Monument Mining Ltd

Mineral Resource Estimate for the Mengapur Cu-Au Deposit, NI 43-101 Technical Report

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1 SUMMARY

This Technical Report describes the Mengapur copper-gold deposit located in the region of Maran, in the State of Pahang, Malaysia. The Mengapur deposit is owned by Monument Mengapur Sdn Bhd (MMSB), a wholly-owned subsidiary of Monument Mining Limited (Monument) and is currently on care and maintenance. This report describes the Mineral Resource estimate (MRE) for the Mengapur deposit.

1.1 Summary of geology and mineralisation

The geology of the Mengapur area is dominated by sedimentary rocks that have been intruded by at least one multiple intrusion dyke complex. The main dyke intrusive complex at Mengapur outcrops in the centre of the deposit and forms a steep resistant ridge that is referred to as Bukit Botak. The sedimentary rocks adjacent to the Bukit Botak intrusion complex and other nearby buried intrusions are altered to skarn.

The Mengapur limestones are typically massive and locally fossiliferous and/or interbedded and can be separated into two distinct facies: a calcareous facies and an argillaceous facies. The sedimentary rocks generally strike north-northeast and dip steeply (45° to 85°) to the east-southeast. The Mengapur limestones have been intruded by multiple phases of felsic intrusive rocks dominated by adamellite (quartz monzonite) with lesser amounts of rhyolite, rhyolitic tuff and rhyolite breccia. The intrusives form a large dyke intrusion complex in the centre of the Mengapur deposit that is approximately 800 m in diameter in surface exposures and has been encountered in historic drilling up to 600 m below the surface. The intrusion complex contains moderately to locally very steep contacts with the adjacent sedimentary rocks and reaches up to 900 m in width at depth. The intrusive rocks appear to intrude sub-parallel along the original sedimentary rock bedding as they generally strike approximately 60° to 65° at the surface and generally dip 55° to 65° to the east-southeast forming large dyke-like bodies.

Hydrothermal alteration at Mengapur is centred on the Bukit Botak intrusive complex with some hornfels and mostly mineralised skarn occurring in the adjacent sedimentary rocks at the intrusive-sedimentary rock contact zone. The skarn alteration extends outward into the sedimentary rocks approximately 300 m to 650 m laterally from the contact and has been intercepted in drillholes up to 750 m below the surface. The skarn alteration halo around the Bukit Botak intrusion complex dips steeply to the southeast. The exoskarn alteration comprises medium green pyroxene-rich skarn and medium to dark brown garnet-rich skarn and is generally massive and coarse-grained near the intrusion complex and bedded and finer-grained distal to the intrusive complex. Tabular, moderately to steeply dipping, garnet-rich skarn bodies are typically narrow (less than 70 m thick) and interbedded with the more abundant and thicker pyroxene-rich skarn.

The Mengapur deposit contains Cu-Au (±Ag ±Fe) mineralisation hosted predominantly by pyroxene-rich and garnet-rich exoskarn that occurs adjacent to the felsic intrusions. The known Cu-Au mineralisation extends over a 1.2 km x 1.5 km area in a concentric geometry haloing the contact of the main Butik Botak intrusion complex and extends up to 630 m below surface.

The Mengapur deposit hosts three types of mineralisation:

- Sulphide (hypogene) Cu-Au (±Ag ±Fe) mineralisation
- Transitional mineralisation that contains mixed oxide and sulphide mineralisation near the oxide-sulphide redox contact
- Near-surface oxide Cu-Au (±Ag ±Fe) mineralisation.

The bulk of the sulphide mineralisation is hosted in sulphide-bearing pyroxene and garnet skarn. Lesser amounts of Cu-Au-Ag mineralisation is hosted in oxidised soil, gossan and locally weathered rock units that overly the sulphide-bearing skarns.

Both the garnet-rich and pyroxene-rich skarn varieties contain low to locally high amounts of sulphide and/or iron-oxide minerals. The most dominant sulphide mineral in the skarn is pyrrhotite followed by lesser amounts of pyrite, chalcopyrite, arsenopyrite and molybdenite. Pyrrhotite occurs as either massive zones or disseminated within the skarn. Iron-oxide minerals in sulphidic pyroxene and garnet skarn are dominated by octahedral magnetite. Chalcopyrite is the dominant copper mineral in the mineralised sulphide skarn and occurs as fine disseminated grains and locally within late quartz-rich veins.

Weathering of the skarns is locally very deep at the margins of the intrusive complex where the oxide zone (historically referred to as “soil”) can locally reach up to 300 m in depth. The oxidation is deepest on the northern and south-western flanks of the intrusive complex. In the south-eastern part of the mineralisation, oxidation reaches up to 120 m deep. The oxide zone is commonly clay bearing and light brown to dark red in colour with the reddish zones typically containing hematite. Weathering can be strong to intense in all rock types and generally decomposes all or most of the original sulphide minerals. The mineralogy of the mineralisation within the oxide zone is dominated by clay, goethite, limonite, jarosite and earthy purple to red hematite with low to moderate amounts of magnetite. Green copper oxide minerals are generally not abundant in the oxide mineralisation and are rarely observed in the oxide zone. The bulk of the mineralised oxide zone that contain greater than 0.1% Cu that is believed to be microcrystalline and intergrown within the goethite and limonite mineral structure.

1.2 Summary of drilling, sampling and quality assurance/quality control

Drilling at the Mengapur deposit began in the 1960s; however, the majority of the drilling was completed by Malaysian Mining Corporation (MMC) in the 1980s and later by Monument in 2011 to 2014. A total of approximately 112,048 m of drilling has been completed to date. Drilling primarily comprises diamond core drilling, with some minor reverse circulation (RC) drilling (approximately 7,942 m) conducted by Monument.

Historical (pre-1990) drilling comprises a total of approximately 59,310 m of drilling, which represents 53% of the total drilling at Mengapur. No details are available on the procedures or quality of the sampling undertaken during these programs. The historical drillhole assay records indicate that the bulk of the diamond drillhole samples were originally analysed on 3 m sampling widths, with the intervals adjusted based on the geological logging. However, the historical core storage building reportedly burned to the ground in 2005 and as a result no historical core is available for viewing or resampling.

Drilling completed by Monument was conducted over four phases, starting in 2011 and ending in 2014. A total of 52,738 m of drilling was completed, comprising primarily of diamond core drilling with some minor RC drilling. RC drilling was largely restricted to the oxide zones and was mainly used for pre-collars. Diamond core drilling used primarily a HQ3 (61.1 mm) diameter core. The average core recovery is 83% across all rock types and oxidation zones. Within the fresh skarn, the core recovery averages approximately 96%, while within the oxide zone (intervals logged as “soil”), the core recovery averages 63%. Downhole surveying of the Monument drilling was initially conducted using a Camteq Proshot downhole survey instrument from mid-2011 to April 2012, which was later replaced by a gyroscopic survey tool from May 2012. Snowden Mining Industry Consultants (Snowden) notes that some of the earlier surveys are affected by magnetic interference.

RC samples were collected at 1 m intervals in large pre-numbered plastic bags from a cyclone. All RC samples were moved to a covered core and sampling facility and sorted. Wet RC samples were identified and dried in an on-site oven at approximately 60°C overnight, prior to splitting and sampling. Individual samples were tipped into a specially constructed manual tiered riffle splitter, producing four subsamples (50%, 25% and two 12.5% splits). The sample split selected for assay depended on the original sample weight.

For the Monument diamond drilling, core was split or sawn in half based on sampling intervals defined by the geologist. Core samples were placed into pre-numbered plastic bags with unique handwritten sample identification numbers.

The assay laboratory for the historical drillhole samples was the MMC Laboratory Services located at Batu Caves near Kuala Lumpur. Samples from the Monument drilling at Mengapur were prepared and analysed by four commercial primary assay labs: Inspectorate (Richmond, Canada); ACME (Vancouver, Canada), SGS-Malaysia (Port Klang and Bau) and SGS-Mengapur (on site near Sri Jaya, Malaysia). Samples were dried and then crushed using a jaw crusher. The crushed samples were riffle split and then pulverised to 85% to 90% passing 75 µm.

Assays for Cu, Pb, Zn, Ag, As, Mo and Bi were carried out on the historical drillhole samples using atomic absorption spectrophotometry (AAS). Gold analyses were completed using fire assay/AAS methods. Sulphur was not originally analysed for the historical diamond drillhole samples and it was not until 1989 that sulphur was analysed using x-ray fluorescence (XRF). For the Monument drilling, four-acid digest with inductively coupled plasma (ICP) (either optical emission spectrometry OES) or mass spectrometry (MS)) was used to assay for up to 50 elements (including Cu). Au analysis was done using fire assay with a 30 g charge and AAS finish. Sulphur was generally assayed using Leco.

For the historical drilling, reports indicate that standards were inserted into the sample batches; however, no complete standard data compilation has been reviewed by Snowden and there has been no independent verification of this process. Similarly, blank samples and umpire laboratories were utilised however, the results are not clearly documented that Snowden is aware of.

The RC and diamond drilling completed by Monument between 2011 and 2014 includes independent quality assurance/quality control (QAQC) samples (standards, blanks, duplicates and pulp sizing analysis) with the sample batches. QAQC results for the Monument drilling indicates a reasonable precision was achieved for both the coarse rejects and pulp sample stages, and assay results of standards shows a reasonable overall analytical accuracy has been achieved for Cu, S, Au and Ag. Blank samples show no evidence of systematic contaminations of samples was occurring during laboratory sample preparation or assaying.

During the 2018 site visit, Snowden verified the collar coordinates of five drillholes, with coordinates measured in the field using a handheld global positioning system (GPS) and compared to the surveyed coordinates in the database. The results show a good comparison between the 2018 measurements and the coordinates stored in the database, taking into account the relative precision of the handheld GPS.

The Qualified Person has no reason to suspect any issues relating to sample security and believes that the data is suitable for use in resource estimation. A lower confidence has been attributed to the historical (pre-1990) data, especially in areas of the resource informed by primarily historical data.

1.3 Mineral processing and metallurgical testwork

Metallurgical testing has been conducted on oxide, transitional and sulphide samples from 2011 to 2014, primarily at Inspectorate Exploration & Mining Services Ltd Metallurgical Division in Canada. The testing was conducted over three phases, with metallurgical samples sourced from both drillhole composites and bulk surface grab samples (ranging from tens of kilograms to over 1,000 kg), as summarised in Table 1.1.

Table 1.1 Metallurgical testing phases on Mengapur samples at Inspectorate, Richmond, Canada

Testing phase	Dates collected in field	Material classification tested	Tenements and previous exploration zones	Sample material type and quantity	Testing types
1	Early August 2011; material stored in a freezer at Inspectorate to minimise oxidation	Sulphide (one low sulphur and one high sulphur sample)	CASB (Zone A)	2 surface grab samples each totalling 100 kg	Bench, kinetic, and cleaning flotation tests
2	October 2011 to mid-February 2012	Oxide (with different magnetite, copper, and Au contents)	CASB (Zones A and C); SDSB (Zone B)	14 surface grab samples totalling 4,672 kg	Sulphuric and cyanide leach tests; some flotation
3	Mid-2011 and to July 2012 (MMSB diamond drilling on coarse reject materials; sulphide materials placed under nitrogen preservation in sealed plastic bags)	Sulphide, Transitional, and Oxide; different Cu and S grades were tested for the TRANS and SUL samples)	CASB (Zone A) and SDSB (Zone B)	Drillhole composites: 586 kg oxide; 1,053 kg transitional; 1,023 kg sulphide	Leaching tests on OX and TRANS; bench, kinetic, and cleaning flotation tests on TRANS and SUL; 3 locked cycle flotation tests on SUL

Notes: OX= oxide; TRANS = transitional; SUL = sulphide

1.3.1 Oxide samples

Metallurgical testing of oxide samples comprised acid leaching for Cu extraction and cyanide leach testing for Au extraction, along with Davis Tube recovery of magnetic Fe-bearing minerals.

The treatment methodology selected for oxide material was informed by the copper and gold content. The head grade of surface grab samples ranged from 0.03% Cu to 1.61% Cu, 0.04 g/t Au to 0.57 g/t Au and 0.04% S to 0.38% S. A series of 10 drillhole composites returned head grades ranging from 0.30% Cu to 0.47% Cu, 0.04 g/t Au to 0.44 g/t Au and 0.03% S to 0.25% S. The maximum copper recovery achieved by acid leaching was approximately 19.9%, while cyanide leaching tests reached over 90% recovery of gold.

Oxide samples were also tested for recovery of magnetic minerals by Davis Tube analysis, with mass recovery reaching approximately 30% in some composites. However, at this stage, a distinction between magnetite and pyrrhotite is yet to be made.

1.3.2 Transitional samples

Tests performed by Inspectorate on Mengapur transition material did not produce any conclusive process routes. Acid and cyanide based leach processes yielded very low metal extractions, whilst the flotation test results indicate that the copper minerals and pyrrhotite cannot be easily upgraded into two separate products.

It was recommended that a broader sampling and testing programme be carried out in the context of determining the benefits, or otherwise of blending transitional material with either oxide of sulphide process feed.

1.3.3 Sulphide samples

Two 100 kg bulk samples of surface material were collected and tested, with head grades of 0.36% Cu to 0.37% Cu, 0.11 g/t Au to 0.17 g/t Au and 8.88% S to 16.90% S. Flotation testing at a grind of P80 90 µm, showed that copper sulphide concentrates containing at least 24% Cu could be produced at recoveries in excess of 60%.

The copper content of drillhole composites of sulphide metallurgical samples ranged from 0.10% Cu to 0.71% Cu, with <0.01 g/t Au to 0.47 g/t Au and 2.41% S to 18.9% S. Flotation testing using the same analytical and testing techniques failed to match the results obtained from the two surface bulk samples, with a maximum copper content of 23.25% Cu at a recovery of 73.7% being achieved in the sulphide concentrate. Evidence from a QEMSCAN mineralogical study suggests there is scope to improve recovery using a finer grind. Additional testwork showed some potential for the recovery of pyrrhotite.

1.4 Mineral Resources

1.4.1 Drillhole data

Snowden notes that some drillhole data outside the SDSB and CASB tenement boundaries was utilised for the geological interpretation, statistical analysis and grade estimation; however, all reported Mineral Resources are limited to within the SDSB and CASB boundaries.

Numerous drilling programs have been completed at Mengapur. Limited information is available regarding the protocols used for historical drilling and assaying. To determine the suitability of the historical drilling for resource estimation, Snowden compared the statistical properties of the historical drilling to the recent Monument drilling.

Based on this analysis, Snowden concluded that the historical drilling is appropriate for the estimation of all elements except sulphur. Given the overall difference of S grades observed between the historical and Monument drilling, Snowden has excluded the S assays from the historical (pre-1990) drilling for resource estimation purposes.

1.4.2 Geological interpretations

Snowden constructed lithological and mineralisation (using a nominal 0.1% Cu cut-off grade) outlines using cross-sectional interpretations. Due to the geometry of the mineralisation around the adamellite intrusive body, the orientation of the sections radiates around the intrusion. Lithological wireframes were created for skarn, shale and gossan. The 0.1% Cu mineralisation shells are contained within these lithological types. The mineralisation shells were used to select the sampling data for grade estimation, and to constrain the block model for estimation purposes. Some isolated mineralised intersections were not included in the interpreted mineralised envelopes due to lack of continuity or sparse data (e.g. at depth).

Weathering surfaces were interpreted on cross-section based on lithological and weathering codes included in the geology database. Material logged as soil was interpreted as the base of complete oxidation (BOCO), weathered skarn or shale as transitional and sulphide as the top of fresh rock (TOFR). The use of lithological codes for interpretation has resulted in significant trenches and peaks in the BOCO surface. Snowden recommends the refinement of this surface as part of future resource estimation procedures.

1.4.3 Drillhole data analysis

Drill spacing at Mengapur is somewhat variable with the drill spacing varying from less than 40 m up to 120 m. The drillhole data was composited downhole prior to running the estimation process using a 2 m compositing interval to minimise any bias due to sample length.

Statistical analysis was carried out on the composited dataset for Cu, Au, Ag, Fe, S and Co grades. The statistics show that the mineralisation generally has positively skewed grade distributions (e.g. Cu and Au) with a low to moderate coefficient of variation (CV).

Variograms for each element for the domains were modelled to assess the grade continuity and as an input to the kriging algorithms. Due to the skewed grade distributions, normal scores variograms were modelled, with the sill parameters back-transformed. The maximum and intermediate directions of continuity were aligned with the overall strike and down dip directions respectively. The minor direction of continuity was aligned in the true thickness direction.

1.4.4 Block model and grade estimation

A block model was constructed based on a parent block size of 25 m (Y) x 25 m (X) x 10 m (Z) with a minimum sub-cell of 6.25 m (Y) x 6.25 m (X) x 2.5 m (Z). The parent block size was selected based on the results of a kriging neighbourhood analysis (KNA), along with consideration of the average drillhole spacing and geometry of the deposit.

Block grades were estimated using the ordinary kriging algorithm using the nugget, sill values and ranges determined from the variogram models. The ranges obtained from the variogram models were used as a guide in determining appropriate search ellipse parameters. All domain boundaries were treated as hard boundaries for estimation purposes, with only assays from within each wireframe/domain used to estimate blocks within that domain. The estimation domains are based on a combination of lithology and Cu mineralisation. Top-cuts were assessed and applied per domain to control the influence of extreme grades on the local block estimates.

A three-pass search strategy was utilised for all grade estimates, with the search radii and number of samples based on the results of the variography and a KNA. The initial search radii range from 75 m to 150 m in the major and semi-major directions, with a minimum of eight samples and a maximum of 24 samples used. A maximum number of four samples per drillhole and maximum vertical search of 12 m was applied to reduce the influence of drillholes that were orientated down-dip to the mineralisation.

The block grade estimates were validated using:

- A visual comparison of block grade estimates and the input drillhole data
- A global comparison of the average composite (naïve and declustered) and estimated block grades
- Moving window averages comparing the mean block grades to the composites.

The model validation shows that globally, the block grade estimates compare reasonably well with the input sample data and that, with the exception of poorly sampled regions, the grade trend plots show a good correlation between the patterns in the block model grades compared with the drillhole grades.

1.4.5 Bulk density

Data from a total of 71 bulk density samples was available from measurements of diamond drill core collected in 2012 by Monument. The samples are generally between 10 cm and 30 cm in length. The bulk density of samples was measured at the ALS laboratory in Vancouver, Canada (Monument, 2012). Monument indicated (Monument, 2012) the measurements were completed by water immersion techniques (weight in air vs weight in water) using wax-coating to preserve porosity. Assaying of the samples by the same laboratory was completed using ICP-MS (Fe and other elements) and Leco (sulphur).

Each sample was characterised geologically in terms of the rock type and oxidation state. Statistics were assessed for each combination of the logged rock type and oxidation state.

For the sulphide (i.e. fresh) skarn lithology, there were sufficient samples (49) to allow an assessment of the relationship between the bulk density and the Fe and S grades. Snowden found that within the fresh skarn the bulk density is strongly correlated with both Fe and S, which, given the presence of pyrrhotite in the mineralisation, this relationship is not unexpected.

Given the correlation of density and grade (Fe and S), Snowden completed a multiple linear regression to estimate the bulk density of a block from the Fe and S grade estimates for the fresh skarn; however, it was found that the inclusion of both Fe and S grade in the regression did not improve the regression materially compared with using just the Fe grade. As such, and given the lack of robust S assays for the historical drilling, Snowden developed a linear regression for bulk density using just the Fe grade.

Bulk density value was assigned to the model blocks based on the lithology and oxidation state (Table 1.2). For the fresh skarn, the bulk density was estimated by regression using the block Fe grade estimate. Some lithology/oxidation combinations do not have any sample data and for these domains, Snowden has used an assumed value. The assumed bulk density values were sourced from Mengapur reports and validated against published density values of similar rock types and observations in the field and from core.

Table 1.2 Bulk density values assigned to resource block model

Rock type	Oxidation	Bulk density (t/m^3)	Comments
Adamellite	Oxide	1.85	Nominal value, no samples
	Trans	2.2	Nominal value, no samples
	Sulph	2.8	Average of samples
Gossan	Oxide	3.4	Nominal value, no samples
Limestone	Oxide	2.1	Nominal value, no samples
	Trans	2.4	Nominal value, no samples
	Sulph	2.75	Average of samples
Shale	Oxide	1.85	Nominal value, no samples
	Trans	2.2	Nominal value, no samples
	Sulph	2.75	Rounded value based on 1 sample
Skarn	Oxide	2.65	Average of WSK samples
	Trans	2.8	Nominal value, no samples
	Sulph	BD = 0.023*Fe% + 3.004	Regression based on Fe grade estimate (use average value of 3.5 t/m^3 for blocks with no Fe estimate)

1.4.6 Mineral Resource classification

The MREs were classified as a combination of Indicated and Inferred Resources in accordance with CIM guidelines.

The Mineral Resource classification criteria were developed based on an assessment of the following items:

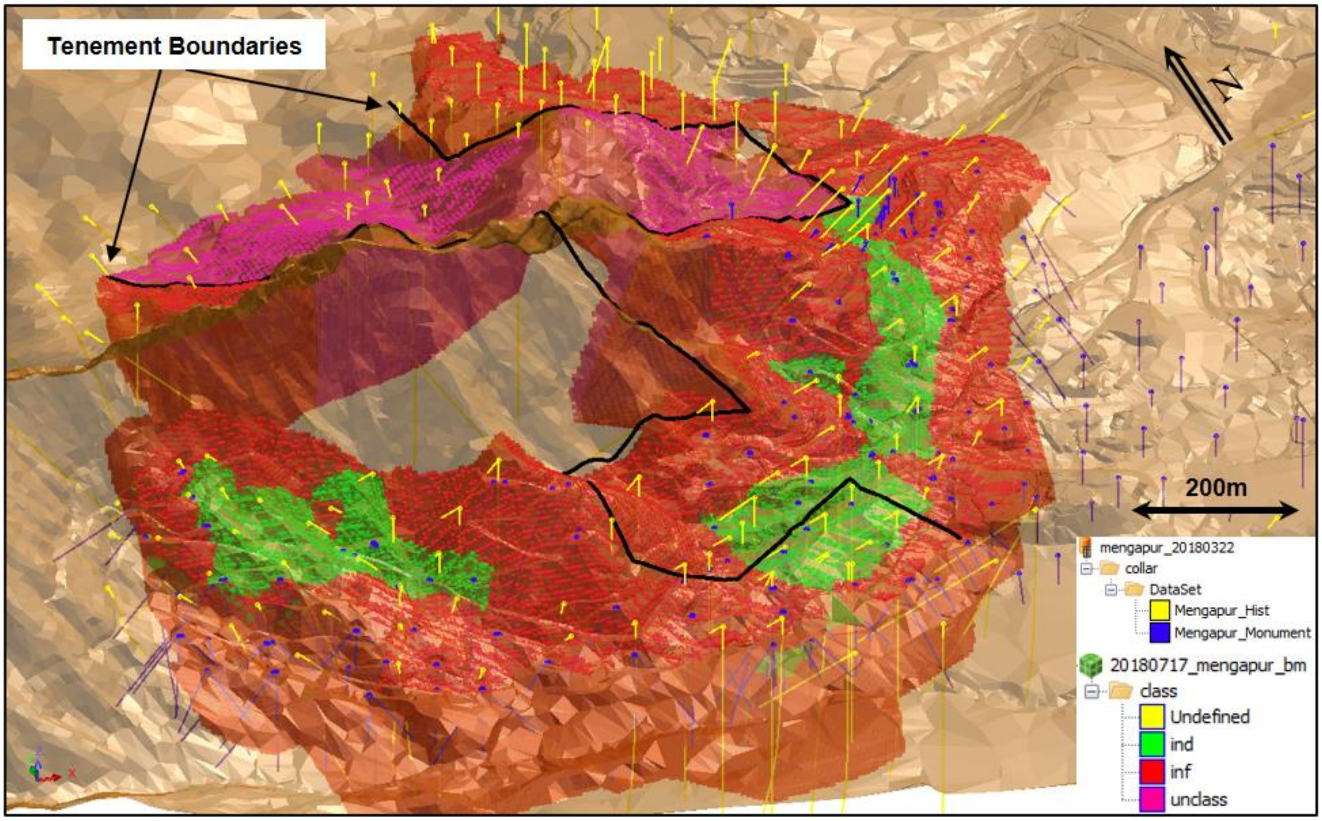
- Confidence in the understanding of the underlying geological and grade continuity and the structural characteristics
- Nature and quality of the drilling and sampling data (historical and recent Monument drilling)
- Drillhole spacing
- Analysis of the QAQC data
- Confidence in the estimate of the mineralised volume
- The availability of bulk density data
- The results of model validation.

The resource classification scheme adopted by Snowden for the Mengapur MRE was based on the following:

- Only mineralisation within the CASB and SDSB permit boundaries provided by Monument were classified. All blocks outside these permits are unclassified and do not form part of the reported Mineral Resource.
- The majority of the interpreted mineralisation is within 200 m of the surface and as such considered by Snowden to be within the limits of extraction by open pit mining.
- Mineralisation was classified as an Indicated Resource where the drillhole spacing was 40 mE x 40 mN (or less) and contained within the skarn.
- Mineralisation defined based on drilling wider than 40 mE x 40 mN and constrained within the skarn, gossan or shale, was classified as an Inferred Resource.
- Where there was mostly historical drilling present, mineralisation was classified as Inferred Resource, irrespective of the drillhole spacing.
- Mineralisation delineated using sparse drillhole data or outside the lithological and mineralisation envelopes was not classified.

The classified resource is depicted in Figure 1.1.

Figure 1.1 Mineral Resource classification scheme (oblique view looking northeast)



1.4.7 Mineral Resource reporting

The Mineral Resource for the Mengapur deposit has been reported above a 0.3% Cu cut-off grade. The cut-off grade represents an assumption of a bulk open-pit mining approach with limited selectivity and is based on values used at other similar deposits, along with consideration of the continuity above the cut-off grade. The majority of the interpreted mineralisation is within 200 m of the surface and as such considered by Snowden to be within the limits of extraction by open pit mining. It is assumed mining would likely be by conventional drill and blast techniques. A cut-off grade of 0.5% Cu, which assumes a more selective open-pit mining approach, shows the impact of reporting the Mineral Resource estimate at a higher cut-off grade.

The lower cut-off grade of 0.3% Cu is considered by Monument to be the base case scenario at this stage, however, further study is required to assess mining and processing options, along with costs. The lower cut-off grade represents a more bulk mining approach with limited selectivity, whereas the higher cut-off grade assumes a more selective mining approach.

Monument indicated that no additional mining has occurred since acquisition of the topographic surface (which is based on a combination of light detection and ranging (LiDAR) data from 2013 and ground surveying conducted in 2015) and as such the Mengapur Mineral Resource is considered to be depleted for all open pit mining to October 2018.

The Mineral Resource for the Mengapur Cu-Au deposit, reported above a 0.3% Cu cut-off, is estimated to comprise Indicated Resources of 39.5 Mt at 0.43% Cu and 0.18 g/t Au, along with Inferred Resources of 50.9 Mt at 0.44% Cu and 0.11 g/t Au. At the higher cut-off grade of 0.5% Cu, the Mineral Resource is estimated to comprise Indicated Resources of 8.1 Mt at 0.65% Cu and 0.16 g/t Au, along with Inferred Resources of 10.5 Mt at 0.68% Cu and 0.14 g/t Au. The lower cut-off grade of 0.3% Cu is considered by Monument to be the base case scenario at this stage.

The Mineral Resources at the two cut-offs are summarised in Table 1.3 and Table 1.4 respectively.

Table 1.3 Mengapur October 2018 Mineral Resource estimate (0.3% Cu cut-off, base case scenario)

Resource classification	Material type	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Contained Cu (t)	Contained Au (oz)	Contained Ag (oz)
Indicated	Oxide	6.3	0.45	0.17	9.7	28,300	34,000	1,960,000
	Transitional	9.7	0.48	0.15	9.8	46,800	47,000	3,060,000
	Fresh	23.5	0.41	0.21	4.5	96,400	159,000	3,400,000
	Total Indicated	**39.5**	**0.43**	**0.18**	**6.6**	**170,000**	**229,000**	**8,380,000**
Inferred	Oxide	15.5	0.41	0.06	19.1	63,600	29,900	9,520,000
	Transitional	12.0	0.50	0.10	17.0	60,000	38,600	6,560,000
	Fresh	23.4	0.43	0.14	6.9	100,600	105,300	5,190,000
	Total Inferred	**50.9**	**0.44**	**0.11**	**13.0**	**224,000**	**180,000**	**21,270,000**

Notes: The Mineral Resource is limited to within the CASB and SDSB permit boundaries. Small discrepancies may occur due to rounding. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 1.4 Mengapur October 2018 Mineral Resource estimate (0.5% Cu cut-off)

Resource classification	Material type	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Contained Cu (t)	Contained Au (oz)	Contained Ag (oz)z
Indicated	Oxide	1.3	0.72	0.12	12.3	9,400	5,000	510,000
	Transitional	3.2	0.67	0.13	12.1	21,400	13,400	1,240,000
	Fresh	3.6	0.61	0.22	5.7	22,000	25,500	660,000
	Total Indicated	**8.1**	**0.65**	**0.16**	**9.3**	**52,700**	**41,700**	**2,420,000**
Inferred	Oxide	2.3	0.63	0.07	17.1	14,500	5,200	1,260,000
	Transitional	3.7	0.75	0.17	12.2	27,800	20,200	1,450,000
	Fresh	4.4	0.66	0.14	10.1	29,000	19,800	1,430,000
	Total Inferred	**10.5**	**0.68**	**0.14**	**12.4**	**71,400**	**47,300**	**4,190,000**

Notes: The Mineral Resource is limited to within the CASB and SDSB permit boundaries. Small discrepancies may occur due to rounding. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

1.5 Conclusions and recommendations

The Mengapur Cu-Au Project has an intermittent history of mining, having been exploited for both iron (magnetite within the free-dig oxide zones) and copper. Drilling has identified a continuous zone of copper and gold mineralisation associated with skarn alteration around an adamellite intrusive body.

The project has been drilled using diamond core drilling techniques down to a nominal spacing of approximately 40 m x 40 m in a significant portion of the deposit area. The author is satisfied that the drill sample database and geological interpretations are sufficient to enable the estimation of Mineral Resources and sample security procedures provide confidence in the integrity of the samples and assay results. Based on the available data, the geological interpretation has considered all known material items and represents an accurate reflection of the current geological understanding.

Accepted estimation methods have been used to generate a three-dimensional (3D) block model of copper, gold and silver grades, along with iron, sulphur and cobalt. In Snowden's opinion, the use of ordinary kriging estimation technique is appropriate for the population distribution and statistical characteristics of the deposit. The estimate has been classified with respect to CIM guidelines with the resources classified as a combination of Indicated and Inferred Resources, considering the geological and data confidence, along with the sample spacing that currently defines the deposit. Snowden believes that Monument should be able to increase the confidence of the Mengapur Mineral Resource through additional drilling and geological assessments.

Metallurgical testing of oxide, transitional and sulphide mineralised samples has been carried out. Results for oxide and transitional samples suggest some acid leachable copper is present in these materials. However, the range of extraction values is such that more detailed assessment of the extent of leachable copper recovery is required. This should aim to tie leachable copper values to the Mengapur resource model. The sulphide material tested has been shown to be amenable to copper sulphide concentration to near, or at typical commercial Cu grades, while achieving modest metal recovery. The extent of sulphide copper recovery should ideally be related to the resource model. Potential for by-product precious metal is apparent, but needs further assessment.

The following key recommendations are made with respect to ongoing work at the Mengapur Cu-Au Project:

- It is recommended that additional bulk density measurements, from all lithology types and oxidation states, are conducted to verify the bulk density values and assumptions applied to the resource model.
- Snowden recommends that Monument complete a pattern of closer spaced drilling (to approximately 10 m x 10 m spacing) in a portion of the resource to better define the short range geological and grade continuity.

- In order to increase confidence in the resource estimate, additional drilling will be required where the resource is predominantly informed by historical drilling or drilling of sub-optimal orientation.
- Additional geotechnical and metallurgical testwork will be required to inform mining studies.
- Given the level of corrosion Snowden observed, it is recommended that Monument source independent advice regarding the existing processing plant.
- Additional metallurgical testwork is required on oxide, transitional and sulphide samples to optimise the copper recovery and improve the quality of the copper concentrates.
- Further metallurgical testwork should be carried out to quantify the potential for the recovery of by-product metals including gold, silver and possibly molybdenum or bismuth. A separate exercise to assess the potential benefit of pyrrhotite recovery should also be completed.

2 INTRODUCTION

This Technical Report has been prepared by Snowden for Monument in compliance with the disclosure requirements of the Canadian National Instrument 43-101 (NI 43-101) and in accordance with the requirements of Form 43-101 F1.

Unless otherwise stated, information and data contained in this report or used in its preparation has been provided by Monument.

The Qualified Persons for preparation of the report and the status of project site visits are shown in Table 2.1.

The responsibilities of each author are provided in Table 2.1.

Table 2.1 Responsibilities of each co-author

Author	Company	Qualified Person responsible for sections	Site visit
John Graindorge	Snowden	1 (excluding 1.3), 2–12, 14–20	Mengapur Project – 1 May 2018
Mike Kitney	Monument	1.3, 13	Mengapur Project – January 2015, along with several visits in late 2013 and 2014

John Graindorge is an employee of Snowden, an independent Qualified Person for the Mengapur Mineral Resource estimate. Mike Kitney is an independent Board Member of Monument, a Qualified Person for the metallurgical aspects of the Technical Report.

Unless otherwise stated, all currencies are expressed in US dollars ($). Tonnage units are expressed as metric tonnes where 1 tonne = 1,000 kg. Contained gold and silver metal is expressed as Troy ounces (oz), where 1 oz = 31.1035 g.

All grid locations are measured in Malaysian Rectified Skewed Orthomorphic (MRSO) mine grid coordinates (easting and northing) in metres using the Kertau 48 map datum.

The effective date of the report is 29 October 2018.

3 RELIANCE ON OTHER EXPERTS

This Technical Report has been prepared by Snowden on behalf of Monument. The information, conclusions, opinions and estimates contained herein are based on:

- Information available to Snowden at the time of preparing this technical report including previous reports prepared on the Project and associated licences within the Project
- Assumptions, conditions and qualifications as set forth in this Technical Report
- Data, reports and other information supplied by Monument and other third party sources.

The results and opinions expressed in this report are based on the author's field observations and assessment of the technical data supplied by Monument. The author has reviewed all the information provided by Monument and believes it to be reliable.

Snowden has not researched property title or mineral rights for the Mengapur Project and expresses no opinion as to the ownership status of the property. As such, the description of the property, and ownership thereof, as set out in Section 4 in this Technical Report, is provided for general information purposes only.

Snowden is reliant on reports, opinions, or statements of other experts who are not Qualified Persons, or on information provided by the issuer, concerning legal, political, environmental, or tax matters relevant to the Technical Report. Specifically, Snowden has relied upon a letter provided by Monument dated 1 September 2018 with the legal opinion of Amelda Fuad Abi & Aidil[1] relating to the Mengapur tenement status.

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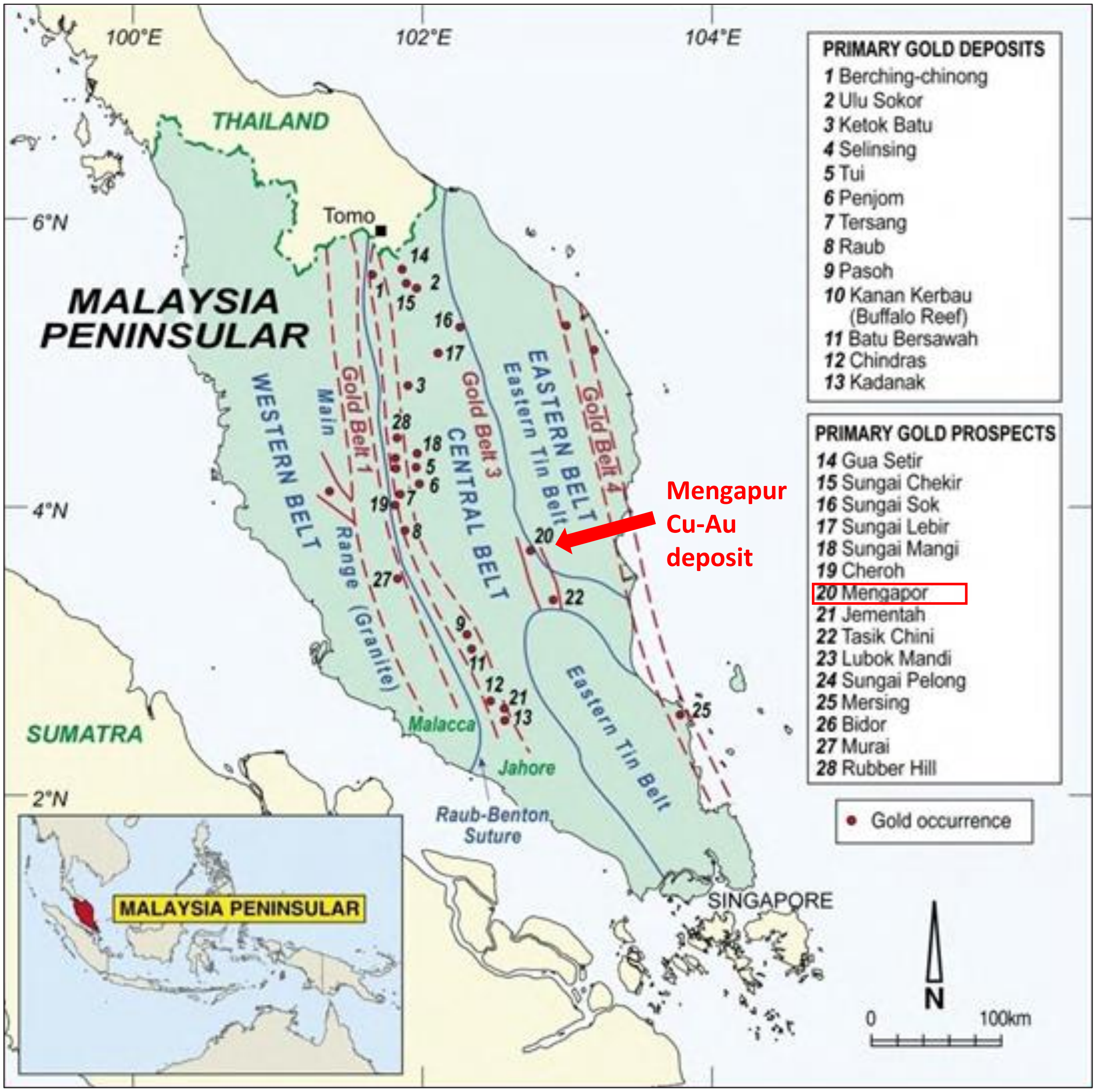
[1] Amelda Fuad Abi & Aidil, Legal Opinion on Mengapur and Star Destiny Sdn. Bhd. Mining Tenements – NI43-101 Report, letter to Monument Mining Ltd, dated 1 September 2018, 2 pp.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Location

The Mengapur copper-gold deposit is located in Pahang State, Malaysia. The project lies approximately 13 km northwest of the town of Sri Jaya, which is on the Kuala Lumpur-Kuantan road, and 145 km northeast of Kuala Lumpur, the capital of Malaysia (Figure 4.1). It is centred on UTM coordinates 536,000 mE and 417,000 mN (Zone 48N).

Figure 4.1 Mengapur location map (modified from Yeap, 1993)



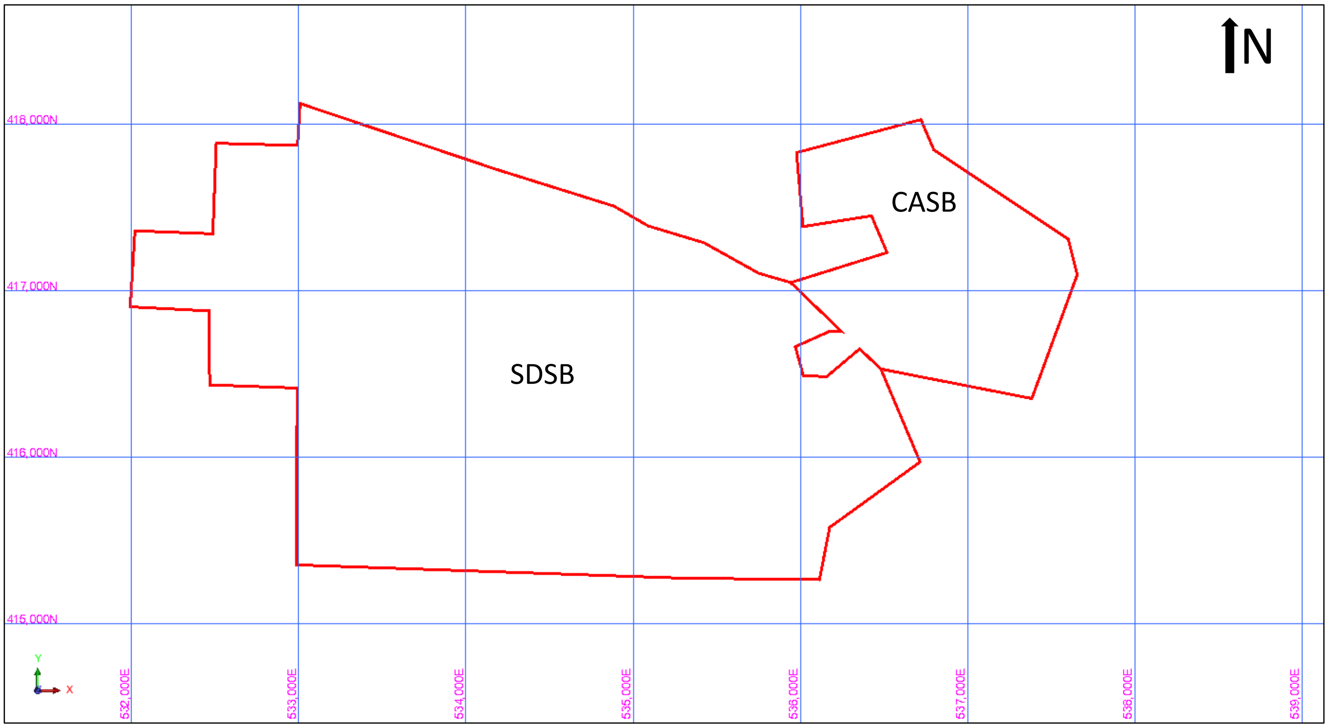
Source: Monument

4.2 Type of mineral tenure

The Mengapur Project is located in the Malaysian state of Pahang and 100% owned by Monument Mining Limited through its holding company, Monument Mengapur Sdn Bhd (MMSB) in Malaysia, which in turn holds tenements through two wholly-owned subsidiaries, Cermat Aman Sdn Bhd (CASB) and Star Destiny Sdn Bhd (SDSB). The tenements cover approximately 935.1 hectares (ha) (Figure 4.2). CASB owns mining lease ML8/2011 (refer Section 4.2.1 below) and SDSB owns prospecting licence SKC(H)1/2008 (refer Section 4.2.2 below).

All tenements are issued by the State Land and Mine Department in Pahang. Monument has submitted several additional land applications to the Malaysian Government for adjacent lands totalling over 1,466 ha, which Snowden understands are still in the review process and as such, do not form part of this Technical Report. The permit details for the CASB and SDSB permits are summarised in Table 4.1.

Figure 4.2 Tenement map



Source: Monument

Table 4.1 Tenement details

Name	Application area (ha)	Granted area (ha)	Title no.	DOU (date of official granting by government)	Current status	Expiry date
CASB	185.1	185.1	ML8/2011	01/06/2011	Renewal granted as of 1 June 2018	31/05/2020
SDSB	750	750	SKC(H)1/2008	25/09/2008	Pending approval for renewal	23/09/2012

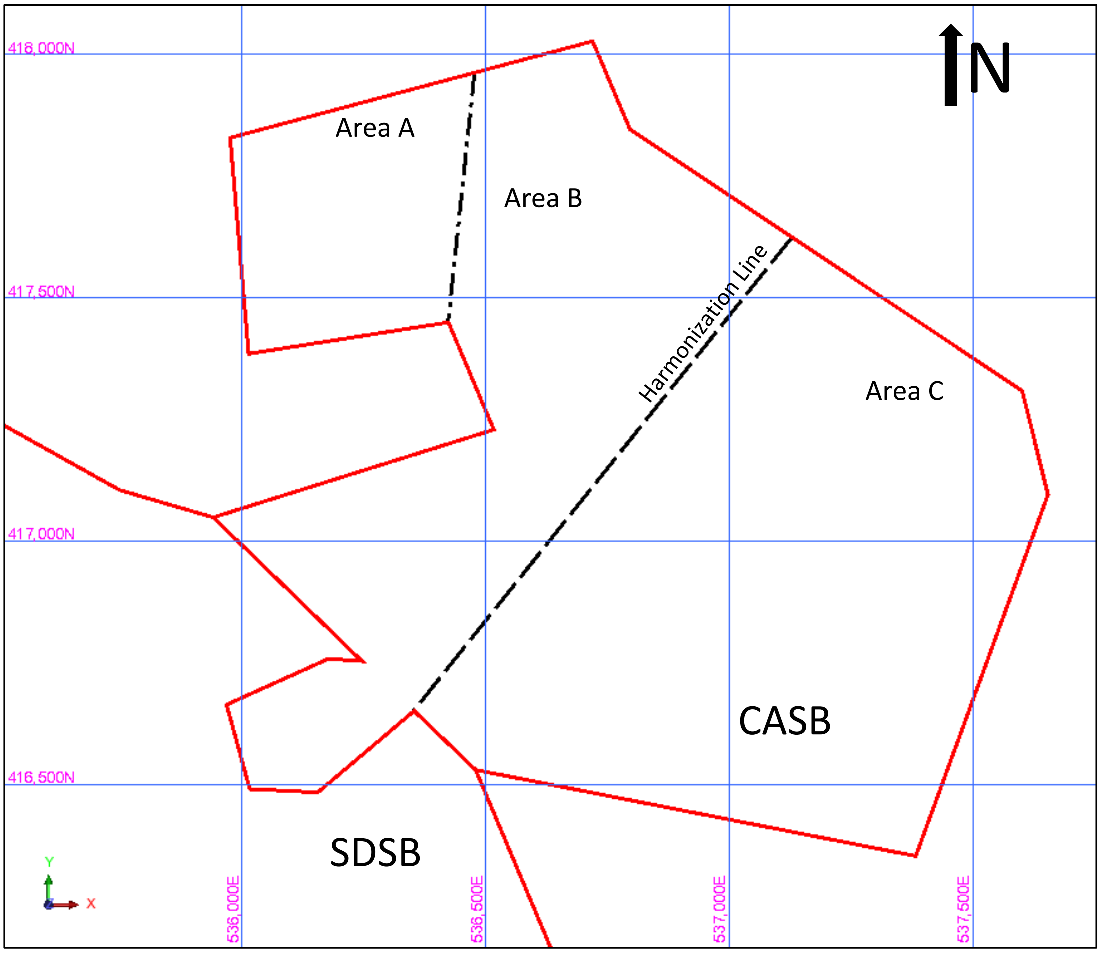
4.2.1 ML8/2011

The title to ML8/2011 (Lot #10210) was registered under CASB on 1 June 2011 for five years. It has since been renewed every two years; on 1 June 2014, 1 June 2016 and 1 June 2018, expiring 31 May 2020. The area included in this title covers 185.1 ha in the Kuantan district. Fees paid for CASB are determined by the Mineral Act of 2001 and set at Malaysian Ringgit (RM) 117,660 due every two years.

There are no encumbrances, mortgages, charges, liens or other interests and/or prohibitory orders registered on or against ML8/2011[2].

In 2012, Monument acquired from Malaco Mining Sdn Bhd (Malaco) 100% of ML8/2011 excluding free-digging oxide magnetite materials in the topsoil, divided into Area A, Area B and Area C (“Malaco Interest”) as detailed in Section 4.3 below and shown in Figure 4.3. In February 2014, Monument acquired 100% of the Malaco Interest in Area C in accordance to the Oxide Magnetite Purchase and Profit-Sharing Agreement.

Figure 4.3 **CASB tenement showing Areas A and B to the northwest of the Harmonization Line, covered under the Harmonization Agreement**



Source: Monument

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[2] Amelda Fuad Abi & Aidil, *Legal Opinion on Mengapur and Star Destiny Sdn. Bhd. Mining Tenements – NI43-101 Report*, letter to Monument Mining Ltd, dated 1 September 2018, 2 pp.

4.2.2 SKC(H)1/2008 renewal

The title to SKC(H)1/2008 was registered under SDSB on 24 September 2008 for four years as a prospecting permit, which expired on 23 September 2012. The area included in this title covers 750 ha in the Kuantan district. Monument acquired SDSB and SKC(H)1/2008 on 21 November 2011.

In November 2011, prior to expiry, SDSB filed a valid application with the Pahang Forest Department for renewal of the exploration permit. As of the effective date of this report, renewal of the exploration permit is pending a decision from the Forestry Department of Malaysia. Legal advice[2] indicates that there are no legal impediments to SDSB's renewal application being granted and that there are no encumbrances, mortgages, charges, liens or other interests and/or prohibitory orders registered on or against SKC(H)1/2008 or its renewal application.

4.3 Royalties, back-in rights, payments, agreements, encumbrances

Prior to June 2015, mining leases in Malaysia carry a 5% gross revenue royalty payable to the Malaysian government. In June 2015, the Pahang state government gazetted a new royalty rate for gold, tin, bauxite and iron ore of 10%, applicable to any tenements granted or renewed after the effective date. The royalty rate for copper, silver and other metals remains at 5%.

Pursuant to the terms of the acquisistion agreement in relation to ML8/2011 dated 23 November 2011, CASB has committed to pay Malaco US$7/t of Primary Iron Ore in the skarn extracted on a free-on-board (FOB) basis.

MMSB and its subsidiary CASB entered into a Harmonization Agreement in October 2012 (Figure 4.3) with Phoenix Lake Sdn Bhd (PLSB) and ZCM Minerals Sdn Bhd (ZCM) – the "Third Parties". Pursuant to the Harmonization Agreement, the Third Parties have exclusive rights to assess and mine near-surface free-digging oxide magnetite contained in topsoil overburden at Area A and Area B under certain conditions and to purchase oxide magnetite from CASB and such rights are not transferable without consent from MMSB and CASB; CASB retains its right to protect its other mineral assets in the topsoil and continue developing access to its resources. Monument carried out grade control and supervision over the Third Parties' mining operation, including collecting proceeds from oxide magnetite sales on behalf of Malaco, with all operating costs incurred by MMSB to be recovered in full with administrative fees applied.

Pusuant to the profit-sharing arrangement related to the acquisition of the Malaco Interest in Area C in February 2014, Malaco will receive, based on a sliding scale profit-sharing arrangement, a share of profit up to US$5/t of Area C marketable grade magnetite delivered and sold by CASB at the nearby Kuantan port. However, no profit-sharing payment will be payable to Malaco on the first US$10.0 million net profits generated from the sales of marketable grade magnetite production from the Area C overburden.

4.4 Environmental liabilities

Prior to Monument's involvement in 2011, the project site was operated by MMSB, which built and operated a 500,000 tonnes per annum (t/a) flotation plant and developed the sulphide open pit. This was guided by the environmental impact assessment (EIA), as approved by the Department of Environment (DoE):

- Production of 3,600 tonnes of copper per annum or 18,000 tonnes of copper concentrate per annum from sulphide ore to be extracted using flotation
- Production of 10,000 tonnes of copper cathode plates per annum extracted from oxide ore to be extracted using heap leaching.

The EIA report was approved with terms and conditions stipulated by the DoE on 13 September 2007. The approval terms include control of earthworks and mining activities; control and supervision of water, air and noise quality; management of waste material, emergency and safety control; environmental mitigation plans; restoration and abandonment plans and management and description of the statutory reporting requirements. Any changes of the processing flowsheet may require written approval from the DoE.

An environmental management plan and erosion, sedimentation control plan were prepared to ensure all activities comply with the requirements of the DoE. This plan describes the Project's environmental conservation policy and procedure and was submitted to the DoE in January 2008.

Malaysian mining regime requires an operational mining scheme (OMS) be submitted by the leaseholder to the Department of Mineral and Geoscience (DMG) of Pahang State over each mining lease period. Upon approval, the operation can start according to the guidance provided in the OMS. Monument indicated CASB has operated under a valid OMS over all past lease periods and shall submit a new OMS for approval on each mining lease renewal.

In 2011, as a part of environmental due diligence conducted during project acquisition, Monument engaged AECOM to undertake an environmental impact gap analysis for the Mengapur Project. AECOM's December 2011 report (AECOM, 2011) identified and reviewed past and current practices, activities and conditions that could affect the environment; including soil, groundwater and/or surface water; identified and critiqued current and historical compliance issues and recommended a consistent and systematic approach. The due diligence included site reconnaissance and sampling of key parameters such as water, air quality, noise, effluent discharge and soils. AECOM identified some non-compliance and suggested mitigation. The non-compliance issues have subsequently been addressed by Monument.

The monitoring and sampling of key environmental parameters are undertaken monthly and reported to the DoE. During the care and maintenance period, the DoE agreed that the sampling frequency could be quarterly and audited qurterly by a third-party auditor. Current environmental management and mitigation works include maintenance of erosion control infrastructure, desilting of sedimentation ponds, hydroseeding work and planting of trees and grass on non-active slopes.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

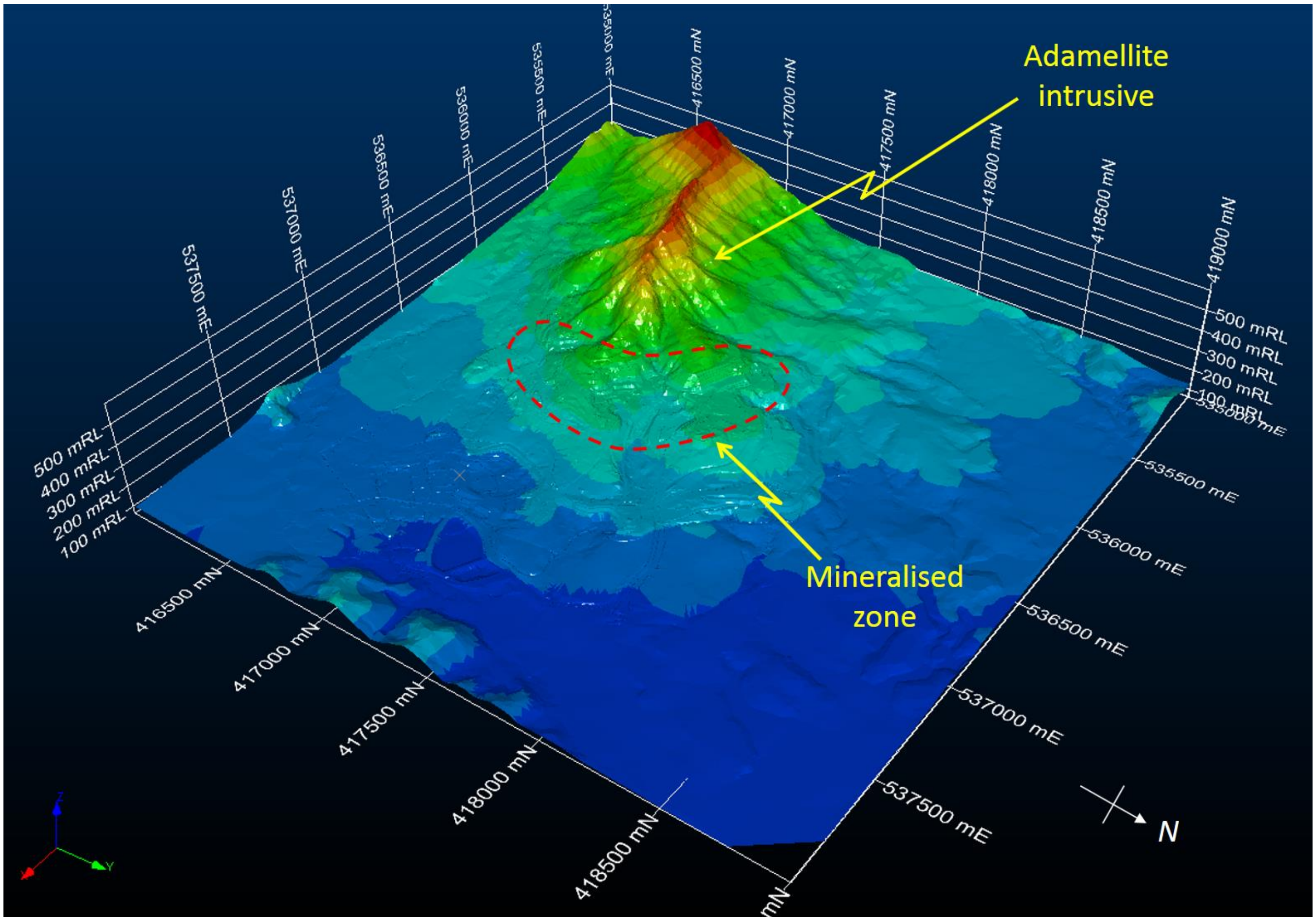
5.1 Topography, elevation and vegetation

The Mengapur region is dominated by a hilly to mountainous limestone karst terrain (Figure 5.1). The mining areas surround an adamellite intrusive which forms a prominent mountain rising some 350 m above the topographic low regions (Figure 5.2), with the summit at approximately 510 m above sea level.

Figure 5.1 Photo showing limestone karst mountains to the south of the Mengapur Project area

Note: Photo taken during April 2018 site visit

Figure 5.2 **Topography of Mengapur Project area**



The Mengapur site is located adjacent to the Hutan Simpan Berkelah forest reserve; however, the eastern side of the Project area is dominated by palm oil plantations. The Project area is covered by secondary jungle surrounded by virgin forest and palm oil plantations. It is situated in an area of dipterocarp forest, the majority of which was previously logged. On the steeper and less accessible lands to the west and northwest, primary dipterocarp forest occurs in a virtually undisturbed state.

5.2 Access

The Mengapur Project is accessed by approximately 16 km of dirt roads from the town of Seri Jaya, located to the southeast of the Project. Sri Jaya is located approximately 180 km from Kuala Lumpur, the capital of Malaysia, and 55 km from the port city of Kuantan, via sealed highways.

5.3 Proximity to population centre and transport

The largest nearby town is Maran, located approximately 20 km south of Mengapur, while Kuantan, a port city with a population of around 370,000, is located 55 km east of Sri Jaya.

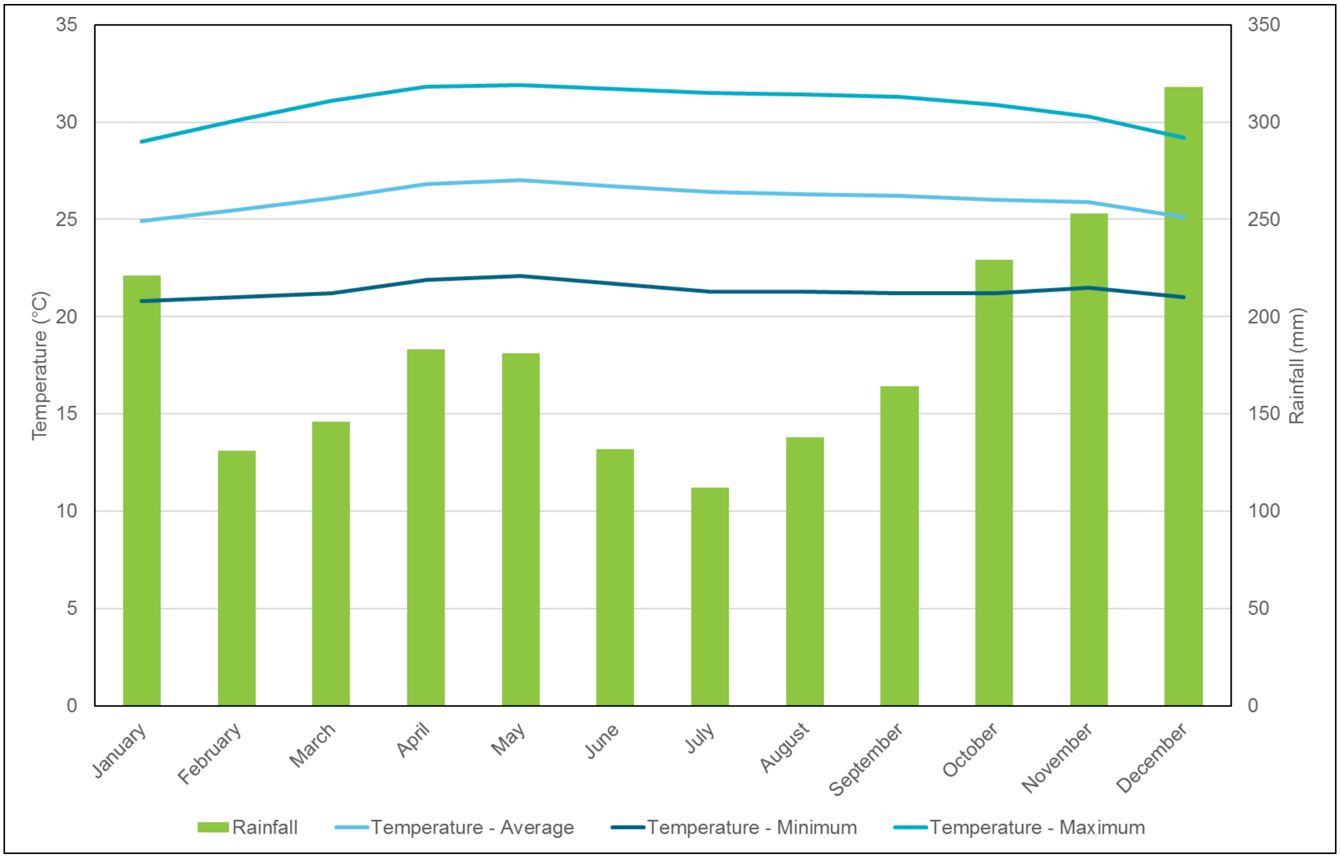
5.4 Climate and length of operating season

Average monthly temperatures at Maran[3] vary from around 25°C to 27°C (Table 5.1 and Figure 5.3). Rainfall occurs throughout the year, averaging approximately 184 mm/month, with increased rainfall from October through to January, which average around 255 mm/month. No operating season is recognised, with activities able to be conducted across the full year.

Table 5.1 Climate of Maran

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average temperature (°C)	24.9	25.5	26.1	26.8	27.0	26.7	26.4	26.3	26.2	26	25.9	25.1
Minimum temperature (°C)	20.8	21.0	21.2	21.9	22.1	21.7	21.3	21.3	21.2	21.2	21.5	21.0
Maximum temperature (°C)	29.0	30.1	31.1	31.8	31.9	31.7	31.5	31.4	31.3	30.9	30.3	29.2
Rainfall (mm)	221	131	146	183	181	132	112	138	164	229	253	318

Figure 5.3 Climate of Maran



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[3] Climate data from https://en.climate-data.org/location/184455/ accessed in July 2018

5.5 Infrastructure

The Mengapur site is currently under care and maintenance, with approximately seven staff on site, with additional support for health and safety, along with maintenance provided by Monument's Selinsing personnel, as required.

Existing facilities at the Mengapur Project (Figure 5.4 and Figure 5.5) include:

- A two-stage crushing plant
- A copper processing plant, designed to produce a sulphide concentrate, consisting of a two-stage grinding mill and froth flotation cells
- Test leach pad area (unlined)
- Two unlined tailings storage facilities (TSFs) and related equipment (e.g. pumps and piping)
- Several unlined process water ponds
- Several aboveground storage tanks
- Eight unlined stockpile areas with no seepage collection controls
- Three waste dumps
- Covered warehouse
- Core storage, sample storage and logging facilities
- Temporary storage areas
- Four 1 Mw diesel generators
- Laboratory building and equipment
- Staff accommodation and messing facilities for up to 76 people
- Support facilities including administrative offices.

At the time of Snowden's site visit, miscellaneous mill equipment, including flotation cells and magnetic separators, was being stored in the covered concentrate warehouse on the western side of the processing plant.

Whilst the Qualified Person is not qualified to comment on the plant design, construction or equipment maintenance, significant corrosion of the structural steel and tanks was observed in places (e.g. flotation circuit). If refurbishment and modification of the existing plant is contemplated, the corroded steelwork will likely require remediation or potentially replacement to ensure the structural integrity of the processing plant (Figure 5.6).

5.5.1 Power

Power for the site, including the laboratory is provided by two 500 kVA generators. Four 1 MW diesel generators are available, but are not currently used.

5.5.2 Water

Water supply for both domestic and industrial use is extracted from the forest catchment area by gravity to raw water tanks for distribution to quarters. Potable (drinking) water is currently purchased by Monument in 19-litre bottles as required. There is no raw water treatment facility at the Mengapur site.

5.5.3 Laboratory

The laboratory is currently not in use but was previously run by SGS up until March 2017. The laboratory has not been used since SGS ceased activities. Facilities include a sample preparation area with drying ovens, crushers and pulverisers, a fire assay area with fusion and cupellation furnaces, and an analysis area with AAS and ICP instruments.

5.5.4 Tailings storage facilities

The two TSFs are located northeast of the plant area and directly north of the staff living quarters. The largest southern tailings pond has a water volume of 120,575 m^3 and, according to Monument, has a reported design capacity of 1,920,000 m^3. The pyrrhotite pond has a volume of 3,724 m^3.

The TSFs are located to the northeast of the site, next to the company staff living quarters. There are two tailing storage ponds; the two ponds are connected via a culvert at the northern part of TSF1. Discharge from the mine processing area is channelled into TSF1 through a main discharge inlet on the south-eastern tip of TSF1. Discharge from TSF2 is via a final spillway to the east of the pond into an earthen drain on the eastern boundary of the site. This earthen drain runs parallel to the eastern boundary of the site and collects discharges from the staff living quarters in addition to the TSF discharge. An underground culvert located to the east of TSF1 diverts the water flow from the earthen drain into a tributary of Sungai Berakit on the other side of the eastern perimeter access road, before converging into Sungai Lepar which is located approximately 2 km to the northeast of the subject site.

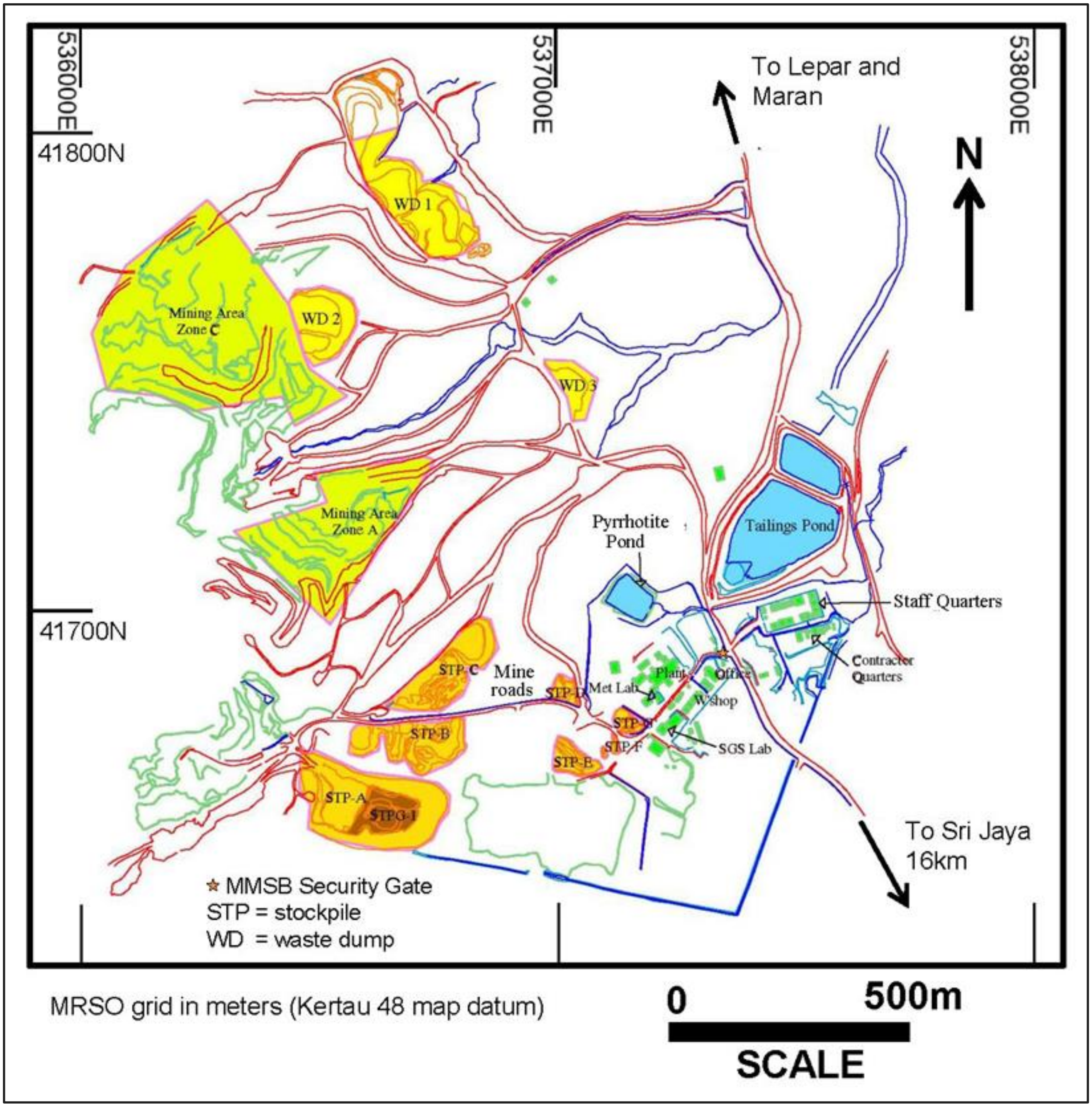
A process water pond is located to the northwest of the processing plant. Process water was recirculated using a submersible pump located by the western side of the process water pond. Used process water from the processing plant was drained into the process water pond through an unlined drain which has two of its underground culvert sections made of metal drums. In addition to process water generated from the processing plant, the process water pond also collects water from the surrounding area through surface runoff or from rainfall. Excess water is discharged through an outlet located to the north-eastern corner of the process water pond into an adjacent drain which runs in a north-easterly direction to TSF1.

There are three other ponds close to the process water pond. To the south of the process water pond, next to the magnetite stockpile, there is a magnetite pond for the storage of discharge/spills from the flotation column.

The TSFs, process water ponds and the connecting drainage are not lined.

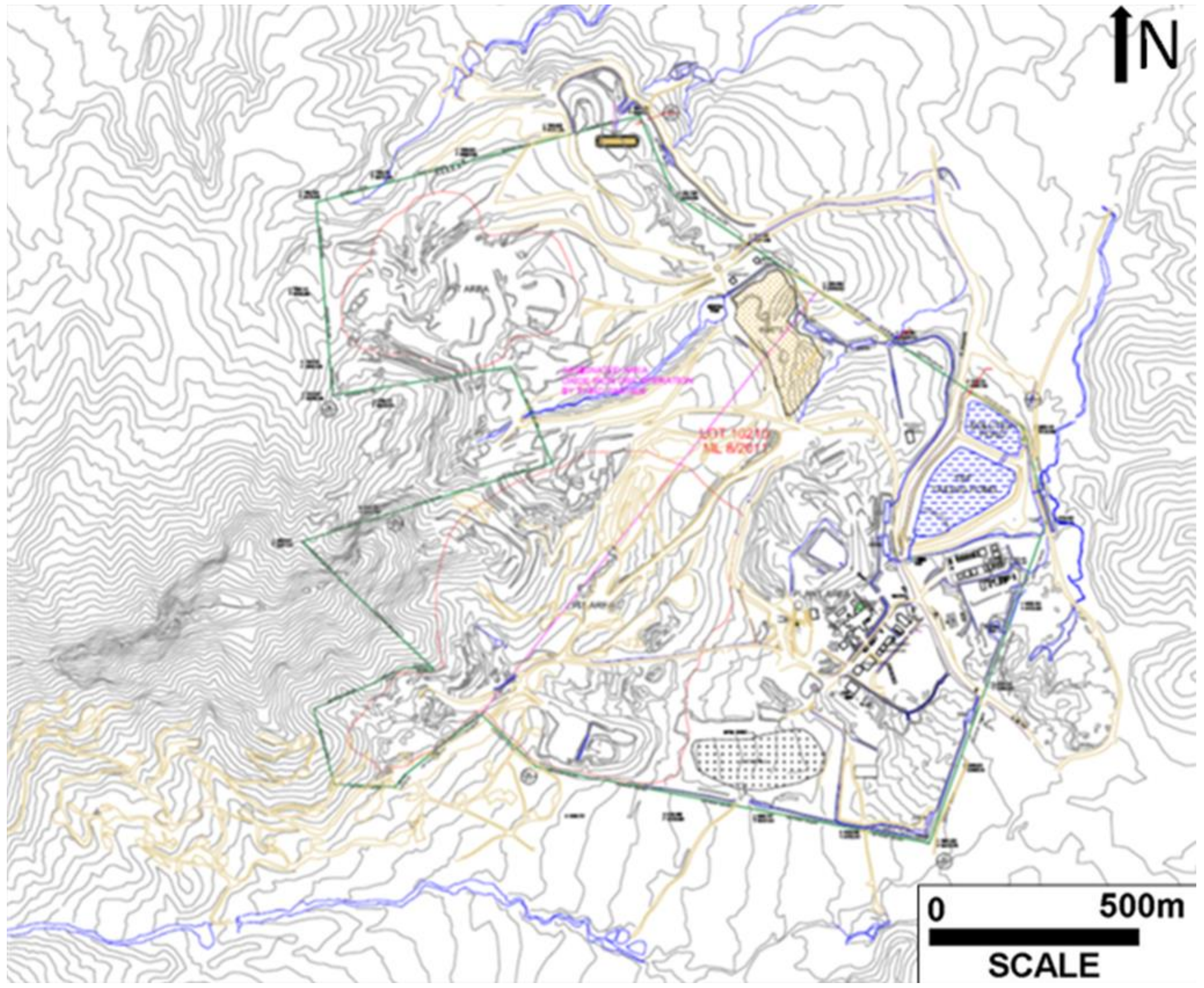
Snowden understands that Monument is planning to acquire adjoining land that was designated in the historical 1990 feasibility study (Normet, 1990) for TSF development.

Figure 5.4 Mengapur site plan as of January 2014



Source: Monument

Figure 5.5 Mengapur site plan as of March 2015 with CASB permit boundary



Source: Monument

Figure 5.6 **Photos of Mengapur plant and infrastructure taken during April 2018 site visit**

Power generators

Primary crusher

Milling (fore) and secondary crushing (back)

Corrosion of structural steel

Flotation circuit

Flotation circuit

Note: Photos taken during April 2018 site visit

6 HISTORY

6.1 Prior ownership and ownership changes

The Mengapur deposit was first identified by the Geological Survey of Malaysia (GSM) from a reconnaissance drilling program carried out in 1979/1980. Twelve diamond drillholes were drilled to investigate a geochemical anomaly detected during an earlier survey. Following this, an agreement was signed between the Government of Pahang and MMC on 16 August 1983. Under the terms of the agreement, the State Government agreed to grant MMC and/or the Operating Company, Mining Rights within 12 months after completion of the exploration and prospecting works or studies, whichever was the later, upon such terms and conditions to be agreed for a 198 km^2 project area at Mengapur.

The MMC interest was to be finalised after completion of a positive feasibility study. After completing a drilling program from 1983 to 1988 and a definitive feasibility study in 1990, MMC did not pursue development of Mengapur and the land reverted back to the Government of Pahang some time after 1993.

Some time before 5 July 2005, CASB acquired the mining lease to Lot 10210 in Hulu Lepar Subdistrict, Kuantan District that covered the majority of the historical reserve outlined in the designed pit. On 5 July 2005, Malaco, a wholly-owned subsidiary of Sumatec Resources, purchased 58% of CASB. Malaco later acquired the remaining 42% of the company. On 1 June 2006, CASB signed an agreement with the State of Pahang and acquired an OMS.

On 17 March 2008, Sumatec sold all its shares in Malaco to Diamond-Hard Mining Sdn Bhd.

Monument acquired the SDSB prospecting licence in November 2011 and has since submitted additional land applications to the Malaysian Government. In 2012, Monument acquired a 100% interest in CASB, which owns 100% of the mining lease for Lot 10210, through two transactions from MMSB. As a result, Monument owns 100% of the Mengapur Project.

In 2012, an iron ore dispute arose in relation to iron ore operations carried out by PLSB and ZCM within certain areas of the Mengapur Project, where the topsoil not only contain oxide iron ore that PLSB and ZCM are exclusively entitled to mine and to purchase, but also contain elevated copper grades across certain parts of the Mengapur mining lease which belong to Monument. Monument signed a Harmonization Agreement on 3 October 2012 between PLSB, ZCM, MMSB and its subsidiary CASB. In the Harmonization Agreement, PLSB and ZCM recognised that MMSB was the exclusive operator for the Mengapur Project and the owner of other metals in the top soils at the designated area and would cooperate with MMSB in order to protect and preserve other metals during its mining and removal of raw iron ore materials; where MMSB and CASB recognise that PLSB/ZCM have exclusive rights to excavate, load, transport and purchase the raw iron ore materials in the top soils from the designated area except other metals and would cooperate with PLSB and ZCM for their iron ore operations. The Harmonization Agreement contains terms such that both parties shall carry out their mining operations in compliance with all environmental and other requirements under the Malaysia mining laws and regulations. Monument indicated to Snowden that the agreement does not affect in any way the company’s interest and ownership in the mineralisation contained within the skarn under the free-digging soils.

On 29 January 2014, Monument entered into a binding Oxide Magnetite Purchase and Profit-Sharing Agreement with Malaco. The agreement confirms Monument’s ownership to oxide magnetite materials in the top soil of Area C and approximately 1.2 Mt of stockpiled iron oxide materials, which was intended to be used as initial inventory for approximately the second year of iron oxide production.

The decision to proceed with recovering the iron oxide to concentrate will depend on the prevailing market price of the iron product, and it is currently on hold. There is an expectation by Monument however that PLSB may resume the production of magnetite iron ore in the future.

Development of the Mengapur Project was placed on hold in 2015 due to a change in Monument's corporate focus to development of its gold portfolio[4]. Consequently, the main plant at the Mengapur site was placed on care and maintenance.

Until 2015, Monument, through MMSB, provided grade control for the oxide mining operations, including air-rotary blasthole drilling, assaying, and geological and survey supervision, in order to track ore grades and provide safe active mining faces and open pit slopes. In addition, MMSB was responsible for a weighbridge operation and other administrative activities related to oxide mining activities on the CASB tenement including making royalty payments to the government.

6.2 Previous exploration

Numerous exploration programs are known to have been conducted at Mengapur since 1962.

In 1962, two small Malaysian companies, the Asia Mining Company and the Jaya Sepakat Mining Company, explored for iron over the Mengapur area and found three areas of skarn mineralisation. During this time, several drillholes and trenches reportedly defined a small volume of iron hosted in near surface soils. The iron-bearing soils were never historically mined as they contained a high base metal content above the marketable limits of the time (Kow & Chang, 1981).

A regional geochemical stream sediment sampling survey and surface geological mapping was conducted over the Mengapur region from 1972 to 1976 by Kow. This work generated an 80 km^2 area of anomalous lead and zinc centred on the Mengapur area. Additional stream sediment sampling and geochemical work in this area was carried out in 1978 and 1979. This program resulted in a large multi-element drainage basin anomaly for lead, zinc, copper, molybdenum and arsenic. Soil sampling over the same area also took place during this period which reportedly returned significant geochemical anomalies that confirmed the earlier stream sediment anomalies.

The Mengapur deposit was later identified by the GSM from a reconnaissance drilling program carried out in 1979 and 1980. Twelve diamond drillholes were drilled to investigate the geochemical anomalies detected during the earlier work programs.

Five phases of drilling were conducted by MMC at Mengapur from 1983 to 1989, which were incorporated into resource and reserve estimates as part of a feasibility study completed in 1990 (Normet, 1990). A total of 210 diamond drillholes (DDMEN numbered drillholes) were completed by MMC between 1983 and 1989, amounting to 59,318 m. Minimal details are available on the procedures or quality of the sampling undertaken during these programs. In addition, the historical drill core was lost due to a fire at the site core shed in 2005. The MMC drilling phases between 1983 and 1989 are summarised as follows:

- Phase one of MMC's drilling program was carried out between November 1983 and March 1985 and totalled 49 drillholes at a spacing of 140–200 m for a total of 17,254 m. Gravity and magnetic surveys were undertaken in 1984 to help target additional drillholes.
- Phase two drilling commenced in April 1985 and consisted of 42 drillholes at a spacing of between 100 m and 200 m for a total of 17,174 m to the end of December 1985. These drillholes were drilled at 45° to 60° inclinations from the horizontal at variable azimuths. Most of these drillholes were completed to depths of 300–400 m below surface with some up to 700 m.
- Phase three infill diamond drilling was carried out between April and November 1986 and consisted of 74 holes totalling 17,298 m. This drill program reduced the average drillhole spacing to 70 m in Zones A and B and 100 to 200 m in Zone C.

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[4] Monument Mining Limited news release dated 1 October 2018, *Monument's Fourth Quarter and Fiscal 2018 Results,* https://www.monumentmining.com/news-media/news/2018/monuments-fourth-quarter-and-fiscal-2018-results/

- Phase Four diamond drilling was carried out between February 1987 and January 1988 and comprised 33 infill holes to delineate the higher grade zones in greater detail. An initial metallurgical testing program was also conducted during this time.
- Phase five drilling was carried out from October 1988 to January 1989 and included eight oriented diamond core drillholes for geotechnical assessment. In addition, five shafts totalling 271.5 m were excavated from 1988 to 1989 to collect additional metallurgical test data, mineralogical data, and specific gravity data. The shafts were sampled on 3 m vertical increments using a rotary vezin-type sampler.

Minimal exploration was conducted from 2005 to mid-2011; however, as discussed in Section 6.4, production was achieved, with the processing plant commissioned in October 2008. Snowden understands that approximately 10 diamond drillholes totalling between 300 m and 600 m were drilled at Mengapur from June 2011 to September 2011.

Monument acquired the Mengapur property in 2011/2012 and has drilled 275 holes between 2011 and 2014, comprising a combination of diamond core and RC drilling, totalling approximately 52,738 m. This equates to approximately half the drilling at the Mengapur deposit.

6.3 Historical Mineral Resource and Mineral Reserve estimates

There are no significant historical Mineral Resource or Mineral Reserve estimates for the Mengapur Project that are relevant for disclosure in this Technical Report.

6.4 Production history

The following historical production data was obtained by Snowden from personal communications with Raymond Quah, General Manager of MMSB in 2011 (Snowden, 2012).

MMSB purchased a ball mill and flotation plant in 2005,with a rated capacity of 500,000 tpa and relocated to site around the end of 2007. The project encountered some delays during the second half of 2007, as the DMG required an EIA be completed for the project before issuing an OMS. The first OMS was finally issued by the DMG in January 2008.

From January to October 2008, the copper plant construction, commissioning of the plant equipment, setup of power generating station, setup of the crushing plant and complete refurbishment of the Larox Filter Press control circuit were all carried out. The copper plant was finally commissioned on 16 October 2008.

Excavation of the tailings pond commenced in August 2007 and was completed in April 2008, with the earthmoving equipment moved to the Bukit Botak hill to develop the mine. The mine was developed until about March 2009 and halted for economic reasons.

Approximately 1.8 Mt of rock and soil was mined from June 2008 to April 2009 to support the Cu processing plant (Table 6.1). Approximately 1.4 Mt of soil, topsoil waste, and magnetite and/or hematite-bearing soil were placed in a stockpile/dump located on Lot 10210. The overburden soil covering the underlying Cu-S mineralisation was known to be iron-bearing and the material was stockpiled for future processing.

Table 6.1 Mengapur southwestern pit statistics

Month-Year	Volume mined	
	Soil (m^3)	Rock (m^3)
Jun-2008	61,800	
Jul-2008	69,100	
Aug-2008	69,300	
Sep-2008	64,900	15,100
Oct-2008	67,900	41,800
Nov-2008	55,700	2,500
Dec-2008	85,900	53,200
Jan-2009	49,000	
Feb-2009	48,800	15,800
Mar-2009 to Apr-2009	53,300	
May-2009 to Jul-2010	Nil	Nil
Aug-2010	5,300	7,600
Sep-2010		5,500
Oct-2010		6,300
Nov-2010 to Dec-2010	Nil	Nil
Jan-2011		4,500
Feb-2011 to Mar-2011		12,200
Total volume (m^3)	*631,000*	*164,500*
Density (t/m^3)	2.2	3.2
Total tonnage (t)	**1,388,200**	**526,300**

Source: Quah (2011)

A total of 59,900 t of Cu ore was fed to the processing plant from October 2008 to June 2009, which produced approximately 250 t of copper concentrate grading 8% to 18% Cu (Table 6.2). This ore was not processed for Fe. The final product did not achieve marketable copper grade. The fine grain size of the Cu minerals made it difficult to recover -40 µm Cu minerals, which required re-grinding and re-flotation. The plant ran intermittently until 11 June 2009 when it was stopped due to lack of capital.

Funding became available in June 2010 and the plant circuit twas modified as an iron processing plant. Three crusher lines were installed to produce an iron ore lump product. The crusher plants operated from June 2010 to November 2010 and March 2011 to May 2011 to produce iron ore lump and fines (-10 mm) run of mine (ROM) feed for the iron plant. Additional small scale open pit mining of 115 kt of material from the A Zone (Malaco) pit occurred from August 2010 to July 2011 to support the iron operations.

The iron processing plant was commissioned in November 2010 and operated until July 2011 with short breaks in January/February 2011 and April 2011 for circuit modification. During this period, the iron processing plant at Mengapur processed 27 kt of iron ore to produce 3,200 t of fines (magnetite) averaging 63% Fe with high contained sulphur of 3% to 4% S and an additional 25 kt of lump averaging 42% Fe.

Table 6.2 Mengapur Cu and Fe crusher and processing plant statistics October 2008 to July 2011

Month-Year	Crusher plants		Processing plant	
	Copper (t)	Iron (t)	Copper (t)	Iron (t)
Oct-2008	6,900		*3,000*	
Nov-2008	12,000		*4,000*	
Dec-2008	2,500		*5,000*	
Jan-2009	4,200		*4,500*	
Feb-2009	5,700		*4,500*	
Mar-2009	13,900		11,200	
Apr-2009	8,800		8,600	
May-2009	13,400		13,600	
Jun-2009	4,000		5,500	
Subtotal	***71,300***		***59,900***	
Jun-2010		3,800		
Jul-2010		29,400		
Aug-2010		26,900		
Sep-2010		28,200		
Oct-2010		23,400		
Nov-2010		9,200		1,900
Dec-2010				4,400
Jan-2011				1,600
Feb-2011				1,700
Mar-2011		17,400		8,000
Apr-2011		42,000		
May-2011		29,200		
Jun-2011				7,100
Jul-2011				2,000
Subtotal		***209,300***		***26,700***
TOTAL	***71,300***	***209,300***	***59,900***	***26,700***

Notes: 71,300 t crushed for period October 2008 to June 2009 were for copper processing. Estimated quantity milled is 59,900 t; about 15% (11,400 t) removed at waste belt before the jaw crusher; Average head grade of the ROM feed to Ball Mill is about 0.5% to 0.6% Cu; A lot of the final Cu product was recycled due to low grade; the remaining final Cu product is about 250 t Cu ore grading 8% to 18% Cu; 209,328 t were crushed for iron which produced about 24,966 t iron ore lumps averaging 42% Fe, and 26,693 t were processed for iron fines that produced 3,168 t iron fines averaging 63% Fe; about 161,104 t of non-mag lumps and fines (waste). Italicised figures are estimates. Small discrepancies may occur due to rounding; data from Raymond Quah of Malaco (October 2011).

Source: Quah (2011)

In October/November 2009, ZCM collected and shipped approximately 19,200 t of iron-bearing soils from Mengapur to the port at Kuantan for testing. An agreement completed in late 2010 allowed ZCM to purchase the raw iron-rich soil from MMSB FOB. ZCM set up a washing plant at a neighbouring site. The sale of the raw iron-rich soil for processing at the Phoenix mill started in October 2010. The reported ore tonnes in Table 6.3 mined by ZCM and PLSB were determined by Quah (2011). After quarter 3 of 2012, tonnes were measured at the weigh bridge located just outside the Mengapur gate entrance. In addition, surveys were conducted monthly by MMSB staff to help calculate the mined tonnes. Iron ore mining production from July 2012 to December 2014 (Table 6.4) was determined by Monument from ZCM and PLSB, truck weights and monthly excavation surveys.

In 2013, work at the Mengapur Project included camp development, set up of an on-site laboratory, construction of a metallurgical lab and an initial refurbishment of the existing copper flotation plant. The mine camp was built to house 104 people on site.

An on-site laboratory was built to help support the exploration work. An agreement between the company and SGS Malaysia was finalised in January 2013. Under the agreement, SGS managed and operated the on-site assay lab which included sample preparation facilities (crushing and grinding and drying), fire assay, AAS, LECO and ICP assaying facilities, with a capacity to process 2,000 samples per month. The laboratory ceased operating in March 2017 and is currently on care and maintenance.

A metallurgical test laboratory was constructed next to the flotation plant focusing on improving the copper recovery in the flotation concentrate and copper leaching testwork, along with recovery testwork on marketable iron ore (magnetite and hematite).

Refurbishment of the Mengapur processing plant was carried out in March 2013, which at the time was intended to produce copper concentrate and a magnetite product. Some of the major components refurbished include a new retaining wall and ramp for the ROM bin, replacement of two conveyors at the primary ball mill feed, re-alignment of the primary ball mill and re-grinding mill, and refurbishment of primary mill pumps and cyclone pumps. The refurbishment was planned as a pilot plant to process 30 kt of sulphide mineralisation mill feed to produce a copper concentrate and magnetite product.

Table 6.3 Sale of iron-bearing soil from MMSB claim Lot 10210

Year	Raw iron rich soils (kt)
2010	50
2011	3,020
Total	**3,070**

Source: Quah (2011)

Table 6.4 Mengapur iron ore mining production July 2012 to December 2014

Month-Year	Waste material (t)	Iron ore (t)	Total (t)
Jul-2012	-	44,930	44,930
Aug-2012	-	224,398	224,398
Sep-2012	1,418	301,588	303,006
Oct-2012	35,231	294,800	330,031
Nov-2012	64,465	293,427	357,892
Dec-2012	47,393	227,349	274,743
Jan-2013	77,262	261,899	339,161
Feb-2013	19,777	78,741	98,518
Mar-2013	212,778	150,165	362,943
Apr-2013	-	138,464	138,464
May-2013	188,033	147,153	335,186
Jun-2013	203,436	155,043	358,479
Subtotal	***849,792***	***2,317,958***	***3,167,750***
Jul-2013	137,614	261,715	399,329
Aug-2013	69,812	219,670	289,482
Sep-2013	-	288,348	288,348
Oct-2013	84,238	293,733	377,971
Nov-2013	53,196	252,097	305,292
Dec-2013	12,663	135,833	148,496
Jan-2014	56,434	243,633	300,067
Feb-2014	50,654	152,304	202,959
Mar-2014	121,373	224,022	345,396
Apr-2014	99,289	273,107	372,396
May-2014	206,329	232,289	438,618
Jun-2014	118,045	222,546	340,591
Subtotal	***1,009,648***	***2,799,295***	***3,808,943***
Jul-2014	28,911	202,259	231,170
Aug-2014	187,585	63,534	251,119
Sep-2014	137,182	57,283	194,465
Oct-2014	166,158	108,567	274,725
Nov-2014	286,036	69,483	355,519
Dec-2014	35,747	7,148	42,895
Subtotal	***841,619***	***508,274***	***1,349,893***
TOTAL	***2,701,059***	***5,625,528***	***8,326,586***

7 GEOLOGICAL SETTING AND MINERALISATION

7.1 Regional geology

Peninsular Malaysia forms part of the Sunda Shield and consists of a northerly and north-northwest fold-mountain system that continues and extends from eastern Burma, through Thailand and south-eastwards into Indonesian Borneo (Breward *et al.,* 1994). The Mengapur deposit is located within the Central Belt of the Malay Peninsula (Figure 7.1) that is characterised by a predominance of gold and base metal mineralisation (Scrivenor, 1928). The Central Belt comprises mainly Palaeozoic shallow marine and continental margin sediments and volcanic and volcaniclastic rocks of acid to intermediate composition. The western margin of the belt is defined by the Raub-Bentong suture that is approximately 20 km wide and consists of tectonised metasediments and ultrabasic rocks (melange-type rocks).

The oldest rocks in the area are the Kambing beds (Figure 7.2), an early Carboniferous sedimentary formation which outcrops in the northeast part of the map area. The Seri Jaya beds, consisting of the Jempul slates and the Mengapur limestones, and the Luit Tuffs unconformably overly the Kambing beds which are a sequence of Permian interbedded argillaceous, calcareous and volcanic rocks. The Seri Jaya beds are unconformably overlain by the Buluh sandstones, Tekam and Serentang Tuffs, a sequence of early Triassic arenites and volcanic rocks, and the Semantan Formation that consists of a group of mid-Triassic argillaceous sedimentary and pyroclastic rocks. The mid-Triassic to early Cretaceous Hulu Lepar beds unconformably overly the Semantan Formation and Buluh sandstones and consists of a sequence of coarse-grained, arenaceous, and argillaceous sedimentary rocks with minor volcanics.

There are three phases of intrusive rocks in the region:

1) The late Carboniferous/early Permian Dagut Granite that occurs in the northwest part of the region.
2) The mid-Triassic Lepar Granodiorite that occurs in the western half of the region that consists mostly of dark grey medium-grained hornblende biotite granodiorite, biotite granodiorite, and quartz monzonite with lesser diorite, granite porphyry, and microgranite.
3) The Berkelah Granite that outcrops dominantly in the eastern half of the region (Lee, 1990).

Intrusive rocks exposed around the Mengapur area were mapped as the Lepar Granodiorite by previous investigators. No intrusive rock exposures in the immediate area at Mengapur were mapped on the regional map in 1990 by the GSM (Figure 7.2).

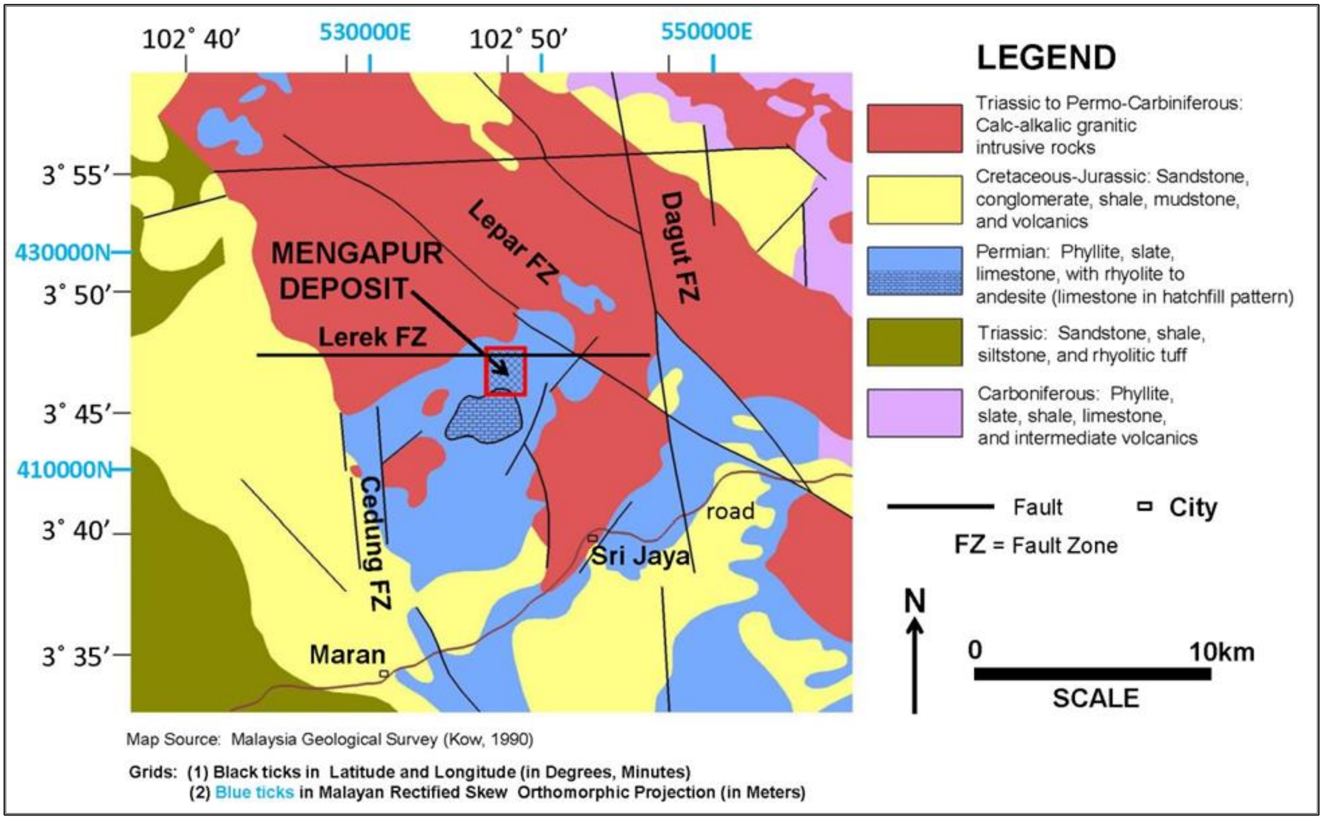
Post-Mesozoic uplift, folding, and faulting occurred in the region during the Cenozoic. Faults in the region are either north-south trending or northwest-trending high-angled normal faults, or east-west and northwest-southeast, or north-northeast to south-southwest trending wrench faults. Numerous synclines and lesser anticlines with north-south and north-northeast striking axial planes have been mapped in the region of the Mengapur District (Lee, 1990).

Quaternary alluvium consisting of unconsolidated fluviatile clay, silt, sand, gravel, and residual soil is locally abundant in the southern part of the region and covers a majority of the Mengapur area.

Figure 7.1 Mengapur location map showing regional gold belts (modified from Yeap, 1993)

Source: Monument

Figure 7.2 Regional geological map – Mengapur



Map Source: Malaysia Geological Survey (Kow, 1990)

Grids: (1) Black ticks in Latitude and Longitude (in Degrees, Minutes)
(2) Blue ticks in Malayan Rectified Skew Orthomorphic Projection (in Meters)

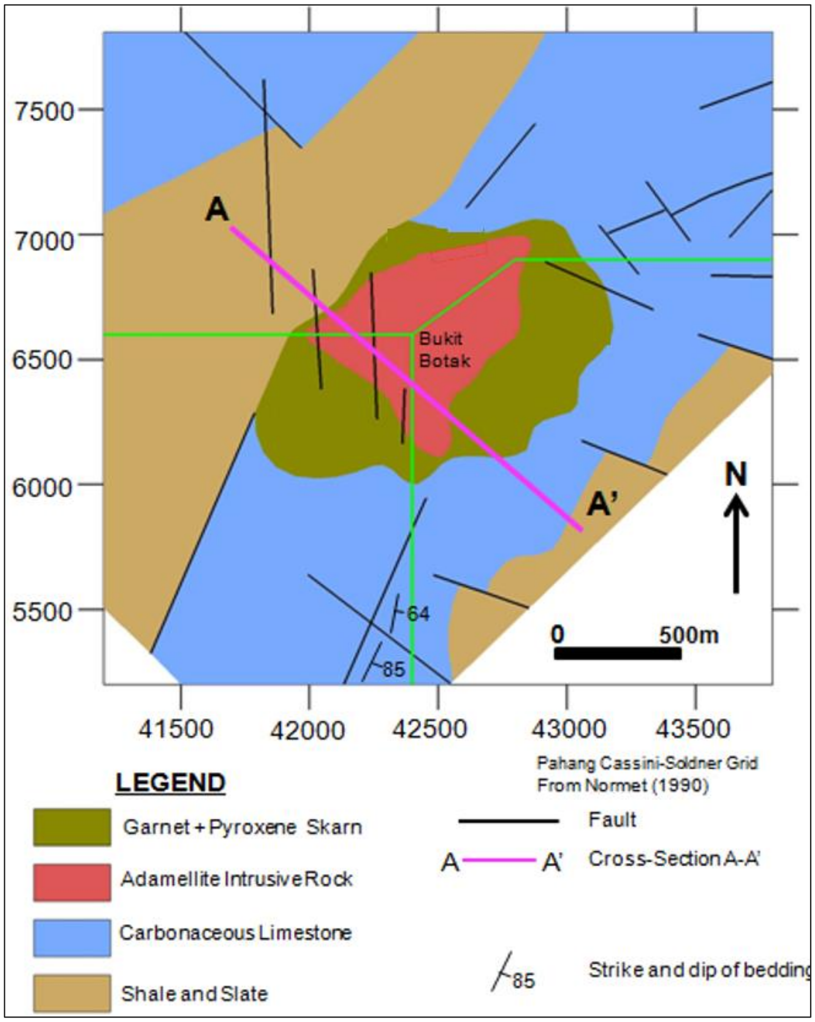
Source: Monument

7.2 Local geology

Mengapur geology is dominated by sedimentary rocks that have been intruded by at least one dyke complex (Figure 7.3). The dyke icomplex outcrops in the centre of the deposit and forms a steep resistant ridge that is referred to as Bukit Botak. The sedimentary rocks adjacent to the Bukit Botak intrusion complex and other nearby buried intrusions are altered to skarn.

The Mengapur deposit is located in the Hulu Lepar area which includes the S. Luit area and has been previously mapped by MMC and the GSM (Normet, 1990), and described by Lee and Chand (1980) and Lee (1990) .

Figure 7.3 Schematic bedrock geology – Mengapur Project

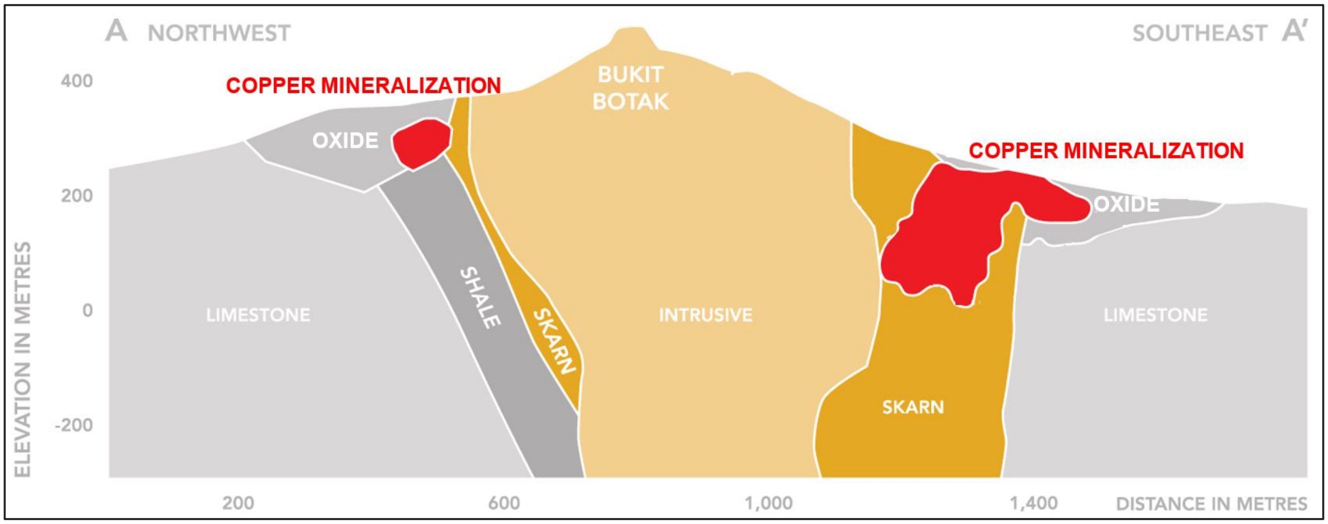


Note: Green lines are historical exploration boundaries (not related to tenement boundaries).

Source: Monument

The Mengapur limestones are typically massive and locally fossiliferous and/or interbedded and can be separated into two distinct facies: a calcareous facies and an argillaceous facies (Lee and Chand, 1980). The younger calcareous facies consists of dark grey carbonaceous limestone locally interbedded with calcareous shale. This unit forms the prominent steep-sided hills in the area. Stylolites have been observed in this unit. The argillaceous facies consists of calcareous shale, graphitic slate, quartz-sericite phyllite, schist, quartzite, and minor interbeds of andesitic, dacitic, and rhyolitic tuff. The sedimentary rocks generally strike north-northeast and dip steeply (45° to 85°) to the east-southeast, based on previous mapping and drillhole information (Figure 7.4).

Figure 7.4 Schematic geological cross-section



Source: Monument

The dyke complex is dominated by adamellite (quartz monzonite) with lesser amounts of rhyolite, rhyolitic tuff and rhyolite breccia and is approximately 800 m in diameter in surface exposures and has been encountered in historical drilling up to 600 m below the surface. The intrusion complex contains moderately to locally very steep contacts with the adjacent sedimentary rocks and reaches up to 900 m in width at depth. The intrusive rocks appear to intrude sub-parallel along the original sedimentary rock bedding as they generally strike approximately 60° to 65° at the surface and generally dip 55° to 65° to the east-southeast forming large dyke-like bodies.

The structure in the area is dominated by north-south and northwest-southeast trending high-angled faults and folding. The Bujit Botak Intrusive Complex intruded the Mengapur limestone sequences along the western limb of a synclinal fold. Oriented core drilling identfied two dominant fault orientations at Mengapur: a set striking 10° to 30° and a second set striking 270° to 315° (Nicholas *et al.,* 1990). Both sets of faults are steeply dipping and consist of broken rock zones with no slickensides, clay, or gauge (Nicholas *et al.,* 1990). MMC geologists interpreted a major east-west wrench fault zone on the northern margin of the intrusive complex which may correspond with the Lerek Fault trend identified on the regional map.

7.2.1 Weathering and oxidation

Weathering of the skarns is locally very deep at the margins of the intrusive complex where the oxide zone (historically referred to as “soil”) can locally reach up to 300 m in depth. The oxidation is deepest on the northern and south-western flanks of the intrusive complex. In the south-eastern part of the mineralisation, oxidation reaches up to 120 m deep.

The oxide zone is commonly clay bearing and light brown to dark red in colour with the reddish zones typically containing hematite. Whilst for the most part, original rock textures have been destroyed in the oxide zone, some relic textures are observed. Hematite-rich “soils” were logged in the historic drilling and referred to as gossan. A transitional zone (sometimes logged as “weathered skarn”) occurs between the highly oxidised zone and unweathered (sulphide) skarn (Figure 7.5). Relict calc-silicate skarn minerals may be present within weathered skarn, dependent on the weathering and fracture intensity. Iron-rich clays that are light apple green in colour (likely nontronite) are locally present in the weathered skarn in the western highwall of the southern oxide open pit.

Magnetite locally occurs both as gravel to cobble-sized gravel pieces and/or as fine free grains disseminated throughout the oxidised zone and/or in gossan zones and in weathered skarn rock. The magnetite has locally been exploited in recent open pit mining.

Figure 7.5 Oxidation zones within skarn

Note: Photo taken during April 2018 site visit

7.2.2 Hydrothermal alteration: skarn and quartz veins

Hydrothermal alteration at Mengapur is centred on the Bukit Botak intrusive complex with some hornfels and mostly mineralised skarn occurring in the adjacent sedimentary rocks at the intrusive-sedimentary rock contact zone. The skarn alteration extends outward into the sedimentary rocks approximately 300 m to 650 m laterally from the contact and has been intercepted in drillholes up to 750 m below the surface. The skarn alteration halo around the Bukit Botak intrusion complex dips steeply to the southeast.

The exoskarn alteration comprises medium green pyroxene-rich skarn and medium to dark brown garnet-rich skarn and is generally massive (Figure 7.5) and coarse-grained near the intrusion complex and bedded and finer-grained distal to the intrusive complex. Tabular, moderately to steeply dipping, garnet-rich skarn bodies are typically narrow (less than 70 m thick) and interbedded with the more abundant and thicker pyroxene-rich skarn.

Both endo and exoskarn varieties can contain small to high amounts of sulphide and iron-oxide minerals. Other silicate minerals that have been identified in the unweathered skarns in lesser abundance by Monument and previous investigators include: epidote, chlorite, idocrase, actinolite, tremolite, quartz, carbonates (calcite, siderite), sphene, plagioclase, prehnite and scapolite.

Other alteration assemblages in the mapped skarn zone as documented by Lee and Chand (1981) and MMC (1990) include:

- Quartz ± chlorite hornfels consisting of equigranular quartz and interstitial chlorite with occasional actinolite, diopside, epidote and/or garnet in the matrix, likely originating from calcareous and/or argillaceous siltstone

- Quartz-rich hornfels is developed in impure tuff units and/or quartzite-rich units
- Sericite-quartz hornfels developed in mudstone or siltstone dominated by fine-grained muscovite
- Calc-silicate hornfels dominated by diopside and or garnet that has finer grained calc-silicate minerals compared to the skarn
- Silicification, consisting of equigranular quartz with biotite and minor to moderate muscovite; this assemblage may locally contain feldspar minerals
- Marble (recrystallised limestone) that may contain carbonate-rich veins or veinlets.

7.2.3 Hydrothermal alteration in intrusive rocks

The intrusive rocks of the Bukit Botak intrusive complex exhibit different alteration styles. Silicification and quartz-sericite-pyrite alteration, with variable amounts of clay, are most abundant in the felsic intrusive rocks and occur as both pervasive flooding and as veins near the contact zone. The quartz-rich veins commonly make up to 10% of the intrusive rock and locally up to 20% of the rock based on observed surface samples near the eastern margin of the intrusive complex. Crackle breccia hosted by adamellite has been observed by previous investigators in some areas near the margins of the Bukit Botak intrusive complex.

Endoskarn alteration (skarn alteration hosted by intrusive rocks) is limited to the north-western corner of the intrusive and forms a body approximately 350 m long x 230 m wide and up to 330 m high near the contact with massive garnet-pyroxene exoskarn. The original intrusive rock texture is observed within the endoskarn with disseminated, medium-grained epidote, chlorite, plagioclase, potassium feldspar, quartz, calcite and some sulphide minerals.

7.3 Mineralisation

The Mengapur deposit contains Cu-Au(±Ag±Fe) mineralisation hosted predominantly by pyroxene-rich and garnet-rich exoskarn that occurs adjacent to the felsic intrusions. The known Cu-Au mineralisation extends over a 1.2 km x 1.5 km area in a concentric geometry haloing the contact of the main Butik Botak intrusion complex and extends up to 630 m below surface.

The Mengapur deposit hosts three types of mineralisation:

- Sulphide (hypogene) Cu-Au(±Ag±Fe) mineralisation
- Transitional mineralisation that contains mixed oxide and sulphide mineralisation near the oxide-sulphide redox contact
- Near-surface oxide Cu-Au(±Ag±Fe) mineralisation.

The bulk of the sulphide mineralisation is hosted in sulphide-bearing pyroxene and garnet skarn. Lesser amounts of Cu-Au-Ag mineralisation is hosted in oxidised soil, gossan and locally weathered rock units that overly the sulphide-bearing skarns. The mineralogy of the mineralised sulphide-bearing skarns at Mengapur has been previously described by Sinjeng (1993) and Lee and Chand (1981) in published reports and by Normet (1990) in unpublished reports. The mineralogy of the supergene oxidised material at Mengapur have been described in Normet (1990) and MMC (1993).

7.3.1 Sulphide mineralisation (exoskarn)

Both the garnet-rich and pyroxene-rich skarn varieties contain low to locally high amounts of sulphide and/or iron-oxide minerals. The most dominant sulphide mineral in the skarn is pyrrhotite followed by lesser amounts of pyrite, chalcopyrite, arsenopyrite and molybdenite. Accessory sulphide minerals in sulphide mineralisation includes: molybdenite, galena, sphalerite, marcasite, chalcocite, covellite, cuprite, native copper, native bismuth, boulangerite, bouronite, tetrahedrite, scheelite, freibergite, pyrargyrite, cassiterite, kesterite, anglesite and native gold. Pyrrhotite occurs as either massive zones or disseminated within the skarn (Figure 7.6).

Iron-oxide minerals in sulphidic pyroxene and garnet skarn are dominated by octahedral magnetite. Specular hematite has been noted in some of the geology drillhole logs to occur in the skarn but is not common. The magnetite is locally intergrown with disseminated to blebby pyrrhotite in the skarn.

Chalcopyrite is the dominant copper mineral in the mineralised sulphide skarn and occurs as fine disseminated grains and locally within late quartz-rich veins. The 0.1% Cu mineralised envelope in the sulphide zone generally forms a wide zone that extends up into the adjacent transitional and oxide zones. Only rare bornite has been logged in some drillholes.

Figure 7.6 Pyrrhotite in skarn hand specimen

Note: Photo taken during April 2018 site visit

Planar quartz-rich veins up to 2 m in width locally cut the skarn assemblages as sheeted veins at similar orientations and contain various amounts of the following sulphide minerals in approximate order of abundance: pyrite, chalcopyrite, arsenopyrite, molybdenite, pyrrhotite, galena, sphalerite, tetrahedrite and native bismuth. These veins are visible in rock outcrops in the Malaco open pit located south of the intrusion complex where the quartz veins are gently to moderately dipping to the east and spaced approximately 0.5 m to 2 m apart. Accessory minerals in the quartz veins may include calcite, sericite, and siderite. Monument indicated that elevated gold assays are often associated with these veins.

Intrusive hosted mineralisation (endoskarn)

Mineralisation hosted by intrusive rocks (i.e. endoskarn) is rare and is exclusively sulphide mineralisation. Endoskarn typically contains blebs and disseminated sulphide minerals consisting of chalcopyrite and pyrite. Some of the endoskarn mineralised zones consist of brecciated intrusive rock with blebby to massive breccia matrix replacement dominated by chalcopyrite and minor digenite and/or chalcocite. Other crackle breccia mineralisation with molybdenite matrix infill has been noted near the Bukit Botak intrusion complex contact by previous workers.

Chalcopyrite, pyrite and molybdenite in altered intrusive rocks occur as rare disseminations and in veins. Local fluorite has been observed by previous investigators in the granitic rocks where it may occur with quartz, chalcopyrite and molybdenite as disseminations and/or veins (Kow and Chang, 1981).

7.3.2 Transitional mineralisation

Transitional mineralisation, which typically hosts variable sulphur grades and locally high Cu grades (>0.3% Cu), occurs below the base of the oxidised zone and above the sulphide mineralisation in the bedrock skarn (Figure 7.5). Transitional mineralisation is exclusively hosted in weathered skarn with variable weathering intensities. Typically, the transitional zone is highly fractured and generally consists of rock with lower competence than the underlying intact sulphide skarn bedrock. The transitional mineralisation also generally exhibits overall lower core recovery values.

Similar to the sulphide mineralisation, the transitional mineralisation haloes the circular contact of the Bukit Botak intrusion complex with the skarn but tends to be poddy and discontinuous. Transitional mineralisation is generally fairly narrow, ranging from a few metres up to 30–50 m, but can locally range up to 90 m thick where higher fracture densities and/or faults are present.

The mineralogy of the transitional mineralisation consists dominantly of pyrite with lesser chalcocite, digenite, covellite, cuprite and rare green copper oxide minerals. The transitional zone has not been logged in the drilling and has been primarily interpreted based on the sulphur assay data.

7.3.3 Oxide mineralisation

Oxide Cu-Au-Ag-magnetite mineralisation is hosted in soil, weathered skarn, gossan and locally in other weathered rocks based on assays from Monument exploration drillholes. The weathered skarn may be strongly weathered to depths up to 150 m below surface. Weathering can be strong to intense in all rock types and generally decomposes all or most of the original sulphide minerals.

The mineralogy of the mineralisation within the oxide zone is dominated by clay, goethite, limonite, jarosite and earthy purple to red hematite with low to moderate amounts of magnetite. Green copper oxide minerals are generally not abundant in the oxide mineralisation and are rarely observed in the oxide zone. The bulk of the mineralised oxide zone that contain greater than 0.1% Cu that is believed to be microcrystalline and intergrown within the goethite and limonite mineral structure. The soil, gossan and weathered skarn can be elevated in Cu, Au, Ag, As, Bi, As, Pb, and Zn.

Magnetite in the oxide zone occurs as either fine free disseminations intergrown with goethite, hematite and clay in soil or weathered skarn, or as fine to coarse gravel and cobble fragments (or lumps) within the soil and weathered skarn. Magnetite has been semi-quantified in the oxide surface soils only in the SDSB tenement using magnetic susceptibility and Davis Tube analyses.

Gossan occurs as thin elongate tabular bodies generally at the base of the oxide zone and overly the sulphide zone. The gossan typically consists of dark brown, porous, competent, goethite-rich rock that is typically massive and microcrystalline with minor silica (Figure 7.7). The majority of the Mengapur gossan bodies are narrow and flat lying but occasionally they can be thick and moderately to steeply dipping, typically reflecting the geometry of the contact between the oxide and sulphide redox boundary. Gossan rocks are typically barren of magnetite mineralisation; however, interbedded zones of gossan and soil may locally contain variable quantities of magnetite.

Figure 7.7 Gossan outcrop at Mengapur

Note: Photo taken during April 2018 site visit

8 DEPOSIT TYPES

The Mengapur deposit is classified as a skarn type deposit. Originally, the term “skarn” was used to describe coarse-grained calc-silicate gangue associated with iron ore deposits of Sweden that included a host of calc-silicate rocks rich in calcium, iron, magnesium, aluminium and manganese. These were formed from the replacement of carbonate rich rocks. The term “skarn” is nowadays used to describe deposits like Mengapur which appear to have resulted from the hydrothermal interaction of hot silicate magmas and cooler sedimentary rocks.

There are several different types of skarn deposits that are characterized by the skarn calc-silicate mineralogy, the contained metal(s) of economic interest and their tectonic setting (Einaudi *et al.,* 1981; Meinert, 1992). Mengapur is best characterised as a copper skarn as it primarily contains economical grades of Cu with much lesser amounts of Au and Ag. The abundance of sulphide minerals is typical of copper skarns mostly in the form of pyrite and/or chalcopyrite. The abundance of pyrrhotite in the skarn is somewhat unique to copper skarns. Pyrrhotite has been documented in other copper-gold (± silver) skarns such as Phoenix-Copper Canyon (Battle Mountain, Nevada, USA) but is typically associated more with a reduced mineralogy and/or intrusive rock character such as the gold skarns at Hedley (British Columbia, Canada).

The Mengapur deposit has several similarities to other well documented Cu skarns in the world. The general association of higher sulphide content with elevated copper and gold at Mengapur is also typical of other copper skarns. The elevated bismuth (Bi) grades in the Mengapur skarns is typical to other copper and gold skarns; although, the gold grades at Mengapur are generally low (<0.2 g/t Au).

Other polymetallic copper skarn deposits that have some similarities with Mengapur include:

- Pumpkin Hallow (Arnold *et al.,* 2018), in Yerington, Nevada, USA, hosts a large polymetallic Cu-Fe-Au-Ag resource and reserve. The Pumpkin Hallow resource has similar grades of Cu, Ag, Au and Fe but generally contains lower S, Bi and Mo grades. Pumpkin Hallow mineralisation is mostly hosted in exoskarn similar to Mengapur, but also contains some mineralisation hosted in endoskarn and Cu-rich magnetite-poor skarn breccia. Pumpkin Hallow skarn mineralisation is associated with an intense retrograde mineralisation assemblage dominated by actinolite-epidote-magnetite-garnet with pyrite, pyrrhotite and chalcopyrite sulphide minerals.
- Craigmont (Cuttle, 2013), in Merritt, British Columbia, Canada, was historically mined for Cu from 1961 to 1982 with some minor by-product Au and Ag. The Craigmont mine stockpiled magnetite during the Cu mining operations. Subsequent magnetite processing operations from 1983 to 1997 has produced magnetite both from the magnetite stockpiles and from the historical Cu tailings.

9 EXPLORATION

Minimal exploration, other than drilling and some grab and channel sampling, has been conducted on the Mengapur Project since approximately 1990. Exploration activities prior to 1990 includes stream sediment and soil sampling, geological mapping and geophysical surveys. The exploration activities, excluding drilling, are summarised in Table 9.1, based on information from Snowden (2012) and Odell (2014).

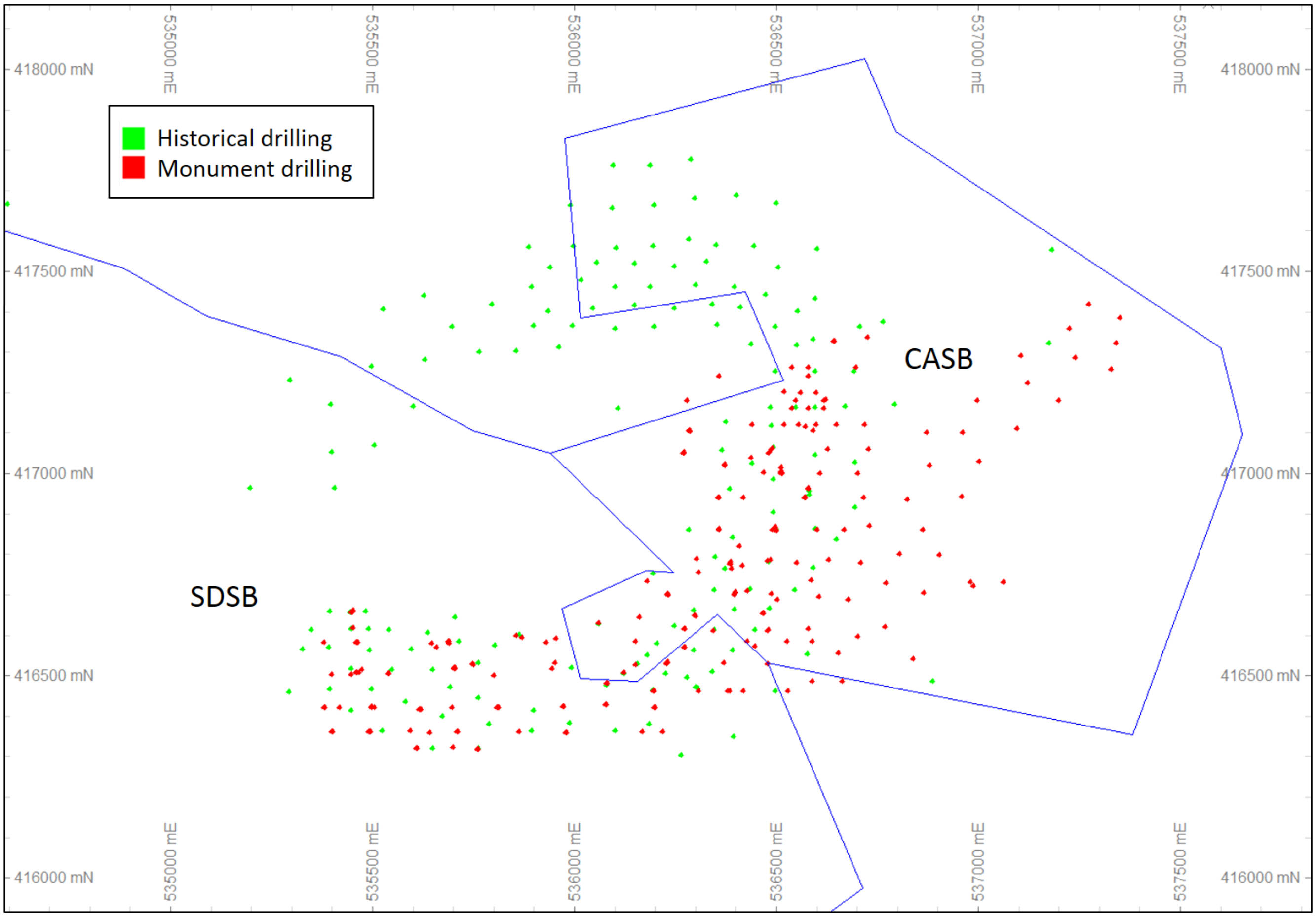
Table 9.1 Summary of exploration activities, excluding drilling

Approx. date	Exploration activity	Comments
1972 to 1976	Regional stream sediment sampling and geological mapping.	80 km^2 area of anomalous Pb and Zn identified centred on Mengapur area.
1978 to 1979	Additional stream sediment sampling in previously identified 80 km^2 Pb-Zn anomaly, along with soil sampling.	Multi-element (Pb, Zn, Cu, Mo and As) drainage basin anomaly identified. Soils sampling results confirmed earlier stream sediment anomalies.
1979 to 1980	Diamond drillholes drilled to investigate the geochemical anomalies.	Drilling of 12 diamond drillholes by GSM, which identifies the Mengapur deposit.
1984	Gravity and magnetic surveys.	Geophysical surveys undertaken, with 120 line kilometres traversed at 70 m and 140 m spacing, delineating several major conductive zones.
1984 to 1985	Geological mapping, soil sampling and downhole electromagnetic surveys.	A programme of geological mapping and geochemical soil sampling was carried out in approximately 1985 to cover a 10 km^2 area at the same time diamond drilling was undertaken. The major Cu, Pb, Zn, Bi and Ag anomalies delineated were coincident with mineralised skarn zones. The major geochemical anomalies were subjected to ground magnetic and time domain electromagnetic surveys between April and September 1984. Downhole electromagnetic logging was also carried out on 14 selected drillholes to determine the geometric configuration of the sulphide body. Minor electromagnetic anomalies (weak conductors) were found to be associated with graphitic horizons and black shales.
1988 to 1989	Geotechnical drilling and mapping plus five shallow shafts sunk for metallurgical testwork.	Preliminary geotechnical assessment from eight oriented core drillholes and surface geotechnical cell mapping. Five shafts totalling 271.5 m were excavated from 1988 to 1989 to collect additional metallurgical test data, mineralogical data, and specific gravity data. The shafts were reportedly sampled on 3 m vertical increments using a rotary vezin-type sampler.

10 DRILLING

Drilling at the Mengapur deposit began in the 1960s; however, the majority of the drilling was completed by MMC in the 1980s and later by Monument in 2011 to 2014. A total of approximately 112,048 m of drilling has been completed to date. Drilling primarily comprises diamond core drilling, with some minor RC drilling (approximately 7,942 m) conducted by Monument. A drillhole collar location plan is presented in Figure 10.1 and the drilling history are summarised in Table 10.1.

Figure 10.1 Drillhole collar location plan



Note: Historical drilling includes all drilling prior to 1990; Monument drilling includes all drilling from 2011 to 2014

Table 10.1 Summary of Mengapur drilling programmes

Dates of drilling	Mining company	No. of holes	Total drilling (m)	Drillhole numbers	Drilling company	Drilling method	Reference
After 1962	Jaya Sepakat Mining Company	Unknown	Unknown	Unknown	Unknown	Unknown	Lee and Chand (1981)
1979	GSM	4	Unknown	CBM7901 to CBM7904	Unknown	Unknown	Lee and Chand (1980)
8 Aug 1980 to 5 Mar 1981	GSM	11	1,733	CBM8001 to CBM8011	Malaysian Soil Investigation Co. Ltd	Diamond drilling	Lee and Chand (1981)
Nov 1983 to Mar 1985	Malaysian Mining Corporation	49 (Phase 1)	17,254	DDMEN002 to DDMEN045, DDMEN19A	Hanover Drilling	Diamond drilling	James Askew Associates (1990)
Apr–Dec 1985	Malaysian Mining Corporation	42 (Phase 2)	17,174	DDMEN046 to DDMEN063; DDMEN15A	Hanover Drilling	Diamond drilling	James Askew Associates (1990)
Apr–Nov 1986	Malaysian Mining Corporation	74 (Phase 3)	17,298	DDMEN064 to DDMEN142; DDMEN13A	Hanover Drilling	Diamond drilling	James Askew Associates (1990)
Feb 1987 to Jan 1988	Malaysian Mining Corporation	33 (Phase 4)	6,342	DDMEN143 to DDMEN167; DDMEN18A	Hanover Drilling	Diamond drilling	James Askew Associates (1990)
Oct 1988 to Jan 1989	Malaysian Mining Corporation	8	1,250	OCH-1 to OCH-9 (OCH-5 not drilled)	Unknown	Oriented core drilling (clay imprint method)	Call & Nicholas (1991)
Mid-2011 to Dec 2011	Monument Mining Ltd	11	2,724	MEN168 to MEN185	Northern Soiles Sdn Bhd, Sekata Bina Sdn Bhd, and UjiTeknik Geoenviro Sdn Bhd	Diamond drilling	Monument database
Jan–Nov 2012	Monument Mining Ltd	102	19,810	MEN175 to MEN282	PT Parts Sentra Indomandiri (PSI-Indo)	Diamond drilling and RC drilling	Monument database
Aug 2012 to Aug 2013	Monument Mining Ltd	123	27,510	MEN283 to MEN392	PT Parts Sentra Indomandiri (PSI-Indo)	Diamond drilling and RC drilling	Monument database
Feb–Dec 2014	Monument Mining Ltd	41	2,408	MOM001 to MOM036; MET001 to MET005	Monument	Diamond drilling	Monument database
TOTAL		**480**	**112,048**				

10.1 Historical drilling pre-1990

Historical drilling comprises a total of approximately 59,310 m of drilling, which represents 53% of the total drilling at Mengapur. The majority of the historical diamond drilling was conducted by MMC in the 1980s (DDMEN series holes). No details are available on the procedures or quality of the sampling undertaken during these programs. Geological and geotechnical logs were stored on paper copies at the mine site and have been scanned into digital formats.

Snowden notes that collar positions of historical drillholes in the field have largely been either mined out or are lost and as such the location of the collars cannot be verified. One hole was able to be measured during the 2018 site visit and is discussed in Section 12.1.

10.2 Monument drilling (2011 to 2014)

The following section is largely sourced from a draft unpublished technical report (Odell *et al.,* 2014) prepared by Practical Mining LLC for Monument in 2014.

10.2.1 Drilling methods

Drilling completed by Monument was conducted over four phases, starting in 2011 and ending in 2014. A total of 52,738 m of drilling was completed, comprising primarily of diamond core drilling with some minor RC drilling.

RC drilling

RC drilling was largely restricted to the oxide zones and was mainly used for pre-collars. RC pre-collar drilling was completed to near the water table elevation and/or where the compressors were no longer able to keep the cuttings dry, and finished to the target depths typically below the groundwater table using diamond drilling methods.

The RC drilling used a 133 mm diameter drill bit with several different air compressors used during the programs, generally with a capacity of 350 psi at 900 cfm (Odell *et al.,* 2014). RC drilling was typically done under dry conditions and water injection was only conducted if necessary.

Diamond core drilling

For the Monument diamond drilling programs, one of Monument's company-owned Desco diamond drill rigs completed 41 drillholes (MOM001–MOM036 and MET001–MET005) at Mengapur totalling 2,408 m, with the remainder drilled by contract drilling companies. Early drilling at the project from mid-2011 to May 2012 was conducted using diamond drilling methods by three separate Malaysian contract drilling companies: Northern Soiles Sdn Bhd, Sekata Bina Sdn Bhd, and UjiTeknik Geoenviro Sdn Bhd. A contract drilling company called PT Parts Sentra Indomandiri (PSI-Indo) utilised up to four drilling rigs (some multipurpose RC and core combination drills) at Mengapur starting in June 2012.

Diamond core drilling used primarily a HQ3 diameter core, unless drilling conditions required a smaller NQ bit size. The drillers marked the core trays with the project name, drillhole number, tray number, and start and end depths. Drilling was conducted on 1.5 m to 3.0 m drill runs. Drillers placed the core in the core trays with as little disturbance as possible and marked core blocks with the depth of the core run.

During drilling, a geologist regularly visited the drill sites to monitor progress, geotechnically log the core, pick up drill core trays and drillers logs, and observe the drilling procedures.

10.2.2 Collar location and rig set-up

Monument used a standard operating methodology for constructing drill pads, surveying drill collars, and setting up the drill on the hole. The exploration geologist submitted a work request to the surveyor with the coordinates of the proposed drillhole along with the proposed azimuth and inclination. The surveyor then located the proposed drillhole in the field as received. The proposed drillhole was marked with a peg and labelled with the hole name, coordinates, azimuth and inclination. Heavy equipment, such as bulldozers or excavators, were used to construct the access roads and drill pads to the proposed drillhole.

Before the drilling department was given permission to drill the hole, the geologist verified the location in the field to ensure all information was correct. The geologist laid out flagging tape or labelled stakes to indicate the planned drilling azimuth to help properly guide the driller to position the drill rig. The geologist checked the direction of the drill rig when mobilising the rig to the hole by using a Brunton compass; however, care was taken due to interference from near-surface magnetic minerals (magnetite and pyrrhotite). The driller set the drill mast to the required dip angle using an inclinometer, which was checked by the geologist. Drill sites were regularly visited by a geologist to monitor the drill pad construction progress and final drillhole collar placement.

Once drilling was complete, the collar was capped with a PVC pipe with a cement cover ground cap and an aluminium or steel sample identification label was attached to the PVC pipe (Figure 10.2). Additionally, the hole number, depth, azimuth and dip were inscribed into the cement cap.

Figure 10.2 Monument drillhole collars

Note: Photos taken during 2018 site visit

Collar surveying

At the completion of drilling, the drillhole collar locations were surveyed by an experienced and qualified surveyor employed by Monument. Surveying was done using a Topcon Total Station QS1AC survey instrument. The accuracy is reportedly ±2 mm in the easting and northing and approximately ±30 mm in the vertical direction. The elevation is based on Bench Mark #C2752 established by the Department of Mapping and Surveying Malay, located near the service station in the town of Sri Jaya, 16 km to the south of the project area. This vertical elevation control was transferred to the Mengapur site using GPS surveying equipment.

Easting and northing coordinates are measured in MRSO mine grid coordinates in metres using the Kertau 48 map datum.

Downhole surveying

Most Monument drillholes were surveyed down the hole by a Monument geologist, with aid from the drillers, after completion to the target depth while the drill is still set up on the hole. The design (plan) azimuth at 0 m depth is used as the starting azimuth for all the downhole survey measurements originally collected in the field. At least two downhole surveys were conducted for each drillhole using the same downhole tool to check validity. For a few Monument drillholes that either collapsed or were abandoned, were not able to be surveyed downhole and as such the design azimuth and dip at the collar are used.

A Camteq Proshot downhole survey instrument was initially used at the project from mid-2011 to April 2012 and may be used for single or multi-shot surveying. The Camteq probe measures azimuth within an accuracy of ±0.5° and inclination within ±0.2°. Snowden understands that this instrument collects azimuth, inclination, magnetic field, roll face, temperature, date and time. The azimuth is reportedly collected in magnetic north. The magnetic declination at the Mengapur project site is minimal (0 degrees 1 minute east) and mine grid north is not calculated. As such, Mengapur downhole drill coordinates are relative to magnetic north. The Camteq downhole survey instrument was periodically calibrated based on the manufacturer's specifications. Snowden notes that the azimuth data collected by the Camteq tool may be affected by proximity and abundance of magnetic minerals.

Downhole surveys using the Camteq downhole survey instrument, were collected every 20 m to 60 m downhole. Two downhole surveys were completed on every hole. While at the drill site, the geologist reviewed the downhole survey data to ensure that the drillhole number, azimuth, inclination and total magnetic field (for the case of the Camteq tool) were within acceptable ranges. All "raw" valid downhole survey data including each survey run down the hole, was compiled by the geologists into a Microsoft Excel spreadsheet. The final "best" downhole survey data was reviewed and validated by a senior geologist prior to being compiled in a master downhole survey Microsoft Excel spreadsheet.

A gyroscopic (gyro) downhole survey tool was purchased from Icefield Tools (Yukon, Canada) and usage began in May 2012. This tool collects azimuth data that is not affected by the presence of magnetic minerals and is more appropriate for use at Mengapur.

Similar downhole survey procedures were used for the gyroscopic downhole survey tool, which was used for the majority of the Monument drilling. The gyroscopic tool requires the use of a manual depthometer (line counter) to be installed over the drillhole to monitor the wireline depth as the tool is placed down/up the hole. The gyro surveying was done at specified depths every 5 m down the hole. Two to four downhole survey runs were completed on every hole: two down the hole and two up the hole. While at the drill site, the geologist reviewed the downhole gyro survey data to ensure that the drillhole name, azimuth, inclination, and net rotation value are within acceptable ranges. The senior geologist later selected the "best" downhole survey run based on a 3D visualisation review.

For most of the Monument drillholes, the azimuth at the collar was later resurveyed by the Monument surveyor after the drillhole was completed. As the actual resurveyed azimuth was typically different from the design planned azimuth value, the previously collected "raw" downhole survey data was imported into the gyro shot software and reprocessed in order to accurately update the downhole azimuth data.

The final "best" reprocessed downhole survey gyroscopic data containing the actual downhole azimuth data was compiled and reprocessed by the senior geologist at Mengapur into a final master downhole survey data Microsoft Excel spreadsheet and later imported into the Datashed drillhole database.

10.2.3 Core handling and logging processes

Core trays were transported from the drill site to the logging facility by either Monument staff or the drillers on a daily basis. The core was stored inside a gated storage area and logging facility where the core was then photographed, logged and sampled. The logging facility was locked and the project site patrolled by roving security personnel.

After the core was logged by the geologists and photographed, the competent core was sawn in half prior to sampling. Oxide and Transitional materials were typically sampled with a spoon or hand scoop tool. One half of the original core material was placed in a labelled sample bag and the other half retained in the core tray and stored at the site in a separate fenced core storage area. The geologists drew “saw” lines in permanent ink directly on competent core samples which contained quartz and/or sulphide-bearing veins to equally represent the vein-style mineralisation for geochemical analysis and storage. In addition, red lines were marked on the core to identify the sample from and to intervals.

10.2.4 Core recovery and RQD values

Drillholes completed from mid-2011 to mid-2012 were geotechnically logged at the core logging facility by geologists, and occasionally sample technicians, using a defined Geotechnical Logging Standard Operating Procedure and logging form (Johnson, 2011). Beginning in mid-2012 geotechnical logging took place at the drill site.

The geologist visually checked core blocks in the core trays looking for any errors by measuring the distance between the labelled core blocks with a measuring tape. The core blocks in the core boxes represent the start and end depths of the drill run. Any errors noted by the geologist were discussed with the drillers and fixed prior to logging and sampling.

The core recovery is based on the measured length of core in the core tray divided by the drill run interval length. The average core recovery is 83% across all rock types and oxidation zones. Within the fresh skarn, the core recovery averages approximately 96%, while within the oxide zone (intervals logged as “soil”), the core recovery averages 63%. Intervals logged as “weathered skarn” average 78% core recovery. An example of the typical core recovery in the sulphide skarn is shown in Figure 10.3.

Rock quality designation (RQD) values are determined by measuring the total length of pieces of core greater than 10 cm in length and dividing by the core run length. The RQD values of oxide material are generally very low (close to 0). Transitional mineralisation containing mixed oxide and sulphide redox types is typically highly fractured and also associated with relatively low RQD values. Skarn rock varieties in the sulphide zone typically exhibit RQD values of 80% or greater.

Figure 10.3 Typical core recovery within the sulphide skarn mineralisation (MEN269)

Note: Oxidation of the surface of the core has occurred during storage since this hole was drilled in 2012. Photo taken during 2018 site visit.

11 SAMPLE PREPARATION, ANALYSES, AND SECURITY

The following section, especially with respect to the Monument drilling conducted between 2011 and 2014, is largely sourced from a draft unpublished, technical report (Odell *et al.,* 2014) prepared by Practical Mining LLC for Monument in 2014.

11.1 RC sampling

RC drilling was generally done as pre-collars to the 2011 to 2014 diamond drillholes completed by Monument. Geologists visited the drill site at least three times per day to inspect the quality and the weight of the recovered RC chips, monitor the sampling procedures, and to handle and label the sample bags. The RC samples were collected at 1 m intervals in large pre-numbered plastic bags from a cyclone (Figure 11.1). All sampling devices were manually cleaned after each sample. Air or water was flushed through the drill rods after each rod addition before advancing the drill bit to flush the hole of cuttings and minimise downhole contamination.

Figure 11.1 RC cyclone and sample bag

Source: Odell et al (2014)

In wet sampling conditions, the wet drill cuttings were collected in the same large pre-numbered plastic bags. If the collected wet RC sample was less than approximately 10 kg, RC drilling was typically stopped and diamond drilling was commenced to the target depth.

All RC samples were moved to a covered core and sampling facility at regular intervals due to the high risk of rainfall. The RC sample bags were sorted at the splitting and sampling facility on the ground in sequential order by drillhole number and depth. The wet RC samples were identified and dried in an on-site oven at approximately 60°C overnight, prior to splitting and sampling. A walk-in oven was installed and used to dry wet RC drillhole samples near the end of the 2013 drill program.

The RC samples were recorded by drillhole number, sample interval, sample number, weight and general moisture condition. A photograph of each RC sample was taken of the open upward side of the sample bag to document the sample character and colour.

Individual samples were tipped into a specially constructed manual riffle splitter that contains a collection bin at the top (Figure 11.2). If the sample contained clayey lumps, they were broken up at this point to be smaller than the riffle size. The dump box was gradually opened and the sample introduced vertically into the top of the three-tier splitter. There are four discharge ports to the sample splitter: 50%, 25% and two 12.5% sample ports. All ports have samples collected and stored. As of January 2014, there were four separate, specially designed, RC sample splitters at the sampling facility.

Figure 11.2 Three-tier riffle splitter

Top-right: looking down into collection bin; bottom right: view of sample discharge ports.

Source: Odell et al (2014)

The sample split selected for assay depended on the original sample weight and is shown in Table 11.1. The 50% sample was collected back into the original labelled plastic sample bag. This sample was placed in a dedicated storage area near the sampling facility. One duplicate RC sample was taken every 20 samples and submitted for geochemical analysis to the primary lab. The splitter was cleaned with compressed air and/or water (for damp samples) after every sample split.

Table 11.1 RC sample splitting methodology (after Odell *et al.*, 2014)

Sample weight from cyclone (kg)	Split to:	Weight of sample for assay (kg)	Duplicate samples for QAQC assay
<5	100% (not split)	<5	0%
5 to 12	50%	3 to 5.5	50%
12 to 24	25%	3 to 5.75	25% and 50%
>24	12.5%	>3	12.5%, 25% and 50%

The RC sample split percentages (i.e. 50%, 25% or 12.5%) selected for assay, duplicate samples and inserted QAQC samples were recorded on a paper sampling sheet and later scanned and filed on the project server. All paper files were stored at the project site.

The split samples were gathered and prepared for dispatch to the primary assay laboratory. Standards and blanks were inserted into the dispatched samples and the original handwritten submission forms compiled and entered into the Datashed database. The digital data was reviewed and validated for data entry errors at the time of submission.

11.2 Diamond core sampling

11.2.1 Historical diamond drilling (pre-1990)

No details are available on the procedures or quality of the core sampling undertaken during these programs. The historical drillhole assay records indicate that the bulk of the diamond drillhole samples were originally analysed on 3 m sampling widths. The selected sample intervals were separated by geological units so that only one primary rock unit was included in an assay interval where possible.

The historical core storage building reportedly burned to the ground in 2005 and as a result no historical core is available for viewing or resampling.

11.2.2 Monument diamond drilling (2011 to 2014)

A geology technician photographed all core and recorded geotechnical data, such as RQD measurements, to a standardised geotechnical log. The geologist recorded the geological data and defined the sampling intervals.

Core was split or sawn in half based on the sampling intervals defined by the geologist (Figure 11.3). The split or sawn core was placed into pre-numbered plastic bags with unique handwritten sample identification numbers. Standards and blank samples were inserted based on the defined Mengapur QAQC protocols. All drillhole logs were scanned and saved on the project computer server. All paper drillhole files including drillhole logs, sample sheets, driller’s logs, sample submission sheets, and any other drilling related paperwork, were filed into spiral notebooks and stored at the project site.

Figure 11.3 Core sawing

Source: Odell et al (2014)

The half-core samples were either placed in sealed labelled 200-litre barrels and shipped off the project site to the preparation laboratory (done from mid-2011 to April 2013), or, as of May 2013, the half-core samples were forwarded to the on-site SGS-Mengapur preparation laboratory. The shipped samples contain the appropriate sample identification transmittal paperwork, shipping information (sample and barrel weights), and laboratory submission forms.

Coarse sample rejects remaining from the crushing process are stored in sealed blue plastic barrels in a specific secured and fenced area at the Mengapur site. The drillhole pulps are also stored in boxes inside the core shed facilities.

Figure 11.4 Coarse reject (left) and pulps (right) at Mengapur site

Note: Photo taken during April 2018 site visit

11.3 Laboratory sample preparation and assaying

The detailed sample preparation methods for the historical diamond drillholes (i.e. initial crushing and later pulverising parameters) have not been described in the Normet 1990 report; however, the assay sheets indicate that half of the diamond drill core was sampled and analysed for the elements noted above.

Samples from the Monument drilling at Mengapur were prepared and analysed by four commercial primary assay labs: Inspectorate (Richmond, Canada); ACME (Vancouver, Canada), SGS-Malaysia (Port Klang and Bau) and SGS-Mengapur (on site near Sri Jaya, Malaysia).

Table 11.2 summarises the locations of the sample preparation laboratory, the assay laboratory, accreditation status and the approximate dates of use. More than one commercial laboratory was used during the drill programs due to timing related issues and the SGS Malaysia laboratory did not have the required equipment in place and fully operational until April 2013.

Table 11.2 Laboratories used for Monument drilling (after Odell *et al.,* 2014)

Company	Sample preparation laboratory	Assay laboratory	Certification	Dates used
Inspectorate	Fairbanks, Alaska	Richmond, Canada	ISO9001:2008	Dec 2011 to Dec 2012
ACME	Fairbanks, Alaska	Vancouver, Canada	ISO9001:2008	Jan 2013 to Jul 2013
SGS Malaysia	Port Klang, Malaysia	Port Klnag, Malaysia (ICP, Leco S); Bau, Malaysia (fire assay)	SAMM; ISO17025:2005	Apr 2013 to Feb 2014; After Mar 2014, only used when >2,000 samples/month submitted
SGS Mengapur	Mengapur site, Malaysia	Mengapur site, Malaysia	Not certified	Sample prep and Leco S started in May 2013; fire assay started in Feb 2014; ICP started Mar 2014

11.3.1 Sample preparation

Sample preparation at each laboratory was generally the same and includes:

- Drying of the sample for less than 24 hours at generally <105°C
- Crushing with jaw crushers to >70% passing 2 mm
- Pulverising a 250 g to 2.0 kg (average 1.0 kg) riffle split subsample to greater than 85% passing 200 mesh (75 µm)
- Generating multiple pulp samples for assaying, metallurgical test work and storage.

The sample preparation processes for the different laboratories are summarised in Table 11.3.

Table 11.3 Sample preparation protocols (after Odell *et al.,* 2014)

Laboratory	Drying	Crush	Pulverisation	Comments[1]
Inspectorate (Nov 2011 to Mar 2012)	8–12 hours at 60°C	>70% passing 10 mesh	250 g pulverised to 85% passing 200 mesh	SP-RX-2K method
Inspectorate (Apr 2012 to Dec 2012)	8–12 hours at 60°C	>70% passing 10 mesh	2,000 g pulverised to 90% passing 200 mesh	SP-RX-2K and SP-PV-OW methods; pulverised in 500 g lots in pulverising bowls and homogenised (rolled) into one 2 kg pulp sample using wax paper (method SP-PU-HM); two master pulps made – one 1 kg pulp for assaying and one 1 kg pulp for storage in Fairbanks
ACME (Jan 2013 to Jul 2013)	<24 hours at 60°C	>85% passing 10 mesh	1,000 g pulverised to 90% passing 200 mesh	R200-1000 method
SGS Malaysia (Jun 2012 to May 2013)	8–12 hours at 60°C (sulphide); <24 hours at 105°C (oxide)	>90% passing 2 mm[2]	1,800 g pulverised to 90% passing 200 mesh[2]	
SGS Mengapur (May 2013 to 2014)	8–12 hours at 60°C (sulphide); <24 hours at 105°C (oxide)	>85% passing 2 mm[2]	1,000 g pulverised to 90% passing 200 mesh[2]	

Notes:

1) All laboratories create a separate 300 g pulp sample in a sealed plastic bag and return to Mengapur site for magnetic susceptibility determination by Monument staff.

2) 1 in every 20 crushed samples has internal laboratory wet screening analysis reported.

3) 1 in every 20 pulverised samples has internal laboratory wet screening analysis reported.

11.3.2 Assaying methods

Assays for Cu, Pb, Zn, Ag, As, Mo and Bi were carried out on the historical drillhole samples using AAS. Gold analyses (2 assay ton) were completed using fire assay/AAS methods. Sulphur analyses of the diamond drillhole samples were originally not analysed as seen on the original assay sheets. It was not until November 1989 that sulphur was analysed using XRF

The primary assay laboratory for the historical drillhole samples was the MMC Laboratory Services located at Batu Caves near Kuala Lumpur (Snowden, 2012). This is based on assay lab sheets and check assay sheets with the MMC and Batu Caves header identification. It is not known if this assay lab still exists.

Four primary assay laboratories used for the sample preparation of the Monument drilling were also used for geochemical analysis of the exploration drillholes from 2011 to 2014. The laboratories and assay methods are listed in Table 11.4.

Table 11.4 Assay methods for Monument drilling (2011 to 2014; after Odell *et al.*, 2014)

Laboratory	Four-acid[(1)] digestion method and ICP	Fire assay Au method	Leco S method	ICP overlimits
Inspectorate, Richmond	50-4A-UT (ICP-MS or ICP-OES finish); 30-4a-UT (ICP-MS or ICP-OES finish)	Au-1AT-AA; 30 g charge; AAS finish	S-LECO	4A-OR-AA (Cu, Pb, As, Zn); Fe-CON
ACME, Vancouver	1EX (46 elements); ICP-MS finish	G601; 30 g charge; AAS finish	2A-13 (Leco S)	Group 7TD (four-acid) for As, Bi, Sb (ICP finish); Group 8TD (four-acid) for Pb and Zn (AAS finish)
SGS-Malaysia	DIG40Q/ICP40Q (OES finish); 32 elements	FAA303; 30 g charge; AAS finish	CSA06V up to 30% S; CSD06V from 30% S to 75% S (Leco S)	DIG43B/AAS43B (Cu, Ag, As, Pb, Zn, Mo)
SGS-Mengapur	DIG40Q/ICP40Q (OES finish); 32 elements	FAA303; 30 g charge; AAS finish	For all sulphide samples and other samples >5% S (ICP); CSA06V up to 30% S; CSD06V from 30% S to 75% S (Leco S)	DIG43B/AAS43B (Cu, Ag, As, Pb, Zn, Fe)

Notes: (1) The four acids used in digestion include HCl, HNO_3, $HClO_4$ and HF.

The 2011 and some of the 2012 drillhole pulps were initially submitted to the Inspectorate (Richmond, Canada) laboratory for 50-element ICP-MS analysis using four-acid digestion. After 30 October 2012 the drillhole pulps submitted to Inspectorate were analysed for 30-element ICP-MS using four-acid digestion. Over-limits were completed for Cu (when >1%), Ag (when >100 ppm), As (when >10,000 ppm), Pb (when >10,000 ppm) and Zn (when >10,000 ppm). In addition, gold fire assay (AAS finish) used 1 assay ton charges and Leco S was analysed by Leco induction. High grade Leco S was reanalysed for Leco S values >20%. Iron over-limits where reanalysed by the Inspectorate and ACME laboratories for original ICP-MS values >30% (in oxide samples only) using the Fe-CON (wet assay) method.

ACME Laboratories purchased Inspectorate in late 2012 and started preparing and analysing the drillhole samples in early January 2013. In several cases, the SGS Malaysia laboratory prepared the drillhole sample pulps in Malaysia and shipped the prepared pulps directly to ACME in Vancouver Canada who then analysed the pulp. Many of the sample analysis protocols conducted by ACME are similar to those done by Inspectorate. ACME also analysed for multi-element ICP-MS using four-acid digestion.

The SGS-Malaysia and SGS-Mengapur laboratories analysed for multi-element ICP using ICP-OES (Codes DIG40Q or ICP40Q). Samples that require over-limit analysis use AAS four-acid digestion (Codes DIG43B and AAS43B). Both laboratories analysed for Leco S and fire assay gold using 1 assay ton charges with AAS finish (FAA303 code).

The SGS-Mengapur lab utilised the following analysis and related equipment: one ICP-OES Optima 7300 DV with auto-sampler, one AAS Perkin Elmer AA400, one sulphur analyser model SC632C, and other miscellaneous equipment (i.e. balances, pH meter, fume hoods, etc.). The pulps generated at the SGS-Mengapur lab after 2 May 2013 were analysed for Leco S at the Mengapur SGS laboratory, while the remaining pulp material was shipped to Port Klang for ICP analysis and to SGS Bau for fire assay. The on-site SGS Mengapur lab at full operational status was under contract to analyse 2,000 samples per month, which included grade control samples and other Monument project samples. Exploration drillhole samples were prepared and stored in separate facilities from the grade control samples.

11.4 Data handling

The digital assay results were managed in an SQL Server Database using the Datashed Data Model and front-end. The digital results were received as comma delimited text files (CSV format) and were loaded into the database using templates defined in Datashed. A best assay result was defined for each element being analysed, with the best result defined based on the type of analysis. Analysis for elements below detection limits were entered as half the detection limit. Analysis for elements that fall above the defined maximum detection limit were entered as the maximum detection limit. Sample analyses exceeding the detection limit for the elements Ag, Cu, Leco S, Pb, Zn and Fe were re-assayed using the techniques defined in Table 11.4 with the higher defined detection limits. The re-assay values over write the initial values in the final “best” assay database. Internal laboratory assay standards and certified reference material (CRM) assays were all entered into Datashed.

Signed laboratory paper certificates of the final assays were scanned by Monument to PDF format and stored on the file server for reference.

11.5 Sample security

Sample security processes with respect to the historical drilling samples is not documented.

Core and RC samples from the 2011 to 2014 Monument drilling programs were stored in enclosed, locked and patrolled facilities throughout the logging and sampling process, up until being shipped for analysis. Early drillhole logging occurred on the ground within a chain-link fenced and locked facility near the administration building. After October 2012, the diamond drillhole logging occurred on tables inside a large newly constructed roofed facility. This facility also secured and housed the core and later became part of the SGS-Mengapur on-site laboratory. A second core shed was later constructed in a new location for logging and related activities. The front access gate to the Mengapur Project has security personnel stationed at a small building with a boom gate.

During the drilling programs, after the core was logged and sampled at the core handling facilities, the samples were stored temporarily in a barbed-wire fenced outdoor facility. Core was covered by plastic wraps to protect from weather. The coarse reject sample storage area was located in the same area. These sample storage sites were regularly visited by roving security guards 24 hours per day during the drill programs. A permanent chain-link fence with a lockable gate was installed around the entire perimeter of the core storage area in late April 2014. The current core storage facility is shown in Figure 11.5.

Figure 11.5 Core storage facility utilised since April 2014

Note: Photo taken during April 2018 site visit

11.6 Quality assurance and quality control

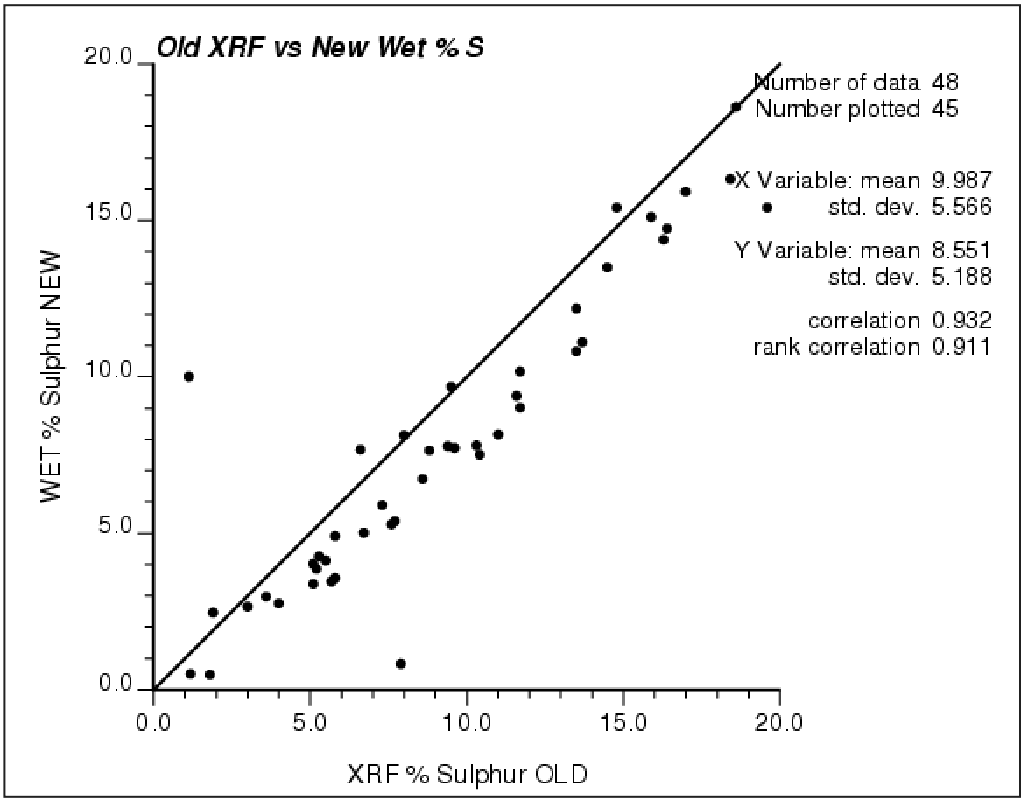
11.6.1 Historical drilling (pre-1990)

The routine insertion of certified standards, blanks, and field duplicates with sample submissions as part of a sample assay QAQC program is current industry best practice, but was not the case historically. Analysis of QAQC data is made to assess the reliability of sample assay data and the confidence in the data used for the resource estimation. Historical quality control measures were briefly reviewed in the 1990 feasibility report (Normet, 1990) and is summarised below.

Field repeat (check) samples were routinely conducted for Cu and Ag and other base metals in each of the four main drilling phases from 1983 to 1988. In addition to the resubmission of samples to the MMC laboratory as field checks, both duplicate analyses and standards were run at frequent intervals as a further check on both the accuracy and precision of the assays. No field checks were reportedly run for Au; however, repeat assays reportedly show good assay correlation (JAA, 1990).

JAA note that 50 duplicate drillhole samples were analysed for wet gravimetric sulphur analysis (JAA, 1990), presumably from the MMC Lab. A scatterplot of the data was compiled and the graph is shown in (Figure 11.6). The graph clearly illustrates the bias of the XRF sulphur results vs. the wet gravimetric sulphur results and this was noted in the JAA report (JAA, 1990). The report indicates that the original sulphur drillhole data were decreased by 15% in grade before they were used in historical resource estimation. Snowden comments that this style of adjustment is not industry best practice and it is not clear whether the S assay data in the drillhole database for the historical drilling is the raw or adjusted values.

Figure 11.6 Scatterplot of XRF S% data vs wet lab S% values



Certified standard samples

Certified standard samples are used to measure the accuracy of analytical processes and are composed of material that has been thoroughly analysed to accurately determine its grade within known error limits. Standards are submitted by the geologist into the sample stream, and the expected value is concealed from the laboratory, even though the laboratory will inevitably know that the sample is a standard of some sort. By comparing the results of a laboratory's analysis of a standard to its certified value, the analytical accuracy of the assay results of the laboratory can be assessed.

Historical data indicates certified reference materials, or standards, whose true values are determined by a laboratory, have been placed into the sample stream at Mengapur to ensure sample accuracy throughout the sampling process. The JAA report (1990) confirms that standards were used. However, no complete standard data compilation has been reviewed by Snowden and there has been no independent verification of this process.

Blank samples

Field blank samples are composed of material that is known to contain element grades that are less than the detection limit of the analytical method in use, and are inserted by the geologist in the field. Blank sample analysis is a method of determining sample switching and cross-contamination of samples during the laboratory sample preparation or analysis processes. Historical reports indicate that blanks were utilised historically at Mengapur; however, the author has no independent verification of this practice.

Duplicate drill core samples (field duplicates)

Historical data indicates no field duplicate checks were utilised but field checks were run at frequent intervals for other assays.

Umpire laboratories

Umpire laboratories were utilised for the Mengapur Project. Eight of the diamond drillhole assay samples were sent to other overseas commercial laboratories for check analyses for Cu, Pb, Zn, Mo, Bi, Ag, Au, and As (Normet, 1990). The assay labs that were used include: Charter, Chemex, Amdel, LNETI, and Australian Assay Laboratories (AAL) in Perth Australia (Normet 1990). Some of the samples that were metallurgically tested were also analysed at different laboratories. However, the results are not clearly documented that Snowden is aware of.

11.6.2 Monument drilling (2011 to 2014)

Mengapur quality control data consists of 6,258 analyses run on a variety of CRMs or standards (Odell *et al.,* 2014). Standards consist of different lithologies and metal grades that are similar to the Mengapur polymetallic mineralisation. The standards and CRMs consisted of “blind” standards submitted along with the drill samples as well as “internal” standards inserted by the laboratories as part of internal laboratory QAQC protocols.

Odell et al (2014) indicate that one standard and one “blank” was placed into the sample number sequence for every 20 drill samples.

The standards (GBMS304-1 to GBMS304-5) were purchased from Geostats Pty Ltd (Australia) and are certified for the following elements: Cu, Leco S, Au and Ag. The standards were inserted by Monument with the drill sample submissions upon shipping to the primary laboratory.

The standards OREAS113, OREAS161, OREAS162 and OREAS163 were purchased from Ore Research & Exploration Pty Ltd (Australia) for varying values of Cu and Fe. These standards were inserted by the laboratory staff at the primary laboratories (Inspectorate and ACME) when running the drill samples for analysis and did not have an assigned unique sample identification number. The OREAS standards were therefore not “blind” and were known to the primary laboratory. The OREAS series Fe-Cu standards were systematically inserted into the sample stream by Inspectorate and ACME staff after 1 July 2012.

The GIOP-94, GIOP-101 and GIOP-120 standards were purchased from Geostats Pty Ltd (Australia) for varying values of Fe. The laboratories used XRF analysis to determine the expected mean and standard deviation. The GIOP standards represent some of the higher Fe values locally present in the Mengapur mineralisation and were inserted into the sample stream by Monument geological or sampling personnel at designated intervals (one in every 20 to 40 samples) with unique sample identification numbers. The GIOP standards were “blind” and not known to the primary laboratory. The GIOP standards were inserted into the sample stream as blind samples starting in December 2012.

The blank standard used was not a CRM and were purchased from a local limestone quarry located near the project area. The quarry is located approximately 2 km south of the main Mengapur entrance gate. The blank material consists of fresh and recrystallised dark grey to black carbonaceous limestone from the Paleozoic Mengapur Limestones sub-unit of the Permian Sri Jaya Beds as identified on the published Government geology map (Odell *et al.,* 2014). The blank material is believed to consist of similar rocks that host the Mengapur polymetallic skarn mineralisation adjacent to the Bukit Botak intrusion complex. The limestone materials locally contain some white calcite veinlets and rare disseminated sulphide minerals based on visual observations from the site geologists (Odell *et al.,* 2014). Blanks samples were inserted into the sample batches in one out of every 20 samples by Mengapur geologists (Odell *et al.,* 2014).

The blank limestone material is purchased from the quarry as a crushed product generally 50–90 mm in size. The purchased crushed blank material was either placed in separate sample bags (as purchased) with unique sample identification numbers, or after 1 May 2013, forwarded to the onsite SGS-Mengapur preparation laboratory and further crushed to less than 10 mm diameter and subsequently bagged with a unique sample identification number and inserted into the sample stream. The companies that owned the limestone quarry in August 2011 were Sri Jaya Limestone Quarry Sdn Bhd and Alunan Maxmur Sdn Bhd.

Duplicate samples for the Monument drilling consisted of three types. One in 20 to one in 40 coarse reject duplicate samples from the initial sample crushing stage conducted at the primary preparation laboratory were sent to a secondary laboratory for pulverisation and analysis. In addition, the coarse reject duplicate samples may be submitted for wet sieve check (gradation or screen) analysis for the coarse size fraction (-2 mm screen). One in 20 to one in 40 pulverised pulp “duplicate” samples were prepared separately from the master pulp sample by the primary laboratory. These were sent to a secondary certified laboratory for check/umpire assaying and wet sieve analysis. Both the coarse reject and secondary pulp duplicate samples were relabelled by the secondary laboratory with the same original sample identification number as received but with a unique suffix added to the ID number in order to maintain a unique sample identification number for storage in the Datashed database. “Field” duplicate samples from the reverse circulation drillholes were collected one in every 20 samples and submitted to the primary laboratory for analysis with a unique sample identification number.

Some of the commercial laboratories were visited in both unannounced and announced visits during the drilling programs by senior Monument representatives in order to observe the laboratory equipment, sampling and analysis protocols, and procedures and equipment used for analysing Mengapur samples.

Four different commercial certified laboratories were used to verify the work done at the primary assay laboratories including: ALS (North Vancouver, Canada), SGS-Malaysia (Port Klang, Malaysia), SGS (Burnaby, Canada), and ALS (Brisbane, Australia). At the time of the assaying, the four laboratories were certified to ISO17025:2005 standards.

Pulp duplicates

The pulp duplicate performance is presented as scatterplots for Cu, Leco S, Au and Ag in Figure 11.7 to Figure 11.10. The original assay from the primary laboratory is plotted on the X-axis with the check assay from the secondary laboratory plotted on the Y-axis. The graphs are sourced from the draft technical report compiled by Odell *et al* (2014); however, it is unclear what the basis for the confidence intervals (red and purple lines) is.

The pulp duplicates show reasonable repeatability (i.e. precision) for Cu and Leco S; however, the secondary laboratory appears to report slightly higher Cu grades on average. Au and Ag show poorer precision; however, Snowden believes that this is largely reasonable given the relatively low grades and inherent variability of Au and Ag at Mengapur. There is some evidence for sample swapping (e.g. Figure 11.9) with assays reporting very low grades at one laboratory and relatively high grades at the other laboratory.

Figure 11.7 Scatterplot – Cu pulp duplicates (after Odell *et al.*, 2014)

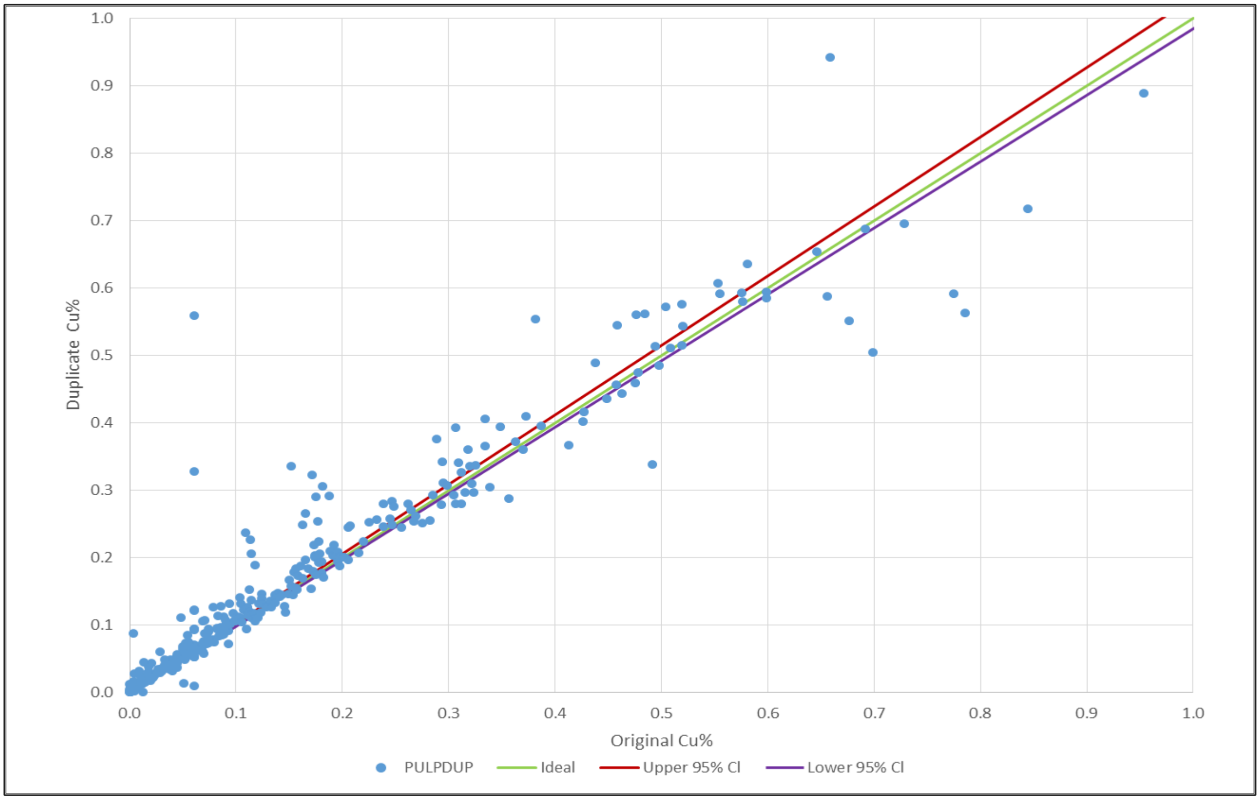


Figure 11.8 Scatterplot – Leco S pulp duplicates (after Odell *et al.*, 2014)

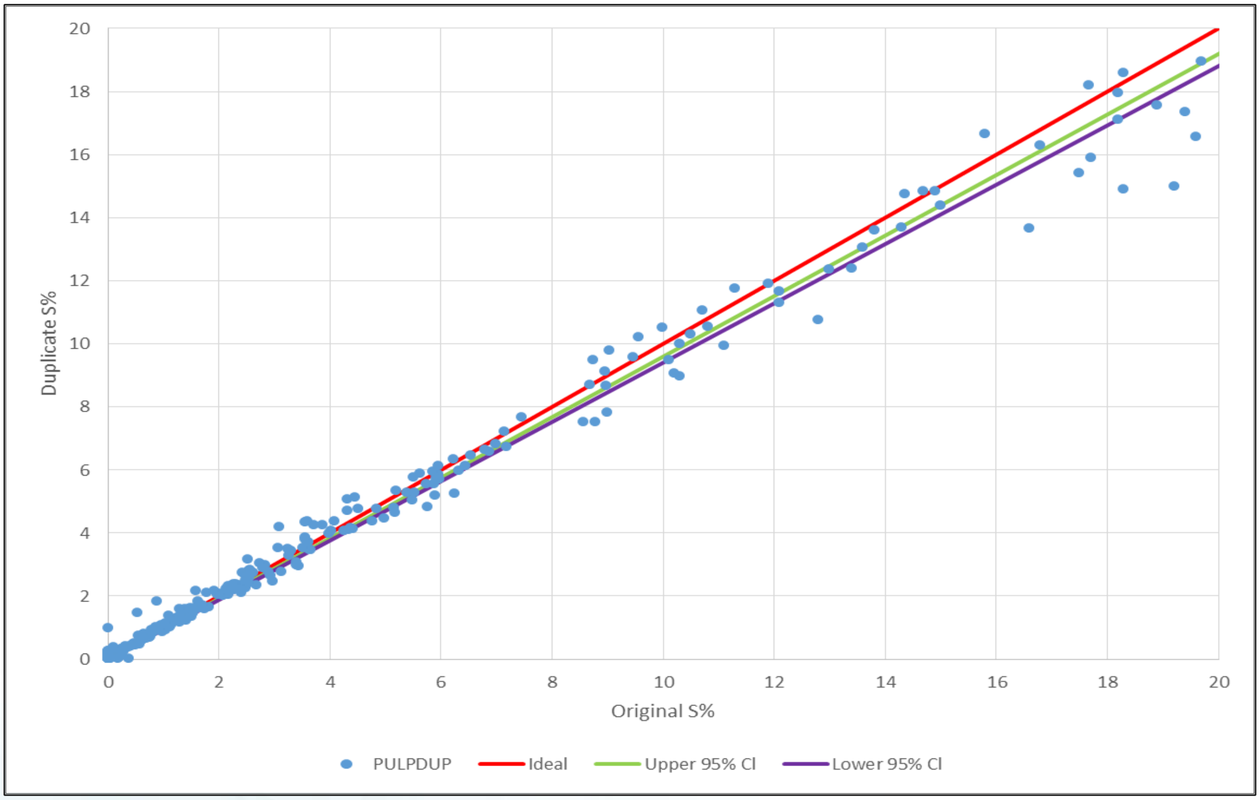


Figure 11.9 Scatterplot – Au pulp duplicates (after Odell *et al.,* 2014)

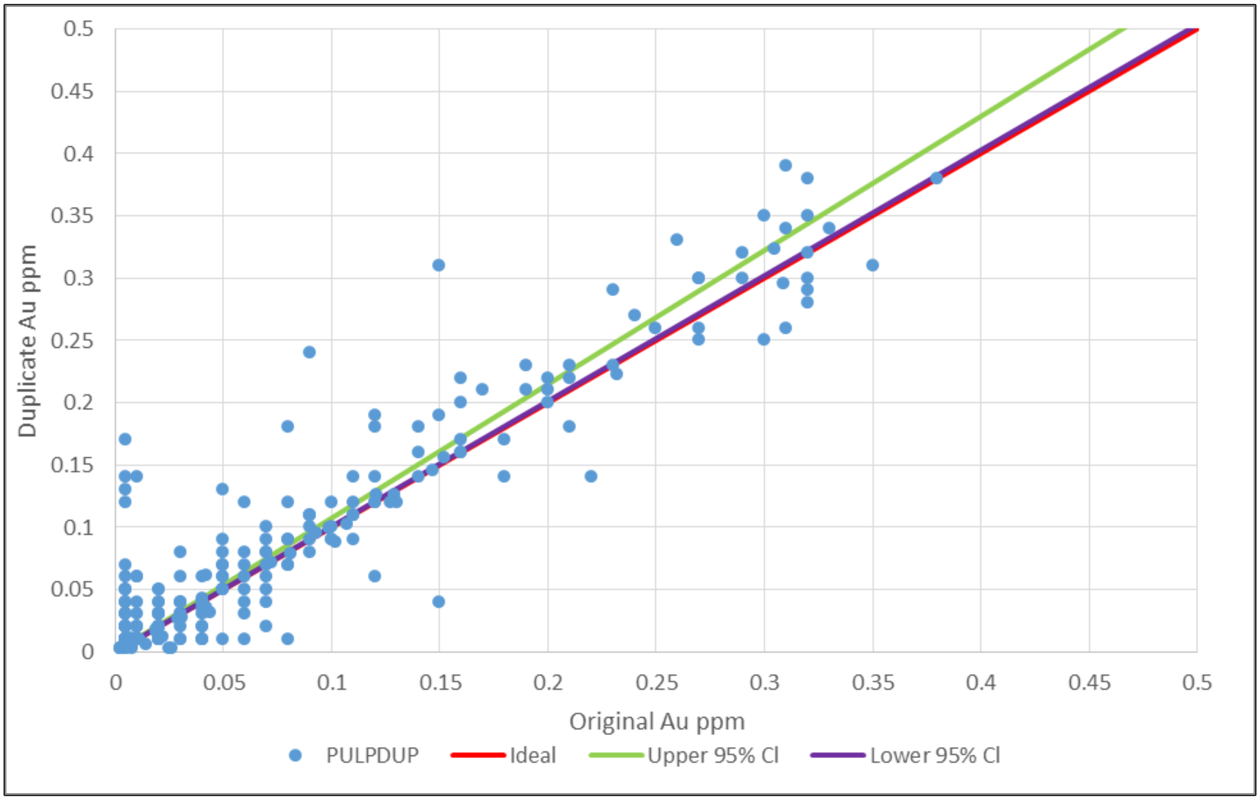
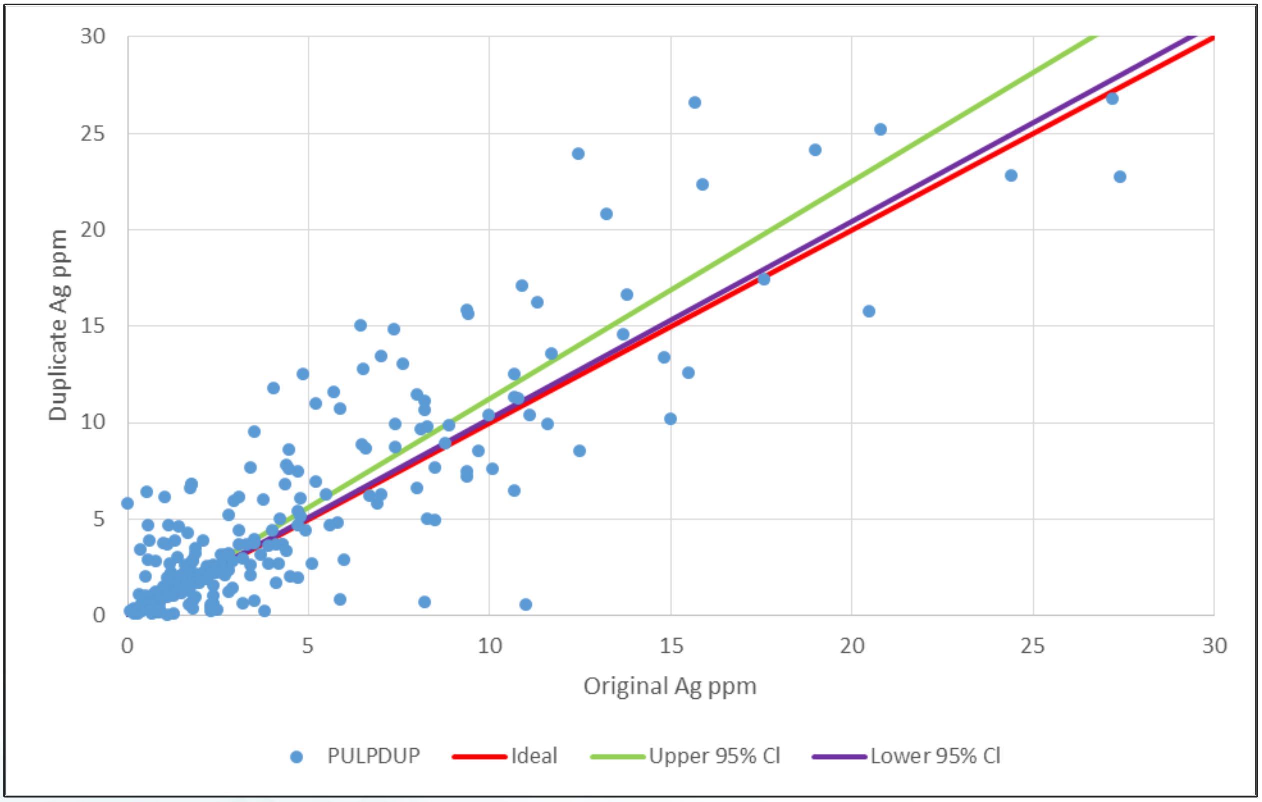


Figure 11.10 Scatterplot – Ag pulp duplicates (after Odell *et al.,* 2014)



Coarse reject duplicates

The coarse reject duplicate performance is presented as scatterplots for Cu, Leco S, Au and Ag in Figure 11.11 to Figure 11.14. The original assay from the primary laboratory is plotted on the X-axis with the check assay from the secondary laboratory plotted on the Y-axis. The graphs are sourced from the draft technical report compiled by Odell *et al* (2014); however, as for the pulp duplicates, it is unclear what the basis for the confidence intervals (red and purple lines) is.

The coarse reject duplicates show reasonable repeatability (i.e. precision) for Cu, Leco S and Au; however, similar to the pulp duplicates, the secondary laboratory appears to report slightly higher Cu grades on average. Ag show poor precision which may be partially related to the relatively low grade and inherent variability of Ag at Mengapur, but overall is not ideal.

Figure 11.11 Scatterplot – Cu coarse reject duplicates (after Odell *et al.,* 2014)

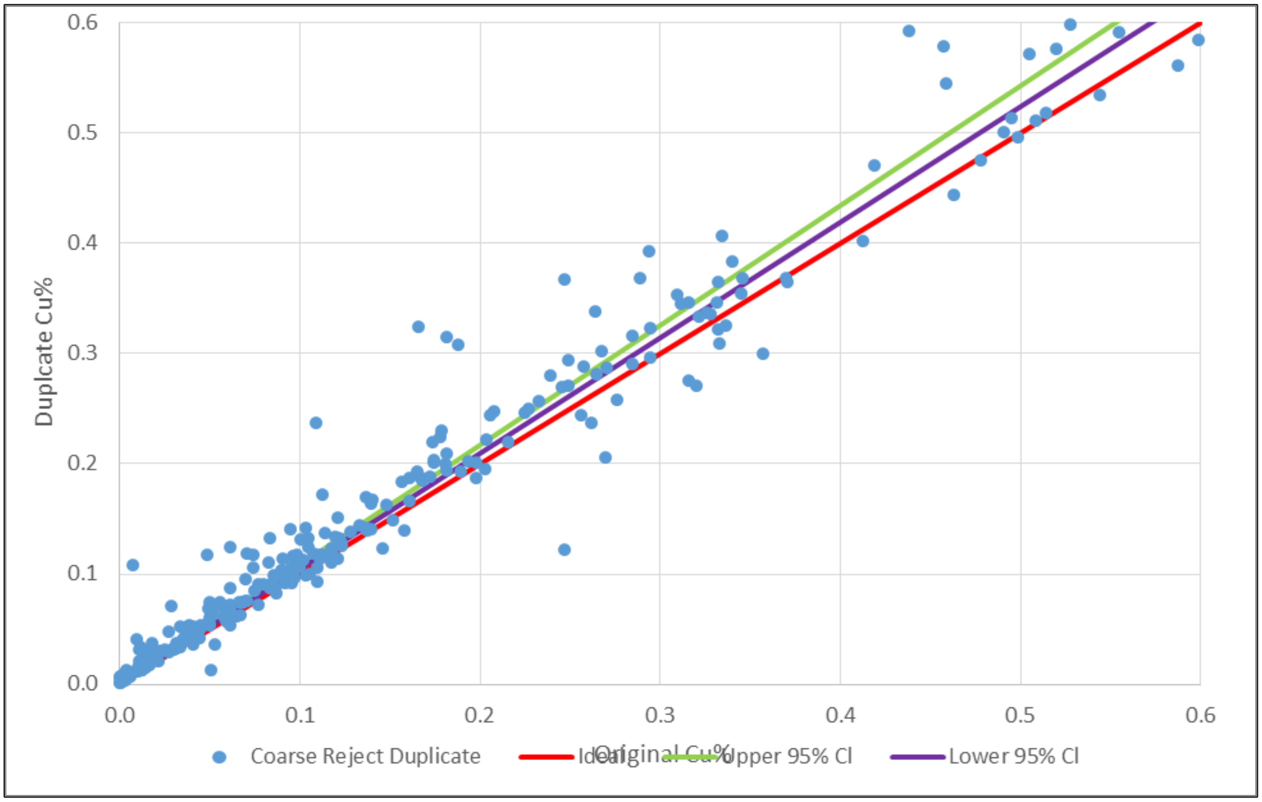


Figure 11.12 Scatterplot – Leco S coarse reject duplicates (after Odell *et al.*, 2014)

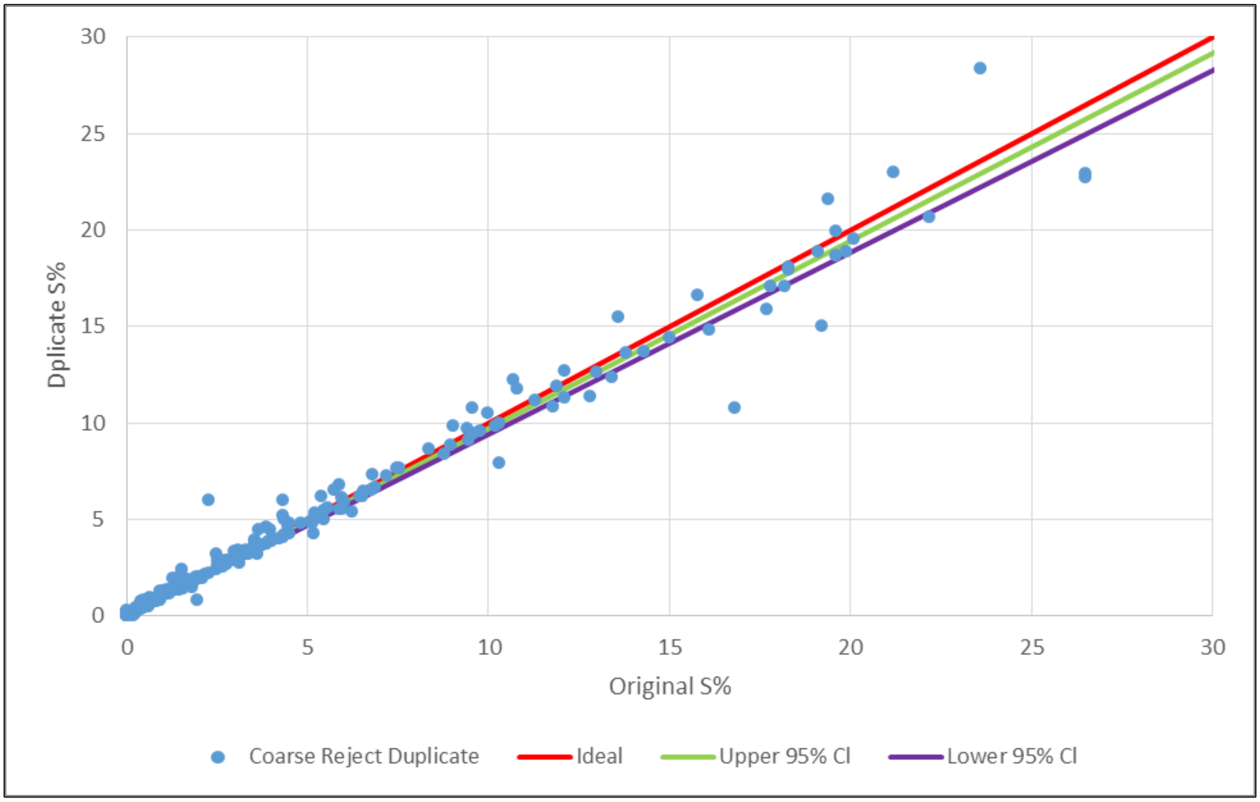


Figure 11.13 Scatterplot – Au coarse reject duplicates (after Odell *et al.*, 2014)

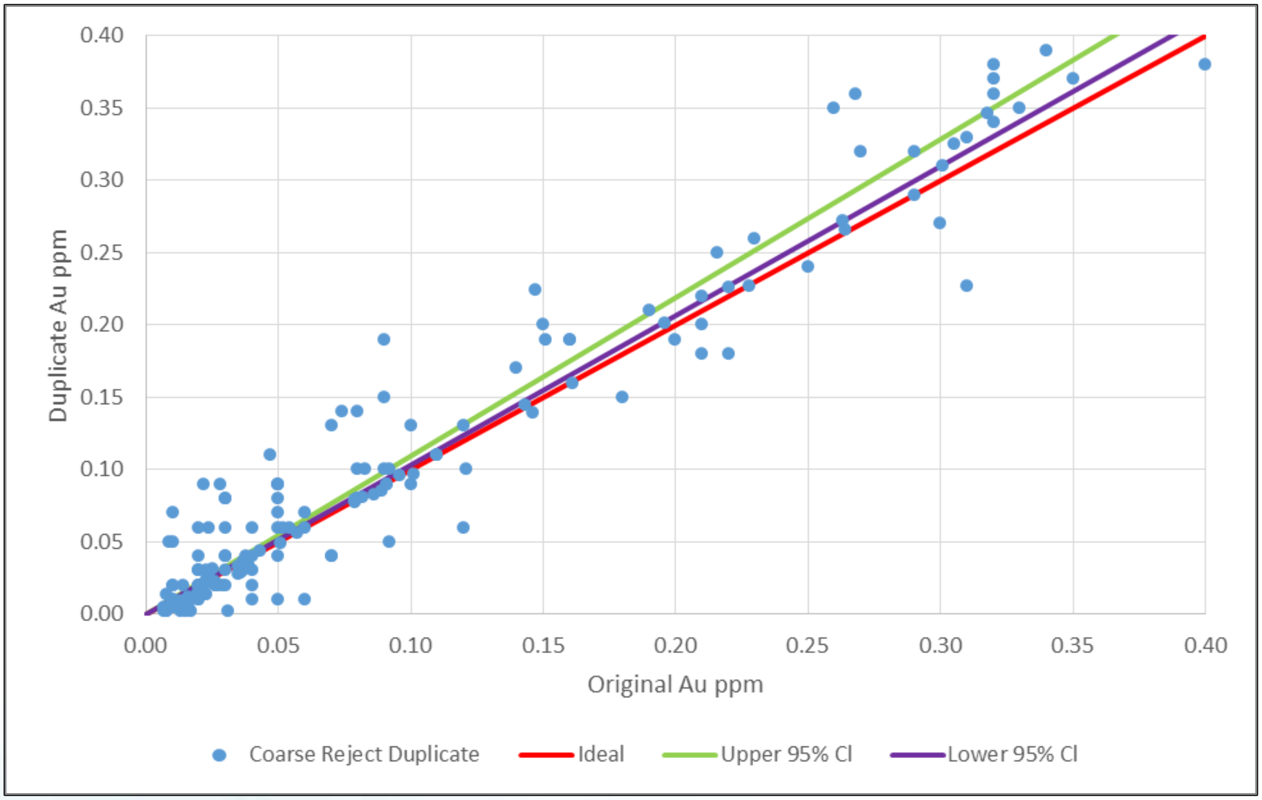
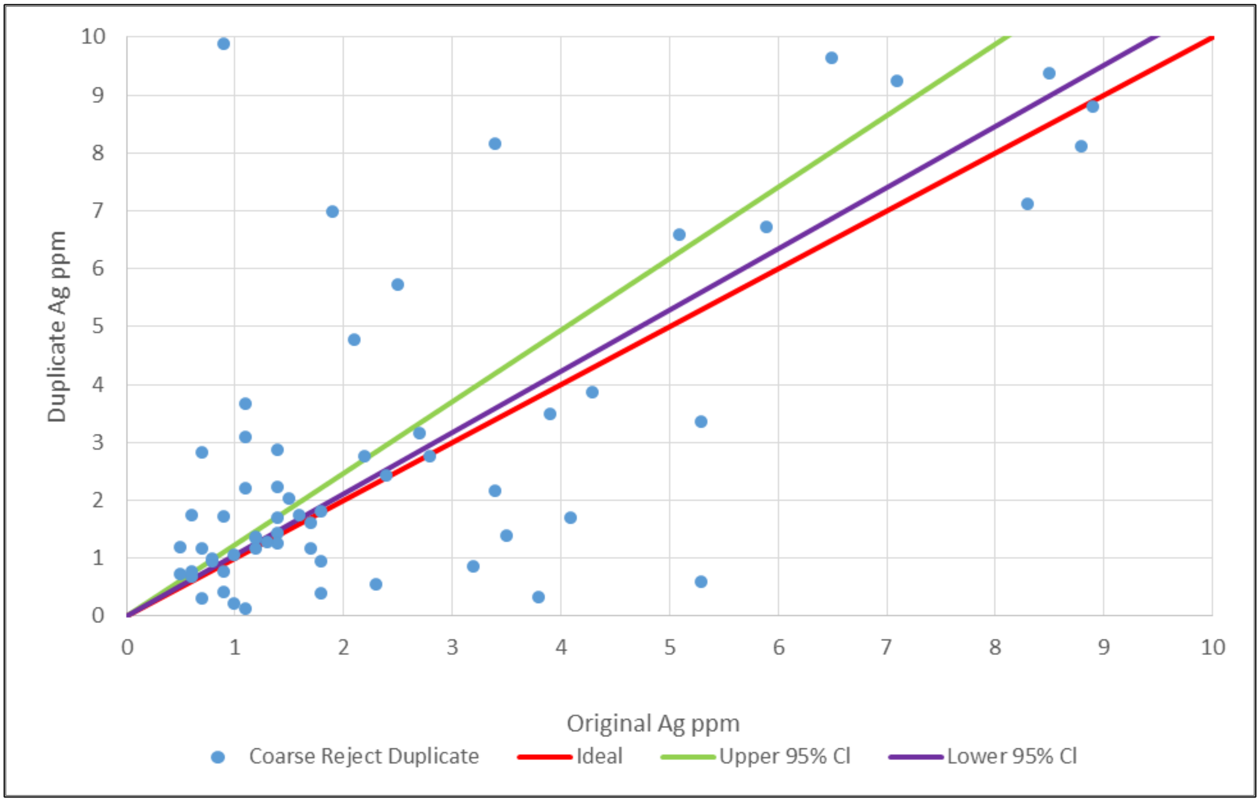


Figure 11.14 Scatterplot – Ag coarse reject duplicates (after Odell et al., 2014)



Blanks

The blank assays for the elements of interest (Cu, S, Au and Ag) were compiled from the Datashed Database, with a total of 863 blank samples. The blanks were analysed by three different laboratories using different assay techniques dependent on the element being analysed. Blank sample assay control charts are presented in Figure 11.15 to Figure 11.19 for Cu, Leco S, Au and Ag. Cu assays are split depending on the assay technique (ICPMS or ICPOES) due to the different detection limits.

The vast majority of the blank samples report results at or close to the analytical detection limit for each element. There is no evidence for systematic contamination of samples during sample preparation and/or assaying.

Figure 11.15 Blank sample control chart – Cu ICP-MS (after Odell, 2014)

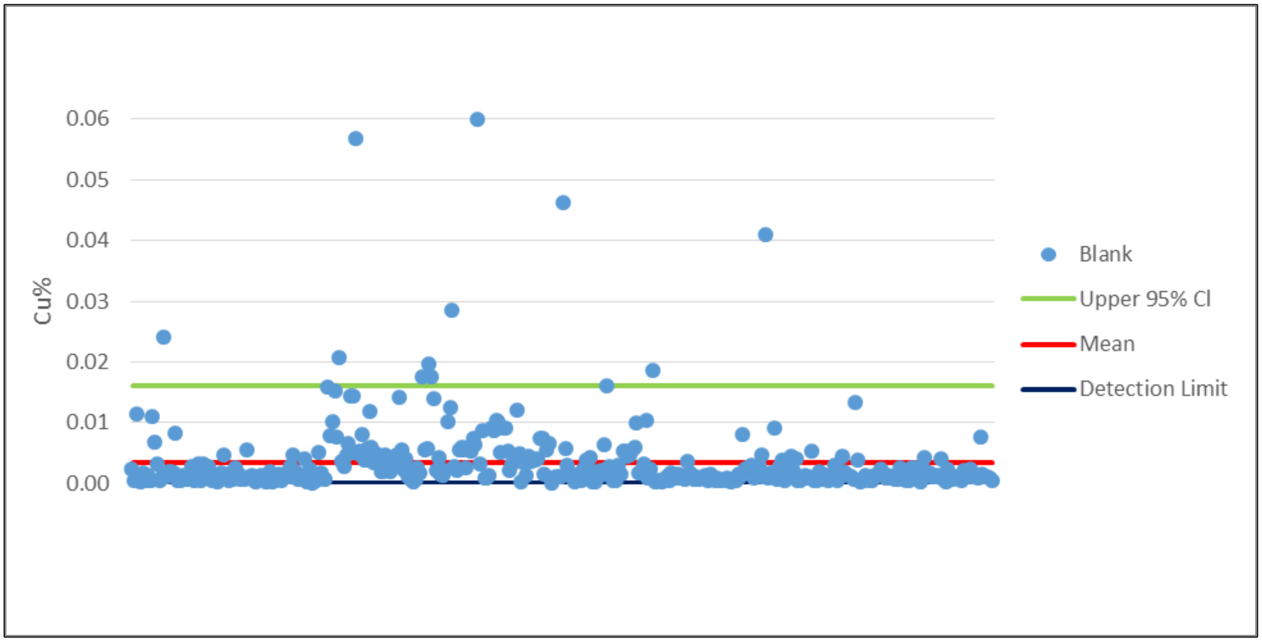


Figure 11.16 Blank sample control chart – Cu ICP-OES (after Odell, 2014)

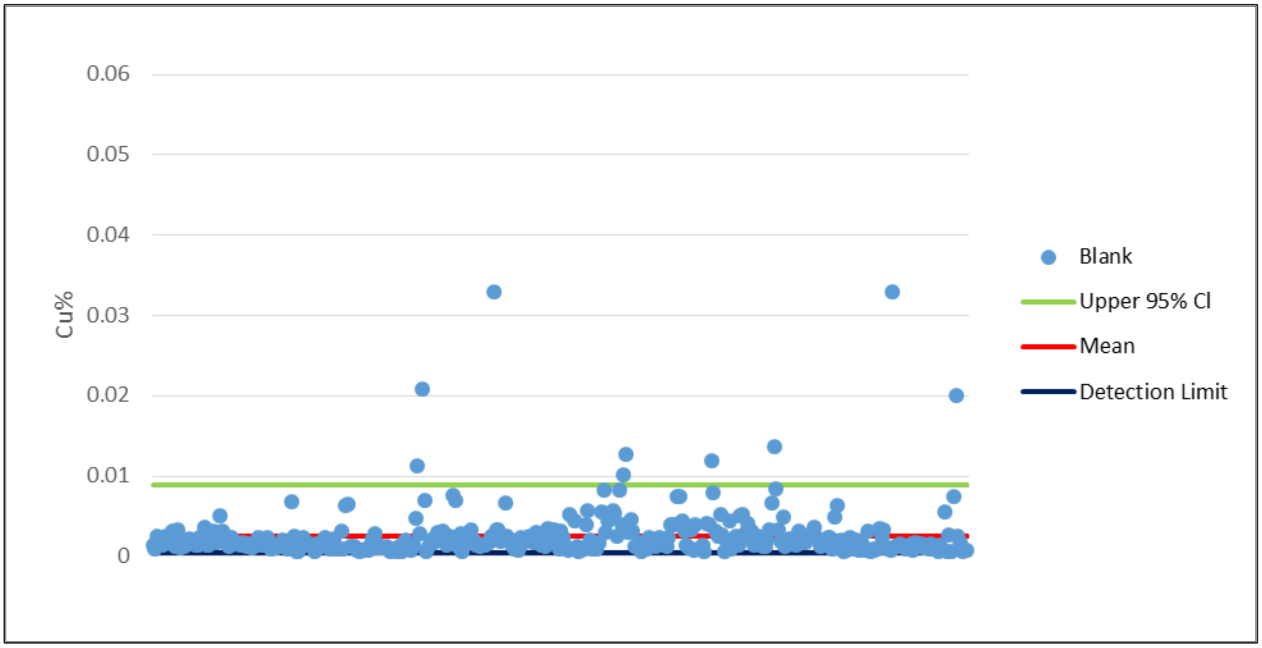


Figure 11.17 Blank sample control chart – Leco S (after Odell, 2014)

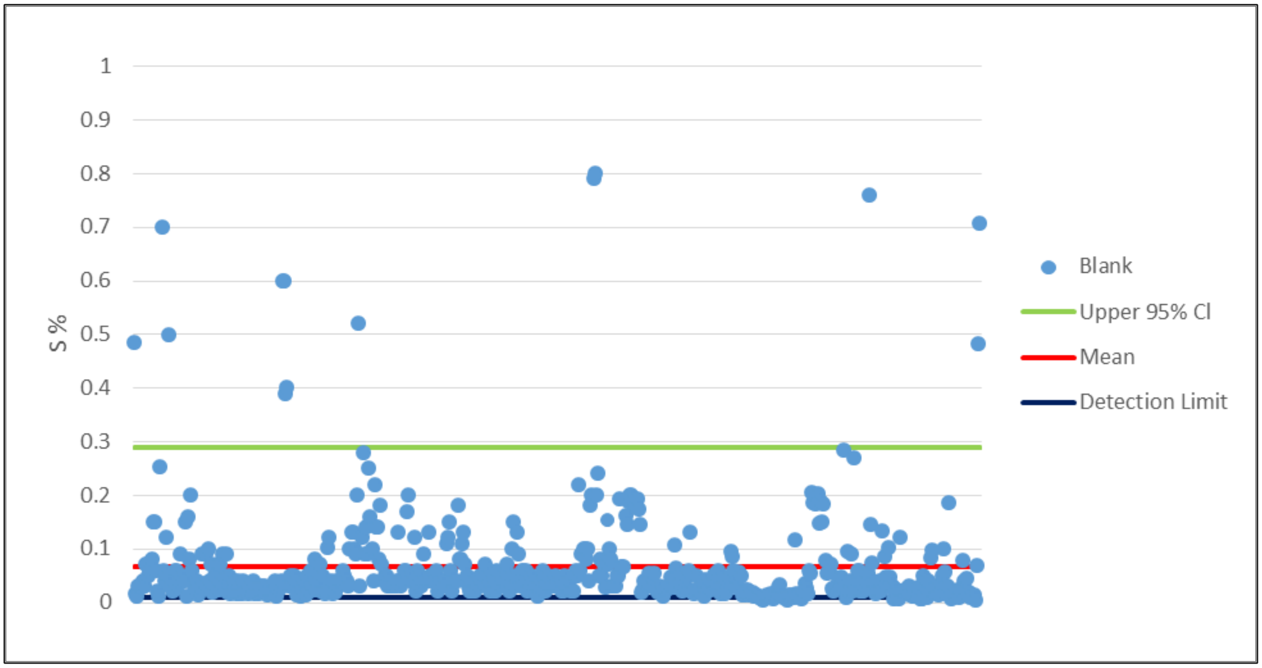


Figure 11.18 Blank sample control chart – Au (after Odell, 2014)

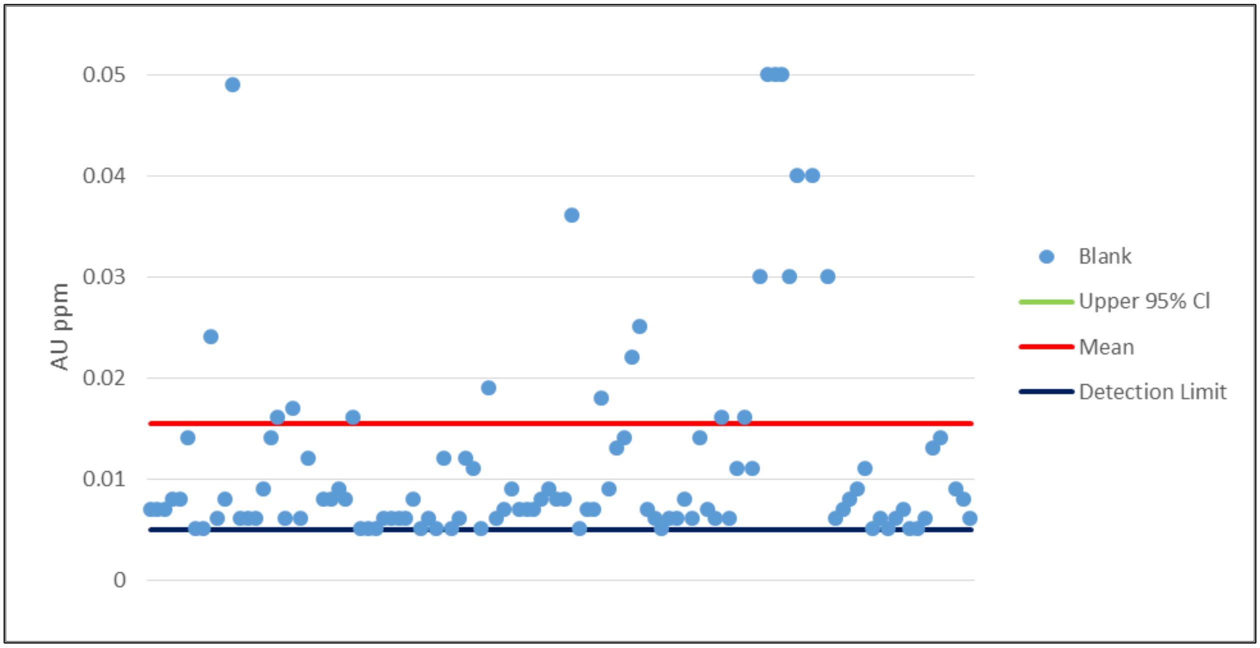
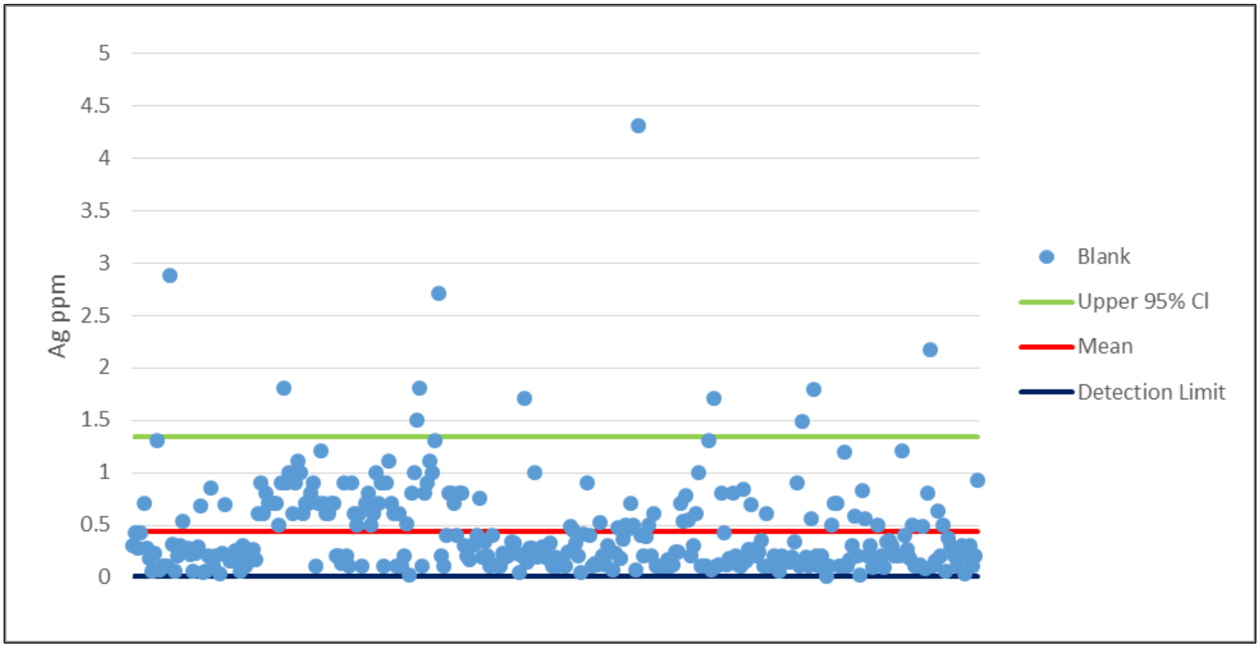


Figure 11.19 Blank sample control chart – Ag (after Odell, 2014)



Standards

Monument used multi-element and single element standards during the 2011 to 2014 drill programs to monitor the analytical accuracy of the assaying. The results are summarised in Table 11.5.

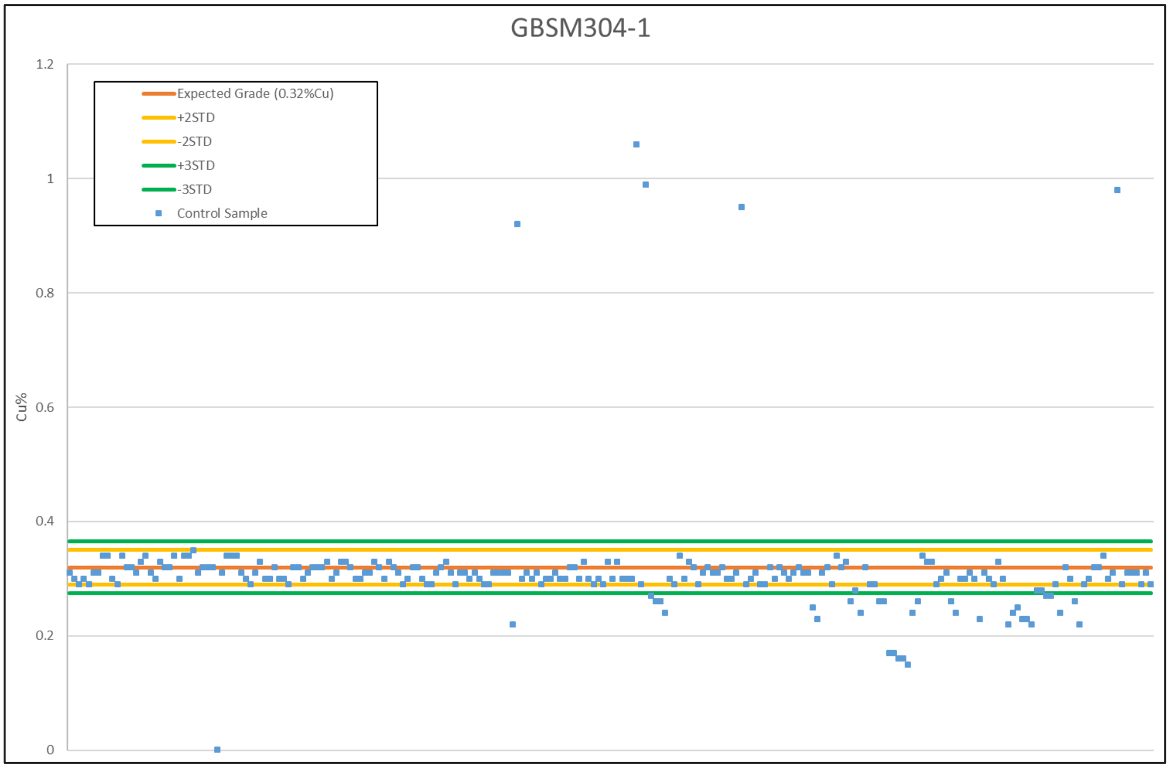
Three different grade ranges of copper standards were used during the Monument drilling programs – one near the average Cu grade of the deposit (ranging from approximately 0.2% Cu to 0.4% Cu), one below the average Cu grade, and one above the average Cu grade. Most of the copper standards were the GBMS series standards purchased from Geostats Pty Ltd.

Control charts for copper for GBMS304-1, GBMS304-3 and GBMS304-4 are presented in Figure 11.20 to Figure 11.22. In Snowden's opinion, a significant amount of the outliers (defined as outside the ±3 standard deviation limits) evident in the standard assays are due to incorrect assignment of the standard ID to the sample. Overall, the standards performed reasonably well, with individual results generally falling within acceptable tolerance limits and the global average of the standard assays close to the expected value for most standards (once outliers have been accounted for).

Table 11.5 Standard assay results

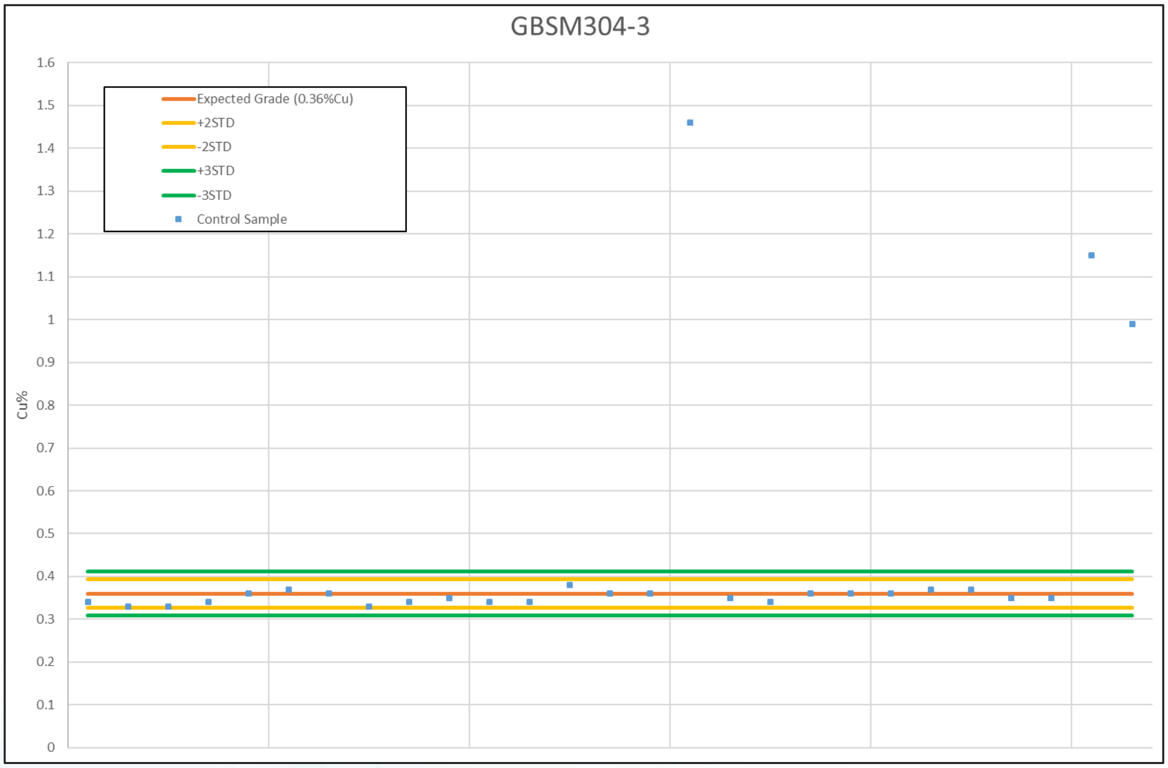
Element	Standard ID	Expected value	Expected standard deviation	No. of analysis	Sample mean	Sample standard deviation
Cu (%)	GBMS304-1	0.32	0.015	233	0.31	0.113
	GBMS304-2	1.43	0.060	35	1.25	0.412
	GBMS304-3	0.36	0.017	27	0.45	0.280
	GBMS304-4	0.97	0.035	210	0.89	0.151
	GBMS304-5	0.23	0.012	122	0.22	0.017
	OREAS113	13.50	0.700	62	12.78	2.690
	OREAS161	0.41	0.012	76	0.40	0.012
	OREAS162	0.77	0.026	67	0.76	0.029
	OREAS163	1.76	0.070	84	1.71	0.169
Fe (%)	GIOP-94	23.97	0.08	295	23.97	2.94
	GIOP-101	37.22	0.14	214	33.29	4.92
	GIOP-120	2.83	0.02	324	3.26	3.84
	OREAS113	28.20	1.00	46	27.70	1.46
	OREAS161	4.26	0.17	76	4.26	0.14
	OREAS162	8.57	0.16	67	8.31	0.36
	OREAS163	11.07	0.15	61	10.68	0.51
S (%)	GBMS304-1	1.33	0.07	232	1.44	0.65
	GBMS304-2	3.34	0.14	36	3.09	0.72
	GBMS304-3	2.35	0.10	28	2.69	1.05
	GBMS304-4	6.27	0.26	208	6.16	0.92
	GBMS304-5	1.04	0.06	123	1.08	0.15
Au (ppm)	GBMS304-1	3.06	0.28	534	3.06	0.45
	GBMS304-2	6.04	0.29	36	5.44	1.41
	GBMS304-3	2.68	0.14	28	2.94	0.96
	GBMS304-4	5.67	0.31	471	5.34	0.89
	GBMS304-5	1.62	0.08	247	1.57	0.42
	GLG304-4	0.12	0.03	295	0.15	0.36
Ag (ppm)	GBMS304-1	1.4	1.0	234	1.39	1.24
	GBMS304-2	5.1	0.6	36	4.82	1.69
	GBMS304-3	1.5	0.5	28	1.76	0.92
	GBMS304-4	3.4	0.8	209	3.09	0.91
	GBMS304-5	0.8	0.2	126	0.79	0.25

Figure 11.20 Standard control chart (Cu) – GBMS304-1



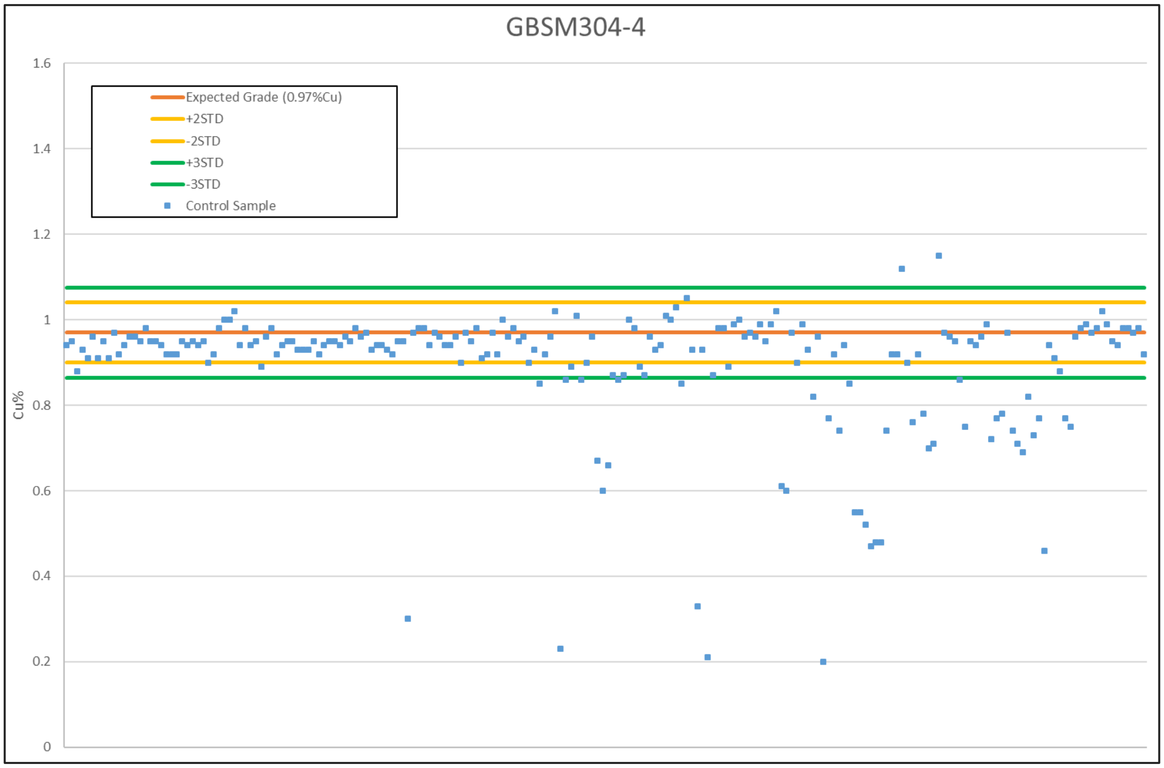
Source: Monument

Figure 11.21 Standard control chart (Cu) – GBMS304-3



Source: Monument

Figure 11.22 Standard control chart (Cu) – GBMS304-4



Source: Monument

Sizing analysis

Check wet sieve (or sizing) analyses using a 2 mm screen were routinely performed by secondary certified laboratories on coarse reject samples in order to monitor the crushing procedures performed by the primary laboratory. Approximately one in 40 coarse reject samples were selected for check wet sizing analysis (Odell *et al.,* 2014). The secondary laboratory check wet sizing results indicate that the primary laboratories were satisfactorily crushing the samples to greater than 70% passing 2 mm.

Wet check sizing analyses were also routinely performed by a secondary certified laboratory on the pulverised samples using the -75 µm screen (200 mesh) to monitor the pulverising performance at the primary laboratory. Approximately one in 40 pulp samples were selected for a wet check sizing tests.

Pulps that did not meet the pulverisation protocols outlined in Table 11.3, based on the check wet sizing analyses, were routinely re-pulverised to greater than 90% passing -75 µm prior to analysis to minimise any potential bias related to the pulp sample preparation (Odell *et al.,* 2014).

According to Odell *et al* (2014), one batch of check pulp duplicate samples that contained some pulps that did not meet the pulverisation protocols, were submitted to two different secondary (umpire) laboratories, where one of the umpire laboratories (ALS – North Vancouver) re-pulverised the pulps to >85% passing 75 µm specification prior to the analytical check assays, and the other umpire laboratory (SGS-Vancouver, Canada) analysed the pulps "as received" with later wet sizing of the pulp to quantify the "sub-par" pulverisation. The 13 pulp samples submitted to SGS Vancouver that under-achieved the pulp pulverisation protocols ranged from 60% passing 75 µm up to 84% passing, with an average of 72.5% passing, and included five oxide samples, four transitional samples, and four sulphide samples. No consistent assay differences or analytical bias was observed by Odell *et al* (2014) in the analytical results between the assay results after re-pulverisation compared to those from the "as received" pulps.

Apparent physical “hardening” of some of the prepared drillhole pulps over time (from when the pulp was prepared to when it was assayed) was noted by Mengapur geological staff and confirmed by a small microscopy study performed by ALS Metallurgy laboratory in Australia (Meng and de Nooy, 2013). The ALS microscopy study examined 15 separate “sulphide” pulp samples from two high-pyrrhotite-bearing drillholes (MEN176 and MEN181) where the initial wet sizing test passed the QAQC protocol of 90% passing 75 µm, but later wet sizing tests indicated a percentage passing 75 µm. The +75 µm dry screened fractions for the 15 pulp samples were made into polished sections by ALS. The samples generally contained a high proportion of pyrrhotite and/or partially oxidised pyrrhotite. The oxidation products of pyrrhotite were determined to include sulphur, gypsum, jarosite and ferric iron hydroxides/oxyhydroxides and tend to act as cement between other pulverised particles, resulting in the formation of agglomerates (less than 800 µm) and could have resulted from a change of environmental factors (e.g. oxygen levels, temperature, moisture content, and/or pH levels) potentially causing oxidation of the sulphide minerals.

Some oxide pulp samples were also occasionally noted to fail the wet screen test. The oxide pulps contain a moderate to high plastic clay component that may be aggregating within the pulp bag over time and therefore becoming coarser than 75 µm. This was noted early in the assay program (Odell *et al.,* 2014) and samples were subsequently prepared prior to sizing by soaking the sample for approximately 24 hours in water prior to performing the wet sieve screen analysis.

The local “hardening” of some pulp samples is believed to have been minimised for samples which were prepared in Malaysia but assayed in Vancouver (i.e. relatively long time delay due to shipping), as the primary assay laboratories (ACME or Inspectorate) were requested to re-pulverise these pulp samples prior to assaying.

11.7 Author’s opinion on the adequacy of sample preparation, security, and analytical procedures

Snowden comments that historical sample preparation and security of diamond drill core samples for Mengapur cannot be verified at this time. Drill core from pre-1990 Mengapur drilling campaigns are unavailable for review as the core storage facilities reportedly burned down in 2005. However, comparisons between the historical drilling and later Monument drilling (see Section 14.3.1) indicate that for Cu, the historical assay data compares reasonably well.

The vast majority of the drilling conducted at Mengapur is diamond core drilling, with good recoveries achieved. Whilst the Qualified Person has not observed the sampling processes, documented practices appear to be in line with standard industry practices.

QAQC results for the Monument drilling indicates that a reasonable precision was achieved for both the coarse rejects and pulp sample stages, and assay results of standards shows a reasonable overall analytical accuracy has been achieved for Cu, S, Au and Ag. Blank samples show no evidence of systematic contaminations of samples was occurring during laboratory sample preparation or assaying.

The Qualified Person has no reason to suspect any issues relating to sample security and believes that the data is suitable for use in resource estimation. A lower confidence has been attributed to the historical (pre-1990) data, especially in areas of the resource informed by primarily historical data.

12 DATA VERIFICATION

12.1 Verification of collar coordinates

During the 2018 site visit, Snowden was able to verify the collar coordinates of five drillholes, with coordinates measured in the field (by Monument with Snowden present) using a handheld GPS (Figure 12.1) which were then compared to the surveyed coordinates in the database. The results show a good comparison between the 2018 measurements and the coordinates stored in the database (Table 12.1), taking into account the relative precision of the handheld GPS.

One historical hole was found within the current pit, however the collar was not labelled. Based on the coordinates, it is assumed this is hole DDMEN135. The location measured is approximately 24.5 m to the west of the location as stored in the database and 19.6 m below (although this area is within the current pit and it is likely the original collar was higher). Given the uncertainty with attributing this location to DDMEN135, Snowden is unable to make any conclusions with respect to this data point.

Figure 12.1 Example of drillhole collar coordinate verification by handheld GPS during 2018 site visit

Note: Photo taken during April 2018 site visit

Table 12.1 Verification of drillhole collar coordinates by handheld GPS during 2018 site visit

Hole no.	Handheld GPS			Database			Absolute difference (m)		
	X	Y	Z	X	Y	Z	X	Y	Z
MET001	536594	417103	232	536592.3	417105.0	235.4	1.7	2.0	3.4
MEN296	536406	416702	205	536400.9	416702.8	208.7	5.1	0.8	3.7
MEN351	536402	416705	206	536400.2	416705.9	208.8	1.8	0.9	2.8
MEN284	536353	416607	207	536344.8	416609.9	207.5	8.2	2.9	0.5
MEN352	536233	416531	214	536232.6	416532.0	213.1	0.4	1.0	0.9
*DDMEN135 **	536411	416716	205	*536435.5*	*416713.6*	*224.6*	*24.5*	*-2.4*	*19.6*

** Historical hole, hole number assumed as collar not labelled, original collar position was likely higher as measured location within current pit.*

12.2 Visual verification of drillhole intersections

Mineralised intersections from three drillholes (MEN249, MEN269 and MEN386) were verified visually by the Qualified Person during the 2018 site visit. The assay data and geological logging was compared to the diamond core. Whilst the core was observed to have significantly deteriorated and oxidised since it was drilled, geological boundaries in the logging were observed in the diamond core, and sulphide (primarily pyrrhotite) mineralisation and copper staining (from the oxidation of copper sulphide minerals) was observed to correlate with the elevated copper assays.

12.3 Qualified Person’s opinion on the adequacy of the data for the purposes used in the technical report

Snowden believes that the drillhole data within the Mengapur database is generally robust, with checks by the Qualified Person confirming collar coordinates and visual inspection of select mineralised intersections. Some errors in downhole surveys were noted during data validation but these are considered minor and where these surveying errors could not be resolved, the impacted drillholes were excluded from the estimation (see Section 14.3). Additionally, comparisons between more recent sulphur assays from the Monument drilling with historical sulphur assays suggests that the historical sulphur assays are biased and have therefore been excluded from the grade estimation (see Section 14.3).

Snowden has not conducted any independent sampling or assaying to verify the tenor of the samples. Given the visual inspections of core, outcropping mineralisation and QAQC results, along with the mining production history, Snowden does not believe that independent sampling is required at this stage.

In Snowden’s opinion, notwithstanding the items mentioned above, the drillhole database for Mengapur is suitable for use to generate MREs.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Introduction

Metallurgical testing has been conducted on oxide, transitional and sulphide samples from September 2011 to March 2014, primarily at Inspectorate Exploration & Mining Services Ltd Metallurgical Division (Inspectorate) in Richmond, BC, Canada. The metallurgical testing has been completed in three general phases:

- An early due diligence phase in late 2011 to early 2012 that focused on two surface grab sulphide samples from the A zone (MMSB) open pit
- A second phase that included several oxide grab surface samples from the previous A and B exploration zones of the CASB and SDSB tenements
- A third phase that included MMSB drillhole sample composites from 2013 to 2014 (Table 13.1).

Table 13.1 Metallurgical testing phases on Mengapur samples at Inspectorate, Richmond, Canada

Testing phase	Dates collected in field	Material classification tested	Tenements and previous exploration zones	Sample material type and quantity	Testing types
1	Early August 2011; material stored in a freezer at Inspectorate to minimise oxidation	Sulphide (one low sulphur and one high sulphur sample)	CASB (Zone A)	2 surface grab samples each totalling 100 kg	Bench, kinetic, and cleaning flotation tests
2	Oct 2011 to mid-Feb 2012	Oxide (with different magnetite, copper, and Au contents)	CASB (Zones A and C); SDSB (Zone B)	14 surface grab samples totalling 4,672 kg	Sulphuric and cyanide leach tests; some flotation
3	Mid-2011 and to Jul 2012 (MMSB diamond drilling on coarse reject materials; sulphide materials placed under nitrogen preservation in sealed plastic bags)	Sulphide, Transitional, and Oxide; different Cu and S grades were tested for the TRANS and SUL samples)	CASB (Zone A) and SDSB (Zone B)	Drillhole composites: 586 kg oxide; 1,053 kg transitional; 1,023 kg sulphide	Leaching tests on OX and TRANS; bench, kinetic, and cleaning flotation tests on TRANS and SUL; three locked cycle flotation tests on SUL

Notes: OX= oxide; TRANS = transitional; SUL = sulphide

The metallurgical testing program was largely done at the Inspectorate facility in Richmond, BC, Canada. The sample collection was conducted with geology supervision to geologically and geochemically characterise the samples and document the sample locations.

The metallurgical testwork at Inspectorate commenced in September 2011 as part of the due diligence work that included two separate surface grab sulphide samples (100 kg each) collected from the open-pit rock exposure in the southeastern part of the A Zone (Malaco Pit). Since the early sulphide metallurgical testwork indicated acceptable recoveries for Cu, S and Au, subsequent metallurgy work was conducted on several surface grab oxide samples in 2012 and several MMSB exploration drillhole composites that included the representative ore types from the oxide, transitional and sulphide zones and different Cu-S-Au-Fe grade ranges. The drillhole composites consisted of coarse reject drillhole intervals prepared by the Inspectorate sample preparation lab in Fairbanks, Alaska. Drillholes that were selected for the metallurgy testwork were completed in 2011 and 2012. The sulphide and transitional coarse reject samples were placed in sealed plastic bags under nitrogen gas in order to minimise oxidation and stored in Fairbanks, Alaska. The selected samples (still under nitrogen in sealed plastic bags) were shipped to the Richmond, BC Inspectorate lab for actual metallurgical testing.

Additional variability testing on the sulphide and transitional samples is strongly recommended. To date, only limited metallurgical testwork has been done for Bi and Mo and should be included in future testing programs. Hardness testing still needs to be performed on the sulphide and transitional samples. In addition, roast testwork on the pyrrhotite concentrates still needs to be done.

13.2 Oxide samples

13.2.1 Sample locations and geological characterisation

Oxide ores included in the Mengapur metallurgical testwork were sourced from both surface grab samples and drillhole composites. The location of the oxide samples is listed in Table 13.2 to Table 13.4 and shown in Figure 13.1.

Mineralogy of four of the surface grab oxide samples based on x-ray diffraction (XRD) work from the University of British Columbia, Canada (Raudsepp, M. et al., 2012) are listed in Table 13.5. Head grade ICP geochemistry for the oxide samples is listed in Table 13.6 and Table 13.7, including Davis Tube and Satmagan results from Inspectorate, along with Leco sulphur (total sulphur) grades.

The mineral percentages shown for each sample have been normalised to 100%, consequently the content of XRD amorphous phases is not apparent. Oxide grab samples would be expected to contain significant amounts of XRD-amorphous phases. It would appear that the content of crystalline sulphides was too low to be detected, as no sulphide minerals appear in this table.

Table 13.2 Oxide surface grab sample locations

Bulk surface sample ID	Collection date	Easting	Northing	Elevation	Quantity (kg)	Rock type*	Tenement
Zone A Comp	6 Sep 2011	536497	416905	245	1,233	SOIL, orange brown	CASB
Zone B Comp	2 Nov 2011	535638	416497	331	1,180	SOIL, light Brown	SDSB
Zone C1 Comp	9 Sep 2011	535905	417365	282	699	SOIL, light orange brown	CASB
Zone C2 Comp	6 Sep 2011	535444	417562	227	563	SOIL, light orange brown	CASB
Zone A-015A	23 Feb 2012	536090	416474	267	604	SOIL, dark brown	CASB
Zone A-016B	23 Feb 2012	535984	416442	288	599	SOIL, reddish brown	CASB
Zone B-048	23 Feb 2012	535563	416531	355	38	SOIL, dark brown	SDSB
Zone B-076	23 Feb 2012	535616	416576	341	36	GOSN, SOIL, reddish brown	SDSB
Zone B-0137	23 Feb 2012	535537	416583	375	44	GOSN, black reddish brown	SDSB
Zone C Hi Mag	23 Feb 2012	536230	417490	260	490	WSK SOIL	CASB
GOSN-C	3 Nov 2012	536250	417635	233	<20	GOSN	CASB

Notes: SOIL: undifferentiated soils at the surface (all oxide); GOSN: gossan, mostly dark brown porous rock with some soil (all oxide); WSK: Weathered Skarn; WSH: Weathered Shale.

Table 13.3 Oxide sample drillhole collar coordinates with azimuth and dip

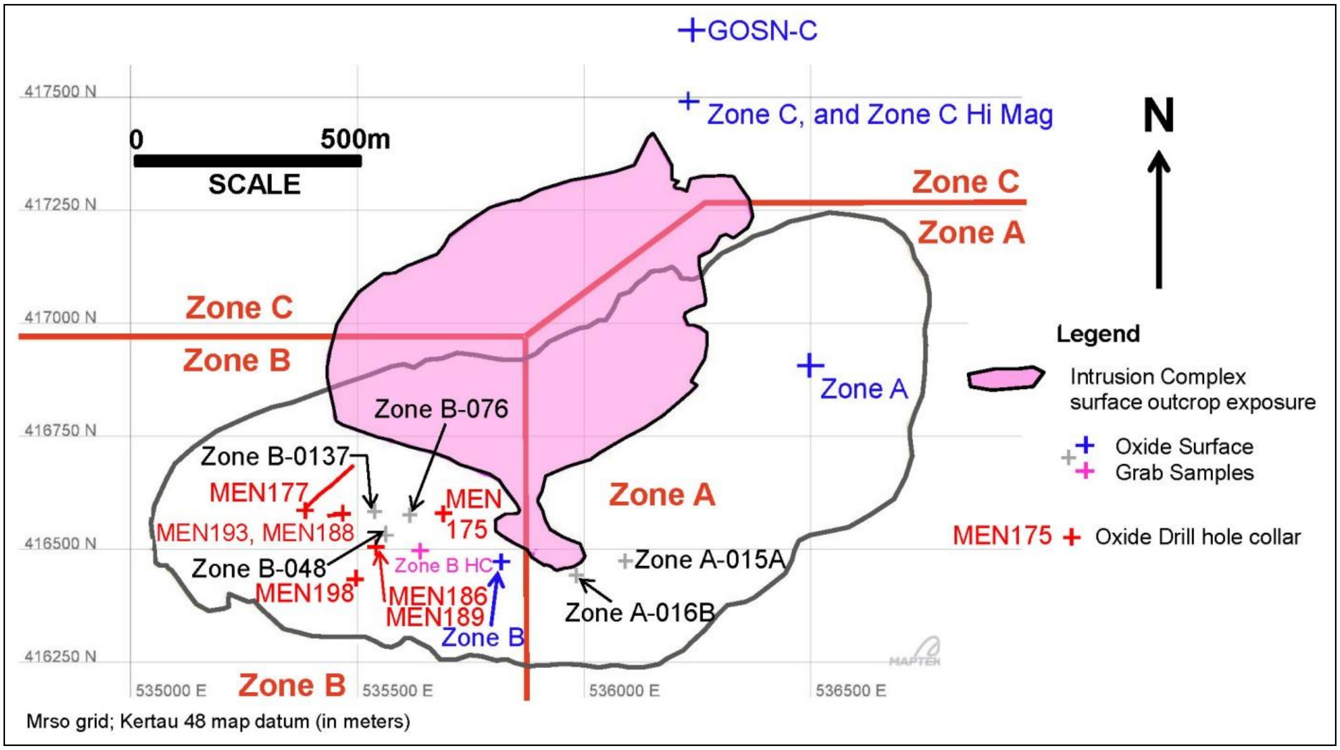
Drillhole ID	Tenement	Easting	Northing	Elevation	Azimuth	Dip	Depth (m)
MEN175	SDSB	535691.0	416577.9	296.0	0	-90	400.8
MEN177	SDSB	535453.1	416617.5	395.5	45	-50	254.0
MEN186	SDSB	535540.3	416503.1	324.8	0	-90	70.4
MEN188	SDSB	535464.6	416579.9	373.1	90	-80	300.0
MEN189	SDSB	535540.9	416503.3	324.8	90	-65	240.0
MEN193	SDSB	535462.8	416579.6	373.2	270	-80	194.2
MEN198	SDSB	535498.3	416421.4	288.8	270	-50	180.0

Table 13.4 Oxide drillhole sample list

Oxide composite	Drillhole intervals	Rock types	Tenement
Compo A	MEN188: 13.70-17.00 MEN188: 26.0-29.0	WSK GOSN	SDSB
Compo B	MEN188: 0.00-3.50m; MEN188: 5.0-13.7m MEN188: 17.0-20.0m	SOIL SOIL SOIL	SDSB
Compo C	MEN193: 0.0-14.0m	SOIL	SDSB
Compo D	MEN186: 14.7-29.7m MEN186: 55.2-57.4m MEN193: 24.5-27.5m MEN175: 9.41-13.84m	WSK WSK WSK WSK	SDSB
Compo E	MEN189: 82.1-84.8m MEN189: 87.5-90.4m MEN189: 185.7-188.6m MEN198: 52.0-54.0m MEN198: 56.0-57.0m MEN193: 151.7-154.5m	WSH WSH WSH WSH WSH WSH	SDSB
Compo F	MEN193: 154.5-166.5m	WSH	SDSB
Compo G	MEN188: 78.6-87.6m	GOSN	SDSB
Compo H	MEN198: 90.0-91.0 MEN198: 92.0-93.0m MEN189: 90.4-93.3m	WSK WSK WSK	SDSB
Compo I	MEN188: 26.0-29.0m MEN189: 58.1-64.0m	WSK WSK	SDSB
Compo J	MEN189: 93.3-97.1m MEN189:	WSK WSK	SDSB
Compo M	MEN177: 73.4-85.7m	GOSN+WSK+WSH	SDSB
Compo N	MEN188: 93.3-102.2m	WSK	SDSB
Compo O	MEN193: 151.7-166.5m	WSH	SDSB
Compo P	MEN193: 166.5-175.0m	WSH	SDSB

Note: See lithology acronyms for Table 13.2.

Figure 13.1 Plan showing the location of oxide metallurgy samples



Note: Zone A, Zone B, Zone C were previous exploration area denominations

Table 13.5 Results of continuous-scan XRD quantitative phase analysis (wt.%) for four surface grab oxide composite samples

Mineral	Ideal formula	Zone A Comp (wt. %)	Zone B Comp (wt. %)	Zone C1 Comp (wt. %)	Zone C2 Comp (wt. %)
Quartz	SiO_2	9.0	6.5	11.3	40.8
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	-	1.0	-	-
Kaolinite	$Al_2Si_2O_5(OH)_4$	10.0	65.3	12.2	20.7
Illite-Muscovite	$K_{0.65}Al_{2.0}Al_{0.65}Si_{3.35}O_{10}(OH)_2$-$KAl_2(AlSi_3O_{10})(OH)_2$	-	2.2	-	7.8
K-Feldspar	$KAlSi_3O_8$	-	5.7	-	4.6
Goethite	α-$Fe^{3+}O(OH)$	59.8	17.2	48.6	20.1
Hematite	α-Fe_2O_3	14.2	-	19.8	3.2
Magnetite	$Fe^{2+}Fe^{3+}{}_2O_4$	6.9	-	7.6	-
Alunite	$K_2Al_6(SO_4)_4(OH)_{12}$	-	-	-	1.2
Jarosite	$K_2Fe_6{}^{3+}(SO_4)_4(OH)_{12}$	-	-	-	0.4
Anatase	TiO_2	-	2.2	0.4	-
Gorceixite	$BaAl_3(PO_4)(PO_3OH)(OH)_6$	-	-	-	1.3
Total		**100.0**	**100.0**	**100.0**	**100.0**

Notes: (1) Bruker D8 Focus Bragg-Brentano diffractometer equipped with a Fe monochromator foil using the Rietveld Method; (2) XRD work done at the University of British Columbia, Canada by Raudsepp et al. (2012).

Table 13.6 Oxide surface grab sample head analyses

Sample ID	Cu (%)	Leco S (%)	Au (ppm)	Fe (%)	Ag (ppm)	Mo (ppm)	As (ppm)	Bi (ppm)	Pb (ppm)	Zn (ppm)	Mag conc. (%)	SATMAG (%)
Zone A Comp	0.19	0.15	0.57	35.6	3.37	695	218	733	2,185	487	18.7	4.6
Zone B Comp	0.35	0.04	0.07	13.6	2.02	25	5,230	85	934	396	0.48	0.4
Zone C1 Comp	0.17	0.10	0.38	35.8	0.89	451	2,653	853	2,902	663	13.39	5.4
Zone C2 Comp	0.13	0.08	0.09	13.7	2.73	277	6,708	380	5,897	252	0.33	0.2
Zone A-015A	0.27	0.18	0.56	33.6	1.42	573	743	793	789	279	6.34	3.6
Zone A-016B	0.05	0.05	0.04	7.5	1.05	22	1,696	111	970	315	0.06	0.0
Zone B-048	0.25	0.06	0.09	10.0	2.59	6	5,864	194	2,608	254	0.12	0.2
Zone B-076	0.35	0.16	0.16	31.5	9.4	17	13,233	343	10,200	432	7.38	3.3
Zone B-0137	1.61	0.03	0.22	21.6	11.19	7	12,315	719	3,721	991	0.08	0.1
Zone C Hi Mag	0.03	0.06	0.13	52.7	0.53	2	112	1,143	1,660	274	36.38	10.4
GOSN-C	0.12	0.38	<0.1	41.5	0.40	23	248	311	3,814	857	ND	ND

Notes: (1) Mag con = magnetic concentrate from Davis Tube (DT) analysis; (2) analysed using 50-4A-UT multi-element ICP analysis by Inspectorate (Richmond, Canada); (3) the "GOSN-C" sample is a hand sample taken from the surface from the C Zone; ND = no data

The DT magnetic concentrate weights reveal the presence of ferromagnetic minerals but the yields from these samples are relatively low, except for Zone C Hi Mag. No assays of the magnetic concentrates are documented but it is likely that magnetic pyrrhotite may be present which would result in elevated sulphur contents. Only trace content of ferromagnetics was recorded for these samples.

Gold head grades appear to be low by gold industry standards. However, evaluation of potential by-product value should be carried out. The content of silver and other base metals would also justify further extraction testing, particularly by flotation.

Table 13.7 Oxide drillhole composite head analyses

Test ID	Sample ID	Cu (%)	Leco S (%)	Au (ppm)	Fe (%)	Ag (ppm)	Mo (ppm)	As (ppm)	Bi (ppm)	Pb (ppm)	Zn (ppm)	Mag conc. (%)
C1	Oxide A	0.46	0.25	0.04	21.7	10.89	5.0	4,751	455	10,422	369	0.09
C2	Oxide B	0.38	0.21	0.04	11.0	1.98	2.0	3,076	103	884	352	0.10
C3	Oxide C	0.32	0.07	0.07	19.3	8.85	13.8	8,261	124	6,595	785	0.01
C4	Oxide D	0.36	0.17	0.04	27.1	10.91	12.9	11,539	157	9,042	1,387	0.18
C5	Oxide E	0.31	0.03	0.02	16.6	13.77	8.9	4,714	122	9,351	5,539	0.03
C6	Oxide G	0.31	0.14	0.02	34.5	1.98	6.9	6,736	155	5,940	279	0.02
C7	Oxide H	0.46	0.09	0.44	17.6	26.92	12.0	13,120	953	15,933	683	0.05
C8	Oxide I	0.30	0.21	0.31	20.1	22.90	17.9	14,151	83	11,640	828	0.00
C9	Oxide J	0.47	0.06	0.13	23.5	20.66	60.0	11,522	452	11,255	773	0.06
C10	Oxide K	0.38	0.04	0.04	12.9	5.95	3.0	3,182	155	1,329	278	0.02

13.2.2 Oxide metallurgy sample specific gravity results

Table 13.8 shows the specific gravity (SG) and bulk density results on the oxide metallurgical test samples analysed using the pycnometric (solids) and cylinder packing methods, respectively. SGs range from a low of 2.52 g/cm^3 to a high of 4.49 g/cm^3. The high SG value for sample number “Zone C – Hi Mag” is associated with very high magnetite content.

Bulk density depends on the size distribution of the material being evaluated, as well as on the specific procedures employed for cylinder packing.

Table 13.8 SG and bulk density results for oxide metallurgical composites

Sample ID	Sample type	SG (g/cm^3)	Bulk density (g/cm^3)
Zone A	Surface grab sample	3.09	1.87
Zone B	Surface grab sample	2.52	1.36
Zone C1	Surface grab sample	3.17	1.67
Zone C2	Surface grab sample	2.59	1.47
Zone A-015A	Surface grab sample	3.16	1.75
Zone A-016B	Surface grab sample	2.62	1.39
Zone B-048	Surface grab sample	2.64	1.46
Zone B-137	Surface grab sample	2.68	1.56
Zone C – Hi Mag	Surface grab sample	4.49	2.85
Oxide A	Drillhole composite	3.02	1.62
Oxide B	Drillhole composite	2.72	1.24
Oxide C	Drillhole composite	2.70	1.42
Oxide D	Drillhole composite	3.28	1.70
Oxide E	Drillhole composite	2.86	1.50
Oxide G	Drillhole composite	3.45	1.97
Oxide H	Drillhole composite	3.03	1.67
Compo I	Drillhole composite	3.13	1.64
Compo J	Drillhole composite	3.15	1.74
Compo K	Drillhole composite	2.97	1.62

13.2.3 Acid and cyanide leach results

Oxide metallurgy sample test results are documented in several reports including: Grewal (2012), Beland and Shi (2014a), and Shi and Beland (2014). Acid leach recovery data from the oxide samples showing Cu, Fe, and Pb extractions are presented in Table 13.9.

The data in Table 13.9 suggest copper extraction rates varying from 1.8% (Oxide G) to 19.9% (Oxide A) may be achieved by acid leaching. An evaluation is required to determine if this level of heap leaching recovery could be of commercial interest.

Cyanide leach recovery data from the oxide samples is presented in Table 13.10 and Table 13.11 and Figure 13.2.

Table 13.9 Oxide sample acid leach recoveries

Oxide sample ID	Cu head grade (%)	Extraction Cu (%)	Fe head grade (%)	Extraction Fe (%)	Pb head grade (%)	Extraction Pb (%)
Oxide A	0.46	19.9	21.7	3.0	1.04	ND
Oxide B	0.38	14.9	11.0	5.7	0.09	ND
Oxide C	0.32	14.5	19.3	4.2	0.66	ND
Oxide D	0.36	17.2	27.1	2.9	0.90	ND
Oxide E	0.31	15.0	16.6	5.4	0.94	ND
Oxide G	0.31	1.8	34.5	1.6	0.59	ND
Oxide H	0.46	13.6	17.6	3.8	1.59	ND
Oxide I	0.30	13.1	20.1	2.4	1.16	ND
Oxide J	0.47	18.6	23.5	4.2	1.13	ND
Oxide K	0.38	13.5	12.9	2.1	0.13	ND
GOSN-C (L25 ST1)	0.12	1.6	41.5	ND	0.38	0.3
GOSN-C (L25 ST2) on ST1 Residue	0.12	27.7	41.5	ND	0.38	49.4

Notes: (1) Extraction recoveries based on 96 hours with 400 kg/t H2SO4 addition; (2) ICP by MS-50; (3) For the GOSN-C surface grab sample, the sulphuric ST1 acid leach (145 kg/t H2S04 addition at 96 hours) was followed with hot hydrochloric acid leach (test #ST2 using 282 kg/t HCL addition @ 90°C) of ST1 washed residue; (3) ND = no data.

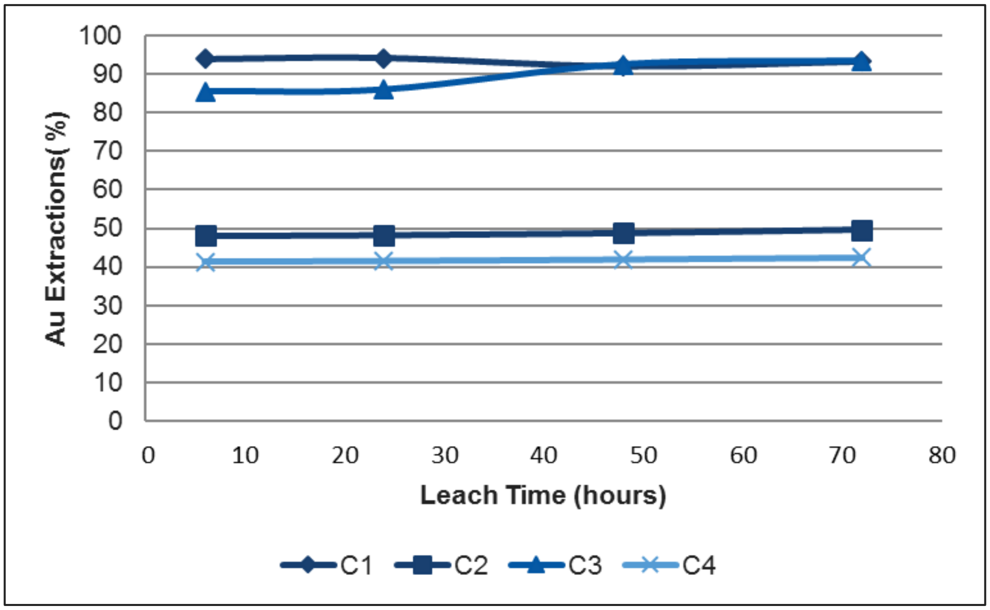
The degree of gold extraction depends on the grind size and head grade. In the cases of Zone A and C1, good recovery is diminished by low estimated head grades of 0.6 ppm Au and 0.3 ppm Au respectively. Silver recovery is of potential interest for Zones C1 and C2.

Table 13.10 72-hour bottle roll cyanide leach test results on oxide surface grab composite samples

Sample ID (Test #)	Grind P80	Extraction			Residue grade			Consumption	
		Au (%)	Ag (ppm)	Cu (%)	Au (ppm)	Ag (ppm)	Cu (ppm)	NaCN (kg/t)	$Ca(OH)_2$ (kg/t)
Zone A Comp (C1)	128	93.2	5.6	0.9	0.04	3.0	2,410	1.2	7.8
Zone B Comp (C2)	126	49.5	8.9	4.3	0.01	2.0	4,101	1.7	9.9
Zone C1 Comp (C3)	88	93.4	58.3	1.0	0.02	0.3	2,187	1.2	6.9
Zone C2 Comp (C4)	79	42.4	30.6	1.5	0.01	1.0	1,468	1.1	5.6

Note: Bottle roll tests use 0.5 g/L NaCN; head grades are presented in Table 13.7.

Figure 13.2 Gold extraction kinetics for four surface grab oxide samples listed in Table 13.10



The leaching profile depicted here shows limited benefit beyond 10 hours of leach contact.

Table 13.11 24-hour bottle roll cyanide leach test results on oxide samples

Sample ID	Extraction		Residue grade		Consumption	
	Au (%)	Ag (%)	Au (ppm)	Ag (ppm)	NaCN (kg/t)	$Ca(OH)_2$ (kg/t)
Oxide A	88.4	7.6	0.01	9.3	1.06	3.9
Oxide B	90.2	65.1	0.01	0.3	0.95	4.7
Oxide C	88.7	15.0	0.01	3.6	1.09	4.9
Oxide D	60.8	17.1	0.03	6.7	1.11	3.4
Oxide E	86.4	19.4	0.01	9.8	1.00	3.1
Oxide G	68.1	49.7	0.02	0.7	0.55	1.9
Oxide H	62.8	8.9	0.18	24.3	0.87	2.1
Oxide I	78.2	20.7	0.07	17.9	0.96	2.8
Oxide J	62.0	9.5	0.06	24.7	1.21	3.0
Oxide K	79.3	21.2	0.02	5.7	1.08	2.6
GOSN-C	54.9	ND	0.03	ND	7.38	6.2

Notes: (1) Bottle roll tests use 0.3 g/L NaCN; (2) the GOSN-C sample was ground to P80 78 µm and used 1.0 g/L NaCN; (3) the Au extraction results for the GOSN-C sample may be erroneous since the measured Au head grade is <0.01 g/t and the PLSB Au grade was at the lower detection limit of 0.01 g/L; (4) ND = no data.

The bottle roll data indicate gold extraction rates varying from 60.8% (Oxide G) to 90.2% (Oxide B) may be achirved. Given these results, a more rigorous examination may support recovery of by-product gold. A similar exercise could be carried out for silver.

13.2.4 Magnetic susceptibility and Davis Tube results from oxide pulp samples

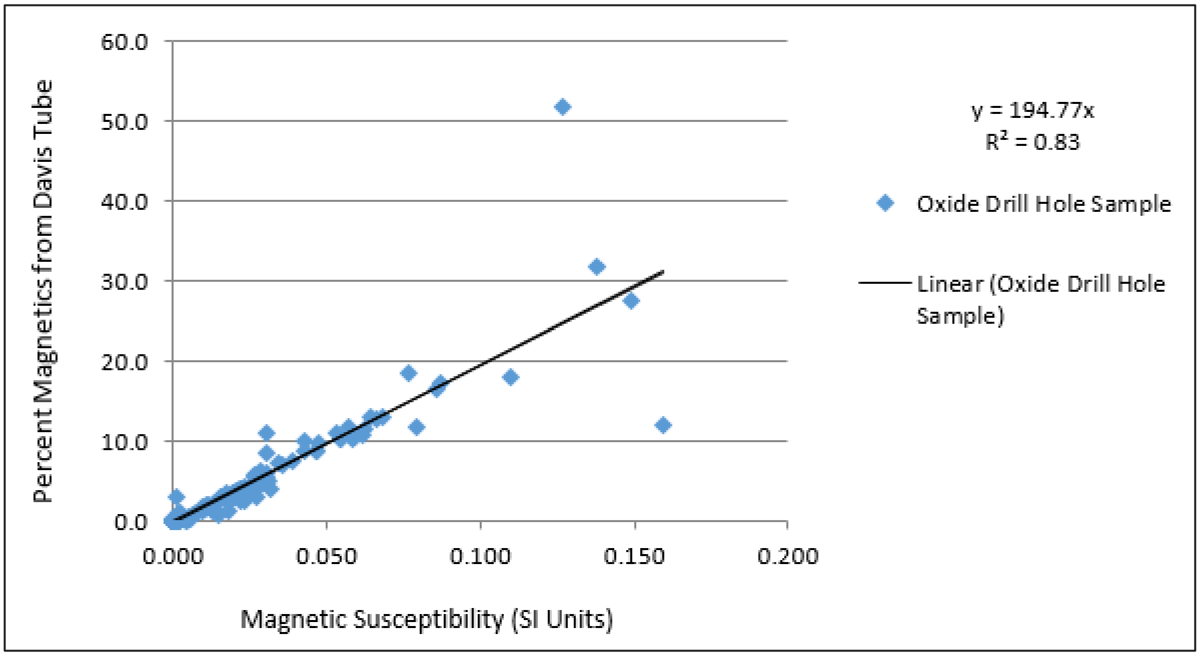
A total of 274 Davis Tube analyses on oxide material from Monument drillhole pulps of 300 g or more were received and compiled for inclusion into the 27 August 2013 drillhole database. The oxide Davis Tube data was obtained at Inspectorate in Richmond, Canada and at ALS Perth, Western Australia using standard Davis Tube equipment employing a magnetic intensity setting of 3,000 gauss.

The magnetic susceptibility (mag sus) data was collected at the Mengapur site by Monument staff using a single hand-held MagROCK magnetic susceptibility tool made by Alpha Geoscience. The magnetic susceptibility data readings were collected by staff geologists eight separate times for each drillhole pulp: four on one side of the pulp envelope and four on the other side of the pulp envelope in the four different corners of the envelope, and then averaged into one final magnetic susceptibility value. The data is stored in the tool and extracted periodically using computer software.

Four separate oxide pulp standards each 400 to 500 g were specifically made at Inspectorate in Richmond, Canada from material that originated from the Mengapur drilling areas. These standards had Davis Tube analyses performed at Inspectorate and the associated magnetic susceptibility values were collected and compiled to determine an acceptable mean and standard deviation level. The standards were analysed approximately every 20 readings in order to track the daily performance and monitor for any potential tool drift and act as a quality control protocol. If any of the standard values were observed to fall outside 3 standard deviations from the mean, the readings for that particular sample were redone. The tool may be internally calibrated at start up by the operator. A senior geologist managed the magnetic susceptibility data collection done at the site.

Magnetic susceptibility readings are a less expensive method for quantifying the magnetic mineral content of the oxide materials relative to the Davis Tube test done by certified labs. The 274 Davis Tube results from oxide pulp samples are plotted against the respective magnetic susceptibility data from the MagROCK tool in Figure 13.3. A linear regression to estimate the percentage of magnetic minerals (assumed to be all magnetite) based on this data returned a slope of 194.77 (assumed intercept is 0) and a corresponding R^2 value of 0.83. This correlation between magnetic susceptibility and Davis Tube results was believed to be satisfactory to help in quantifying the magnetite volume in oxide ores at Mengapur (Odell, 2014). However, the same author has not commented on the probability of occurrence of pyrrhotite in the samples tested.

Figure 13.3 Magnetic susceptibility vs. Davis Tube results for 274 oxide MMSB drillhole pulps from Zone A and Zone B (all data from certified commercial assay labs)



The correlation here between magnetic susceptibility and Davis Tube yield is good. However, further work is required to quantify actual magnetite content in the deposit and the extent to which pyrrhotite influences the magnetic response of the mineralisation.

13.3 Transitional samples

13.3.1 Sample locations and geological characterisation

Transitional samples included in the Mengapur metallurgical testwork were sourced from drillhole composites. The locations of the transitional samples are listed in Table 13.12 and Table 13.13 and in Figure 13.4.

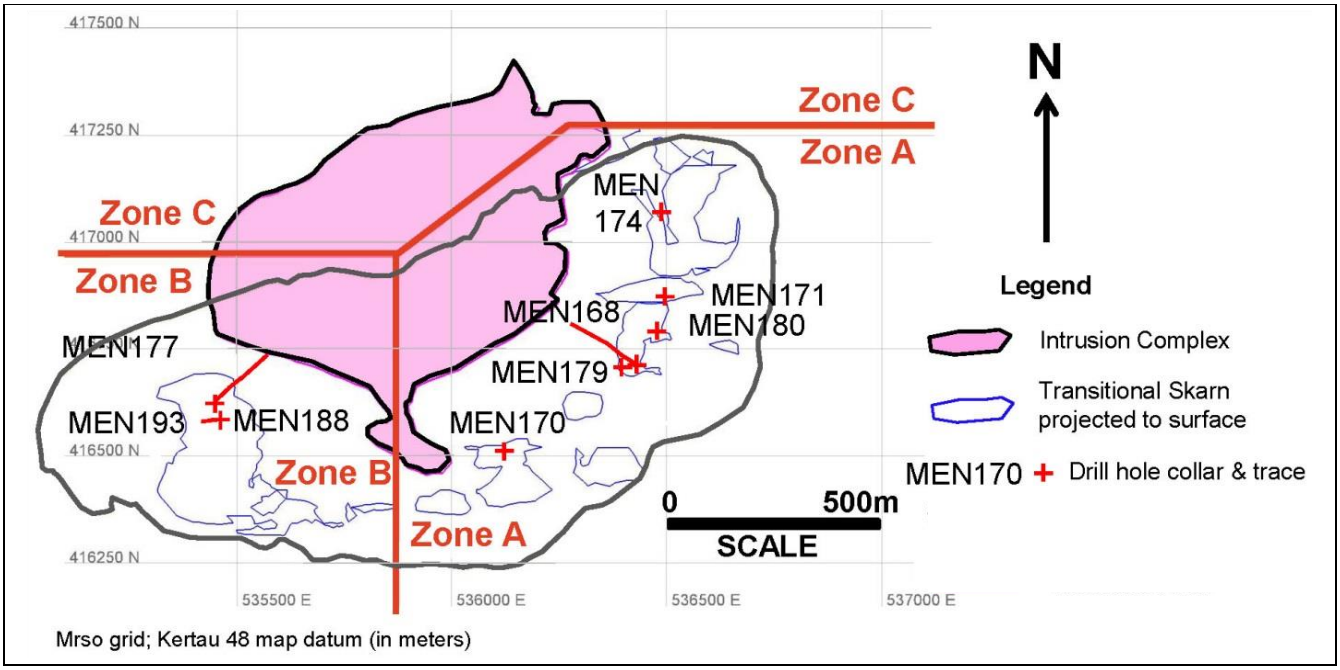
Table 13.12 Transitional drillhole collar coordinates with azimuth and dip

Drillhole ID	Tenement	Easting	Northing	Elevation	Azimuth	Dip	Depth (m)
MEN168	CASB	536429	416707	205.2	308.6	-50	280.9
MEN170	CASB	536123.7	416505.5	222.0	0	-90	248.3
MEN171	CASB	536498.3	416865.6	223.9	0	-90	201.0
MEN174	CASB	536491.2	417062.1	277.3	0	-90	279.06
MEN177	SDSB	535453.1	416617.5	395.5	45	-50	254.0
MEN180	CASB	536479.5	416783.0	206.5	0	-90	301.7
MEN188	SDSB	535464.6	416579.9	373.1	78.1	-80	300.0
MEN193	SDSB	535462.8	416579.6	373.2	270	-80	194.2

Table 13.13 Transitional composite drillhole sample list

Transitional composite	Drillhole intervals	Rock types	Tenement
Compo A	MEN168: 43.28-50.26m	WSK	CASB
Compo C	MEN170: 43.5-51.0m MEN170: 52.5-55.5m	WSK WSK	CASB
Compo D	MEN171: 46.8-50.88m	WSH and WLS	CASB
Compo E	MEN174: 71.4-80.3m	WSK > MAG	CASB
Compo F	MEN174: 80.3-91.25m	WSK + GOS	CASB
Compo G	MEN174: 91.25-98.9m; MEN174: 99.6-101.15m	WSK+SKSUL+QZVN WSK	CASB
Compo I	MEN180: 37.11-48.87m MEN180: 50.13-51.77m	WSK WSK	CASB
Compo J	MEN177: 30.0-37.7m	Dyke + WSK	SDSB
Compo K	MEN177: 38.1-55.7m	WSK	SDSB
Compo L	MEN177: 55.7-59.7m MEN177: 62.3-73.4m	WSK WSK	SDSB
Compo M	MEN177: 73.4-85.7m	GOS+WSK+WSH	SDSB
Compo N	MEN188: 93.3-102.2m	WSK	SDSB
Compo O	MEN193: 151.7-166.5m	WSH	SDSB
Compo P	MEN193: 166.5-171.0m MEN193: 171.9-175.0m	WSH WSH	SDSB

Figure 13.4 Plan showing the locations of the transitional metallurgy samples



Note: Zone A, Zone B, Zone C were previous exploration area denominations

Davis Tube recoveries are mainly less than 0.5% and indicate that only trace levels of ferromagnetic minerals are present.

Table 13.14 contains head analyses for the transitional ore composites.

Table 13.14 Transitional drillhole composite head assay results

Sample ID	Cu (%)	Leco S (%)	Au (ppm)	Fe (%)	Ag (ppm)	As (ppm)	Bi (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Mag Conc. (%)
Compo A	0.46	8.76	0.12	31.4	5.95	39	351	263	404	635	0.13
Compo C	1.66	21.30	1.07	21.8	14.93	4,230	1697	27	1,442	627	0.22
Compo D	0.62	14.90	0.23	18.2	4.95	707	447	109	537	5,748	0.08
Compo E	0.08	2.40	0.11	23.2	0.99	34	211	69	134	1,861	15.60
Compo F	0.66	0.65	0.76	24.1	43.65	367	1417	312	437	1,051	0.38
Compo G	0.55	18.80	0.42	19.2	3.00	65	762	110	190	619	0.33
Compo I	1.02	7.74	0.24	21.6	4.97	1,070	585	186	1,443	1,750	0.18
Compo J	0.29	2.96	0.07	23.1	5.93	541	237	2	156	301	0.19
Compo K	0.82	1.63	0.13	20.5	4.98	5,193	500	7	362	1,040	0.17
Compo L	0.19	1.37	0.07	16.9	1.98	1,335	247	6	242	655	0.17
Compo M	0.52	2.16	0.16	11.6	13.87	7,620	361	6	2,453	1,038	0.19
Compo N	1.72	1.62	0.13	12.6	19.74	3,499	596	18	3,564	307	0.13
Compo O	0.97	0.13	0.01	11.6	12.88	2,936	7	10	4,717	7,240	0.26
Compo P	1.51	3.45	0.14	15.5	29.75	6,119	675	7	3,264	3,187	0.14

Notes: (1) Mag Conc = magnetic concentrate from Davis Tube analysis done on a 100g pulp; (2) Analysed using 50-4A-UT multi-element ICP analysis by Inspectorate (Richmond, Canada).

13.3.2 Transitional metallurgy sample specific gravity results

SGs range from a low of 2.91 to a high of 3.67 (Table 13.15).

Table 13.15 SG results for transitional metallurgy composites

Sample ID	Sample type	SG (g/cm^3)
Compo A	Drillhole composite (pulp)	3.39
Compo C	Drillhole composite (pulp)	3.49
Compo D	Drillhole composite (pulp)	3.12
Compo E	Drillhole composite (pulp)	3.67
Compo F	Drillhole composite (pulp)	3.28
Compo G	Drillhole composite (pulp)	3.13
Compo I	Drillhole composite (pulp)	3.07
Compo J	Drillhole composite (pulp)	2.97
Compo K	Drillhole composite (pulp)	3.05
Compo L	Drillhole composite (pulp)	2.96
Compo M	Drillhole composite (pulp)	2.91
Compo N	Drillhole composite (pulp)	3.00
Compo O	Drillhole composite (pulp)	2.97
Compo P	Drillhole composite (pulp)	3.00

13.3.3 Transitional metallurgy sample leach test results

Bottle roll test results on the transitional drillhole metallurgy composite samples are shown in Table 13.16. Acid consumptions are high and are probably a consequence of the long leach durations employed. Bottle roll tests at different head particle sizes, conducted for 24 hours, followed by column leaching tests on the optimum head size are recommended for further testing. Cyanide leach test results on the transitional drillhole metallurgy composite samples are shown in Table 13.17.

Table 13.16 Transitional drillhole composite sulphuric acid bottle roll leach recoveries

Sample ID	Duration (hours)	Leco S head (%)	Cu head (%)	Extraction Cu (%)	Fe head (%)	Extraction Fe (%)
Compo A	264	8.76	0.46	39.1	31.4	15.7
Compo C	264	21.3	1.66	53.0	21.8	9.4
Compo D	264	14.9	0.62	13.5	18.2	35.8
Compo E	264	2.4	0.08	48.7	23.2	20.0
Compo F	264	0.65	0.66	72.8	24.1	9.0
Compo G	264	18.8	0.55	8.9	19.2	23.6
Compo I	264	7.74	1.02	49.7	21.6	8.4
Compo J	168	2.96	0.29	32.8	23.1	19.0
Compo K	168	1.63	0.82	55.6	20.5	13.7
Compo L	168	1.37	0.19	38.6	16.9	22.3
Compo M	168	2.16	0.52	61.3	11.6	18.4
Compo N	168	1.62	1.72	76.2	12.6	14.2
Compo O	168	0.13	0.97	37.4	11.6	14.8
Compo P	168	3.45	1.51	60.2	15.5	14.8

Notes: Samples prepared at 100 µm grind with 150 kg/t H_2SO_4 *addition*

The transitional mineralisation samples show a broader range of copper grades than do the oxide samples, with values from 0.08% to 1.66% Cu. Copper extractions by acid leaching ranged from 8.9% (Compo G) to 76.2% (Compo N). Further evaluation of copper recovery is warranted.

Sulphur grades range from 0.13% S to 8.76% S, suggesting beneficiation of transitional mineralisation by froth flotation may be warranted. A flotation program should aim to concentrate non-leachable copper and quantify the occurrence of pyrrhotite and pyrite in the ore.

Gold grades in the transitional metallurgical samples ranged from 0.01 g/t Au to 1.07 g/t Au in Compo C. However, gold grades are predominantly less than 0.5 g/t Au.

Table 13.17 contains the results of gold leaching tests carried out on the transitional ore samples.

Table 13.17 Transitional drillhole composite cyanide leach test results

Sample ID	Extraction		Residue grade		Consumption	
	Au (%)	Ag (%)	Au (ppm)	Ag (ppm)	NaCN (kg/t)	$Ca(OH)_2$ (kg/t)
Compo A	69.4	51.1	0.05	2.4	10.4	16.4
Compo C	42.8	1.2	0.62	13.2	9.11	17.8
Compo D	84.2	50.4	0.04	2.2	13.65	25.2
Compo E	66.4	53.3	0.05	0.7	3.43	6.2
Compo F	60.0	43.6	0.36	25.0	8.36	3.9
Compo G	86.3	5.1	0.07	2.9	14.96	24.4
Compo I	63.4	3.7	0.10	4.3	8.35	13.7
Compo J	80.1	68.6	0.02	2.3	6.44	25.8
Compo K	72.3	24.9	0.05	3.8	6.16	14.2
Compo L	71.9	32.7	0.02	1.7	4.19	12.9
Compo M	71.5	52.2	0.04	7.0	5.64	4.1
Compo N	26.0	0.5	0.09	16.0	6.69	7.5
Compo O	62.5	10.2	0.01	10.0	5.76	5.6
Compo P	59.6	1.3	0.07	23.7	6.76	3.5

Note: Cyanide leach tests used 1.0 g/L NaCN

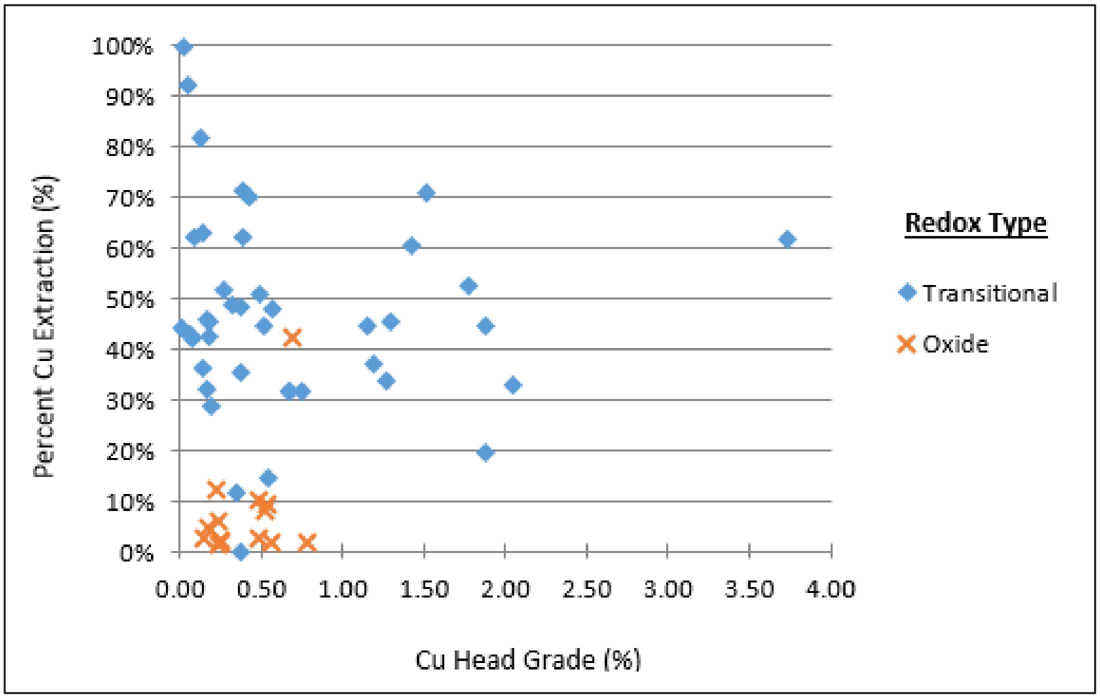
The maximum gold extraction was 84.2% (Compo D) with a minimum observed gold extraction of 26% (Compo N). Cyanide consumptions for all these transition samples were uniformly high, together with many of the lime consumptions. Assessment of the by-product gold opportunity should be carried out.

Acid leaching results on transitional and some oxide drillhole pulps using the “quick leach method” are listed in Table 13.18 and shown in Figure 13.5 to Figure 13.7. The quick leach method is not a certified laboratory test but gives an indication of the leachability of the sample.

Table 13.18 Sulphuric acid bottle roll vs. quick pulp leach results for transitional drillhole composite samples

Sample ID	Leco S head grade (%)	Cu head grade (%)	Drill core Cu extraction (%)	30 g pulp weighted average Cu extraction (%)	Fe head grade (%)	Drill core Fe extraction (%)	30 g pulp weighted average Fe extraction (%)
Compo E	2.40	0.08	48.7	**80.9**	23.2	20.0	**21.2**
Compo G	18.8	0.55	8.9	**32.1**	19.2	23.6	**45.2**
Compo J	2.96	0.29	32.8	**33.3**	23.1	19.0	**20.7**
Compo L	1.37	0.19	38.6	**41.7**	16.9	22.3	**24.5**
Compo O	0.13	0.97	37.4	**52.6**	11.6	14.8	**14.5**

Figure 13.5 **Transitional and oxide drillhole samples showing Cu head grade (%) vs. quick sulphuric acid Cu leach extraction results (%) for MMSB drillhole pulps**



The quick leach results show no firm correlation with head copper grade. These results possibly reflect variable mineralogy within the transition zone.

Figure 13.6 **Cyanide soluble Cu head grade (%) vs. quick-leach Cu extraction results for MMSB oxide and transitional drillhole pulp samples**

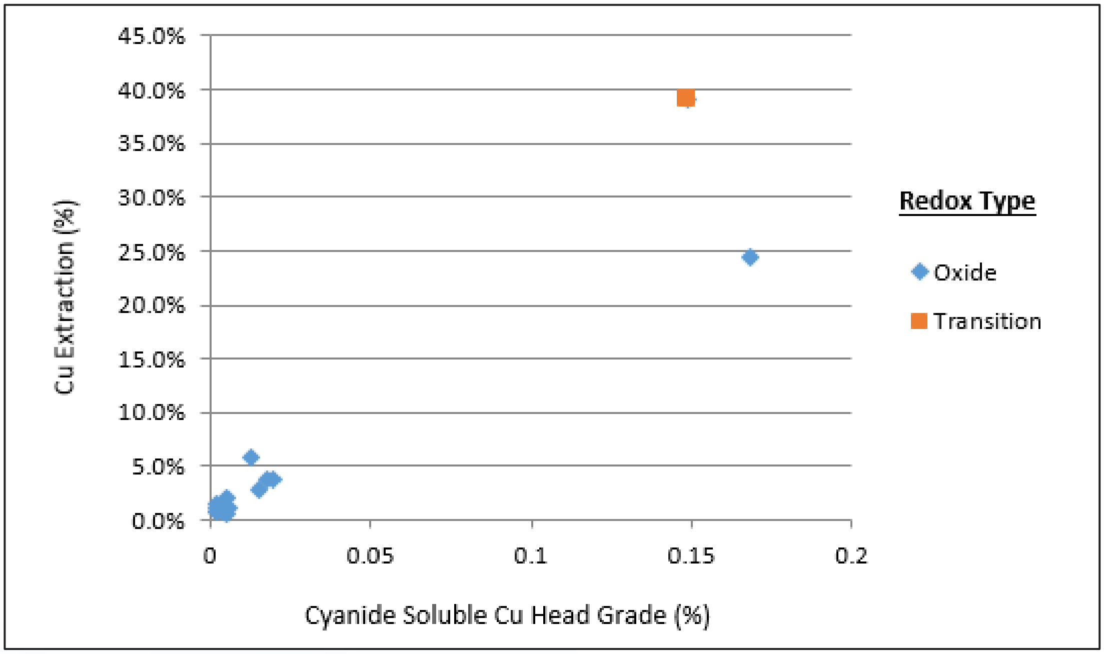
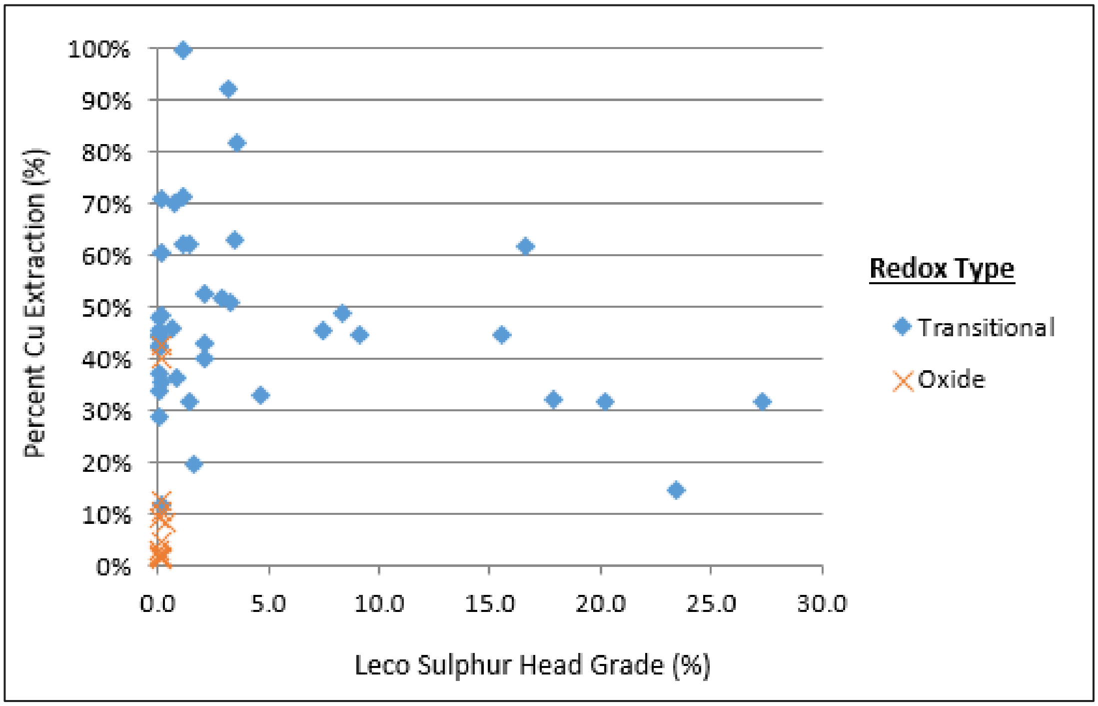


Figure 13.7 Transitional and oxide drillhole samples showing Leco S head grade vs. quick sulphuric acid Cu leach (% Cu extraction) results for MMSB drillhole pulps



13.3.4 Transitional flotation metallurgy results

Transitional metallurgy sample test results are documented in a Technical report by Beland and Shi (2014b). Tests performed by Inspectorate on the Mengapur transitional material did not produce any conclusive process routes. Acid and cyanide based leach processes yielded very low metal extractions, whilst the flotation test results indicate that the copper and pyrrhotite minerals cannot be easily upgraded into two separate products.

Inspectorate recommended that a broader sampling and testing program be carried out in the context of determining the benefits, or otherwise, of blending transitional material with either oxide of sulphide process feed.

13.4 Sulphide samples

13.4.1 Sample locations and geological characterisation

Sulphide samples included in the Mengapur metallurgical testwork were sourced from surface grab samples and drillhole composites. The locations of the sulphide metallurgical samples are listed in Table 13.19 to Table 13.21 and Figure 13.8. Two sulphide grab samples were taken in August 2011 as part of the project due diligence. The other drillhole samples were collected by Monument staff as part of the definition drill program and shipped to an Inspectorate sample preparation laboratory in Fairbanks, Alaska (USA). The Fairbanks laboratory prepared the metallurgy samples and sent them to Inspectorate's metallurgy laboratory in Richmond, BC (Canada) for analysis.

Table 13.19 Sulphide drillhole collar coordinates with azimuth and dip

Drillhole ID	Tenement	Easting	Northing	Elevation	Azimuth	Dip	Depth (m)
MEN169	CASB	536390.6	416764.7	220.2	45	-70	250.1
MEN170	CASB	536123.7	416505.5	222.0	222.0	0	248.3
MEN171	CASB	536498.3	416865.6	223.9	223.9	0	201.0
MEN174	CASB	536491.2	417062.1	277.3	0	-90	279.06
MEN177	SDSB	535453.1	416617.5	395.5	45	-50	254.0
MEN179	CASB	536396.6	416699.5	209.6	0	-90	371.0
MEN180	CASB	536479.5	416783.0	206.5	0	-90	301.7
MEN188	SDSB	535464.6	416579.9	373.1	78.1	-80	300.0

Table 13.20 Sulphide surface bulk sample location and description

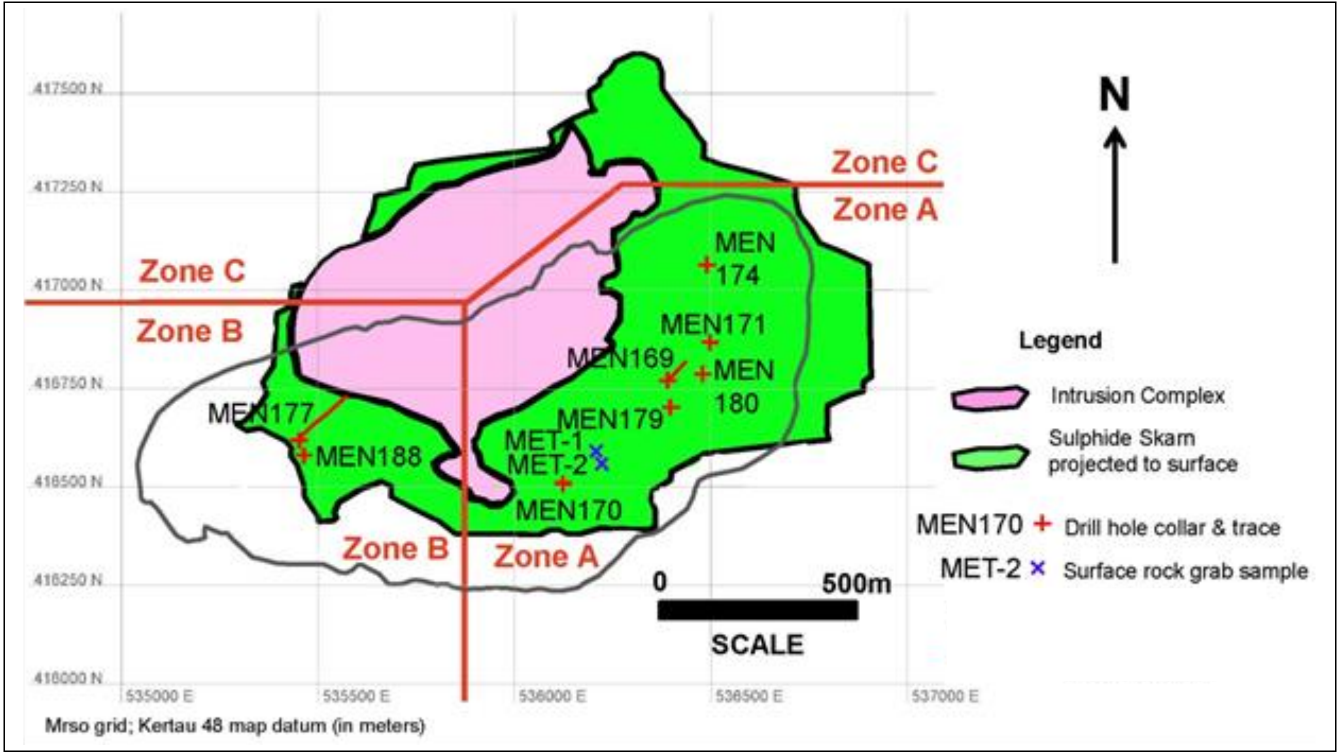
Bulk surface sample ID	Tenement	Easting	Northing	Elevation	Quantity material (kg)	Rock type
MET-1	CASB	536208	416581	258	100	SKSUL + SKPX
MET-2	CASB	536223	416555	252	100	SKPX

Note: The MET-1 sample consists of pyrrhotite-rich pyroxene skarn

Table 13.21 Sulphide drillhole composite sample list

Composite sample ID	Drillhole intervals	Rock type	Tenement
Sul A	MEN169: 47.9-61.8m	SKGA	CASB
Sul B	MEN179: 106.4-118.45m	SKGA	CASB
Sul C	MEN177: 97.5-109.5m	SKPX	SDSB
Sul D	MEN169: 14.0-27.0m	SKPX	CASB
Sul E	MEN171: 71.3-79.8m	SKPX	CASB
Sul F	MEN174: 165.7-175.28m	SKPX	CASB
Sul G	MEN180: 75.72-90.24m	SKPX	CASB
Sul H	MEN188: 133.0-151.0m	SKPX	SDSB
Sul I	MEN179: 67.02-78.92m	SKPX	CASB
Sul J	MEN170: 102.0-113.9m	SKPX	CASB
Sul K	MEN174: 101.15-120.16m	SKPX	CASB
Sul L	MEN171: 101.2-140.4m	SKPX	CASB
Sul M	MEN170: 67.0-78.0m	SKPX	CASB
Sul N	MEN180: 51.77-60.56m	SKPX	CASB

Figure 13.8 Plan showing the location of the sulphide metallurgy samples



Note: Zone A, Zone B, Zone C were previous exploration area denominations.

The geochemistry of the sulphide metallurgy composite samples is shown in Table 13.22 and Table 13.23.

Table 13.22 Sulphide drillhole composite head analyses

Sample ID	Cu (%)	Leco S (%)	Au (ppm)	Fe (%)	Ag (ppm)	As (ppm)	Bi (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Mag conc. (%)
Sul A	0.14	3.32	<0.01	9.3	2.98	13	82	1453	112	131	2.22
Sul B	0.10	2.41	0.26	9.0	4.98	178	588	1397	189	137	1.20
Sul C	0.26	3.17	0.03	16.6	2.95	1,189	117	4	174	271	1.27
Sul D	0.14	5.31	0.08	18.4	3.97	14	192	120	108	121	2.13
Sul E	0.18	6.02	0.07	17.6	0.98	30	189	154	29	179	0.31
Sul F	0.11	5.65	0.11	25.5	3.00	153	201	16	330	229	19.22
Sul G	0.27	9.78	0.15	21.0	1.98	47	242	58	74	154	8.02
Sul H	0.25	6.94	0.03	18.9	11.92	2,005	191	6	473	306	7.48
Sul I	0.28	8.97	0.26	20.4	5.91	7	668	75	398	190	0.56
Sul J	0.43	8.84	0.20	19.7	2.98	181	300	12	72	272	17.76
Sul K	0.31	13.4	0.47	22.8	5.98	261	908	66	533	433	1.63
Sul L	0.28	10.5	0.14	20.2	2.99	57	304	30	570	580	1.25
Sul M	0.71	18.9	0.31	26.7	2.96	32	445	15	47	269	26.89
Sul N	0.34	13.6	0.28	21.2	1.97	41	611	377	145	230	5.11

Notes: (1) Mag Conc = magnetic concentrate from Davis Tube analysis on a minimum 100 g sample; (2) Analysed using 50-4A-UT multi-element ICP analysis by Inspectorate (Richmond, Canada).

Copper values in the sulphide samples ranged from 0.10% Cu to 0.71% Cu. Inspection of these values suggests some of these values may be economic and further evaluation is warranted.

Table 13.23 Sulphide bulk surface sample composite head analyses

Sample ID	Cu (%)	Leco S (%)	Au (ppm)	Fe (%)	Ag (ppm)	As (ppm)	Bi (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Mag conc. (%)
MET-1	0.36	16.90	0.17	31.9	1.99	136	199	12	193	173	0.95
MET-2	0.37	8.88	0.11	23.5	1.52	24	107	37	78	212	0.70

Notes: (1) Analysed using 50-4A-UT multi-element ICP analysis by Inspectorate (Richmond, Canada); (2) C-Leco for MET-1 = 0.56% and MET-2 = 0.44%; Inorganic C for MET-1 = 0.05% and MET-2 = less than 0.01%; (3) Sala equipment at Inspectorate (Richmond, Canada) used to determine the percent magnetic concentrate values at a magnetic field strength of 3700 gauss.

13.4.2 Sulphide metallurgy sample specific gravity results

SG results on the sulphide ore metallurgical test samples are listed in Table 13.24. The SGs range from a low of 3.30 g/cm^3 to a high of 3.82 g/cm^3.

Table 13.24 SG results for sulphide metallurgy composites

Sample ID	Sample type	SG (g/cm^3)	Leco S grade (%)	SG method
Sul A	Drillhole composite (pulp)	3.36	3.32	Pycnometric (solids)
Sul B	Drillhole composite (pulp)	3.44	2.41	Pycnometric (solids)
Sul C	Drillhole composite (pulp)	3.53	3.17	Pycnometric (solids)
Sul D	Drillhole composite (pulp)	3.56	5.31	Pycnometric (solids)
Sul E	Drillhole composite (pulp)	3.52	6.02	Pycnometric (solids)
Sul F	Drillhole composite (pulp)	3.77	5.65	Pycnometric (solids)
Sul G	Drillhole composite (pulp)	3.59	9.78	Pycnometric (solids)
Sul H	Drillhole composite (pulp)	3.37	6.94	Pycnometric (solids)
Sul I	Drillhole composite (pulp)	3.58	8.97	Pycnometric (solids)
Sul J	Drillhole composite (pulp)	3.30	8.84	Pycnometric (solids)
Sul K	Drillhole composite (pulp)	3.56	13.4	Pycnometric (solids)
Sul L	Drillhole composite (pulp)	3.62	10.5	Pycnometric (solids)
Sul M	Drillhole composite (pulp)	3.53	18.9	Pycnometric (solids)
Sul N	Drillhole composite (pulp)	3.59	13.6	Pycnometric (solids)
MET-1	Bulk surface sample	3.82 (Apparent)	16.90	Wax immersion (intact rock sample)
MET-2	Bulk Surface Sample	3.41 (Apparent)	8.88	Wax immersion (intact rock sample)

Note: SG analyses performed at Inspectorate (Richmond, Canada).

13.4.3 Sulphide metallurgy results

Sulphide metallurgy sample test results are documented in two reports by Chen and Shi (2014), and by Beland and Shi (2014c), both of which have been reviewed. All the test and analytical methods employed in their investigation are appropriate.

Chen and Shi reported testwork on two sulphide grab samples, one of which (MET1) was composed of pyrrhotite-rich pyroxene skarn and the other (MET2) on pyrrhotite-poor pyroxene skarn.

Both samples contained less than 1% of recoverable magnetic concentrate. Three different grinds were tried and the best copper recovery performance for both samples was achieved at the finest grind tested, with P_{80} ~90 µm. A sequential flotation circuit was tried with copper sulphides floated first and then iron sulphides. Best copper performance for MET1 was at a pH of 11 using PAX collector, while for MET2 best Cu rougher recovery came from use of Aerophine 3418A at a pH of 8.5 to 9.0.

In cleaning tests, the best MET1 performance was from Test F26 giving 24.99% Cu in the fourth cleaner concentrate at a copper recovery of 61.4%. For MET2 the best performance was from Test 14 which gave a third cleaner concentrate grading 24.60% Cu at a recovery of 69.7%. These test results indicate that a commercial grade of copper sulphide concentrate can be achieved from Mengapur sulphide mineralisation.

The comparable study reported by Beland and Shi (2014c) failed to achieve satisfactory copper concentrate grades, although concentrate grades greater than 20% Cu were achieved. This study employed the same analytical and testing techniques as used in the earlier study, which were applied to 12 separate composites for a total of 36 flotation tests. In addition, locked cycle flotation tests were conducted on three master composites prepared from three separate and discrete combinations of the original 12 composites. The Beland and Shi (2014c) report included a QEMSCAN mineralogical study which confirmed that a minimum 70% liberation of chalcopyrite was not achieved by the grind combinations assessed. This suggests that there is scope for improved results using finer grinds.

In both reports the flotation sequence also produced an iron sulphide concentrate. The most likely sales outlet for such a product would be to a roasting facility producing sulfuric acid for industrial consumption.

Testing of Composite Sul M had a third cleaner concentrate grading 23.25% Cu for 73.7% copper recovery. Similarly, test F34 on Master Composite S2 produced a third cleaner concentrate grading 22.77% Cu at 59.2% copper recovery.

14 MINERAL RESOURCE ESTIMATES

14.1 Disclosure

Mineral Resources reported in Section 14 were prepared by Ms V. O'Toole, Senior Consultant, an employee of Snowden, and reviewed by Mr J. Graindorge, Principal Consultant for Snowden.

Mr Graindorge is a Qualified Person as defined in NI 43-101. Snowden is independent of Monument.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Snowden notes that some drillhole data outside the SDSB and CASB tenement boundaries was utilised for the geological interpretation, statistical analysis and grade estimation; however, all reported Mineral Resources are limited to within the SDSB and CASB boundaries. This data was legally obtained by Monument when Monument acquired the Mengapur Project.

14.1.1 Known issues that materially affect Mineral Resources

Snowden is unaware of any issues that materially affect the Mineral Resources in a detrimental sense. These conclusions are based on the following:

- Monument has represented that there are no outstanding legal issues; no legal action, and injunctions pending against the Project
- Monument has represented that the mineral and surface rights have secure title, although Snowden notes that the CASB and SDSB tenements have expired and that, while renewals have been submitted, the renewals are still pending as of the effective date of this report
- There is no known marketing, political or taxation issues
- Previous mining at Mengapur demonstrates that a sulphide copper concentrate can be produced from the Mengapur deposit
- There are no known infrastructure issues.

14.2 Method

The estimates were prepared using the following broad steps:

- Data validation
- Geological interpretation and modelling
- Establishment of block models and definitions
- Compositing of assay intervals
- Data analysis and variography
- Ordinary kriging estimation
- Model validation
- Assignment of dry bulk density
- Classification of the resource in accordance with CIM definition standards
- Resource tabulation and reporting.

14.3 Drillhole data

Numerous drilling programs have been completed at Mengapur. For the purpose of resource definition, the programs were categorised as historical or more recent drilling completed by Monument. Limited information is available regarding the protocols used for historical drilling and assaying. To determine the suitability of the historical drilling for resource estimation, Snowden compared the statistical properties of the historical drilling to the recent Monument drilling.

Based on this analysis, Snowden concluded that the historical drilling is appropriate for the estimation of all elements except sulphur. Sulphur values for historical drilling were excluded from the data due to limited confidence of these results.

The drilling database comprises a total of 472 drillholes and was supplied by Monument in Microsoft Access format. Validation routines were run using Surpac software to identify any discrepancies such as duplicate or missing records. No significant issues were identified. Some minor survey data errors were noted as detailed in Table 14.1.

Table 14.1 List of adjusted drillholes

Hole ID	Program	Comments
MEN279	Monument	Erroneous EOH azimuth value deleted
MEN342	Monument	Collar location snapped to the topography
MEN384	Monument	Erroneous azimuth values adjusted to EOH
DDMEN046	Historical	Erroneous EOH azimuth value deleted

Eight drillholes were excluded for estimation purposes due to unrealistic downhole survey traces (e.g. excessive or unrealistic deviation) which could not be resolved (Table 14.2). The majority of these holes occur in the eastern and south-eastern parts of the mineralisation.

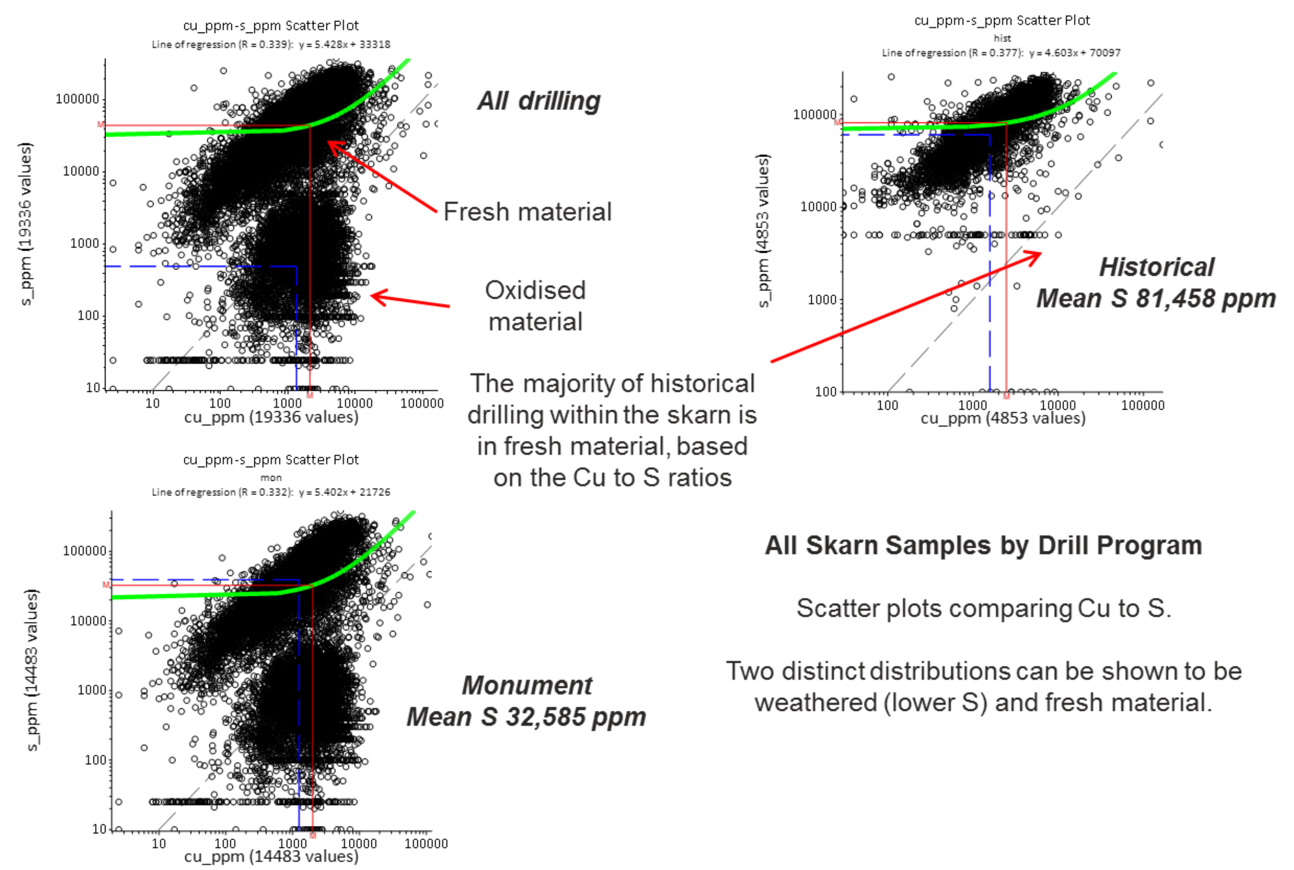
Table 14.2 List of excluded drillholes

Hole ID	Program	Comments
DDMEN021	Historical	Unrealistic drillhole trace
DDMEN022	Historical	Unrealistic drillhole trace
DDMEN025	Historical	Unrealistic drillhole trace
DDMEN044	Historical	Unrealistic drillhole trace
DDMEN046	Historical	Unrealistic drillhole trace
DDMEN95A	Historical	Unrealistic drillhole trace
MEN191	Monument	Erroneous survey values, unable to be resolved
MEN268	Monument	Erroneous survey values, unable to be resolved

14.3.1 Comparison of historical drilling to Monument drilling

There is limited information available relating to the drilling and sampling procedures and processes implemented during the historical drilling campaigns. Therefore, to assess the reliability of the historical drillhole data for resource estimation, Snowden compared the distribution of grades for historical (pre-1990) and Monument (i.e. 2011 to 2014) drilling. In general, the grades for Cu and Au compared well however initial analysis of S grades within skarn material demonstrated overall higher grades for the historical drilling for all material types (fresh and oxidised, including transitional). To investigate the cause of this discrepancy, the Cu to S ratio for each drilling program was generated (Figure 14.1). This demonstrates two distinct populations likely due to varying weathering types. The overall higher average S grade for the historical drilling within the skarn material is caused by the lack of sampling of oxidised material within the historical drilling.

Figure 14.1 All skarn material Cu to S ratio



The majority of historical drilling within the skarn is in fresh material, based on the Cu to S ratios

All Skarn Samples by Drill Program

Scatter plots comparing Cu to S.

Two distinct distributions can be shown to be weathered (lower S) and fresh material.

To further analyse the reliability of the historical S results, Snowden analysed the results from a twin drilling program completed by Monument comprising seven diamond core holes designed to twin historical diamond core holes. Overall, the comparisons (Figure 14.2 and Figure 14.3) show good results for Cu, with some poorer correlations likely the result of variability within the weathered zones. However, for S the comparisons demonstrate overall higher grades within each weathering profile, including fresh rock, for the historical drilling compared to the more recent drilling by Monument.

Figure 14.2 Twin drilling analysis – Cu and S, all material and oxidised material

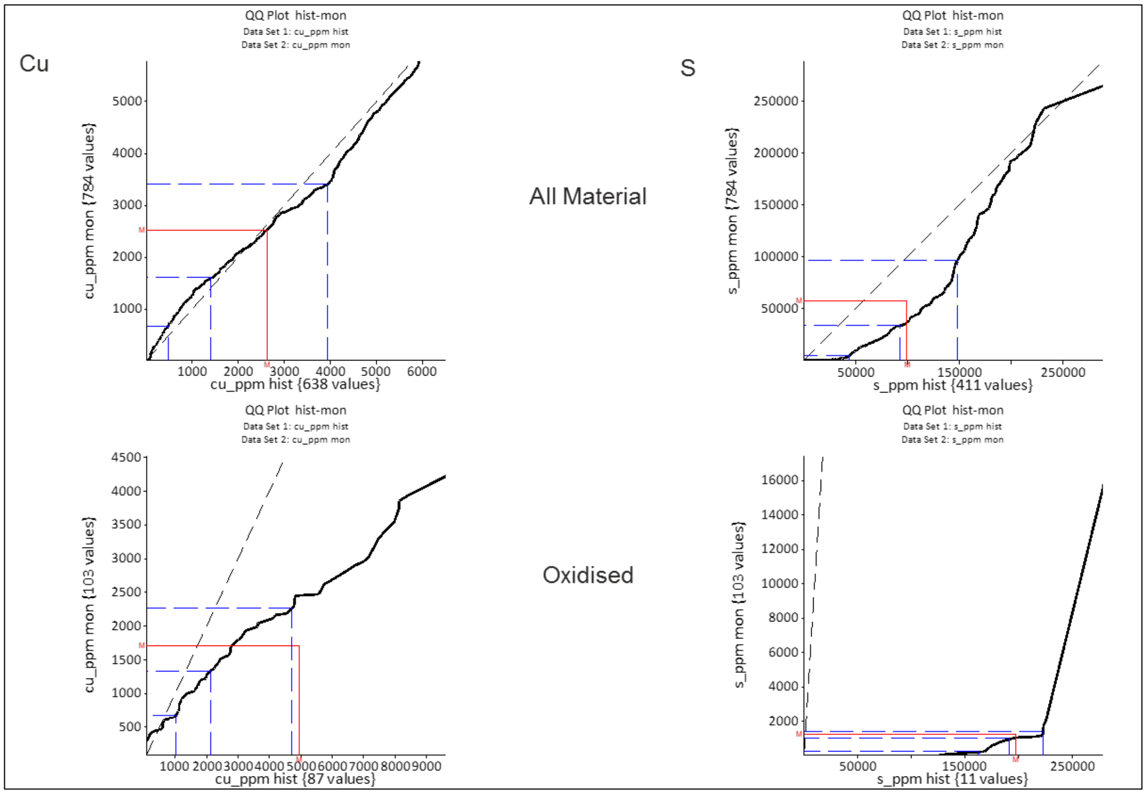
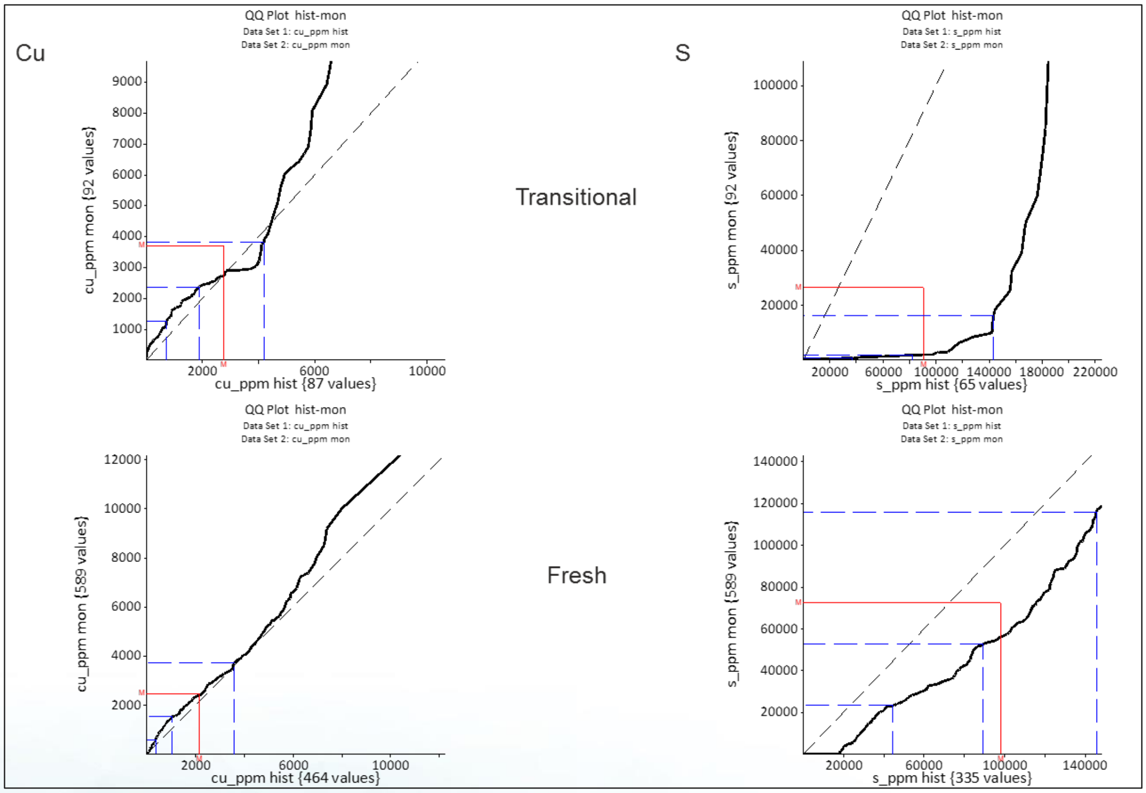
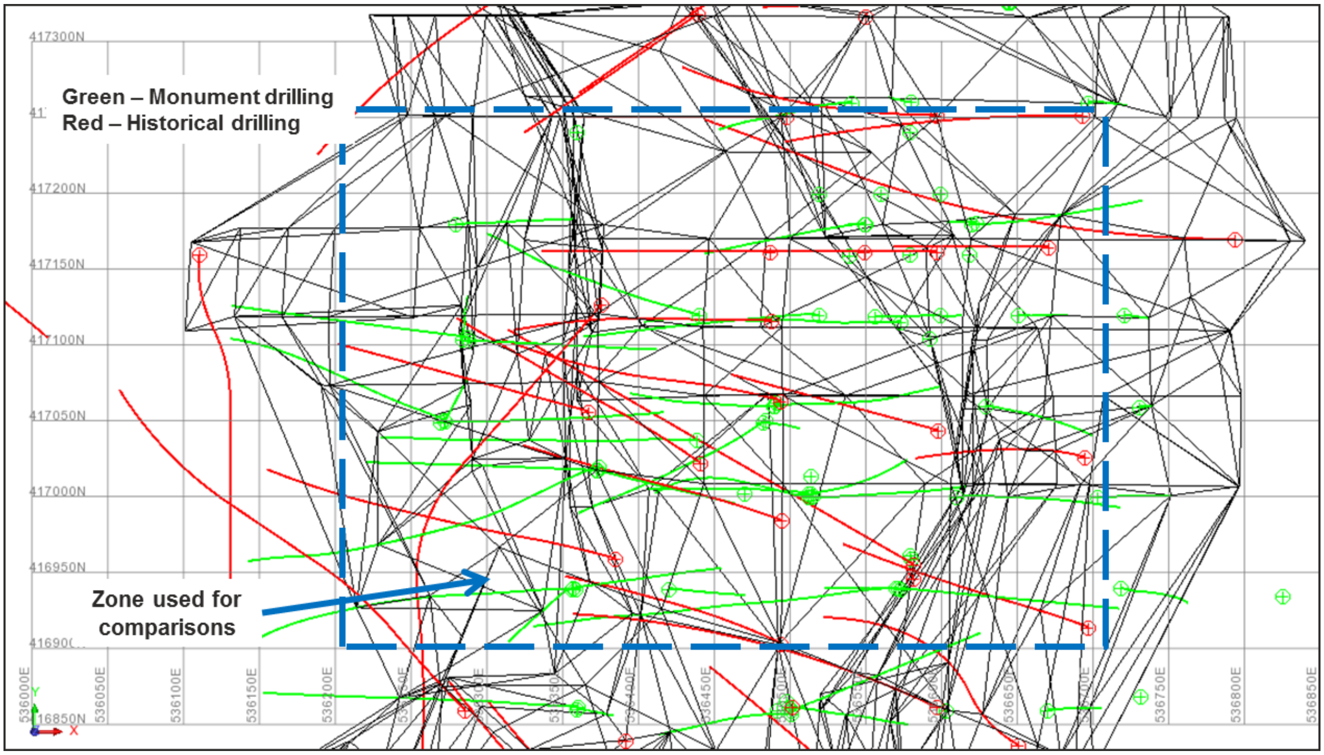


Figure 14.3 Twin drilling analysis – Cu and S, transitional and fresh material



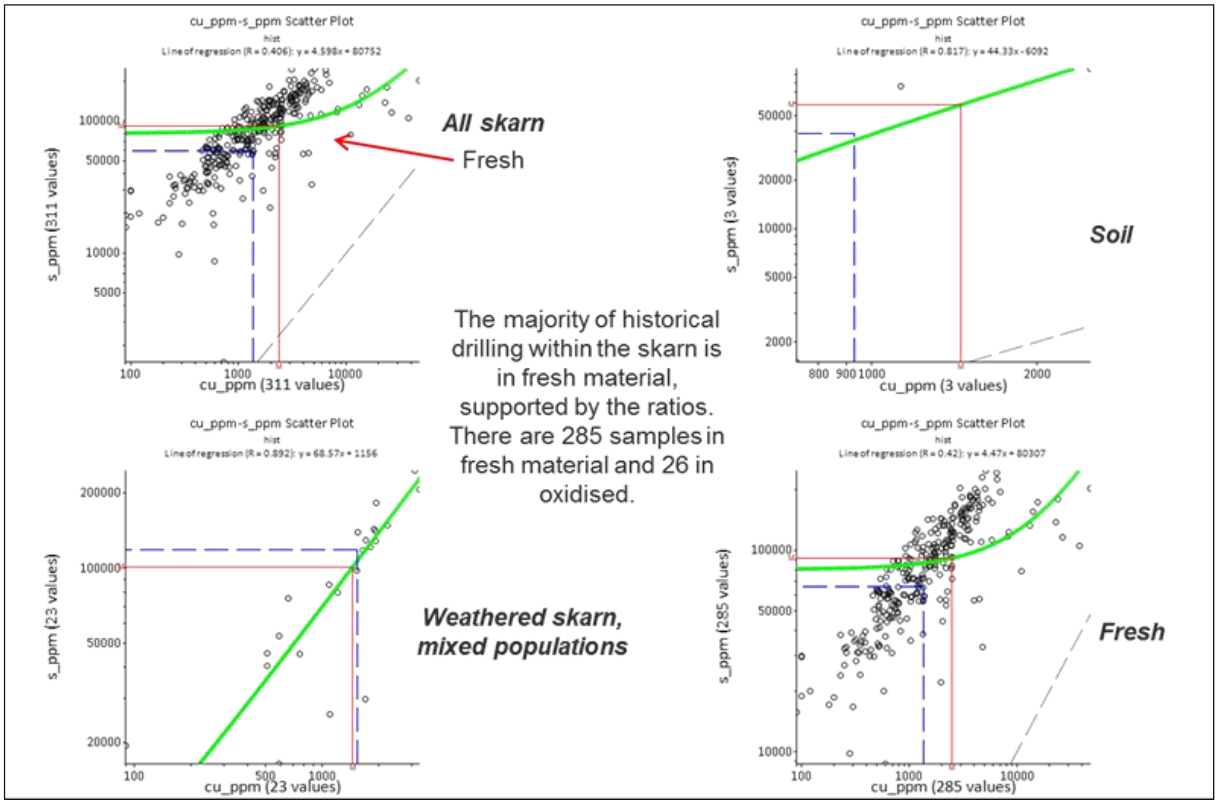
To ensure the comparison was not unduly impacted by the coverage and orientation of the drilling, a restricted area within the skarn material was chosen where the amount and orientation of both drilling sets was similar. The depth of drilling was also limited to greater than 50 mRL. Figure 14.4 shows the restricted area used to compare the historical and Monument drilling. The analysis, limited to within the restricted area only, shows similar results as displayed in Figure 14.1, where two distinct populations exist due to varying weathering types and highlights there was no sampling of oxidised material within the historical drilling (Figure 14.5 and Figure 14.6).

Figure 14.4 Restricted skarn zone used for comparative analysis



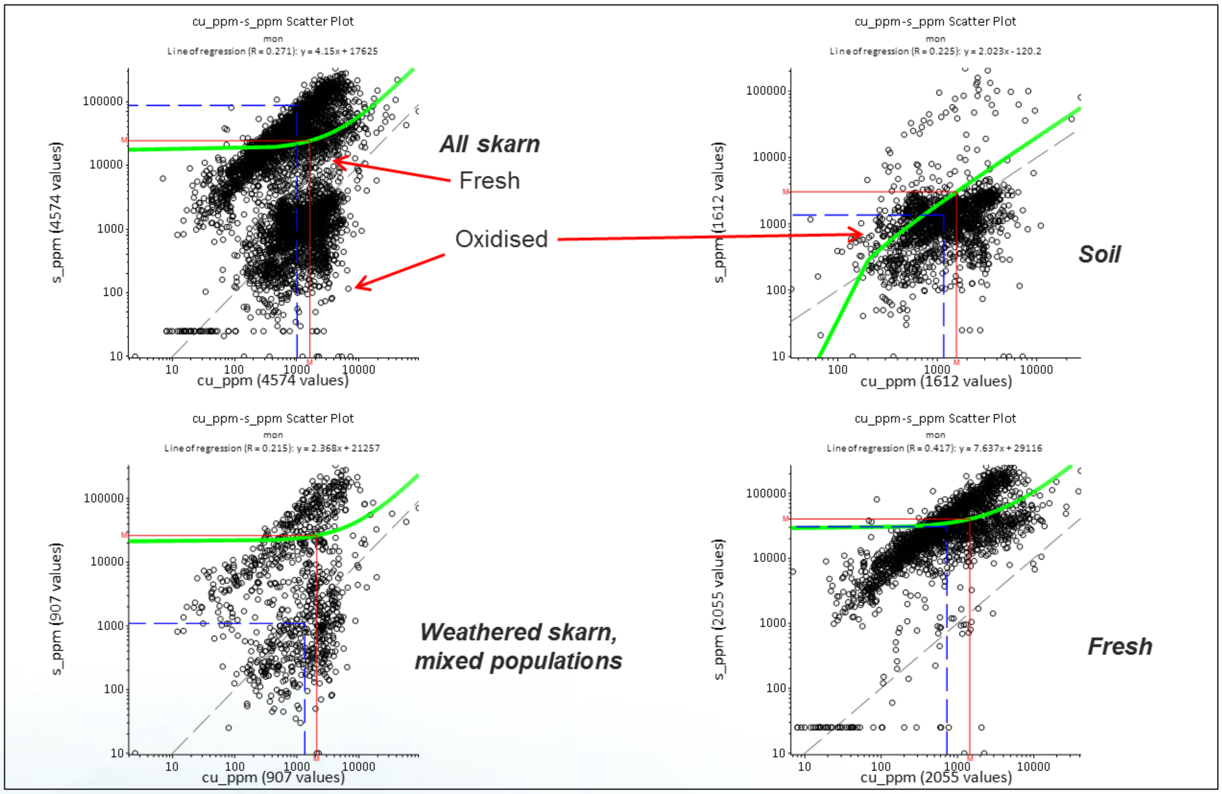
Note: Grey wireframe is the interpreted skarn

Figure 14.5 Restricted skarn results – historical drilling



The majority of historical drilling within the skarn is in fresh material, supported by the ratios. There are 285 samples in fresh material and 26 in oxidised.

Figure 14.6 Restricted skarn results – Monument drilling



Given the overall difference of S grades observed between the historical and Monument drilling, Snowden has excluded the S assays from the historical (pre-1990) drilling for resource estimation purposes.

14.4 Geological interpretation

14.4.1 Lithology and mineralisation

Snowden constructed lithological and mineralisation (using a nominal 0.1% Cu cut-off grade) outlines using cross-sectional interpretations. Due to the geometry of the mineralisation around the adamellite intrusive body, the orientation of the sections radiates around the intrusion. Lithological wireframes were created for skarn, shale and gossan. The 0.1% Cu mineralisation shells are contained within these lithological types. The mineralisation shells were used to select the sampling data for grade estimation, and to constrain the block model for estimation purposes. Some isolated mineralised intersections were not included in the interpreted mineralised envelopes due to lack of continuity or sparse data (e.g. at depth). Low grade material outside of the 0.1% Cu shells and still contained within the skarn was also estimated. To form ends to the wireframes, the end section strings were copied to a position midway to the next section or to a length of 20 m and adjusted to match the dip, strike and plunge of the zone. The wireframed objects were validated using Surpac software and set as solids as shown in Figure 14.7 and Figure 14.8.

A summary of each Cu zone (domain) is presented in Table 14.3.

Table 14.3 Summary of Cu zones

Cu zone	Rock type	Within 0.1% Cu shells
1	Skarn	Yes
2	Skarn	Yes
3	Skarn	Yes
4	Skarn	Yes
5	Gossan	Yes
6	Gossan	Yes
7	Gossan	Yes
8	Shale	Yes
9	Skarn	No

Figure 14.7 Lithological wireframes

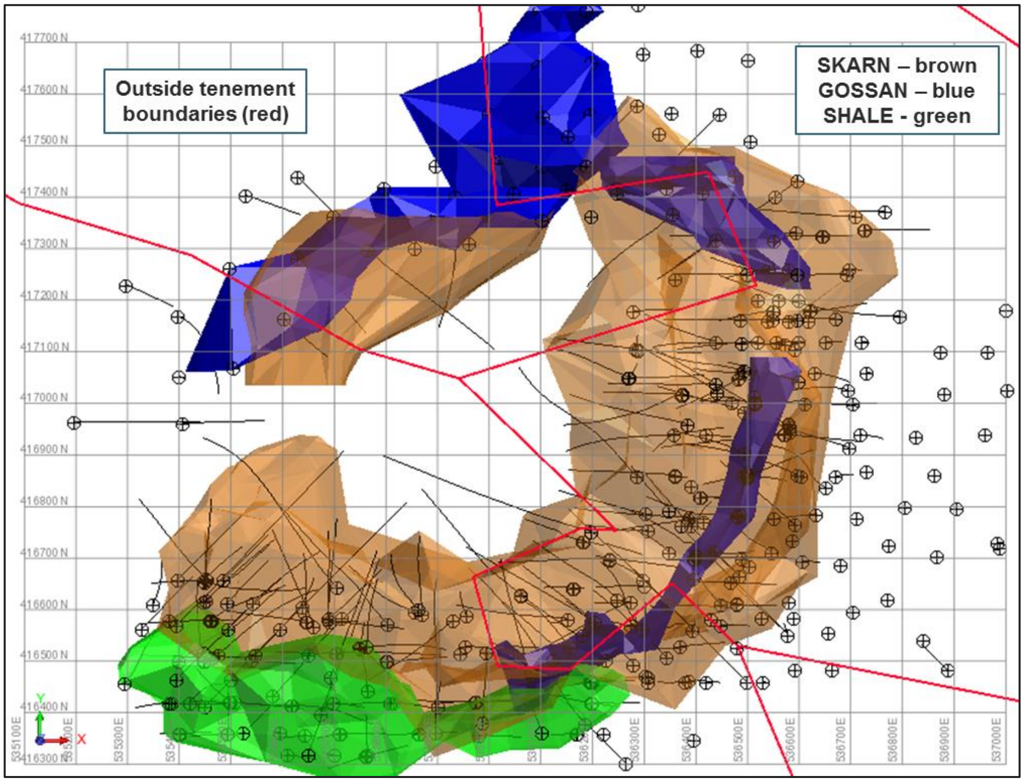
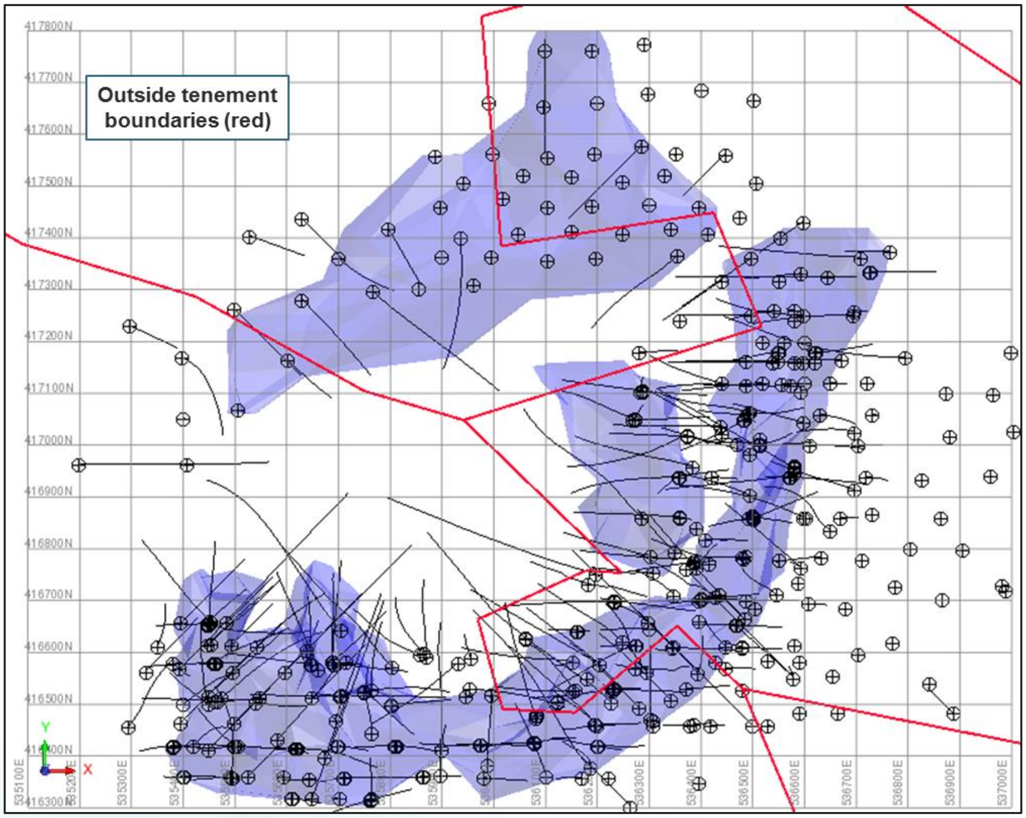


Figure 14.8 Mineralisation based on 0.1% Cu cut-off



14.4.2 Weathering surfaces

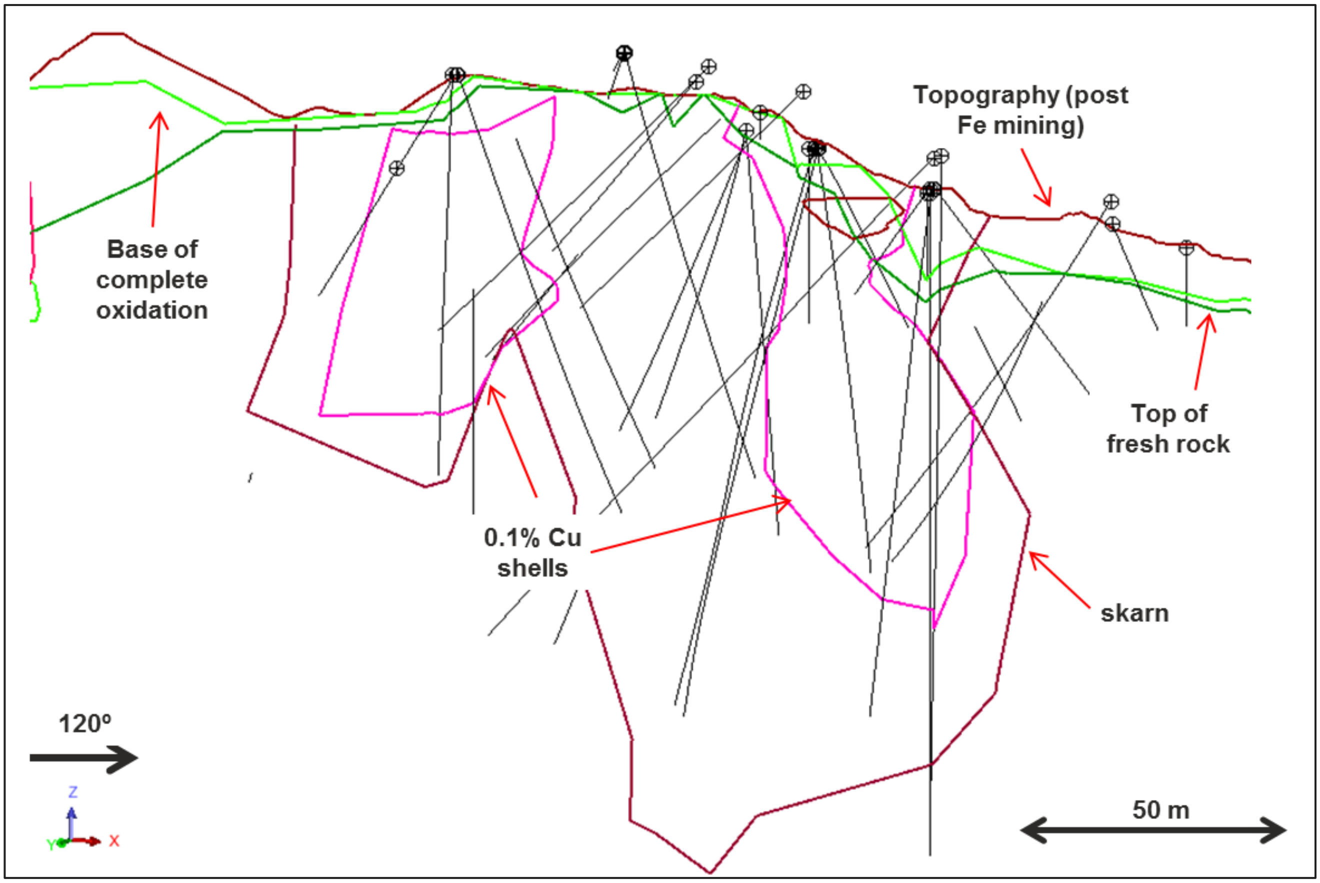
Weathering surfaces were interpreted on cross-section based on lithological and weathering codes included in the geology database. Material logged as soil was interpreted as the BOCO, weathered skarn or shale as transitional and sulphide as the TOFR. The use of lithological codes for interpretation has resulted in significant trenches and peaks in the BOCO surface. Snowden recommends the refinement of this surface as part of future resource estimation procedures.

14.4.3 Topographic surface and tenement boundaries

A topographic surface was supplied by Monument, compiled using a combination of LiDAR data (acquired in 2013) and ground surveying conducted in September 2015. Monument indicated that no mining has occurred since generation of the topographic surface. The topography surface was used to validate the collar locations of each drillhole and limit the block model.

Tenement boundaries were supplied as strings and used to constrain the reporting of the resources. A typical cross-section is presented in Figure 14.9.

Figure 14.9 Typical cross-section



14.5 Compositing of assay intervals

Based on the dominant sample length, 2 m composites for Cu, S, Fe, Ag, Au and Co were extracted within the coded lithological and mineralisation domains to ensure that composite intervals did not cross the lithological or mineralisation boundaries. To allow for uneven sample lengths within each of the domains, the Surpac composite process was run using the variable sample length method. This adjusts the composite intervals, where necessary, to ensure all samples are included in the composite file (i.e. no residuals) while keeping the composite interval as close to the desired interval as possible.

The compositing process was checked by:

- Comparing the lists of lithological and mineralisation domain values in the raw and composite files, which matched.
- Comparing the sample length statistics in the raw and composite files. The two total length values matched and the mean composite interval was 2 m.

14.6 Exploratory data analysis – summary statistics

Basic statistical parameters for Cu and Au within the main Cu zones (domains) are provided in Table 14.4. An assessment of the coefficient of variation (CV = ratio of the standard deviation to the mean) parameter resulted in the decision to top-cut selected elements during grade estimation for some domains. The top-cut values and percentage of sample cut are provided in Table 14.5. No top-cuts were applied to Co or Fe for any domains.

Table 14.4 Cu and Au statistics for major domains

Cu zone	Type	Element	Composite number	Minimum (ppm)	Maximum (ppm)	Mean (ppm)	CV
1 (skarn)	Oxidised	Cu	658	100	41,600	2,417	0.86
		Au	658	0.01	5.3	0.3	1.48
	Transitional	Cu	524	63	169,600	3,720	2.75
		Au	524	0.01	6.2	0.2	1.96
	Fresh	Cu	1,220	14	26,500	2,366	0.78
		Au	1,220	0.2	290	4.2	3.74
2 and 3 (skarn)	Oxidised	Cu	1,428	61	122,550	3,598	1.71
		Au	1,428	0.01	2.9	0.09	1.98
	Transitional	Cu	1,344	29	113,000	4,095	1.56
		Au	1,344	0.3	260	8.7	2.23
	Fresh	Cu	1,978	32	17,293	3,508	0.64
		Au	1,978	0.01	1.5	0.3	1.05

Table 14.5 Top-cuts applied during grade estimation

Cu zone	Type	Copper		Gold		Silver		Sulphur	
		Top-cut (ppm Cu)	% samples cut	Top-cut (ppm Au)	% samples cut	Top-cut (ppm Ag)	% samples cut	Top-cut (ppm S)	% samples cut
1 (skarn)	Oxidised	-	-	1.5	2.0	40	2.0	-	-
	Transitional	40,000	0.4	1.5	1.4	70	1.5	60,000	3.7
	Fresh	-	-	-	-	50	1.0	-	-
2 and 3 (skarn)	Oxidised	-	-	1.0	0.5	100	0.1	100,000	2.0
	Transitional	-	-	-	-	100	0.5	200,000	4.6
	Fresh	-	-	1.5	1.2	80	0.1	-	-
4 (skarn)	Oxidised	-	-	-	-	-	-	-	-
	Transitional	-	-	0.3	3.7	-	-	40,000	5.0
	Fresh	-	-	0.2	0.8	50	1.3	-	-
5 (gossan)	Oxidised	-	-	0.6	2.4	125	2.6	-	-
	Transitional	-	-	-	-	-	-	-	-
6 (gossan)	Oxidised	-	-	-	-	150	2.2	-	-
	Transitional	-	-	0.4	0.8	150	1.5	-	-
7 (gossan)	Oxidised	10,000	1.6	-	-	120	1.2	30,000	1.1
	Transitional	-	-	0.4	0.8	-	-	-	-

14.6.1 Correlations

Table 14.6 and Table 14.7 present the correlation statistic for the drillhole composite data within the fresh and oxidised skarn respectively. Those shown as red display a correlation near 0.7 (moderately strong relationship), those in green near 0.6 (moderate relationship).

Table 14.6 Correlation matrix – fresh skarn material

	Cu	S	Fe	Ag	Au	Co
Cu	1	**0.68**	0.53	0.43	0.27	**0.58**
S	**0.68**	1	**0.70**	0.01	0.32	0.61
Fe	0.53	**0.70**	1	-0.03	0.27	0.51
Ag	0.43	0.01	-0.03	1	0.09	-0.02
Au	0.27	0.32	0.27	0.09	1	0.36
Co	**0.58**	**0.61**	0.51	-0.02	0.36	1

Table 14.7 Correlation matrix – oxidised skarn material

	Cu	S	Fe	Ag	Au	Co
Cu	1	0.14	0.23	0.14	0.21	0.34
S	0.14	1	-0.12	0.01	0.04	0.01
Fe	0.23	-0.12	1	-0.01	0.26	0.08
Ag	0.14	0.01	-0.01	1	0.02	0.34
Au	0.21	0.04	0.26	0.02	1	0.04
Co	0.34	0.01	0.08	0.34	0.04	1

Within fresh material, there is a moderate to moderately strong relationship between Cu, Co, Fe and S. The stronger relationship between Fe and S is likely relating to pyrrhotite content, while the Cu-S (and Fe) correlation relates to the chalcopyrite content. Ag shows a moderate to weak relationship to Cu. Within oxidised material, there is minimal correlation between all elements.

The correlations were used to guide the variography and estimation approach.

14.7 Variography

Variograms were generated to assess the grade continuity of the various constituents and as inputs to the ordinary kriging algorithm used to interpolate grades. Snowden Supervisor software was used to generate and model the variograms.

Variograms for each element (Cu, S, Fe, Ag, Au and Co) were developed for each domain and oxidation type, provided there was sufficient data to support robust variograms. In some domains, variograms were adopted from other similar domains, with the major direction of continuity adjusted in line with the interpreted orientation. All elements were modelled using the same orientations for each domain. All variograms were modelled using the following general approach:

- All variograms were standardised to a sill of one
- Variograms were modelled using spherical variograms with a nugget effect and two nested structures
- The variograms were evaluated using normal scores variograms and the nugget and sill values back-transformed using the discrete Gaussian polynomials technique.

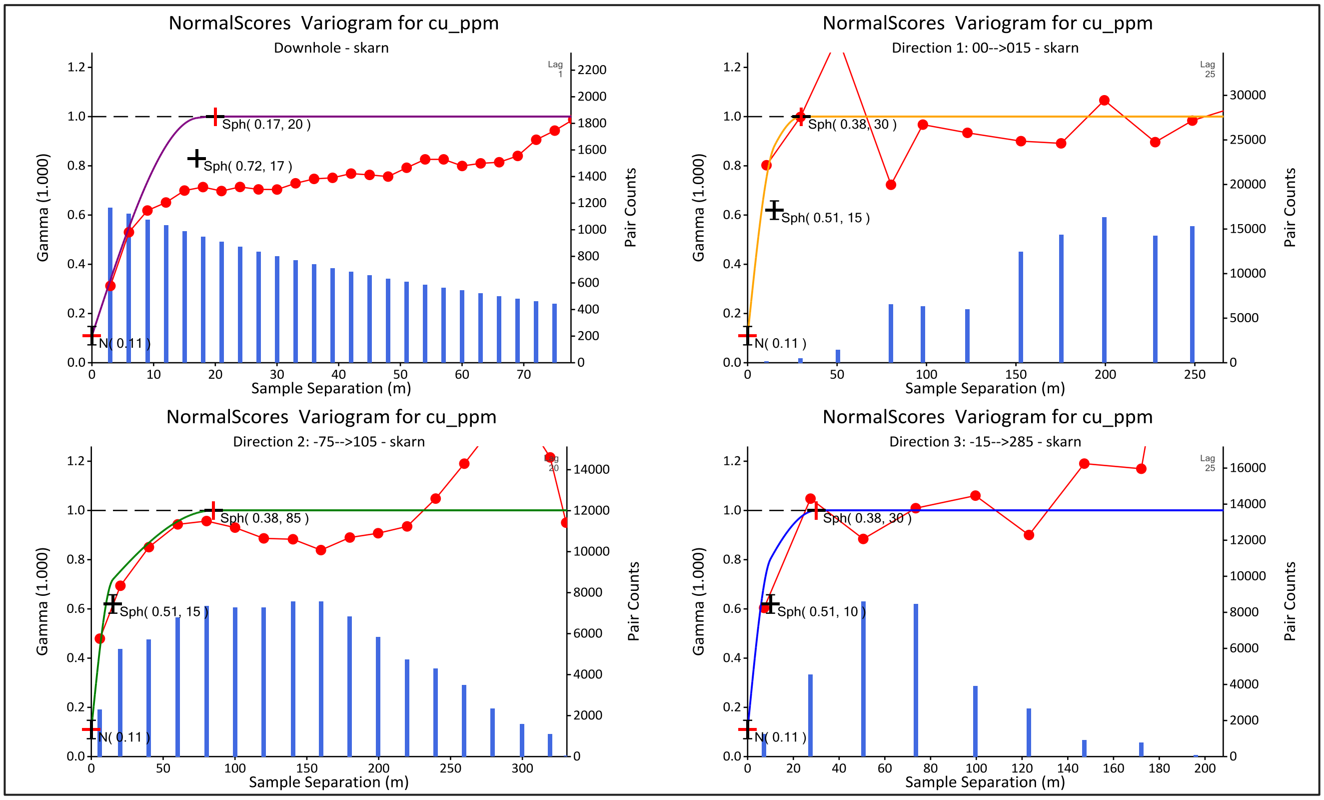
Variograms for Cu for each of the domains are summarised in Table 14.8 and the variogram models for Cu for Domain 1 are shown in Figure 14.10.

Table 14.8 Variogram parameters for Cu

Cu zone	Ox type	Directions			Nugget	Structure 1				Structure 2			
		Major	Semi-major	Minor		Sill	Range (m)	Major/ Semi-major	Major/ Minor	Sill	Range (m)	Major/ Semi-major	Major/ Minor
1	Ox	00→000	00→090	90→000	0.08	0.61	25	0.6	2.5	0.31	40	0.6	0.7
	Tr	00→015	75→285	-15→285	0.24	0.69	30	3.0	2.0	0.07	80	2.0	2.7
	Fr	00→015	75→285	-15→285	0.11	0.51	15	1.0	1.5	0.38	30	0.4	1.0
2	Ox	00→280	-20→010	70→010	0.08	0.61	25	0.6	2.5	0.31	40	0.6	0.7
	Tr	00→055	00→145	90→000	0.29	0.54	70	2.0	7.0	0.17	110	1.0	1.7
	Fr	00→055	-60→325	-30→145	0.20	0.42	25	1.7	1.3	0.38	215	2.0	2.7
3	Ox	00→310	00→040	90→000	0.08	0.61	25	0.6	2.5	0.31	40	0.6	0.7
	Tr	00→310	00→040	90→000	0.29	0.54	70	2.0	7.0	0.17	110	1.0	1.7
	Fr	00→310	70→220	-20→220	0.20	0.42	25	1.7	1.3	0.38	215	2.0	2.7
4	Ox	00→350	00→080	90→000	0.08	0.61	25	0.6	2.5	0.31	40	0.6	0.7
	Tr	00→350	00→080	90→000	0.29	0.54	70	2.0	7.0	0.17	110	1.0	1.7
	Fr	00→350	00→080	90→000	0.20	0.42	25	1.7	1.3	0.38	215	2.0	2.7
5	Ox	00→060	00→150	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
	Tr	00→060	60→150	30→330	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
6	Ox	00→150	00→240	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
	Tr	00→150	00→240	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
7[1]	Ox	00→055	00→145	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
	Tr	00→055	00→145	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
7[2]	Ox	00→000	00→090	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
	Tr	00→000	00→090	90→000	0.27	0.59	10	0.6	1.0	0.14	25	0.5	1.3
8	Ox	00→280	20→010	70→190	0.09	0.5	15	0.3	2.1	0.41	135	1.1	2.3
	Tr	00→280	20→010	70→190	0.12	0.6	25	0.8	1.7	0.28	90	0.9	2.3
	Fr	00→280	20→010	70→190	0.12	0.6	25	0.8	1.7	0.28	90	0.9	2.3
9	Ox		varying		0.08	0.61	25	0.6	2.5	0.31	40	0.6	0.7
	Tr		varying		0.24	0.69	30	3.0	2.0	0.07	80	2.0	2.7
	Fr		varying		0.11	0.51	15	1.0	1.5	0.38	30	0.4	1.0

Notes: [1] Defined by easting 536,260m to 537,100m; [2] Defined by easting 534,950m to 536,260m

Figure 14.10 Variogram models for Cu within Domain 1, fresh skarn



14.8 Estimation

14.8.1 Block model definitions

A block model was created in Surpac to encompass the full extent of the known deposit. A list of block model parameters used in the estimate is displayed in Table 14.9.

The block model is based on a parent block size of 25 m (Y) x 25 m (X) x 10 m (Z) with a minimum sub-cell of 6.25 m (Y) x 6.25 m (X) x 2.5 m (Z). The parent block size was selected based on the results of a KNA, along with consideration of the average drillhole spacing and geometry of the deposit.

Table 14.9 Block model definition and attributes

Model file name: 20180712_mengapur_bm.mdl			
	Y	**X**	**Z**
Minimum coordinates	416,000	535,000	-200
Maximum coordinates	418,000	537,000	600
Block size (sub-blocks)	25 (6.25)	25 (6.25)	10 (2.5)
Block discretisation	4	4	3
Attributes			
cu_ppm	Cu grade estimate (ppm)		
cu_pct	Cu grade estimate (%)		
s_ppm	S grade estimate (ppm)		
fe_pct	Fe grade estimate (%)		
ag_ppm	Ag grade estimate (ppm)		
au_ppm	Au grade estimate (ppm)		
co_ppm	Co grade estimate (ppm)		
cu_zone	Cu mineralisation zone (domain)		
lith	Lithological type – skarn, shale, gossan, waste		
bd	Bulk density (t/m^3)		
class, class_code	Classification – Indicated, Inferred, unclassified (2,3,4)		
type, type_code	air, ox, tr, fr (0,1,2,3)		
tenement	Tenement code – outside, SDSB, CASB (-1, 1, 2)		
ave_dis_cu_ppm, ave_dis_s_ppm, etc	Average distance (m) to samples for interpolation of each element		
min_dis_cu_ppm, min_dis_s_ppm, etc	Minimum distance (m) to samples for interpolation of each element		
num_sam_cu_ppm, num_sam_s_ppm, etc	Number of informing samples for interpolation of each element		
kvar_cu_ppm, kvar_s_ppm, etc	Kriging variance for each element		
pass_cu_ppm, pass_s_ppm, etc	Search pass number for interpolation of each element (1,2,3); -99 attributed for assigned values		

14.8.2 Estimation method

Block grades were estimated using the ordinary kriging algorithm (parent cell estimation) using the nugget, sill values and ranges determined from the variogram models. The ranges obtained from the variogram models were used as a guide in determining appropriate search ellipse parameters. All domain boundaries were treated as hard boundaries for estimation purposes, with only assays from within each wireframe/domain used to estimate blocks within that domain. The estimation domains are as defined in Table 14.3, which are based on a combination of lithology and Cu mineralisation.

14.8.3 Search parameters

For each domain, the same major direction (orientation of mineralisation) was used for each element in order to maintain the ratios of the various constituents (i.e. metal balance). The search ellipse axis lengths were derived based on the variogram modelling.

To ensure that each block within a domain includes an estimated grade value, a dynamic search volume approach using three search passes was used. A maximum number of four samples per drillhole and maximum vertical search of 12 m was applied to reduce the influence of drillholes that were orientated down-dip to the mineralisation. Based on the KNA results, a maximum number of 24 samples was used for estimation. Where a block remained unestimated after the third search pass due to sparse data, an average value for the element was attributed. Search parameters are presented in Table 14.10, with the same search parameters used for all elements to maintain correlations between elements. Search ellipse rotations are as per the variogram rotations, as summarised in Table 14.8.

Table 14.10 Estimation parameters

Cu zone	Oxidation type	Anisotropy ratios		Pass 1		Pass 2		Pass 3	
		Major-semi-major	Major-minor	Major distance	Minimum samples	Major distance	Minimum samples	Major distance	Minimum samples
1	Oxide	1	2	75	8	150	8	300	1
	Transitional	3	2	75	8	150	8	500	2
	Fresh	1	2	75	8	150	4	300	1
2	Oxide	1	3	150	8	300	4	500	2
	Transitional	1	4	75	8	150	8	500	2
	Fresh	2	1	75	8	150	8	500	2
3	Oxide	1	2	75	8	150	8	300	2
	Transitional	1	4	75	8	150	8	300	2
	Fresh	2	1	75	8	150	6	300	2
4	Oxide	1	3	75	8	150	8	300	2
	Transitional	3	2	75	8	150	8	300	2
	Fresh	1	2	75	8	150	8	500	2
5	Oxide	1	3	150	6	300	4	500	1
	Transitional	3	2	150	6	300	4	500	1
6	Oxide	1	2	150	8	300	4	500	1
	Transitional	1	2	150	8	300	4	500	1
7	Oxide	1	2	75	8	150	4	300	2
	Transitional	1	2	75	8	150	6	300	2
8	Oxide	1	3	75	8	150	8	500	2
	Transitional	1	2	75	8	150	8	500	2
	Fresh	1	2	75	8	150	8	500	1
9	Oxide	1	3	75	8	150	8	500	2
	Transitional	3	2	75	8	150	8	500	2
	fresh	1	2	75	8	150	8	500	2

**Note: Fe and S varies for Pass 3 due to less samples (historical data does not include Fe and S); maximum number of samples for all search passes is 24*

14.8.4 Model validation

A three-step process was used to validate the Mengapur grade estimates. A qualitative/visual assessment was completed by slicing sections (vertical and horizontal) through the block model in positions coincident with drilling. A quantitative validation of the estimates was then completed by comparing the global average grades of the input composite (i.e. samples) against the block model estimate for each Cu zone and oxidation type. Figure 14.11 and Figure 14.12 show example sections comparing estimated Cu block model grades to the drillhole data. Table 14.11 presents the global mean validation for Cu within each domain.

Figure 14.11 Example section showing estimated block Cu grade compared to drillhole grades – Zone A

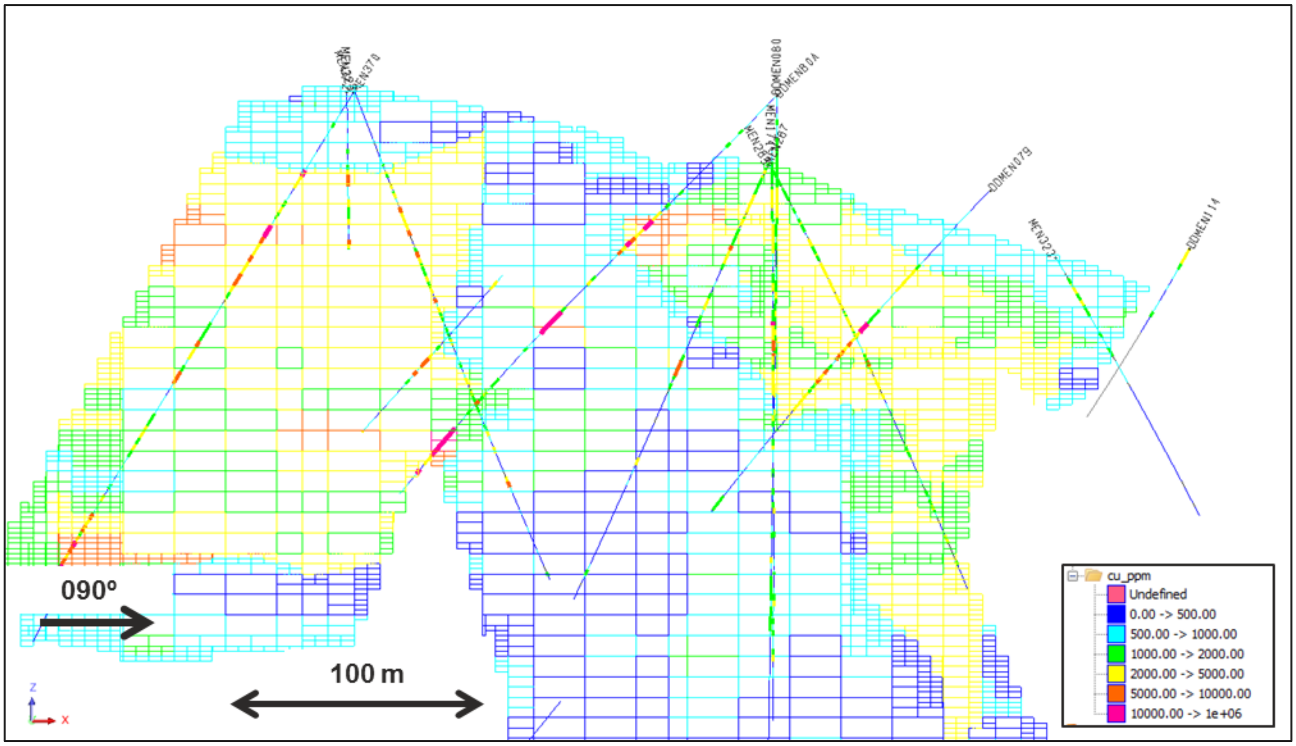


Figure 14.12 Example section showing estimated block Cu grade compared to drillhole grades – Zone B

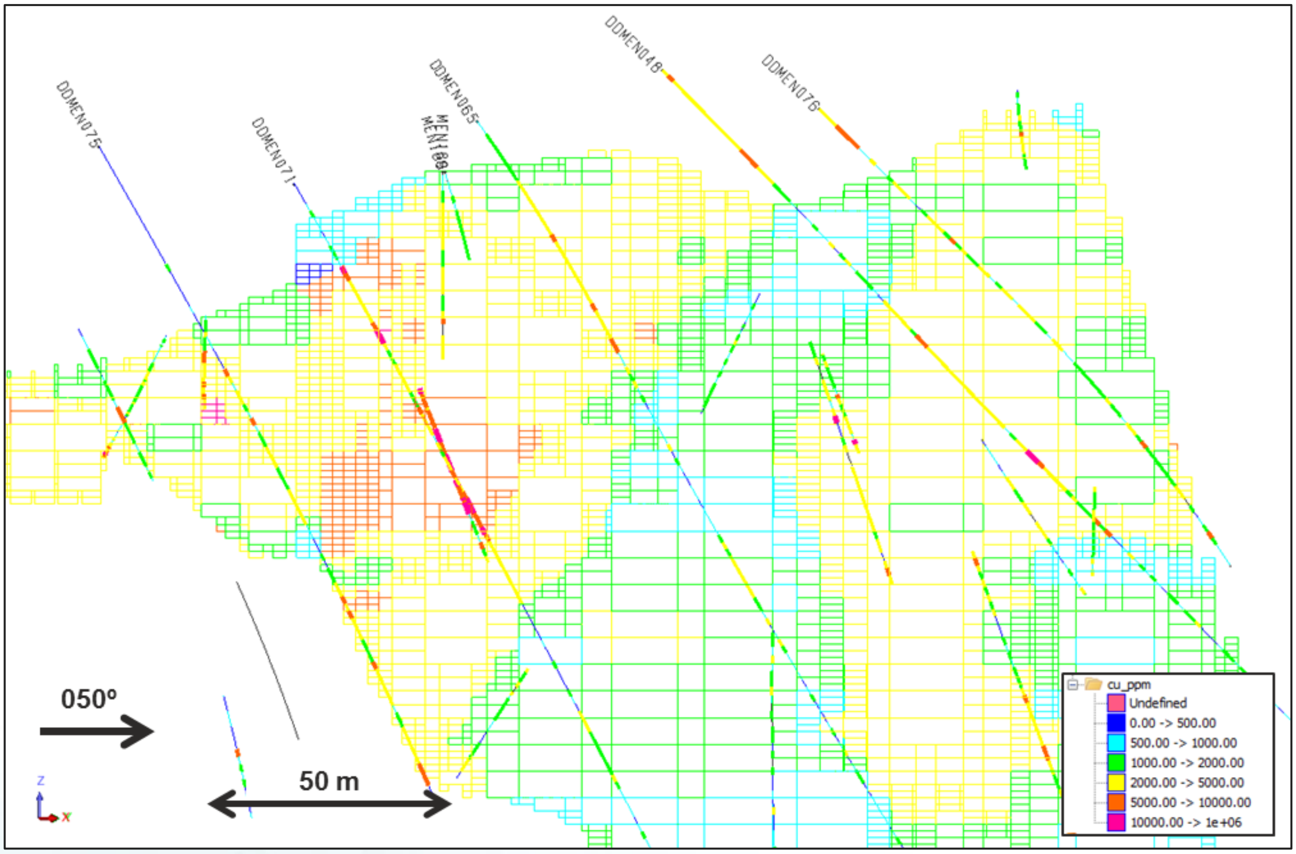


Table 14.11 Global mean validation – Cu

Cu zone	Type	Element	No. of composites	Drillhole mean (ppm Cu)		Block model mean (ppm Cu)	% difference	
				Naïve	Declustered		Naïve vs. model	Declustered vs. model
1	Ox	Cu	658	2,417	2,354	2,521	4.3%	7.1%
	Tr	Cu	524	3,295	3,273	3,171	-3.8%	-3.1%
	Fr	Cu	1,220	2,365	2,348	2,307	-2.5%	-1.7%
2+3	Ox	Cu	1,428	3,598	3,640	3,444	-4.3%	-5.4%
	Tr	Cu	1,344	4,094	4,051	4,302	5.1%	6.2%
	Fr	Cu	3,108	3,211	3,149	3,064	-4.6%	-2.7%
4	Ox	Cu	28	1,318	1,411	1,287	-2.3%	-8.7%
	Tr	Cu	52	1,564	1,656	2,007	28.4%	21.2%
	Fr	Cu	1,032	2,767	2,794	2,726	-1.5%	-2.4%
5	Ox	Cu	151	1,752	1,731	1,911	9.1%	10.4%
	Tr	Cu	103	1,706	1,615	1,615	-5.3%	0.0%
6	Ox	Cu	735	2,730	2,721	2,908	6.5%	6.9%
	Tr	Cu	742	2,738	2,732	3,115	13.8%	14.0%
7	Ox	Cu	252	3,171	3,212	3,231	1.9%	0.6%
	Tr	Cu	178	3,413	3,754	3,522	3.2%	-6.2%
8	Ox	Cu	940	2,756	2,927	3,037	10.2%	3.8%
	Tr	Cu	544	3,641	3,606	3,640	-0.0%	1.0%
	Fr	Cu	143	4,854	5,095	4,919	1.4%	-3.5%
9	Ox	Cu	1,261	891	901	878	-1.5%	-2.6%
	Tr	Cu	1,267	890	902	730	-18.0%	-19.1%
	Fr	Cu	8,558	973	983	940	-3.5%	-4.5%

As a further check, a trend analysis was completed to ensure that the block grade estimates honour the trends in the input drillhole data. The trend analysis was completed for horizontal slices using a 10 m bench height, and for vertical slices using a 20 m interval in the Y direction. Examples trend plots (Cu zone 1, fresh rock) are presented in Figure 14.13 and Figure 14.14.

Figure 14.13 Cu validation trend plot (Y) – Cu_zone = 1, fresh rock

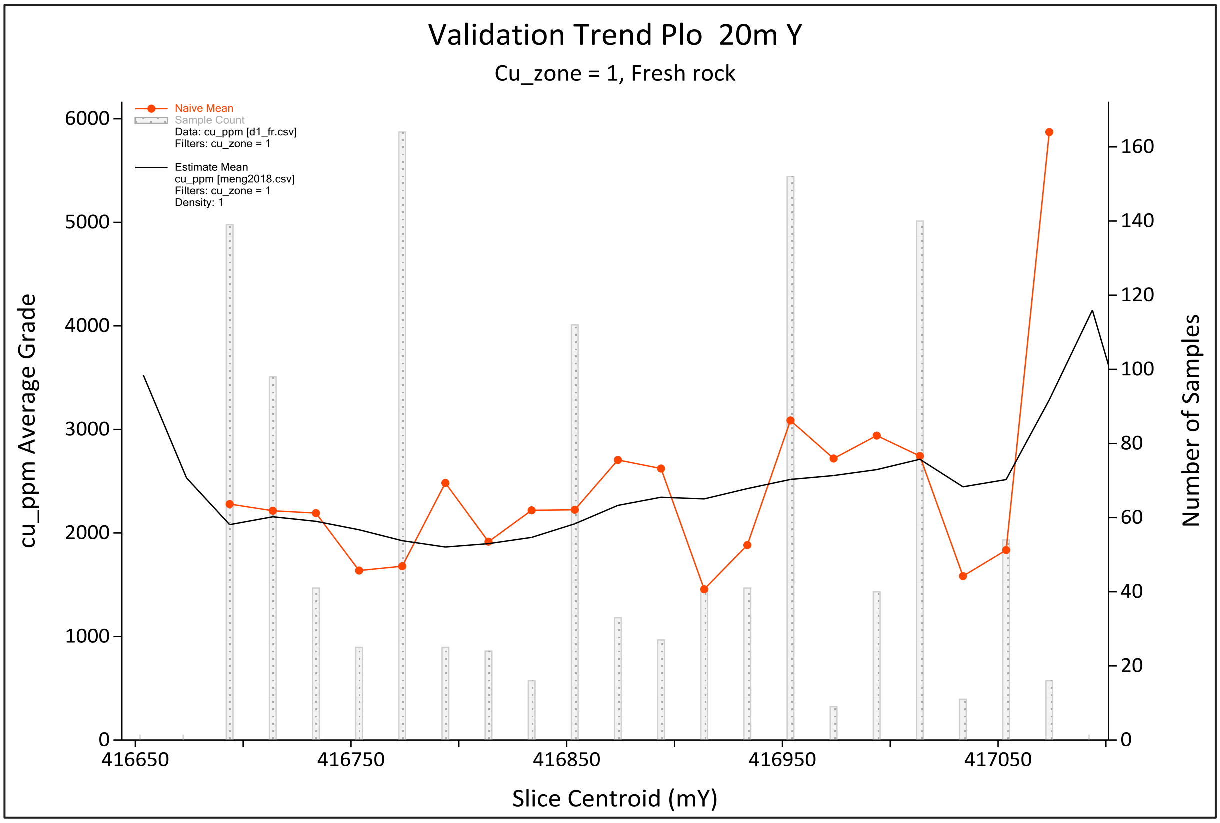


Figure 14.14 Cu validation trend plot (Z) – Cu_zone = 1, fresh rock

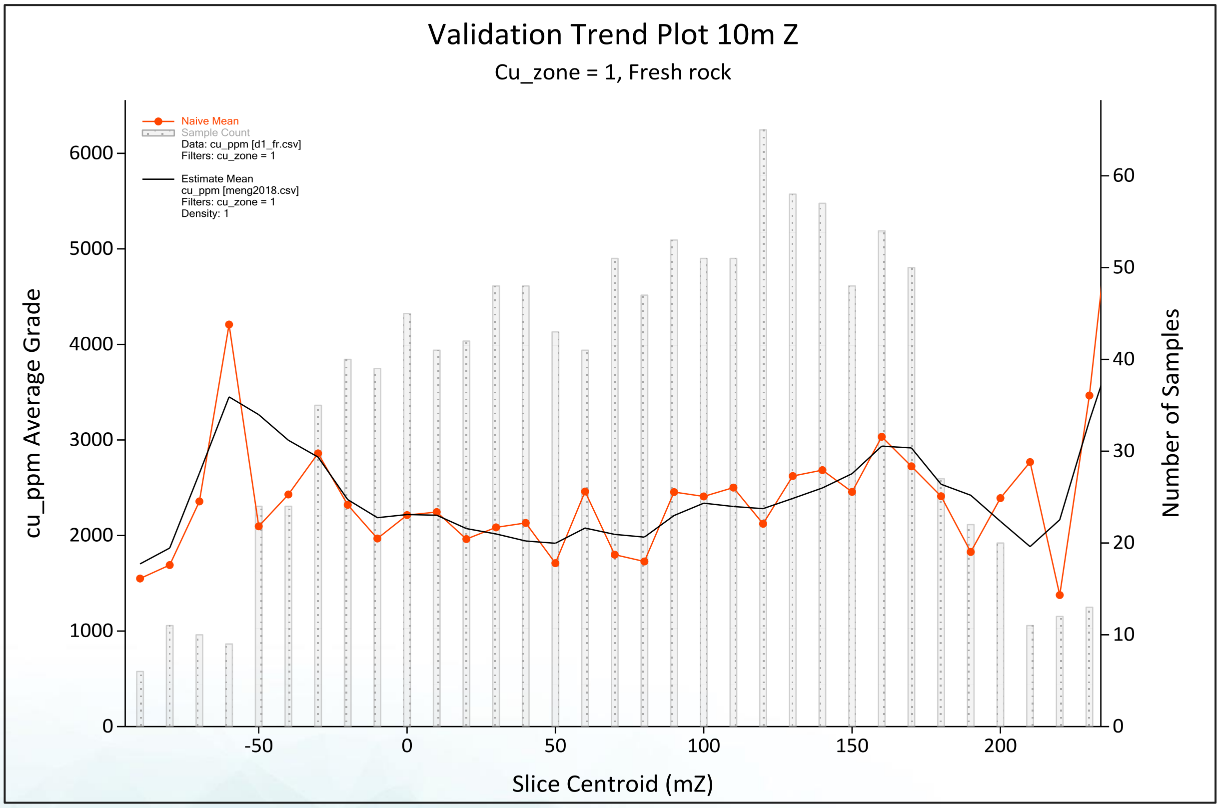


Figure 14.15 Au validation trend plot (Y) – Cu_zone = 1, fresh rock

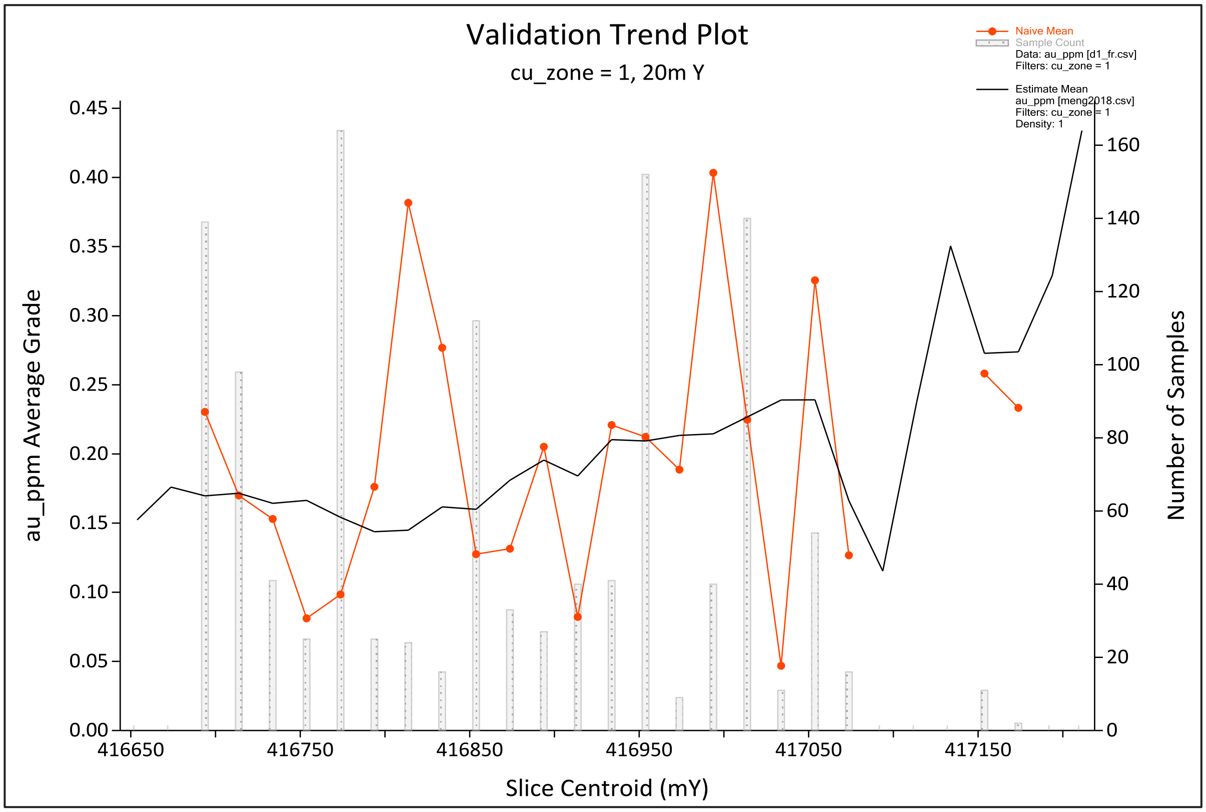
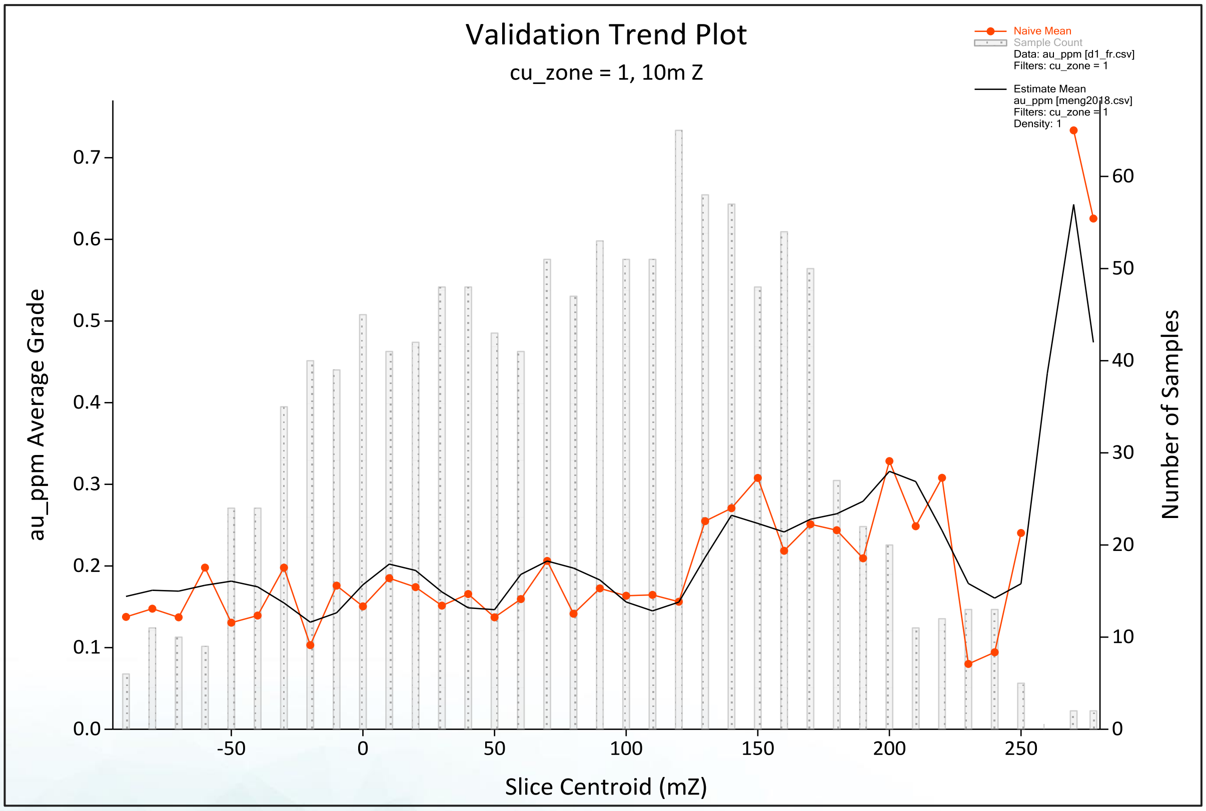


Figure 14.16 Au validation trend plot (Z) – Cu_zone = 1, fresh rock



The conclusions from the model validation work are:

- Global comparison of the model grades and the corresponding drillhole composite grades generally shows a good outcome (<5% difference) for each element estimated within most Cu zones and rock types:
  - For the transitional gossan (domain 6) and unmineralised skarn (domain 9), the differences for Cu are higher due to extrapolation, along with, in the case of the unmineralised skarn, the overall lower grade
  - Some higher differences are observed within the oxide and transitional domains where the S and Fe distributions are more skewed (higher CV); however, this does not impact on the reported grades (Cu and Au).
- Trend plots show a good correlation between the composite grades and the block model grades by northing and elevation. The trends in the raw data are honoured in the block grade estimates. The comparisons also show the smoothing inherent in the interpolation process, which results in smoothing of the block grades compared to the composite grades (i.e. lower variance for block grades, which is expected).
- The estimated model adequately preserves correlations observed in the input sample data.

14.9 Bulk density

Data from a total of 71 bulk density samples was available from measurements of diamond drill core collected in 2012 by Monument. The samples are generally between 10 cm and 30 cm in length. The bulk density of samples was measured at the ALS laboratory in Vancouver Canada (Monument, 2012). Monument indicated (Monument, 2012) that the measurements were completed by water immersion techniques (weight in air vs weight in water) using wax-coating to preserve porosity. Assaying of the samples by the same laboratory was completed using ICP-MS (Fe and other elements) and Leco (sulphur).

Each sample was characterised geologically in terms of the rock type and oxidation state. Statistics were assessed for each combination of the logged rock type and oxidation state, as summarised in Table 14.12.

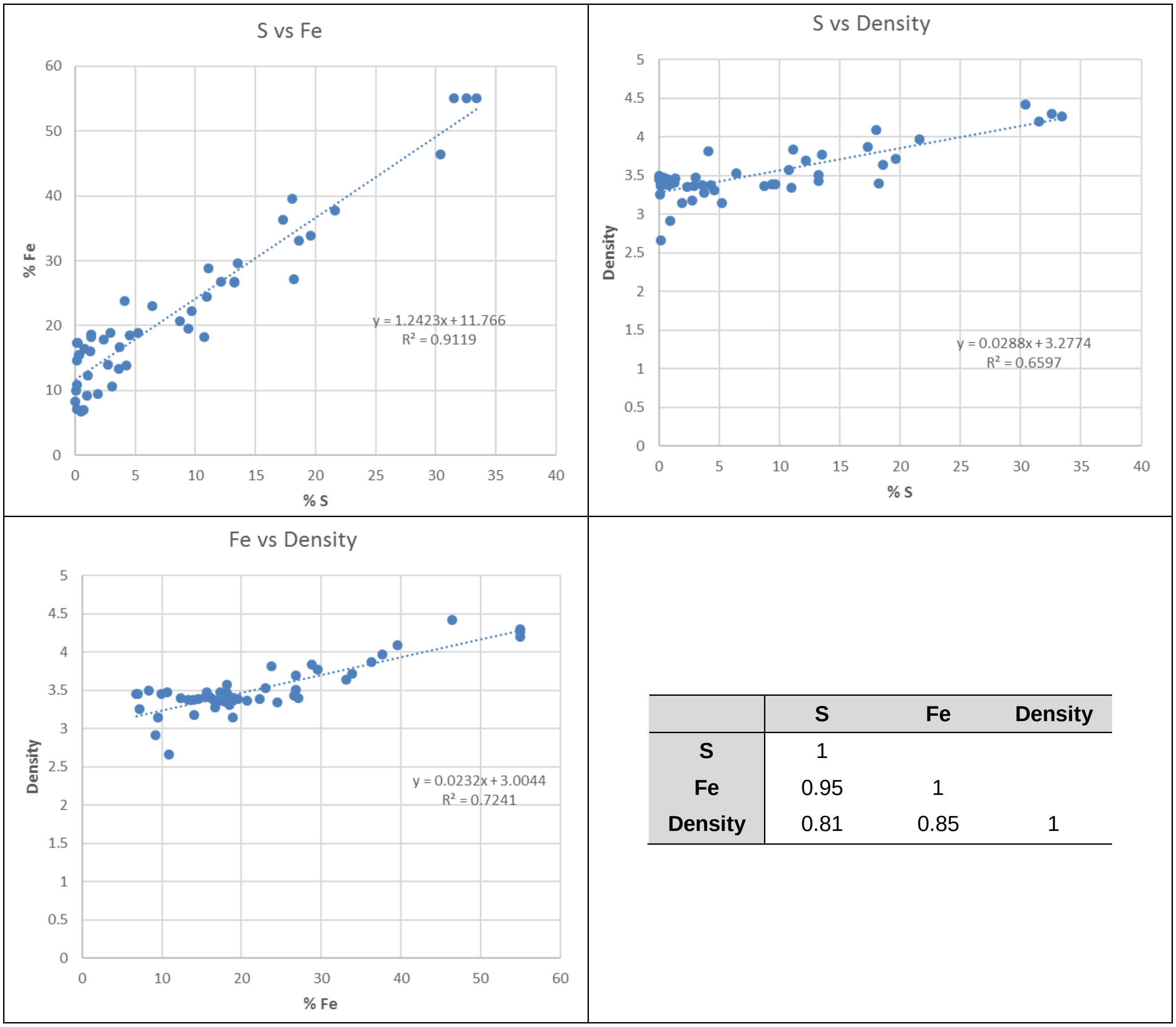
Table 14.12 Bulk density sample statistics by logged rock type and oxidation state

Oxidation	Logged code	Count	Average length (m)	Average grade		Density (t/m^3)		
				% S	% Fe	Average	Minimum	Maximum
Ox	QZVN	1	0.15	0.37	6.48	2.22	2.22	2.22
	WRHYL	1	0.18	3.05	20.7	2.95	2.95	2.95
	WSK	5	0.18	2.32	16.9	2.83	2.24	3.31
	WSLAT	1	0.15	0.08	28.9	2.53	2.53	2.53
Ox total		**8**	**0.17**	**1.89**	**17.6**	**2.73**	**2.22**	**3.31**
Sul	ADAM	2	0.19	0.15	2.79	2.78	2.66	2.89
	LMCB	2	0.21	1.39	2.95	2.74	2.70	2.77
	LMST	6	0.19	0.40	0.92	2.74	2.70	2.86
	MAG	1	0.20	1.19	49.0	4.33	4.33	4.33
	SHL	1	0.16	0.06	3.46	2.76	2.76	2.76
	SKGA	5	0.22	0.85	8.54	3.46	3.45	3.50
	SKPX	37	0.53	6.40	20.3	3.44	2.66	4.30
	SKSUL	7	0.25	23.9	41.6	3.98	3.43	4.42
	WSK	2	0.18	0.18	29.8	2.24	1.62	2.85
Sul total		**63**	**0.40**	**6.59**	**19.2**	**3.35**	**1.62**	**4.42**
GRAND TOTAL		**71**	**0.37**	**6.06**	**19.1**	**3.28**	**1.62**	**4.42**

Notes: QZVN: quartz-bearing vein; WRHYL: weathered rhyolite; WSK: weathered skarn; WSLAT: weathered slate; ADAM: adamellite; LMCB: carbonaceous limestone; LMST: limestone; MAG: magnetic rock; SHL: shale; SKGA: garnet skarn; SKPX: pyroxene skarn; SKSUL: sulphide skarn

For the sulphide (i.e. fresh) skarn lithology, there were sufficient samples (49) to allow an assessment of the relationship between the bulk density and the Fe and S grades. Snowden found that within the fresh (i.e. sulphide) skarn the bulk density is strongly correlated with both Fe and S, as shown by the correlation coefficients and scatterplots in Figure 14.17. Given the presence of pyrrhotite in the mineralisation, this relationship is not unexpected.

Figure 14.17 Scatterplots between density, Fe and S, with correlation matrix



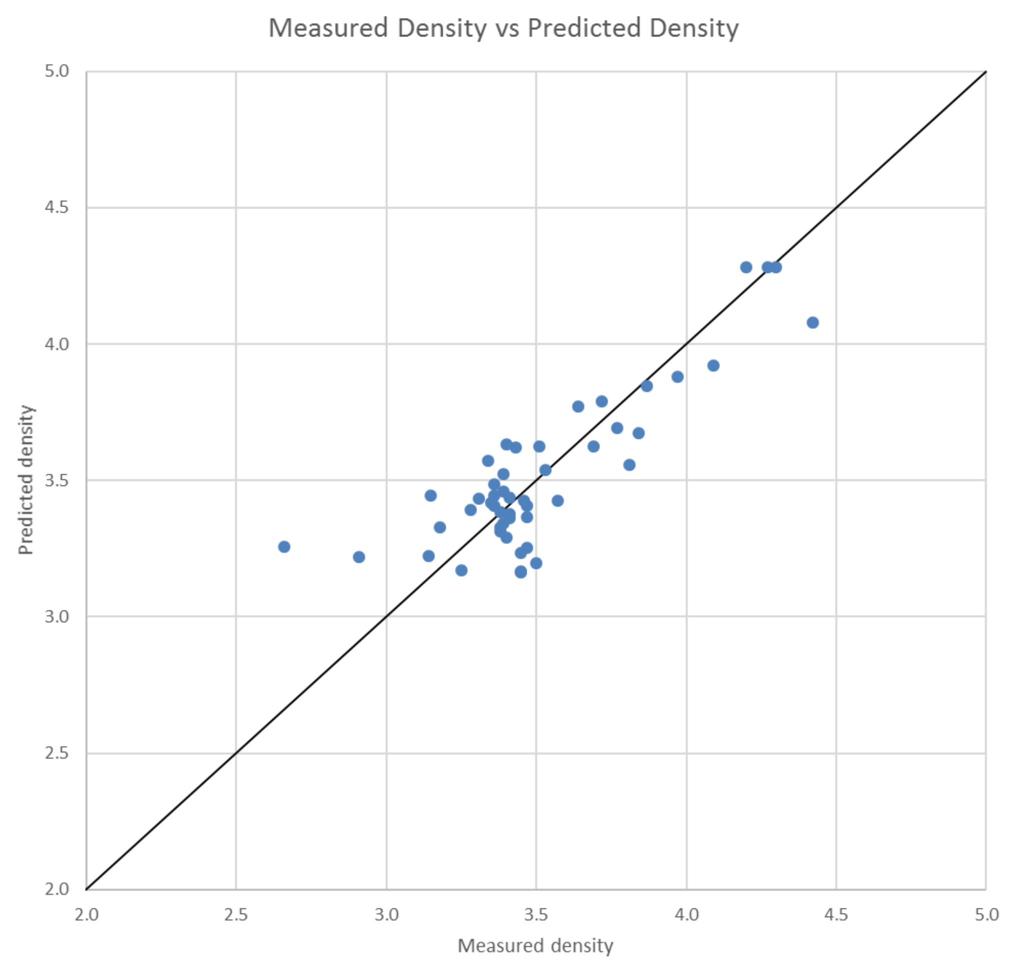
	S	Fe	Density
S	1		
Fe	0.95	1	
Density	0.81	0.85	1

Given the correlation of density and grade (Fe and S), Snowden completed a multiple linear regression to estimate the bulk density of a block from the Fe and S grade estimates; however, it was found that the inclusion of both Fe and S grade in the regression did not improve the regression materially compared with using just the Fe grade. As such, and given the lack of robust S assays for the historical drilling, Snowden developed a linear regression for bulk density using just the Fe grade. The regression equation is:

$$Density(t/m^3) = 0.023 \times Fe(\%) + 3.004$$

Analysis of residuals shows no bias in the residuals. For the 49 sulphide skarn density samples, the measured density compares well to the density predicted using the equation above, as shown in Figure 14.18.

Figure 14.18 Measured density compared with predicted density from regression



Bulk density was assigned to the model blocks based on the lithology and oxidation state, as detailed in Table 14.13. Some lithology/oxidation combinations do not have any sample data and for these domains, Snowden has used an assumed value. The assumed bulk density values were sourced from Odell *et al* (2014) and validated against published density values of similar rock types[5] and observations in the field and from core.

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[5] Rutter, H. (2011). *Field Geologist's Manual*. 4th ed. Carlton, Vic.: Australasian Institute of Mining and Metallurgy, pp.338-341.

Table 14.13 Bulk density values assigned to resource block model

Rock type	Oxidation	Bulk density (t/m^3)	Comments
Adamellite	Oxide	1.85	Nominal value, no samples
	Trans	2.2	Nominal value, no samples
	Sulph	2.8	Average of samples
Gossan	Oxide	3.4	Nominal value, no samples
Limestone	Oxide	2.1	Nominal value, no samples
	Trans	2.4	Nominal value, no samples
	Sulph	2.75	Average of samples
Shale	Oxide	1.85	Nominal value, no samples
	Trans	2.2	Nominal value, no samples
	Sulph	2.75	Rounded value based on 1 sample
Skarn	Oxide	2.65	Average of WSK samples
	Trans	2.8	Nominal value, no samples
	Sulph	BD = 0.023*Fe% + 3.004	Regression based on Fe grade estimate (use average value of 3.5 t/m^3 for blocks with no Fe estimate)

14.10 Mineral Resource classification

The MREs were classified as a combination of Indicated and Inferred Resources in accordance with CIM guidelines.

The Mineral Resource classification criteria were developed based on an assessment of the following items:

- Confidence in the understanding of the underlying geological and grade continuity and the structural characteristics
- Nature and quality of the drilling and sampling data (historical and recent Monument drilling)
- Drillhole spacing
- Analysis of the QAQC data
- Confidence in the estimate of the mineralised volume
- The availability of bulk density data
- The results of model validation.

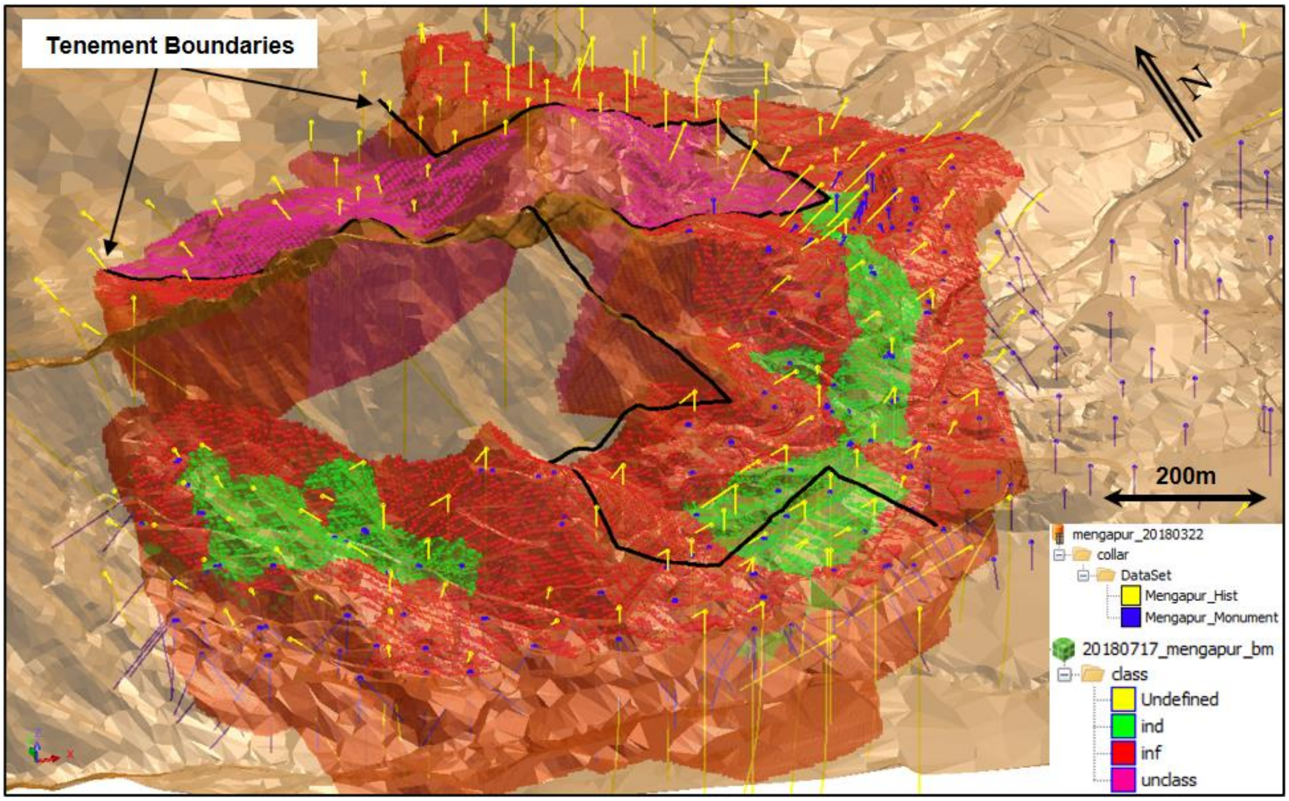
The resource classification scheme adopted by Snowden for the Mengapur MRE was based on the following.

- Only mineralisation within the CASB and SDSB permit boundaries provided by Monument were classified. All blocks outside these permits are unclassified and do not form part of the reported Mineral Resource.
- The majority of the interpreted mineralisation is within 200 m of the surface and as such considered by Snowden to be within the limits of extraction by open pit mining.
- Mineralisation was classified as an Indicated Resource where the drillhole spacing was 40 mE x 40 mN (or less) and contained within the skarn.
- Mineralisation defined based on drilling wider than 40 mE x 40 mN and constrained within the skarn, gossan or shale, was classified as an Inferred Resource.

- Where there was mostly historical drilling present, mineralisation was classified as Inferred Resource, irrespective of the drillhole spacing.
- Mineralisation delineated using sparse drillhole data or outside the lithological and mineralisation envelopes was not classified.

The classified resource is depicted in Figure 14.19.

Figure 14.19 Mineral Resource classification scheme (oblique view looking northeast)



14.11 Mineral Resource reporting

14.11.1 Cut-off grade

The Mineral Resource for the Mengapur deposit has been reported above a 0.3% Cu cut-off grade. The cut-off grade represents an assumption of a bulk open-pit mining approach with limited selectivity and is based on values used at other similar deposits, along with consideration of the continuity above the cut-off grade. The majority of the interpreted mineralisation is within 200 m of the surface and as such considered by Snowden to be within the limits of extraction by open pit mining. It is assumed mining would likely be by conventional drill and blast techniques. A cut-off grade of 0.5% Cu, which assumes a more selective open-pit mining approach, shows the impact of reporting the Mineral Resource estimate at a higher cut-off grade.

The lower cut-off grade of 0.3% Cu is considered by Monument to be the base case scenario at this stage, however, further study is required to assess mining and processing options, along with costs. The lower cut-off grade represents a more bulk mining approach with limited selectivity, whereas the higher cut-off grade assumes a more selective mining approach.

14.11.2 Moisture

All Mineral Resources have been reported on a dry tonnage basis.

14.11.3 Depletion for mining

Monument indicated that no additional mining has occurred since acquisition of the topographic surface (which is based on a combination of LiDAR data from 2013 and ground surveying conducted in 2015) and as such, the Mengapur Mineral Resource is considered to be depleted for all open pit mining to October 2018.

14.11.4 Mengapur Mineral Resource statement

The Mineral Resource for the Mengapur Cu-Au deposit, reported above a 0.3% Cu cut-off, is estimated to comprise Indicated Resources of 39.5 Mt at 0.43% Cu and 0.18 g/t Au, along with Inferred Resources of 50.9 Mt at 0.44% Cu and 0.11 g/t Au. At the higher cut-off grade of 0.5% Cu, the Mineral Resource is estimated to comprise Indicated Resources of 8.1 Mt at 0.65% Cu and 0.16 g/t Au, along with Inferred Resources of 10.5 Mt at 0.68% Cu and 0.14 g/t Au. The lower cut-off grade of 0.3% Cu is considered by Monument to be the base case scenario at this stage.

The Mineral Resources at the two cut-offs are summarised in Table 14.14 and Table 14.15 respectively, with grade-tonnage reporting at multiple cut-off grades in Table 14.16 and Table 14.17, and a grade-tonnage curve is provided in Figure 14.20.

Table 14.14 Mengapur October 2018 Mineral Resource estimate (0.3% Cu cut-off, base case scenario)

Resource classification	Material type	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Contained Cu (t)	Contained Au (oz)	Contained Ag (oz)
Indicated	Oxide	6.3	0.45	0.17	9.7	28,300	34,000	1,960,000
	Transitional	9.7	0.48	0.15	9.8	46,800	47,000	3,060,000
	Fresh	23.5	0.41	0.21	4.5	96,400	159,000	3,400,000
	Total Indicated	**39.5**	**0.43**	**0.18**	**6.6**	**170,000**	**229,000**	**8,380,000**
Inferred	Oxide	15.5	0.41	0.06	19.1	63,600	29,900	9,520,000
	Transitional	12.0	0.50	0.10	17.0	60,000	38,600	6,560,000
	Fresh	23.4	0.43	0.14	6.9	100,600	105,300	5,190,000
	Total Inferred	**50.9**	**0.44**	**0.11**	**13.0**	**224,000**	**180,000**	**21,270,000**

Notes: The Mineral Resource is limited to within the CASB and SDSB permit boundaries. Small discrepancies may occur due to rounding. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 14.15 Mengapur October 2018 Mineral Resource estimate (0.5% Cu cut-off)

Resource classification	Material type	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Contained Cu (t)	Contained Au (oz)	Contained Ag (oz)
Indicated	Oxide	1.3	0.72	0.12	12.3	9,400	5,000	510,000
	Transitional	3.2	0.67	0.13	12.1	21,400	13,400	1,240,000
	Fresh	3.6	0.61	0.22	5.7	22,000	25,500	660,000
	Total Indicated	**8.1**	**0.65**	**0.16**	**9.3**	**52,700**	**41,700**	**2,420,000**
Inferred	Oxide	2.3	0.63	0.07	17.1	14,500	5,200	1,260,000
	Transitional	3.7	0.75	0.17	12.2	27,800	20,200	1,450,000
	Fresh	4.4	0.66	0.14	10.1	29,000	19,800	1,430,000
	Total Inferred	**10.5**	**0.68**	**0.14**	**12.4**	**71,400**	**47,300**	**4,190,000**

Notes: The Mineral Resource is limited to within the CASB and SDSB permit boundaries. Small discrepancies may occur due to rounding. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 14.16 Mengapur October 2018 grade-tonnage report – Indicated Resource

Cut-off grade (% Cu)	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Cu (t)	Au (oz)	Ag (oz)
0.10	103.8	0.30	0.15	5.3	311,000	501,000	17,700,000
0.15	97.2	0.31	0.16	5.5	301,000	500,000	17,200,000
0.20	82.0	0.33	0.16	5.7	271,000	422,000	15,000,000
0.25	58.5	0.38	0.18	6.1	222,000	339,000	11,500,000
0.30	**39.5**	**0.43**	**0.19**	**6.6**	**170,000**	**229,000**	**8,420,000**
0.35	27.2	0.48	0.18	7.2	131,000	157,000	6,300,000
0.40	18.2	0.53	0.17	7.8	96,500	99,500	4,560,000
0.45	12.2	0.59	0.17	8.5	72,000	66,700	3,330,000
0.50	**8.1**	**0.65**	**0.17**	**9.3**	**52,700**	**41,700**	**2,420,000**
0.60	3.6	0.79	0.14	11.7	28,400	16,200	1,350,000
0.70	1.7	0.94	0.13	14.0	16,000	7,100	765,000
0.80	1.1	1.05	0.13	14.7	11,600	4,600	520,000
0.90	0.7	1.17	0.13	14.0	8,200	2,900	315,000
1.00	0.4	1.30	0.14	13.6	5,200	1,800	174,000
2.00	0.01	2.38	0.11	18.5	200	30	6,000

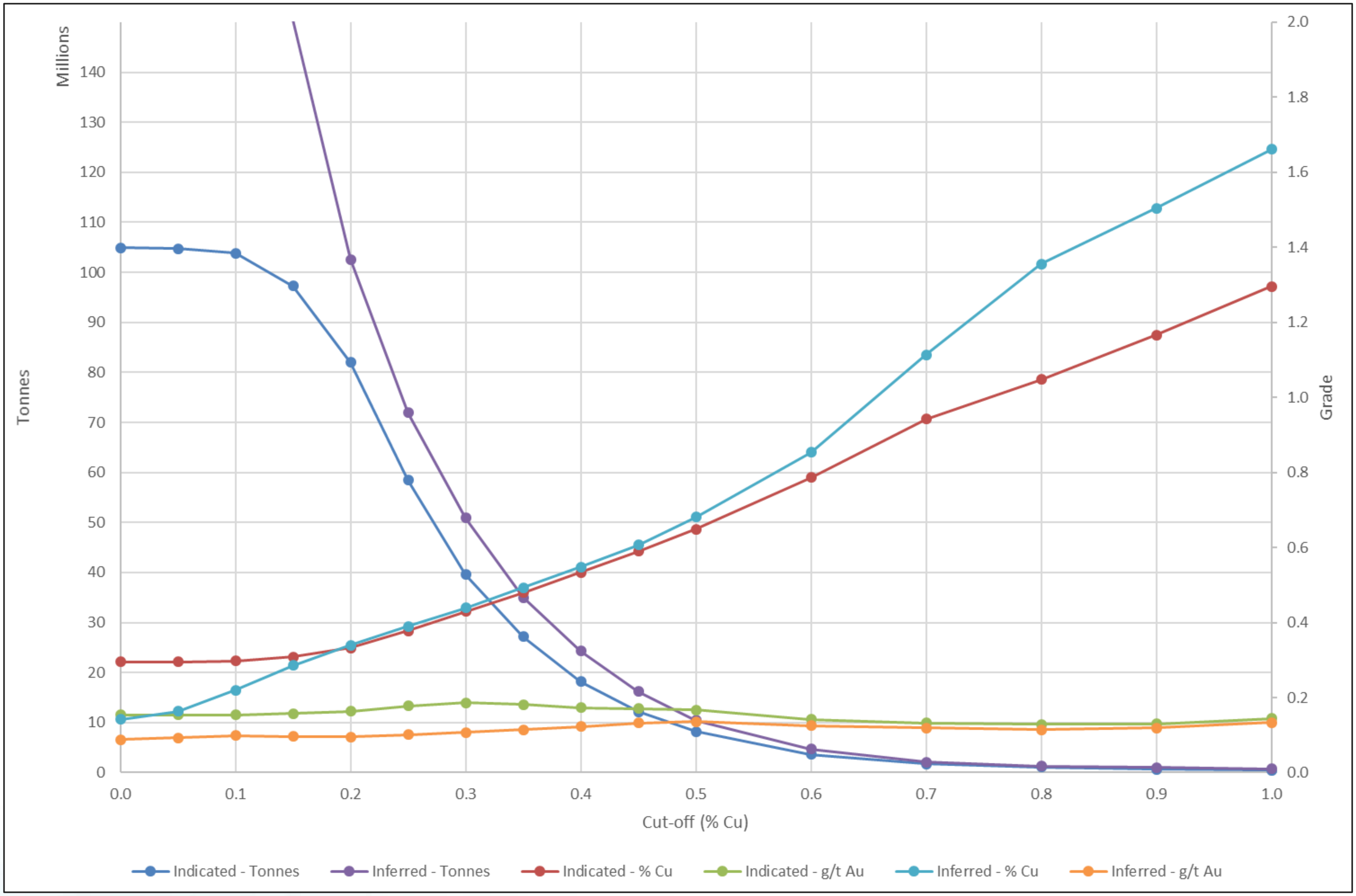
Notes: The Mineral Resource is limited to within the CASB and SDSB permit boundaries. Small discrepancies may occur due to rounding. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 14.17 Mengapur October 2018 grade-tonnage report – Inferred Resource

Cut-off grade (% Cu)	Tonnes (Mt)	Cu (%)	Au (g/t)	Ag (g/t)	Cu (t)	Au (oz)	Ag (oz)
0.10	249.1	0.22	0.10	7.1	548,000	801,000	56,900,000
0.15	150.4	0.29	0.10	9.4	436,000	484,000	45,500,000
0.20	102.6	0.34	0.10	11.4	349,000	330,000	37,600,000
0.25	72.0	0.39	0.10	12.6	281,000	231,000	29,200,000
0.30	**50.9**	**0.44**	**0.11**	**13.0**	**224,000**	**180,000**	**21,300,000**
0.35	35.0	0.49	0.11	12.6	172,000	124,000	14,200,000
0.40	24.3	0.55	0.12	11.8	134,000	93,800	9,220,000
0.45	16.2	0.61	0.13	12.0	98,800	67,700	6,250,000
0.50	**10.5**	**0.68**	**0.14**	**12.4**	**71,400**	**47,300**	**4,190,000**
0.60	4.7	0.85	0.12	15.2	40,000	18,100	2,300,000
0.70	2.1	1.11	0.12	17.0	23,300	8,100	1,150,000
0.80	1.3	1.36	0.11	19.2	17,700	4,600	802,000
0.90	1.0	1.50	0.12	20.0	15,000	3,900	643,000
1.00	0.8	1.66	0.13	20.5	13,300	3,300	527,000
2.00	0.1	3.37	0.35	30.9	3,400	1,100	100,000

Notes: The Mineral Resource is limited to within the CASB and SDSB permit boundaries. Small discrepancies may occur due to rounding. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Figure 14.20 Grade-tonnage curve



15 MINERAL RESERVE ESTIMATES

No Mineral Reserves have been defined on the property.

16 ADJACENT PROPERTIES

There is no information from adjacent properties applicable to the Mengapur Cu-Au Project for disclosure in this report. Some small-scale iron (magnetite) mining occurs on nearby properties, including by Phoenix Lake Sdn Bdh; however, no information relating to these activities is available publicly and Snowden does not believe that these operations are material to the Mengapur Cu-Au Project.

17 OTHER RELEVANT DATA AND INFORMATION

As far as Snowden is aware, there is no other relevant data or information to disclose that makes the Technical Report not misleading.

18 INTERPRETATION AND CONCLUSIONS

The Mengapur Cu-Au Project has an intermittent history of mining, having been exploited for both iron (magnetite within the free-dig oxide zones) and copper. Drilling has identified a continuous zone of copper and gold mineralisation associated with skarn alteration around an adamellite intrusive body.

The project has been drilled using diamond core drilling techniques down to a nominal spacing of approximately 40 m x 40 m in a significant portion of the deposit area. The author is satisfied that the drill sample database and geological interpretations are sufficient to enable the estimation of Mineral Resources and sample security procedures provide confidence in the integrity of the samples and assay results. Based on the available data, the geological interpretation has considered all known material items and represents an accurate reflection of the current geological understanding.

Accepted estimation methods have been used to generate a 3D block model of copper, gold and silver grades, along with iron, sulphur and cobalt. In Snowden's opinion, the use of ordinary kriging estimation technique is appropriate for the population distribution and statistical characteristics of the deposit. The estimate has been classified with respect to CIM guidelines with the resources classified as a combination of Indicated and Inferred Resources, considering the geological and data confidence, along with the sample spacing that currently defines the deposit. Snowden believes that Monument should be able to increase the confidence of the Mengapur Mineral Resource through additional drilling and geological assessments.

Metallurgical testing of oxide, transitional and sulphide mineralised samples has been carried out. Results for oxide and transitional samples suggest some acid leachable copper is present in these materials. However, the range of extraction values is such that more detailed assessment of the extent of leachable copper recovery is required. This should aim to tie leachable copper values to the Mengapur resource model. The sulphide material tested has been shown to be amenable to copper sulphide concentration to near, or at typical commercial Cu grades, while achieving modest metal recovery. The extent of sulphide copper recovery should ideally be related to the resource model. Potential for by-product precious metal is apparent, but needs further assessment.

Table 18.1 outlines some of the potential technical risks that Snowden considers may impact development of the Mengapur Project.

Table 18.1 Potential Mengapur Project risks

Risk	Potential impact	Comments and mitigation
Geological interpretation	Changes to the geological interpretation may impact the tonnes and/or grade of the resource.	Additional drilling is required to confirm the geological interpretation and improve confidence.
Drilling orientation	Some drillholes are drilled essentially down dip.	Samples sub-optimal and geological boundaries may not be adequately defined in these areas. Additional drilling oriented appropriately to geological boundaries is required in these areas to improve confidence. Classification of the Mineral Resource considers the drilling orientation.
Tenement status	Loss of tenement rights	The SDSB tenement expired on 23 September 2012. A renewal has been submitted to the relevant government department but is still pending as of the effective date of this technical report. Legal opinion[6] provided by Monument indicated that, to their knowledge, there are no legal impediments to the renewal application for the SDSB tenement being granted.
Permit boundaries insufficient for pit and infrastructure	Potential reserves and pit designs will be limited by the permit boundaries.	Monument has submitted several additional land applications on adjacent lands, which Snowden understands are still in the review process.
Deterioration of existing infrastructure, including process plant	Existing process plant shows significant corrosion and may need rectification if consideration is given to re-use of existing infrastructure.	Obtain independent advice on the state of the existing infrastructure and any potential requirements for rectification if necessary.
Bulk density	Change in bulk density will impact the estimated tonnage and therefore contained metals.	Additional bulk density samples from core and hand specimens required to improve confidence in the bulk density assumptions.
Product specification	Processing during historical mining was unable to produce a copper sulphide concentrate of sufficient grade.	Additional metallurgical testwork is required to optimise the process flow route.
Weather	Heavy rainfall may impact pit wall stability and potential mining productivity.	Geotechnical studies required to assess suitable parameters and include sufficient provision in future mining studies relating to productivity losses due to weather.

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[6] Amelda Fuad Abi & Aidil, Legal Opinion on Mengapur and Star Destiny Sdn. Bhd. Mining Tenements – NI43-101 Report, letter to Monument Mining Ltd, dated 1 September 2018, 2 pp.

19 RECOMMENDATIONS

The following recommendations are made with respect to ongoing work at the Mengapur Cu-Au Project:

- It is recommended that additional bulk density measurements, from all lithology types and oxidation states, are conducted to verify the bulk density values and assumptions applied to the resource model.
- Snowden recommends that Monument complete a pattern of closer spaced drilling (to approximately 10 m x 10 m spacing) in a portion of the resource to better define the short range geological and grade continuity.
- In order to increase confidence in the resource estimate, additional drilling will be required where the resource is predominantly informed by historical drilling or drilling of sub-optimal orientation, along with Inferred areas due to sparse drilling.
- A structural study should be contemplated to enhance the geological understanding of the mineralisation controls and geological interpretation.
- Snowden recommends the refinement of the interpreted base of complete oxidation surface as part of future resource modelling.
- Additional geotechnical and metallurgical testwork will be required to inform mining studies.
- Given the level of corrosion Snowden observed, it is recommended that Monument source independent advice regarding the existing processing plant.
- It is recommended that Monument investigate expanding the current permit boundaries or securing access from surrounding landholders as some mineralisation occurs outside the existing permit boundaries which is not included in the current Mineral Resource. Moreover, additional area may be required to ensure mine designs are not constrained by permit boundaries.
- Additional metallurgical testwork is required on oxide, transitional and sulphide samples to optimise the copper recovery and improve the quality of the copper concentrates.
- Further metallurgical testwork should be carried out to quantify the potential for the recovery of by-product metals including gold, silver and possibly molybdenum or bismuth. A separate exercise to assess the potential benefit of pyrrhotite recovery should also be completed.

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21 CERTIFICATES

21.1 Certificate of Qualified Person – John Graindorge

I, John Graindorge, Principal Consultant of Snowden Mining Industry Consultants Pty Ltd, Level 6, 130 Stirling Street, Perth, Western Australia, do hereby certify that:

a. I am a co-author of the technical report titled Mineral Resource Estimate for the Mengapur Cu-Au Deposit dated 29 October 2018 (the "Technical Report") prepared for Monument Mining Limited.

b. I graduated with a Bachelor's degree in Geology from the University of Western Australia. I also completed a Post-Graduate Certificate in Geostatistics in 2007 at Edith Cowan University. I am a Member of the Australasian Institute of Mining and Metallurgy and a Chartered Professional Geologist. I have worked as a Geologist continuously for a total of 18 years since my graduation from university. I joined Snowden in 2005 and have been involved in resource estimation and evaluation for 13 years. I have read the definition of "Qualified Person" set out in NI 43-101 ("the Instrument") and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a "Qualified Person" for the purposes of the Instrument. I have been involved in resource evaluation, including gold projects for at least five years.

c. I visited to the Mengapur Property on 1 May 2018.

d. I am responsible for the preparation of all sections except sections 1.3 and 13 of the Technical Report.

e. I am independent of the issuer as defined in section 1.5 of the Instrument.

f. I have no prior involvement with the property that is the subject of the Technical Report.

g. I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

h. As of the effective date of this Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Perth, Western Australia, on 29 October 2018

[signed]

John Graindorge, BSc (Hons), Grad. Cert. Geostatistics, MAusIMM(CP)

21.2 Certificate of Qualified Person – Michael Kitney

I, Michael Kitney, Principal Consultant of Metallurgical Design, Unit 8, 296 Mill Point Road, South Perth, Western Australia, do hereby certify that:

a. I am a co-author of the technical report titled Mineral Resource Estimate for the Mengapur Cu-Au Deposit dated 29 October 2018 (the "Technical Report") prepared for Monument Mining Limited.

b. I graduated with an Associateship in Metallurgy from the Western Australian Institute of Technology, and subsequently completed the Graduate Diploma in Extractive Metallurgy at the WA School of Mines. I also completed a Master's Degree in Mineral Economics awarded by Curtin University of Western Australia. I am a Member of the Australasian Institute of Mining and Metallurgy. I have worked as an Extractive Metallurgist continuously for a total of 47 years since my graduation from university. I have read the definition of "Qualified Person" set out in NI 43-101 ("the Instrument") and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a "Qualified Person" for the purposes of the Instrument. I have been involved in resource evaluation, including gold projects for at least twenty years.

c. I visited the Mengapur Property on eight occasions between December 2013 and January 2015 inclusive.

d. I am responsible for the preparation of sections 1.3 and 13 of the Technical Report.

e. I am independent of the issuer as defined in section 1.5 of the Instrument.

f. I have no prior involvement with the property that is the subject of the Technical Report.

g. I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

h. As of the effective date of this Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Perth, Western Australia, on 29 October 2018

[signed]

Michael Kitney, MSc (Mineral Economics), MAusIMM, MAICD