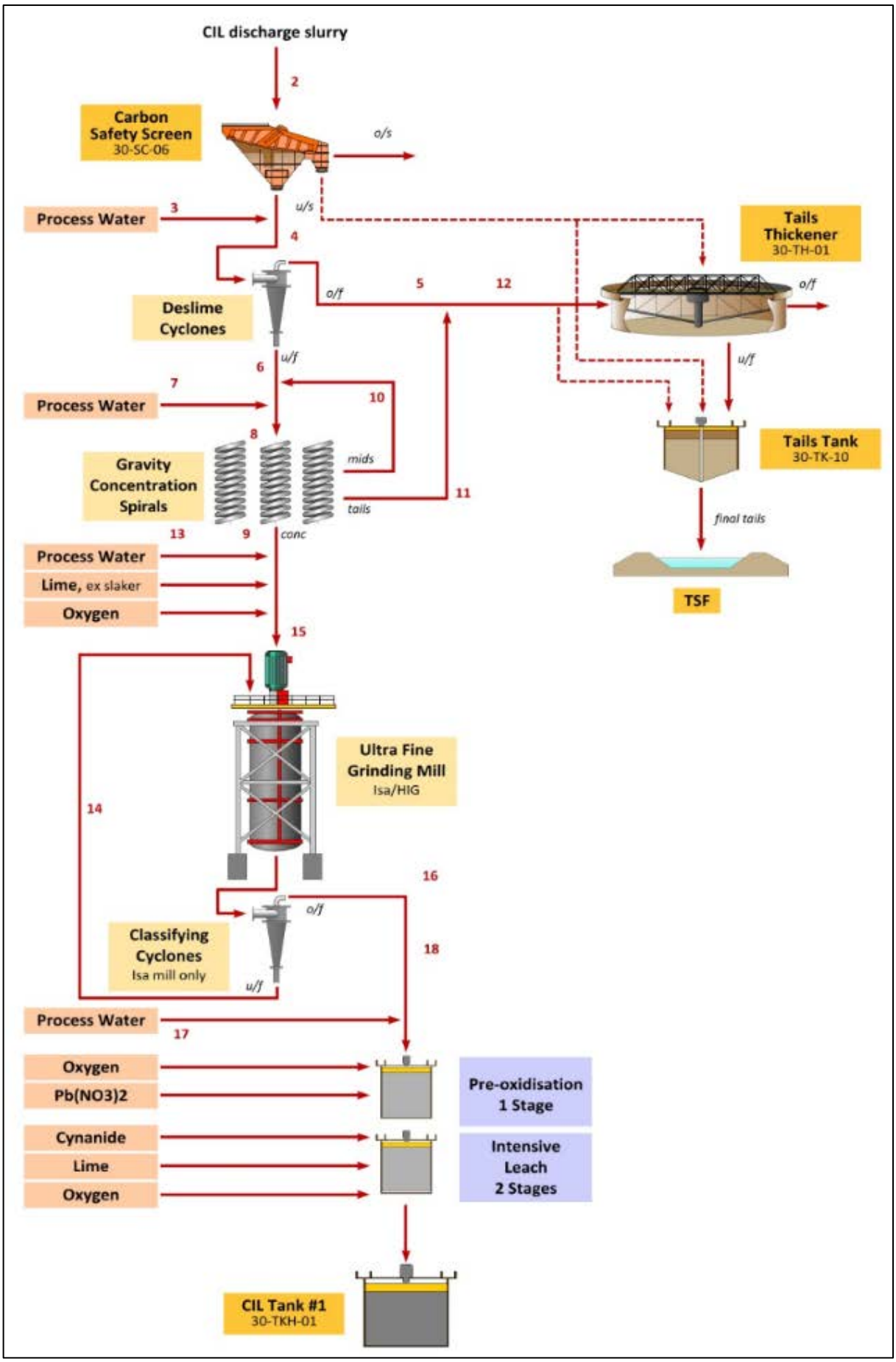


***Figure 2**: Plant Expansion flow sheet*

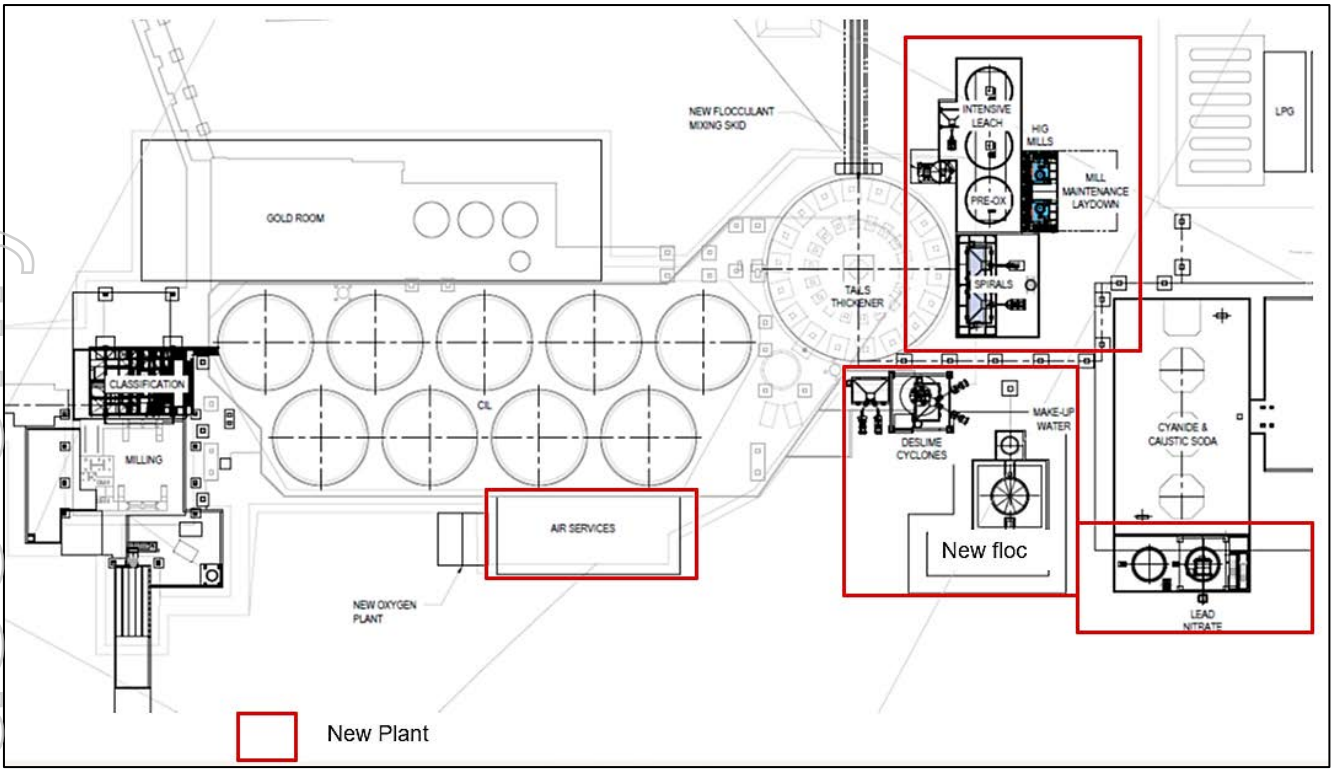


***Figure 3**: Plant Expansion Layout*

Upgrade Capital Cost

The cost estimation component of the Trade-Off Study provided a development capital cost estimated based on prices provided by key vendors for the major equipment and application of installation engineering factors. The direct costs associated with the spiral tails concentrating plant were estimated at $15 million.

Upgrade Operational Cost

Operating cost for the spiral concentrating plant was estimated utilising the installed power, reagent consumption estimates, manning estimates, maintenance allowances and site provided cost for labour, reagents and power. The operating cost per tonne of mill feed was estimated at $3.60/ tonne in addition to the existing processing cost.

Current Test Program

Further test work is underway to enhance and optimise the proposed tails treatment circuit utilising a single whole composite from hole #GEDDMET009. The metallurgical composite was prepared by taking all the provided ½ core material from 0m to 66m, crushing and blending to provide a whole-of-hole composite for preliminary testing.

Metallurgical test work is currently ongoing with this sample with the following preliminary information available:

- The test program being undertaken is in line with the ALS laboratory flow sheet "Flow Sheet - Millennium - Golden Eagle Study - Scouting Sample - Rev 1". The test on a 1 kg sub sample indicated that:
    - CIL leaching produced a 52.6% Au recovery
    - Gravity concentration of the leach tail produced a concentrate with 73.4% of the gold from the tailings in 6.8% of the tailings mass
    - CIL leaching of the concentrate following grinding to a p80 of 10 um provided a

27.9% leach recovery; and

- The leaching of the concentrate was carried out at cyanide levels higher than the standard laboratory CIL (0.2% vs 0.1%) but below the levels expected for intense cyanidation treatment (5%+)

Following the outcome of this program, a larger (100kg) sub-sample (ALS Flow Sheet-Millennium-Golden Eagle- Scouting Sample-BULK LEACH-Jan 2018) of the whole of hole composite was generated for leach, gravity concentration and concentrate leach optimisation work. The test work on this sample is ongoing and will evaluate the intense cyanidation and enhanced cyanide leach options for concentrate leaching.

Metallurgical drill sampling has been undertaken on the Golden Eagle ore source incorporating Stages 1 and 2 and Golden Eagle South. At the completion of the 100 kg sub-sample test program, a bulk composite incorporating all drill holes and variability samples representing the various metallurgical domains within the samples will be generated for testing on the process established on the GEDDMET009 sample.

Next Steps

1. Re-optimise Sulphide Resource and Reserve inventory – June and September Quarter
2. Commence procurement of process equipment - June Quarter
3. Updated mine plan – September Quarter
4. Begin plant construction – September Quarter
5. Increase focus on sulphide exploration - ongoing
6. Target commissioning during the first quarter of 2019

Competent Persons Statements – Mineral Resources

The information in this Report which relates to Golden Eagle Mineral Resource estimates accurately reflects information prepared by Competent Persons (as defined by the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves).

The Golden Eagle Mineral Resource Estimates have been compiled and prepared by Graeme Thompson (MAUSIMM) who is a full time employee of Millennium Minerals Limited and is a Competent Person as defined by the Australasian Code for the reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code) 2012 Edition and who consents to the inclusion in this report of the matters based on the information in the form and context in which it appears.

The Key components that relate to Metallurgical factors or assumptions and cost assumptions used as input for the Nullagine Golden Eagle Processing Plant expansion feasibility study estimate have been compiled and prepared by Mr Dale Harrison, (MAusIMM) of MineScope Services Pty Ltd who is a Competent Person as defined by the Australasian Code for the reporting of Exploration Results(Metallurgical factors or assumptions), Mineral Resources and Ore Reserves (JORC Code) 2012 Edition and who consents to the inclusion in this report of the matters based on the information in the form and context in which it appears. Mr Harrison has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined by the JORC Code 2012.

Qualifying Statement

This release may include forward-looking statements. These forward-looking statements are based on Millennium's expectations and beliefs concerning future events. Forward-looking statements are necessarily subject to risks, uncertainties and other factors, many of which are outside the control of Millennium, which could cause actual results to differ materially from such statements. Millennium makes no undertaking to subsequently update or revise the forward-looking statements made in this release, to reflect the circumstances or events after the date of this release.

Ends

Appendix 2 – JORC 2012 Edition – Table 1

JORC 2012 Edition - Table 1

Section 1 Sampling Techniques and Data

Criteria	JORC Code Explanation	Commentary
Sampling techniques	• *Nature and quality of sampling (e.g. cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.* • *Include reference to measures taken to ensure sample representatively and the appropriate calibration of any measurement tools or systems used.* • *Aspects of the determination of mineralisation that are Material to the Public Report.* • *In cases where 'industry standard' work has been done this would be relatively simple (e.g. 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (e.g. submarine nodules) may warrant disclosure of detailed information.*	*Golden Eagle Stage 1 and 2:* • *Stage 1: The samples were RC chips from a total of 4 drill holes* • *Stage 2: The samples were RC chips from a total of 3 drill holes* •

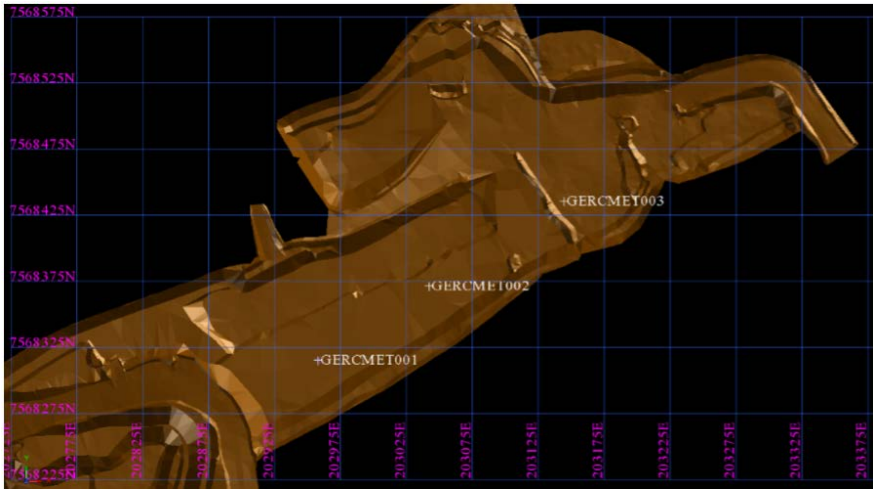
Deposit	*No of Holes*	*From m*	*To m*	*Predominant Oxidisation class from Lithology*	*No of Composites created*
Golden Eagle Stage 1 GERCMET004 - 07	*4*	*54*	*99*	*Fresh*	*13 RC*
Golden Eagle Stage 2 GERCMET001 - 03	*3*	*2*	*40*	*Transition*	*20 RC*
Golden Eagle GEDDMET 01 - 06	*6*				*1 PQ*
Golden Eagle	*1*				*TBD*

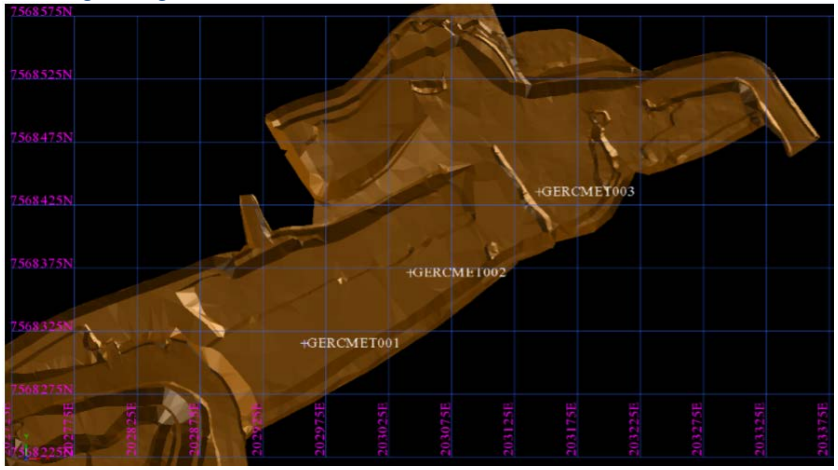
• *Reverse circulation drilling and diamond core drilling was used to obtain samples,*
• *Recent RC Sampling was carried out under Millennium protocols and QAQC procedures, as per industry best practice (field & lab duplicates, blanks & certified reference standards). 1 m interval RC samples were sub-sampled to 3 kg by a rig-mounted cone or riffle splitter under Millennium's supervision.*
• *HQ3 sized core was drilled for GEDDMET09. Core sampling was carried out to geological boundaries with minimum sample intervals of 0.3m. It was cut using a core saw with half core submitted for gold and multi-element analyses. A composited sample from the remaining half core was created using the Au and multielement results. The composite intervals were crushed with a jaw crusher (<8mm) and split with a riffle splitter for samples <6kgs or sample >6kgs using a rotary sample divider (RSD)*

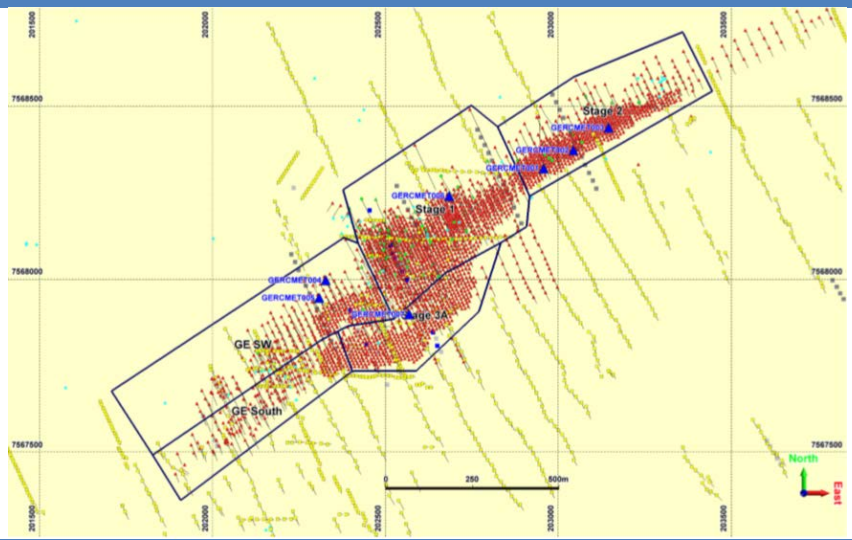
Golden Eagle GERCMET001 - 03:
• *A total of 20 test composites were prepared from the test intervals supplied. Not all samples were used, only the ones nominated.*
• *Each composite component (i.e. individual meter intervals) was blended by passing through a rotary sample divider (RSD) and the nominated weight split out (as per table shown below). The individual components were then added together to form the 20 composites. Each composite was then stage-crushed to P100 3 mm, homogenised and then rotary split into 1 kg test charges.*

Golden Eagle GERCMET004 - 07:
• *A total of 13 test composites were prepared from the test intervals supplied. Not all the samples were used, only the ones nominated.*
• *Each composite component (i.e. individual meter intervals) was blended by passing*

Criteria	JORC Code Explanation	Commentary
		through a rotary sample divider (RSD) and the nominated weight split out (as per the table shown below). The individual components were then added together to form the 13 composites. Each composite was then stage crushed to P100 3 mm, homogenised, and then rotary split into 1 kg test charges *Golden Eagle GEDDMET 01 – 06:* • *Each individual sample received was crushed at a closed side setting of 20 mm and placed in one of two drums, the drums were then mixed and split to homogenise the samples to produce the master composite. After compositing, 75 kg was sent for further crushing down to 100% passing 2mm for the present round of test work, whilst the remaining sample was placed in two drums and sent to cold storage to prevent any further oxidation.* •
Drilling techniques	• *Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).*	• *Reverse circulation (RC) drilling and Diamond (HQ3) triple tube drilling was used; The core was oriented, using Reflex Act II electronic orientation device (Bottom of hole orientation).*
Drill sample recovery	• *Method of recording and assessing core and chip sample recoveries and results assessed.* • *Measures taken to maximise sample recovery and ensure representative nature of the samples.* • *Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.*	• *A record of RC sample recovery % and moisture content was recorded by field assistants under supervision of the rig geologist. Check weights were done periodically at the rig. Overall sample weight and quality were good to very good (2.0-3.5 kg).* • *ALS (assay lab since mid-2011) also records sample weights on receipt of samples.* • *Core recoveries from diamond drilling was above98%.* • *No further detail is considered material to the Metallurgical analysis being reported.*
Logging	• *Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.* • *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.* • *The total length and percentage of the relevant intersections logged.*	• *The logging has been validated and is regarded as being comprehensive and of good quality.* • *Geological logging is both qualitative and quantitative in nature. Whilst drilling the lithology, colour, grain size, regolith, alteration, weathering, veining and mineralisation were recorded. Sulphide and vein content were logged as a percentage of the interval. Photography has been taken of the diamond drill core.* • *RC chip trays are retained at site.* • *Geological loggings are used for identification of weathering profiles*
Sub-sampling techniques and sample preparation	• *If core, whether cut or sawn and whether quarter, half or all core taken.* • *If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.* • *For all sample types, the nature, quality and appropriateness of the sample preparation technique.* • *Quality control procedures adopted for all sub-*	• *For core samples, the core was cut using a core saw with half core submitted for analysis. For metallurgical holes ½ core was used to create composites for metallurgical testing.* • *The RC samples were split using a rig mounted, levelled cone splitter. The vast majority of the samples were dry with moist and wet samples recorded on the sampling sheet.* *Golden Eagle Stage 2:* • *Each composite component (i.e. individual meter intervals) was blended by passing through a rotary sample divider (RSD) and the nominated weight split out (as per table shown below). The individual components were then added together to form the 20*

Criteria	JORC Code Explanation	Commentary
	sampling stages to maximise representivity of samples. • *Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.* • *Whether sample sizes are appropriate to the grain size of the material being sampled.*	*composites. Each composite was then stage-crushed to P100 3 mm, homogenised and then rotary split into 1 kg test charges.*  *Golden Eagle Stage 1:* • *Each composite component (i.e. individual meter intervals) was blended by passing through a rotary sample divider (RSD) and the nominated weight split out (as per the table shown below). The individual components were then added together to form the 13 composites. Each composite was then stage crushed to P100 3 mm, homogenised, and then rotary split into 1 kg test charges*
Quality of assay data and laboratory tests	• *The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.* • *For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.* • *Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.*	• *The industry best practice standard assay method of 50g charge Fire Assay for this style of mineralisation was employed.* • *Commercially prepared, predominantly matrix-matched blanks, low, medium & high value certified reference QAQC standard, blanks, assay laboratory and field duplicate samples were inserted at a rate of 1:20 into the sample stream* • *The QAQC results from this protocol were considered to be acceptable.* • *No geophysical tools were used to determine any element concentrations used for these results.* • *Sample preparation checks for fineness were carried out by the laboratory as part of their internal procedures to ensure the grind size of 85% passing 75 micron was being attained. Laboratory QAQC involves the use of internal lab standards using certified reference material, blanks, splits and replicates as part of the in house procedures.* • *Results highlight that sample assay values are accurate, and that contamination has been contained.*
Verification of sampling and assaying	• *The verification of significant intersections by either independent or alternative company personnel.* • *The use of twinned holes.* • *Documentation of primary data, data entry*	• *Metallurgical holes were drilled at the deposit; these were twinned to RC holes to provide confirmation of the grade within sampled intervals and geological relationships.* • *Assay results were not adjusted.*

Criteria	JORC Code Explanation	Commentary
	procedures, data verification, data storage (physical and electronic) protocols. • *Discuss any adjustment to assay data.*	
Location of data points	• *Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.* • *Specification of the grid system used.* • *Quality and adequacy of topographic control.*	• *Immediately post hole completion, a handheld GPS coordinate was taken, then subsequently the collars surveyed with a real Time Kinematic (RTK) DGPS device to a ±10mm positional precision. All collars were then validated against planned positions as a cross check. Surveyed collar co-ordinates were uploaded into the Company SQL database.* • *Grid datum is GDA94 51K (East Pilbara).* • *Downhole surveys were completed on all holes at 30m maximum downhole intervals (initial survey at 10m downhole). Surveys were magnetic via electronic multi-shot survey tool (Camprodual or Camteq), as lithologies have negligible magnetic susceptibility (greywacke). Re-surveying was carried out to check the quality of measurements. Selective gyroscopic surveys were undertaken on the deeper holes to confirm the trajectory. Where taken the gyroscopic surveys were used in preference to the electronic multi-shot surveys.* *Golden Eagle Stage 2 – Met Drill Hole Locations*  *Golden Eagle Stage 1 – Met Drill Hole Locations*

Criteria	JORC Code Explanation	Commentary
		
Data spacing and distribution	• *Data spacing for reporting of Exploration Results.* • *Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.* • *Whether sample compositing has been applied.*	• *Drill spacing and hole locations were defined using the deposits recovery model, weathering surfaces, Structural mapping and considerations* •
Orientation of data in relation to geological structure	• *Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.* • *If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.*	• *Geological mapping and structural measurements have been taken at the deposit and they confirm the orientation of mineralisation defined by the drilling. Based upon the above information the drilling was largely perpendicular to the mineralisation with some exceptions. This was due to steep and inaccessible terrain that meant holes needed to be drilled slightly oblique to the mineralisation to intersect the desired target.* • *No significant orientation bias has been identified in the data at this point.*
Sample security	• *The measures taken to ensure sample security.*	• *Samples were given an ID, cross checked by field personnel that the interval assigned was matched, packed and then the geologist on the rig will check sample ID. The laboratory assigned the same sample ID to the pulps and checking against geology, alteration and further use of QAQC to confirm data ID.* • *Samples were collected on completion of each hole and stored in a secure shed prior to dispatch to the assay laboratory.* • *Monitoring of sample dispatch is undertaken for samples sent from site and to confirm that samples have arrived in their entirety and intact at their destination.* • *Sample security is managed with dispatch dates noted for each sample by the core technician, this is checked and confirmed at the laboratory on receipt of samples and*

Criteria	JORC Code Explanation	Commentary
		discrepancies are corrected via telephone link up with laboratory and Supervising Geologist
Audits or reviews	• *The results of any audits or reviews of sampling techniques and data.*	• *Internal lab audits conducted by Millennium have shown no material issues.* • *Sampling and data protocols have been externally audited by CSA Global with no matters that were serious or were likely to impair the validity of the Mineral Resource estimate.*
Metallurgical factors and assumptions	• *The metallurgical process proposed and the appropriateness of that process to the style of mineralisation.* • *Whether the metallurgical process is well-tested technology or novel in nature.* • *The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied.* • *Any assumptions or allowances made for deleterious elements.* • *The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole.* • *For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications?*	• *The Nullagine processing plant is currently in operation and has been since 2012. It is an industry standard 1.5 Mt pa primary crusher, SAG mill, gravity circuit and carbon-in-leach tankage facility.* • *This is conventional, well-tested technology, and is appropriate for oxide and free milling lode style of mineralisation in all the Project deposits, as demonstrated by successful plant operation since commercial production was declared in February 2013.* • *Recovery factors of 70% to 95% (varies between deposits) have been assumed in the estimation of the Ore Reserves. The recovery factors are based on comprehensive test work on metallurgical core holes, mini BLEG and Leachwell analyses on RC and Diamond Core samples.* • *The Ore Reserves are quoted 'delivered to mill' basis; this excludes metallurgical recovery factors.* • *Pyrite and arsenic as arsenopyrite are present in the ore and are known to interfere with the metallurgical performance of the ore. The treatment of these minerals is seen as key to providing the enhancement or recovery in the treatment process.* • . *Metallurgical test work completed in 2017 (Process Plants International report – PPI-003-PR-RWEP-02_Nullagine testwork) has indicated that with appropriate processing routes, CIL gold recoveries of between 63% and 80% on the Golden Eagle ore can be achieved. These figures were based on grinding the whole ore sample to the target size followed by a conventional laboratory cyanide leach.* *The samples tested in this program were from Stages 1 & 2 of the Golden Eagle ore body and were made up of RC and blast hole samples.* *With the overall potential leach recovery identified in this work, an option was assessed for a potential process route that could deliver the desired recoveries without the need to grind the entire ore to the target, fine grind size.* *Research into existing processing routes in the Western Australian Goldfields region provided evidence of processing options that could be used (New Celebration Gold Mine[1] and Granny Smith Gold Mine[2] tailings retreatment circuits). This process option was based on:* o *Processing the whole ore through the existing CIP circuit at the current process conditions* o *treating the tailings stream (gravity circuit) to recover a concentrate containing the un-leached sulphide materials* o *fine grinding of this concentrate to the desired liberation size (20 micron or less)* o *intense cyanidation of the ground concentrate for final Au recovery* *Preliminary test work has been conducted on a single diamond core sample from Golden Eagle South. The core was crushed and blended to produce a whole of ore zone sample with subsamples being split for various test work. The test program followed is as per ALS*

Criteria	JORC Code Explanation	Commentary

		laboratory flow sheet "Flow Sheet - Millennium - Golden Eagle Study - Scouting Sample - Rev 1"
		• *The test on a 1 kg sub sample indicated that:*
		  o *CIL leaching produced a 52.6% Au recovery*
		  o *Gravity concentration of the leach tail produced a concentrate with 73.4% of the gold from the tailings in 6.8% of the tailings mass*
		  o *CIL leaching of the concentrate following grinding to a p80 of 10 um provided a 27.9% leach recovery*
		• *The leaching of the concentrate was carried out at cyanide levels higher than the standard laboratory CIL (0.2% vs 0.1%) but below the levels expected for intense cyanidation treatment (5%+)*
		
		Following the outcome of this program, a larger (100Kg) sub-sample (ALS *Flow Sheet-Millennium-Golden Eagle- Scouting Sample-BULK LEACH-Jan 2018) of the whole of hole composite was generated for leach, gravity concentration and concentrate leach optimisation work. The test work on this sample is ongoing and will evaluate the intense cyanidation and enhanced cyanide leach options for concentrate leaching.*
		Metallurgical drill sampling has been undertaken on the Golden Eagle ore source incorporating stages 1,2 and Golden Eagle South. At the completion of the 100 kg sub-sample test program, a bulk composite incorporating all drill holes and variability samples representing the various metallurgical domains within the samples will be generated for testing on the process established on the GEDDMET009 sample.
		
		Ausenco Engineering were engaged to complete a trade-off study of the available processing options for the Golden Eagle ore based on the existing metallurgical test work. The study report (Millennium Minerals Nullagine Gold Mine Sulphide Project Trade off Study March 2016 – 102427-RPT-0001 Rev C) included the conceptual flow sheets and capital and operating cost for the processing options identified.
		
		Based on the finalised designed flow sheet, further quotations have been obtained from various Vendors on Modular packaged major equipment components. The final Capital cost estimation for the plant expansion is estimated to be in line with the direct capital cost estimated from the Ausenco trade-off study results, A$14.7M.
		
		Operational costs were developed from the design criteria parameters as well as inputs from the existing Nullagine Gold Operations processing cost base, including consumables, maintenance and overhead costs. The final Operating cost estimation for the plant expansion is estimated to be in line with the operating cost estimated from the Ausenco trade-off study results, $3.57/tonne in addition to the existing processing costs.
		
		[1] Martins, V.,R. Dunne and G. Delahey, "New Celebrations Tailings Treatment Plant – 18 Months Later", *in XVIII International Mineral Processing Congress, Sydney, May 1993. 1215-*

Criteria	JORC Code Explanation	Commentary
		1222. [2] Recovery Of Gold Carriers at the Granny Smith Mine Using Kelsey Jigs J1800 *G.Butcher and A.R. Laplante*

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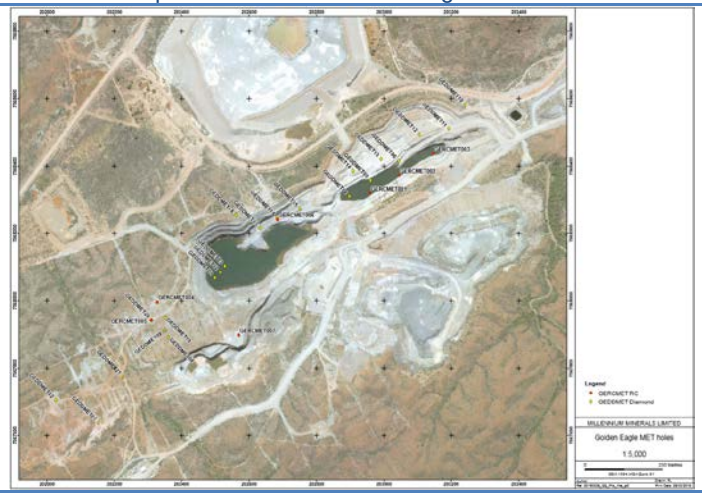
Section 2 Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	• *Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.* • *The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.*	• The Nullagine Gold Project prospects and deposits lie within fully granted Mining Leases within the Pilbara Gold Field (46), as detailed below. All the tenements are in good standing with no known impediments. Golden Eagle^+ - M46/186, M46/300 (100% MML); *^ These tenements are located within the Palyku title claim (WC99/16).* *+ A $10/oz royalty payable to Tyson Resources Pty Ltd.*
Exploration done by other parties	• *Acknowledgment and appraisal of exploration by other parties.*	• Not applicable – The current report pertains to Metallurgical analysis of composite domains
Geology	• *Deposit type, geological setting and style of mineralisation.*	• Golden Eagle deposit is structurally controlled, sediment-hosted, lode gold style deposits. It is situated in the Mosquito Creek Basin that consists predominantly of Archean aged, turbidite sequences of sandstone, siltstone, shale and conglomerate units.
Drill hole Information	• *A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:* o *easting and northing of the drill hole collar* o *elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar* o *dip and azimuth of the hole* o *down hole length and interception depth* o *hole length.* • *If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.*	• Reporting of individual drill holes is not considered material to the Composite Metallurgical analysis being reported. The Metallurgical Domains represent regions as opposed to single localities.
Data aggregation methods	• *In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated.* • *Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.* • *The assumptions used for any reporting of metal equivalent values should be clearly stated.*	• Sampling was carried out on a composite domain basis. This approach, by definition represents an aggregation of data from discrete regions across the deposit • No cutting of high grades occurred • No metal equivalents have been reported
Relationship between mineralisation widths and intercept lengths	• *These relationships are particularly important in the reporting of Exploration Results.* • *If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported.*	• Most of the drilling is perpendicular to the mineralisation; however, in early exploration the dip direction is sometimes uncertain and thus holes some holes can be drilled sub-parallel to the mineralisation producing longer and higher-grade intersection than the true

Criteria	JORC Code explanation	Commentary
	• *If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').*	intercept. Quoted widths are down-hole widths. Most other True-widths are likely to be approximately 60-90% of down-hole widths. • The drill hole orientations relative to the ore zones have ensured accurate interpretations and 3D modelling.
Diagrams	• *Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.*	
Balanced reporting	• *Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.*	• The accompanying document is considered to represent a balanced report.
Other substantive exploration data	• *Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.*	• Metallurgical test work at the laboratory scale has demonstrated the ability to achieve overall gold recovery of up to 75% from the deposit
Further work	• *The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling).* • *Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.*	• Extra 3 diamond (PQ3) holes are drilled and sample and composite preparation are ongoing for further Metallurgical test work