A MINERAL RESOURCE ESTIMATE FOR THE KGWAKGWE HILL MANGANESE PROJECT, BOTSWANA

Prepared For

Giyani Metals Corporation

Report Prepared by

srk consulting

SRK Consulting (Kz) Limited

KZ0647

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A MINERAL RESOURCE ESTIMATE FOR THE KGWAKGWE HILL MANGANESE PROJECT, BOTSWANA

1 SUMMARY

1.1 Introduction

SRK Consulting (Kazakhstan) Ltd was commissioned by Giyani Metals Corporation (hereafter referred to as Giyani, the Company, or the Client) to undertake an update to the Mineral Resource Estimate for the Kgwakgwe Hill Project (hereafter referred to as K-Hill, or the Project), which is located in the Republic of Botswana. The mineral resource estimate (MRE) section of this report incorporates new drilling data acquired since the previous MRE reported by SRK in March 2021. The rest of the report sections remain the same as from the preliminary economic assessment (PEA) study published in April 2021.

1.2 Property Description, Location and Ownership

K-Hill is located next to the town of Kanye, which is the administrative center of the Southern District of the Republic of Botswana in southern Africa. The Project area is accessed by a short section of unpaved roads and tracks from a network of paved national roads, namely the A1 and A2, with the A2 highway being just a few kilometres from the Project.

The mineral rights are owned by the Republic of Botswana. Giyani, through Menzi Battery Metals (Pty) Ltd., holds the exclusive right to engage in prospecting activities for "Metals" within the Project area through the issued prospecting permit in terms of Section 16 of the Mines and Minerals Act of the Republic of Botswana. The K-Hill Project is located within Prospecting Licence No. 322/2016. The K-Hill prospecting area is 438 km^2 of the total area of approximately 2,600 km^2 that Menzi Battery Metals (Pty) Ltd. holds prospecting rights to. All prospecting licenses were granted on the 1st July 2020 and were valid until the 30th of June 2022, with the exception of PL258/2017 which was granted on 1st January 2021 and expires on the 31st of December 2022.

1.3 History

Historical mining in the Kanye area took place from 1957 to 1971. The first company to operate at Kgwakgwe Hill was Marble Lime and Associated Industries (Marble Lime), which also developed the asbestos mine at Moshaneng, northwest of Kgwakgwe Hill. Marble Lime mostly mined manganiferous shale, which was beneficiated before it was sold. Marble Lime ceased mining activities around 1967 (Aldiss, 1989).

In 1981, Rand London Manganese investigated the possibility of mining the manganiferous shale deposits at Kgwakgwe, Otse and Gopane (near Lobatse) together feeding a single planned processing plant at Lobatse. The Kgwakgwe deposit was considered to require further drilling for evaluation, but no further work was completed, and the licence was relinquished within a year (Aldiss, 1989).

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In addition to formal mining and geological investigations at the Project, isolated artisanal mining has occurred creating a network of underground adits and galleries within the manganiferous horizons. Due to the informal nature of the mining, no production records have been kept. The Company has attempted to account for the location and scale of these workings and this is described in more detail in following sections 14.2.5.

The proposed K-Hill mine is in an area that has been disturbed by mining activities; little or no rehabilitation has taken place, so remnants of the old operations remain (e.g., spoil heaps). In recent years K-Hill has been used to dump general waste illegally. An environmental and social impact assessment is currently underway; specialist studies to date have shown there are no legacy issues that could have a negative economic impact on the Project.

1.4   Geology and Mineralization

The manganese mineralization at K-Hill occurs primarily as a supergene enriched manganiferous shale occurring in two distinct horizons in the upper portion of a larger package of shale within the Black Reef Quartzite Formation of the Transvaal Supergroup. The Mn-Shale horizons are overlain by a hard chert breccia unit. In plan, the K-Hill deposit is approximately kidney shaped, reflecting the pattern of outcrop along the edges of the hill. The Upper Mn-Shale, which hosts the highest grade manganese oxide (MnO) mineralisation, varies between approximately 2 m and 12 m in thickness, with an average thickness of 4 m. The unit dips shallowly (5-10°) towards the NW, and has a delineated extent of approximately 900 m N-S and 350 m E-W. The Upper Mn-Shale can be divided into a continuous high-grade core with distinct, although slightly less continuous, lower-grade zones in the immediate footwall and hangingwall. The lower Mn Shale horizon has a parallel strike and dip, ranges from 12 m to 1 m in thickness with an average thickness of 3.5 m and does not show the distinct banding of grade seen in the Upper Mn Shale horizon. The two main mineralised horizons are separated by approximately 4 m of shale waste rock.

1.5   Drilling

Giyani carried out drilling in three phases. The first phase of Diamond Drilling (DD) was between April and June 2018 and consisted of a program of 18 holes of approximately 50-80 m in depth. Drillholes were located within the northern and southern portion of the deposit. Holes in the northern portion were drilled along three northwest striking lines approximately 50 m and 130 m apart. The holes were drilled at approximately 100 m spacing along the lines. Holes in the southern portion of the deposit were drilled along a single north-northeast striking line with holes at approximately 100 m apart along the line.

Of the 18 vertical DD holes drilled at K-Hill; 17 were for exploration purposes and one was for metallurgical test-work. Triple tube coring was utilised for drilling, and standard operating procedures (SOPs) were in place to guide the drilling operations. A total of 1,109 m was drilled, with 368 core samples assayed together with 57 quality control (QC) samples.

A second phase of drilling commenced in November 2020 and was completed in June 2021. The drilling was undertaken using a Reverse Circulation (RC) drilling rig and totalled 96 holes (including 6 redrills) for which logging, laboratory analysis and handheld Portable X-Ray Fluorescence (p-XRF) analysis have been made available. The available data accounts for a total of 3,697 m drilled.

A third phase of DD drilling was run synchronously with the phase 2 RC program for geotechnical purposes and to twin historical RC holes. The program totalled 346 m. Although logging data was available for use in the MRE, no laboratory analysis was undertaken as the core was submitted in full for geotechnical and comminution testwork.

Drilling data are stored in Microsoft Excel spreadsheets, which make up the database.

SRK considers that the quantity and quality of data collected in the K-Hill drilling programme is sufficient to support the reporting of a Mineral Resource in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Code and reporting guidelines. That said, core recovery from the DD program is poor, particularly within the Upper Mn Shale unit that is host to the MnO mineralisation. Specifically, based on recoveries measured during the DD program, average core recovery within the Upper Mn Shale is 41%. At this stage no clear relationship has been identified between core recovery and grade. That said, there is only limited data available at this time, and it is possible that additional drilling may yield a more definitive relationship between MnO grade and recovery, either positive or negative. Confidence in the accuracy of the individual assay grades is reduced as a result of the overall poor core recovery. It has not been possible to derive an accurate assessment of recovery from the most recent RC drilling, however a relative study of bag weight changes downhole indicated that there was no significant decrease in bag weights in areas with logged Mn Shale, relative to other rock types. This provides some confidence that RC drilling is unbiased in terms of recovery.

Diamond drilling provided suitable material for density determinations, however, due to the tendency of the more friable portions of drill core to fragment when dry, Giyani did not oven dry the drill core from the Phase 1 DD program prior to completing density determinations. As no moisture content for the samples is recorded, it has not been possible to accurately account for the water content of the samples and as such, SRK has only used data collected during the Phase 3 DD program in determining the density for this latest study, where samples were fully dried, and wax coated prior to density determination. Although this data is deemed to be more accurate, it is a significantly smaller dataset and does not have corresponding MnO assays to establish a correlation between MnO grade and density. SRK recommends that Giyani continue to undertake density measurements using this wax coating method and to link these to the assay grades.

1.6   Sample Preparation, Analysis and Security

Sample preparation and analyses for both analysed RC and DD programs were conducted at SGS laboratory in South Africa.

QC samples were routinely inserted within the drillhole sample stream as part of an QAQC process. The type of QC samples used included certified reference material (CRM), blanks and coarse duplicates. As an additional check, 40 of the samples analysed at SGS were assayed by Intertek Genalysis laboratory in Australia.

The results of the QAQC measures applied for K-Hill do not indicate significant contamination and demonstrate a high degree of accuracy and precision. The umpire laboratory assays completed at Intertek Genalysis confirm the primary laboratory assays within close limits. The sample preparation, security and analytical procedures are considered to be adequate for the style of mineralization evident at K-Hill.

1.7   Data Verification

Mike Beare (General Director and Corporate Consultant – Mining Engineering) of SRK Kazakhstan and James Haythornthwaite (Senior Consultant – Resource Geology) of SRK UK, visited the K-Hill Project site in December 2019 and January 2020 respectively. A follow up visit by John Paul Hunt (Senior Exploration Geologist) of SRK Exploration Services took place during the Phase 2 RC drilling program in March 2021 to observe and validate procedures during active drilling.

During the January 2020 site visit, the following checks were undertaken by James Haythornthwaite:

- Inspection of mineralisation outcrops and artisanal mine workings

- Check of the Giyani core storage and sampling facility

- Review of the remaining drill core for holes DDKH18_002, DDKH18_005, DDKH18_008, DDKH18_0011 and DDKH18_013, including check logging

During the March 2021 site visit the following checks were undertaken by John Paul Hunt:

- Inspection of RC drilling practices

- Inspection of sample storage facilities and sample dispatch

Check logging completed by SRK during the January 2020 site visit did not indicate any serious flaws in the logging completed by Giyani. SRK considers that the database is adequate for the purpose of Mineral Resource estimation.

1.8   Metallurgical Testwork and Plant Design

To support the initial 2019 PEA for K-Hill, Lab 4 Inc. (Canada) was engaged by Giyani to provide metallurgical consulting services based on producing High Purity Electrolytic Manganese Metal (HPEMM). Since that time a new program of metallurgical testing has been initiated by Tetra Tech for the Feasibility Study that is currently in progress. The ongoing metallurgical testwork and updated plant design will focus on a slight modification to the planned flowsheet in order to produce High Purity Manganese Sulphate Monohydrate (HPMSM).

For this April 2021 PEA update, Tetra Tech reviewed the historical test work and used it as basis for their PEA flowsheet design but as stated has already initiated a detailed metallurgical test work program to inform their feasibility study (FS) level design work that will be carried out during remainder of 2021 as part of their contribution to the FS.

1.9   Mineral Resource Estimate

SRK has completed an update to the MRE undertaken by SRK in March 2021. The updated Mineral Resource detailed in this report incorporates new RC and DD drilling data as well as improved density testwork resulting in a new set of estimation domains and an updated block model. The main differences between the previous estimate and the updated model are as follows:

- Incorporation of laboratory assays for the remaining 79 holes of the phase 2 RC program that were not complete at the time of the March 2021 MRE

- Incorporation of logging data from the phase 3 DD geotechnical program

- Creation of fault domains based on offsets in the mineralised units

- Inclusion of new geological mapping and trenching to better constrain the pattern of outcrop on the Western flank of the main hill

- Use of new wax coated core density data, removing the reliance on the use of the previous "wet" density data, which required factoring to account for the water content

- Use of a newly acquired high resolution topographic surface derived from satellite photogrammetry

In modelling and estimating the K-Hill block model, SRK completed the following:

- Constructed a geological model of the key lithological units and faults based on the geological logging completed by Giyani geologists

- Sub-domained the Upper Mn-Shale into three estimation domains, on the basis of a bi-modal MnO population within the Upper Mn Shale Domain. The Upper Mn Shale model was split into a high-grade core domain (A2) bounded by low grade hangingwall (A1) and footwall (A3) domains based on an approximate 20% MnO modelling cut-off

- Developed wireframes for the lower Mn Shale horizon (B) which took in to account faulting

- Created a single mineralised domain (C) for a minor Mn bearing horizon in the Northeast of the project below the Lower MN Shale (B)

- Composited the assays and density data inside of the mineralisation domains to 0.5 m

- Created a block model, coded and sub-blocked by the estimation domains. The parent block size was set at 25 mX * 25 mY * 1 mZ and the minimum sub-block size as 5 mX * 5 mY * 0.5 mZ

- Estimated the block model, based on the following:

    o High-grade and low-grade margin domains estimated separately, using hard boundaries

    o All variables were estimated into the high-grade A2 and B domains using Ordinary Kriging (OK). It was not possible to construct robust variograms for the two low-grade margin domains (A1 and A3) and the lowest C horizon. Inverse distance squared (IDW2) was used for block estimates in these domains. Density was assigned to blocks based on average densities derived for each geological and mineralisation unit

    o A two-pass search strategy was used for estimation of the high-grade domains, with the first search range set at 120 mX * 180 mY * 10 mZ, which filled the vast majority of blocks. The second search was set to 500 mX * 500 mY * 100 mZ to fill the remaining few blocks. In the remaining lower grade domains, a single large search pass was used

    o The search ellipsoid was orientated dynamically, using the corresponding domain wireframe as a guide

    o A minimum of 4 samples and maximum of 12 samples were used to estimate into each block for the first and second search pass, with a maximum of 2 samples per drillhole

- Visually and statistically validated the estimated block grades relative to the estimation composites

- Classified the A1, A2 and A3 domains as Indicated Mineral Resources for all blocks within 40 m of a drillhole, and Inferred Mineral Resources for areas with geological support, but were greater than 40 m from a drillhole. A small portion of the A1, A2 and A3 horizons have not been classified at the margins where poor geological and drilling support exists. SRK has classified the B and C horizons as Inferred Mineral Resources due to the reasonable level of geological and grade confidence, but lack of appropriate metallurgical testwork. As with the A horizons, a small portion of the B and C horizons have not been classified at the margins where poor geological and drilling support exists

- The block model was depleted using surveys of underground artisanal workings

- In order to determine the quantities of material offering "*…reasonable prospects for eventual economic extraction*" by open pit mining, a pit optimisation analysis was completed on the estimated block model. This was based on reasonable mining assumptions. The Mineral Resource has been restricted to estimated blocks that fall inside of the resulting pit shell, which is based on a High Purity Manganese Sulphate Monohydrate (HPMSM) price of USD1,588 /t and reported above a cut-off grade of 7.3% MnO

1.10 Mineral Resource Statement

The Mineral Resource has been classified according to the CIM Best Practice Guidelines and is reported in accordance with the 2014 CIM Definition Standards, which have been incorporated by reference into National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101). The Mineral Resources are classified into the Indicated and Inferred categories.

The Qualified Person (QP) in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Code (CIM Code), with responsibility for the reporting of the Mineral Resource Statement presented herein is Dr Lucy Roberts, MAusIMM(CP), a Principal Consultant (Resource Geology) with SRK.

Mineral Resources are not Mineral Reserves and have not demonstrated economic viability. SRK are not aware of any factors (environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors) that have materially affected the Mineral Resource estimate. It is uncertain whether further exploration will convert Inferred Mineral Resources to higher confidence categories.

Table ES 1:   K-Hill SRK Mineral Resource Statement, reported within an optimised shell and at a cut-off grade of 7.3% MnO, as of September 2nd, 2021

Classification	Tonnes (Millions)	MnO %	Al2O3 %	SiO2 %	Fe2O3 %	LOI %
Indicated Mineral Resources	1.6	22.0	10.9	35.7	16.5	7.9
Inferred Mineral Resources	1.4	13.9	9.6	51.4	13.1	6.3

(1) The Indicated and Inferred Mineral Resources are reported above a cut-off grade of 7.3% MnO
(2) All tonnages are reported as dry
(3) The Mineral Resource Estimate is constrained within estimation domains based on geological modelling and grade and within a Lerchs-Grossman optimised pit shell based on an HPMSM price of USD1,588 /t and the following technical-economic parameters:
   a. Mining Cost – USD3.46 /t rock
   b. Processing Cost – USD213 /t) Run of Mine (RoM)
   c. Selling cost – 3% and a freight cost of USD60 /t HPMSM
   d. G&A – USD20 /t Run of Mine (RoM)
   e. Discount Rate – 10%
   f. Processing Recovery – 90.7%
   g. Mining Recovery – 98%
   h. Mining Dilution – 3%
   i. Geotechnical Slope Angle - 41°
(4) SRK notes that the long term HPMSM price quoted is based on 2020 market data, which was available at the time of reporting the Mineral Resource. SRK understands that additional pricing information will be available for input into subsequent technical studies, and this may impact on the Mineral Resource reported. In light of the sensitivity of the Mineral Resource to the selling price, this is not considered to be a material risk in reporting the Mineral Resource and may present a further opportunity.
(5) All figures are rounded to reflect the relative accuracy of the estimates.
(6) Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.
(7) It is uncertain if further exploration will convert Inferred Mineral Resources to higher confidence categories.

The Mineral Resource is presented by estimation domain in Table ES 2 below.

Table ES 2:   K-Hill Mineral Resource, Reported by Estimation Domain

Estimation Domain	Category	Tonnes (Millions)	MnO %	Al2O3 %	SiO2 %	Fe2O3 %	LOI %
A1	Indicated	0.30	11.9	11.9	53.1	11.3	5.8
	Inferred	0.01	11.6	11.4	54.7	10.8	5.8
A2	Indicated	0.89	30.0	10.2	22.6	19.4	9.8
	Inferred	0.08	28.6	10.6	23.5	19.2	9.7
A3	Indicated	0.39	11.2	11.5	52.3	13.7	5.0
	Inferred	0.06	9.7	11.6	54.1	14.0	5.1
B	Indicated	-	-	-	-	-	-
	Inferred	1.20	13.3	9.4	53.0	12.6	6.2
C	Indicated	-	-	-	-	-	-
	Inferred	0.05	9.8	9.1	54.8	14.9	6.6

1.11 Risks

Aside from the usual cyclical price risks associated with the mining industry, a number of significant risks have been identified for the Project:

- Market Risk

    o The Project is predicated upon marketing manganese from the K-Hill Project to the HPMSM market. Although results of the PEA test-work have been encouraging, the capital costs of a plant to produce this high-purity product have not been verified. More work is required to reduce this cost uncertainty

- Mineral Resource Risk.

    o The currently defined Mineral Resource is limited to the K-Hill topographic high. It is a relatively small deposit and has limited upside potential

    o Core recovery is poor, particularly within the Mn Shale unit that is host to the MnO mineralisation. At this stage there is no clear relationship between core recovery and grade. It is possible that additional drilling may yield a more definitive relationship between MnO grade and recovery, either positive or negative

    o The extent of known historical underground mining excavations has been interpreted based on a survey of workings by Terravision completed in 2020. The survey used ground penetrating radar and direct laser distometer surveys within the voids. It is likely that additional artisanal mining voids with obscured, collapsed entrances exist, which have not been identified to date

    o Channel structures interpreted in the base of the overlying CDB unit that erode the Upper Mn-Shale horizon may be more persistent and interconnected than is currently modelled. The total volume of the Mn Shale model could be reduced in the order of up to 15%

    o The density database used to provide average densities for each domain in the block model are taken from a small database of wax coated core samples. Although of a high quality, the quantity of data presents a significant risk for the project. SRK notes the close correlation with the much larger density database of "wet" density readings used in the previous MRE, where the samples were not dried prior to measurements being taken and a reduction factor of 10% was applied to account for the quantity of water in the sample. The wet density values have not been used in this MRE due to uncertainties about the moisture content

- Future Mining Risk

  o A portion of the Mineral Resource underlies a municipal water reservoir that is under construction. Although the reservoir overlies a small portion of the Mineral Resource (<5%), the potential impact of this reservoir to the Project has not been fully ascertained in terms of the cost of relocating it. Initial discussions regarding the relocation of the reservoir have been positive, although no formal agreement has yet been made

1.12 Conclusions

- The manganese mineralization at K-Hill occurs primarily in two supergene enriched manganiferous shales (the Upper and Lower Mn-Shale) occurring in the upper portion of a larger shale package within the Black Reef Quartzite Formation of the Transvaal Supergroup. The Mn-Shale is overlain by, and in places eroded away by a hard chert breccia unit

- In plan, the K-Hill deposit is approximately kidney shaped. The Upper and Lower Mn-Shales, which hosts the mineralisation, varies between approximately 2 m and 12 m thick with an average thickness in the order of 4 m. The unit dips shallowly (5 to 10°) towards the NW, and has a delineated extent of approximately 900 m N-S and 350 m E-W

- The Upper Mn-Shale can be divided into a continuous high-grade portion with discontinuous lower-grade margins in the immediate hangingwall and footwall

- A total of 18 diamond drillholes were drilled by Giyani between April and June 2018. Of these holes, 15 are interpreted to have intersected the Mn-Shale unit. Three of these have holes have no core recovery at the anticipated depth of the Mn-Shale. This is interpreted to be a result of either poor drilling practice, or the holes intersecting voids relating to the historical underground mining. In addition, 96 RC holes (including 6 re-drills) have been drilled as part of the most recent drilling program. All of these holes have geological logging and laboratory analytical data available to help guide the location and thickness of the mineralisation and waste geology domains

- A survey of artisanal mining workings by Terravision in 2020 allowed the block model to be depleted based on the interpreted voids

- SRK considers that the quantity and quality of data collected in the K-Hill drilling programme is sufficient to support the reporting of a Mineral Resource estimate. That said, some concerns have been identified, most notably the limited quantity of reliable density data

- The current updated Mineral Resource estimate totals 1.6 Mt of Indicated Resources at 22.0% MnO and 1.4 Mt of Inferred Resources at 13.9% MnO. This represents an overall 75% increase in tonnage and 29% decrease in MnO grade, relative to the March 2021 SRK Mineral Resource estimate

- Changes to the geological model can be attributed to a significant increase in the quantity of assayed drillhole intervals, including the addition of the lower grade Lower Mn Shale horizon (B domain). The inclusion of this horizon has resulted in a significant increase in tonnes and reduction in average grade. A small decrease in tonnage in the high-grade core (A2 domain) has been offset to a certain extent by an increase in the tonnage of the low-grade footwall (A3 domain), resulting in a slight lowering of tonnage and average grade for the Upper Mn shale

- The difference in tonnage and grade can be attributed to the reduction in cut-off grade as well as closing the gap between the north and south parts of the model with infill drilling, although these gains are somewhat offset by the creation of narrow erosional channels in the mineralised horizon. A small increase in tonnage is also associated to the application of the surveyed artisanal mining wireframes to deplete the block model, rather than blanket factors, with the surveyed workings resulting in an approximately 6% reduction in tonnes, as opposed to the combination of 10% and 5% used in previous Mineral Resource estimates

- The planned open pit mining of the K-Hill deposit is a relatively straightforward operation, with no known or expected issues. Blasting has been assumed to be required and a drilling rig has been budgeted

- Mining conditions in terms of geotechnical and hydrogeological issues are simple and no major challenges are expected from the work completed to date. The open pit will be almost dry and it is relatively shallow

- The PEA level design for the TSF (not including the plant tailings costs) are assessed at USD2.738 M in capital costs, and USD0.6 /t for operating costs

- The Project is located in an area that is well served with roads, power and other infrastructure. No significant infrastructure issues have been identified in the PEA study that present significant risk or cost to the Project. Short gravel access roads will link the project to the bitumen highway that is located < 1 km from the site. A number of water sources have been identified which will be studied in the FS. Electricity will be sourced from the National Grid with an option for solar power being considered in the FS

- Process testwork has been carried out for the PEA that demonstrates that a viable process flowsheet can be achieved produce the required product for sale to battery producers

- Technical work completed by SRK and others has planned for a self sufficient mine site with its own accommodation, offices and supporting infrastructure

- Studies have been undertaken by the Client that demonstrate that there is a market for the anticipated HPMSM which is planned to be produced from K-Hill

- Environmental and social studies are well advanced for the Project and from the work carried out to date by Giyani and its sub-contractors, widespread support is apparent for the planned operation both among local people and government

- The Project reflects a positive NPV of USD332 M at a 10% discount rate. Further investment and technical studies are therefore warranted

- Average operating costs have been estimated at USD306 /t milled

- Total life of mine capital expenditure has been estimated at USD153 M

- The Project NPV is most sensitive to revenue (grade or commodity price) but has lower sensitivity to operating costs and is least sensitive to capital costs

1.13 Recommendations

The following recommendations are provided to assist in progressing the delineation and understanding of the K-Hill Mineral Resources:

- Giyani should construct a detailed geological map of the in-situ outcrops of the Mn Shale unit at K-Hill, including observed footwall and hangingwall contacts and associated contact dip and strike data

- SRK suggests that Giyani undertake further diamond drilling to generate core for density analysis using wax coated core samples. Although SRK considers the current database of density samples generated using this method to be of high quality, it contains a very limited number of samples and further density data needs to be collected

- Current exploration to define extensions to the known deposits is continued to fully define the potential of the area. The total expected cost inclusive of all ancillary work including access clearing, data collection and incorporation of data into the geological and block models, is expected to be approximately CAD3,250,000

- A demonstration plant to produce pilot-scale production of final product based on the final optimised metallurgical process flow sheet should be constructed to support the FS work. SRK estimates that the cost of engineering and construction is approximately CAD6,300,000

- As part of the FS, the following should be undertaken (which is in progress):

    o A geotechnical study is required to investigate the validity of the assumed pit wall slopes

    o A detailed water supply study should be carried out to determine the optimal water source for the Project

    o Further detailed test work to be completed to support the product specification, recoveries, operating costs, plant flowsheet and capital costs

    o Further metallurgical testing to firm up the process route and challenges with upscaling to industrial scale should be addressed with follow up metallurgical test work. The sample material should be collected from different parts of the orebody to ensure that the variability of the deposit can be accounted for

    o The design of the TSF assumes the downstream construction of the containment with the mine waste material and no lining of the TSF to prevent any fugitive seepage. The need for lining should be assessed

    o Develop an implementation schedule with associated timing and dates for all project related infrastructure and investment. The estimated capital expenditure should then be updated within the financial model to reflect the implementation schedule

    o As the Project progresses commence negotiation with the GoB to confirm the applicable tax regime for the Project

    The total expected outstanding cost, inclusive of all ancillary work, for the above updated FS program is expected to be approximately CAD1,500,000 from an aggregate global budget for the program of around CAD4,900,000.

- Following completion of the FS, Giyani should commence preparations for commercial-scale production through the contracting of front end engineering and design (FEED) studies and procurement of long-lead mine and plant items. SRK estimates that FEED studies will cost approximately CAD2,500,000 and prepayments on critical long-lead equipment will be approximately CAD4,000,000

2   INTRODUCTION

2.1   Scope of Work

Giyani Metals Corp. (Giyani or the Company) trades on the TSX Venture Exchange (TSX-V) under the stock symbol EMM, and on the Frankfurt Stock Exchange under the stock symbol KT9: GR. Giyani is focussed on the development of manganese projects in the Republic of Botswana aimed at supplying manganese to the battery industry.

SRK Consulting (Kazakhstan) Ltd (SRK) has been commissioned by Giyani to undertake a Mineral Resource estimate (MRE) on the Company's Kgwakgwe Hill Project (the Project or K-Hill) located in the Republic of Botswana, in which the Company holds a 100% interest.

This Technical Report has been prepared to comply with disclosure and reporting requirements set forth in the TSX-V Corporate Finance Manual, Canadian National Instrument 43-101, Companion Policy 43-101CP, Form 43-101 F1, the 'Standards of Disclosure for Mineral Projects' of June 2011 (the Instrument) and the Mineral Resource and Reserve classifications adopted by CIM Council on the 10th May 2014.

2.2   Principal Sources of Information

SRK has based its technical work on information provided by Giyani along with technical reports by consultants, government agencies and previous tenements holders, and other relevant published and unpublished data. A listing of the sources of information is included at the end of this MRE. SRK QPs have endeavoured, by making all reasonable enquiries, to confirm the authenticity and completeness of the technical data upon which the MRE is based. A final draft of the report was also provided to Giyani, along with a written request to identify any material errors or omissions prior to lodgement.

A personal inspection of the project by SRK was made between 16th and 18th December 2019 by Mr Michael Beare of SRK and on 28-29th January 2020 by Mr James Haythornthwaite, also of SRK. A follow up site visit by Mr John Paul Hunt of SRK was conducted on the 4th of March 2021 to verify the drilling practices applied by the Company during the active RC drilling. The Qualified Person (QP) in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Code (CIM Code), with responsibility for the reporting of the Mineral Resource Statement presented herein is Dr Lucy Roberts, MAusIMM(CP), a Principal Consultant (Resource Geology) with SRK. Dr Roberts has the relevant experience in reporting Mineral Resources on various base, precious and ferrous metal assets globally.

This Mineral Resource estimation section of this report has been prepared on information available up to and including 20th July 2021.

Giyani's K-Hill mineral property is considered to represent an exploration project which is inherently speculative in nature. The property is also generally considered to be sufficiently prospective, subject to varying degrees of exploration risk, to warrant further exploration and assessment of its economic potential, consistent with the proposed programmes.

All monetary figures expressed in this report are in United States of America dollars (USD) unless otherwise stated.

2.3 Qualifications, Experience and Independence

Neither SRK, nor the authors of this report, has or has had previously, any material interest in Giyani or the mineral properties in which Giyani has an interest. Our relationship with Giyani is solely one of professional association between client and independent consultant. This report is prepared in return for professional fees based upon agreed commercial rates and the payment of these fees is in no way contingent on the results of this report.

3 RELIANCE ON OTHER EXPERTS

3.1 Introduction

The QPs, as authors of this report, have relied on the following sources of information in respect of previous reports, mineral tenure and environmental matters pertaining to the Project.

3.2 Mineral Tenure

The mineral rights are owned by the Republic of Botswana. Giyani, through Menzi Battery Metals (Pty) Ltd., holds the exclusive right to engage in prospecting activities for "Metals" within the Project area through the issued prospecting permit in terms of Section 16 of the Mines and Minerals Act of the Republic of Botswana. The K-Hill project is located within Prospecting Licence No. 322/2016. The K-Hill prospecting area is 438 km^2 of the total area of approximately 2,600 km^2 that Menzi Battery Metals (Pty) Ltd. holds prospecting rights to. All prospecting licenses were granted on the 1st of July 2020 and are valid until the 30th of June 2022.

SRK can confirm that the mineralisation lies within the licenced areas but has not independently verified, nor is it qualified to verify, the legal status of these concessions. The present status of tenements listed in this report is based on information and copies of documents provided by Giyani, and the report has been prepared on the assumption that the tenements will prove lawfully accessible for evaluation.

3.3 Environmental Matters

Giyani contracted the services of Loci Environmental (Pty) Ltd (Loci) to undertake Environmental Screening studies for its projects in Botswana, including K-Hill, in August 2018. SRK notes that no significant issues were identified during this process.

Giyani received a request from the Department of Environmental Affairs (DEA) of Botswana to complete an Environmental Management Plan (EMP) for the K-Hill prospect area. Under this EMP Giyani will have clearance to conduct exploration and evaluation work including but not limited to geophysics and other non-invasive exploration techniques, drilling and sampling.

The proposed K-Hill mine is in an area that has been disturbed by historical mining activities; little or no rehabilitation has been undertaken, so remnants of the old operations are present (e.g., spoil heaps and tailings). In recent years K-Hill has been used to dump general waste illegally by unknown parties.

Giyani has appointed Loci, as an independent consultancy, to carry out a full Environmental and Social Impact Assessment (ESIA) as part of the authorisation process for mining. A scoping study with terms of reference for the ESIA was completed by Loci and submitted to the DEA as per the requirements of the Environmental Assessment Act (2011). Specialist studies for the ESIA are underway and the results will be incorporated into an Environmental and Social Impact Statement (ESIS) and submitted to the DEA for review and decision-making, on whether the Project can go ahead. The Company plans to submit the report during Q1 2022.

Specialist studies to date have shown there are no legacy issues that could have negative economic impacts on the Project; spoil and mine waste into new streams (for processing or disposal). Similarly, neither SRK nor the authors of this report are qualified to provide comment in detail on any environmental issues associated with the K-Hill Project.

No warranty or guarantee, be it express or implied, is made by SRK with respect to the completeness or accuracy of the legal or environmental aspects of this document. SRK does not undertake or accept any responsibility or liability in any way whatsoever to any person or entity in respect of these parts of this document, or any errors in or omissions from it, whether arising from negligence or any other basis in law whatsoever.

3.4   Benchmark Minerals

SRK has relied on Benchmark Minerals for a Market study and price predictions. The Benchmark Minerals market study assessed the supply and demand dynamics of the HPMSM market based on projected consumption by the EV battery market versus known and estimated sources of future production to determine a long-term average price for HPMSM.

4   PROPERTY DESCRIPTION AND LOCATION

4.1   Introduction

The following description of the property location, company overview and licencing has been reproduced from the MSA 2018 ITR.

4.2   Location

K-Hill is located next to the town of Kanye, which is the administrative centre of the Southern District of the Republic of Botswana in southern Africa. K-Hill is accessed by a short section of unpaved roads and tracks from a network of paved national roads, namely the A1 and A2, with the A2 being just a few kilometres from the Project. Gaborone, the governmental and economic capital city of Botswana is approximately 100 km by paved road from Kanye (Figure 4-1).
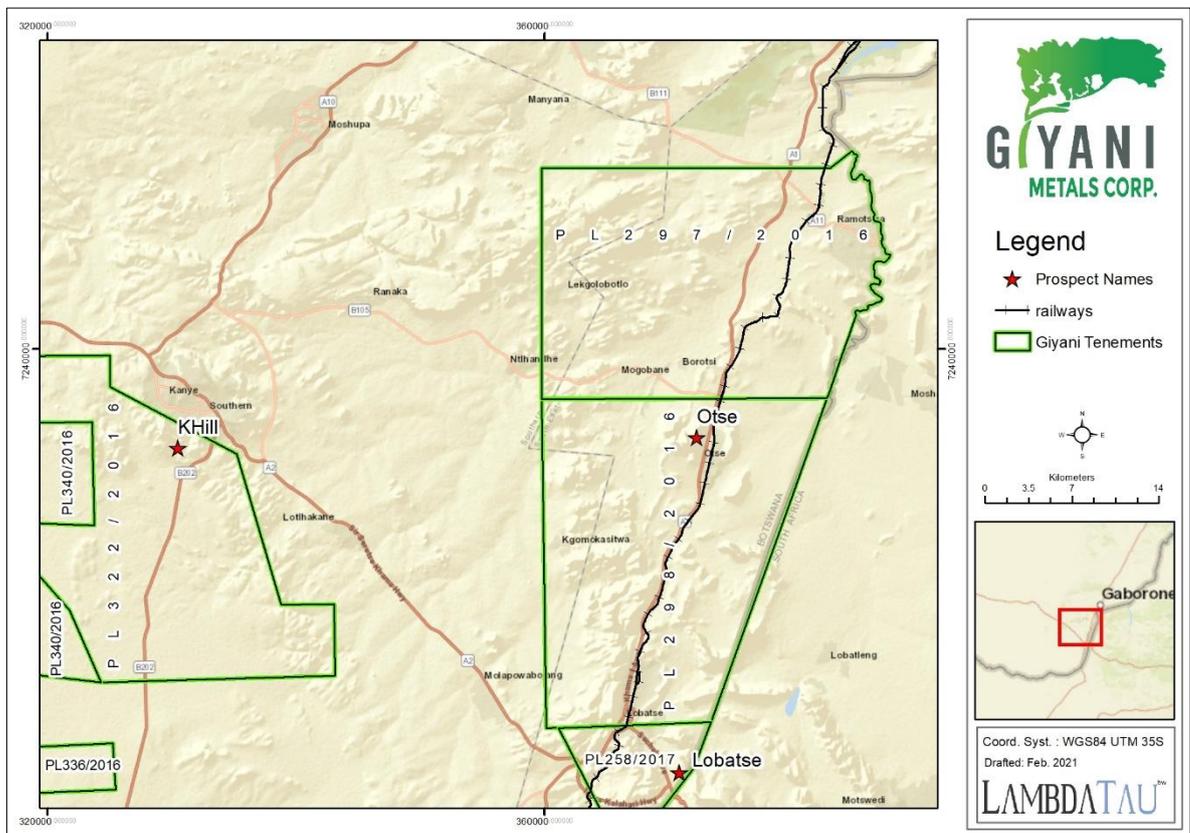
Source: LambdaTau, 2021
Figure 4-1:   Location of the K-Hill Project

4.3   Project Ownership

The entire Project area extends over 2,588 km^2 of tenements, with the K-Hill project in a 438 km^2 licence area, held under the Botswana registered entity, Menzi Battery Metals (Pty) Ltd., Giyani is the only shareholder and owns 100% of Menzi Battery Metals (Pty) Ltd..

4.4   Mineral Tenure

SRK notes that Giyani holds the exclusive right to engage in prospecting activities for "Metals" within the Project area through prospecting permits issued in terms of Section 16 of the Mines and Minerals Act of the Republic of Botswana. The K-Hill project is located within Prospecting Licence No. 322/2016. All the Giyani prospecting licenses, through Menzi Battery Metals (Pty) Ltd. were renewed on the 1st July 2020 and are valid until the 30th of June 2022, with the exception of PL258/2017 which was renewed on 1st January 2021 and expires on the 31st of December 2022 (Table 4-1). According to the Mines and Mineral Act, the holder of a prospecting licence may, at any time not later than three months before the expiry of such licence, apply for renewal of the prospecting licence and shall be entitled to the grant of no more than two renewals thereof, each for the period applied for, which periods shall not in either case exceed two years, provided that-(a) the applicant is not in default; and (b) the proposed programme of prospecting operations is adequate.

The location of the Prospecting Licence No. 322/2016 in relation to Giyani's other permits is shown in Figure 4-2.

Table 4-1:   Summary of Giyani's licence holdings in Botswana

Licence number	Licence holder	Issue date	Licence type	Expiry date	Size (km^2)
PL294/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	479
PL297/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	483
PL298/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	479
PL322/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	438
PL336/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	118
PL337/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	144
PL338/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	127
PL339/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	77
PL340/2016	Menzi Battery	01-July-2020	Prospecting	30-June-2022	148
PL258/2017	Menzi Battery	01-January-2021	Prospecting	30-June-2022	95
				TOTAL	**2,588**
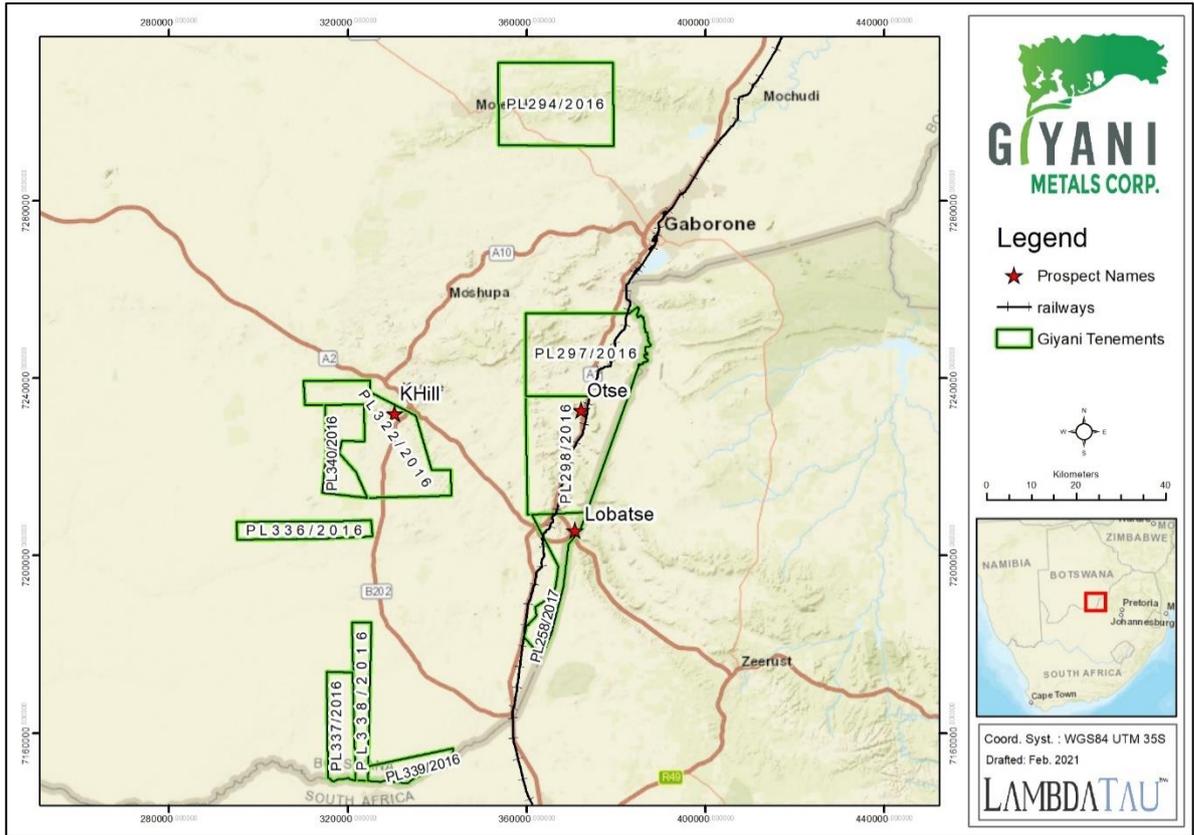
Source: LambdaTau, 2021

Figure 4-2:   Location of Giyani's licence holdings in Botswana

4.5   Surface Rights

The Ngwaketse Land Board granted permission to Giyani to access the land at K-Hill. The larger area around K-Hill is managed by the Ngwaketse Tribal Administration who manage the land on behalf of the community across parts of the larger area of the Project.

Water for drilling was sourced from the Mmamokhasi Dam. Permission to use the water was granted by the Mmamokhasi Dam Group. A written agreement to that effect has since expired however, no issues for utilizing this water source for future activities is envisaged.

4.6   Property Obligations and Agreements

According to Section 70 of the Mines and Minerals Act of the Republic of Botswana, the Licence Holder at the time of issue of this licence and on each anniversary thereafter is required to pay to the Office of the Director of Department of Mines, an annual charge equal to five Botswana Pula (BWP5.00) multiplied by the number of square kilometres in the Licence Area subject to a minimum annual charge of One Thousand Pula (BWP1,000.00).

Giyani, through Menzi Battery Metals (Pty) Ltd., is expected to carry out the prospecting operations set out in the prospecting licence (Table 4-2).

Table 4-2:   Programme of prospecting operations for the K-Hill Prospecting Licence No. 322/2016

Programme of prospecting operations	Proposed minimum expenditure
Year 1 (2020): Definitive Feasibility Study i. Resource drilling, Infill drilling and exploration drilling ii. Infill drilling on the established resource. iii. Upgrading the resource from inferred to measured. iv. Further brownfield exploration.	One million Pula (BWP1,000,000)
Year 2 (2021): Conduct a FS for the K-Hill Mn Deposit i. Complete FS for K-Hill project. ii. Complete EIA iii. Apply for mining license	One million five hundred thousand Pula (BWP1,500,000)

4.7   Environmental Liabilities

Giyani contracted the services of Loci Environmental (Pty) Ltd to undertake Environmental Screening studies for its projects in Botswana, including K-Hill, in August 2018. No significant issues were identified during this process.

Giyani received a request from the Department of Environmental Affairs (DEA) of Botswana to complete an Environmental Management Plan (EMP) for the K-Hill prospect area. Under this EMP Giyani will have clearance to conduct exploration and evaluation work including but not limited to geophysics and other non-invasive exploration techniques, drilling and sampling. The approval of the EMP for the K-Hill Project and Otse prospect area was granted in July 2019, valid until 2021 and renewable.

Giyani will be required to do a detailed Environmental Impact Assessment (EIA) before any mining and/or processing can commence.

4.8   Significant Risk factors

A portion of the Mineral Resource underlies a municipal concrete water tank. The tank overlies a small portion of the Mineral Resource (<5%) and the potential impact of this facility to the Project has not been fully ascertained. SRK considers that a replacement will need to be provided.

5   ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1   Introduction

The following description of the property infrastructure, geographical setting and local resources has been reproduced from the MSA 2018 ITR.

5.2   Accessibility

The Project area is well networked by paved national roads, namely the A1 and A2. K-Hill is within a few kilometres of the A2 highway. The A2 highway runs from Buitepos, at the Namibian border, through Jwaneng, Kanye and Lobatse to the South African border at Pioneer Gate, near Zeerust, South Africa. The A2 is a major component of the Trans-Kalahari Corridor, which is a highway corridor that provides a direct route from Maputo in Mozambique via Pretoria to central Namibia, in particular to Windhoek and the port of Walvis Bay.

Access to site from the national road is by a few kilometres of unpaved roads from Kanye. Old mining tracks are largely overgrown and degraded by erosion, and access to some areas is by foot or four-wheel drive vehicle.

Local communities own the surface areas around Kgwakgwe Hill and access is granted by notification only. The larger project area consists of a combination of privately-owned land and communal/tribal land.

5.3   Climate and Physiography

The land surface of Botswana is mostly flat or gently undulating, with the greatest topographical relief being in the southern parts of the country. Kanye is at an elevation of approximately 1,300 masl and Kgwakgwe Hill itself forms a district topographic high next to the town of Kanye (Figure 5-1 and Figure 5-2), with elevations reaching nearly 1500 masl.

Spoil heaps, stockpiled manganese mineralization and tailings occur in the K-Hill project area, which together with historical open-pit mining forming cliffs into the steep hillside have disrupted the natural topography (Figure 5-3).

Generally, Botswana can be divided into three main physiographic regions:

- The Wetland region around the delta to the north

- The Hardeveld region with outcropping metamorphic geology in the south east, in which the Project area lies, and

- The Sandveld region which comprises of the central Kalahari sands

Most of southern Botswana is covered in some form of savanna. In the Project area, common shrubs and small thorn trees exist and no protected or scarce trees such as the Baobab, Marula, Mopane or Fig trees have so far been observed at K-Hill (LambdaTau, 2017).

The climate is generally considered to be warm and arid with a summer rainfall season. Operations can continue throughout the year.

Source: MSA 2018

Figure 5-1:   View from Kgwakgwe Hill towards Kanye, taken from a drilling site

Source: MSA 2018

Figure 5-2:   View of Kgwakgwe Hill, showing historical spoil heaps

Source: Giyani, 2018

Figure 5-3:   Birds-eye view of K-Hill Project area

5.4   Local Resources and Infrastructure

K-Hill is just outside the town of Kanye, which has electricity supply from the national grid. The town water supply is from the Mmamokhasi dam, which is approximately 5 km from site. Water from this source has been used for drilling activities.

Formal mining in Botswana for copper, nickel, coal, gold and diamonds has taken place from the 1900's to present, as well as historical manganese mining in the Kanye area. Both underground and open-pit mining skills are available in the country as well as skills gained from migrant labour in neighbouring South Africa. Kanye is located 70 km from Jwaneng Mine, a large open-pit diamond mine. An historical tailings area is present on the site (Figure 5-3).

6   HISTORY

The following description of the history of the K-Hill Project has been largely reproduced from the MSA 2018 ITR.

The discovery of manganese in the Kanye area led to mining from 1957 to 1971 (Aldiss, 1989). The first of many companies operating at Kgwakgwe Hill was Marble Lime and Associated Industries (Marble Lime), which also developed the asbestos mine at Moshaneng, northwest of Kgwakgwe Hill. Marble Lime mostly mined the bedded type mineralisation (described as manganiferous shale during the Phase 1 mapping exercise completed by Giyani), which required beneficiation before it could be saleable (Aldiss, 1989). Marble Lime ceased mining activities around 1967.

Further exploration work was carried out by Johannesburg Consolidated Investments Co. Ltd. (JCI), during the late 1960's and early 1970's.

In 1981, Rand London Manganese investigated the possibility of mining the manganese shale deposits at Kgwakgwe, Otse and Gopane (near Lobatse) together feeding a single planned processing plant at Lobatse. The Kgwakgwe deposit was considered to require further drilling for evaluation, but no further work was completed and the licence was relinquished within a year (Aldiss, 1989).

Historical production of manganese from Kgwakgwe was reported by Baldock et al (1977) to be 64,180 tonnes from 1957 to 1967, and 131,563 tonnes from 1968 to 1972 (Table 6-1). Variable prices were received for the product due to both metallurgical and high-grade battery-active products being supplied, with the latter attracting a premium at the time (Baldock et al. 1977). It is not stated how much of these tonnages were from open-pit or underground mining and these figures have not been verified by the QP's.

Table 6-1:   **Manganese Production from Kgwakgwe (after Baldock *et al.* 1977)**

Year	Amount (Tonnes)	Value (Rand)
Total 1957-1967	64,180	798,678
1968	39,751	16,863
1969	16,732	290,433
1970	40,488	695,396
1971	34,387	140,655
1972	205	9,970
Total 1968-1972	131,563	
Grand Total	**195,743**	

7   GEOLOGICAL SETTING AND MINERALIZATION

7.1   Introduction

The overview of the regional geology, local geology and mineralization provided below has been reproduced from the MSA 2018 ITR.

7.2   Regional Geology

The stratigraphy in the K-Hill area consists predominantly of late Archean to early and middle Proterozoic rocks from the Ventersdorp (meta-volcanics) and Transvaal (meta-sedimentary) Supergroups, as well as the early Precambrian Gaborone Granite (intrusives) and later Waterberg (sedimentary) Groups (Key and Ayres, 2000).   The location of the K-Hill prospect is shown superimposed on the 1973 regional geological map of Botswana in Figure 7-1.   The Archean basement in southeast Botswana is well studied on a regional scale and maps are generally accurate.   The prospect occurs within the mapped Transvaal Supergroup sediments consisting of shales, quartzites, limestones and conglomerates (blue shades in Figure 7-1) and in the vicinity of the Kanye Group (part of the Ventersdorp Supergroup) consisting of a variety of extrusive lavas and subordinate siltstones and shales (purple shades in Figure 7-1).   To the east, the early Precambrian intrusive igneous units of the Gaborone Granite suite occur (red and pink shades in Figure 7-1).   The youngest succession in the Project area is the Waterberg Group sediments (green shades in Figure 7-1).   A subsequent regional (1:1,000,000) geological map of Botswana was published by Roger M Key and Neil Ayres in 1998, but most of the government regional mapping in the Project area was completed prior to 1980 so for this area, the 1973 map is still accurate (Key and Ayres, 2000).
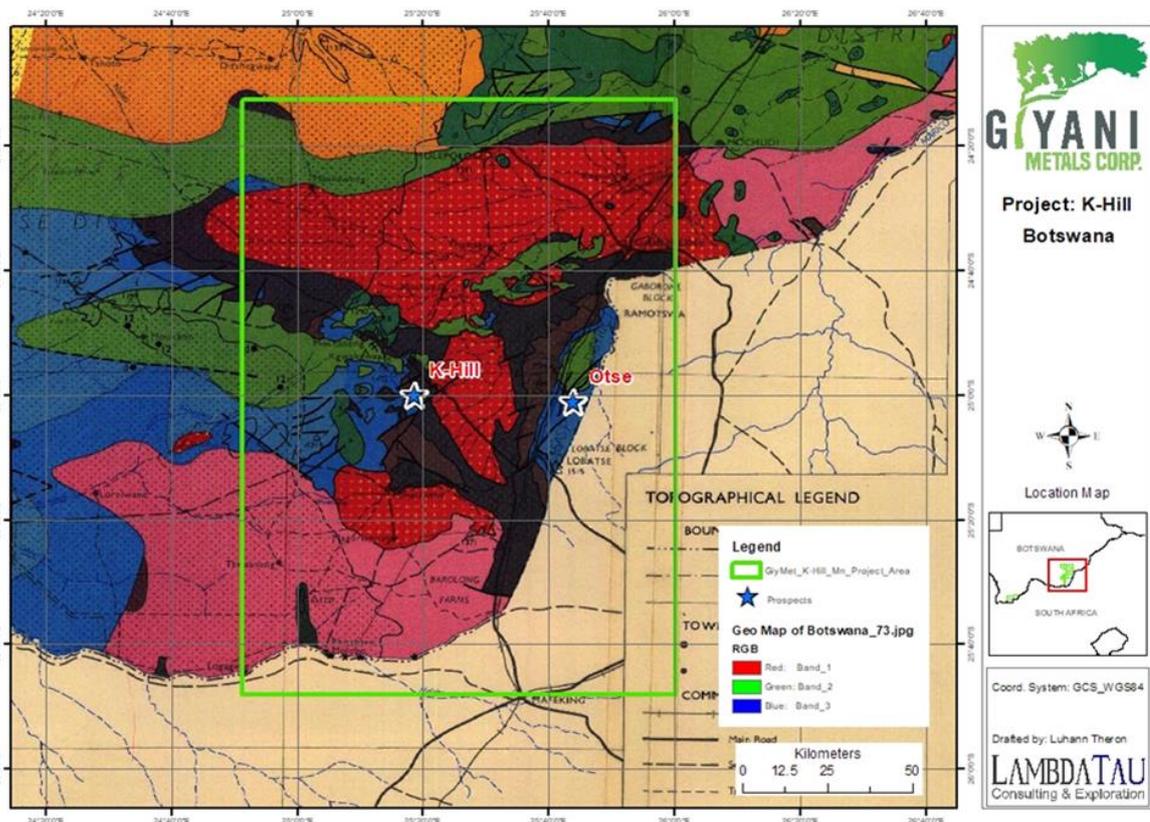
Source: 1973 Regional Geological Map of Botswana

Figure 7-1:   Location of the K-Hill prospect on the regional geological map of Botswana, 1973

The Moshaneng-Kanye area contains outcrops of a Transvaal-age sedimentary sequence which forms part of the so-called Kanye Basin. This basin is oval in shape, with its long axis orientated northwest-southeast and extends over the Kgomodikae, Segwagwa and the Moshaneng areas. It is separated from the Transvaal sediments in the Lobatse area by Ventersdorp-age rocks which comprise the Lobatse Volcanic Group, remnants of Archaean basement rocks, and the Gaborone Granite, all of which define the north-south trending Vryburg Arch between Kanye and Lobatse. At Kanye the arch begins to swing westwards through Moshaneng towards Jwaneng. Although partially separated by a veneer of Waterberg age rocks, the Transvaal Supergroup sequence around Moshaneng forms a structural continuum with that exposed around Kanye as evidenced by the isolated ridges of chert breccia between the two. The Transvaal sediments outcrop in a poorly defined ring structure near the village of Moshaneng. The core of this structure is composed of alkaline rocks of the Moshaneng Complex.

In the Kanye area, only the lower parts of the Transvaal succession, the Black Reef Quartzite Formation and the Taupone Dolomite Group, are present. The sediments of the Black Reef Quartzite Formation constitute a sequence that fines upwards from conglomerates at the base through arenites to shales and mudstones at the top. This suggests a progressive increase in water depth consistent with a major marine transgression. The discontinuous clast-supported conglomerates are thought to have been deposited in localized stream channels within an active tidal beach environment. This conclusion is supported by the occurrence of very mature quartz arenites overlying the conglomerates.

The Black Reef unit passes gradationally through an interval of bluish grey shales and mudstones into the overlying carbonates. The carbonates are interpreted as being predominantly deposited on a tidal flat. Local sandstone lenses may occur in the upper portions of the dolomite sequence and mark the start of a regressive cycle in which terrigenous sediment was reintroduced.

The predominance of the Paupone Dolomite Group and the extensive development of chert breccias, as opposed to banded iron formation, suggests that the deposition of the Transvaal Supergroup rocks took place in a tectonically active basin. Tectonic instability is also evident during the deposition of the Black Reef, as indicated by the development of localised fault-scarp conglomerates as its base.

7.3   Local Stratigraphy

7.3.1   Summary

The mineralization at Kgwakgwe Hill is primarily associated with the upper shale horizon of the Black Reef Quartzite Formation. The quartzite package underlying the shales, rests unconformably on Archaean felsites of the Kanye Volcanic Group. The shales in turn are overlain by the chert breccias of the Paupone Dolomite Group (Figure 7-2), which suggests non-deposition of the intervening dolomites or a massive unconformity. The Kgwakgwe Chert Breccia Formation in the Kanye area can be subdivided into two main varieties:

- A dark brown chert breccia with milk-white angular chert fragments cemented together by brown haematitic material

- A reddish-brown chert breccia with abundant jaspilitic fragments and a high content of jasper in the matrix

Source: MSA, 2018

Figure 7-2:   Chert breccia at K-Hill

7.3.2   Lithologies

A total of 6 lithologies were consistently intersected during drilling operations. These include a Chert or Chert-Dolomite breccia unit, which occurs at the top of the stratigraphic sequence. Below that is an approximately 50 m thick package of shale identified to be part of the Black Reef formation which hosts the manganese mineralisation, within the shale units. Below this shale lies an iron rich shale, which is often intruded by Mn-oxide material into fractures and joints. Below the Fe-shale lies a lower iron shale unit, typically a beige colour with no significant Mn-content. A shale containing Mn-clay is also observed within the beige shale. Between the overlying shales and the Felsite footwall unit, lies a conglomerate marker unit, observed in almost all the holes.   In some holes this marker conglomerate has a gritty texture with small clasts and is also mineralized with Mn-oxides.

7.3.3   Chert Dolomite Breccia (CDB)

This unit consists of angular chert (Dolomite) clasts, within a haematite rich matrix. The CDB unit decreases in grain size and abundance vertically. In addition, the unit becomes laminated before transitioning into the underlying and softer, manganiferous shale unit. The contact is typically broken and is assumed to be sharp and erosional. Minor overburden of typically less than 1 m thickness is also intersected at the top of the sequence.

7.3.4   Mn-shale (MSH)

The manganiferous shale lithology (MSH), is the primary mineralization host. The lithology consists of massive and homogenous Mn-oxide mineralization, with a steel grey, submetallic lustre. The horizons are generally associated with higher magnetic susceptibility readings when compared to adjacent shale and Chert Breccia units, especially when Mn-Oxides are observed visually. The Mn-shale lithology also has a dark black, friable shale/clay component which makes up the bulk of the unit. These dark black sections are thought to contain Mn-wad, a high-grade Manganese dioxide complex. Laminae of Kaolin clay are also observed. The Mn-shale horizons are typically 3 to 4 m thick. Core recovery is usually poor due to the friable nature.

7.3.5 Fe-shale (FSH)

The iron-rich shale unit is found above and below the MSH and is, generally the most extensive lithology in the K-hill area. The unit hosts sporadic, vein and fissure fill mineralization of Mn-Oxide and can also occur as thin 1 to 3 cm thick bands. Mineralization is confined to the upper sections of the unit and grades into alternating weak to moderate non-mineralized Fe-shales downhole. Haematite and bleaching alteration often occur.

7.3.6 Beige-cream shale (SHL)

The beige – cream shale is a non-mineralized, homogenous unit, occurring below the Fe-shales. The beige-cream units have gradual contacts and are interspersed between a manganese clay and/or conglomerate unit.

7.3.7 Mn-clay (MCLAY)

The manganiferous clay unit contains low level mineralization present in the form of laminations or pervasive blotches. Moderate limonite alteration is typical of this unit.

7.3.8 Conglomerate (CONG)

The conglomerate unit is the primary marker of the footwall. This unit appears to be weakly mineralized in the south of the KHill region. The conglomerate units within the north have a coarser grain size than the units in the south. The unit is characterized by a granular/sugary texture with subhedral clasts of quartz. This unit is often interspersed by 10 cm bands of cream shale with sharp upper and lower contacts.

7.3.9 Felsite (FEL)

This unit is a fine-grained silica-rich igneous extrusive rock forming the footwall to the shale and conglomerate units. The exact composition of the unit is unknown and is referred to as felsite. The unit is not mineralized and contains pervasive-blotchy haematite alteration and localised-pervasive limonite alteration.

7.4 Property Geology

The Mn-shale horizon is of limited extent and has only been traced for a short distance to the south of Kgwakgwe Hill where it apparently terminates in the superficial deposits which constituted the most southerly of the historical mine workings.

The stratigraphy has been duplicated by thrusting in places. Small displacements have also been observed along steeply dipping east to northeast trending faults. The shales have been intensely folded and slumped in the vicinity of these dislocations and in addition, subparallel breccia zones and quartz veining may be evident.

The entire Transvaal package is cut out against the Waterberg sediments to the west of the Kgwakgwe Hill along what are thought to be northerly trending faults.

The manganese shale outcrops along the northerly scarp slope of the Kgwakgwe Hill and dips into the hill (Figure 7-3). The strata at K-Hill dip gently towards the northwest at an average of approximately 5 - 10° and small-scale S and Z folding is common. In plan, the manganese shale unit kidney shaped. The unit varies between approximately 2 m and 12 m thick with an average thickness in the order of 4 m and has a delineated extent of approximately 900 m N-S and 350 m E-W.

Source: MSA, 2018

**Figure 7-3:   Manganese shale (black unit) and overlying shale (pale brown unit) exposed
                at the entrance to artisanal workings**

A simplified geological map of the mineralized area, including the positions of surface grab samples
of manganiferous material, is shown in Figure 7-4. The outcrop defining the limit of the manganese
shale is well defined in the east, with the areas to the west being partially covered by alluvium and/or
exposed by historical surface mining into the hillside.
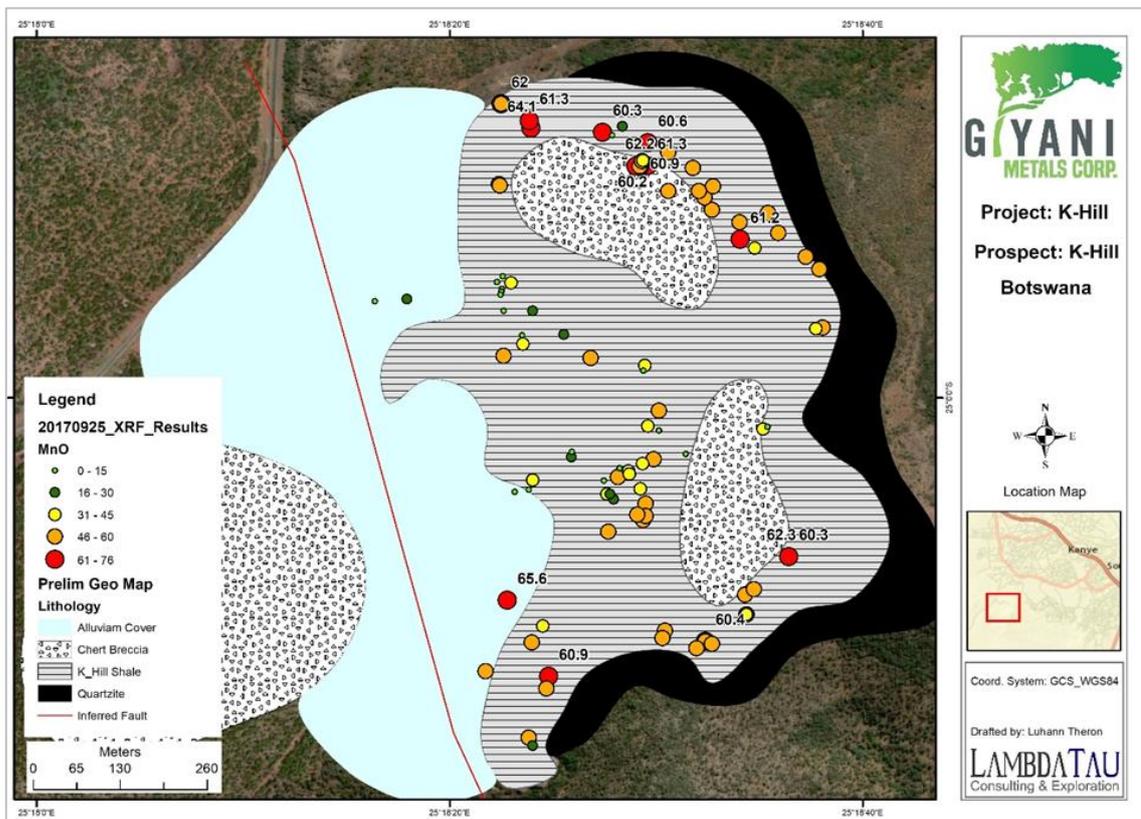
Source: LambdaTau, 2017

Figure 7-4:   Simplified geological surface map of the K-Hill Project area

A schematic section illustrating an interpretation of the geology at K-Hill is shown in Figure 7-5. This is interpreted based on the mapped mineralization outcrops and the historical open pit area. A fault has been inferred which could result in potential for additional mineralization towards the west. A single drillhole DDHKH18_0009 was drilled to test this hypothesis and no additional mineralization was found. The potential for additional mineralization has not yet been ruled-out and further exploration may be warranted. The shale has been interpreted to occur to the south based on geophysical surveys. SRK notes that further exploration is required to confirm the presence of manganiferous shale in this area.

A typical cross section is provided in Figure 7-6 showing the main manganiferous horizons and how they have been coded for the purposes of modelling the mineral resource. The layers are coded from A to C with the highest layer coded as A, central layer as B and lowest layer as C. In addition, the A horizon has been subdivided into the A1, A2 and A3 horizons reflecting changes in manganese content across the layer.
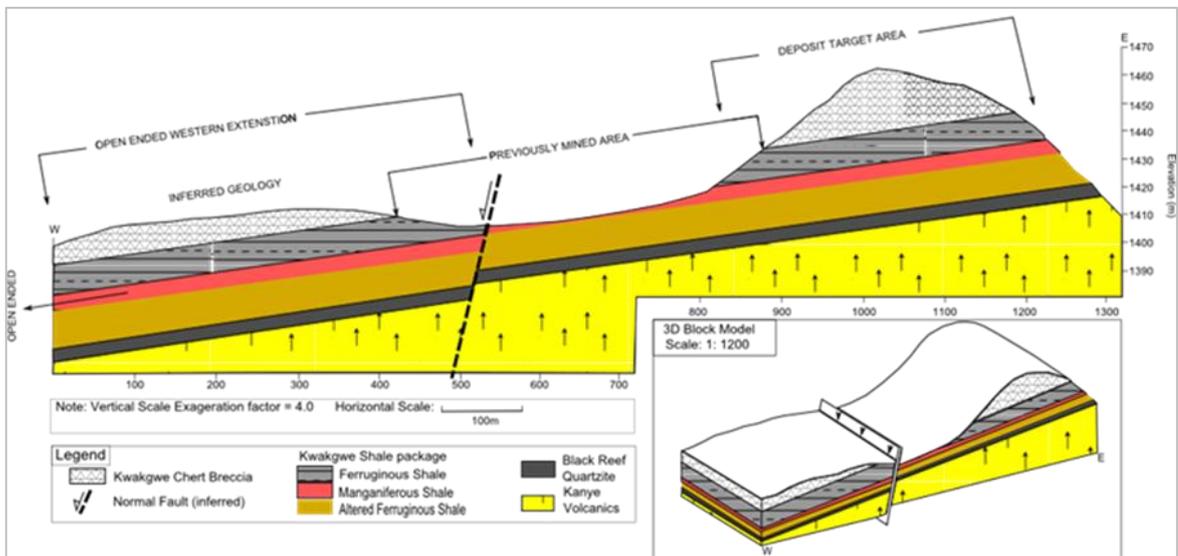
Source: LambdaTau, 2017

Figure 7-5:   Conceptual cross section through K-Hill showing the outcropping mineralization mapped and sampled to the east, the historical mined area and potential mineralization towards the west
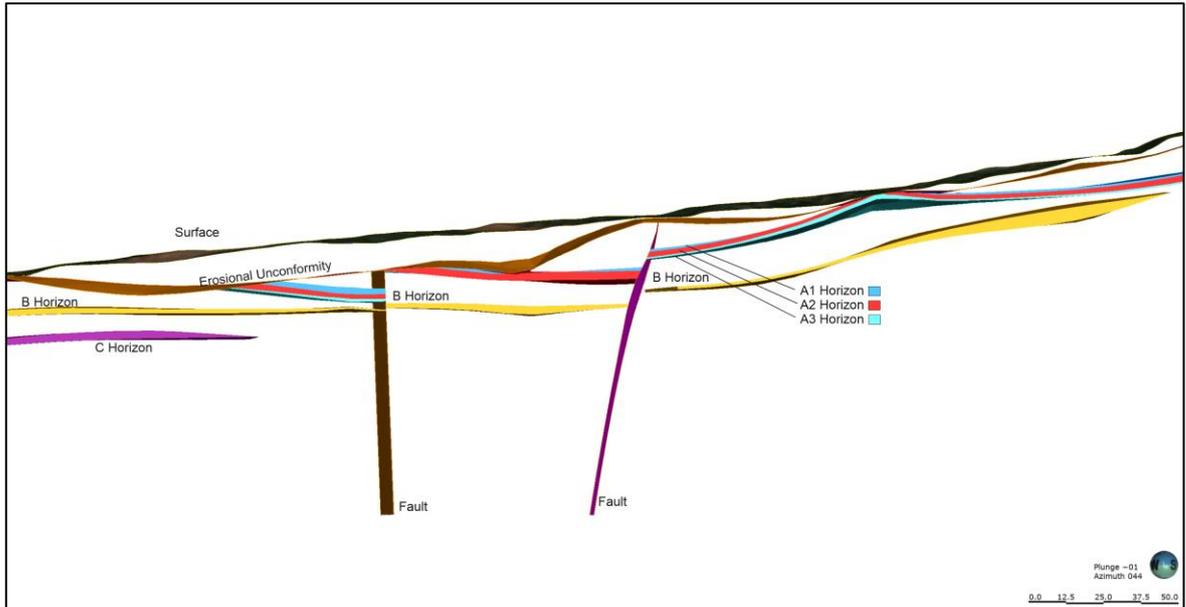
Figure 7-6:   Typical cross section through the KHill manganiferous shale horizons

8   DEPOSIT TYPES

The discussion on the style of mineralisation and context in terms of global manganese deposit types provided below has been reproduced from the MSA 2018 ITR.

The manganese mineralization occurs as a supergene enriched shale (the Mn-Shale) within the Black Reef Quartzite Formation.

The Mn-Shale itself appears to represent primary manganese deposition in a shallow marine basin as per the Canon and Force model referred to in Figure 8-1. As is typical for most manganese deposits, there is clear evidence of upgrading by means of supergene enrichment. This evidence includes:

- Only manganese oxide mineralogy has been noted to date

- Observed manganese mineral textures are consistent with secondary precipitation

- The presence of fine manganese wad and the presence of cavities and vugs intersected in the drill holes in the Mn-Shale

There are two possible time intervals during which weathering and supergene enrichment could have occurred, these being the recent period of exposure as well as the ancient period of exposure associated with the unconformity at the base of the Chert Breccia. If supergene enrichment is only related to the current exposure then the enrichment could be limited in extent by the current geomorphology and may only extend under the hill to the limit of weathering. If there was supergene enrichment during the period associated with the unconformity, then more extensive supergene enrichment may have occurred. The latter possibility appears to be supported by the drillhole intersections. Two mineralising processes are evident, namely an initial phase of mineralization by precipitation and diagenesis during sedimentation (forming the Mn-Shale) followed by one (and possibly two) phases of redistribution and concentration during weathering and supergene enrichment.

Interpretation of the gravity map allows the recognition of a very clear marine basin embayment paleogeography of the type typically recognised in the Cannon and Force (1988) model. The Archaean floor to the basin seems to be well described by the gravity anomalies. Interpretation of the gravity map indicates the possible presence of two shallow marine embayments with a north-south running paleo-shoreline shoaling to the east and deepening westward.
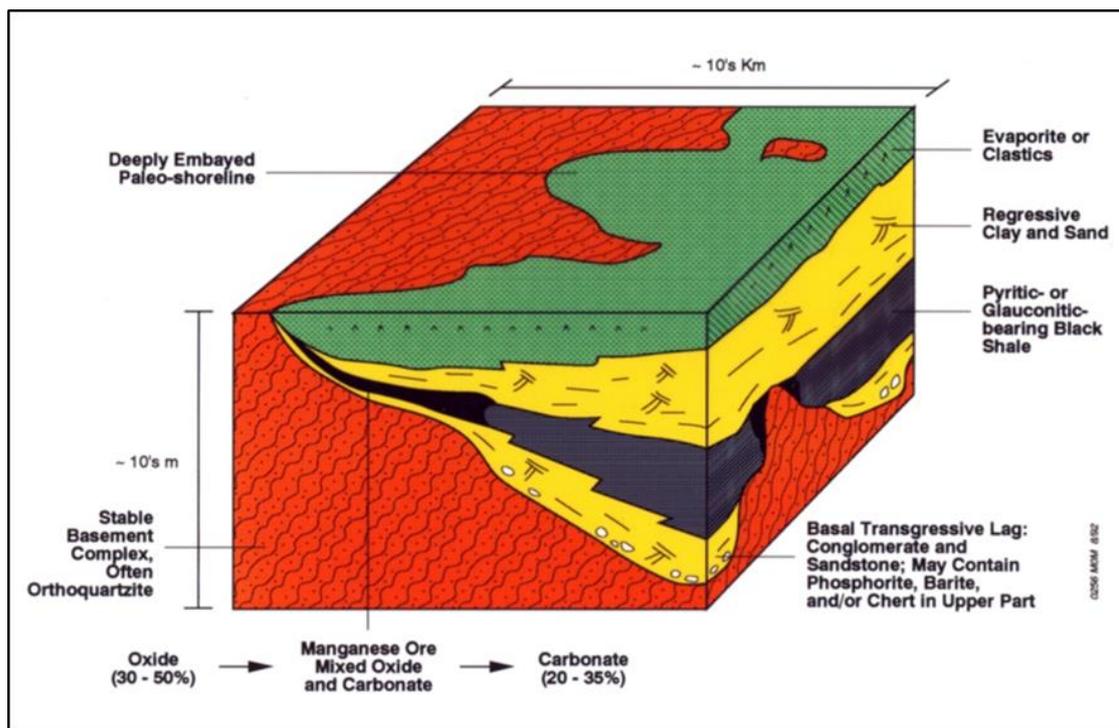
Source: Cannon and Force (1988)

Figure 8-1:   Illustration of the Cannon and Force (1988) model for sedimentary manganese mineralization

8.1   Mineralization Style

Key elements of the Canon and Force model and this mineralization style may be summarised as follows:

- The Cannon and Force model is a depositional model for a large number of sedimentary manganese deposits that apparently have their formation during times of high sea level stand and stratified sea columns in common. Manganese precipitation occurs at intersections of horizontal oxidation-reduction interfaces with shallow marine substrates within shallow marine embayments

- The manganese occurs in typically thin flat lying stratiform and stratabound layer(s), often of enormous lateral extent. They are stratiform marine basin-margin deposits, which may be present in oxide and (or) carbonate facies, tend to be in condensed stratigraphic sequences, result from low energy deposition, and have little clastic dilution. Characteristically the manganese horizon is a thin but laterally extensive stratigraphic condensed sequence type interval

- Basin analysis has shown that these types of deposits typically occur in settings characterised by deposition in localised basins or shallow marine embayments around littoral paleo-islands, peninsulas and shoals. It is important to delineate barrier island, embayments and shoal settings because of the role of basin sills in isolating anoxic seas and favouring black shale formation. The relationship to the basin's basement and floor is critical. Major deposits usually formed close to the basin margin. Deposits are often less than 100 m above the basement

- The host rocks are typically sandstone (or orthoquartzite), siltstone and claystone, shales and black shale. Subordinate poorly consolidated limey sediments (marls) occur. Diatomaceous clays, radiolarian sediments and shell beds are common. Black organic- and pyrite-rich-shales and glauconitic sands are common in footwall rocks

- Mineralogically they typically include an oxide facies; an oxide–carbonate facies; and a carbonate facies. Currently there is only evidence of oxide facies in the K-Hill deposit:

  o The oxide-facies manganese mineralization most commonly includes cryptomelane-group minerals and pyrolusite and over forty oxide minerals. Less-oxic deposits contain manganite, braunite, and kutnohorite. Psilomelane and wad (primary and supergene iron and manganese oxide mineral intergrowths) are commonly listed in older literature. Gangue typically includes clay minerals (commonly montmorillonite), carbonate minerals, glauconite, quartz, chert, and biogenic silica

  o If developed, the oxide-carbonate facies include psilomelane, manganite, manganoan calcite and rhodochrosite

  o Carbonate facies mineralization typically includes rhodochrosite, kutnohorite, and manganoan calcite, siderite, mixed manganese and iron carbonate minerals, pyrite and wad. Gangue typically includes clay, calcium and calcium-magnesium carbonate minerals, glauconite, organic matter, pyrite, quartz, and biogenic silica

- Secondary superimposed weathering and supergene processes are common. In situ weathering and oxidation enhance both the oxide and carbonate primary mineralisation. Manganese carbonates may weather to a brown non-descript rock. Black secondary oxides are common. Penecontemporaneous erosion, oxidation and sedimentary reworking (tidal lag) of oxide and oxidized carbonate mineralisation can give rise to higher grades. Contacts between primary and supergene-enriched zones are typically sharp

  This mineralisation type typically presents manganese grades as follows:

- Primary: 20% to 40% Mn, low Fe

- Secondary: 30% to 50% Mn, low Fe

- Fe content - Host rocks are low in Fe

- Examples of this mineralisation-type include:

- Groote Eylandt, Australia

- Nikopol & Bolshoi Tokmakskoe, Ukraine

- Chiatura, Georgia

- Obrochischte – Bulgaria

9   EXPLORATION

9.1   Introduction

The following overview of exploration activities completed on the K-Hill project has been reproduced from the 2018 MSA ITR, with additional information documented by SRK regarding more recent activities.

9.2   Mapping and Sampling

Early exploration at K-Hill was designed to geologically map and geochemically sample the prospect area. Geologists equipped with a Garmin GPSMAP 64S GPS, Brunton Compro Pocket Transit compass as well as RockLogger Android software, spent a total of 13 days mapping and sampling in and around the main prospect area.

A preliminary stratigraphic column was interpreted from the field observations. It is important to note that the Mn-Shale and the K-Hill shale are not the same unit. The K-Hill shale, as shown in Figure 9-1, refers to the entire shale unit. This unit varies in composition and character but represents the same geological event. The Mn-Shale refers to a specific horizon within the K-Hill shale that contains enhanced levels of manganese mineralization.

The focus of historical mining efforts was towards the inner area, with unmined outcropping mineralization towards the outer northern and north-western edges. Adits from artisanal mining around this outcropping area are common.

Outcropping mineralization, as well as exposed mineralization in the historical mining pits, were sampled. Various mineralization styles were observed and sampled. Grab samples were taken from the K-Hill Shale within and away from the Mn-Shale outcrop. These were taken where outcrop existed and access allowed. A total of 97 grab samples were collected from the K-Hill prospect and additionally 25 samples were submitted as duplicates to test variability in sampling technique and analyses. All samples were taken from surface and within old open-pit faces except for two samples that were taken from artisanal adits. Sampling was focussed on mineralized units, although some samples were also collected from the non-mineralized footwall and hangingwall units. Rock units sampled included manganiferous shale, ferruginous shale, quartzite, chert breccia and siliceous/silicified shale.

Analysis of the grab samples was by borate fusion followed by XRF and was performed by SGS laboratories in Randfontein, Johannesburg, South Africa.

It should be noted that the grab sampling had the sole purpose of identifying the location and nature of the mineralization. Samples of this nature are not suitable for estimating the grade of the deposit. The grab samples are not representative of the grade of the complete mineralised unit and sampling of this nature is inherently biased, generally towards a higher grade.

Samples collected from outcropping Mn-Shale units yielded the highest manganese grade, as can be expected. Lower grade and non-mineralized footwall and hangingwall units were sampled where exposed by historical workings. Instances of high grade MnO (>50% MnO) occur along the entire approximate 1.25 km of Mn-Shale outcrop. Due to the biased nature of the grab sampling this should not be misconstrued as the in-situ grade of the Mn-Shale unit but does illustrate that occurrences of high-grade manganese mineralization do occur within the outcrop.
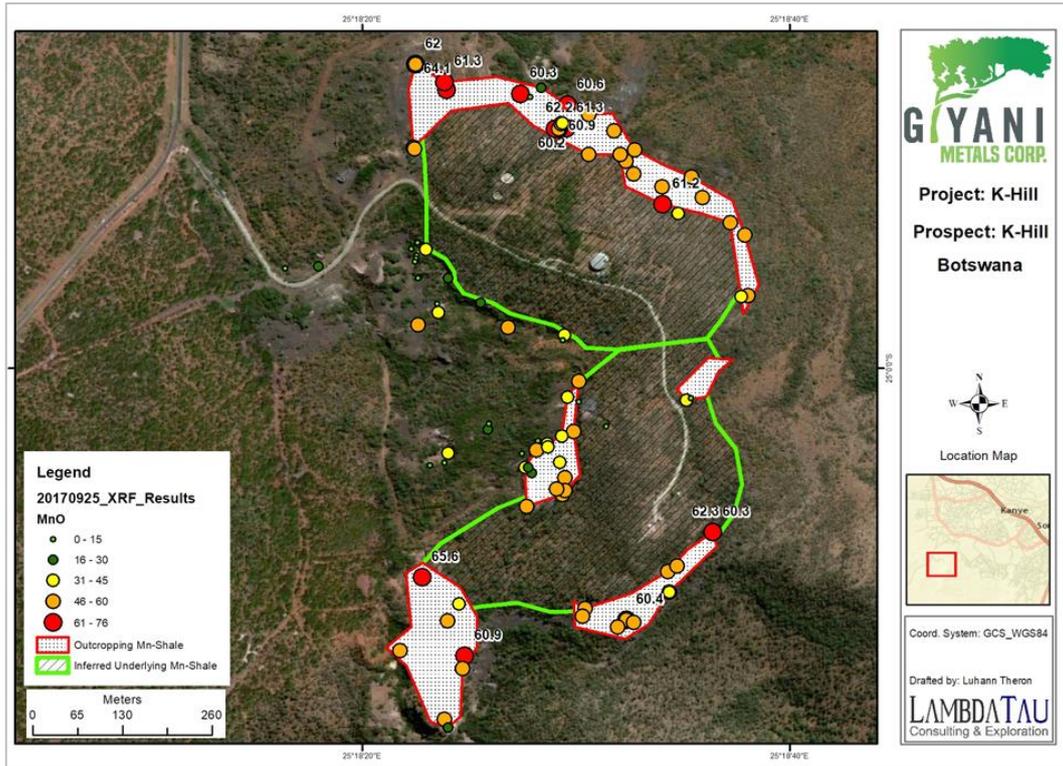
Source: LambdaTau, 2017

Figure 9-1: **Location of outcropping Mn-Shale as well as the area of Mn-Shale inferred to underly Kgwakgwe Hill**

A preliminary geological map is shown in Figure 9-2. More detailed work is required to refine this surface map.
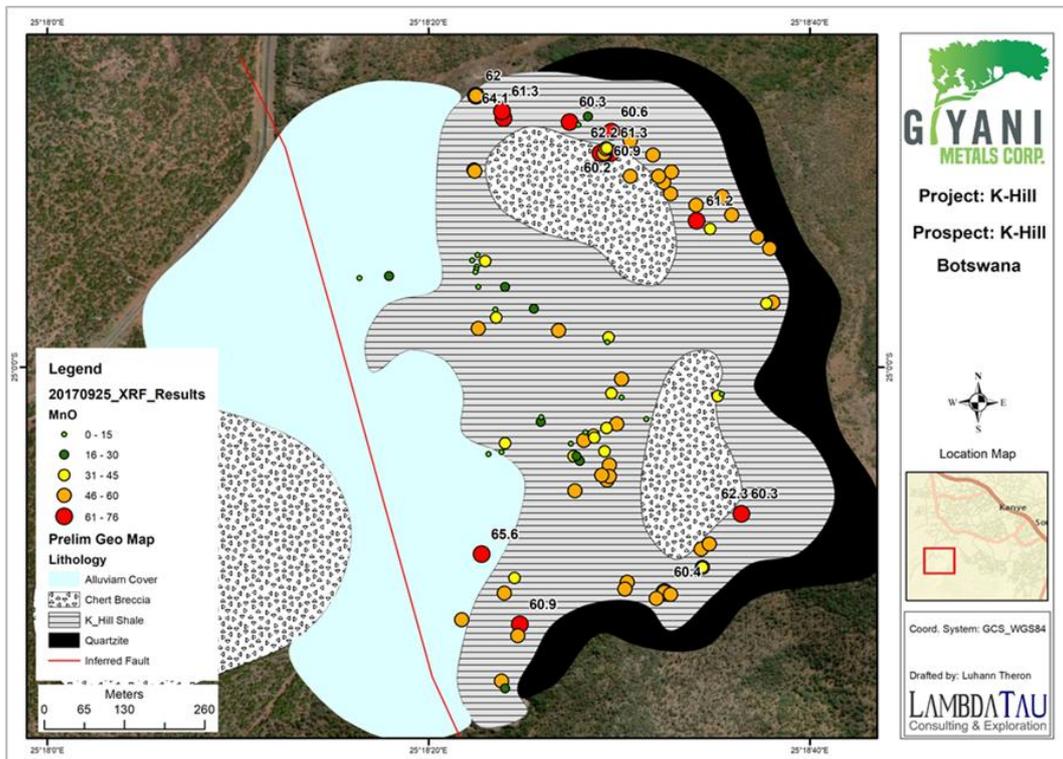
Source: LambdaTau, 2017

Figure 9-2: **Preliminary geological surface map of the K-Hill prospect area showing the grab sample locations and grades as ranges**

Table 9-1 summarises the average MnO values of the units sampled by the grab sampling programme at the K-Hill Project. It should be noted that the figures shown in Table 9-1 are the average results of a grab sampling exercise focussed on identifying the location of enhanced manganese mineralization and the potential of different units to contain elevated levels of manganese. These figures are not intended to represent an estimate of the grade of the units.

Table 9-1:   Summary of analytical results from the K-Hill grab sampling programme

Unit	Number of samples	Maximum MnO (%)	Minimum MnO (%)	Average MnO (%)	Comments
Manganiferous Shale	74	64.1	1.7	44.5	Main mineralised unit
Ferruginous Shale	9	0.08	0.04	0.05	
Chert Breccia	4	0.04	0.03	0.04	Hanging Wall
Silicified Shale	5	0.04	0.03	0.03	Hanging Wall
Quartzite	1	32.3	32.3	32.3	Footwall: Sample probably contaminated

9.3   Chip Channel Sampling Programme

Channel chip sampling was conducted at K-Hill at two locations. The aim was to collect representative samples from the Mn-Shale without any loss in material. The intended use of the samples was for future metallurgical test-work.

Two outcrops were identified for sampling, KH18CC_0001 and KH18CC_0002 (Figure 9-3). Site preparation included excavation at the bottom of the face to a depth of 1 m to achieve a full 3 m of exposed face. The exposed face was cleaned by removing the outer 5 cm of weathered material. Sampling was conducted over a 3 m intersection of the Mn-Shale unit in intervals of 1 m. A fourth sample consisting of a complete channel chip sample through the entire 3 m interval was also collected at each location.
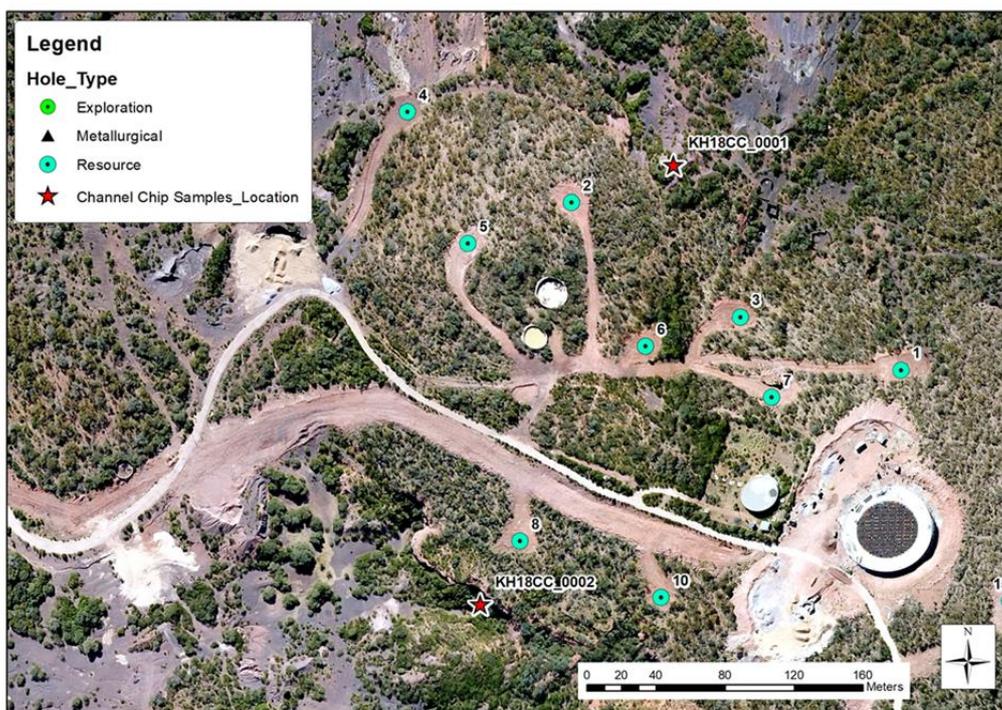
Source: LambdaTau, 2017

Figure 9-3:   Locations where the two channel chip samples were taken (shown as red asterixis)

9.4   Geophysics (Gravity, IP and Magnetics) Programme

Remote Exploration Services (Pty) Ltd (RES) was engaged by Giyani to complete high-resolution ground gravity and ground magnetic surveys over K-Hill. RES describes the geophysical surveys as follows (Remote Exploration Services, 2018):

- The K-Hill ground gravity grid comprised 1,987 planned gravity stations. All gravity grids were planned with 50 x 50 m spaced stations. Ground magnetic data were collected on the same survey lines as the gravity grids along north-northeast to south-southwest oriented lines at K-Hill. All data were collected in continuous surveying (Walkmag) mode which translates to a reading every 1 to 2 m on 50 m spaced survey lines. In total 101 km of magnetic data were collected over K Hill. Three 1 km IP/DC traverses were undertaken based on the results from the gravity and magnetic data

- Ground gravity station positions were measured using a Trimble R6 RTK DGPS. Coordinates for the beacons were provided by the Botswana Land Board in Cape LO25 format with orthometric heights. These coordinates were transformed to WGS 84 UTM 35S. Gravity station positions were marked and measured by walking a pattern which included approximately 5% internal repeats as well as approximately 5% external repeats. Following RTK surveying, gravity readings were taken over all stations. A Scintrex CG-5 Autograv gravity meter was used to complete the gravity survey

- Magnetic data were collected using a GEM Systems GSM19 Overhauser magnetometer in Walkmag at a 1 second sampling interval. A GEM proton precession magnetometer was used to monitor and correct for diurnal variations. Location data were collected with handheld GPS which was time synchronised with both Walkmag and base station magnetometers

- As regards IP/DC data collection and in order to evaluate the effectiveness of IP/DC techniques, three approximately 1 km lines of IP/DC were collected. IP/DC traverses were designed to extend from felsic volcanic basement, (Kanye Volcanic Formation), over the basal unit of the Transvaal quartzites (Black Reef Quartzite Formation), into Lower Transvaal shales (Kgwakgwe Shale Formation) and into upper Transvaal chert breccia (Kgwakgwe Chert Breccia Formation). The results of the ground gravity data were used to assist with the survey design. IP/DC data were collected in dipole-dipole configuration with a = 50 m and n = 1 – 7. A Zonge GDP32 receiver, GGT10 10 kVA transmitter and ZMG 7.5 kVA Generator were employed

- Various filters and processes were applied

9.4.1   Interpretation of Geophysical Data

Bouguer Anomaly and Total Magnetic Intensity images are provided in Figure 9-4 and Figure 9-5. The following broad geophysical characteristics can be ascribed to the geological units:

- Both gravity and magnetic datasets are dominated by the response of the felsic volcanics in the northeast and eastern portion of the survey area. These units produce significant gravity and magnetic anomalies

- The sedimentary units of the overlying Transvaal Supergroup are clearly mapped as distinct, structurally controlled, gravity lows

- A subtle contrast exists between the Lower and Upper Transvaal sedimentary units with Upper Transvaal rocks appearing to be denser and producing small gravity highs

- Thicker portions of the target Lower Transvaal units have been interpreted to correlate with more prominent associated gravity lows as a result

- No direct gravity response appears to be associated with the manganese oxides

- No clear magnetic contrasts have been mapped within the Transvaal sedimentary units although there is some evidence of subtle structure in the magnetic data

Source: Remote Exploration Services, 2018

Figure 9-4:   1:125,000 scale geology with survey stations and features of interest highlighted

Using a number of different filter and image products as well as depth slices through the unconstrained density volume, the relationships described above were used to map basin controlling structures, contacts with the target Lower Transvaal and areas where the Lower Transvaal units appear to thicken. The interpreted contacts and target areas for thicker Lower Transvaal correlate well with known geology and sample results. Additional prospective target areas have been identified under recent cover.
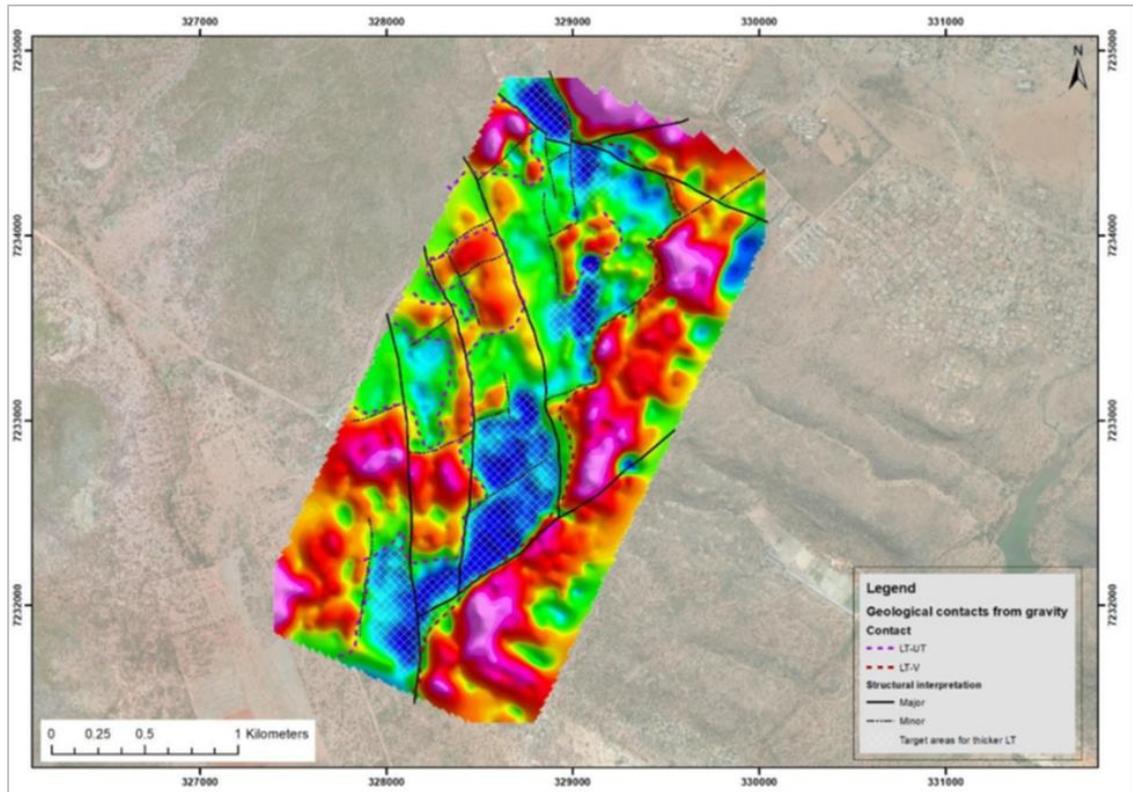
LT= Lower Transvaal, UT = Upper Transvaal, V = Ventersdorp
Hatched areas are the target areas for thicker Lower Transvaal
Source: Remote Exploration Services, 2018

Figure 9-5:   **Residual filtered Bouguer Anomaly image with structure, Lower Transvaal contacts and prospective areas for thicker Lower Transvaal units highlighted**

Ground gravity surveying proved to be an effective method for mapping out the extent and possible structural controls for manganese mineralization in the Lower Transvaal host rocks. Basement felsic volcanics are clearly delineated in both magnetic and gravity data where they are manifest as anomalous highs. IP/DC proved to be an effective means of mapping conductive Lower Transvaal host rocks over resistive Upper Transvaal and basement volcanics, as well as potentially higher chargeability manganese mineralization (RES,2018).

The IP/DC traverses results demonstrate high correlation with the gravity inversion and interpretation. As expected, the Lower Transvaal shale units are more conductive (lower resistivity) than underlying volcanics and overlying chert breccias correlate well with low density portions of the inverted density volume. Distinct IP chargeability anomalies coincide with the anticipated position of Mn-Shale. Significant cultural noise in the northern IP/DC traverse across the known mineralization has made direct comparison with the known mineralization somewhat ambiguous (RES, 2018).
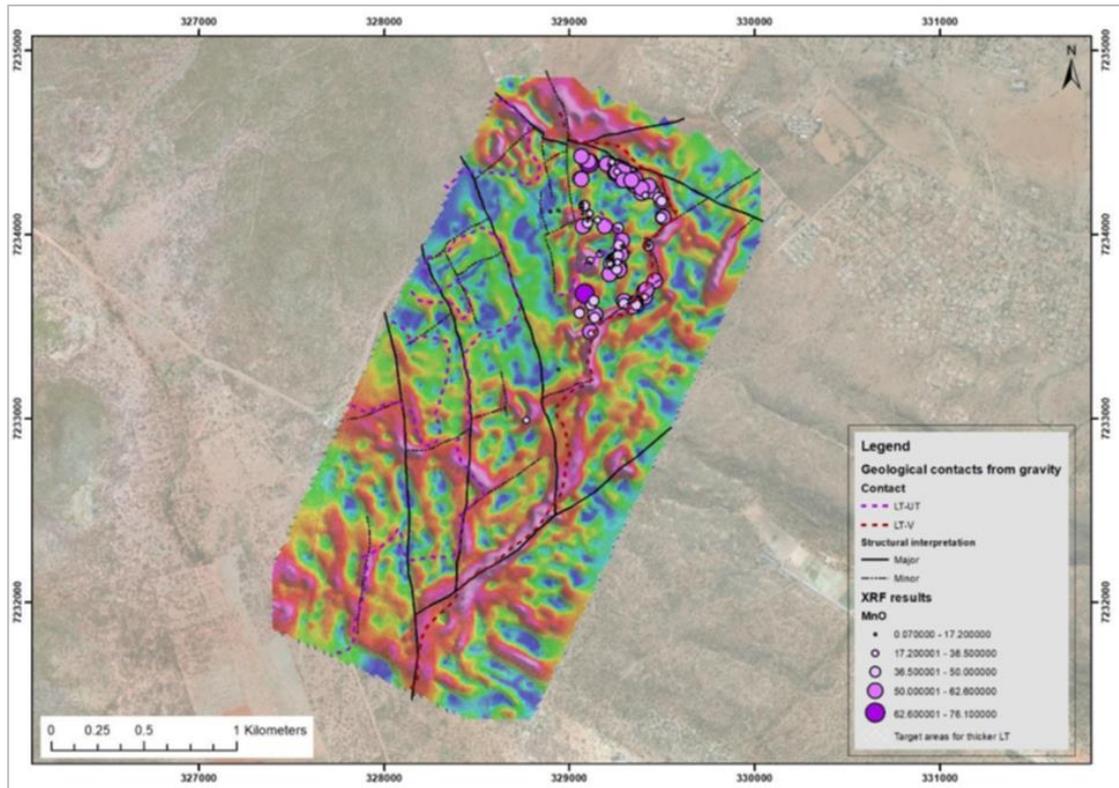
LT= Lower Transvaal, UT = Upper Transvaal, V = Ventersdorp
Source: Remote Exploration Services, 2018

Figure 9-6:   Total horizontal derivative of the Bouguer Anomaly with structure, Lower Transvaal contacts and prospective areas for thicker Lower Transvaal units highlighted. XRF MnO grab sample results are illustrated as scaled symbols

9.5   Topographic Survey

Giyani engaged the services of PhotoSat Information Ltd in April 2021 to acquire a 1m stereo satellite survey and 50cm orthophoto for the 31Km^2 Project area. The satellite photos were acquired on April 2nd, 2021. The 1 m satellite survey and 50 cm precision orthophoto were produced using PhotoSat's proprietary geophysical satellite processing system. PhotoSat were supplied with an additional 2,180 ground control points collected by DGPS and were able to use this data to vertically rectify the survey to an accuracy of 15 cm.

9.6   Mineralogical Investigation

A mineralogical analysis was performed on the K-Hill manganese oxide bearing rocks by Dr Flint at the Dalhousie Minerals Engineering Centre in Halifax Nova Scotia Canada (LambdaTau, 2018). Four samples were tested to determine the mineralogical composition of the manganese minerals. Haematite, other iron oxides, some pyrite along with silica, and kaolin in one horizon of the shales, are evident as well as manganese oxides. This study is described in more detail in Item 13 of this report.

10   DRILLING

10.1   Introduction

Drilling was undertaken in three programs at K-Hill: an initial diamond drilling (DD) program of 18 holes completed in June 2018 totalling 1,109 m, a follow up infill program of 96 reverse circulation (RC) holes (including 6 redrills) that commenced in November 2020 and was completed in June 2021 totalling 3,346 m, and a synchronous DD program of 11 holes for 346 m. The 2020 / 2021 diamond drilling was primarily completed for the purposes of geotechnical analysis, and as such this core has not been subject to sampling and assaying. That said, density determinations completed on the geotechnical holes (described in Section 10.3.4) have been utilised by SRK in assigning density to the Mineral Resource model.

10.2   Drillhole locations

Drilling has been completed on approximate 35 m to 50 m centres along the main axis of the deposit, with surface outcrop mapping delineating the margins where it intersects the hill topography. A map showing all drillhole collars coloured by drilling type is presented in Figure 10-1.   All drillholes were drilled vertically.
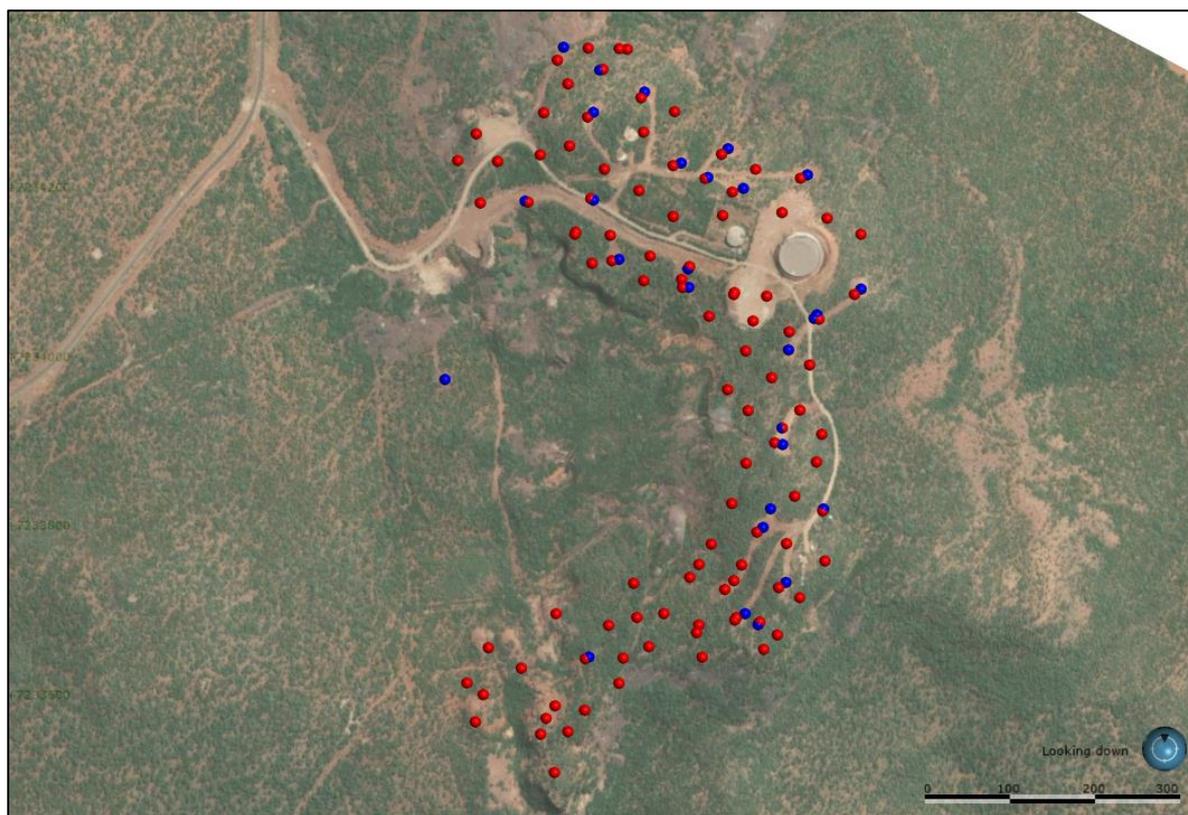
Figure 10-1:   **Plan view of the drillhole collars (red = RC, blue = DD) overlain on the K Hill satellite imagery**

10.3   Diamond Drilling

The below description of the DD drilling completed on the K-Hill Project to date is adapted and expanded upon from the November 2018 MSA ITR. SRK notes that the drill contractor, rig and supervision team remained unchanged for both the 2018 and the 2021 DD drilling program.

All DD drilling was undertaken by RotsDrill Botswana (RotsDrill). RotsDrill using an Atlas Copco CS14 diamond drilling rig. The drilling programmes were managed by Lambda Tau (a consultant to Giyani appointed to manage its exploration activities in Botswana). Holes were drilled using PQ core diameter and cased to depth with PVC Casing.

The standard operating procedure provides for a geologist to be assigned to the drill-rig to manage the drilling, stake collars, align and communicate with the drilling team. The drilling supervisor reported to the geologist on the progress of drilling twice a day at the change of each shift.

The geologist was also for and environmental matters. The drill-rig, drill site preparation and setup were audited at the start and during the drilling programme. The geologist also ensured that all sites were rehabilitated according to the Environmental Management Standards set forward by Giyani, prior to the drilling team leaving the drilling site.

Casing was left in the hole once a hole was completed. This was to ensure that the hole remained intact for any future down-hole geophysical surveys that might be required. A concrete plinth was constructed around the drillhole collar, such that 50 cm of casing protrudes above the concrete block to permanently mark the collar. The drillhole casing was sealed at the collar and a plate was inserted with the drillhole ID (Figure 10-2).

Source: MSA 2018

Figure 10-2:   Drillhole collar and site for DDKH18_0005

10.3.1 Storage

Drilled core was placed in core trays. The trays were labelled with drillhole ID at the top right corner of the box, as well as on the side. The drilling contractor was responsible for inserting core blocks to mark the drilled depths at the end of each run. Mechanical breaks in the core were marked with two small stripes on both sides of the break to enable appropriate fitting of the core later.

The drill contractor was responsible for all the core handling at the drill site and transportation of the core to the core shed, located in Kanye. The core was transported in core boxes, stacked to a maximum of five boxes, with a lid on the top core box. The stacked boxes were strapped together using a ratchet strap and further secured to the sides of the vehicle. The delivered core was accepted at the designated core shed by the on-site geologist or manager.

10.3.2 Logging

Geotechnical and geological logging and other data were recorded at the core shed. Standard logging codes were created to ensure that logging was standardized and to reduce errors in rock identification.

10.3.3 Sampling

The cores were cut longitudinally in half using a rotating diamond saw blade. For samples that were too soft or friable to be cut with a diamond saw, the samples were longitudinally cut in half manually with a knife blade. Half core samples were collected continually through the mineralised units at a 1 m nominal length, which was adjusted to smaller intervals in order to honour the lithological contacts. Half core samples were collected between core blocks where the recovery was less than 50%. This resulted in samples with drilled lengths longer than 1 m in some instances.

10.3.4 Density Measurements

2020 - 2021

A total of 35 density measurements were carried out using the Archimedean water immersion method on pieces of core, in both mineralised and waste rock. This method involves oven drying core samples, then weighing the dry core in air, and then weighing the same core while immersed in water. Giyani established that, when completely dry, the core samples tend to fragment and break down more readily once placed in water, precluding straightforward density determinations. As such, samples were wax coated prior to immersion.

2018

A total of 732 core density measurements were completed on the drill core during the 2018 drill programme. These samples were not dried or wax coated prior to undertaking density measurements. Thus, the recorded densities were considered to be wet, and not dry. SRK has not used this data in the derivation of the Mineral Resource presented herein, and instead has utilised the 2021 dataset, which, whilst comprising only a small number of density determinations, is considered to be a more accurate dataset. Further discussion is provided in Section 14.9.

10.3.5 Recovery

The Mn-Shale is soft and weathered, within which harder layers of MnO mineralization on a centimetre scale occur. Recovery was calculated through dividing the drilled length by the recovered length. In Phase 1 (2018), poor core recoveries were observed in most of the intersections of the Mn-Shale, averaging approximately 50% in the high-grade mineralization. Improved recoveries were achieved during the second phase of DD drilling (2020-2021), with recoveries averaging 91% in the manganiferous shale horizons.

10.3.6 Other Captured Data

On completion of each hole, collar locations were collected using a handheld global positioning system (GPS). Downhole surveying was not considered necessary because both the RC and DD holes were short and vertical, with end of hole depths rarely exceeding 70 m. The following information was recorded in the database:

- Hole number, with collar location, length, inclination and direction

- Drilled lengths and recovered lengths (for DD only)

- Geological and mineralogical descriptions

- Assay results

- Quality assurance and quality control (QAQC) samples

Following completion of all holes, a differential GPS (DGPS) of all collar locations was undertaken to provide highly accurate locations.

10.4 Reverse Circulation Drilling

An infill RC drill campaign was initiated in November 2020 and completed in June 2021. An approximate 40 m - 50 m spacing with an average depth of about 30 m was completed for this program.

RC drilling has been undertaken by two drill contractors, Stewardship Drilling and Master Drilling. Stewardship Drilling was responsible for the completion of the first 46 RC holes of the infill campaign, each drilled with a diameter of 127 mm. Master Drilling completed the remaining 50 RC holes of the 2020-2021 drill campaign. Master Drilling operates two remote-controlled, GPS-enabled Atlas Copco D65 drill machines, drilling holes with a diameter of up to 140 mm. All RC drilling was managed by Lambda Tau, who are appointed by Giyani to manage exploration activities in Botswana.

The standard operating procedure provides for a geologist to be assigned to the drill-rig to manage the drilling, stake collars, align the rig, and communicate with the drilling team. The drilling supervisor reports to the geologist on the progress of drilling twice a day at the change of each shift.

The geologist is also responsible for safety and environmental matters. The geologist also ensures that all sites are rehabilitated according to the Environmental Management Standards set forward by Giyani, prior to the drilling team leaving the drilling site.

The completed RC holes are capped by concrete plugs with the hole names written onto them consisting of the campaign by year of drilling, e.g. RCKH20, followed by the three digit hole number (Figure 10-3).

Source: SRK 2021

Figure 10-3:   Concrete RC collar plugs used to close and mark completed RC holes

10.4.1 Logging

Geological and alteration logging of chips are recorded at the core shed. Standard logging codes were created to ensure that logging was standardized and to reduce errors in rock identification.

10.4.2 Sampling

RC samples are collected at the rig-side directly from the cyclone at 0.5 m intervals and laid out sequentially (Figure 10-4). Sample bags are pre-prepared to ensure their correct labelling. The site geologists report that the samples typically range from between 10 – 12 kg. The entire sample is transported to the core shed for sample preparation and analysis.

Source: SRK 2021

Figure 10-4:   RC samples collected at 0.5 m intervals and laid out sequentially at the rig

10.4.3 Density Measurements

Density measurements are not carried out on RC samples.

10.4.4 Recovery

Giyani routinely monitored RC bag weights to track sample recovery during drilling. The average bag weight per each drilled metre, after being composited to 1 m, is plotted against the prevalence of logged intervals of Mn Shale. Analysis of this data shows no systematic effects or unexpected changes in recovery down hole and no significant decrease in recovery in zones of Mn-Shale.

10.4.5 Other Captured Data

On completion of each hole, collar surveys were completed using a handheld GPS. Downhole surveying was not necessary because the drilled holes were short and vertical, with end of hole depths ranging from 10 m to 41 m, typically 30 m. The following information was recorded in the database:

- Hole number, with collar location, length, inclination and direction

- Drilled lengths and recovered lengths

- Geological and mineralogical descriptions including weathering and alteration

- Assay results

- Quality assurance and quality control (QAQC) samples

Upon completion of the drilling, all collar locations were accurately surveyed using a DGPS.

10.5   Drillhole Database

Drilling information was captured into Microsoft Excel spreadsheets. After entry the data were checked by Luhann Theron, of Lambda Tau, Giyani's Chief Geologist. All the data were backed up on storage servers. The Microsoft Excel sheets were combined to create a drillhole database.

The K-Hill drillhole database consists of 143 holes with a total length of 4,736 m (excluding redrills) and 3,311 assays.

10.6   SRK Comment

SRK considers that the quantity and quality of data collected in the K-Hill drilling programme is sufficient to support the reporting of a Mineral Resource estimate. That said, the following concerns are highlighted:

- Core recovery in the phase 1 DD program is very poor, particularly within the Upper Mn Shale unit that is host to the MnO mineralisation. Specifically, average core recovery within the Upper Mn Shale is 41%. Recovery is less than 80% for approximately 85% of samples, and less than 50% for approximately 60% of samples. Three holes have no core recovery at all at the anticipated depth of the Upper Mn Shale unit. SRK notes that recoveries are much improved in the most recent Phase 3 DD drilling campaign, averaging 91% in the Mn Shales. At this stage there is no clear relationship observed between core recovery and grade (see Figure 10-5), although there is only limited data available as the phase 3 DD drilling program was undertaken for geotechnical purposes and therefore not assayed

- As noted in Section 10.3.4, due to the tendency of the more friable portions of drill core to fragment when dry, Giyani did not oven dry the drill core from the Phase 1 DD program prior to completing density determinations. As no moisture content for the samples is recorded, it has not been possible to accurately account for the water content of the samples and as such, SRK has only used data collected during the Phase 3 DD program where samples were fully dried and wax coated prior to density determination. Although this data is deemed to be more accurate, it is a significantly smaller dataset and does not have corresponding MnO assays to establish a correlation between MnO grade and density. SRK recommends that Giyani continue to undertake density measurements using this wax coating method
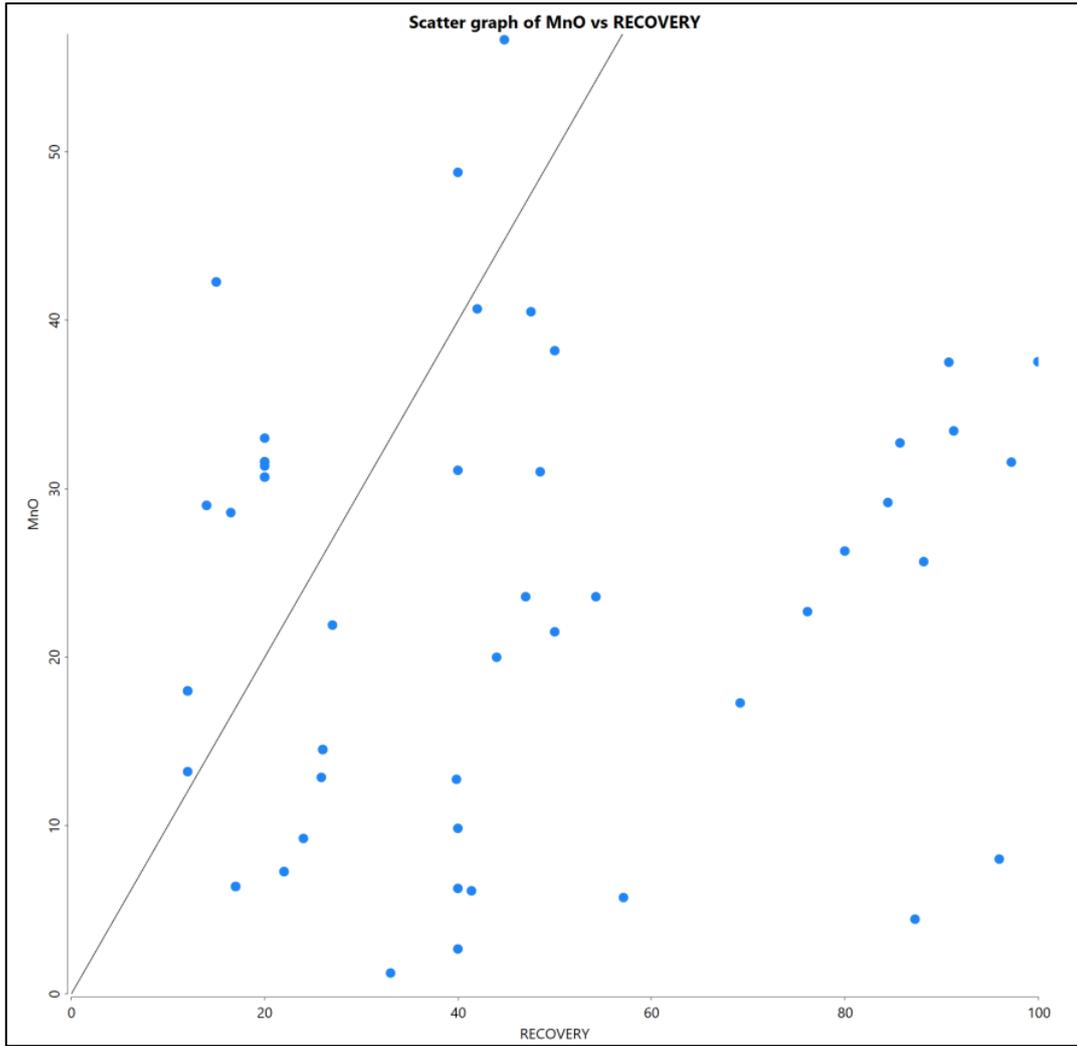
Figure 10-5:   **Scatterplot of Recovery (X axis) against MnO % (Y axis) in the Mn Shale. X=Y line shown in black. Data taken from the Phase 1 DD campaign only**

11 SAMPLE PREPARATION, ANALYSES AND SECURITY

11.1 Introduction

The following description of sample preparation, analysis and QAQC checks undertaken on the Phase 1 diamond drilling has been reproduced from the MSA 2018 ITR. SRK has documented sample preparation, analysis and QAQC checks undertaken on the RC drilling campaign.

11.2 DD and RC Sample Dispatch

Samples were dispatched in batches of approximately 100 samples. The sample batches were exported by Aramex (for the DD program) and Pinnacle Express (for the RC program) to SGS laboratory in Randfontein, South Africa, for geochemical analysis.

The chain-of-custody was maintained by signature at every point that the samples exchanged hands, from the core shed in Kanye, where the samples were stored, to the laboratory. As part of the laboratory procedure, all samples were weighed. All the persons involved in the chain-of-custody were required to submit a copy of their receipt of handover of the samples to the project manager for record keeping on site.

11.3 Sample Preparation

11.3.1 Diamond Drill Core Sample Preparation

Samples were prepared and analysed at SGS Laboratories in Randfontein, South Africa (SGS). This is an independent commercial laboratory, which is ISO17025 accredited by SANAS for chemical analysis. The sample preparation method code used is PRP87, which entails the following procedure:

- Samples are weighed on arrival

- The samples are dried and then crushed using a jaw crusher to 80% passing through a 2 mm screen

- A 500 g sub-sample is collected from a riffle splitter

- The 500 g sub-sample is pulverized using a carbon steel ring and puck to 85 % passing through a 75-micron screen

- Pulps are logged against sample numbers and submitted for analysis

    All pulverized reject samples are stored at SGS

11.3.2 RC Sample Preparation

Sample preparation for the RC samples follows a procedure detailed in the LT20051R standard operating procedure:

- Samples received from the drill site are weighed to record the full primary sample

- A 3-4 kg "A-sample" subset is collected from a riffle splitter, with the residual primary sample retained until the completion of the A-sample analysis or for metallurgical test-work

- Samples are washed to collect a reference chip sample and to visually identify the interval of Mn mineralisation

- The mineralised intervals, including 4 bounding samples either side, are compiled with QAQC samples to form the sample stream for laboratory analysis

- If two or more mineralised intersections are identified, all material internal to these intervals are sampled too

- The A-sample mineralised stream is separated and marked for pXRF analysis

- 10 – to 15g of A-sample is pulverised for a programmed time and speed (240 seconds) using an Equilab EQM-402 MixerMill, then placed into a sample cup for analysis by pXRF

11.4   DD and RC Sample Analysis

All samples were assayed at SGS Laboratories in Randfontein, South Africa by method XRF76V, which assays major element oxides by x-ray fluorescence (XRF) using borate fusion. The oxides assayed included Al_2O_3, CaO, Cr_2O_3, Fe_2O_3, MgO, MnO, Na_2O, P_2O5, K_2O, SiO_2, TiO_2 and V_2O_5 reported in percent, as well as loss on ignition.

The analytical procedure involves the following:

- A pulverised sample between 0.2 g and 0.7 g is required for analyses

- The samples are mixed with 10 g of flux, which is made up of equal amounts of lithium tetraborate-metaborate and a non-wetting agent

- The sample is fused to create a bead

- X-ray fluorescence is carried out on the fused bead

- Loss on ignition is determined separately by roasting approximately 1g of the pulverized sample at 1,000 degree Celsius for 1 hour in a furnace

11.5   Quality Assurance and Quality Control (QAQC)

11.5.1 Diamond Drilling

This section describes the quality control procedures undertaken for samples submitted as part of the Phase 1 DD program. No comment is provided on the Phase 3 DD program as the drilling was undertaken for geotechnical purposes and no core analysis was undertaken.

Quality control samples were inserted to test analytical accuracy, laboratory contamination and repeatability on a hole by hole basis. Certified reference material (CRM) samples and blank samples were inserted into the sample stream with the core samples. Duplicate samples were inserted at the laboratory. Empty bags with sample labels were submitted to the sample preparation laboratory with an instruction to make a duplicate of a specified sample and insert into the sample sequence. One CRM, one blank and one duplicate sample were inserted into the sample stream for every 20 core samples.

Blanks

A total of 19 blank samples were inserted within the field sample stream in order to detect contamination, especially in the preparation stage. The number of blank samples inserted equals a 5% insertion rate, which is in line with industry practice. Giyani used blank silica chips from African Mineral Standards (AMIS; Table 11-1).

Table 11-1:   AMIS0439 blank silica chips certified mean grades and two standard deviation values

Variable	Certified value (%)	Two standard deviations (%)
Al_2O_3	0.99	0.13
CaO	0.02	0.01
Cr_2O_3	0.01	0.002
Fe_2O_3	1.53	0.23
K_2O	0.21	0.04
MgO	0.03	0.01
MnO	0.01	0.01
Na_2O	0.02	0.01
P_2O_5	0.01	0.003
SiO_2	96.9	0.4
TiO_2	0.06	0.01

All the MnO assays of the blank samples, except two, are below the upper limit. The upper limit is the upper threshold below which the blank assays are expected to be when there is no contamination and is generally taken at ten times the lower detection limit for the method used for each analyte. The blank assays that returned values beyond the upper limit had assays of between 0.19% and 42.5% MnO.

An assay of 42.5% MnO is considered to be too high to result from contamination. It is therefore concluded that this sample was swapped with a field sample. The other blank failure, with an assayed grade of 0.19%, could have been due to contamination as it follows a CRM, which has an assayed grade of 60.1% MnO. Contamination should not have taken place during the sample preparation phase as CRMs are inserted as pulverised material, so they do not require any crushing where most contamination takes place. Overall, the blank sample assay grades for MnO show that there may have been some contamination at the laboratory, but this was low and would not have any significant impact on the MnO grade of the drillhole core samples (Figure 11-1).

Analyses of blank samples were also undertaken for Al_2O_3, CaO, Fe_2O_3, MgO and P_2O_5. The Al_2O_3 and Fe_2O_3 grades were judged in reference to three standard deviations of the certified values. The average assayed grade of the blank sample for Al2O3 and Fe2O3 is 1.4% and 2.6%, respectively. Out of 19 samples, one was interpreted to be a sample swap, 11 Fe2O3 assays are outside three standard deviations of the certified value, and five Al2O3 assays are outside three standard deviations of the certified value.

It is considered that the level of possible contamination within the Phase 1 DD samples is low. The reason for the elevated Fe_2O_3 values is uncertain as the sample cannot be contaminated for only one analyte. This is more likely either an assay accuracy issue or inherent variability in the blank material. It is recommended that Giyani carefully monitor the accuracy of the SGS laboratory results for Fe_2O_3 as the project develops.
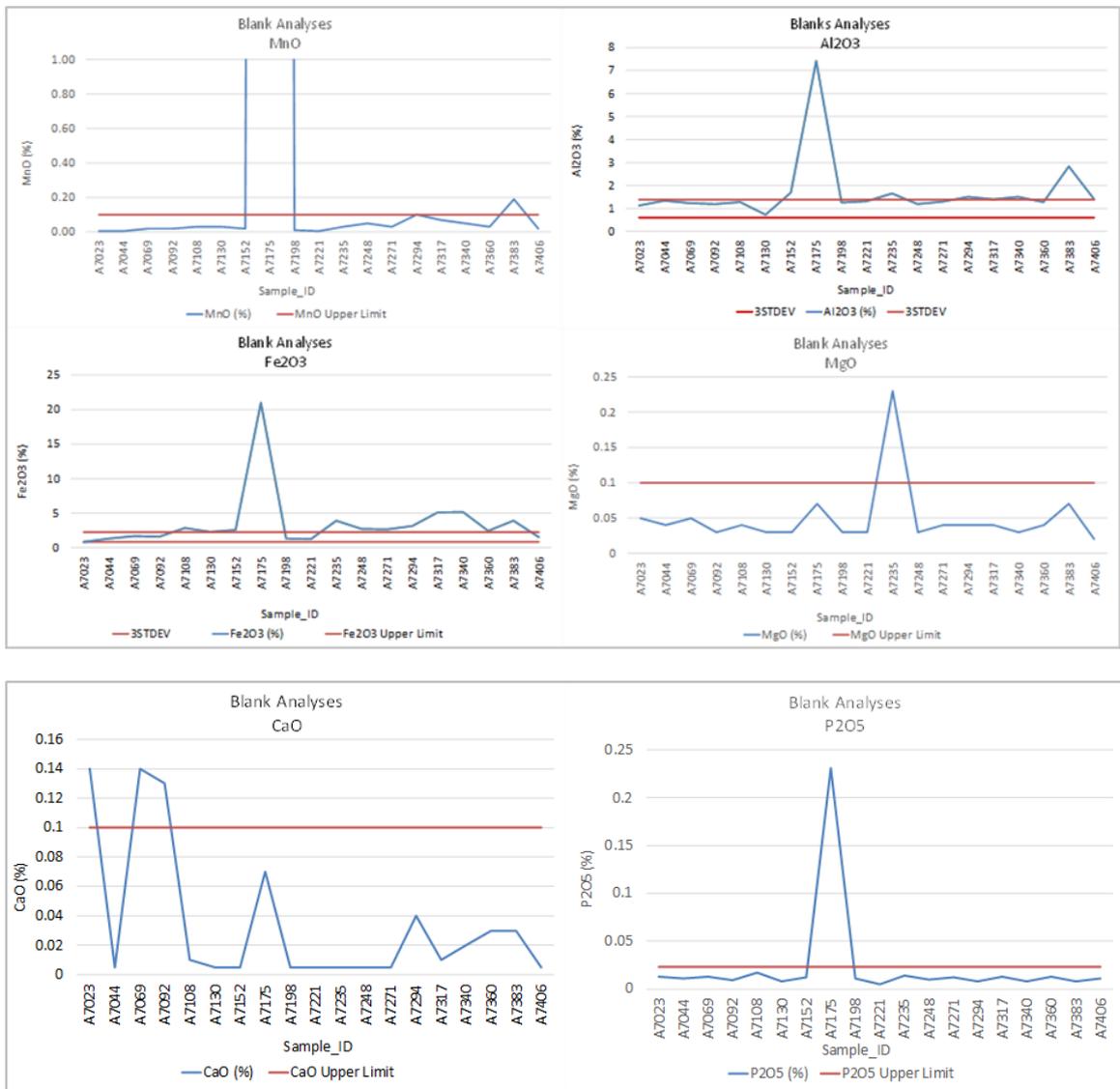
Source: MSA, 2018

Figure 11-1:   Results of blank sample assays

11.5.2 CRM

Samples of a single CRM (AMIS0403) were inserted within the K-Hill drillhole core sample stream. This CRM was made from manganese mineralisation from the Wessels Mine in the Kalahari Manganese Field in South Africa and is described in Table 11-2 below.

Table 11-2: AMIS0403 certified value and two standard deviation value

Variable	Certified value (%)	Two standard deviations (%)
MnO	60.42	0.64
Al_2O_3	0.37	0.02
CaO	5.12	0.14
Fe_2O_3	18.52	0.36
MgO	0.66	0.06
P_2O_5	0.08	0.008
SiO_2	5.25	0.18
LOI	4.27	0.48

Source: MSA, 2018

The number of CRMs inserted was 19, equating to a 5% insertion rate within the K-Hill samples, which is in line with acceptable industry practice. The MnO grade of the CRM was high relative to the K-Hill samples and more than one CRM is generally recommended.

Out of 19 samples, only one sample returned a value outside three standard deviations of the certified MnO value. This sample had a grade of 0.02% MnO and is considered to be a sample swap. The average grade of the CRM assays, excluding the sample swap, is 60.51% MnO, which compares favourably with the CRM certified value of 60.42% MnO (Figure 11-2).

The CRM samples were also assayed for Al2O3, CaO, Fe2O3, MgO, P2O5 and SiO2. The CRM assays for these variables are within three standard deviations of the certified value of the respective variables, except for one Al2O3 assay that returned a value above the limit. None of the variables showed significant bias, and none exceeded 4% relative difference from the certified values (Figure 11-2).

In general the assayed grades of the Phase 1 DD CRM samples indicate acceptable analytical accuracy at the grade of the CRM. That said, the single CRM used does not fully confirm the accuracy of assays at the ranges of MnO grades at K-Hill, since the K-Hill drillhole core samples have lower MnO grades than the certified value of the CRM.
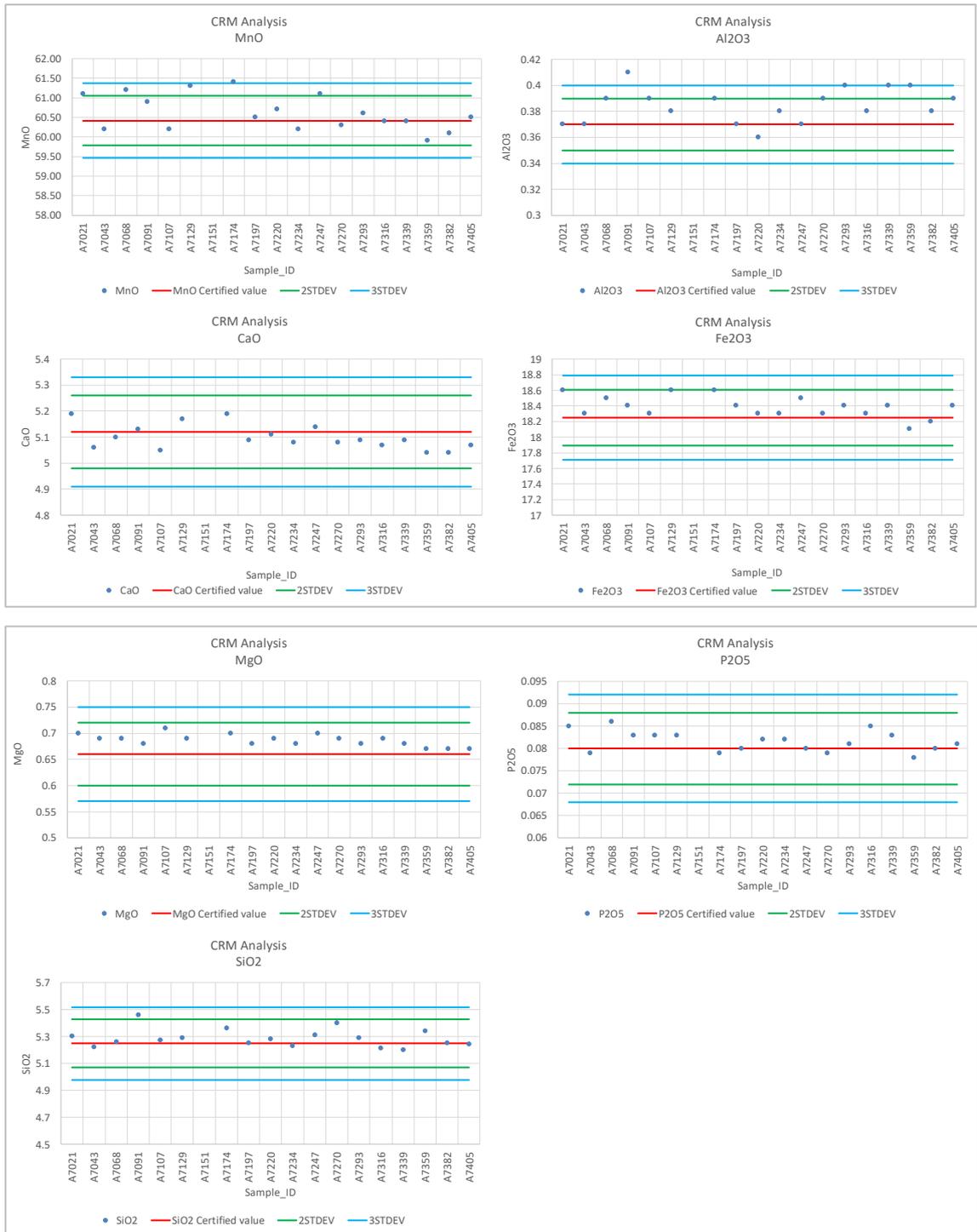
Source: MSA, 2018

Figure 11-2:   Results of AMIS0403 CRM sample assays

11.5.3 Coarse Duplicates

Coarse duplicates were inserted to assess the adequacy of the sub-sampling process after crushing and the repeatability of the analytical process. As per the laboratory sample preparation standard operating procedure, a sub-sample of 500 g was collected using a riffle splitter after crushing. At this point, a second sub-sample was collected as a coarse duplicate and assigned a different sample number.

The duplicate assays of MnO, Al_2O_3, CaO, Fe_2O_3, MgO, P_2O_5 and SiO_2 show good precision (or repeatability) with linear correlation coefficients of greater than 0.9 (Figure 11-3 and Figure 11-4). This suggests that the sub-sampling process and the analytical processes are repeatable, and the results thereof are appropriate for Mineral Resource estimation.
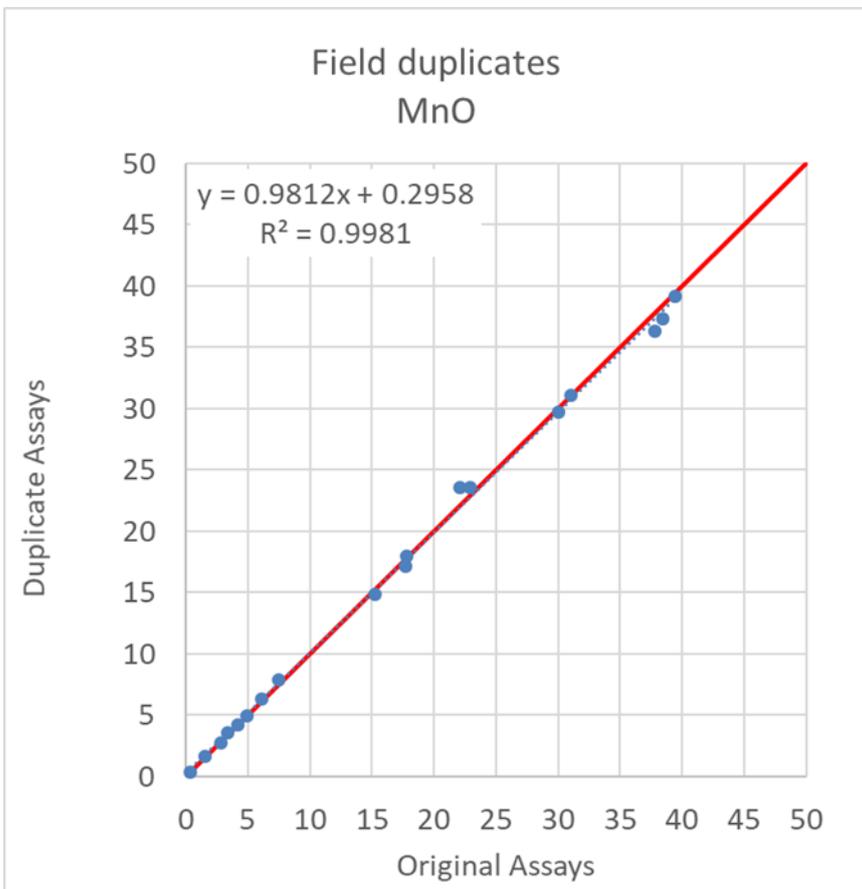
Source: MSA, 2018

Figure 11-3:   Scatterplot of MnO assay pairs (in percent) of duplicate samples
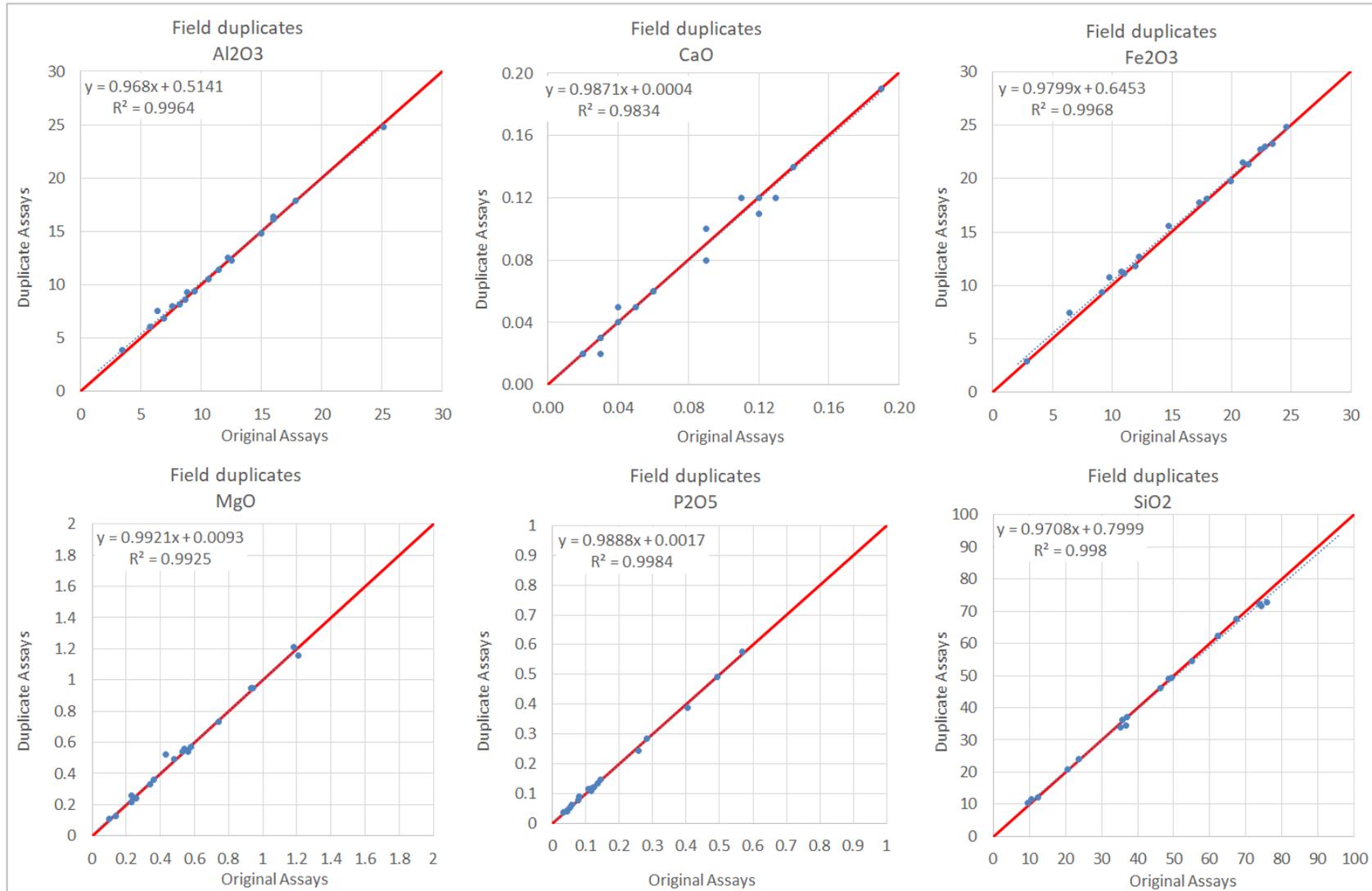
Source: MSA, 2018

Figure 11-4:   Scatterplots of duplicate sample assay pairs (in percent)

11.5.4 Check Assays

Reject material from 40 samples that had previously been assayed by SGS was submitted to Intertek Genalysis laboratory in Maddington, Australia. This is an independent commercial laboratory, which is ISO17025 accredited by the National Association of Testing Authorities, Australia (NATA) for chemical testing. The duplicate samples were accompanied by 4 CRM and 4 blank samples. The assay method undertaken on these samples was x-ray fluorescence (XRF), similar to the primary laboratory (SGS) assay method. The insertion rate was 10%.

The blank samples accompanying the check assays returned grades close to the detection limit for all variables, including MnO (Figure 11-5). This indicates that there was limited, if any, contamination at the laboratory, during the assaying of these samples.
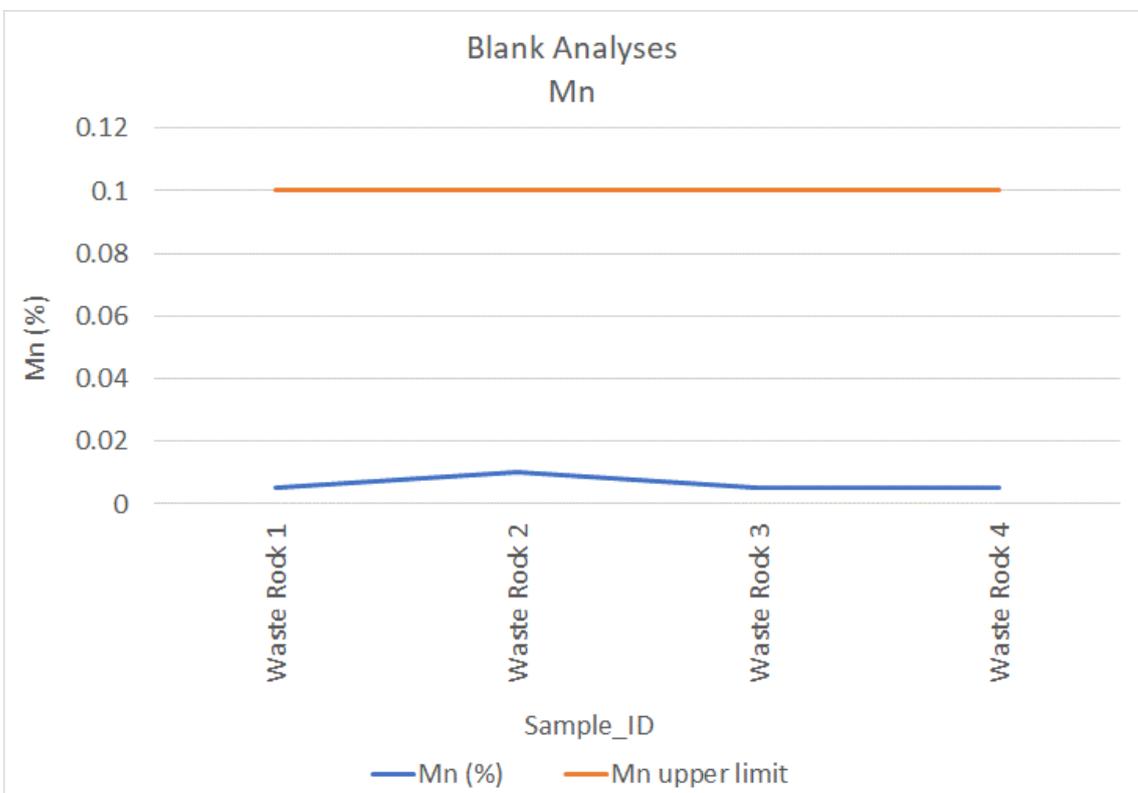
Source: MSA, 2018

Figure 11-5:   Assays of MnO in blank samples accompanying the check assays

The CRM samples inserted with the check assay batch were sourced from AMIS0407. The assays that were returned are within two standard deviations of the certified MnO value for this method (Figure 11-6).
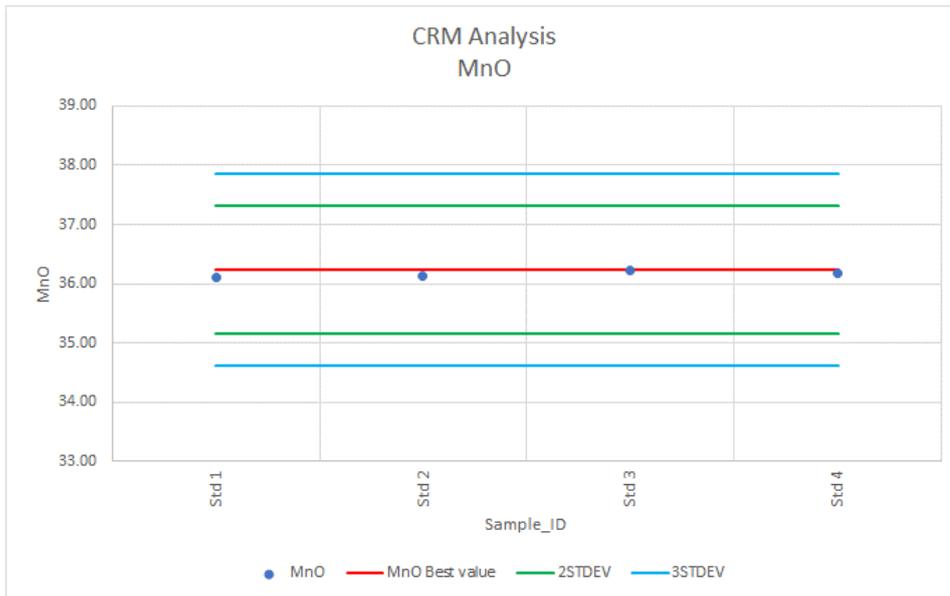
Source: MSA, 2018

Figure 11-6:   MnO assays (in percent) of AMIS0407 samples by the check laboratory

A scatterplot comparing the MnO assays from the primary and the secondary laboratory shows very good correlation, with a linear correlation coefficient of approximately 1 (Figure 11-7).
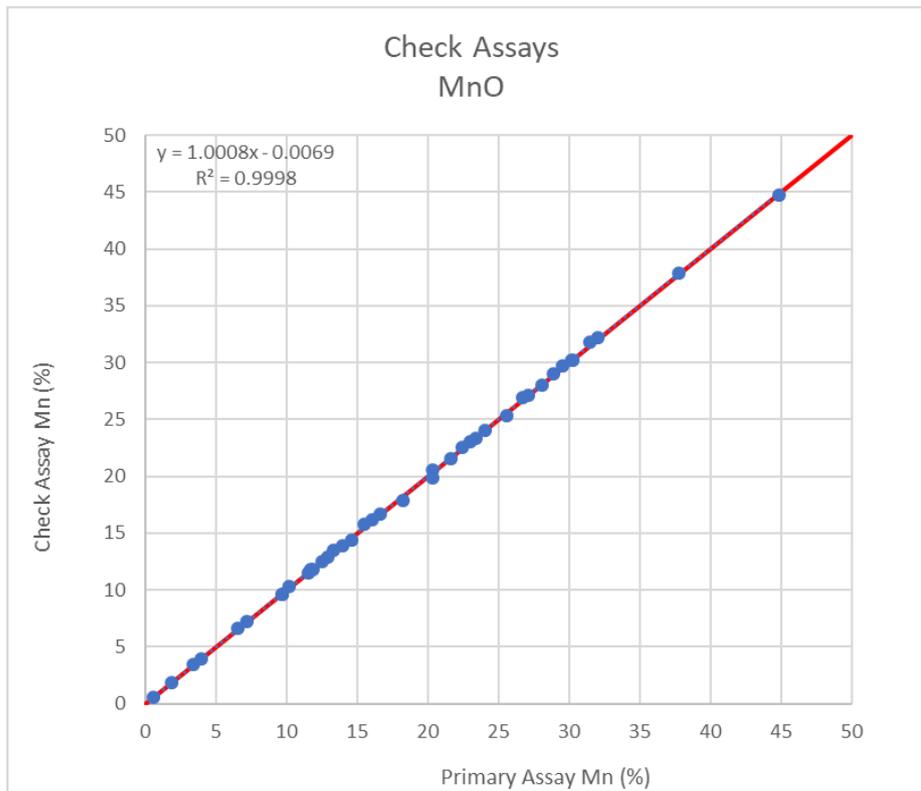
Source: MSA, 2018

Figure 11-7:   Scatterplot of MnO assays (in percent) of the primary laboratory versus the secondary laboratory

11.5.5 SRK Comments on Phase 1 Diamond Drilling QAQC

The results of the QAQC measures applied for K-Hill do not indicate significant contamination and demonstrate a high degree of accuracy and precision. The check laboratory assays confirm the primary laboratory assays within close limits.

SRK have not completed an independent check or visit to observe the sample preparation and analysis at the SGS laboratory in Randfontein. That said, the results of the QAQC process do not highlight any significant concerns in the quality of the diamond drilling assay data used in the derivation of the K-Hill Mineral Resource estimate. It is noted that the MnO grade of the CRM selected for QAQC analysis by Giyani is not representative of the K-Hill deposit. Giyani should aim to use a combination of CRM over a range of grades that are reflective of the grade profile of the K-Hill deposit in future, rather than a single CRM.

11.5.6 RC Drilling QAQC

During the RC drilling campaign (96 drillholes) conducted between November 2020 and June 2021 a total of 427 QAQC samples were inserted into the sample stream. The QAQC samples included 121 blanks, 224 CRM, 42 field duplicates and 40 pulp duplicates, representing an overall QAQC sample insertion rate of approximately 13%.

11.5.7 Blanks

Giyani used "AMIS 0681" and "AMIS 0439 Blank Silica Chips for blank material submission to the laboratory to monitor sample contamination, with the results shown in Figure 11-8 and Figure 11-9. The results show a significant proportion of samples at, or exceeding the specified failure threshold (0.01% MnO). A total of three samples returned MnO (%) values greater than 0.1%, but all <1% MnO. Whilst noting that the results suggest minor contamination, the degree of contamination (typically <0.05% MnO) is not considered material in the context of the average MnO grades within the shale horizons.
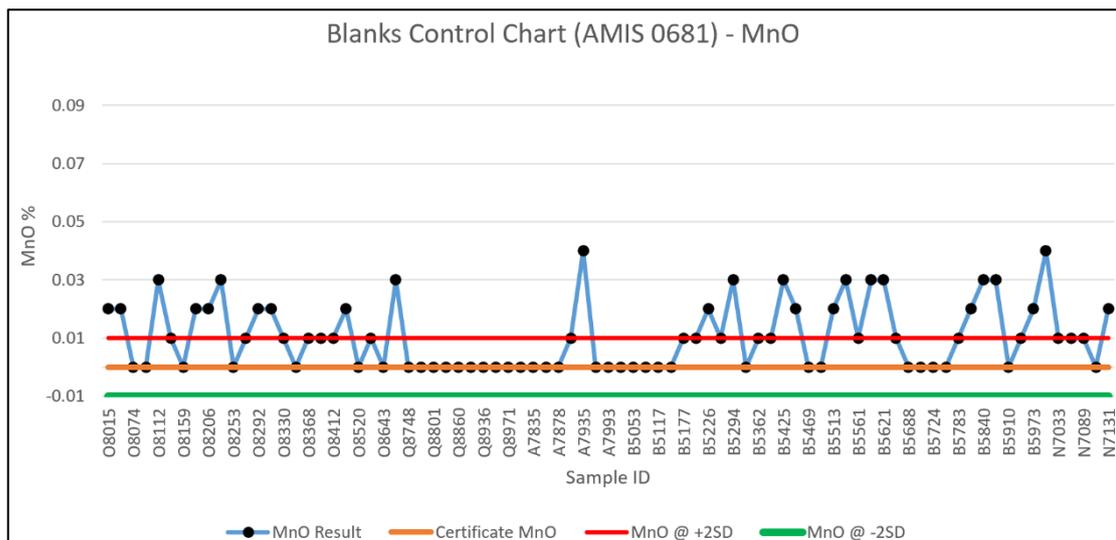
Figure 11-8:   Blank sample (AMIS 0681) control plot – 2020/21 RC drilling
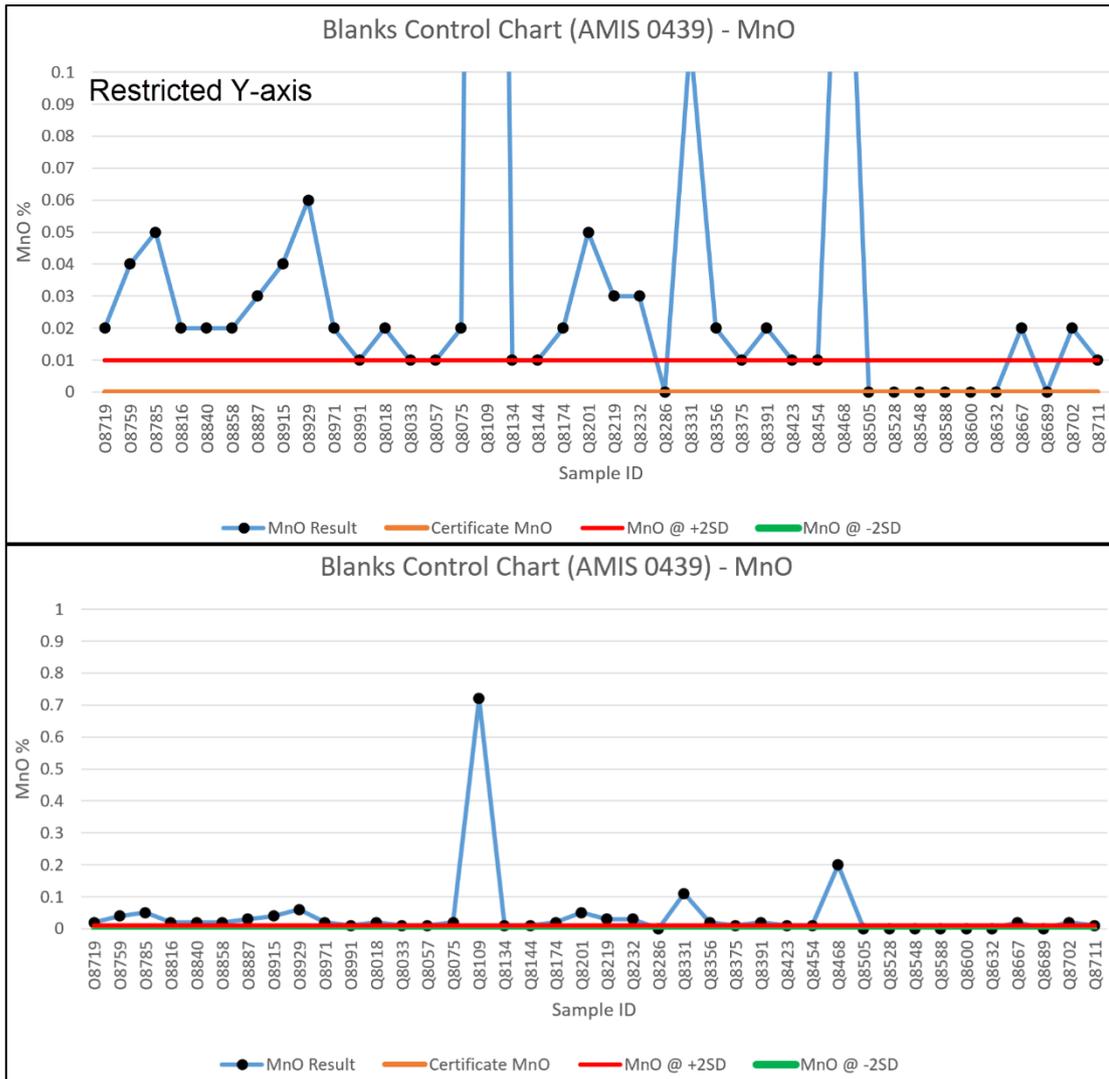
Figure 11-9:   Blank sample (AMIS 0439) control plot – 2020/21 RC drilling

11.5.8 CRM

Samples of 3 separate CRM (AMIS0407/533/535), covering a grade range of approximately 24-47% MnO, were inserted into the K-Hill drillhole core sample stream. The CRM are produced by African Mineral Standards (AMIS) and derived from manganese mineralisation from the Sakura Ferro-Alloy (Malaysia) and the Mamatwan Mine in the Kalahari Manganese Field, South Africa. CRM grades for the main analysed elements are provided in Table 11-3 below. The MnO grades of the CRM are appropriate to the average grade of the mineralised K-Hill samples, although inclusion of a lower grade CRM at or around the Mineral Resource reporting grade (8-12% MnO) would be a beneficial addition.

Table 11-3:   CRM values for MnO(%)

CRM	Certified value (%)	Two standard deviations (%)
AMIS0407	46.81	0.74
AMIS0533	23.97	0.555
AMIS0535	26.70	0.83

The submission and failure rates of the three CRM are summarised in Table 11-4, with performance illustrated graphically in Figure 11-10 to Figure 11-12.

Table 11-4:   Summary of CRM performance for the Phase 2 RC drilling campaign

CRM	Number of Submissions	Insertion rate (%)	Number of Failures	Failure Rate (%)
AMIS0407	73	2.2%	7	10%
AMIS0533	78	2.3%	2	3%
AMIS0535	73	2.2%	2	3%
Totals	**224**	**6.7%**	**11**	**5%**
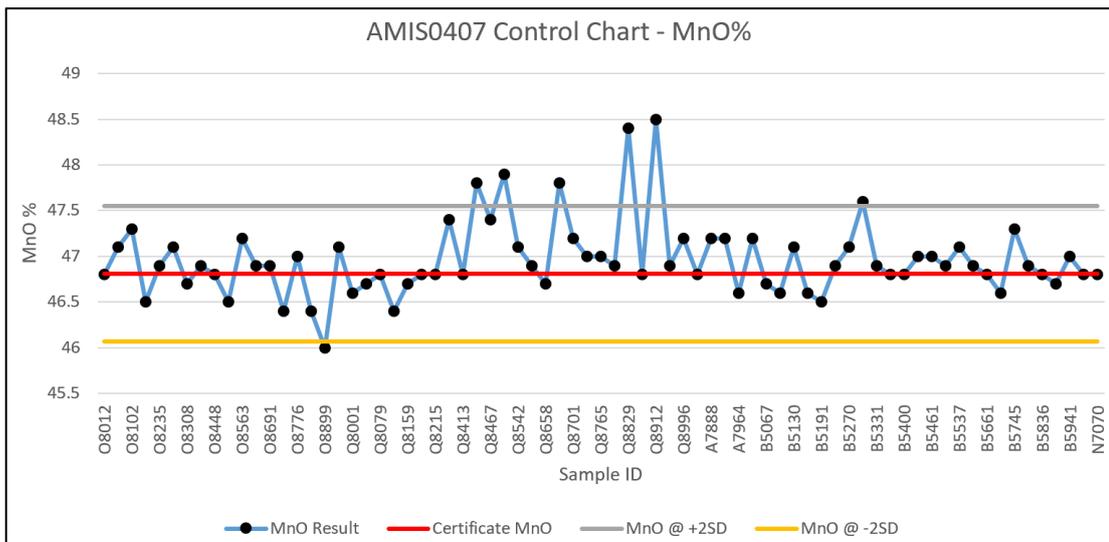
Figure 11-10:   CRM control plot for CRM AMIS0407 – 2020/21 RC drilling
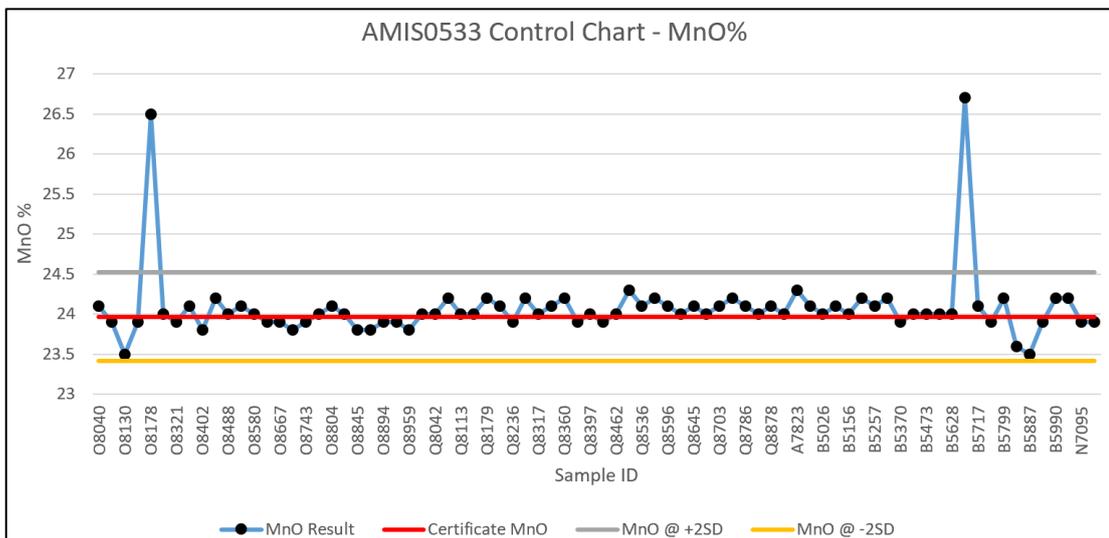
Figure 11-11:   CRM control plot for CRM AMIS0533 – 2020/21 RC drilling
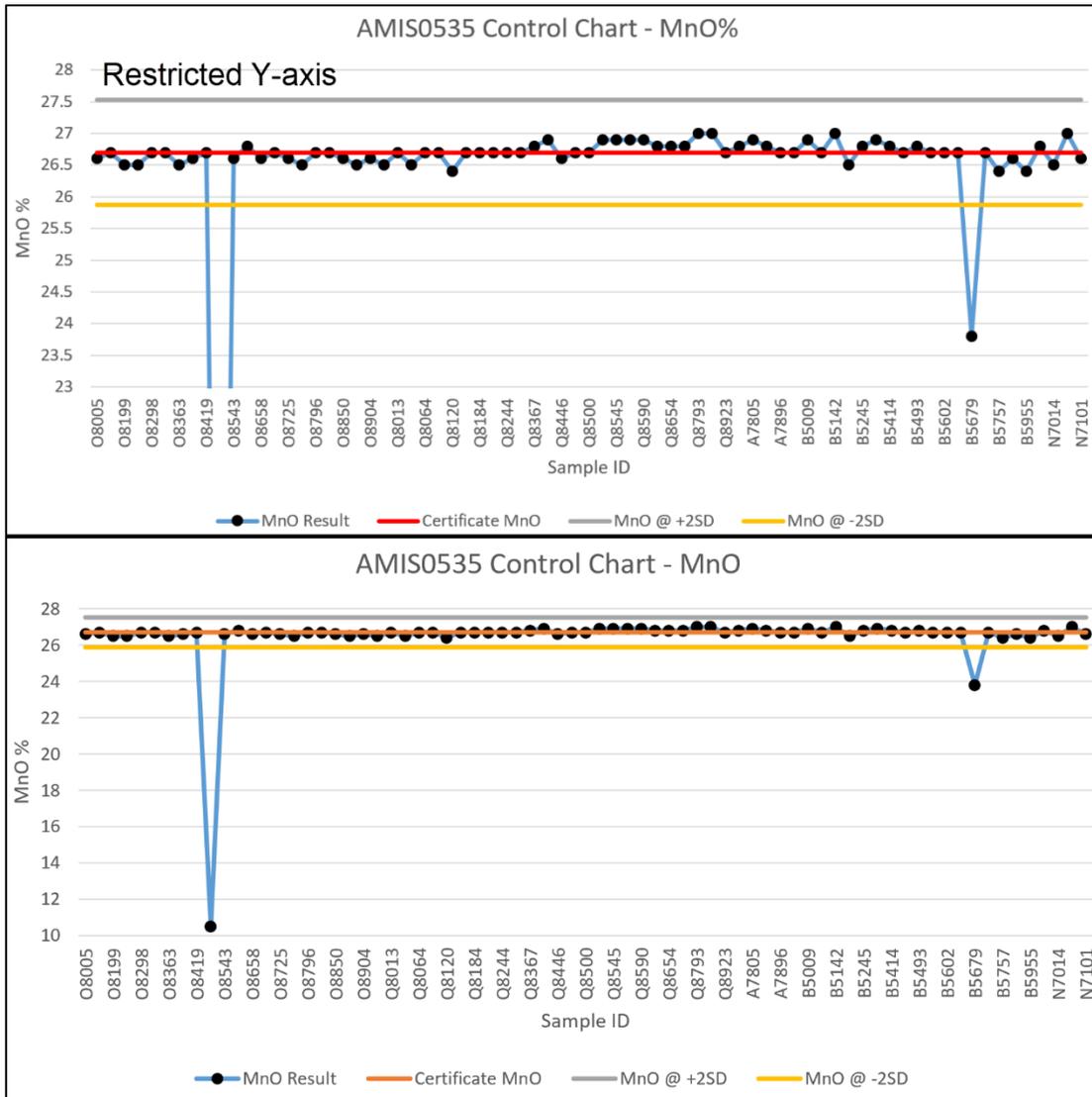
Figure 11-12:   CRM control plot for CRM AMIS0535 – 2020/21 RC drilling

Overall, the two lower grade CRM (AMIS0533 and AMIS0535) perform well, with the two AMIS0533 failures likely due to sample swaps with AMIS0535 samples, and the same being true of one of the two AMIS0535 failures. The higher grade AMIS0407 CRM shows some periods of systematic over-reporting of true grades by approximately 0.5-1.0% MnO. However, given that the majority of samples fall within 2 standard deviations of the certified value for this CRM, SRK does not consider there to be a material risk to the accuracy of the sample analyses during this period.

The CRM samples were also assayed for Al_2O_3, CaO, Fe_2O_3, MgO, P_2O_5 and SiO_2. For brevity, SRK has not provided graphs of CRM performance of these elements. The CRM assays for these variables are all within four standard deviations of the certified value of the respective variables, except for samples previously identified as likely CRM swaps. None of the variables showed any significant, consistent bias.

11.5.9 Duplicates

A total of 42 field and 40 pulp duplicates were inserted into the regular sample stream during the 2020/21 RC drilling campaign, representing insertion rates of approximately 1.3% and 1.2%, respectively. Overall, both duplicate sample types show good precision (Figure 11-13 and Figure 11-14). As such, SRK considers that the sub-sampling and analytical processes show an acceptable degree of repeatability, and the precision of the assay results determined during this drilling campaign is appropriate for Mineral Resource estimation.
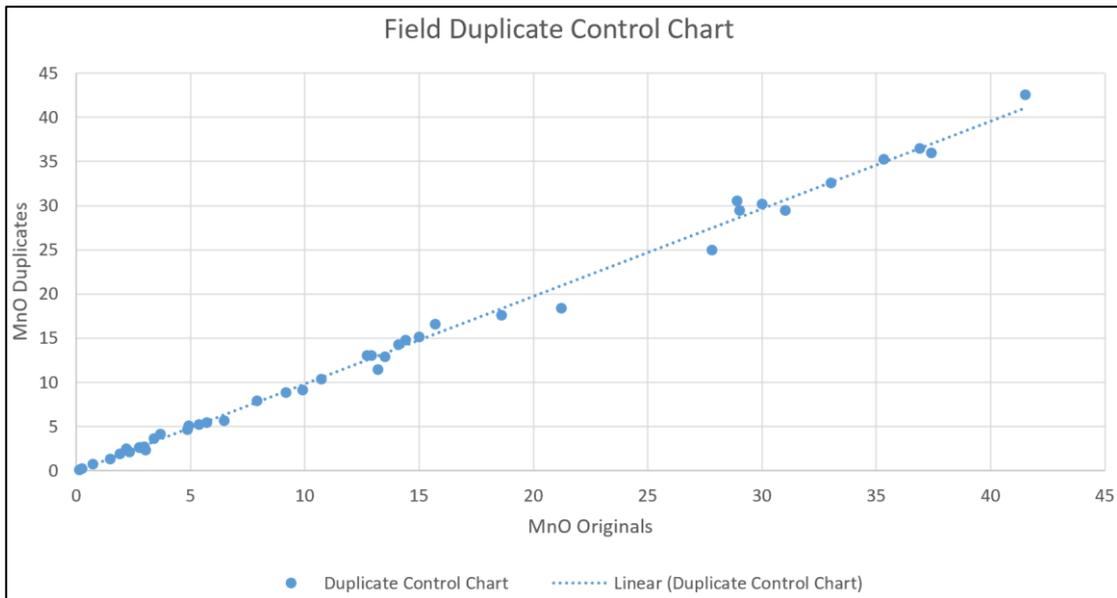
Figure 11-13:   Field duplicate control plot – 2020/21 RC drilling
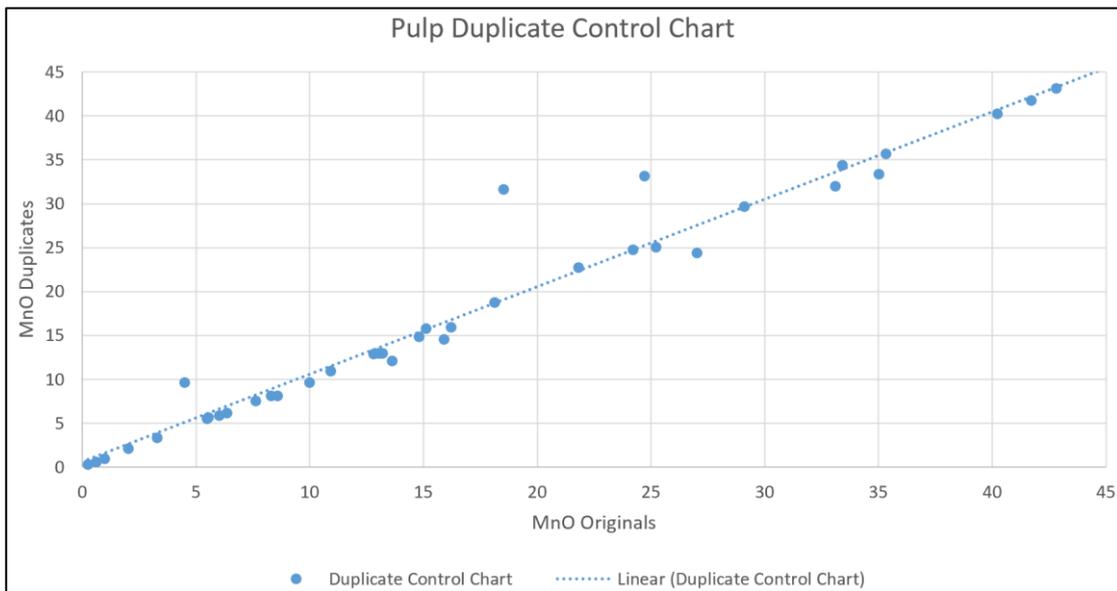
Figure 11-14:   Pulp duplicate control plot – 2020/21 RC drilling

11.5.10 Umpire Analyses

As an external control, a total of 139 duplicate samples from the 2020-21 RC drilling programme were sent to an umpire laboratory (Intertek Genalysis, Australia) for analysis. Overall, there is an excellent correlation (R^2 > 0.99 for the major oxides of interest) between original (SGS) and Umpire (Intertek) analyses for each of the elements analysed (Figure 11-15 to Figure 11-16). Based on these results, SRK does not consider there to have been a material issue with the accuracy, precision or contamination of RC sample analyses conducted at the SGS laboratory during this period.
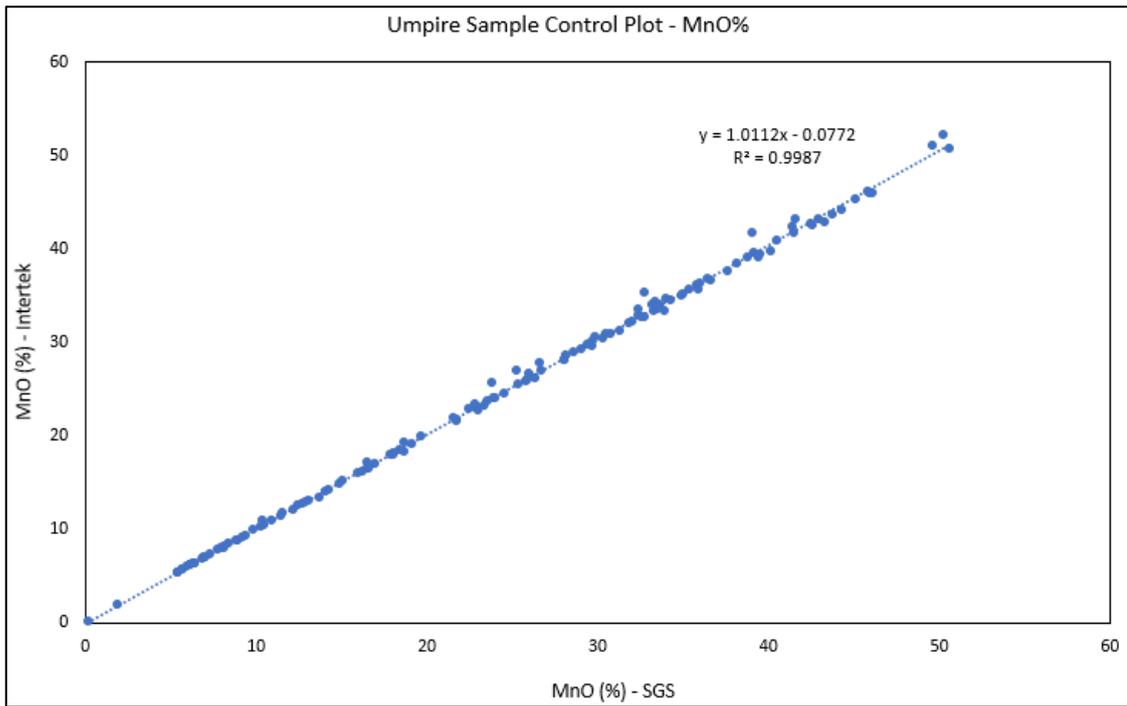
Figure 11-15: Umpire sample control plot for MnO (%) analyses at the primary (SGS and Umpire (Intertek) laboratories
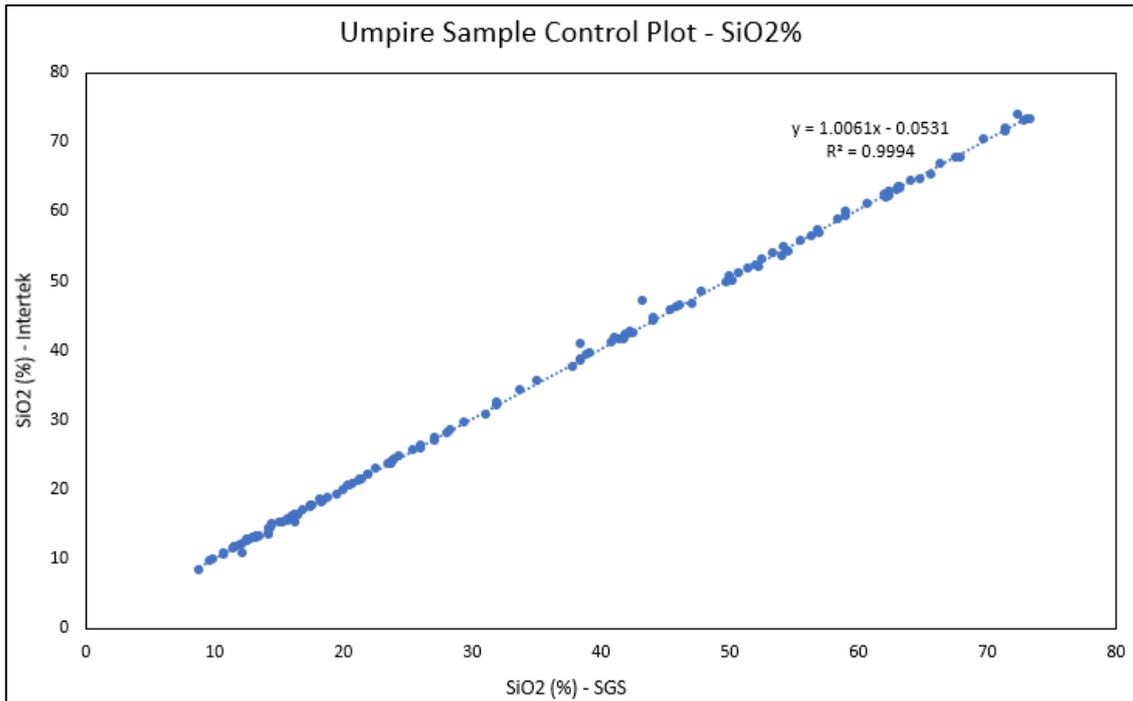
Figure 11-16: Umpire sample control plot for SiO$_2$ (%) analyses at the primary (SGS and Umpire (Intertek) laboratories

12   DATA VERIFICATION AND DATABASE ADJUSTMENTS

12.1   Twin Drillhole Analysis

SRK undertook an analysis of the twin drilling completed by Giyani comparing Phase 1 DD holes against Phase 2 RC holes. Two of the RC holes twin previously completed diamond holes, allowing for an analysis of the conformity of grade and logging between the DD and RC drilling to be undertaken. Twin plots showing analytical grade for MnO as well as logged geology are presented in Figure 12-1 and Figure 12-2**Error! Reference source not found.**. The analysis suggests that the assays derived from RC drilling and DD drilling show similar location, thickness and grade across the mineralised zones, but that geological logging differs significantly between the RC and DD drilling. Consequently, when using the RC drilling to construct mineralisation wireframes, SRK has relied more heavily on the laboratory (where available) and p-XRF assay data to guide the boundary locations of the wireframes, over the geological logging.
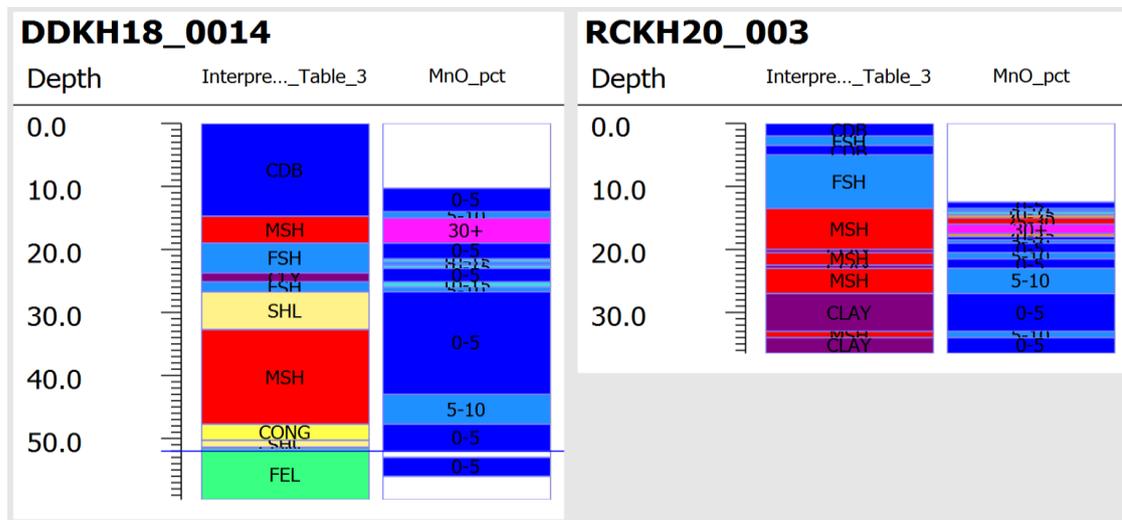
Figure 12-1:   **Twin plot showing logged geology and assayed MnO grade for holes DDKH18_0014 and RCKH20_003**
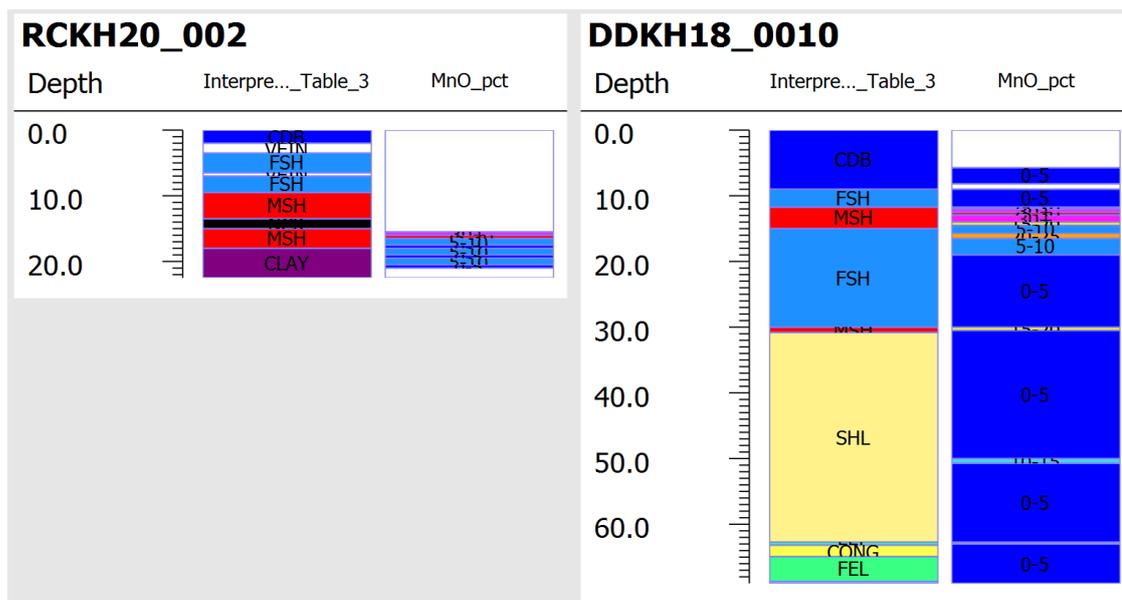
Figure 12-2: **Twin plot showing logged geology and assayed MnO grade for holes DDKH18_0010 and RCKH20_002**

12.2   Database Validation / Adjustments

SRK undertook a high-level validation process which included the following checks:

- Examining the sample assay, collar information, and geology data to ensure that the data were complete for all drillholes

- Examining the de-surveyed data in three dimensions to check for clear spatial errors and their position relative to mineralization

- Checks for "FROM-TO" errors, to ensure that the sample data do not overlap one another or that there are no unexplained gaps in the sampling

- Assays below the analytical detection limit were assigned the lower detection limit value

- Intervals of core that were not sampled due to no core recovered were left absent. These intervals had a loss of core caused by the soft and friable nature of the rock

12.3   SRK Site Visits

Mike Beare (General Director and Corporate Consultant, Mining Engineering) of SRK Kazakhstan and James Haythornthwaite (Senior Consultant, Resource Geology) of SRK UK, visited the K-Hill Project site in December 2019 and January 2020 respectively. The initial site-visits completed by SRK took place after Phase 1 diamond drilling was completed (and before the initiation of the Phase 2 RC drilling) and so active drilling activities were not observed. A follow up site visit was undertaken by John Paul Hunt (Senior Exploration Geologist) of SRK Exploration Services (Johannesburg) in March 2021 to observe and verify active drilling during the most recent RC drilling campaign.

During the January 2020 site visit, the following checks were undertaken by James Haythornthwaite:

- Inspection of mineralisation outcrops

- Inspection of the underground mine workings

- Check of the Giyani core storage and sampling facility

- Review of the remaining drill core for holes DDKH18_002, DDKH18_005, DDKH18_008, DDKH18_0011 and DDKH18_013, including check logging

During the March 2021 site visit, the following checks were undertaken by John Paul Hunt:

- Inspection of the RC drill sites and equipment

- Check of the Giyani core storage and sampling facility

SRK commentary on the drilling procedure employed by Giyani is provided in Section 10.6. Check logging completed by SRK during the January 2020 site visit did not indicate any serious flaws in the logging completed by Giyani. SRK reviewed a number of drillholes to confirm that the interval depths of mineralised intervals, according to the assay database, correspond with visible MnO mineralisation. No discrepancies between the downhole depth of the Mn-Shale in drill core and the depth of mineralised intervals according to the assay database were identified.

12.4 Summary

SRK considers that the drilling, sampling, assaying and QAQC procedures utilised by Giyani have resulted in data which is of sufficient quality to support a subsequent Mineral Resource estimate.

13   MINERAL PROCESSING AND METALLURGICAL TESTING

13.1   Introduction

To support the initial 2019 PEA for K Hill, Lab 4 Inc. (Canada) was engaged by Giyani to provide metallurgical consulting services based on producing High Purity Electrolytic Manganese Metal (HPEMM). Since that time a new program of metallurgical testing has been initiated by Tetra Tech for the Feasibility Study that is currently in progress. The ongoing metallurgical testwork and updated plant design will focus on a slight modification to the planned flowsheet in order to produce High Purity Manganese Sulphate Monohydrate (HPMSM).

This section details the mineralogical and metallurgical test work completed by Lab 4, as summarised by Tetra Tech as part of the 2021 PEA update.

Investigations conducted by Lab 4, the Department of Geology of Dalhousie University and the Minerals Engineering Centre of Dalhousie University, all of Halifax, Nova Scotia, Canada, were completed under the guidance of Dr Ian Flint of Lab 4 Inc. (Canada) in two stages:

- Stage 1 included optical and electron probe work that identified both valuable as well as waste minerals, mineral particle size distributions, and the approximate grind sizes required for mineral phase liberation or exposure

- Stage 2 included tests on the leaching of three samples to determine the dissolution characteristics and residence times required to extract the manganese in the primary leach stage of a hydrometallurgical process

A summary of these investigations is presented in this section. Tetra Tech analysed all the metallurgical test work results with the objective of identifying the most appropriate process flowsheet. The metallurgical studies indicated that the mineralised material is amenable to reductive acid leaching and can be processed using a flowsheet that consists of an acid leach followed by solution purification, solvent extraction and vacuum crystallisation for the production of a high purity manganese sulphate monohydrate product (HPMSM) suitable for sale into the battery market.

Based on the metallurgical test work results, the overall metallurgical recovery for manganese (Mn) is estimated to be 90.7%.

13.2   Source Documents

Tetra Tech does not have access to the original laboratory reports but has reviewed the documents listed below.

- Kgwakgwe Hill Manganese Project Independent Technical Report, SRK Consulting, February 2020

- Mineral Resource Estimate for the K-Hill Manganese Project, Botswana, NI 43-101 Technical report, MSA Group (Pty) Ltd, September 2018

All the test work reported in this section is taken from the information presented in these documents

13.3   Mineralogical Test work

Dalhousie University undertook a mineralogical analysis of the K-Hill mineralised material using optical and electron microscopy probes. The analysis was performed on a selection of manganese oxide bearing rocks taken as grab samples from K-Hill mineralisation. Four samples were tested to determine the mineralogical composition of the Mn minerals. These samples and the resulting determinations are shown in Table 13-1.

Table 13-1   Identified and Possible Mineral Species in K-Hill Samples

Sample	Description	Mineral	Formula
KH17 MT01	Dump Material	Cryptomelane	$K(Mn^{4+}_7Mn^{3+})O_{16}$
		Hausmannite	$Mn^{2+}Mn^{3+}_2O_4$
		Hollandite	$Ba(Mn^{4+}_6Mn^{3+}_2)O_{16}$
		Psilomelane	$Ba(Mn^{2+}Mn^{4+}_3)O_{16}(OH)_4$
		Pyrolusite	MnO_2
KH17 MT02	Altered Shale	Jacobsite	$Mn^{2+}Fe^{3+}_2O_4$
		Coronadite	$PbMn^{4+}_6Mn^{3+}_2O_{16}$
KH17 MT03 KH17 MT05	Shale with Kaolin	Cryptomelane	$K(Mn^{4+}_7Mn^{3+})O_{16}$
		Hausmannite	$Mn^{2+}Mn^{3+}_2O_4$
		Hollandite	$Ba(Mn^{4+}_6Mn^{3+}_2)O_{16}$
		Psilomelane	$Ba(Mn^{2+}Mn^{4+}_3)O_{16}(OH)_4$
KH17 MT04	Silicified Shale	Hausmannite	$Mn^{2+}Mn^{3+}_2O_4$
		Psilomelane Group	$Ba(Mn^{2+}Mn^{4+}_3)O_{16}(OH)_4$

It was reported that in terms of presentation, the manganese minerals occurred in three forms:

- As staining on the silicates, iron oxides and as themselves

- As small veins where manganese oxides have been deposited on each other particularly within well fissured zones

- As nodules where the Mn has built up into botryoidal masses that may contain other minerals within them. It was also reported that the mineralogical analysis did not specifically investigate the nodules owing to insufficient samples

It was also reported that the head assays of the samples were reported after converting them to the standard oxide form. The assays are shown in Table 13-2.

Table 13-2:   Head Assays

Sample	Description	FeO (%)	MnO (%)
KH17 MT01	Dump Material	39.7	48.7
KH17 MT02	Altered Shale	27.3	48.8
KH17 MT04	Silicified Shale	4.5	4.3
KH17 MT03 KH17 MT05	Shale with Kaolin	23.2	60.8

13.4   Metallurgical Test work

13.4.1 Test work sample

Tetra Tech was not involved with the sample selection for the metallurgical test work completed by Dalhousie University. It is understood that three different intervals from a single drill hole were used for the meallurgical test work. The sample description and related pictures are shown in Table *13-3*.

Table 13-3:   Metallurgical Test Work Samples

Sample	Description	From (m)	To (m)	Photograph
KH18 MT010	Mn Shale	23.73	27.00	
KH18 MT011	Fe Shale	27.00	30.85	
KH18 MT012	Mn Oxide	48.00	50.73	

Head assays

Dalhousie University reported the Mn and iron (Fe) head assays for the test samples. The analytical methods were not specified in the available reports.

Table 13-4:   Head Assays

Sample	Mn (%)	Fe (%)
KTH18 MT010	24.7	13.8
KTH18 MT011	30.7	12.1
KTH18 MT012	6.85	1.99

Comminution test work

Tetra Tech understands that comminution test work was not completed. This means the important design parameters such as Bond Ball Mill work index must be assumed for the process development and estimation work.

Leach test work

Dalhousie University conducted run of mine acid leach tests with sucrose added as a reductant. In addition, base line leach tests were also conducted at the same conditions but without any reductant addition. The tests were conducted with 125 millilitres (ml) of 3.64 Molar H_2SO_4 solution. Summary test conditions are shown in Table *13-5*.

Table 13-5:   Leach Test Work Conditions

Description	Value
Grind size- P80 (µm)	200
Sample Mass (g)	25
Acid concentration (g/l)	260
Temperature (°C)	90
Retention time (hr)	3

Key: °C = degrees centigrade, g = gram, g/l = gams per litre, hr = hour, µm = micron

Summary of the leach results are shown in Table 13-6.

Table 13-6:   Summary of Leach Test Results

Sample	Reductant	Leach Extraction (Mn - %)			Leach Extraction (Fe - %)		
		1hr	2hr	3hr	1hr	2hr	3hr
MT10	No	2.9	3.1	3.2	13.7	16.6	24.4
	Yes	91.7	91.4	87.7	29.1	29.4	22.4
MT11	No	2.3	2.1	0.4	18.9	13.9	6.6
	Yes	83.1	93.9	90.8	58.3	78.8	74.2
MT12	No	1.8	2.3	1.8	32.0	38.0	40.0
	Yes	100.5	94.6	98.9	87.0	83.3	87.0

The Mn leach kinetics for the leach with sucrose reduction and without sucrose reduction are shown in Figure 13-1.
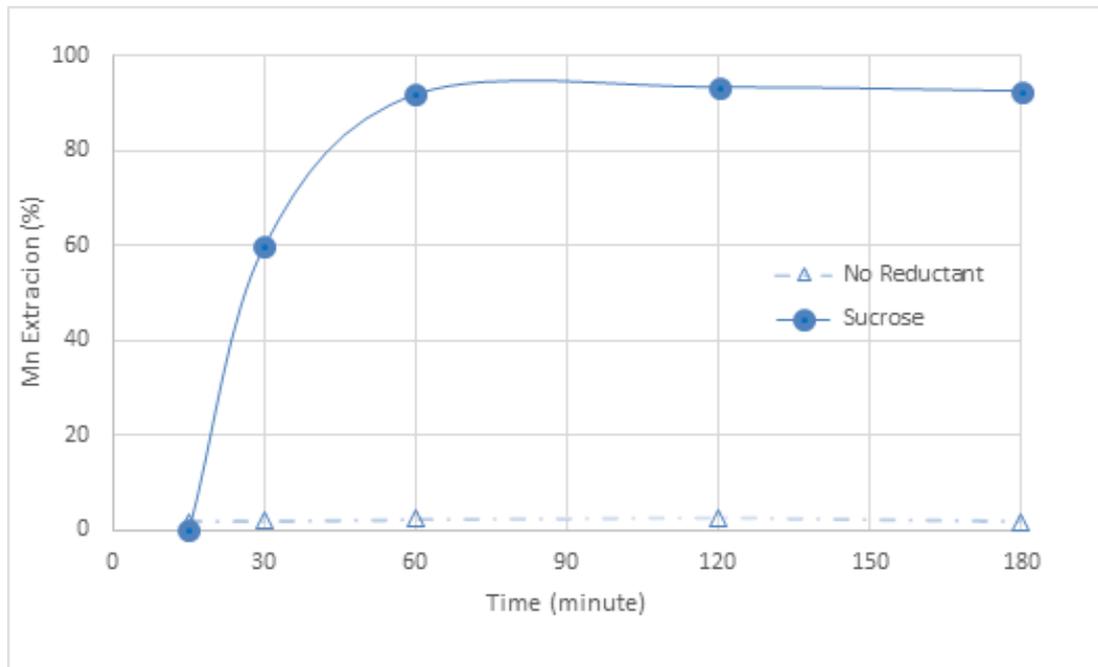
Figure 13-1:   Mn Leach kinetics

The results clearly indicate that the reductant has significantly improved the Mn extraction as well as the leach kinetics. However, the test work programme did not evaluate other possible reductants such as SO2 which is used in acidic sulphite reduction processes. This is an established process for Mn extraction and is used in several operating plants for Mn extraction. It is important to note that significant savings could be obtained by adopting the SO2 reduction process, owing to the fact that the SO2 is used as a reductant in the process and H2SO3 is produced during solubilisation as an intermediate reactant. The H2SO3 continues to take part in further chemical reactions with oxygen to make H2SO4, which is used as the lixiviant in the leach process. This leads to savings as a result of reduced acid consumption.

The solution assays for various elements at the end of the leach test are shown in Table 13-7.

Table 13-7:   Solution Assays

Element	Assay (mg/l)	Element	Assay (mg/l)	Element	Assay (mg/l)	Element	Assay (mg/l)
Ag	1.0	Cr	1.5	Mn	26,470.0	Si	217.0
Al	938.0	Cu	29.0	Mo	0.1	Sn	1.0
As	0.1	Fe	6,589.0	Na	111.0	Sr	2.4
Ba	0.1	Ga	0.5	Nb	1.0	Ta	28.0
Be	0.3	Ge	5.0	Ni	38.0	Te	1.0
Bi	0.5	In	1.0	P	19.0	Ti	21.0
Ca	132.0	K	641.0	Pb	2.2	Tl	10.0
Cd	0.1	La	2.0	S	78,634.0	V	21.2
Ce	20.0	Li	3.1	Sb	1.0	Zn	18.0
Co	138.0	Mg	206.0	Se	7.5	Zr	1.1

Key: mg/l = milligrams per litre

The assays indicate that a number of metals (Fe, Al, Cu, Zn, Ni & Co) are co-extracted during leaching as sulphates. The solution can be purified and the Fe and aluminium (Al) sulphates removed in the form of hydroxides by precipitation with lime as indicated in the chemical reactions shown in Equation 1 and Equation 2.

Equation 1 $Fe_2(SO_4)_3 + 3Ca(OH)_2 + 6H_2O = 2Fe(OH)_3 + 3CaSO_4.2H_2O$

Equation 2 $Al_2(SO_4)_3 + 3Ca(OH)_2 + 6H_2O = 2Al(OH)_3 + 3CaSO_4.2H_2O$
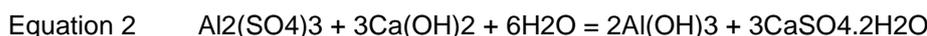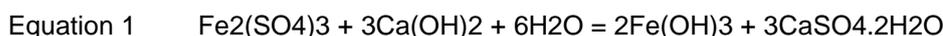
The solution can be further purified by removal of the base metals in the form of sulphides via precipitation with sodium hydrosulphide, as shown in Equation 3 to Equation 6.

Equation 3 $CuSO_4 + NaHS = CuS + NaHSO_4$

Equation 4 $ZnSO_4 + NaHS = ZnS + NaHSO_4$

Equation 5 $NiSO_4 + NaHS = NiS + NaHSO_4$

Equation 6 $CoSO_4 + NaHS = CoS + NaHSO_4$
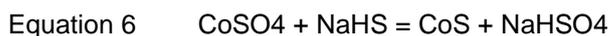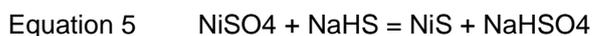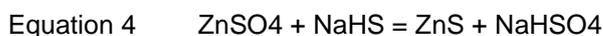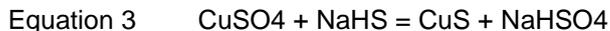
Solvent extraction test work

Solvent extraction tests were conducted by Dalhousie University on the pregnant leach solution produced from the leach tests. The solutions were tested with the organic extractant D2EPHA. The pH conditions and results of each test are summarised in Table *13-8*.

Table 13-8:   Solvent Extraction Test Results

Sample	Mn (ppm)	Mn Extraction (%)	pH
KTH18 MT010	16,908	95.8	3.0
KTH18 MT011	12,222	96.7	3.7
KTH18 MT012	7,047	92.2	3.6

The results indicated that approximately 96% of Mn could be extracted by D2EPHA into the organic phase. The loaded organic solvent can then be stripped with concentrated H2SO4 to produce a concentrated manganese sulphate solution, the sulphate can then be recovered by vacuum crystallisation to produce high purity manganese sulphate salt (HPMSM) product.

The Solvent extraction tests reported above were not optimised but conducted as a standard scoping test. Thus, the 96% extraction is lower than expected from a fully optimised process. In this context, 98.5% Mn extraction is assumed for this study, this will be verified during future test work.

13.5   Metallurgical Recovery

Metallurgical recovery has been estimated based on the test work results and industry standard assumptions for the proposed flowsheet (Section 17). Estimated metallurgical recovery is shown in Table 13-9.

Table 13-9:   Metallurgical Recovery Calculation

Description	Value (%)	Source
Leach Extraction	93.3%	Test work
Mn Recovery (Fe & Al Precipitation)	99.9%	Assumption
Mn Recovery (Base metal Precipitation)	99.8%	Assumption
Mn Recovery (Solvent Extraction)	98.5%	Assumption
Crystallisation Efficiency	99.0%	Assumption
Overall Recovery	90.7%	Calculation

Based on the information provided in Table 7, the overall metallurgical recovery of Mn is estimated as 90.7%.

14   MINERAL RESOURCE ESTIMATES

14.1   Introduction

SRK has completed an update of the Mineral Resource Estimate for the Kgwakgwe Hill Manganese Project. Detailed herein is an overview of the work completed by SRK in constructing the model upon which the estimate is based, as well as conducting, validating and reporting the estimate.

To the best of the Qualified Person's knowledge there are currently no title, legal, taxation, marketing, permitting, socio-economic or other relevant issues that may materially affect the Mineral Resource other than those described in this report.

The Mineral Resource estimate incorporates drilling data collected by Giyani from 16th April 2018 to 19th July 2021 inclusive (as described in Section 10), which, in the Qualified Person's opinion, is adequate for the purpose use in the subsequent Mineral Resource estimate.

The Mineral Resource has been classified according to the CIM Best Practice Guidelines and is reported in accordance with the 2014 CIM Definition Standards, which have been incorporated by reference into National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101). The Mineral Resource is classified in the Indicated and Inferred categories

The Mineral Resource, which represents an update to the Mineral Resource reported by SRK in early 2021, is based upon an updated block model and constrained by an updated optimised pit shell. Domain modelling was undertaken in Leapfrog Geo and estimation in Leapfrog Edge.

The Mineral Resource Estimate was completed by Mr Oliver Jones (MAusIMM), an Associate Resource Geologist of SRK, under the supervision of Dr Lucy Roberts, MAusIMM(CP), a Principal Consultant (Resource Geology) with SRK and the Qualified Person ("QP") in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Code ('CIM Code'). Dr Roberts holds the responsibility for the reporting of the Mineral Resource Statement presented herein. Dr Roberts has the relevant experience in reporting Mineral Resources on various base, precious and ferrous metal assets globally.

14.2   Estimation Domain Modelling

Estimation domains were created using all available drillhole data, as well as surface mapping and surveys of underground artisanal mining voids. DGPS collar surveys and a high resolution satellite survey surface provide topographic constraints to the model.

14.2.1 Lithology Model

SRK constructed wireframes of the key lithological units, based on the geological logging completed by Giyani geologists. Adjustments to the contact location of the manganese shale horizons to snap the contacts of the wireframes to the laboratory assays for MnO, to adhere to a modelling cut-off of approximately 7% MnO for the mineralised Mn Shale horizons. The modelling cut-off was chosen as it appears to be a natural cut-off between the lower grade unmineralized sediments and the low-grade Mn-Shale margins. The following units (from hangingwall to footwall) were modelled:

- Overburden (OVB)

- Chert Breccia (CDB)

- Fe Shale (FSH 1)

- Upper Mn Shale (A1, A2 and A3)

- Lower Mn Shale (B)

- Lower discontinuous Mn Shale (*northeast only) (C)

- Lower Fe Shale (FSH 2)

- Felsite (FEL)

In addition to the modelling of lithological domains, SRK has constructed a total of 3 fault wireframes that break the model into independent fault blocks. The faults have been interpreted from clear "steps" in the manganiferous shale horizons that show normal offsets to the mineralisation in the order of 5 m to 15 m. The fault and lithology wireframes were clipped below the topography surface. Plan and oblique views of the lithology domains are presented in Figure 14-1 and Figure 14-2. A typical cross section through the deposit showing the nature of faulting is provided in Figure 14-3.
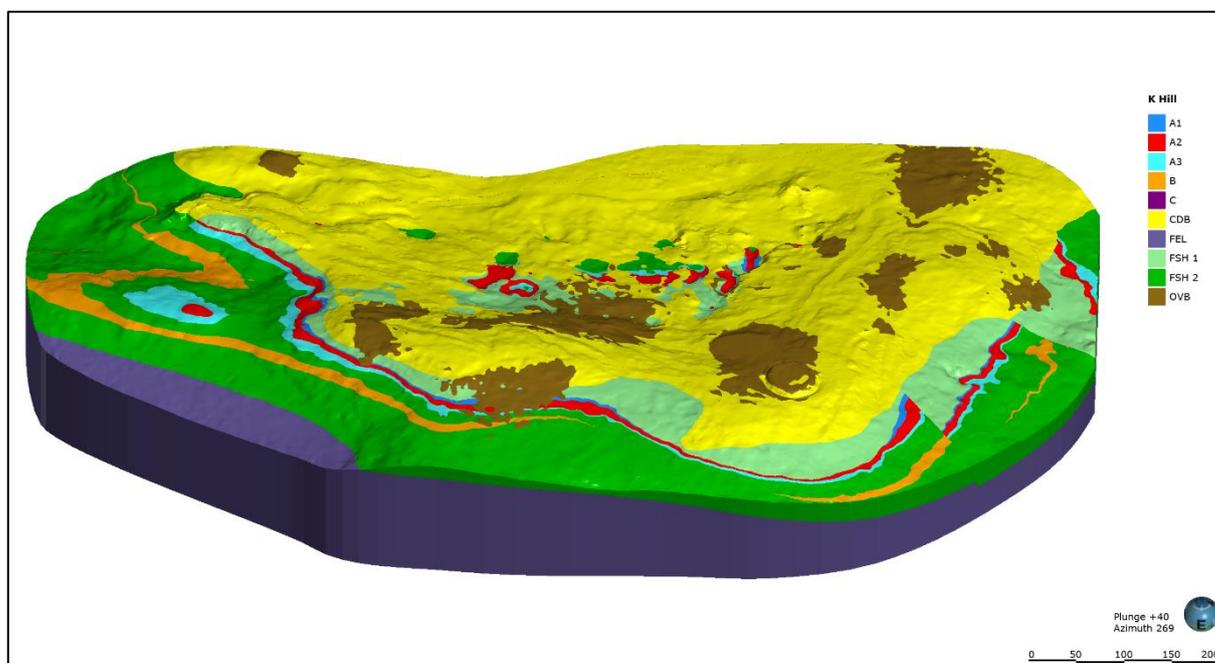
Figure 14-1:   Oblique view of the K-Hill geology model (looking due west)
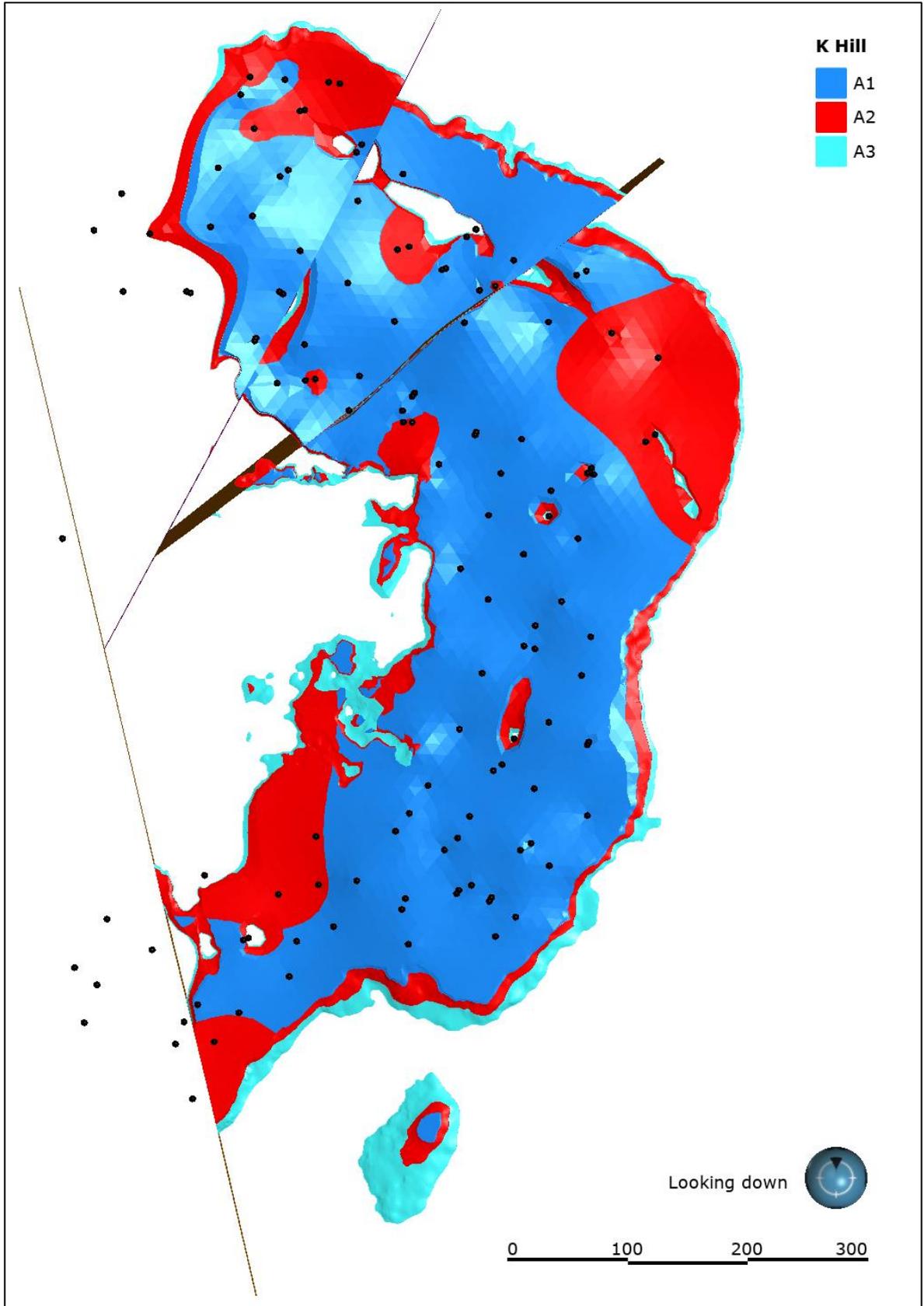
Figure 14-2: **North orientated plan view of the high grade A2 Mn-Shale and surrounding low grade A1 and A3 Mn-Shale margin domains, with drillhole collars marked as black dots**
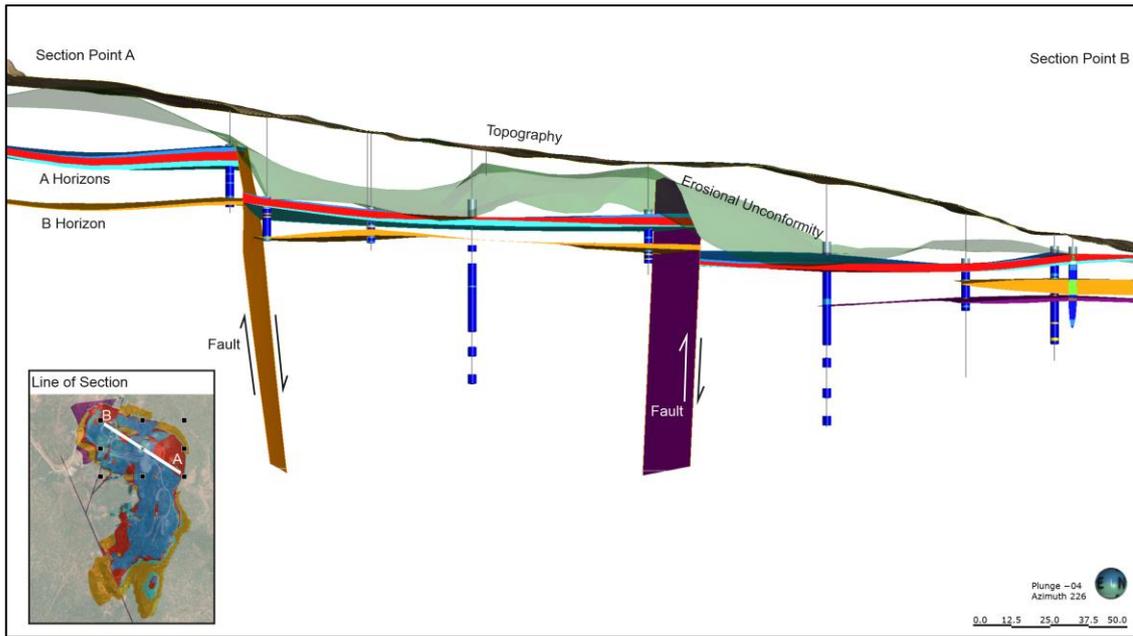
Figure 14-3:   Southwest facing cross section through the KHill geology model showing the location of faults and relative offsets of manganiferous shale horizons

14.2.2 Upper Mn Shale Sub-Domaining

SRK conducted a statistical analysis of the MnO assays within each of the lithological domains. This highlighted a bi-modal MnO population within the Upper Mn Shale domain (see Figure 14-4). After a review of the two populations in 3D and in sections, SRK decided to model low grade horizons (A1 and A3) above and below a high-grade domain core (A2) within the Upper Mn Shale, based on a 20% MnO cut-off. The high-grade core of the Upper Shale is generally continuous across the deposit area with the exception of areas where it has been eroded (Section 14.2.3). The lower grade domains are largely continuous but are absent in some areas. Figure 14-4 shows a histogram of the un-composited sample MnO grade for the entire Upper Mn Shale horizon, showing a clear bi-modal distribution. Figure 14-5 shows the resulting histograms once the three domains have been separated.
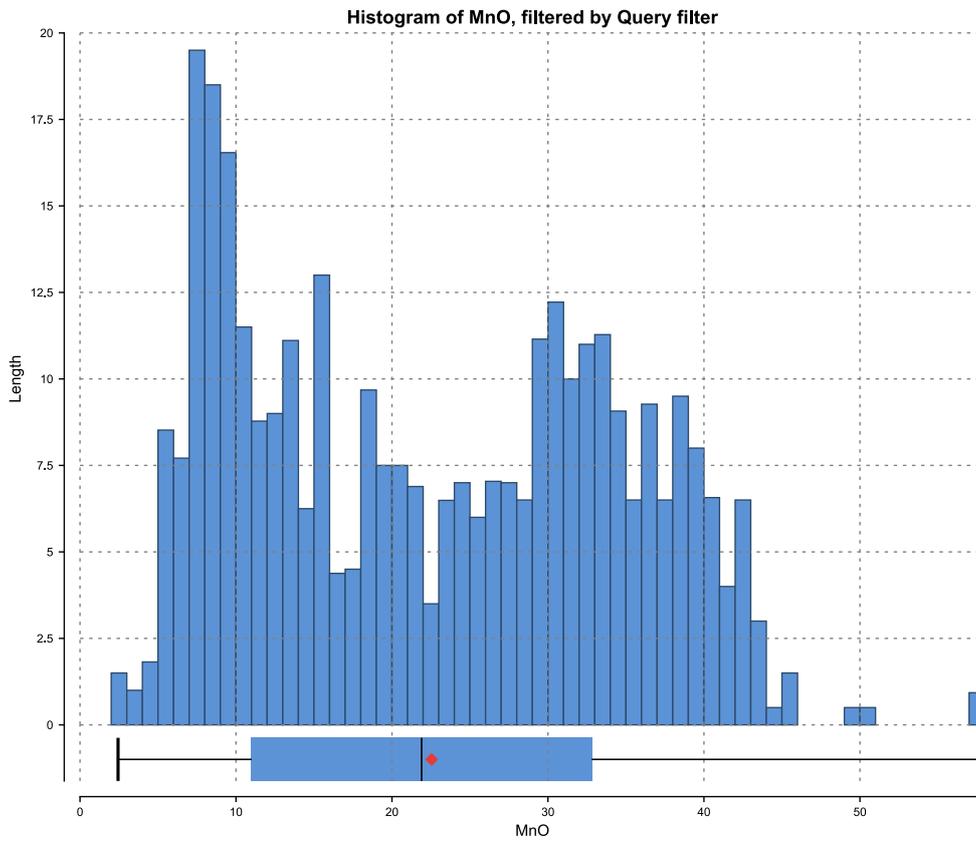
Figure 14-4: **Histogram of K-Hill un-composited sample MnO grade (in percent) for the entire upper Mn-Shale**

Figure 14-5: **Overlaid histogram of the subdomained A1, A2 and A3 domains showing the distinct populations**

Checks on the drill core completed by SRK during the January 2020 site visit indicate a clear visual distinction between the low grade and high grade Upper Mn shale areas (Figure 14-6), and a sharp transition between the two, which supports the separation of these three mineralisation horizons in the estimation domain model.

Figure 14-6: **Core photograph for approximately 10m - 30m in DDKH18_0005, highlighting the Upper Chert Breccia (in blue), Low Grade Manganese Shale (in orange), High Grade Manganese Shale (in Red) and Footwall Fe Shale (in yellow)**

SRK concluded that the Lower Mn-Shale horizon (B) does not comprise multiple MnO populations and thus did not require further sub-domaining. A histogram of MnO values within the B horizon is presented in Figure 14-7.
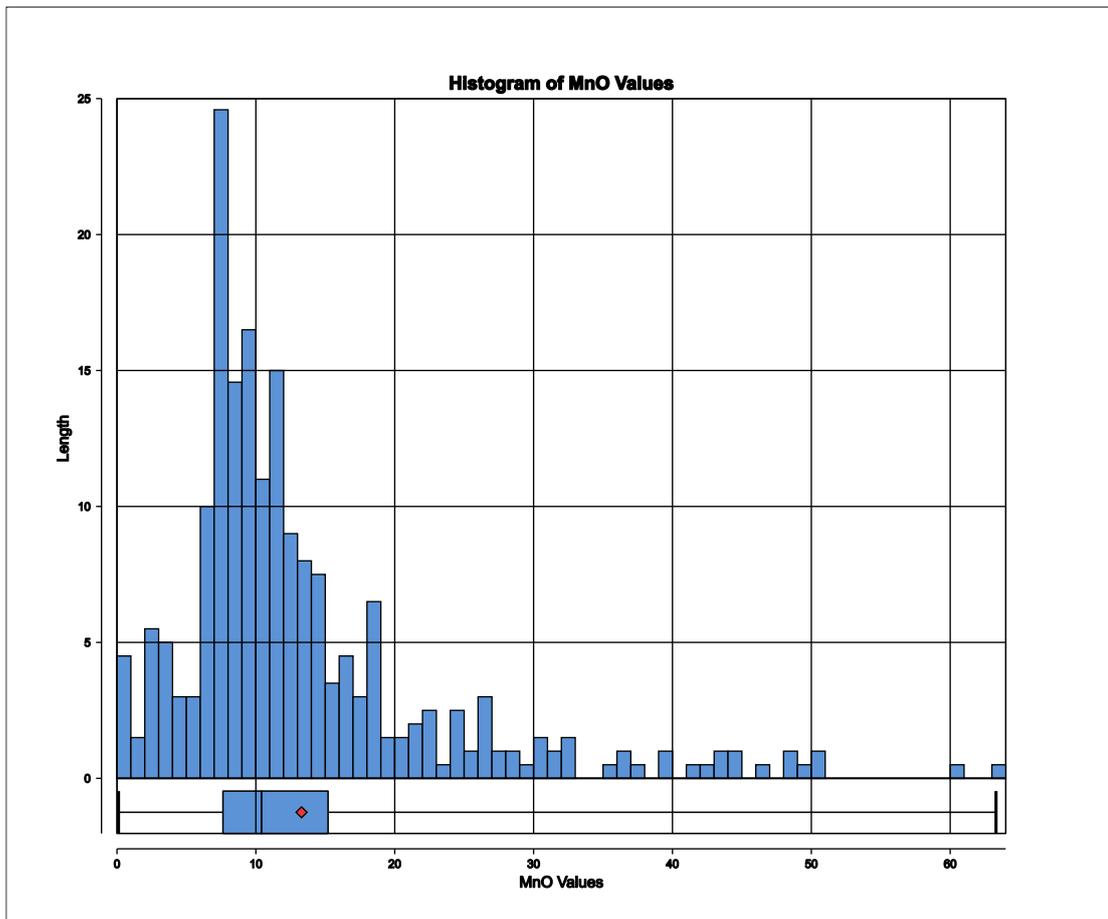
Figure 14-7:   Histogram of MnO values within the B horizon showing a single population

14.2.3 Erosional Channel

In creating the geological model for the K-Hill Project, SRK identified a number of holes in the north of the deposit where a large section of the central stratigraphy, including the upper mineralised horizon, have been lost and replaced with a significantly thickened package of the overlying CDB breccia horizon. Due to the coarse nature of the CDB unit, a sharp contact with underlying sediments, loss of stratigraphy and the dynamic depositonal/erosional environment inferred by the deposit gentic model, SRK inferred a channelised erosional cause for the loss of the Upper Mn-Shale. Further drilling has allowed the extents and margins of this feature to be more clearly defined.

The narrow extent of the channel is well constrained along its shortest axis by drilling to the southwest and outcropping mineralisation to the northeast, as well as surveyed artisinal activity, which notably abruptly stops at the edge of the modelled channel. The channel is less well constrained along it's long axis and may extend as far as DDKH18_0015 to the southeast which also intersects thickening of the CDB and loss of the Upper Mn-Shale horizon. The channel feature and possible continuation are shown in Figure 14-8 and Figure 14-9.
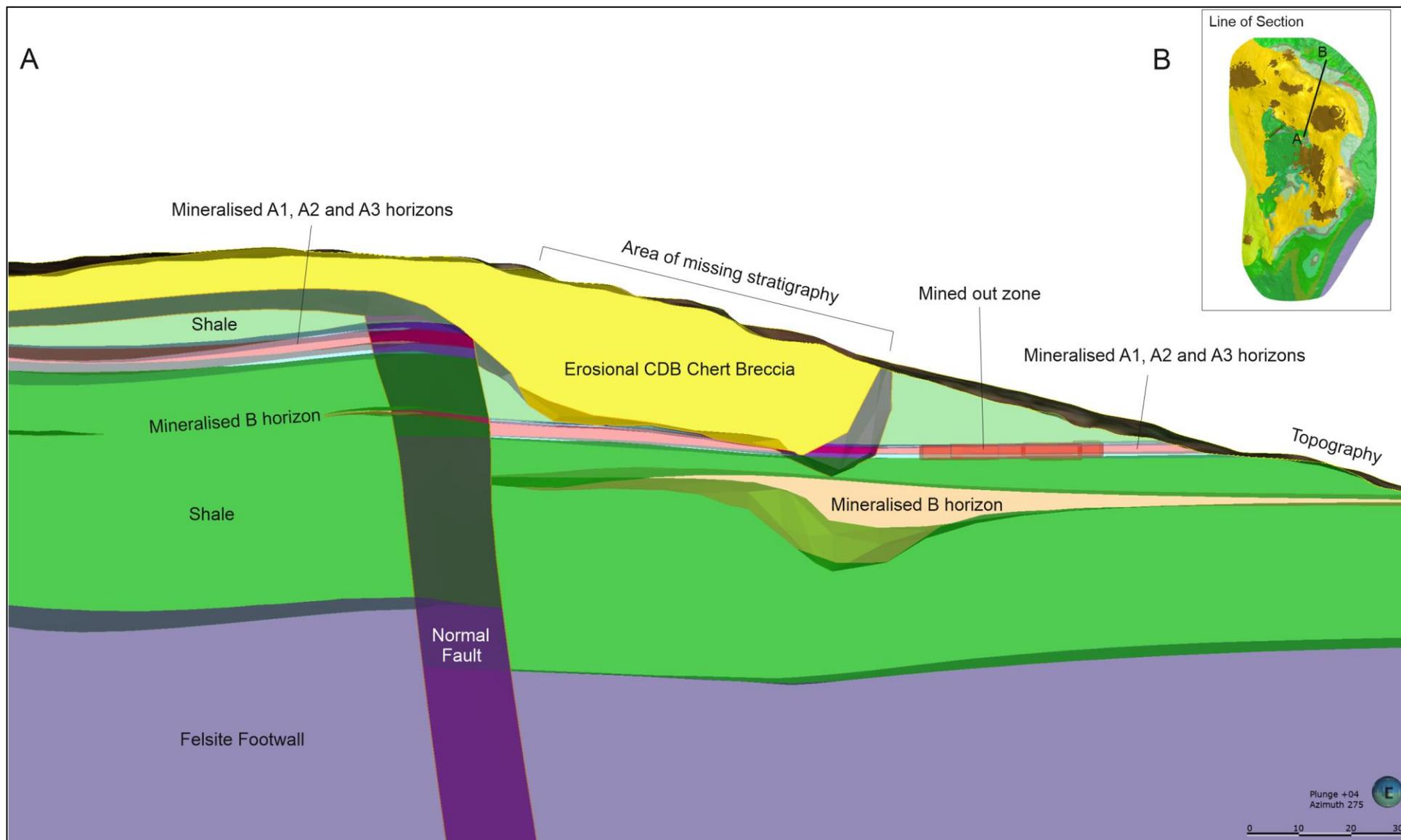
Figure 14-8: **Section looking along axis of erosional channel (scale is in metres)**
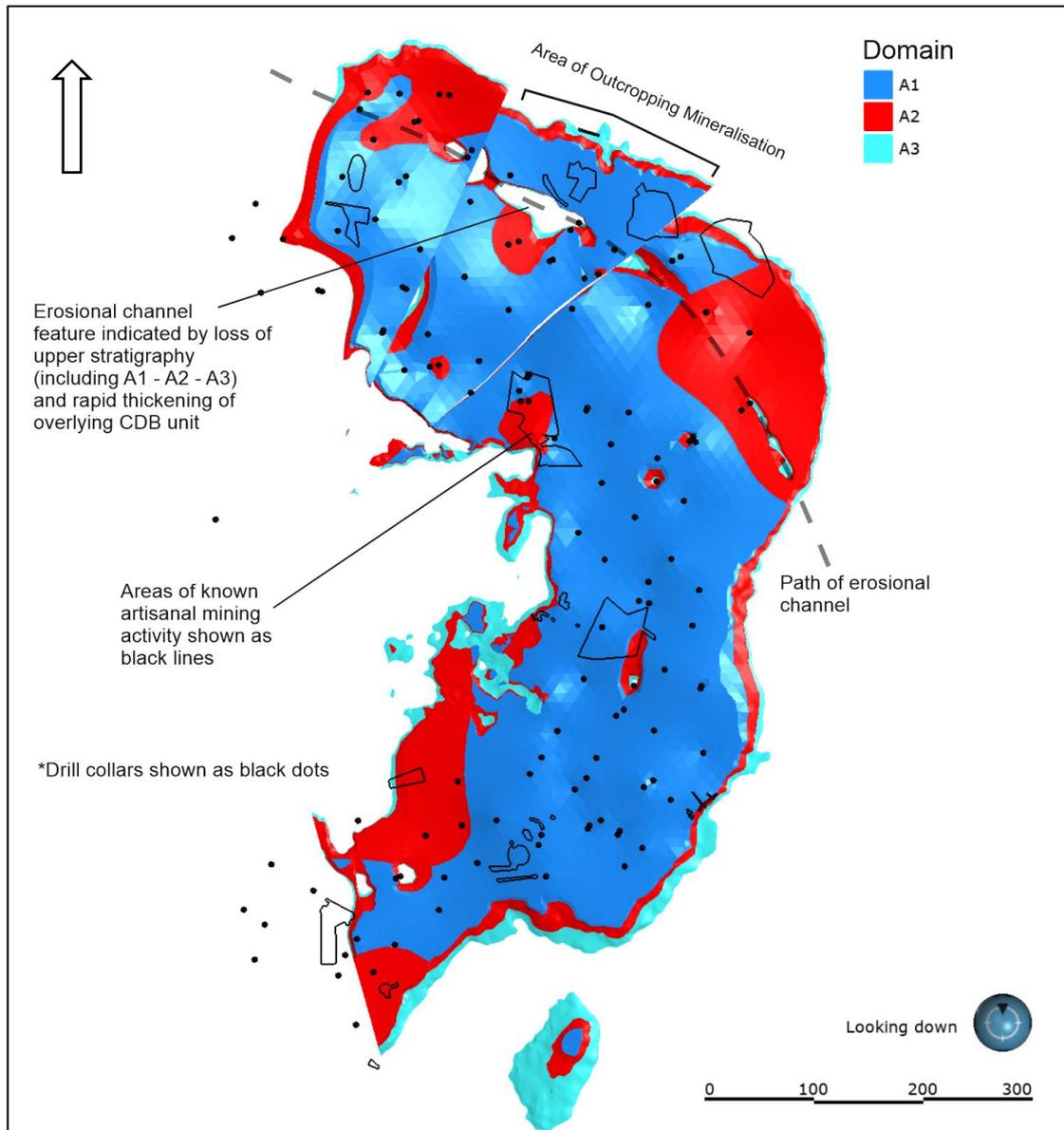
Figure 14-9:   Channel structure and erosion of Upper Mn-Shale unit in plan (scale in metres)

14.2.4 Final Estimation Domains

The final estimation domains and domain codes used in the estimate are provided in Table 14-1. The Mineral Resource Statement presented herein is comprised of all modelled Mn-Shale horizons (A1-3, B and C).

Table 14-1:   Final Estimation domains, with mineralised zones highlighted

Geological domain	Estimation domains
Overburden	MOD OVB
Chert dolomite breccia	MOD CDB
Fe Shale	MOD FSH 1
Low grade Upper Mn-Shale top margin	A1
High grade Upper Mn-Shale	A2
Low grade Upper Mn-Shale bottom margin	A3
Lower Mn-Shale	B
Fe Shale	MOD FSH 2
Isolated NW Lower Mn-Shale	C
Felsite	MOD FEL

14.2.5 Artisanal Mining

Artisanal mining activities have been well documented at K-Hill for a significant period of time. Giyani engaged Terravision (December 2020) to undertake a survey of the workings using Ground Penetrating Radar ("GPR") and laser rangefinders. A total of 46 survey lines were made, covering a total of 5 km. Although these surveys were not exhaustive or systematic, it is considered likely that the majority of major workings will have been intercepted by these survey lines. Terravision interpreted the survey data and provided a 3D dataset outlining areas of artisanal workings, which has subsequently been applied as depletion prior to the reporting of the Mineral Resource. SRK has reviewed this interpretation and it appears to be reasonable. However, SRK notes that the survey lines were not conducted in a completely systematic manner and were focussed on areas of known workings. It is possible that unidentified workings with obscured accesses exist and have not yet been captured. The workings are understood to be largely within the highest grade A1, A2 and A3 domains, however, two depletion voids are identified in the far southwest of the deposit where the A horizons do not exist and the B horizon is found with higher grades. In this area, the artisanal mining survey has been used to deplete the B horizon in the Mineral Resource model. A plan view of the artisanal mining depletion wireframes and how they have been applied is provided in Figure 14-10.
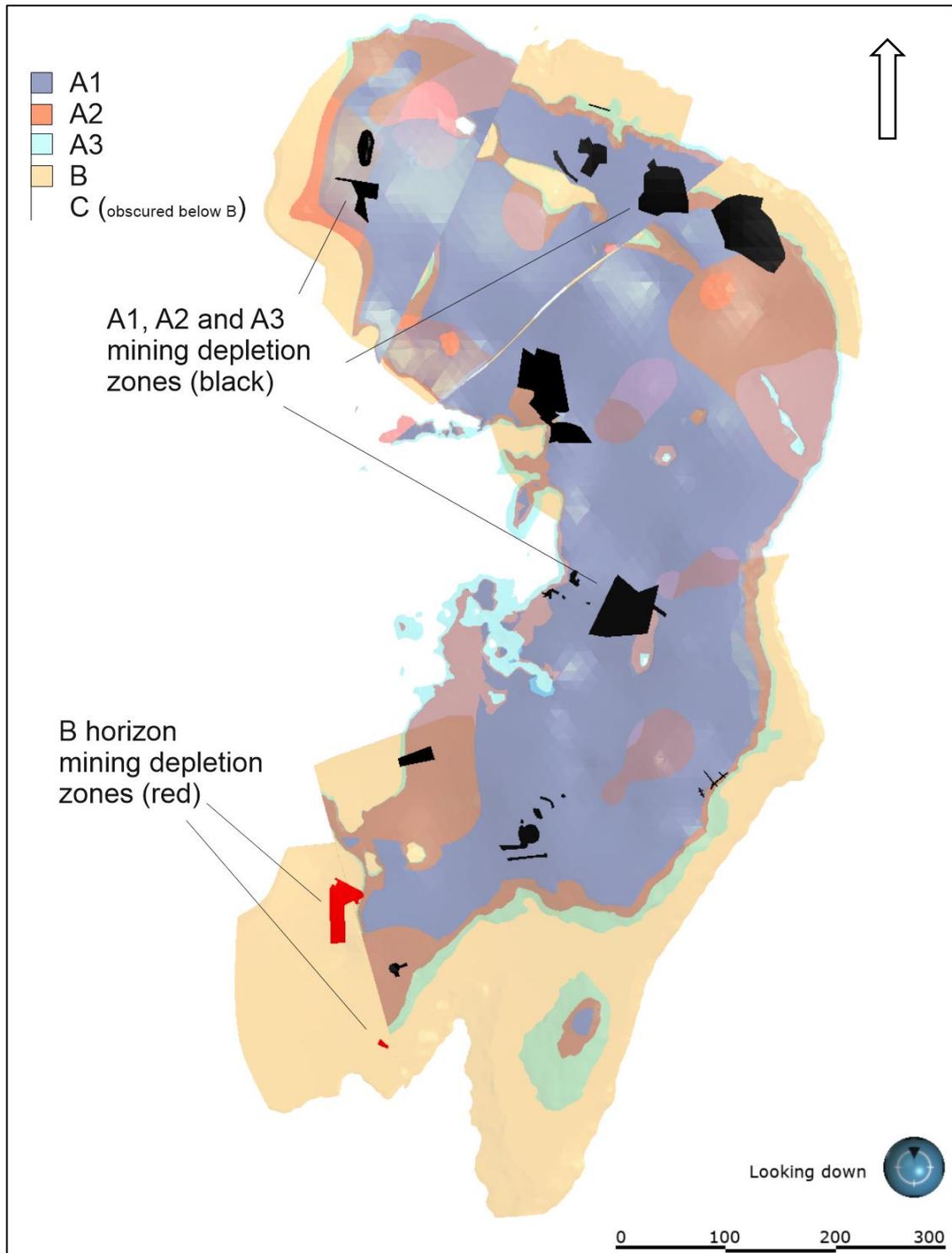
Figure 14-10: Plan view of the mineralisation domains and artisanal mining depletion wireframes (scale in metres)

14.3   Estimation Variables

The following variables were estimated into the 3 mineralised domains of the K-Hill block model:

- MnO

- Al_2O_3

- SiO_2

- LOI (Loss on Ignition)

- Fe_2O_3

14.4   Data Conditioning

14.4.1 Drillholes used for Domaining and Estimation

As previously noted, the Mineral Resource presented herein forms an update to the previous March 2021 MRE, which was conducted in parallel to an active RC drilling program, and as such SRK used laboratory assays relating to the RC drilling where available, plus a combination of lithological logging and p-XRF data to define the position and thickness of the mineralised zones that were yet to be returned from the laboratory. During the previous MRE, SRK did not use the p-XRF data in the estimation of block grades, instead relying solely on the assay analyses undertaken at the laboratory. For the MRE detailed in this report, all drillholes have been completed, effectively doubling the quantity of analytical data from RC drilling. It has not been necessary to utilise p-XRF data in either the definition of the domain boundaries or the estimation of block grades.

An analysis of twin drilling of DD holes by RC holes is provided in Section 11.4. SRK has removed the RC twins from the estimation and modelling to limit the impact of these drillholes on the block model. SRK also notes that as the Phase 3 DD drilling was drilled as twins of RC holes for geotechnical purposes and the core not analysed. These holes have been checked against the corresponding RC hole to check that the thickness and depth of Mn-shale zones are reasonably consistent between hole types, but not used in the estimation of grades, particularly as no assaying has been completed on these holes.

A list of holes used for domaining and holes used for estimation is provided in Table 14-2.

Table 14-2:   List of holes used for estimation and domaining

Drillhole Id	Used for Estimation	Used for Domaining	Comment
DDKH18_0001 To DDKH18_0018	Yes	Yes	-
RCKH20_001 To RCKH20_090	Yes	Yes	-
DDKH21_0019 To DDKH21_0028	No	Yes	Geotechnical DD drilling program, core not assayed

14.4.2 Compositing and Data Restrictions

SRK completed a sample length analysis of the raw assays used to inform the estimation domain wireframes. Sample lengths within the Upper Mn Shale are between 0.1 m and 3.00 m, with the vast majority of samples being 0.5 m in length (Figure 14-11).
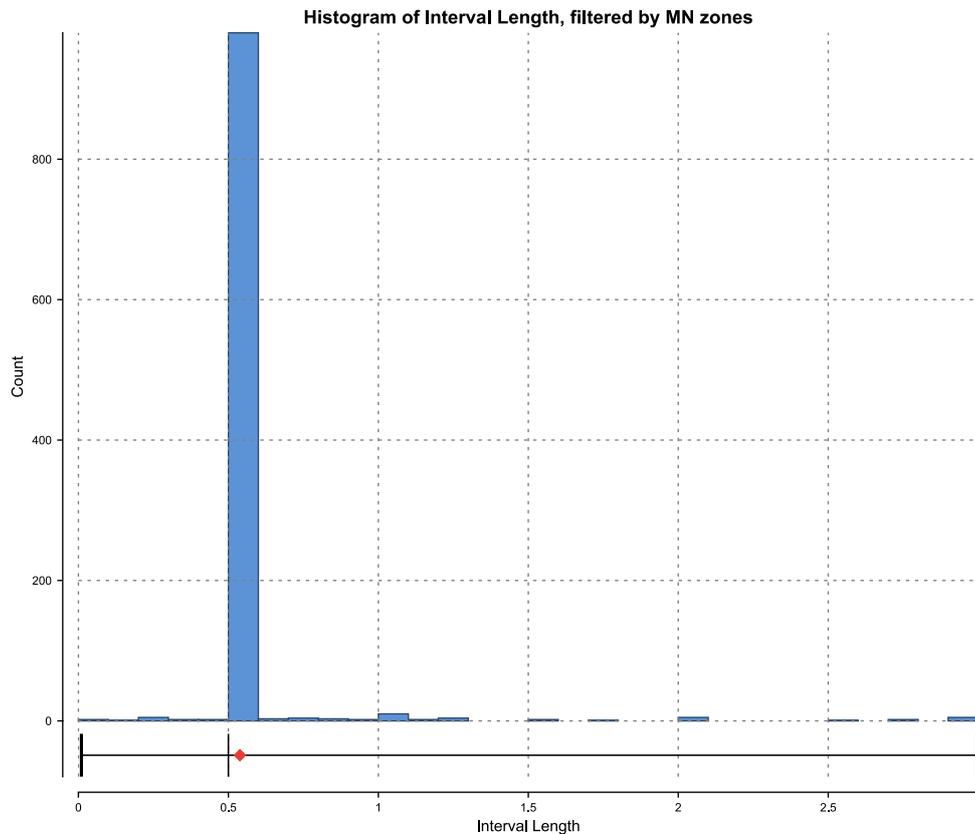
Figure 14-11:   Histogram of K-Hill sample length (m) for Mn-Shale intersections

On the basis of the sample length analysis completed, SRK has composited to 0.5 m, with the estimation domain wireframes applied as compositing triggers. The minimum composite length allowed was 0.25 m, with any shorter residual intervals at the end of the intersection added to the previous composite.

SRK applied a top cut to the MnO values in the A2 and B domains of 51% MnO. The top cut was applied to a total of two samples in both domains. A histogram of values inside the A2 domain is presented in Figure 14-12 and B domain in Figure 14-13 showing the two samples that have been capped to 51% MnO in both domains. SRK also applied a top cut of 28% MnO to the A3 domain and 25% MnO to the C domain. In both cases the top cut was applied to a single sample. Histograms of the values inside the A3 and C domains are presented in Figure 14-14 and Figure 14-15 respectively.
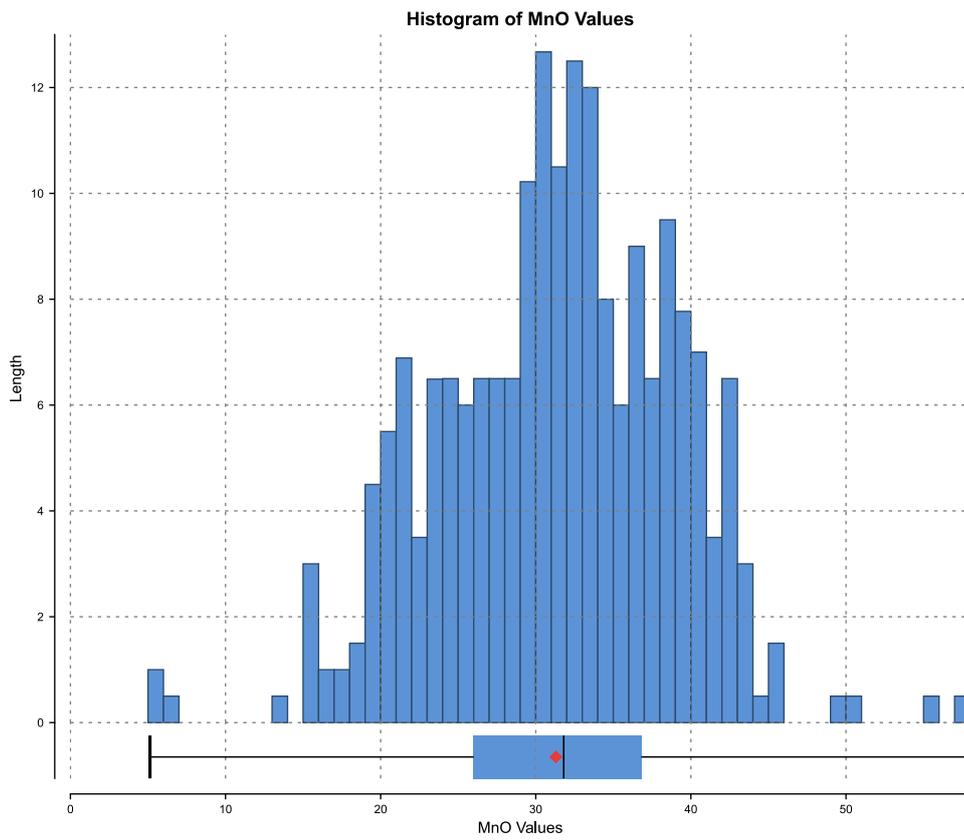
Figure 14-12:   Histogram of composited MnO values in the A2 domain before capping has been applied (51% MnO), showing two outlier high grades
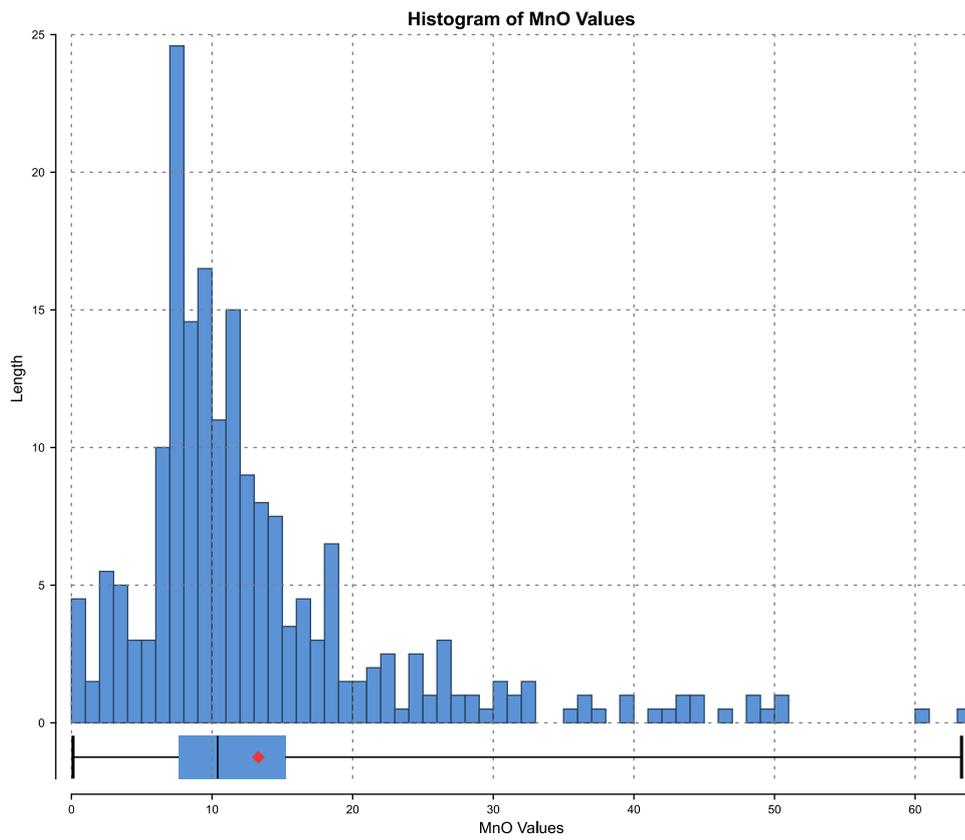
Figure 14-13:   Histogram of composited MnO values in the B domain before capping has been applied (51% MnO), showing two outlier high grades
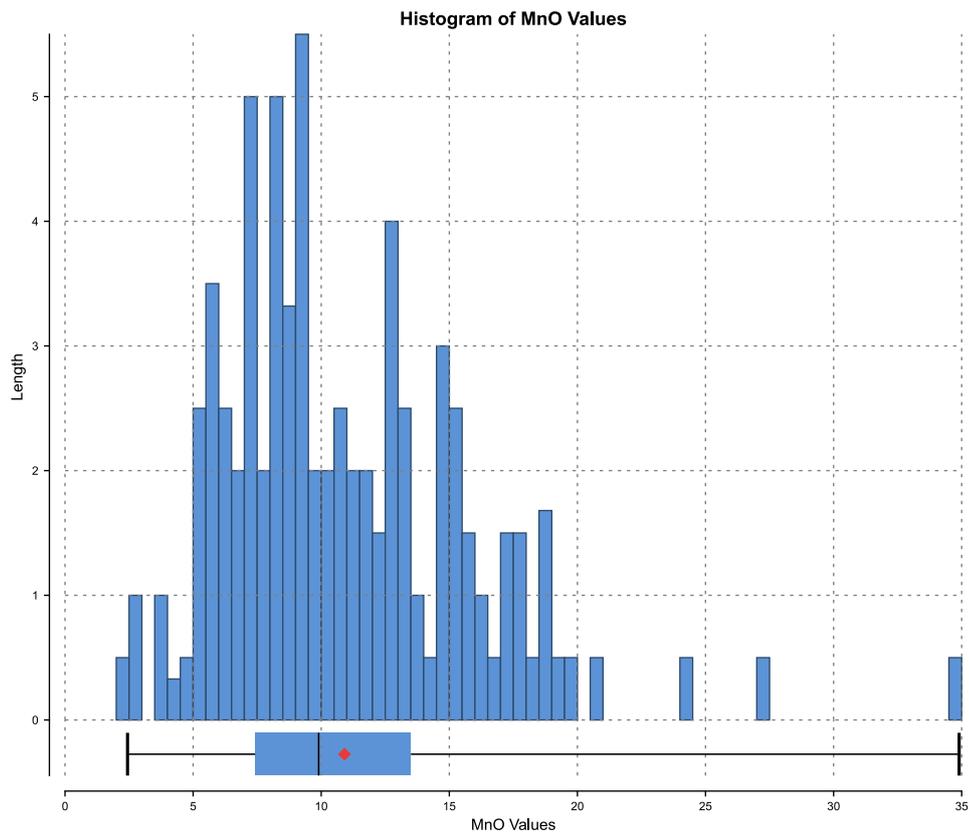
Figure 14-14: **Histogram of composited MnO values in the A3 domain before capping has been applied (28% MnO), showing single outlier high grade**
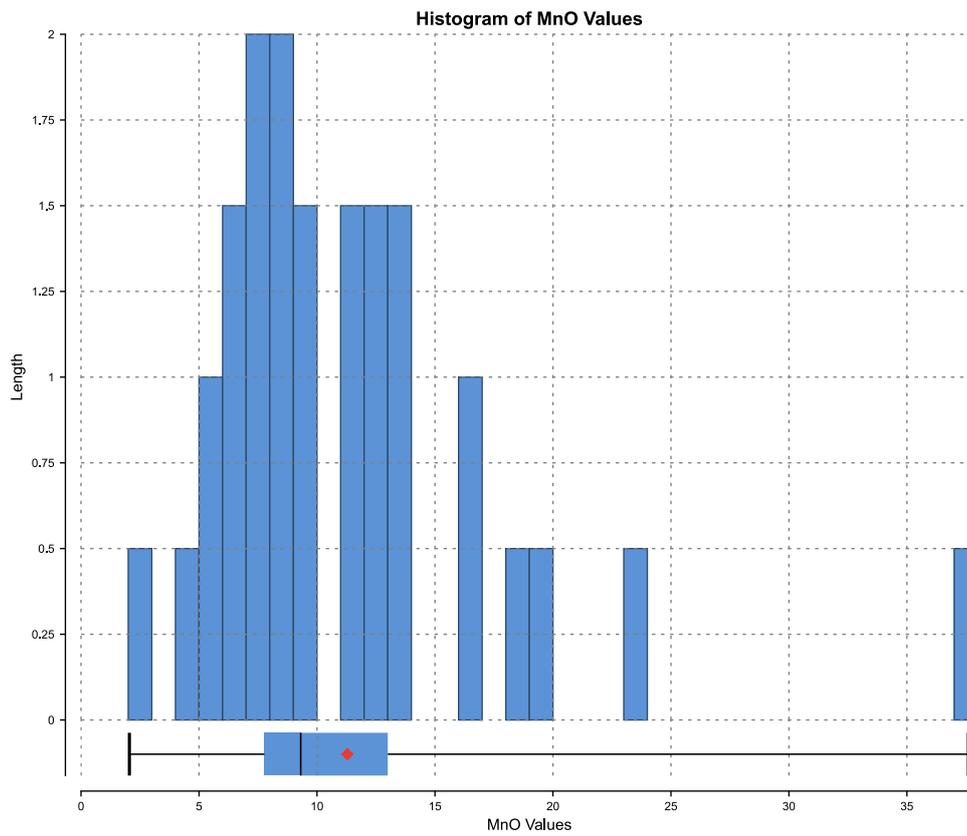
Figure 14-15: **Histogram of composited MnO values in the C domain before capping has been applied (25% MnO), showing single outlier high grade**

Final capped and uncapped composited assay and SG statistics for each domain are shown in Table 14-3.

Table 14-3:   Capped and Uncapped composite statistics by domain

Domain	Variable	Number of Composites	Uncapped Mean (if capping applied)	Capped Mean	Coefficient of Variation
A1	Al_2O_3	158	-	11.58	0.27
	Fe_2O_3	158	-	10.64	0.40
	MnO	158	-	11.53	0.33
	LOI	158	-	5.60	0.30
	SiO_2	158	-	54.82	0.20
A2	Al_2O_3	393	-	9.97	0.21
	Fe_2O_3	393	-	19.25	0.22
	MnO	393	31.29	31.26	0.24
	LOI	393	-	9.99	0.18
	SiO_2	393	-	21.60	0.47
A3	Al_2O_3	143	-	11.76	0.28
	Fe_2O_3	143	-	12.98	0.42
	MnO	143	10.87	10.82	0.43
	LOI	143	-	4.96	0.30
	SiO_2	143	-	53.26	0.21
B	Al_2O_3	374	-	9.67	0.46
	Fe_2O_3	374	-	11.90	0.50
	MnO	374	13.29	13.24	0.73
	LOI	374	-	6.10	0.45
	SiO_2	374	-	53.56	0.26
C	Al_2O_3	33	-	9.16	0.28
	Fe_2O_3	33	-	14.05	0.42
	MnO	33	11.28	10.90	0.48
	LOI	33	-	6.56	0.22
	SiO_2	33	-	54.90	0.16

14.5 Geostatistical Analysis

Directional semi-variograms were investigated by SRK using the 0.5 m composite data. For the A2 and B domains, experimental variograms were determined to be sufficiently robust, showing structures with ranges in the order of 50 to 100 m, to be used for estimation of all variables by Ordinary Kriging ("OK"). Modelled variograms for estimated variables are provided for the A2 domain in Figure 14-16 to Figure 14-20 and for the B domain in Figure 14-21 to Figure 14-25. Variograms for the A2 horizon were modelled using a single structure, however a two structure variogram model was used for the B horizon semi-variograms, often showing a short range in the first structure with a much longer range in the second structure. A table of variogram parameters is provided in Table 14-4. For the remaining domains, a lack of data resulted in an inability to model robust variograms.
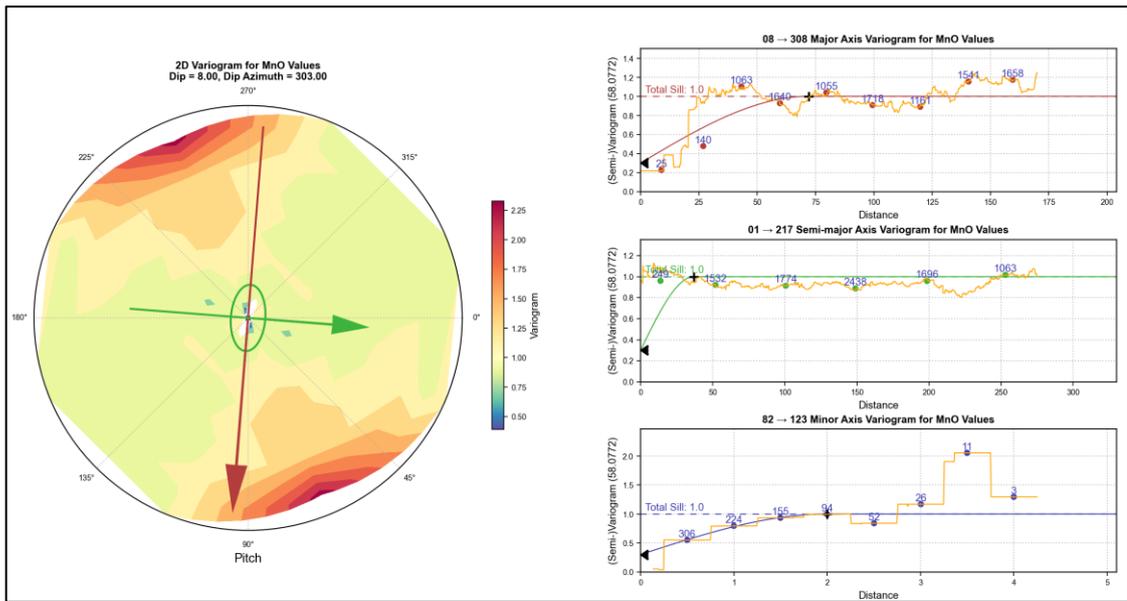
Figure 14-16:   MnO directional variograms and 2D variogram continuity fan for the A2 domain
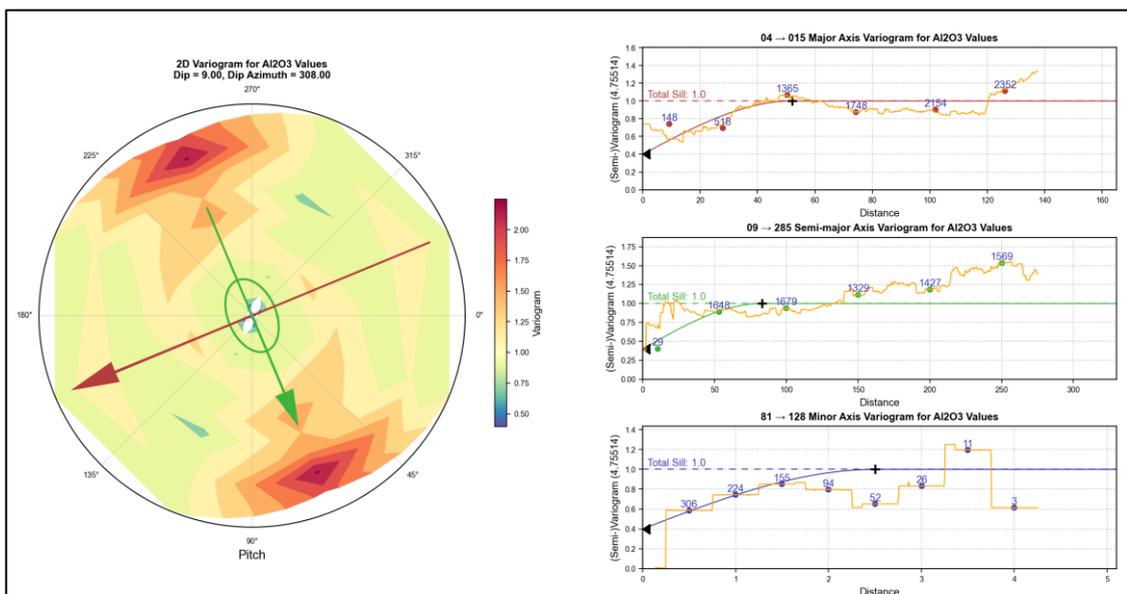
Figure 14-17:   Al2O3 directional variograms and 2D variogram continuity fan for the A2 domain
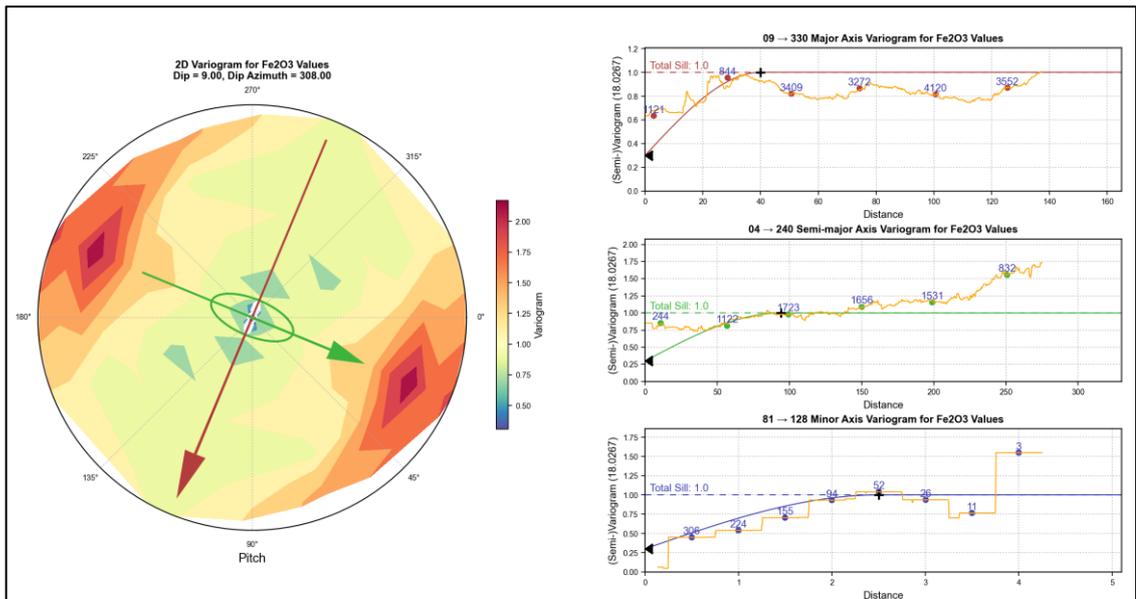
Figure 14-18:   Fe2O3 directional variograms and 2D variogram continuity fan for the A2 domain
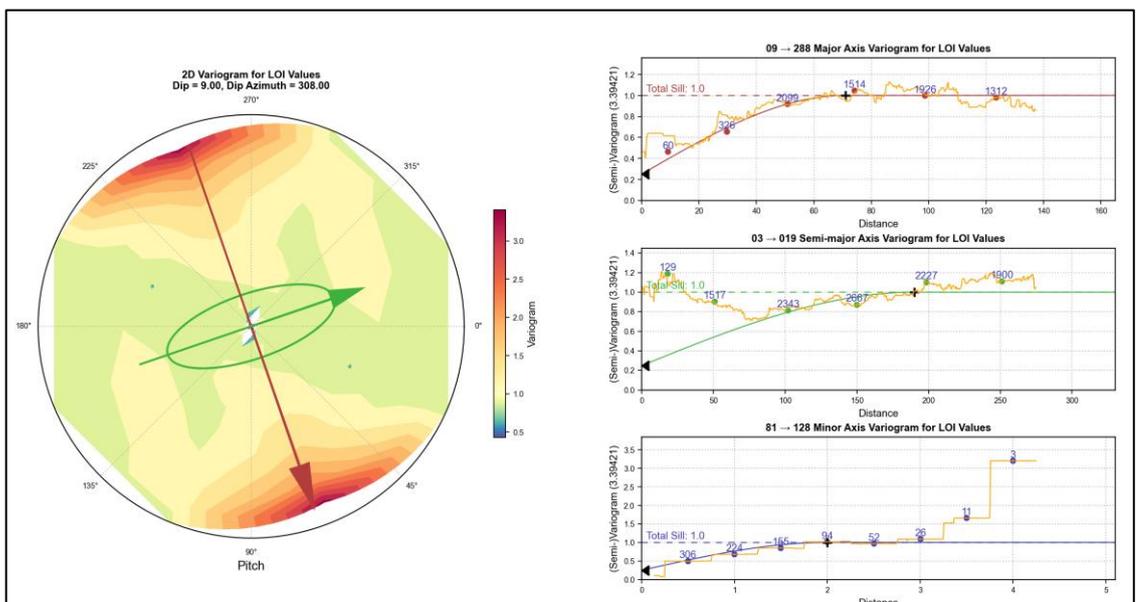
Figure 14-19:   LOI directional variograms and 2D variogram continuity fan for the A2 domain
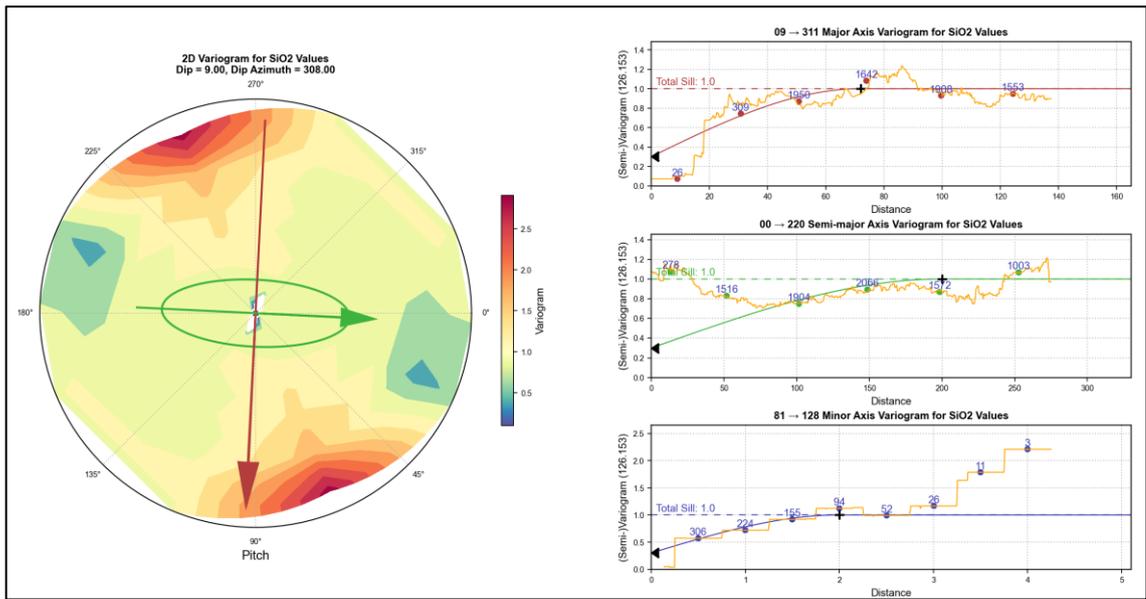
Figure 14-20:   SiO2 directional variograms and 2D variogram continuity fan for the A2 domain
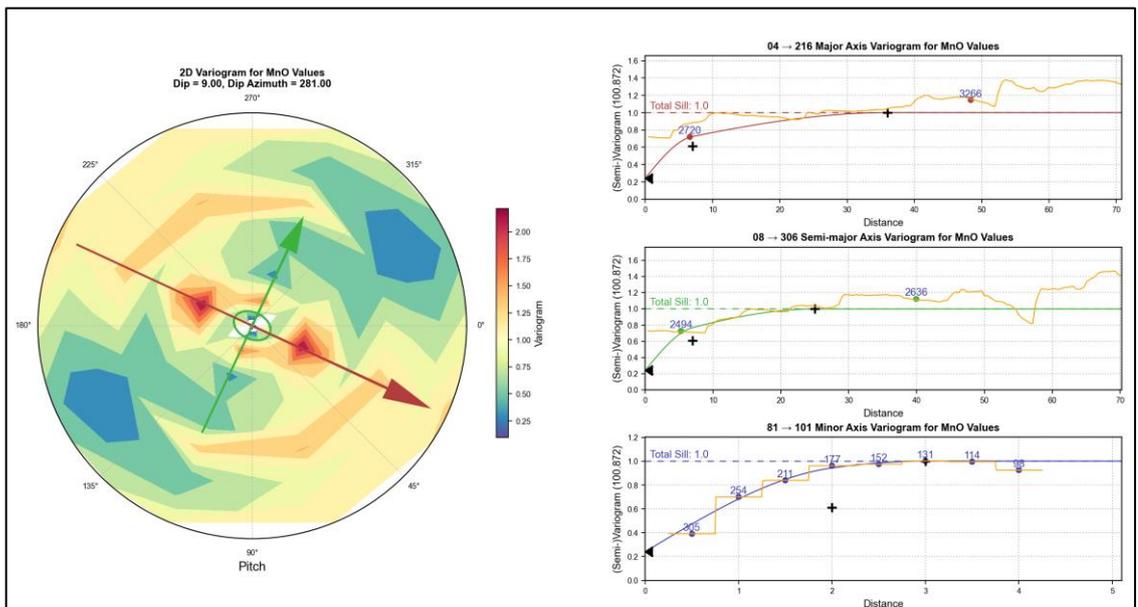
Figure 14-21:   MnO directional variograms and 2D variogram continuity fan for the B domain
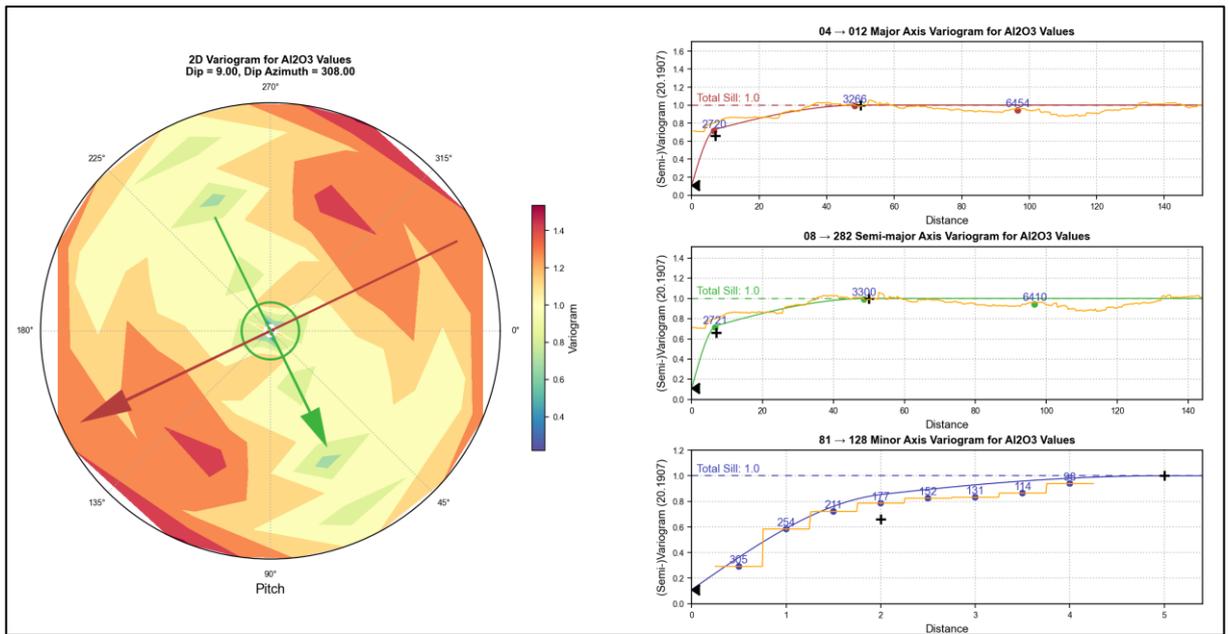
Figure 14-22:   Al2O3 directional variograms and 2D variogram continuity fan for the B domain
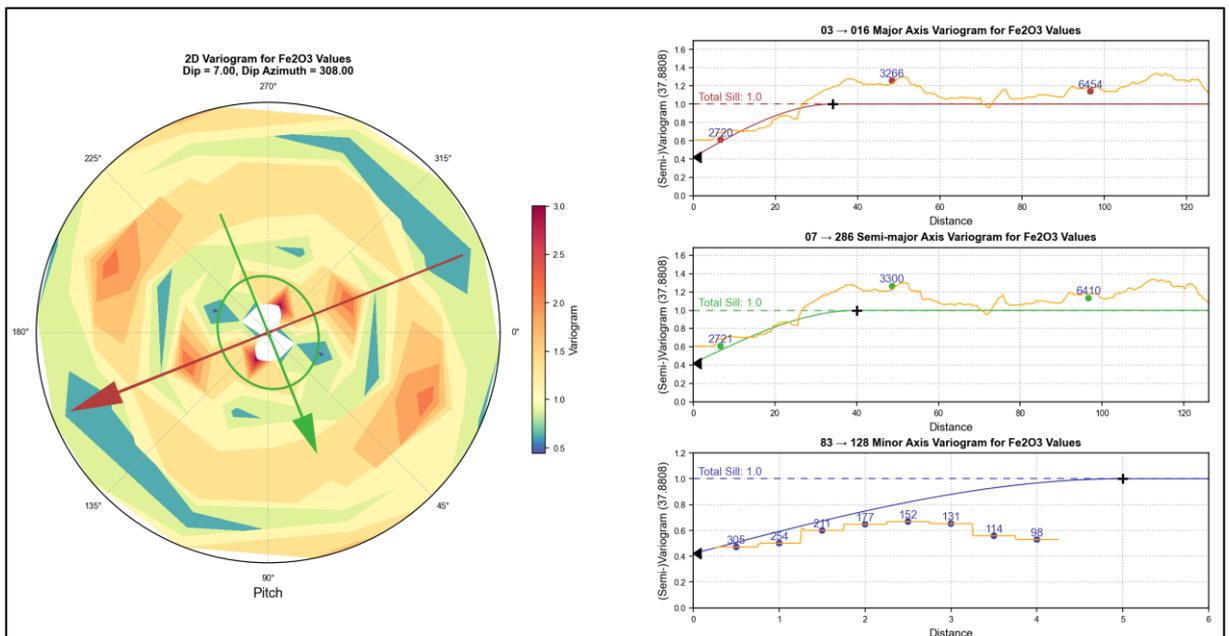
Figure 14-23:   Fe2O3 directional variograms and 2D variogram continuity fan for the B domain
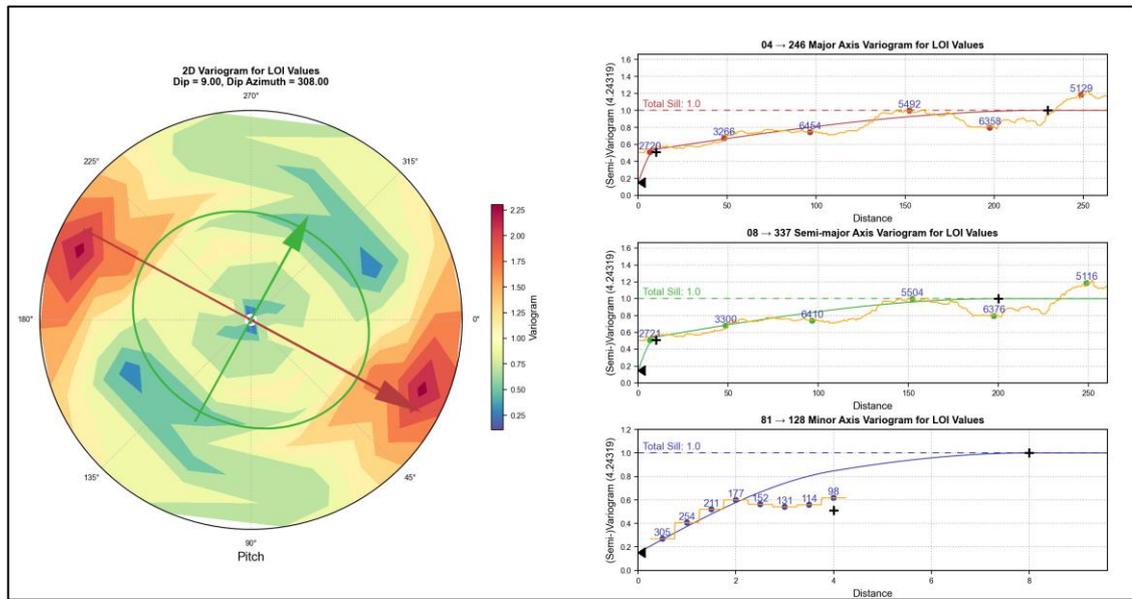
Figure 14-24: LOI directional variograms and 2D variogram continuity fan for the B domain
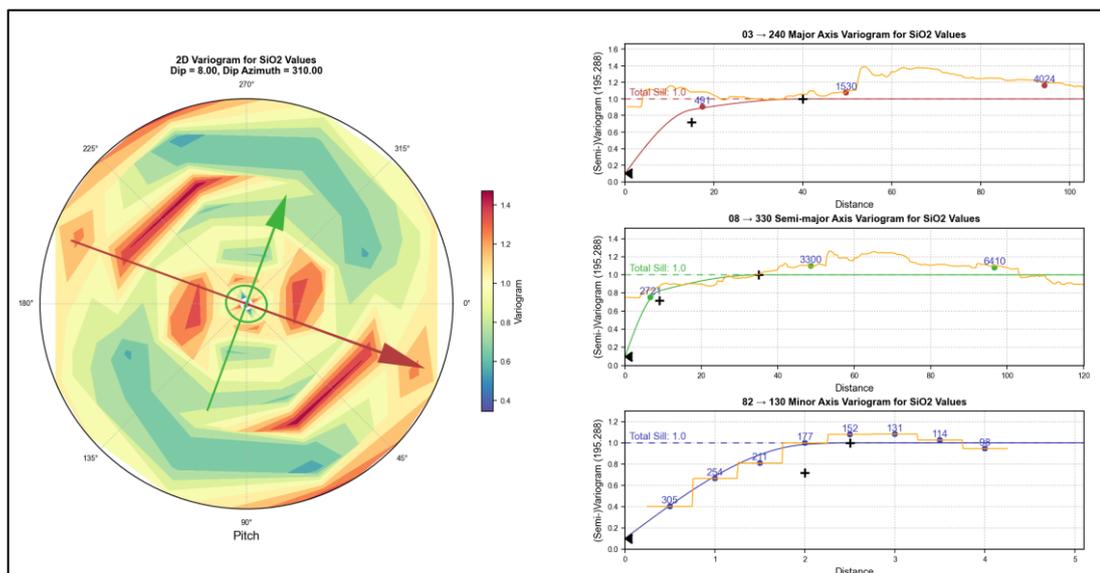
Figure 14-25: SiO2 directional variograms and 2D variogram continuity fan for the B domain

Table 14-4:   Table of variogram parameters for domains estimated using OK

Domain	Variable	Major Range (m)		Semi-Major Range (m)		Minor Range (m)	
A2	**Al_2O_3**	52		83		2.5	
	Fe_2O_3	40		94		2.5	
	MnO	72		37		2	
	LOI	71		190		2	
	SiO_2	72		200		2	
		Structure 1	Structure 2	Structure 1	Structure 2	Structure 1	Structure 2
B	**Al_2O_3**	7	5 0	7	50	2	5
	Fe_2O_3	34	-	40	-	5	-
	MnO	7	36	7	25	2	3
	LOI	10	230	10	200	4	8
	SiO_2	15	40	9	35	2	2.5

14.6   Block model

A block model was constructed by SRK with cell dimensions of 25 mX by 25 mY by 1 mZ. The block size was chosen based on the average drillhole spacing of 50 m, and results in 2 parent blocks between drillholes (in plan). The block model was sub-blocked to a minimum sub-cell size of 5 mX by 5 mY by 0.5 mZ. The small sub block height in the Z axis was necessary to retain the granularity of gradational change in the Z axis. Estimation domain wireframes were used as sub-blocking triggers.

14.7   Estimation

14.7.1   Estimation Parameters

For the high-grade domain, where variograms could be modelled, a two-pass search strategy was used for estimation into parent blocks by Ordinary Kriging ("OK"). The first search ellipsoid radii were set at 120 m by 180 m by 10 m. Approximately 70% of the blocks were estimated in the first pass. The second search was undertaken to estimate all the remaining blocks, using a significantly expanded search ellipsoid of 500 m by 500 m by 100 m. All other estimation parameters were unchanged from the first search pass. The search ellipsoid used a variable orientation based on the mineralisation domain wireframes, aligned with the sub-horizontal layering. The minimum number of composites required to estimate a block was 4 and the maximum was restricted to 12. A maximum of 2 composites per drillhole was applied to the estimation of each block. The application of this restriction aimed to maintain across-strike variability in the block estimates. This approach also ensures that multiple drillholes are used to inform each block estimate.   The search parameters for the A2 and B domains are summarised in Table 14-5.

Since variograms could not be modelled for the remaining mineralised domains, all the assayed variables were estimated into parent blocks using IDW2. The minimum number of composites required to estimate a block was 4 and the maximum was restricted to 12. A maximum of 2 composites per drillhole was applied to the estimation of each block. Search ellipsoid ranges were set to 600 m by 600 m by 200 m. All blocks were estimated in the first search pass. As with the high-grade domain, a variable orientation search was applied, aligned with the sub-horizontal layering.

The search parameters for the top and bottom low-grade margins are summarised in Table 14-6.

Table 14-5:   K-Hill Estimation search parameters (A2 and B domains)

Pass 1 Search Distance			Number of Composites		Max Composites per Drillhole	Pass 2 Search Distance		
X	Y	Z	Min	Max		X	y	z
120 m	180 m	10 m	4	12	2	500 m	500 m	100 m

Table 14-6:   K-Hill Estimation search parameters (A1, A3 and C domains)

Search Distance			Number of Composites		Max Composites per Drillhole
X	Y	Z	Min	Max	
600 m	600 m	200 m	4	12	2

14.8   Validation

Validation of estimated grades and densities was undertaken by SRK using the following methods:

- Visual examination of the input data against the block model estimates

- Swath plots, that compare the average grades of the block model against the input data along a number of corridors in various directions through the deposit

- Comparison of the input data statistics against the model statistics

The validation checks completed by SRK suggest that the drillhole grades are well represented by the estimated block model domains, both locally and globally, and that, in general, the model validation does not highlight any material concerns in the quality of the estimation. Swath plots of MnO in the five estimation domains are displayed in Figure 14-26 to Figure 14-30. The mean composite sample grades are compared to the average model grades, by estimation domain, in Table 14-7. Relative differences between the model grade and input data grade for the main mineralised domains are generally less than 5%. No declustering was applied.
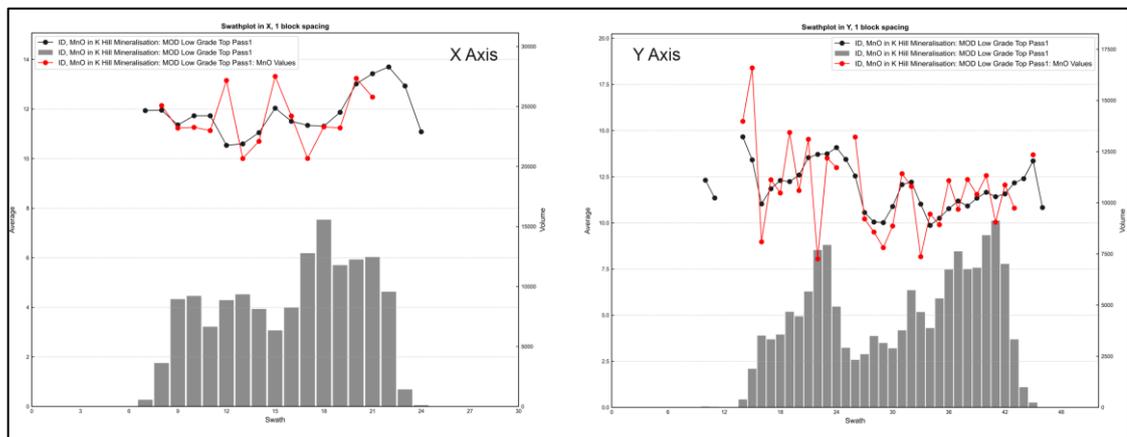
Figure 14-26: **Swath plots for MnO in the A1 domain. Block grades are shown as the black line, composite sample grades in red and a histogram of sample counts as grey bars**
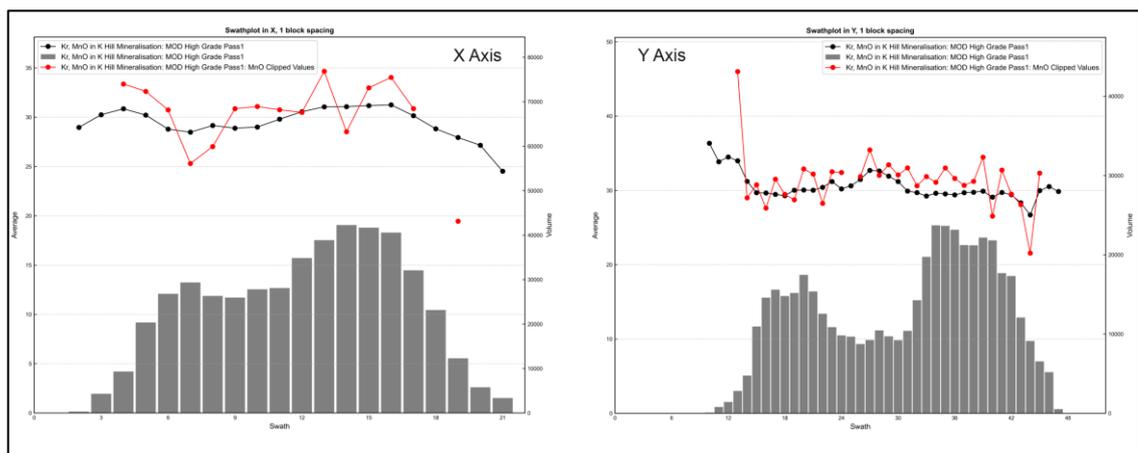
Figure 14-27: **Swath plots for MnO in the A2 domain. Block grades are shown as the black line, composite sample grades in red and a histogram of sample counts as grey bars**
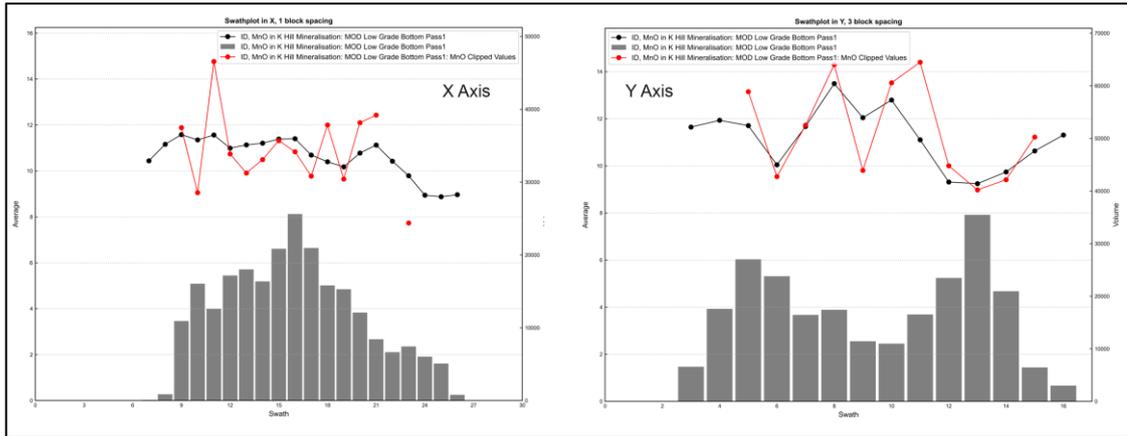
Figure 14-28: Swath plots for MnO in the A3 domain. Block grades are shown as the black line, composite sample grades in red and a histogram of sample counts as grey bars
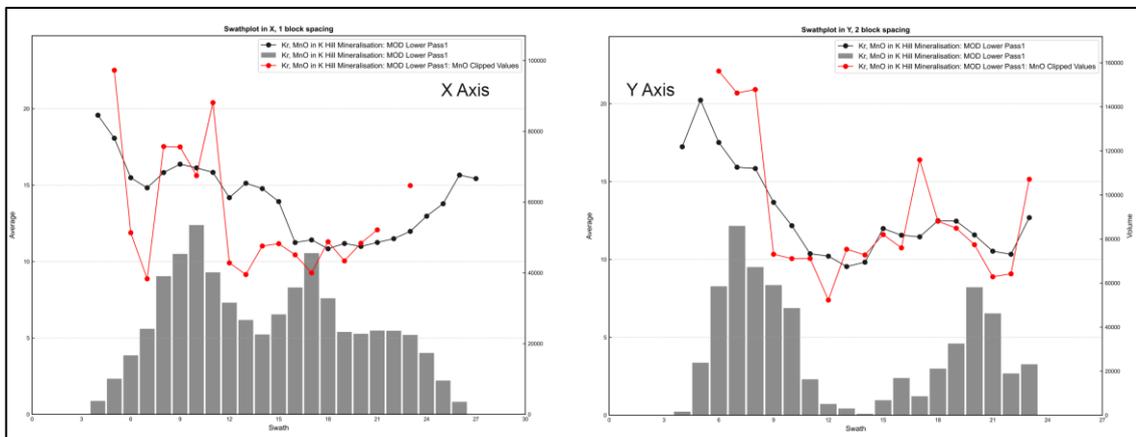
Figure 14-29: Swath plots for MnO in the B domain. Block grades are shown as the black line, composite sample grades in red and a histogram of sample counts as grey bars
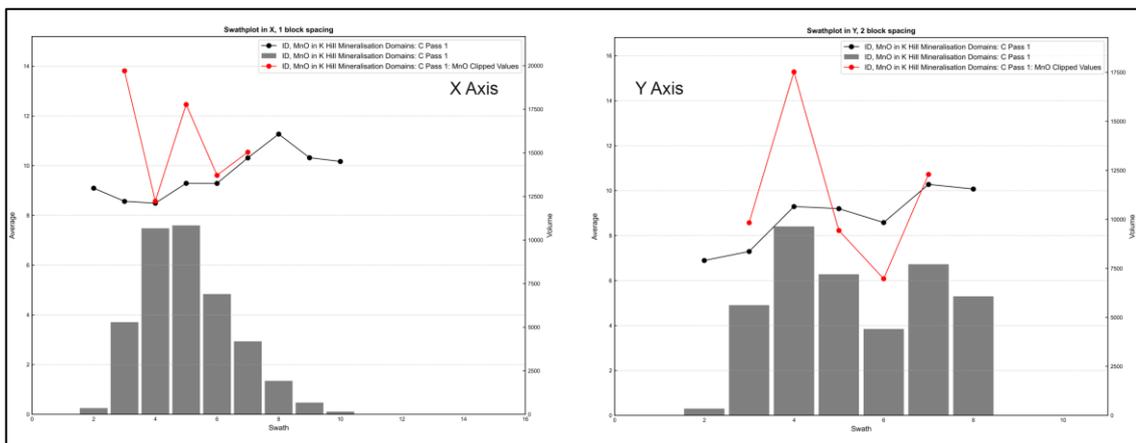
Figure 14-30: Swath plots for MnO in the C domain. Block grades are shown as the black line, composite sample grades in red and a histogram of sample counts as grey bar

Table 14-7:   Comparison of mean of the composite data with the mean of the model data

Domain	Composite mean grade					Block Model mean grade					Percentage difference (%)				
	MnO (%)	Al$_2$O$_3$ (%)	Fe$_2$O$_3$ (%)	LOI (%)	SiO$_2$ (%)	MnO (%)	Al$_2$O$_3$ (%)	Fe$_2$O$_3$ (%)	LOI (%)	SiO$_2$ (%)	MnO	Al$_2$O$_3$	Fe$_2$O$_3$	LOI	SiO$_2$
A1	11.55	11.56	10.65	5.62	54.83	11.85	11.81	11.24	5.82	53.35	3	2	6	4	-3
A2	31.29	9.97	19.26	9.99	21.86	29.93	10.25	19.40	9.81	22.63	-4	3	1	-2	4
A3	10.86	11.78	13.04	4.97	53.22	10.89	11.56	13.81	4.97	52.63	0	-2	6	0	-1
B	13.23	9.68	11.93	6.11	53.55	14.32	9.01	12.66	6.56	52.03	8	-7	6	7	-3
C	10.90	9.15	14.30	6.56	54.90	9.20	9.33	14.55	6.54	55.89	-16	2	2	0	2

The block model grades largely correspond well with the input sample data. It is noted that the block model average MnO grade in Domain C is 16% lower than the raw composite sample mean. This is due to the presence of a single high-grade composite (18.98% MnO) that is well constrained by other samples.

Plan view images of the block estimates, coloured by MnO grade, alongside the drillhole MnO grades composited to a single composite grade per drillhole intersection are also provided in Figure 14-31 to Figure 14-35. The plans visually confirm that the block model is representative of the composite input data.
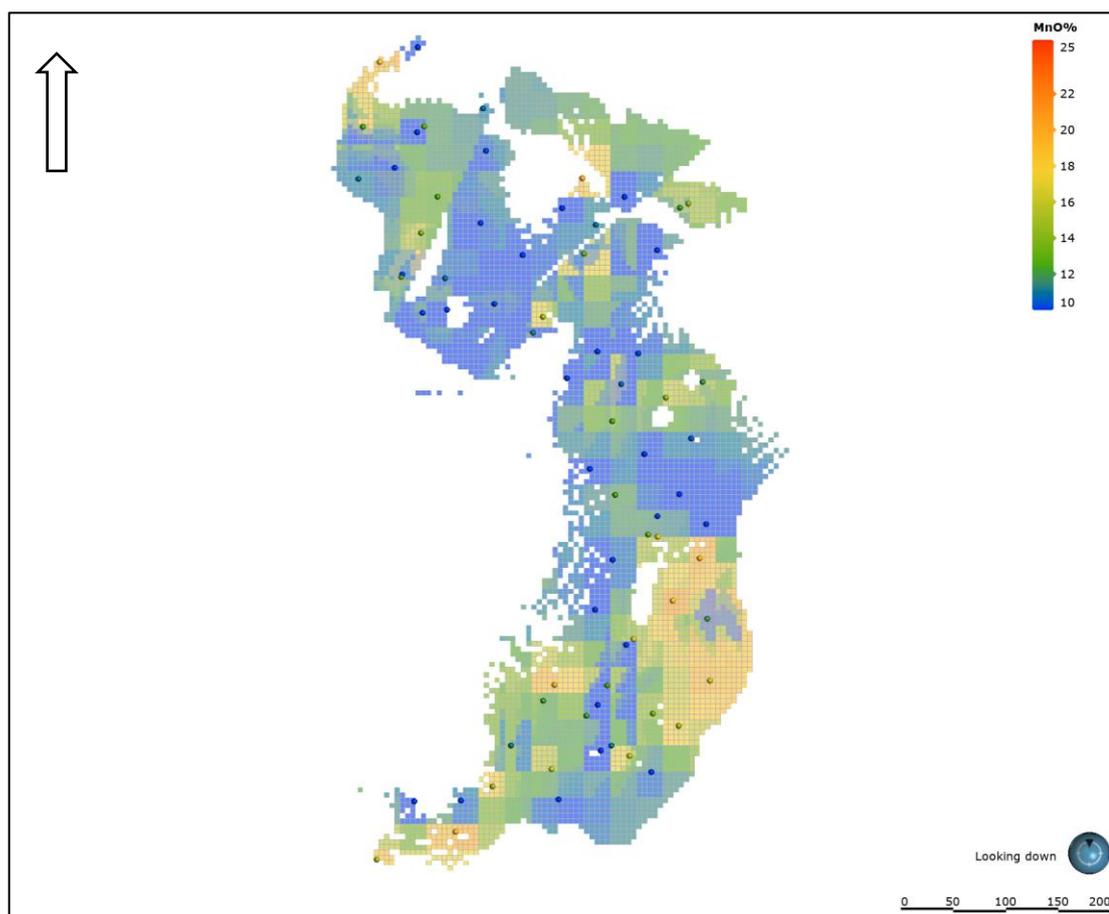
Figure 14-31:   Plan view of the A1 domain block model, coloured by MnO grade, shown alongside the drillhole grades (as points). Scale is in metres
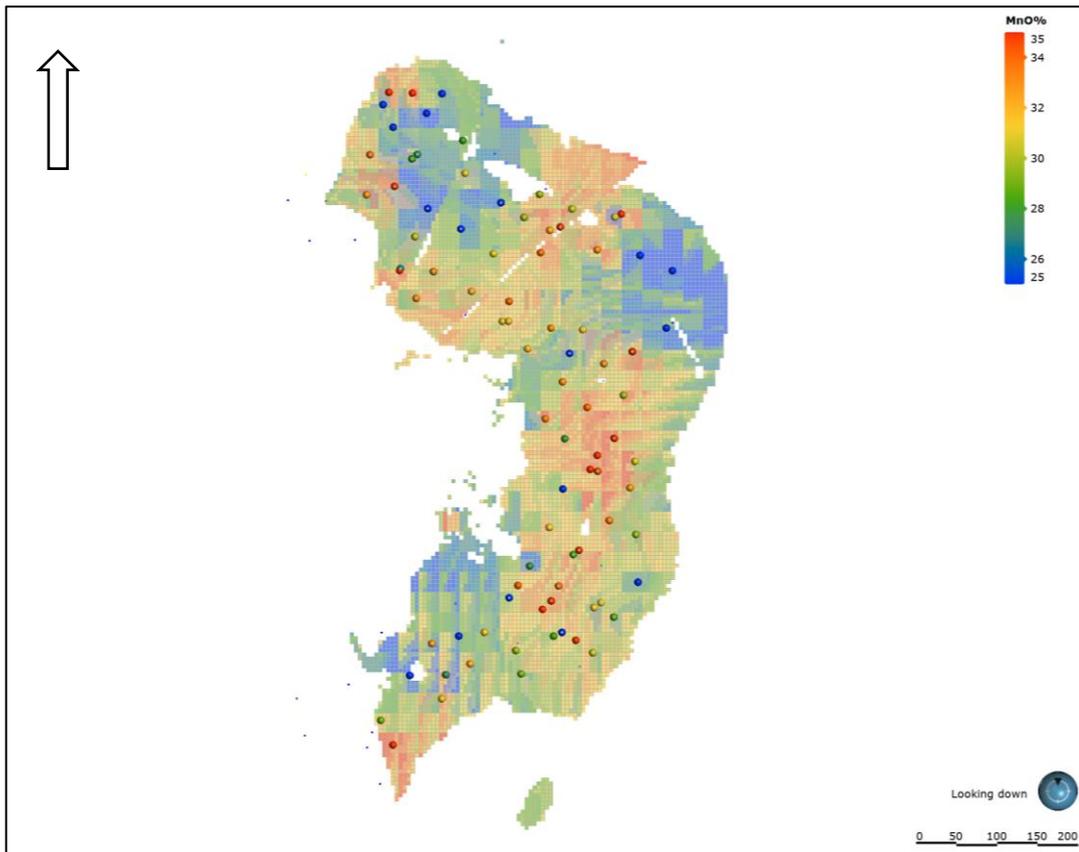
Figure 14-32:   Plan view of the A2 domain block model, coloured by MnO grade, shown alongside the single composite drillhole grades (as points). Scale is in metres
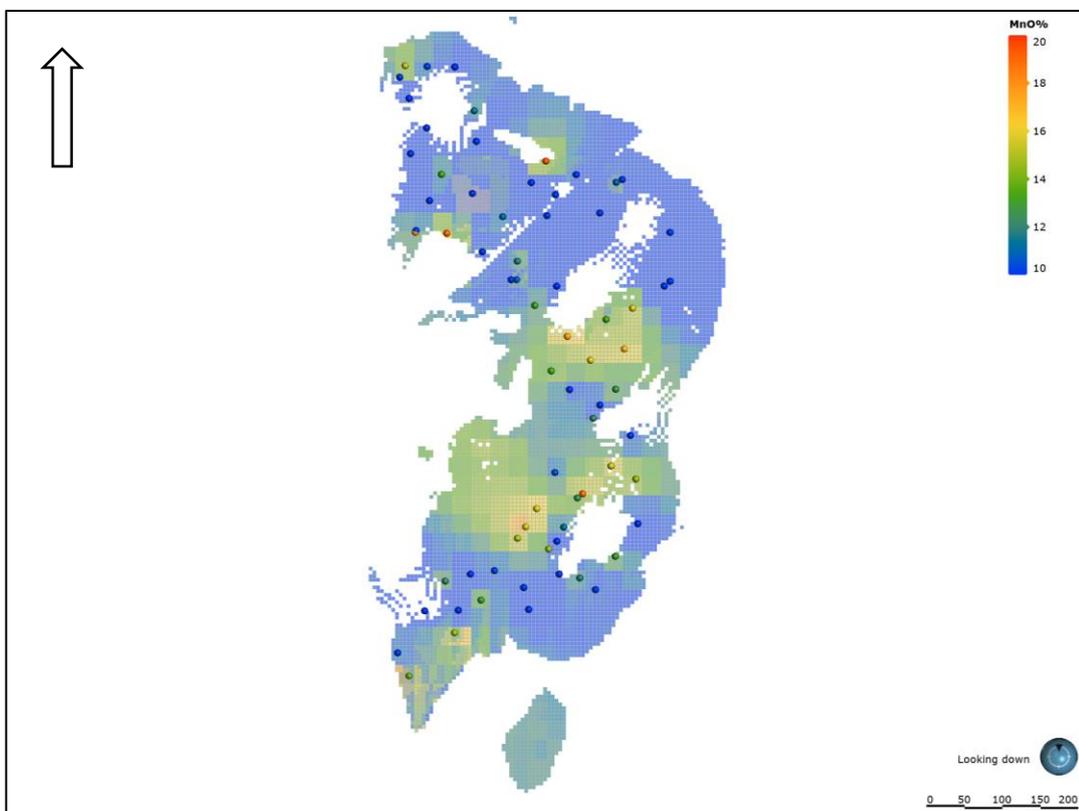
Figure 14-33:   Plan view of the A3 domain block model, coloured by MnO grade, shown alongside the drillhole grades (as points). Scale is in metres
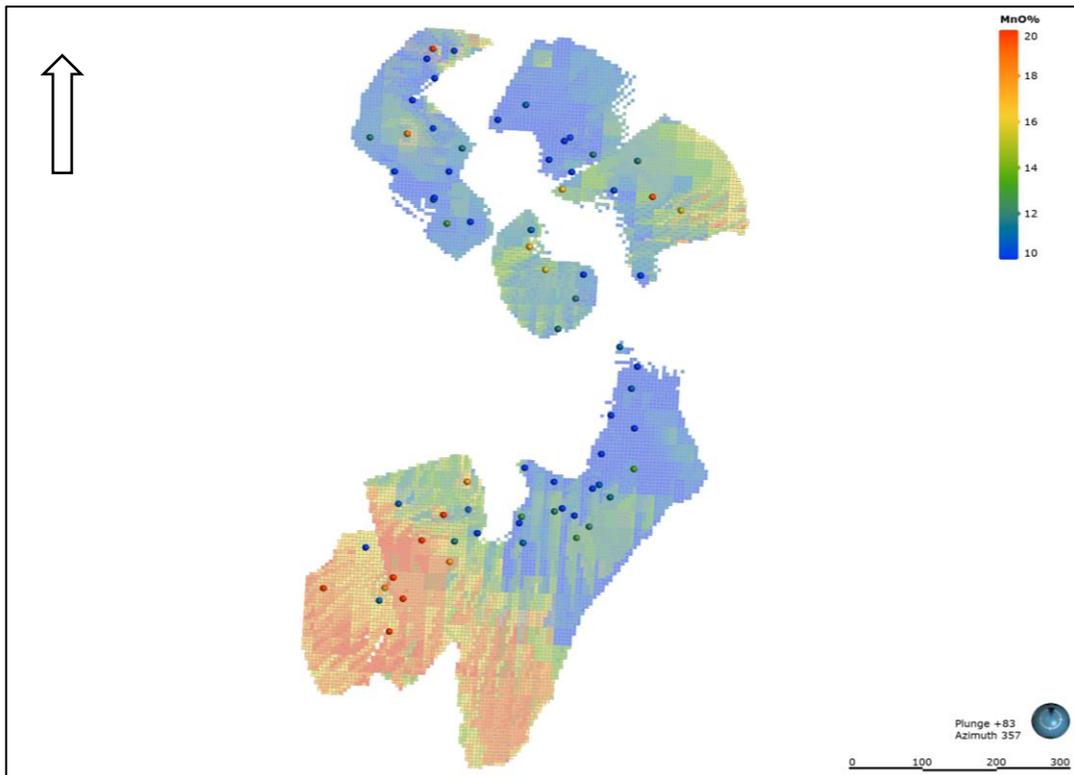
Figure 14-34: **Plan view of the B domain block model, coloured by MnO grade, shown alongside the drillhole grades (as points). Scale is in metres**
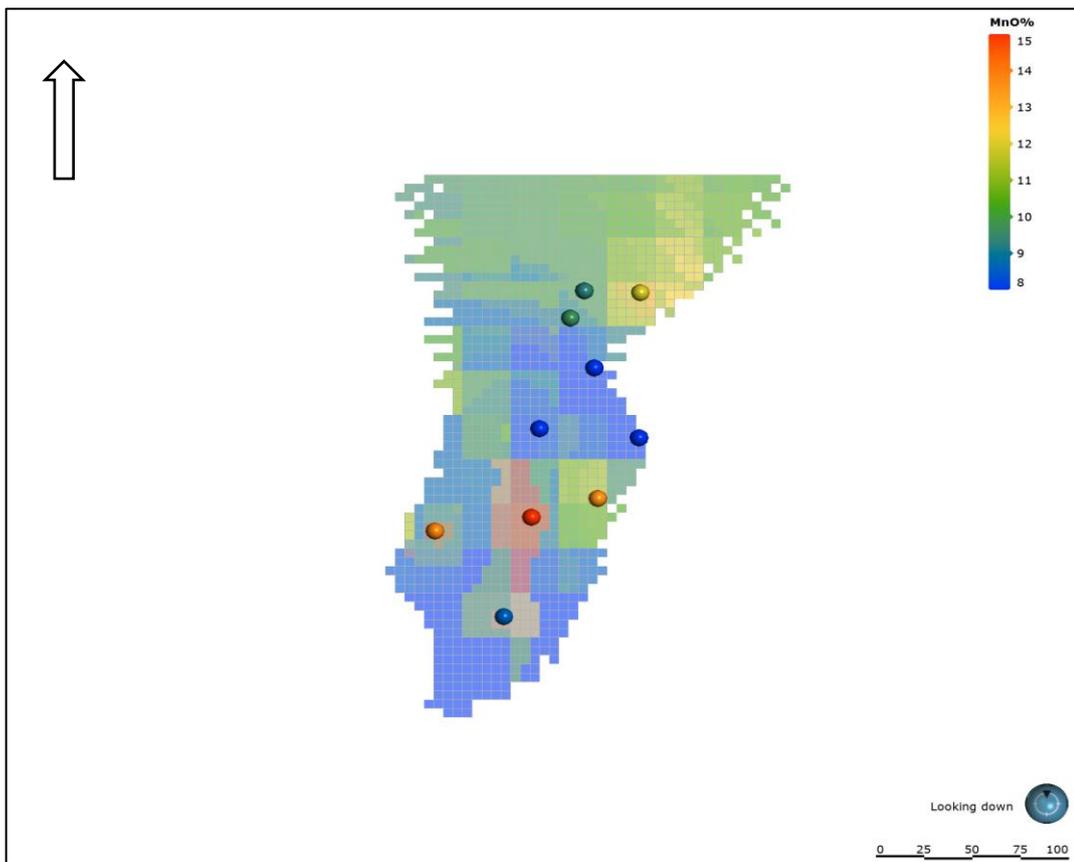
Figure 14-35: **Plan view of the C domain block model, coloured by MnO grade, shown alongside the drillhole grades (as points). Scale is in metres**

14.9   Assignment of Density to the Block Model for Tonnage Estimation

SRK was provided with a number of different density datasets and has analysed them separately in order to decide on the best approach to assigning densities to the block model. The datasets are described below:

- SET 1: A dataset of 732 density samples taken from the Phase 1 DD program and measured using the Archimedes method, of which, 207 are taken within mineralisation. Core was sampled wet and not dried prior to measurement

- SET 2: A dataset of 49 density samples taken from the Phase 2 DD program and measured using the Archimedes method, of which, 25 are taken within mineralisation. Samples were dried and wax coated prior to measurement

- SET 3: A dataset of 30 core samples taken from outcrop using a handheld coring machine. Sample densities were calculated using the volume of the core barrel and the weight of the sample after drying, rather than by the Archimedes method. All samples were taken in mineralisation

- SET 4: A dataset of 3 trial pits in mineralisation where pits were filled with water to measure volume and the excavated material dried and weighed to calculate density. All samples were taken in mineralisation

In the March 2021 MRE, only the SET 1 dataset was available. SRK utilised this dataset and applied a 10% reduction to the density values in order to account for the assumed water content. This value was a high level estimation and impossible to determine accurately. As a result, SRK requested that the client collect further density data prior to the current MRE. Giyani then collected the SET 2, 3 and 4 datasets. Of these, only the SET 2 dataset provided sufficiently robust data for use in the MRE. Sets 3 and 4 datasets were disregarded after analysis as they were taken from a single locality and showed very large variances in calculated density values. For the SET 3 dataset, this is likely due to the calculation of density based on the volume of expected material in the core barrel and is not possible to account for any loss of core during drilling. For the SET 4 data, the large variation is likely due to the fact the pits were not lined and water loss into the ground during filling is therefore hard to account for accurately.

In deciding on an approach to assigning density data to individual blocks and domains, SRK investigated the correlation between MnO grade and density to create a regression. The study of the relationship between MnO grade and density yielded poor results, with no clear relationship between MnO grade and density identified. A scatter plot showing the relationship between the two variables is shown in Figure 14-36. SRK notes that it was only possible to conduct this analysis on the Phase 1 DD density dataset, as no assays were undertaken on core used for density determinations from the most recent Phase 3 DD program.

SRK consider that there is insufficient samples within the SET 2 dataset to justify direct estimation of this data into the block model. It was therefore decided to apply average density values to the block model on a domain-by-domain basis. No samples are available for the thin overburden cover (OVB). As such, a standard density for soil and loose rock of 1.5 g/cm^3 was applied to this domain. Similarly, no density samples were taken within the minor C horizon. SRK assigned average density value from the B horizon to this domain, as both domains have a broadly similar grade profile. There are also no samples available in the SET 2 database for the FEL waste rock domain. Here, SRK used the SET 1 data, with the application of a 10% decrease in density to account for moisture content. Table 14-8 provides a summary of the density and methodology used for each domain.

SRK considers the limited quantity of appropriate dry density data a potential risk to the reported K-Hill Mineral Resource. It is strongly recommended that additional density data is captured to better inform the assignment of density to the block model in future updates.
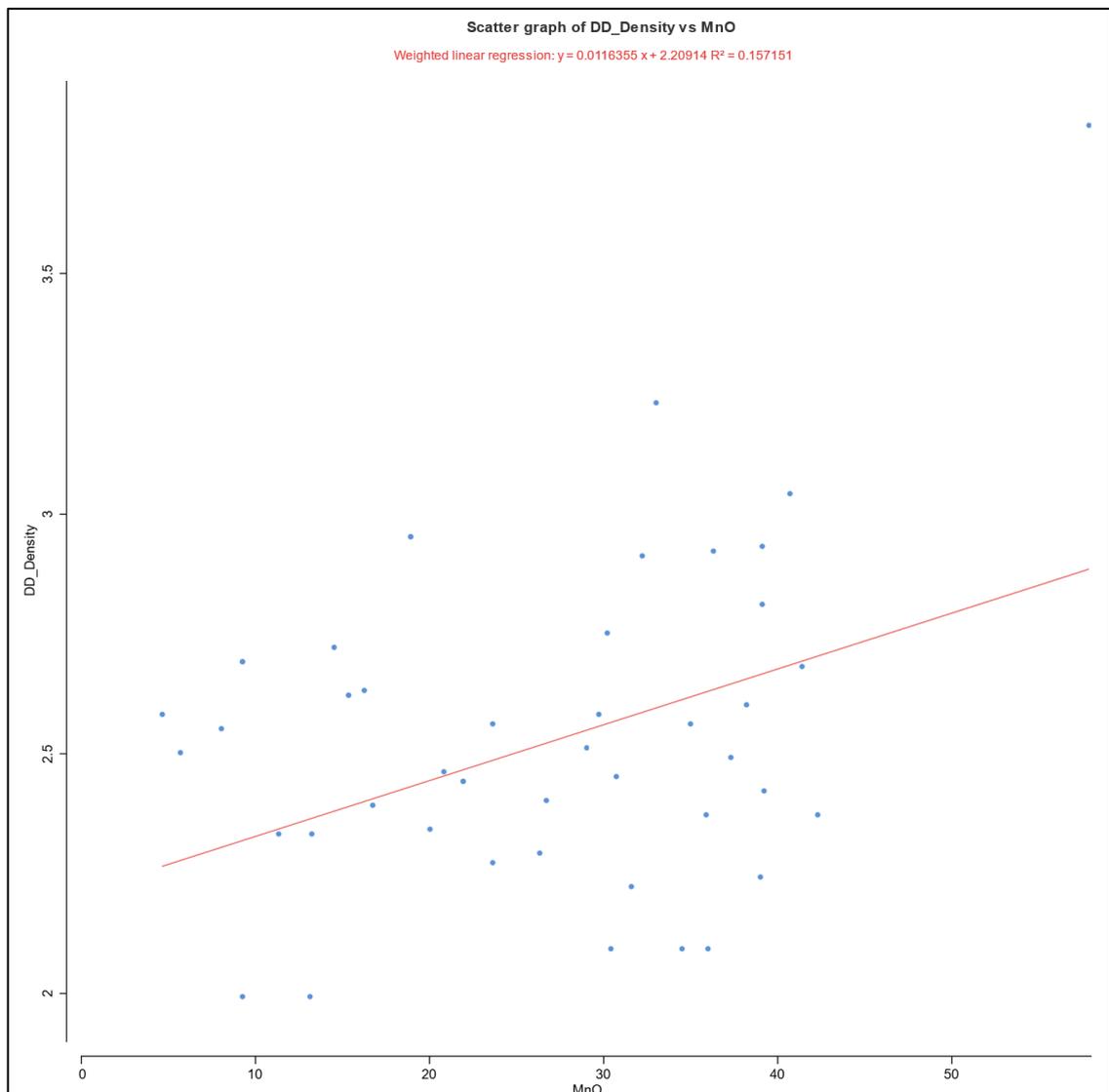
Figure 14-36: **Scatter plot of Density vs MnO grade within the three mineralised domains, taken from the Phase 1 DD program**

Table 14-8:   Summary of densities and methodologies applied

Domain Type	Domain	Methodology	SG applied (g/cm³)	Number of Samples
Mineralised Zones	**A1**	Average of density samples in domain from SET 2	2.18	2
	A2	Average of density samples in domain from SET 2	2.14	14
	A3	Average of density samples in domain from SET 2	2.28	5
	B	Average of density samples in domain from SET 2	2.32	4
	C	Average of samples from the B domain used from SET 2	2.32	0
Waste Rock	**OVB**	Assumed soil density applied	1.5	n/a
	CDB	Average of density samples in domain from SET 2	2.48	7
	FSH 1	Average of density samples in both FSH domains from SET 2	2.01	17
	FSH 2	Average of density samples in both FSH domains from SET 2	2.01	17
	FEL	Average taken from SET 1 dataset, with 10% reduction applied	2.38	22

14.10 Classification

The K-Hill Mineral Resource was classified based on confidence in the data, confidence in the geological model, grade continuity and variability and the frequency of the drilling data. The main considerations in the classification of the Mineral Resource were as follows:

- Confidence in the accuracy and precision of the assay data, which is considered appropriately robust for the reporting of a Mineral Resource

- The variability in MnO grade within the Upper Mn Shale domains

- The extent of the mineralisation based on mapped outcrops and geological confidence in the extent of the mineralization, which is considered to be high

- The drilling recoveries in the Phase 1 DD program are very poor due to the friable nature of the near surface material, however, significant improvements in drilling technique have been made allowing for much higher recoveries in the later phase 3 DD campaign. RC recoveries are hard to assess but do not show any systematic biases

- Reliable density data is limited, despite Giyani's best efforts to explore numerous methods of collecting density data. The reliance on a small but high quality dataset of wax coated, dry density measurements is the most significant risk identified. SRK notes that the average values derived from the smaller wax coated density dataset correlate well with the average values derived from the much larger "wet density" dataset used in the previous MRE, once the 10% reduction in density has been applied to account for the presence of water

- The topographic survey used to limit the vertical extent of the geological interpretation and block model is considered to have a high degree of accuracy

- The extent of underground workings is now reasonably well understood. SRK notes that there is a potential risk that additional underground workings of significance may exist than have not been currently identified

- The drillhole collars were measured using a DGPS and thus the X and Y collar locations have a high degree of accuracy and precision

- Direct metallurgical testwork has not been undertaken on material from the B and C horizons. At this stage it is unclear whether this material will have the same comminution and processing characteristics as the tested material from the A horizons. Initial geological observations suggest that the material is lithologically similar to that found in the A horizons. Although the MnO grade of the B and C horizons is significantly lower than the A2 domain. Processing testwork on other mineralised material conducted to date has indicated that Mn recovery is not sensitive to changes in head grade. Until detailed testwork has been completed, the processing characteristics of the A and B horizons remains an unknown, and this has been considered in the classification of the updated Mineral Resource

Given the above, SRK has classified the A1, A2 and A3 domains as Indicated Mineral Resources for all blocks within 40 m of a drillhole and Inferred Mineral Resources for areas with adequate geological support, but are greater than 40 m from a drillhole. A small portion of the A1, A2 and A3 horizons have not been classified at the margins where poor geological and drilling support exists. SRK has classified the B and C horizons as Inferred Mineral Resources due to the reasonable level of geological and grade confidence, but lack of appropriate metallurgical testwork. As with the A horizons, a small portion of the B and C horizons have not been classified at the margins where poor geological and drilling support exists.

Plan views of the classified domains are provided in Figure 14-38 to Figure 14-41. All other estimation domains, as well as the areas impacted by artisanal mining, are not considered as part of the Mineral Resource.

The increase in classification from Inferred to Indicated since March 2021, for the upper portion of the deposit, reflects the significant increase in laboratory analysed drillhole intersections and reduction in drillhole spacing since the previous Mineral Resource was declared.

SRK has provided a series of recommendations (Section 26) on steps required to improve confidence in the data quality, geological and grade continuity, and grade / tonnage estimation.
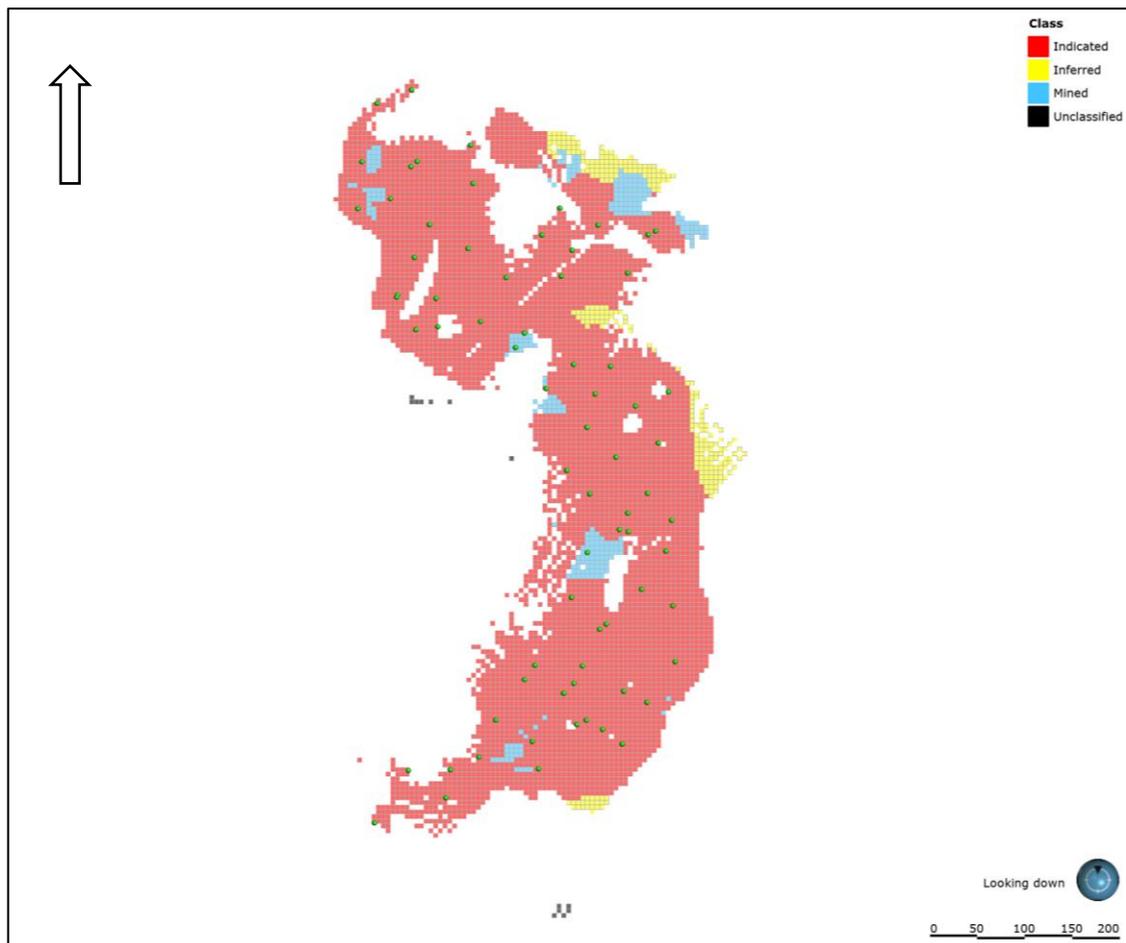
Figure 14-37:   A1 domain coloured by classification. Sample locations used to estimate the domain displayed as points. Artisanal mining depletion shown in blue. Scale is in metres
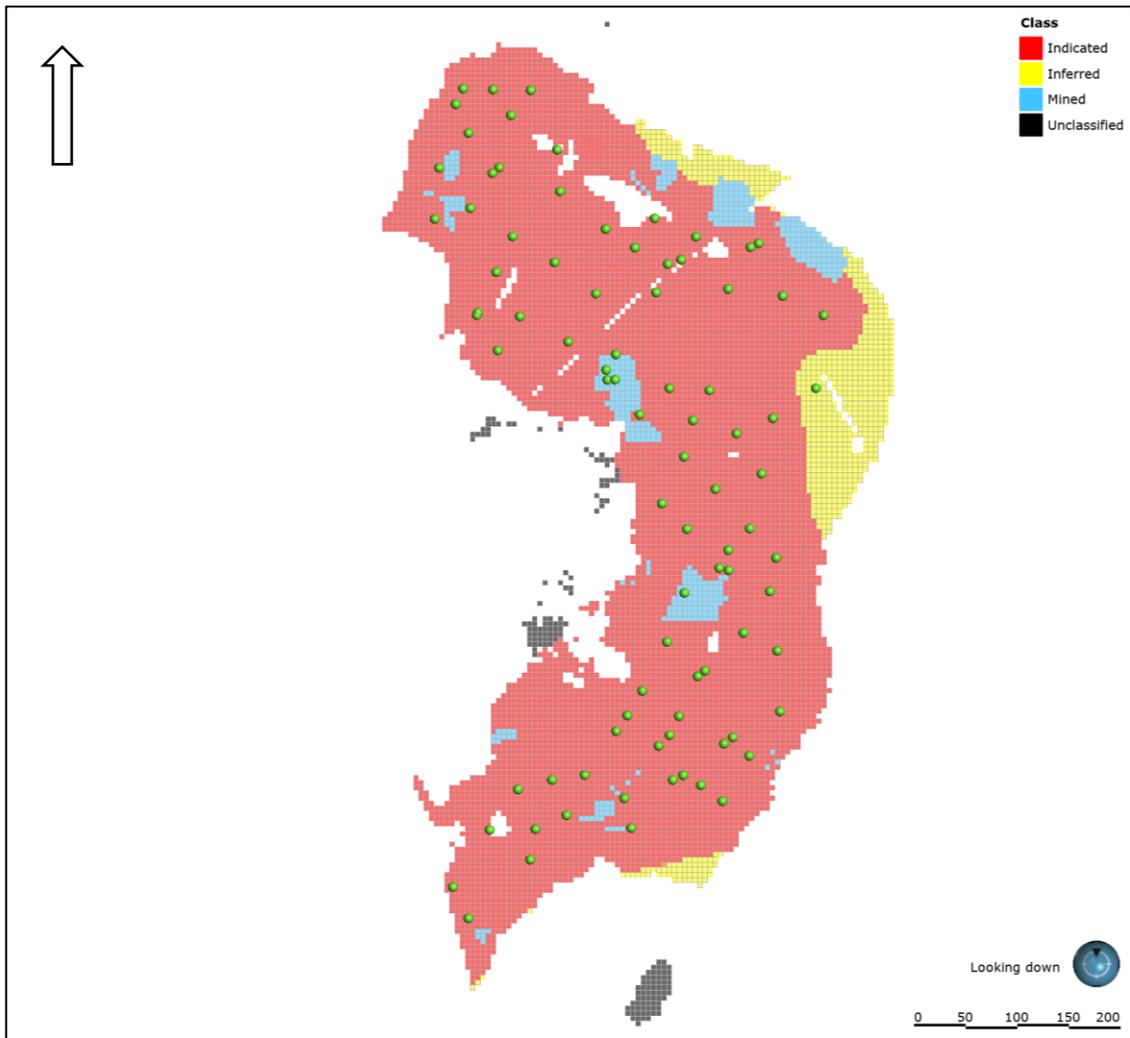
Figure 14-38:   A2 domain coloured by classification. Sample locations used to estimate the domain displayed as points. Artisanal mining depletion shown in blue. Scale is in metres
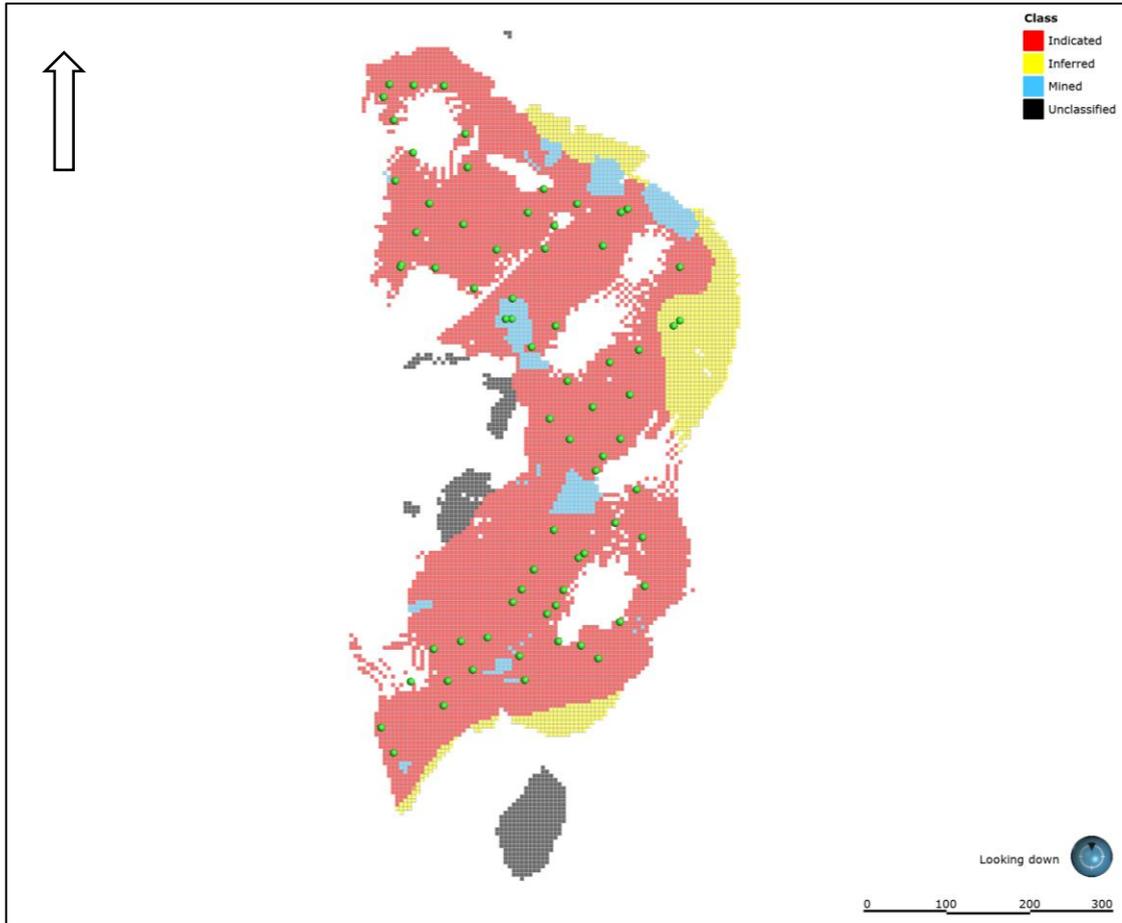
Figure 14-39: A3 domain coloured by classification. Sample locations used to estimate the domain displayed as points. Artisanal mining depletion shown in blue. Scale is in metres
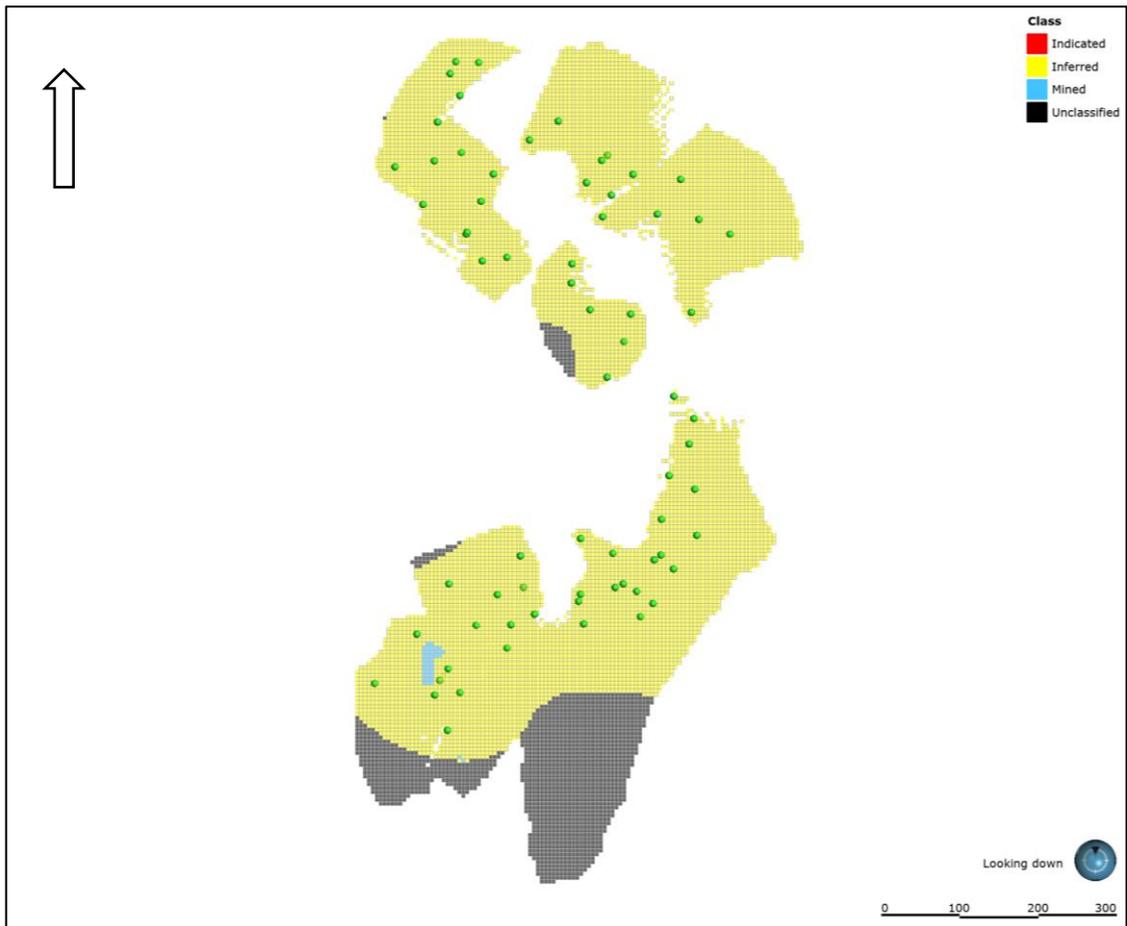
Figure 14-40:   B domain coloured by classification.   Sample locations used to estimate the domain displayed as points.   Artisanal mining depletion shown in blue.   Scale is in metres
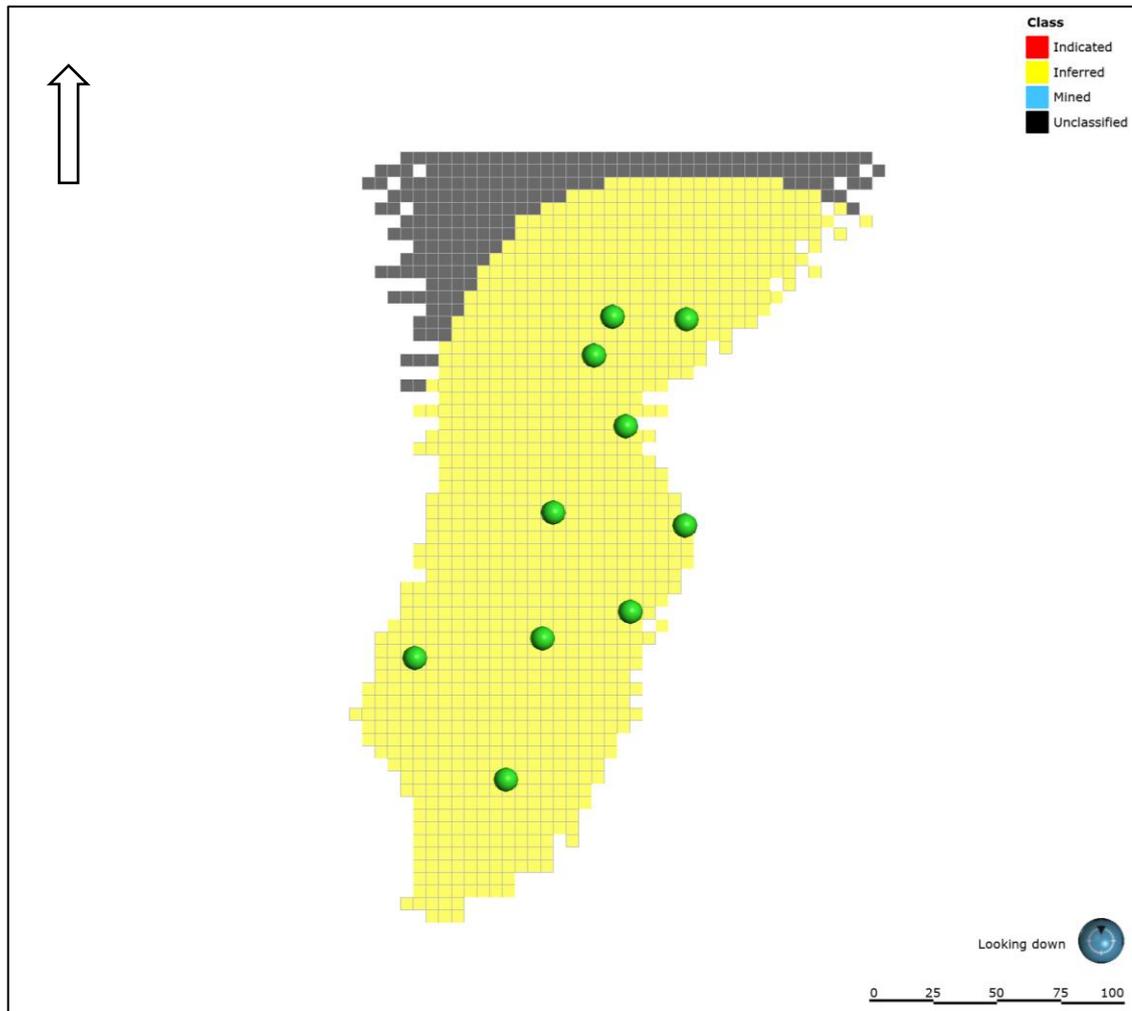
Figure 14-41:   C domain coloured by classification. Sample locations used to estimate the domain displayed as points. Artisanal mining depletion shown in blue. Scale is in metres

14.11 Reasonable Prospects for Eventual Economic Extraction

In order to assess the quantities of material offering "*…reasonable prospects for eventual economic extraction*", SRK has completed a pit optimisation study based on economic and mining assumptions to evaluate the proportions of the block model that could be "reasonably expected" to be mined from an open pit.

The open pit optimisation was undertaken using NPV Scheduler software. NPV Scheduler uses the Lerchs-Grossmann algorithm for determining the shape of an optimal pit using a set of input parameters.   The Project assumes the production of a high purity manganese sulphate monohydrate ("HPMSM") product. For the purposes of the pit optimisation study, SRK has applied a long-term price for HPMSM of USD1,588 /t CFR Japan/Korea based on market data supplied by a 3rd party marketing consultant acting on behalf of the Company.

SRK notes that the long term HPMSM price quoted is based on 2020 market data, which was available at the time of reporting the Mineral Resource. SRK understands that additional pricing information will be available for input into subsequent technical studies, and this may impact on the Mineral Resource reported. In light of the sensitivity of the Mineral Resource to the selling price, this is not considered to be a material risk in reporting the Mineral Resource and may present a further opportunity.

The pit optimisation parameters are outlined in detail in Table 14-9 and include consideration for the relevant operating costs, selling costs (incorporation of freight charges to reflect Free on Board pricing, and royalties).

Table 14-9:   Pit optimisation parameters

Parameters	Units	Base Case
Production		
Production Rate – RoM	(tpa)	200,000
Geotechnical		
Overall Slope Angle	(Deg)	41
Mining Factors		
Dilution	(%)	3
Recovery	(%)	98
Processing		
Total process recovery MnO	(%)	90.7
Operating Costs		
Mining Cost	(USD/t_{rock})	3.46
Processing	(USD/t_{RoM})	213.0
Selling Cost Mn	(%)	3.0
	(USD/t MnO)	114.0
G&A	(USDm/Year)	3,500,000
	(USD/t_{RoM})	20.0
Metal Price		
MnO	(USD/t)	3,784
HPMSM	(USD/t)	1,588
Other		
Discount Rate	(%)	10
Cut-Off Grade		
Marginal	(% MnO)	7.3

SRK notes that the pit optimisation and the pit selected is relatively insensitive to changes in product pricing above a HPMSM price of circa USD1000 /t (approximate 2% reduction in reported metal using a pit at this price).

In addition to the application of a pit shell for reporting, the Mineral Resource is reported above a marginal cut-off grade of 7.3% MnO, calculated based on the parameters outlined in Table 14-9.

14.12 Mineral Resource Statement

The Mineral Resource Statement reported herein has been restricted to all classified material falling within the optimised pit shells described in Section 14.11 representing an HPMSM price of USD1,588 /t and through the application of the parameters outlined in Table 14-9. Additionally, the Mineral Resource is reported above a cut-off grade of 7.3% MnO. This represents the material which SRK considers has reasonable prospects for eventual economic extraction.

The Mineral Resource has been classified according to the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Best Practice Guidelines and is reported in accordance with the 2014 CIM Definition Standards, which have been incorporated by reference into National Instrument 43-101 – Standards of Disclosure for Mineral Projects (NI 43-101). The Mineral Resource is classified into the Indicated and Inferred Mineral Resource categories as shown in Table 14-10. The Mineral Resource represents an update to the Mineral Resource reported by SRK in the March 2021 PEA.

The Qualified Person ("QP") in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Code ('CIM Code'), with responsibility for the reporting of the Mineral Resource Statement presented herein is Dr Lucy Roberts, MAusIMM(CP), a Principal Consultant (Resource Geology) with SRK. Dr Roberts has the relevant experience in reporting Mineral Resources on various base, precious and ferrous metal assets globally.

Mineral Resources are not Mineral Reserves and have not demonstrated economic viability. SRK are not aware of any factors (environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other relevant factors) that have materially affected the Mineral Resource Estimate. It is uncertain if further exploration will convert Inferred and Indicated Mineral Resources to higher confidence categories.

Table 14-10:   K-Hill SRK Mineral Resource Statement, reported within an optimised shell and at a cut-off grade of 7.3% MnO, as of September 2021

Classification	Tonnes (Millions)	MnO %	Al2O3 %	SiO2 %	Fe2O3 %	LOI %
Indicated Mineral Resources	1.6	22.0	10.9	35.7	16.5	7.9
Inferred Mineral Resources	1.4	13.9	9.6	51.4	13.1	6.3

(1) The Indicated and Inferred Mineral Resources are reported above a cut-off grade of 7.3% MnO
(2) All tonnages are reported as dry
(3) The Mineral Resource Estimate is constrained within estimation domains based on geological modelling and grade and within a Lerchs-Grossman optimised pit shell based on an HPMSM price of USD1,588 /t and the following technical-economic parameters:
   a.   Mining Cost – USD3.46 /t rock
   b.   Processing Cost – USD213 /t Run of Mine (RoM)
   c.   Selling cost – 3% and a freight cost of USD60 /t HPMSM
   d.   G&A – USD20 /t Run of Mine (RoM)
   e.   Discount Rate – 10%
   f.   Processing Recovery – 90.7%
   g.   Mining Recovery – 98%
   h.   Mining Dilution – 3%
   i.   Geotechnical Slope Angle - 41°

(4) SRK notes that the long term HPMSM price quoted is based on 2020 market data, which was available at the time of reporting the Mineral Resource. SRK understands that additional pricing information will be available for input into subsequent technical studies, and this may impact on the Mineral Resource reported. In light of the sensitivity of the Mineral Resource to the selling price, this is not considered to be a material risk in reporting the Mineral Resource and may present a further opportunity.
(5) All figures are rounded to reflect the relative accuracy of the estimates.
(6) Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.
(7) It is uncertain if further exploration will convert Inferred Mineral Resources to higher confidence categories.

Table 14-11:   K-Hill Mineral Resource, Reported by Estimation Domain

Estimation Domain	Category	Tonnes (Millions)	MnO %	Al2O3 %	SiO2 %	Fe2O3 %	LOI %
A1	Indicated	0.30	11.9	11.9	53.1	11.3	5.8
A1	Inferred	0.01	11.6	11.4	54.7	10.8	5.8
A2	Indicated	0.89	30.0	10.2	22.6	19.4	9.8
A2	Inferred	0.08	28.6	10.6	23.5	19.2	9.7
A3	Indicated	0.39	11.2	11.5	52.3	13.7	5.0
A3	Inferred	0.06	9.7	11.6	54.1	14.0	5.1
B	Indicated	-	-	-	-	-	-
B	Inferred	1.20	13.3	9.4	53.0	12.6	6.2
C	Indicated	-	-	-	-	-	-
C	Inferred	0.05	9.8	9.1	54.8	14.9	6.6

14.13 Grade-Tonnage Curves

Figure 14-42 shows the MnO grade-tonnage curve for all Indicated and Inferred blocks that fall inside the optimised pit shell. The results show that the Mineral Resource is relatively insensitive to the applied cut-off grade, up to approximately 8% MnO. At increasing cut-off grades, there is a steep reduction in tonnage and increase in grade, particularly between 8% MnO and 20% MnO. This mostly relates to blocks in the A1, A3, B and C horizons. The Mineral Resource is less sensitive to changes in cut-off grade between approximately 20% MnO and 25% MnO. At increasing cut-off grades above 25% MnO there is a steep reduction in tonnage and increase in grade up to 37% MnO, beyond which there are no remaining blocks. This higher grade population mostly relates to blocks in the A2 horizon.
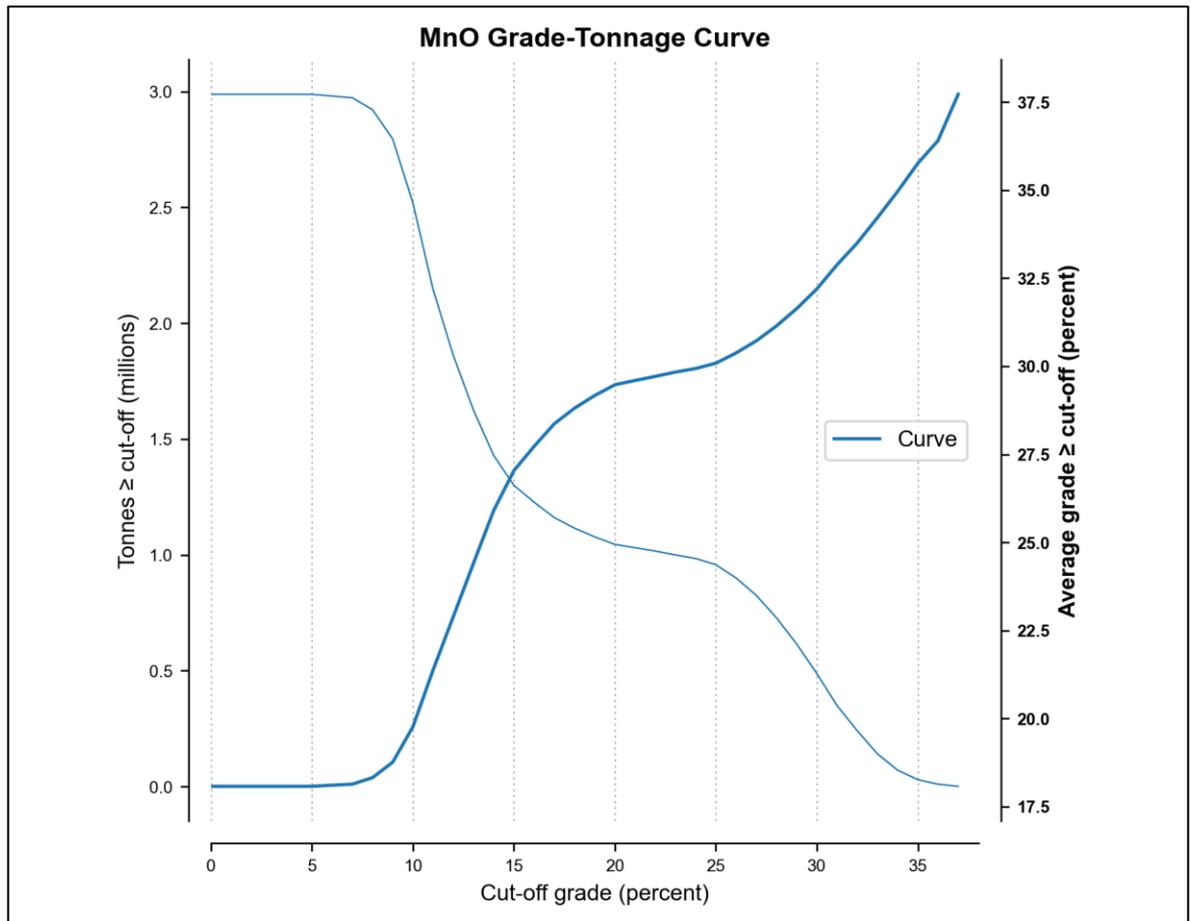
Figure 14-42: **MnO grade-tonnage curve for all Indicated and Inferred blocks above the optimised pit shell. Thick blue line = MnO%, thin blue line = tonnage (Mt)**

14.14 Comparison to Previous Mineral Resource Estimates

A Mineral Resource estimate for the K-Hill Project was previously reported by SRK in March 2021. The Inferred Mineral Resource totalled 1.7 Mt at 25.7% MnO, as detailed in Table 14-12.

Table 14-12: **SRK March 2021 Mineral Resources, as reported by SRK on 15th March 2021 at a cut-off grade of 7.3% MnO**

Category	Tonnes (Millions)	MnO %	Al$_2$O$_3$ %	SiO$_2$ %	Fe$_2$O$_3$ %	LOI %
Inferred Mineral Resource	1.7	25.7	10.5	30.9	16.8	8.7

The current Mineral Resource, as reported herein, represents an updated interpretation and estimate. The updated model has included additional RC and DD data available as of 19th July 2021, as well as an updated density testwork and a new high resolution topographic model to allow the construction of an updated geological model. With regard to the available data and approach taken, the Mineral Resource differs from the March 2021 Mineral Resources in the following specific ways:

- An updated block model and set of estimation domains has been created, based on a significantly updated drillhole database. The previous MRE relied on data from 18 DD holes, as well as 38 additional RC holes, of which only 11 had laboratory analysis data that was used in the estimation of block grades. The updated database for the Mineral Resource presented herein includes 18 assayed DD holes and 96 assayed RC holes, increasing the total number of holes with corresponding assays from 29 to 114. The model further takes into account the location and extent of the erosional channels that affect the upper A manganiferous horizons, as well as identifying and integrating a number of normal faults into the model that offset the mineralisation in the order of 5 m to 15 m

- Addition of the B and C domains to the Mineral Resource, based on new drillhole data allowing for the modelling of these domains to an acceptable degree of confidence for the classification of these horizons as Mineral Resources

- Upgrade of much of the A horizon to Indicated, given the increase data quantity, decreased drillhole spacing and improved geological confidence in this zone

- The use of an updated density dataset, as described in Section 14.9, allowing for the application of average dry density values on a domain-by-domain basis. Whilst of limited coverage, the updated density data is considered to be of improved accuracy relative to the density database used in the assignment of density to previous resource models, which was considered as "wet" density data, and required the application of a 10% tonnage reduction factor to account for moisture content in the samples upon which determinations were completed

The updated Mineral Resource estimate of as presented in Table 14-10, represents a 75% increase in total reported tonnage, a 29% relative decrease in MnO grade, 39% relative increase in SiO_2 grade, and 11% relative decrease in Fe_2O_3 grade, compared to the March 2021 Mineral Resource estimate.   The difference in tonnage and grade can largely be attributed to the inclusion of the lower grade B horizon after a significant increase in the spread and quantity of drilling data for the Project.

15   MINERAL RESERVE ESTIMATES

This is not applicable because there is no Feasibility Study completed for the Project at the current time.

16   MINING METHODS

16.1   Introduction

The envisaged mining method for the K-Hill Project is traditional open pit truck and shovel. Due to the low processing throughput, and reasonable strip ratio, the volume of total material moved (TMM) is easily manageable. The key tasks that were undertaken are listed below.

16.1.1 Key Tasks for the PEA Mining Study

- Analysis of the geological model and adaptation for mine planning purposes

- Definition of key operating cost components, revenue and applicable royalties

- Open pit optimisation to generate a pit shell

- Generation of a mining schedule, including pushbacks

- Equipment calculations to determine fleet requirements

- Determination of mining fleet based on similar operations worldwide

16.2   Mining Model Description

The block model provided by the Company was in Datamine format and called "*KHill Sub-blocked Model*". The block model and its attributes are described in Table 16-1. Only revenue from the MnO grade was used for generating a pit shell, other metals were ignored.

Table 16-1:   **Block Model Variables and Header**

Block Model header				
Name	**KHill Sub-blocked Model: Extents**			
		X	**Y**	**Z**
Minimum Co-ordinates		328,919.1	7,233,414.6	1,311.9
Maximum Co-ordinates		329,569.1	7,234,464.6	1,471.9
Parent Block Size		25.0	25.0	1.0

Attributes	Description
K Hill M	Domain
AI Combi	
Fe Combi	
LOI Comb	
MnO Comb	Metal grade used for optimisation
Si Combi	
Dry Dens	Dry Density

Class	Rock Type Inferred, Waste and Unclassified

16.2.1 Grade-Tonnage Curve

Generating a Grade-Tonnage curve for the resource tonnage (Inferred material only) from the block model, SRK notes that 68% of the resource has a grade above 20% MnO.

Resource Model Grade Tonnage Curve
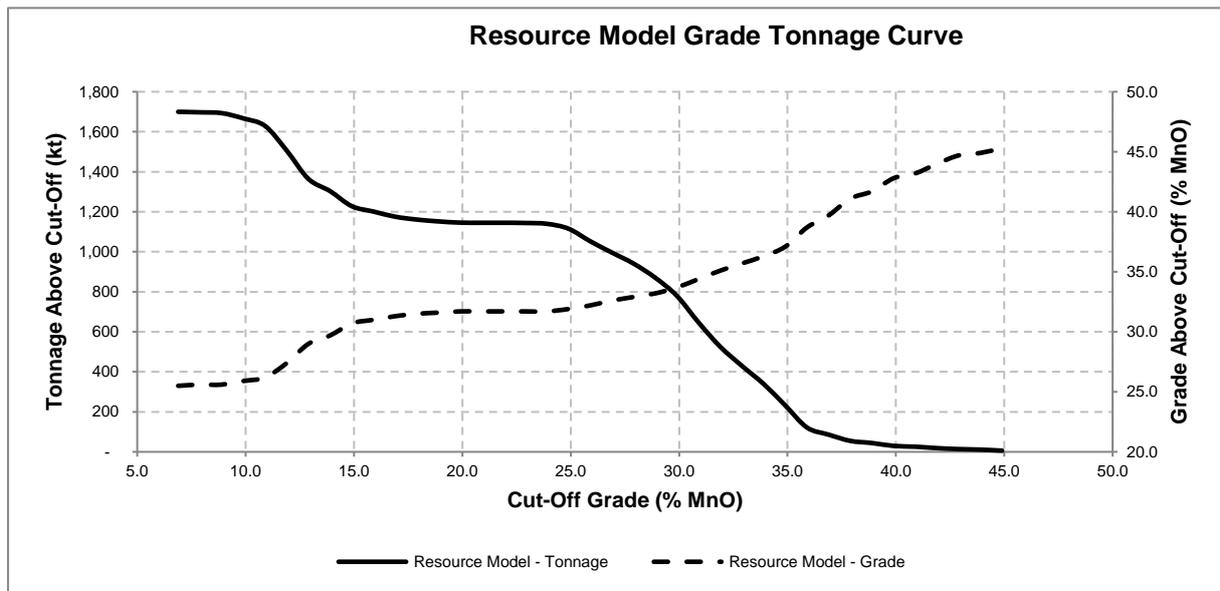
Figure 16-1:   Resource Model Grade-Tonnage Curve

16.3 Open Pit Optimisation

In order to assess the open pit potential for the K-Hill Manganese deposit, SRK has undertaken open pit optimisation using NPV Scheduler software. NPV Scheduler uses the Lerchs-Grossmann algorithm for determining the shape of an optimal pit using a set of input parameters.

The optimisation process produces a series of "nested" pit shells, each the maximum economic pit at a given metal price. The nested pit shells provide an indication of the sensitivity of the deposit at various metal prices given the same input costs and modifying factors. The nested pit shells are evaluated using base case reference metal price of USD3,784 /t MnO. Revenue Factor ("RF") is the factor by which the revenue for each block is scaled in order to produce one of the nested pit shells.

The objective of the open pit optimisation has been to assess the potential economic pit extents, understand the economic and physical characteristics of the deposit, and then select a pit shell to use as the basis for the detailed pit design.

The optimisation process has included Inferred material only. There is no Measured or Indicated material in the MRE model. Pit optimisation was done using the industry-standard NPV Scheduler software package, which uses a Lerch-Grossman type optimisation algorithm.

16.3.1 Pit Optimisation Parameters

The pit optimisation parameters are shown in General and Administration cost is high, expressed per tonne due to the relatively small throughput. The Client estimates that the mine should be able to operate comfortably at USD3.5 M per annum. Royalty in Botswana for Manganese is assumed to be 3%. The Marginal Cut-off Grade ("CoG") calculated for a selling price of USD3,784 /t MnO is 7.3%. It should be noted that a price of USD1,588 /t for HPMSM corresponds to a price of USD3,784 /t MnO and are discussed below in Table 16-2.

The mining cost was estimated based on the S&P database for published 2018 mining costs for similar small-scale mining operations around the world, as well as a similar-sized SRK client operation in Mozambique. A total of 6 operations was considered and a weighting was applied to the relevance of the operation.

Dilution and recovery were estimated based on similar results achieved on relatively small-scale equipment and considering the well-defined shale horizon. It is anticipated that the given figures might be improved upon in a well-run operation.

The processing recovery used in the pit optimisation was based on the latest results from the metallurgical test work on leaching. An overall processing recovery of 90.7% was applied that combines a 3-stage loading and 2-stage stripping solvent extraction circuit using D2EPHA modified kerosene as the organic phase.

Table 16-2:   Pit Optimisation Parameters

Parameters	Units	Base Case	Basis
Production			
Production Rate - RoM	(tpa)	200,000	Client provided
Geotechnical			
Overall Slope Angle	(Deg)	45	SRK Assumption
Mining Factors			
Dilution	(%)	5	SRK Calculation
Recovery	(%)	95	SRK Calculation
Processing			
Total process recovery MnO	(%)	90.7	Client provided
Operating Costs			
Mining Cost	(USD/t_{rock})	3.46	SRK Calculation
Processing	(USD/t_{RoM})	213.0	SRK Calculation
Selling Cost Mn	(%)	3.0	Royalty in Botswana
	(USD/t MnO)	114.0	
G&A	(USDm/Year)	3,500,000	Client assumption
	(USD/t_{RoM})	20.0	
Metal Price			
MnO	(USD/t)	3,784	Client provided from the 2020 Benchmark Intelligence Report
HPMSM	(USD/t)	1,588	
Other			
Discount Rate	(%)	10	
Cut-Off Grade			
Marginal	(% MnO)	7.0	SRK Calculation

16.3.2 Pit Optimisation Footprint Constraints

No specific footprint constraints have been applied in the pit optimisation process.

16.3.3 Pit Optimisation Results and Shell Selection

Figure 16-2 shows the metal price sensitivity results from the pit optimisation. Table 16-3 shows the pit optimisation results.

The RoM tonnage increases slightly between the USD1,892 /t MnO and USD2,838 /t MnO, after which the rate of increase is less, however continues to increase gradually up to the USD4,541 /t MnO pit shell. No significant step increases in RoM tonnage are seen at higher metal prices.

The strip ratio also increases gradually up to the USD4,541 /t MnO pit shell. The discounted cash flow increases steadily up to the USD2,838 /t MnO pit shell and remains relatively stable. No large step decreases in Discounted Cash Flow ("DCF") are observed at the higher price shells. The gradual decrease in DCF suggests that higher price shells could be selected in order to increase the contained metal and RoM tonnage, with only relatively small reduction in project value. The diluted grade decreases from around 24.5% MnO to 24.3% between the USD3,784 /t and USD1,892 /t MnO pit shell. No notable step decreases in grade are observed, and the diluted grade remains relatively stable at around 24.3% MnO for all shells above USD3,784 /t MnO.
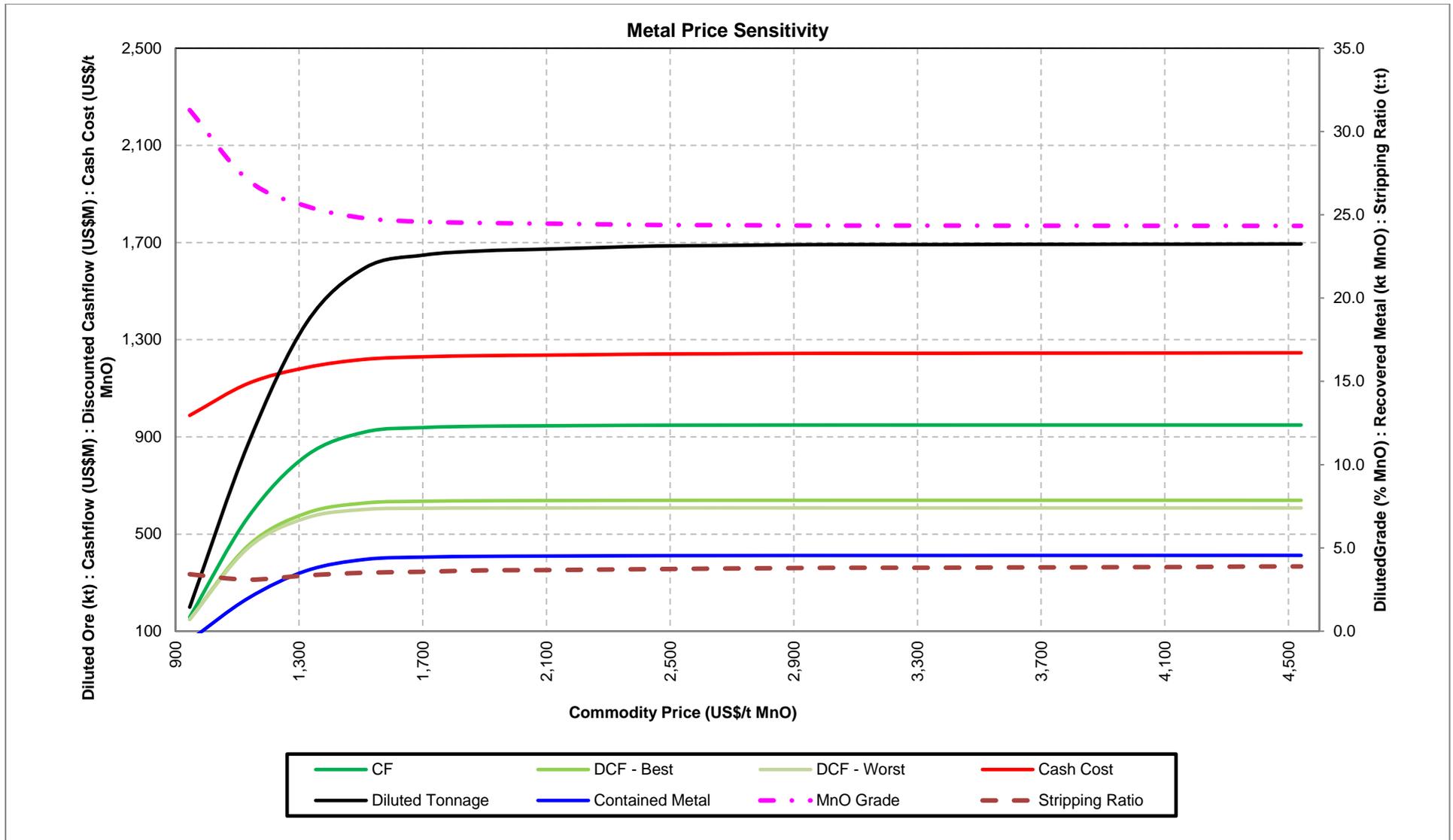
Figure 16-2:   Metal Price Sensitivity

Table 16-3: Pit Optimisation Results

Optimisation Results	MnO Rev Factor Units	USD1892 /t 0.50	USD2838 /t 0.75	USD3784 /t 1.00	USD4541 /t 1.20
In-situ					
Inventory	(kt)	1,669.7	1,694.4	1,696.8	1,698.3
	(% MnO)	25.73	25.58	25.56	25.55
Metal	(t MnO)	429,688	433,373	433,712	433,912
Modifying Factors					
Mining Dilution	(%)	5.0	5.0	5.0	5.0
Mining Recovery	(%)	95.0	95.0	95.0	95.0
MnO Metallurgical Recovery	(%)	90.70	90.70	90.70	90.70
Diluted					
Inventory	(kt)	1,665.5	1,690.2	1,692.6	1,694.1
	(% MnO)	24.51	24.36	24.34	24.33
Metal	(t MnO)	408,204	411,704	412,026	412,216
Quantities					
Total Rock	(kt)	7,751.2	8,086.1	8,180.4	8,284.6
Mineral Inventory	(kt)	1,665.5	1,690.2	1,692.6	1,694.1
Total Waste	(kt)	6,085.7	6,396.0	6,487.8	6,590.5
Waste	(kt)	6,074.9	6,385.1	6,476.9	6,579.6
Inventory (Below Cut-off)	(kt)	10.8	10.9	10.9	10.9
Stripping Ratio	(t:t)	3.7	3.8	3.8	3.9
Operating Expenditures					
Mining	(USD/t$_{mined}$)	3.46	3.46	3.46	3.46
	(USD/t$_{ore}$)	16.11	16.56	16.73	16.93
Processing + G&A	(USD/t$_{ore}$)	233.0	233.0	233.0	233.0
MnO Selling Cost	(USD/t$_{metal}$)	114	114	114	114
Product					
Recovered Metal (MnO)	(t MnO)	370,241	373,415	373,708	373,880
Economic Summary					
Metal Price	(USD/t)	1,892	2,838	3,784	4,541
Revenue	(USDm)	1,401	1,413	1,414	1,415
Mining Costs	(USDm)	27	28	28	29
Processing Costs	(USDm)	388	394	394	395
Selling Costs	(USDm)	42	42	42	42
Other Costs	(USDm)				
Cashflow	(USDm)	944	949	949	949
Discount Rate	(%)	10.0	10.0	10.0	10.0
DCF - Best Case	(USDm)	637	639	639	639
DCF - Worst Case	(USDm)	607	608	608	607
Cut-Off Grade					
MCOG - OPEX	(USD/t$_{ore}$)	233.0	233.0	233.0	233.0
MCOG	(% MnO)	14.0	9.3	7.0	5.8

The shell selected for the basis of pit design is the shell with a revenue factor of 1.0, therefore corresponding to the optimal shell for an MnO price of USD3,784 /t.

16.4 Pit Design

16.4.1 Pit Design Parameters

The overall inter-ramp slope angle used was 41^0, as explained in section 24.1.3. To accommodate small equipment and reduce dilution, mining is done on a 4-metre bench height, mined in 2 flitches of 2 metres. The face angle is 70^0 based on observations in the field. This gives a standard berm width of 3.2 m. No catch berms are considered necessary due to the relatively low height of the permanent walls. In most walls, the slope angle is considerably lower than the recommended inter-ramp angle, due to the placement of the ramps on the footwall, going into the hillside.

The pit optimisation shells indicate that the pits will have relatively a large amount of room on the pit floor with good access. Ramps are relatively short and in most instances two ramps can be accommodated without adding too much waste, thereby allowing for a drive-in ramp and a drive-out ramp. Considering the size of the equipment, such as the Caterpillar 725C2 articulated trucks (or equivalent), a ramp width of 10 m was chosen.

The clearing radius of the Caterpillar 725C2 is 8.05 m, and this has been taken into account in the pit designs. The final pit design can be seen in Figure 16-5.

16.5 Waste Dump Design

The Waste Dump design has been done on industry standard parameters, using 37^0 face angles, and an overall slope of 23^0. Bench heights used were 20 m, and ramps were created at 30 m wide to allow easy access and reduce risk of collision.

The Waste Rock Dump (WRD) was designed on the required waste dumping volumes, assuming a 30% swell factor. Figure 16-6 shows the indicative WRD position and layout.

16.6 Strategic Assessment

SRK has undertaken a strategic assessment to guide the detailed mine planning for the K-Hill Manganese operation. The objective of the strategic assessment has been to determine a practical cutback sequence and mining rate in order to achieve the target mill throughput and maximise the project value.
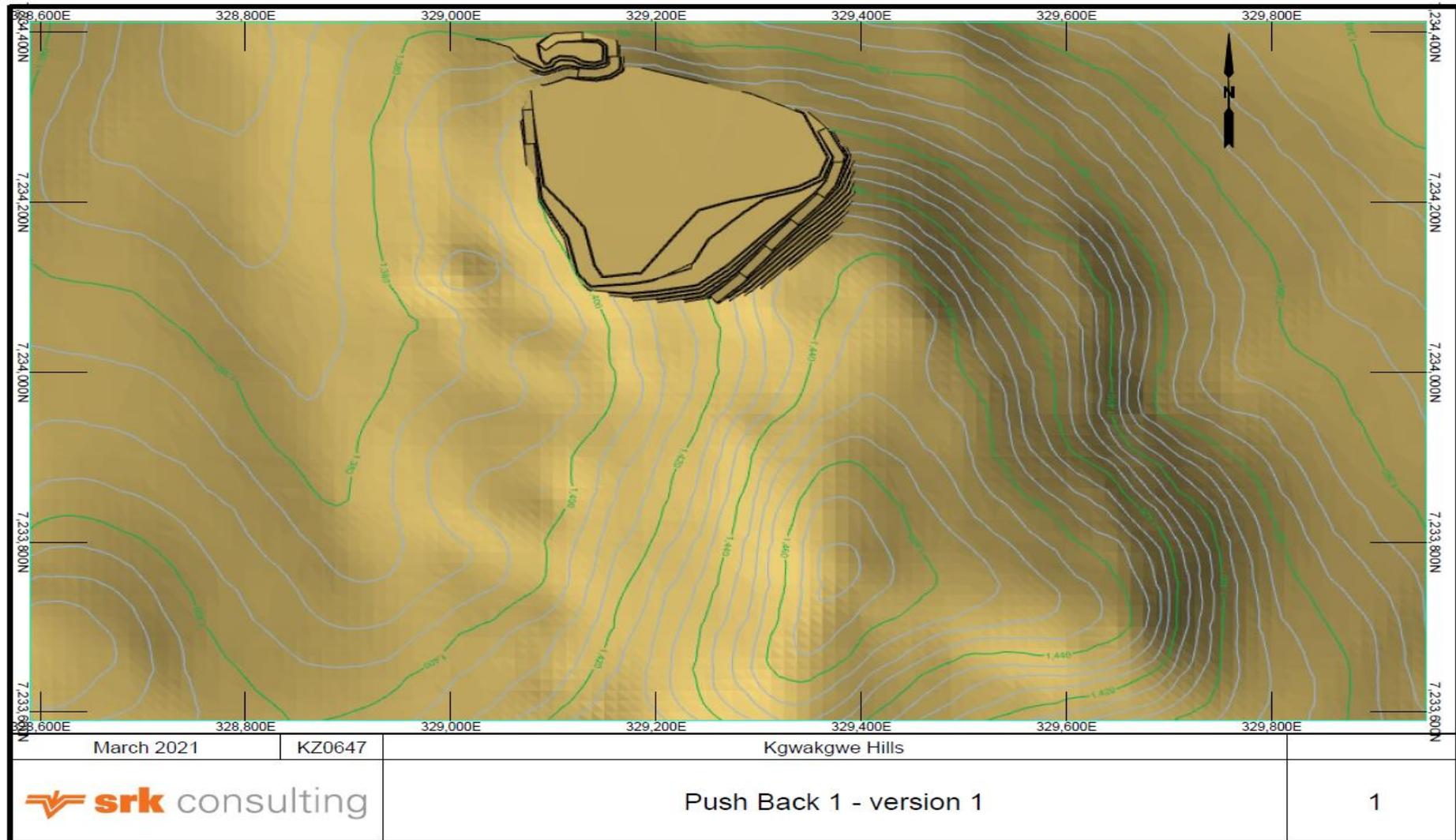
Figure 16-3:   Pit design of Pushback 1
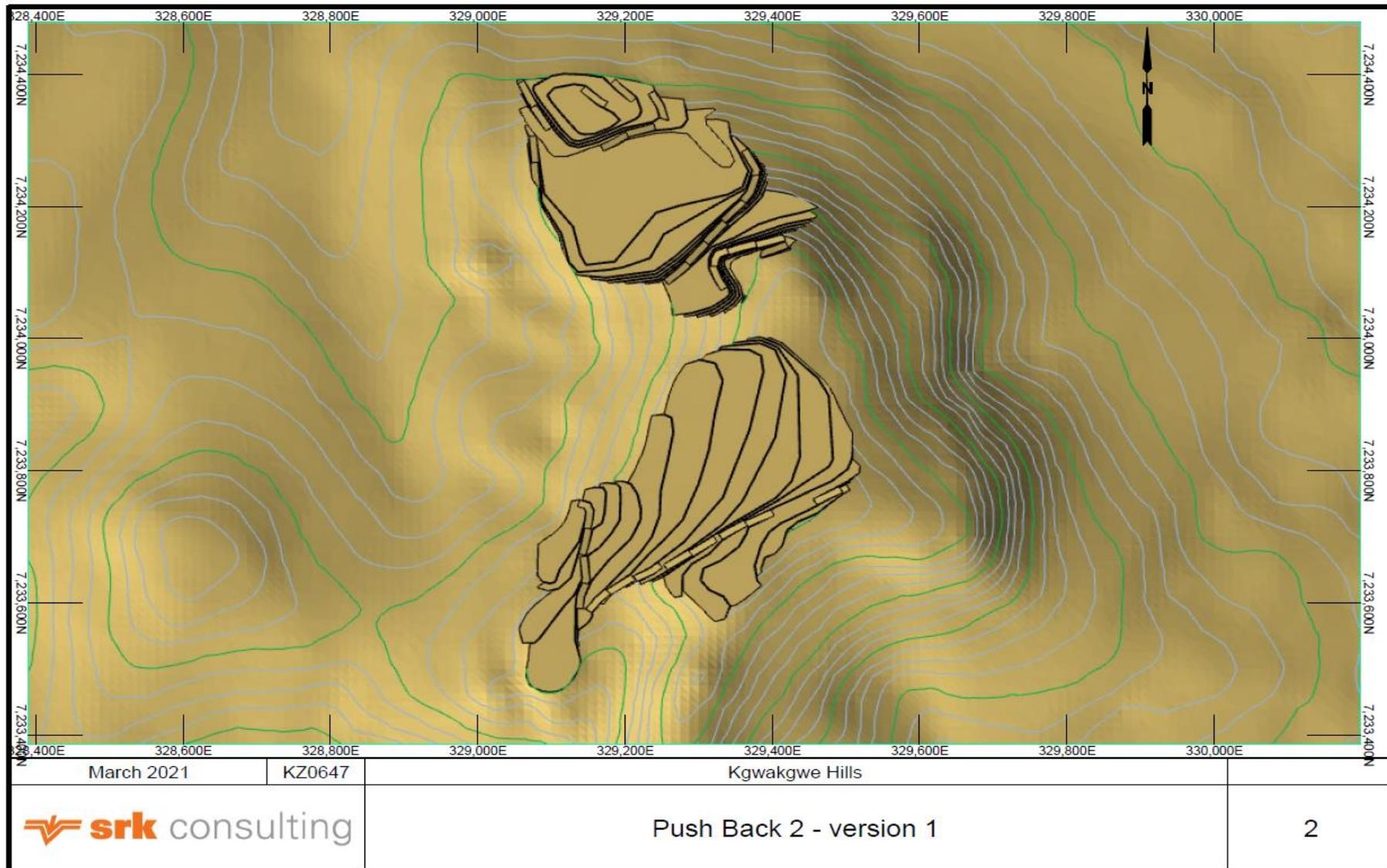
Figure 16-4:   Pit design of Pushback 2
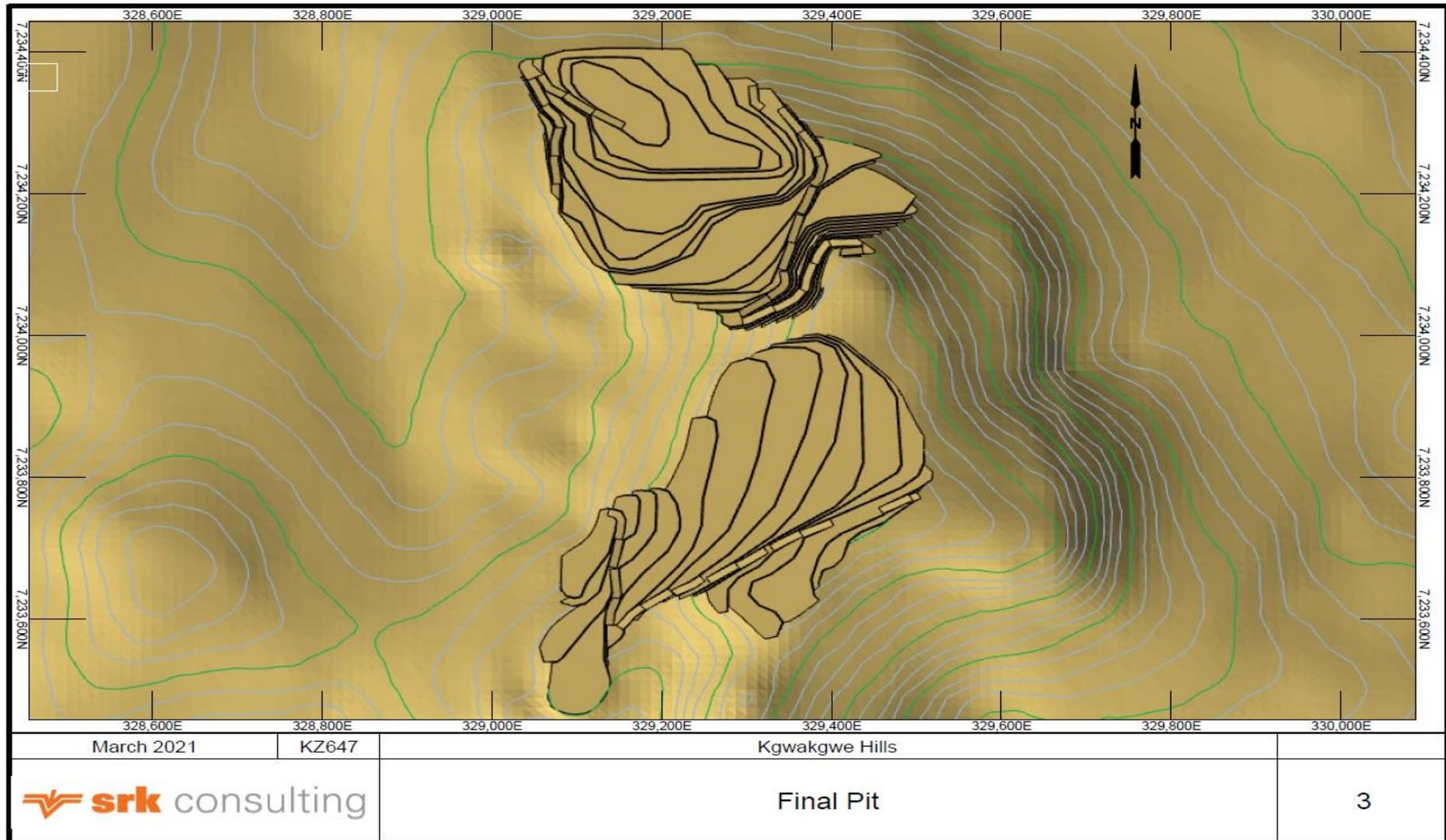
Figure 16-5:   Final Pit Design
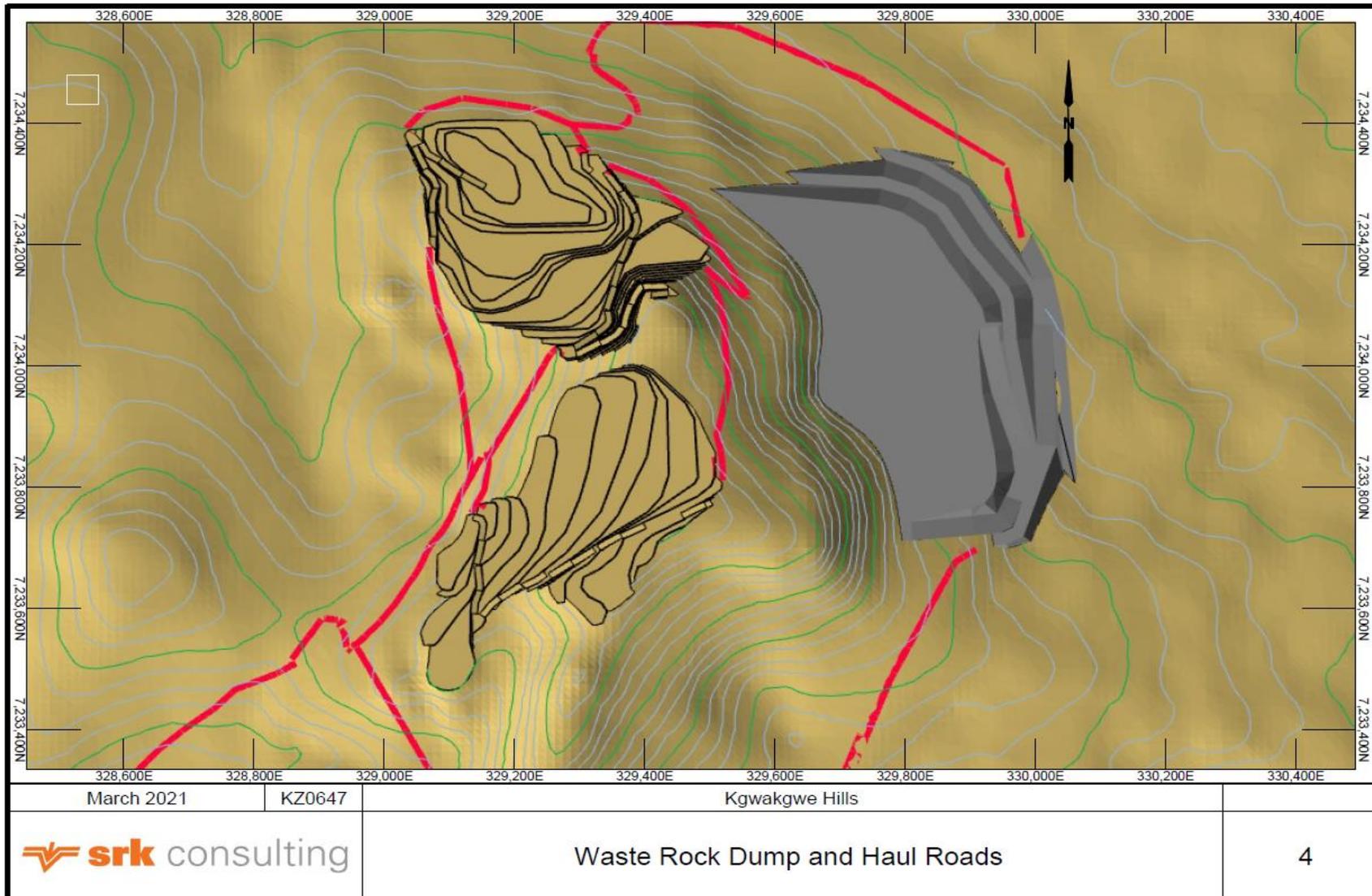
Figure 16-6:   Waste Rock Dump

16.7   Pushback Sequence

The pit shells were used to determine a strategic schedule with pushbacks (also known as cutbacks) to balance the waste and RoM stripping. Figure 16-7 and Figure 16-8 show the total material moved from each cutback, and how much RoM is delivered to the plant from each year.

16.8   Mining Schedule

The mining schedule for total material movement is shown in Figure 16-7 below. The Figure does not include the first year of the project when the plant is constructed.
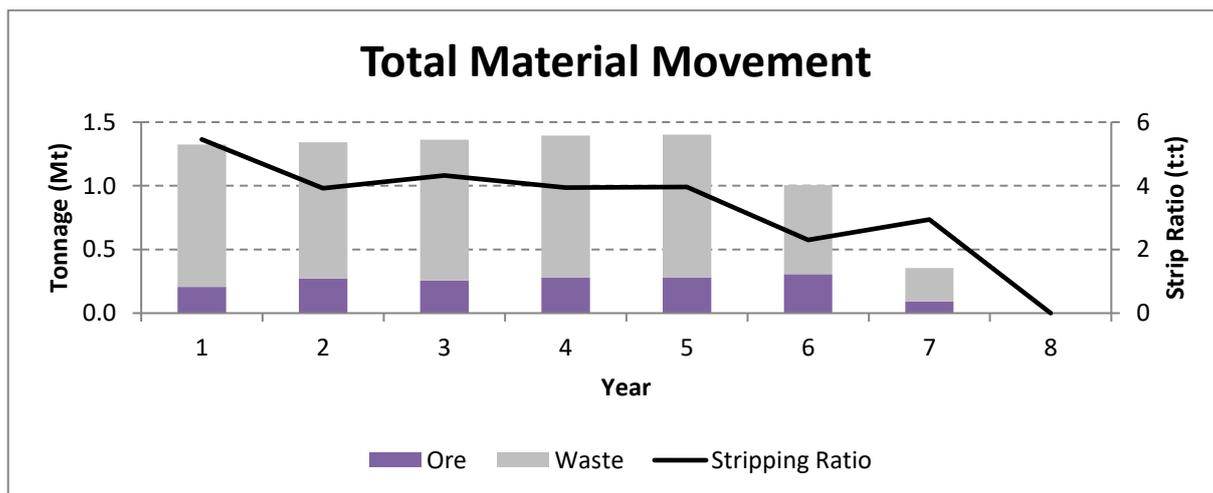
Figure 16-7:   Total Material Movement for K-Hill

The schedule shows a steady production for the life of mine. Additionally, the stripping ratio remains constant in the schedule before it is reduced in the final 2 years. The next round of pit designs will also reflect that the 2 separate pits will merge into a combined pit.

16.9   Delivered Mill Feed

The full production rate is planned to be 200 kt per year. However, the first year of mining achieves a production rate of 171 kt. It is noted that plant construction will need to commence nine months before waste stripping commences giving a lead time to production of around 14 months (Refer to Table 22-2). The schedule assumes a modular process plant which will greatly reduce assembly time on site.

The delivery of RoM to the plant is consistent and the grade delivered is quite evenly distributed with some spikes that will be flattened by blending. Notably the grades delivered in mining Year 2 are higher than the LoM average, as can be observed in Figure 16-8.

For scheduling purposes, the high grade and low grade material will be processed at different years. High grade accounts for material greater than 15% MnO, whereas, low grade accounts for material less than 15% MnO and above cut-off grade. The low grade material will be stockpiled until year 7 where it will be processed with the high grade material. A breakdown of this and the life of mine schedule can be seen in the figure below.
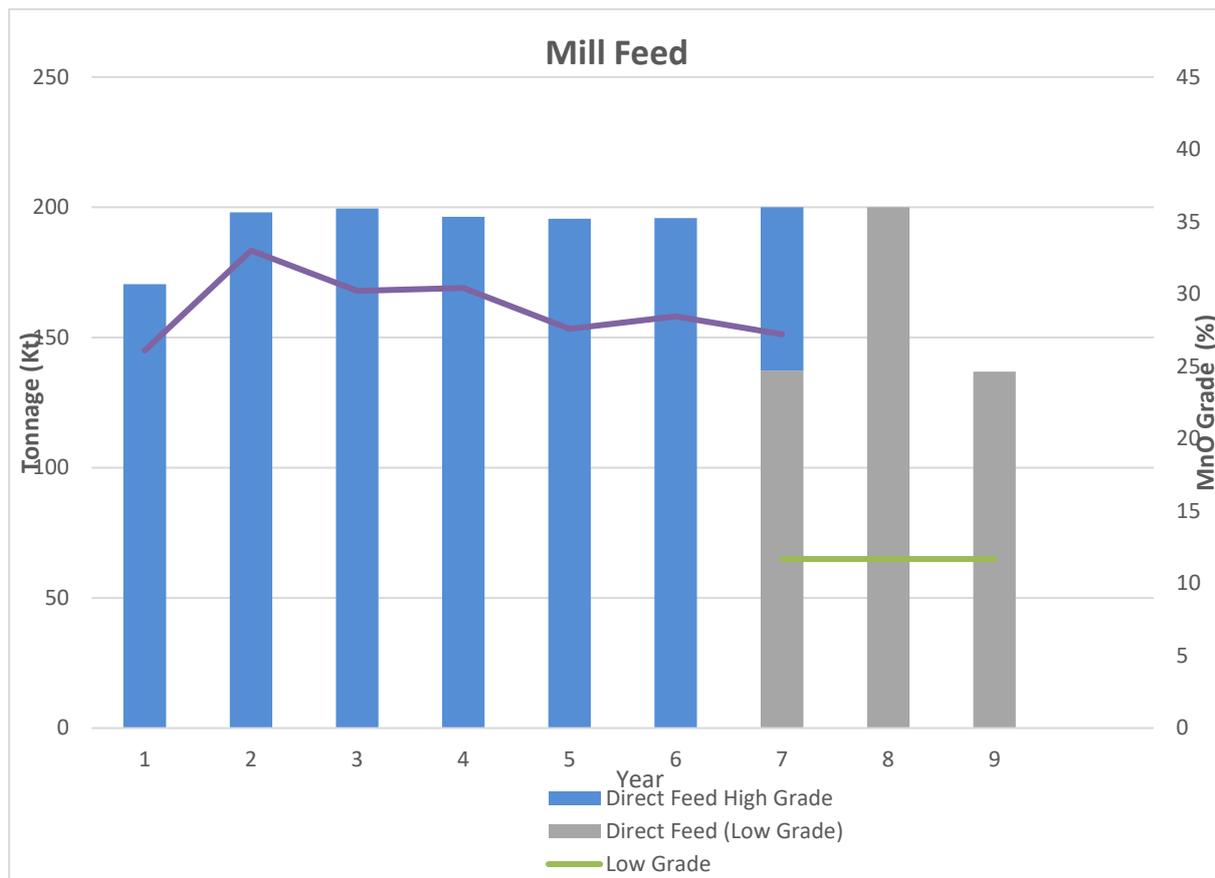
Figure 16-8:   Mill Feed

16.10 Cut-Off Grade and Stockpiling Strategy

At this stage of the Project, no detailed work has been done on a stockpiling strategy other than low grade material being stockpiled and not processed until to the end of mine life. The deposit delivers fairly even grade and supplying the plant is not limited by the mining fleet.

16.11 Equipment

The location of the Project, close to the South African border and the Botswana diamond mines ensures good access to mining equipment, spares and services. There is also a large market of second-hand mining equipment that can be utilised to reduce initial capital expenditure for the mining fleet, and in fact quotes have been sourced by the Company which have been used in the capital estimate.

This report assumes that the Project will be owner-operated and that all required equipment will be bought. Table 16-4 below shows the equipment number and capital estimate for the mining fleet for the K-Hill Project.

The quote for the yellow equipment is from the South African manufacturer BELL, which has a full sale and services branch in Gaborone.

Table 16-4:   Mining Fleet Capital estimate

Equipment	QTY	Cost (BWP)	Cost (USD)	Total (USD)	Country Scaling	Total (USD)
Excavator 2,1BCM - Kobelco SK380LC	1	2,558,991	237,163	237,163	1.1	260,880
Backhoe TLB - BELL 315SL	1	891,520	82,625	82,625	1.1	90,887
Articulated Dump Truck - Bell B30E	4	3,641,109	337,452	1,349,809	1.1	1,484,790
Track Dozer - Bell 850J	2	3,510,517	325,349	650,698	1.1	715,768
FEL 2,3 BCM - Bell L1506E	1	1,785,026	165,433	165,433	1.1	181,977
Water Bowser - 18kl	1	2,794,508	258,991	258,991	1.1	284,890
Light Vehicles	4		50,000	200,000	1.0	200,000
Motor Grader - Bell 770G	1	3,446,141	319,383	319,383	1.0	319,383
Lighting plants, radios, misc	1		80,000	80,000	1.0	80,000
Epiroc ROC D65 Drill	1	8,416,200	780,000	780,000	1.0	780,000
						4,398,575
Exchange rate BWP:USD	10.79					

16.12 Haulage Fleet Requirements

The assumption for the mining operation is that work will be done on 340 days a year, using three 8-hour shifts per day.

PEA-level calculations for the load and haul requirements have revealed that one single shovel with a 2.2 m3 bucket can deal with the total material movement for the LoM. A smaller backhoe will be used for back up to the main excavator, as well as for small jobs and mining RoM whilst the main excavator is mining waste. There is not enough data to confirm the rock mass characteristics at this stage to decide if blasting will be required for excavation. It is necessary to see the results of the GT drilling, mapping and any lab testing results before a final decision on blasting can be made. It is assumed that the excavator will be able to break some of the ground at site closer to the surface. For the breccia, however, this will be tough to achieve, and blasting might be required. SRK has therefore assumed for this PEA that a blast hole drill rig will be required.

The assumption for haulage calculations assumed an average of 2 km haulage and an on-site speed of 20 km/h for loaded trucks. This means that the operation requires two 30 t articulated dump trucks, with a spare to ensure continuity of operation during maintenance. The additional tonnage required in Year 4 will require one additional truck, bringing the total to 4. It is assumed for the financial model in this study that this truck will be bought, but it could be rented instead.

Due to the low truck requirements after Year 4, it is considered reasonable to not budget for a rebuild. Working capital in the financial model covers the spares cost.

16.13 Ancillary Requirements

One Front-End Loader (FEL) will be used to feed the plant. One track dozer will be used to construct mine roads, and level the dumps. Considering the distance between the dumps and the pit, it is considered unpractical to use only 1 track dozer, and therefore one will be stationed at the dumps and one at the pits.

One motor grader will be used to grade and maintain the mine roads. A 18,000 litre water bowser will be used for dust suppression, which is important considering the proximity of the town. Four light vehicles have been budgeted for, as well as lighting plants, radios and other light equipment.

16.14 Mine Labour

A relatively light compliment of labour suffices for this straight-forward operation. The table below shows the estimated labour compliment.

Table 16-5:   Mining Labour Requirements

K-Hill Mining Department Labour requirements			
	Per shift	Total	
Chief Surveyor	1	1	
Surveyor Assistant	1	2	
Production Super	1	1	
Foreman	1	3	
Geologist	1	1	
Articulated Truck Driver	4	16	
Excavator Operator	1	4	
Backhoe Operator	1	4	
Dozer Operator	2	8	
Grader Operator	1	2	*Not at night*
Drill Rig Operator	1	2	*Not at night*
Bowser driver	1	2	*Not at night*
FEL Operator	1	4	
Total	**17**	**50**	

The surveying and geology requirements are relatively light and can be dealt with by setting out in advance and sharing responsibility between the chief surveyor and the assistants, as well as the Production Superintendent and the Geologist.

It has been assumed that cool conditions at night allow the bowser to be run only 12 hours of 24.

16.15 Reserve Statement

Considering that all the RoM material is classified as Inferred, no reserve statement can be given. However, the life of mine schedule for this report is given in Table 16-6 at the end of this chapter.

Table 16-6:   PEA Mining Schedule for K-Hill

Case	Units	Total	1	2	3	4	5	6	7	8	9
Project Year			1	2	3	4	5	6	7	8	9
Discount Year			1	2	3	4	5	6	7	8	9
NPVS Period			1	2	3	4	5	6	7	8	9
Physicals											
Rock	(kt)	8,185	1,325	1,343	1,361	1,394	1,401	1,007	354	-	-
Waste	(kt)	6,492	1,120	1,070	1,106	1,112	1,119	702	264	-	-
Ore	(kt)	1,693	205	273	255	282	282	305	90	-	-
Stripping Ratio	(t:t)	3.84	5.46	3.93	4.33	3.94	3.96	2.30	2.95	-	-
Expit Ore											
Total RoM											
	(kt)	1,693	205	273	255	282	282	305	90	-	-
	(% MnO)	24.3	23.9	27.1	26.2	24.7	22.6	22.3	22.7	-	-
	(kt MnO)	412	49.06	73.98	66.90	69.79	63.73	68.20	20.38	-	-
	(kt HPMSM)	982	116.90	176.30	159.42	166.31	151.86	162.52	48.56	-	-
Low Grade (< 15% MnO)	(kt)	474	35	74	56	86	87	109	27	-	-
	(% MnO)	11.7	13.2	11.6	11.8	11.7	11.3	11.4	12.3	-	-
	(kt MnO)	55	5	9	7	10	10	12	3	-	-
	(kt HPMSM)	132	11	21	16	24	23	30	8	-	-
High Grade (> 15% MnO)	(kt)	1,218	171	198	199	196	196	196	63	-	-
	(% MnO)	29.3	26.1	33.0	30.2	30.4	27.6	28.5	27.2	-	-
	(kt MnO)	357	44	65	60	60	54	56	17	-	-
	(kt HPMSM)	850	106	156	144	142	129	133	41	-	-
Stockpile in	(kt)	474	35	74	56	86	87	109	27	-	-
	(% MnO)	11.7	13.2	11.6	11.8	11.7	11.3	11.4	12.3	-	-
	(kt MnO)	55	5	9	7	10	10	12	3	-	-
Stockpile Out	(kt)	474	-	-	-	-	-	-	137	200	137
	(% MnO)	11.7							11.7	11.7	11.7
	(kt MnO)	55							16	23	16
Balance	(kt)		35	109	165	251	338	447	337	137	-
	(% MnO)		13.2	12.1	12.0	11.9	11.7	11.7	11.7	11.7	-
	(kt MnO)		5	13	20	30	40	52	39	16	-
Processing											
LG Mill Feed	(kt)	474							137	200	137
Grade	(% MnO)	11.7							11.7	11.7	11.7
Contained Metal	(kt MnO)	55							16	23	16
	(kt HPMSM)	132							38	56	38
HG Mill Feed	(kt)	1,218	171	198	199	196	196	196	63		
Grade	(% MnO)	29.3	26.1	33.0	30.2	30.4	27.6	28.5	27.2		
Contained Metal	(kt MnO)	357	44	65	60	60	54	56	17		
	(kt HPMSM)	850	106	156	144	142	129	133	41		
Total Mill Feed	(kt)	1,693	171	198	199	196	196	196	200	200	137
Grade	(% MnO)	24.3	26.1	33.0	30.2	30.4	27.6	28.5	16.6	11.7	11.7
Contained Metal	(kt MnO)	412	44	65	60	60	54	56	33	23	16
	(kt HPMSM)	982	106	156	144	142	129	133	79	56	38
Processing Recovery	(%)		90.70	90.70	90.70	90.70	90.70	90.70	90.70	90.70	90.70
Recovered Metal	(kt MnO)	374	40.4	59.3	54.7	54.2	48.9	50.5	30.0	21.2	14.5
	(kt HPMSM)	891	96.2	141.3	130.3	129.1	116.6	120.5	71.6	50.5	34.6

17   RECOVERY METHODS

17.1   Introduction

The process plant will treat 200 thousand tonnes per year (ktpa) of run-of-mine (ROM) from the K-Hill Manganese open pit to produce High Purity Manganese Sulphate Monohydrate (HPMSM). The mineralised material comprises manganese (Mn) and iron shales, is moderately hard and amenable to reductive acid leaching at a characteristic grind size (P80) of 200 microns (µm). The process flowsheet is a conceptual design based on the historical metallurgical test work (Section 13) and established manganese extraction chemistry.

17.2   Process Flowsheet Development

The process flowsheet is based on the outcome of the historical test work review and two subsequent conceptual process options studies. In one study Tetra Tech compared three potential reductants (sucrose, sulphur dioxide (SO2) and carbon) for reductive sulphuric acid (H2SO4) leaching and selected SO2 because it offered the best economic outcome.

The second study compared the net present value (NPV) of the two flow sheets that would produce HPEMM and HPMSM respectively. HPEMM is electrowon whereas HPMSM is crystallised, both from the solvent extraction (SX) strip solution. Even though both product streams demonstrated a positive economic outcome, the HPMSM option performed better. As such, vacuum crystallisation was included in the flowsheet for the production of HPMSM.

The most effective way to remove the iron, aluminium and base metals, that dissolve (with the manganese) during leach extraction, is through a two-step precipitation prior to SX. First iron and aluminium are almost completely and cheaply removed as hydroxides through the addition of lime and limestone followed by the precipitation of copper, nickel and cobalt as sulphides through the addition of Sodium hydrosulphide (NaHS) or equivalent.

A conceptual block flow diagram of the proposed process plant is shown in Figure 17-1.
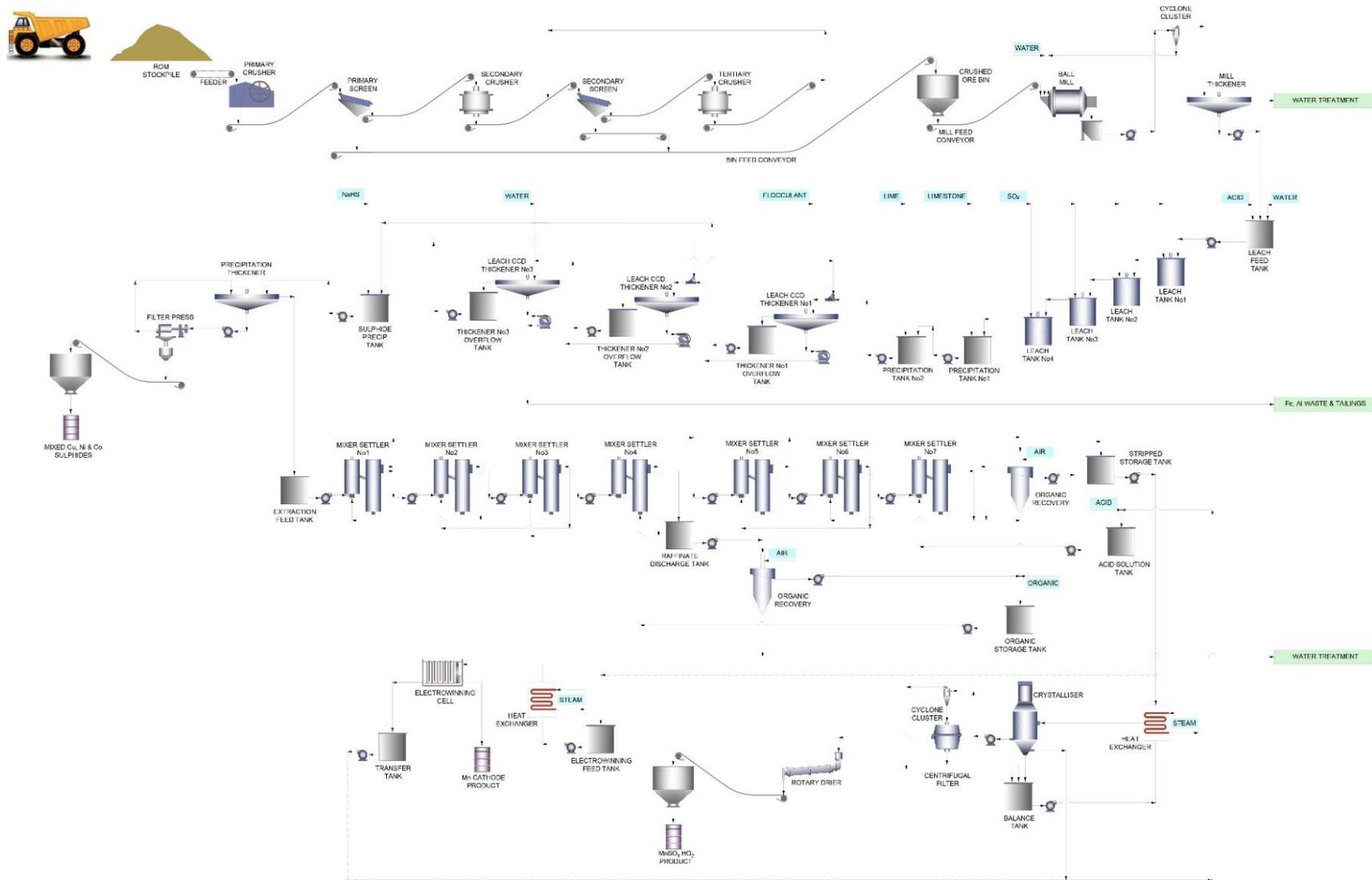
Figure 17-1:   Conceptual Block Flow Diagram

17.3 Process Design Criteria

The conceptual process design criteria were derived from the following sources of information:

- Test work results, as reported in Section 13

- Information from the NI 43-101 PEA technical report (Feb 2020)

- A conceptual process flow diagram and mass balance

- Information in the public domain, industry standard assumptions and in-house experience gained from similar projects or unit operations

- Technical information and Solvent Extraction research relating to the extraction process chemistry

Table 17-1 summarises the principle process design criteria established for a 200 ktpa project.

Table 17-1: Process Design Criteria

Description	Unit	Value	Source
GENERAL			
Annual Processing Rate, Overall	t/a (dry)	200,000	Mining Schedule
Product	-	High Purity Manganese Sulphate Monohydrate (HPMSM)	Assumption
PLANT OPERATING SCHEDULE			
Shifts per Day	-	3	Assumption
Hours per Shift	h	8	Assumption
Hours per Day	h	24	Fact
Days per Year	Days	365	Fact
PLANT OPERATING TIME			
Crushing Plant operating days	days	292	Assumption
Crushing Plant operating hours	h	5,957	Assumption
Daily Processing Rate	t/d	599	Calculation
Processing Rate, Operating	t/h	29.4	Calculation
Milling Plant Operating days	days	347	Assumption
Milling Plant Operating hours	h	7,912	Assumption
Daily Processing Rate	t/d	505	Calculation
Processing Rate, Operating	t/h	22.1	Calculation
ORE CHARACTERISTICS			
Ore Specific Gravity	t/m^3	2.7	Mining schedule
Ore Bulk Density	t/m^3	1.6	Assumption
Ore Moisture Content	-	5%	Assumption
Head Grade - Mn	-	25.9%	PEA Feb 2020
METALLURGICAL RECOVERY & METAL PRODUCTION			
Mn Recovery	-	90.7%	Test work, calculation
Mn Product Purity	-	99.9%	Assumption
Mn Production	t/a	41,151	Estimate
			Table continues…
Description	**Unit**	**Value**	**Source**
CRUSHING			
Primary Crusher Type		Primary Jaw	Assumption
Crusher Feed Particle Size F80	mm	400	Assumption
Crusher Product Particle Size, P80	mm	133	Assumption

Open Side Setting	mm	90	Assumption
Secondary Crusher Operating Mode	-	Open Circuit	Assumption
Secondary Crusher Type	-	Cone	Assumption
Crusher Feed Particle Size F80	mm	133	Assumption
Crusher Product Particle Size, P80	mm	44	Assumption
Closed Side Setting	mm		Assumption
Tertiary Crusher Operating Mode	-	Close Circuit	Assumption
Tertiary Crusher Type	-	Cone	Assumption
Crusher Feed Particle Size F80	mm	44	Assumption
Crusher Product Particle Size, P80	mm	15	Assumption
Closed Side Setting	mm		Assumption
Screen Type	-	Double deck Vibratory	Assumption
GRINDING			
Mill Type	-	Ball Mill - Overflow Discharge	Assumption
Product Size, P80	µm	200	Assumption
Ball Mill Recycle Load	%	250	Assumption
Classification	-	Cyclones	Assumption
Overflow Product size P80	µm	200	Assumption
ACID LEACHING AND CCD WASHING			
Leach Type	-	Agitated Tank	Assumption
Leach Retention Time	h	2	SGS test work
Number of tanks	-	2	Assumption
Leach pulp density	% solids	45%	Assumption
Leach discharge	-	CCD Washing	Assumption
Number of CCD stages	-	3	Calculation
CCD thickener diameter	m	15	Calculation
Wash efficiency per stage	%	99%	Assumption
Wash efficiency overall	%	97%	Assumption
PURIFICATION			
Fe & Al Precipitation			
Precipitation Method	**-**	Agitated Tank	Assumption

Description	Unit	Value	Source
Reactions	**-**	$Fe_2(SO_4)_3 + 3CaCO_3 + 9H_2O$ $= 2Fe(OH)_3 + 3CaSO_4.2H_2O + 3CO_2$	Technical data
	-	$Al_2(SO_4)_3 + 3CaCO_3 + 9H_2O$ $= 2Al(OH)_3 + 3CaSO_4.2H_2O + 3CO_2$	Technical data
	-	$Fe_2(SO_4)_3 + 3Ca(OH)_2 +$ $6H_2O = 2Fe(OH)_3 + 3CaSO_4.2H_2O$	Technical data
	-	$Al_2(SO_4)_3 + 3Ca(OH)_2 +$ $6H_2O = 2Al(OH)_3 + 3CaSO_4.2H_2O$	Technical data
Solution flow rate	m^3/h	37.6	Mass balance
Precipitation reagents	-	$CaCO_3$, $Ca(OH)_2$	Technical data
Precipitate Compounds	-	$Fe(OH)_3$, $Al(OH)_3$, $CaSO_4.2H_2O$	Technical data
Precipitate Discharge	t/h	41.5	Calculation
Base Metal Precipitation			
Precipitation Method	**-**	Agitated Tank	
Reactions	**-**	$CuSO_4 + NaHS = CuS + NaHSO_4$	Technical data
	-	$ZnSO_4 + NaHS = ZnS + NaHSO_4$	Technical data
	-	$CoSO_4 + NaHS = CoS + NaHSO4$	Technical data

	-	NiSO$_4$ + NaHS = NiS + NaHSO$_4$	Technical data
Solution flow rate	m^3/h	51.2	Mass balance
Precipitation reagents	-	NaHS	Technical data
Precipitate Discharge	t/h	0.07	Calculation
Precipitate Compounds	-	CuS ,ZnS, CoS, NiS	Technical data
SOLVENT EXTRACTION			
Feed	-	Purified Solution	Block Flow Diagram
Number of Extraction stages	-	3	Assumption
Organic Solvent	--	D2EPHA	Assumption
Organic Carrier		Kerosene	Assumption
Aqueous to Organic ratio	-	2:1	Assumption
Number of Striping Stages	-	2	Assumption
Organic to Acid Ratio	-	1:1	Assumption
Acid	-	H$_2$SO$_4$	Assumption
CRYSTALLISATION			
Feed	-	Pregnant Acid Solution	Assumption
Number of units	-	1	Assumption
Drying method	-	Steam Heat Exchanger	Assumption
Product	-	MnSO$_4$	Assumption

Key: % = percent, Al = aluminium, C = carbon, Ca = calcium, CCD = counter current decantation, Co = cobalt, Cu = copper, Fe = Iron, h = hour, H$_2$O = water, m^3/h = cubic metre per hour, mm = millimetre, Na = sodium, Ni = nickel, t/a = tonnes per year, t/d = tonnes per day, t/h = tonnes per hour, t/m^3 = tonnes per cubic metre, Zn = zinc

17.4   Primary Equipment list

Table 17-2 shows the primary equipment list for the 200 ktpa annual throughput conceptual process design.

Table 17-2:   Primary Equipment list

	Quantity	Unit Power (kW)	Installed Power (kW)
Comminution			
Vibrating Grizzly Feeder	1	55	55
Rock Breaker	1	45	45
Primary Jaw Crusher (0.25 m X 0.61 m)	1	38	38
Secondary Crusher (0.76 m)	1	94	94
Tertiary Crusher (0.9 m)	1	150	150
Vibrating Feeders (1.2 m X 2.4 m)	5	2	10
Conveyors (width 0.61 m)	6	15	90
Vibrating Screens (Double deck 1.2 m X 3 m)	2	4	8
Conveyor Belt Scale	2		
Tramp Magnet	3		
Belt Sampler	2		
Dust Collector Bin	1	6	6
Ball Mill (3 m X 3.7 m)	1	450	450
Ball Mill Cyclone Pack (4 X 76 cm Cyclones)	1	-	-
Mill Discharge Pumps	2	11.25	23
Mill Thickeners (15 m)	1	1.5	2
Thickener Underflow Pump	2	3.75	8
Thickener Overflow Pump	2	3.75	8
Leaching			
Sulphur storage Bin	1	5	5
Vibrating Feeders (1.2 m X 2.4 m)	1	1.5	3
Conveyors (width 0.61 m)	1	15	15
Sulphur burner & Ancillaries	1		
SO_2 Compressor and receiver	1	50	50
Acid leach tanks (5.16 m X 5.16 m)	5		
Leach tank agitators	5	7.5	38
Leach discharge Pump	2	3.75	8
Purification			
Fe Precipitation tanks (5.16 m X 5.16 m)	2	0	-
Fe Precipitation agitators	2	7.5	15
Discharge Pumps	2	3.75	8
Thickeners (15 m)	3	1.5	5
Thickener Underflow Pump	6	3.75	23
Thickener Overflow Pump	6	3.75	23
Flocculant package	1		
Agitator	1	0	-
Filter Press	1	7.5	8
Reagent preparation tank	2	3.75	8
Reagent Pump system	3	1.5	5
Fe Precipitation tanks (5.16 m X 5.16 m)	6	3.75	23
Fe Precipitation agitators	6	3.75	23
Discharge Pumps	1	0	-
Thickeners (15 m)	1	7.5	8

Equipment Description	Quantity	Unit Power (kW)	Installed Power (kW)
Solvent Extraction			-
Feed Solution Stock Tank	1	0	-
Solution Feed Pumps	2	3.75	8
Carrier (diluent) Storage	1	0	-
Mixer settler - Absorption	3	TBD	TBD
Mixer settler - Strip	2	TBD	TBD
Barren Transfer Tank	1	0	-
Barren Transfer Pump	2	3.75	8
Strip Acid Storage Tank	1	0	-
Manganese Sulphate Solution Storage Tank	1	0	-
Crystallisation			-
Crystalliser	1	0	-
Boiler	1	22,500.00	22,500
Heat Exchanger	1	0	-
Barren Transfer Tank	1	0	-
Barren Transfer Pump	2	3.75	8
Neutralisation & Tailings			-
Limestone Storage Bin	1	0	-
Limestone Feeder	1	1.5	2
Limestone Ball mill	1	112.5	113
Limestone Cyclone	1	0	-
Lime Storage Bin	1	0	-
Slaked Lime Stock Tank	1		-
Lime Slaker	1	0	-
Tailings Tank	1	0	-
Tailings Tank Agitator	1	1.5	2
Tailings Pumps	2	37.5	75

Key: cm = centimetre, kW = kilowatt, m = metre, TBD = to be determined

17.5   Summary Process Description

The ROM material will be crushed by a conventional three stage crushing circuit to a characteristic size P80 = 13 mm and then ground in a single stage ball mill operating in closed circuit with a cluster of cyclones in order to produce a slurry with an optimum size for leaching. The ground slurry, with a characteristic particle size of P80 = 200 µm will be fed into a pre-leach thickener. The thickener underflow will then be pumped to a reductive acid leach circuit, in which sulphur dioxide gas is used as the reductant, in order to extract Manganese along with other soluble metals. The acid leach circuit consists of agitated leach tanks, neutralisation and a CCD circuit in order to separate the solids and pregnant solution from the leach discharge slurry. The solution will be pumped to the purification circuit while the solids will be discharged to the neutralisation circuit.

Aluminium and iron hydroxide precipitates generated during neutralisation are removed in the CCD circuit while base metals in the form of sulphide precipitates are removed in a subsequent precipitation step. The purified solution will be pumped to a conventional solvent extraction circuit in which the manganese will be extracted into an organic phase and subsequently recovered into an acid strip solution in order to produce a high concentration manganese sulphate solution. The concentrated solution will be treated in an evaporative crystallisation circuit in order to make a HPMSM product suitable for the battery market.

17.5.1 Crushing

ROM material will be trucked to the ROM pad, the material will then be fed to the crushing and screening circuit. The crushing and screening unit will be configured for closed circuit crushing. The ROM material will be fed to a vibrating grizzly where the fine material will be removed and passed directly to the secondary crushing circuit screen. The coarse fraction will be crushed in the primary jaw crusher, the product from the jaw crusher will then also be directed to the secondary crushing circuit screen. The secondary crusher will operate in open circuit with a double deck screen. Screen oversize will be crushed by a secondary cone crusher and the underflow product will be discharged to the tertiary crushing screen feed. The screen undersize will bypass the secondary crusher and be conveyed directly to the tertiary screen.

The tertiary crushing circuit will employ a tertiary cone crusher operating in closed circuit with a double deck screen to produce a final screen product with a P80 of 13 mm, suitable as ball mill feed. The screen undersize from the secondary crushing circuit will be conveyed to a crushed material bin where it will be reclaimed and fed to the processing plant as required. The crushed material bin will be designed with enough surge capacity to provide an uninterrupted feed supply to the mill during crusher shut down periods.

17.5.2 Grinding

The crushed material will feed directly into the ball mill via a feed conveyor belt and feed hopper. A single ball mill will be used to achieve the required grind size for acid leaching. The ball mill will be a standard open discharge mill operating in closed circuit with a cluster of cyclones in order to produce a slurry with an optimum size for leaching. The ground slurry, with a characteristic particle size of P80 = 200 μm will be fed into a pre-leach thickener. The thickener underflow will then be pumped to a reductive acid leach circuit in order to extract Manganese along with other soluble metals. Thickener overflow will be recirculated back to the process water tank.

17.5.3 Acid Leach

Thickener underflow is first mixed with the required acid in the leach feed stock tank and the slurry density adjusted with recycled solvent extraction barren solution. Leaching of the ground slurry will be completed in enclosed agitated leach tanks, designed to give a total residence time of approximately two hours. During leaching the ore will be subjected to an acid reductive leach using sulphur dioxide gas injected into the tanks. On completion of leaching, slurry from the last leach tank will be processed through the first stage of purification tanks. The precipitated slurry will then be pumped to a CCD circuit in order to efficiently separate the solids and pregnant solution for further processing. The solution will be pumped to a second stage purification circuit. The solid residue will be pumped to tails.

Sulphuric acid and sulphur dioxide gas will be added to the leach tanks and a pH of approximately 1.5 maintained throughout leaching. The Sulphuric acid will be added at a rate of 333 kilograms per tonne (kg/t) of feed from acid stored in the reagent handling area. Sulphur dioxide gas will be produced on site by burning elemental sulphur in a sulphur burner and supplied to the process via compressor and accumulator arrangement.

17.5.4 Solution Purification

The primary purification stage consists of agitated neutralisation tanks located between the leach and CCD sections. The acid slurry will be treated with limestone slurry and milk of lime in two agitated tanks arranged in series to precipitate aluminium and iron hydroxides. These precipitates along with the gypsum produced as a by-product during the chemical reaction will be washed and separated from the solution in the CCD thickeners. The thickener underflow will be pumped to the final neutralisation circuit and after treatment discharged to tails. The thickener overflow will be pumped to the secondary precipitation circuit.

The secondary stage of the purification circuit consists of an agitated precipitation tank, a clarifier and filter press. The solution will be treated with sodium hydro-sulphide solution in the precipitation tank with the objective of producing a base metal sulphide precipitate. The discharge from the tank will be thickened and subsequently filtered within the circuit to separate the base metal precipitate from the solution. The clarifiers and the filter press will include washing in order to facilitate counter current washing. The purified solution will then be pumped to a solvent extraction circuit. The base metal precipitate filter cake will be drummed and stored for potential sale as a by-product.

17.5.5 Solvent Extraction

The solvent extraction circuit will consist of multiple stages of conventional mixer-settlers for both the extraction and stripping stages. The mixer settlers in the extraction and stripping circuit are arranged in a way that allows the immiscible liquids to separate under laminar flow conditions so that the barren aqueous solution and loaded organic solution are collected in separate launders at the end of each mixer-settler.

The purified solution will enter the first extraction stage and subsequently flow to the following two stages. The organic phase consists of D2EPHA extractant in kerosene carrier (diluent) at a ratio of 20:80 flowing in a counter current direction to the pregnant solution flow. The loaded organic solution will be collected in a tank and pumped to the stripping circuit. During extraction the phase ratio of pregnant solution to the organic solution will be kept at a constant 2:1.

The loaded organic phase will be pumped to the stripping circuit where it is stripped counter currently with sulphuric acid to facilitate the transfer of manganese ions from the organic phase to the acid phase. The acidic manganese sulphate solution will be collected in a separate tank and pumped to the crystallisation circuit. The depleted organic solution will be pumped to the barren organic solution tank and recycled back to the extraction stage.

17.5.6 Crystallisation

The concentrated manganese solution at near saturation will be treated in an evaporative crystallisation circuit in order to make HPMSM product suitable for the battery market. The crystallisation circuit consists of a vacuum crystalliser, heat exchanger and ancillary equipment. The feed solution is heated to 90 degrees centigrade (0C) by steam generated from an electric boiler. Water vapour removed under low pressure is condensed, the condensate being used to pre-heat feed solution. By this means the manganese sulphate solution becomes saturate and the manganese sulphate crystallises out. The hot suspension of manganese crystals (magma) is bled from the evaporator chamber and pumped to a cyclone that "dewaters" the feed to a centrifuge. The centrifuge further separates the solution from the sulphate crystals, thereafter the crystals are dried by an indirect rotary drier, cooled and then drummed for shipment to market.

18   PROJECT INFRASTRUCTURE

18.1   Introduction

The K-Hill Manganese Project (the Project) is located on the outskirts of the town of Kanye, the administrative centre of the Southern District of the Republic of Botswana in southern Africa. The required infrastructure for the Project consists of the following major areas:

- Roads, including country road network, access roads and site roads

- Port facilities in neighbouring countries

- Air transport

- Power supply, including the high voltage feed and substations

- Water supply, including all boreholes and pumping systems

- Process Plant

- Ancillary building including stores, warehouses, offices, gate house and fuel depot

- Tailings storage facility

- Mine, including the open pit and waste rock dump

18.2 Roads

18.2.1 Road Network

South Africa has the best road infrastructure in Africa which extends to Gaborone and Kanye via a well maintained and modern road system that services the most economically active part of Botswana, as shown in Figure 18-1. This paved national road network is usable all year round and provides access to the Project area via the A1 and A2 roads.

The nearest border post is Skilpadshek Pioneer Gate located 2.5 km to the southeast of the town of Lobatse. This is a major border post which is open from early morning to midnight. Substantial loads are regularly transported from the Gauteng province in South Africa to mines such as Jwaneng via the N4 toll road. It is common practise to temporarily remove power lines for oversized loads. This is likely only to be necessary for a few items during the construction of the plant.
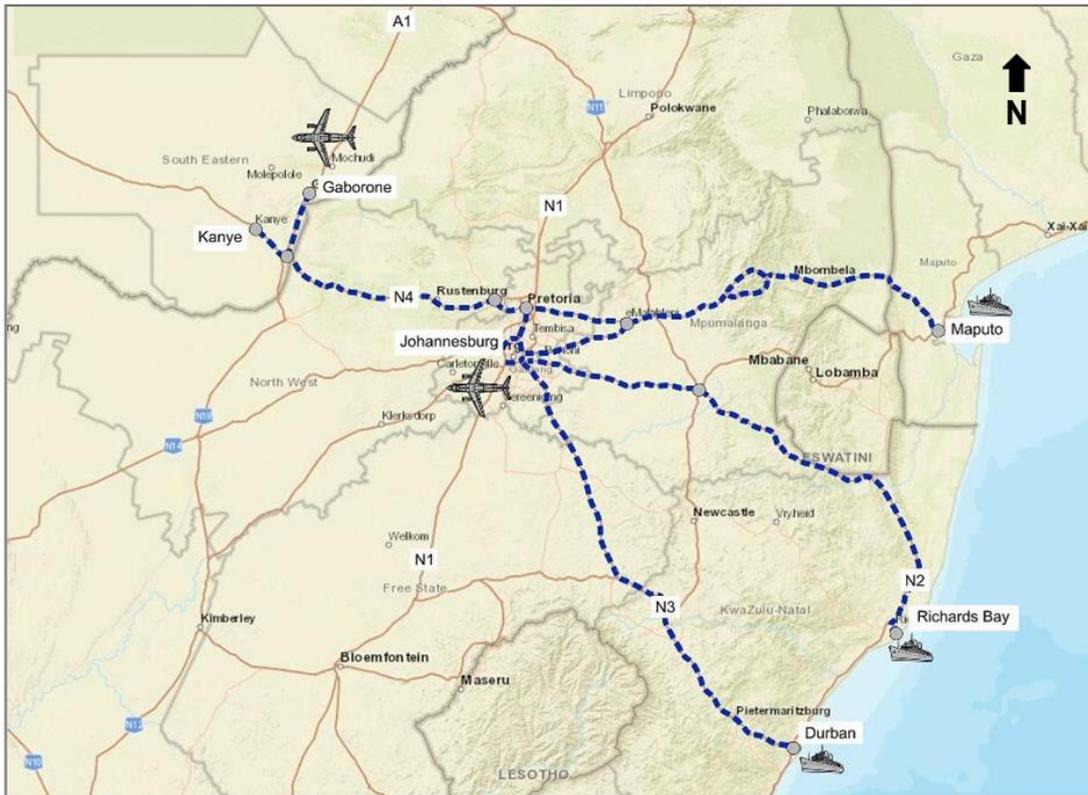
Figure 18-1:   Regional road network

18.2.2 Access Roads

The A1 highway leading to Kanye from both Gaborone and the A2 highway from Lobatse run through the centre of Kanye which require that most mine site traffic, especially hazardous loads, by-passes the town using dedicated short sections of unpaved roads and tracks of approximately 4 km as traffic is diverted from A2 to the Kanye-Mnathethe road before entering Kanye as shown in Figure 18-2.
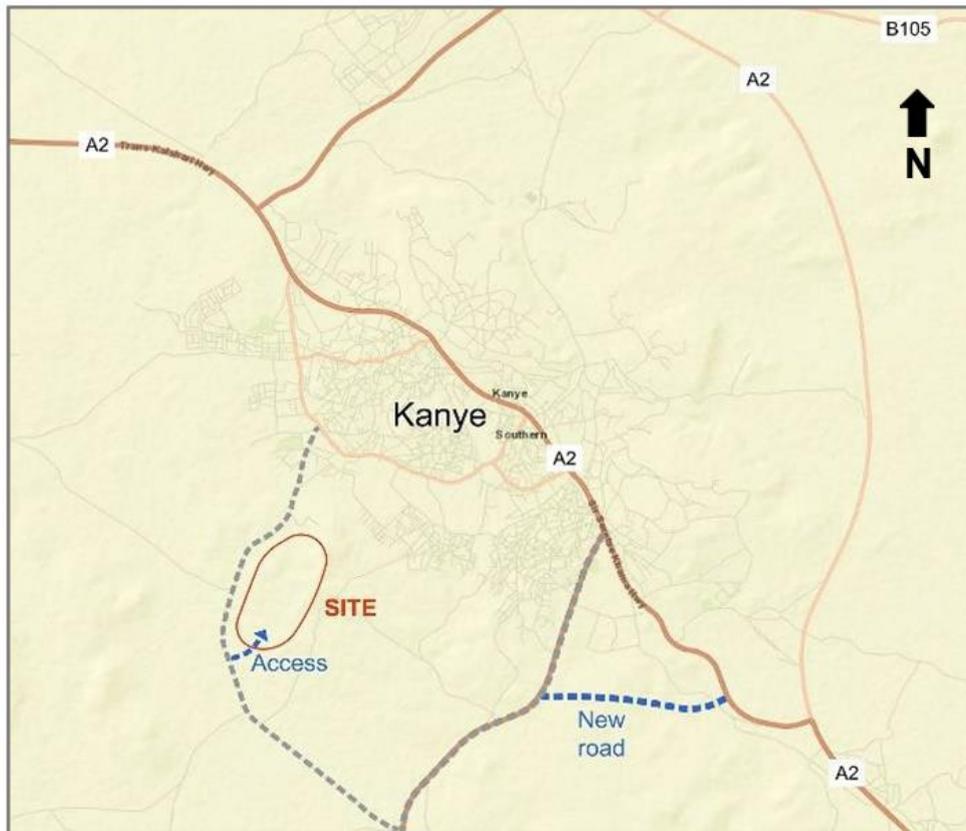
Figure 18-2:   Site access roads

18.2.3 General Site Plan and Roads

In general, site roads will be unsealed which will allow them to be maintained using standard earthmoving equipment. A dedicated haul road of approximately 1.5 km will connect the open pit to the ROM Pad, while maintenance tracks will provide access to the TSF, the tailings pipeline and various bore hole locations. Dust suppression will be provided throughout the year by the mine water truck.

While routine road maintenance will be done by the mine using mining equipment, major road works will be outsourced to a local contractor. A general site plan is shown in Figure 18-3 below.
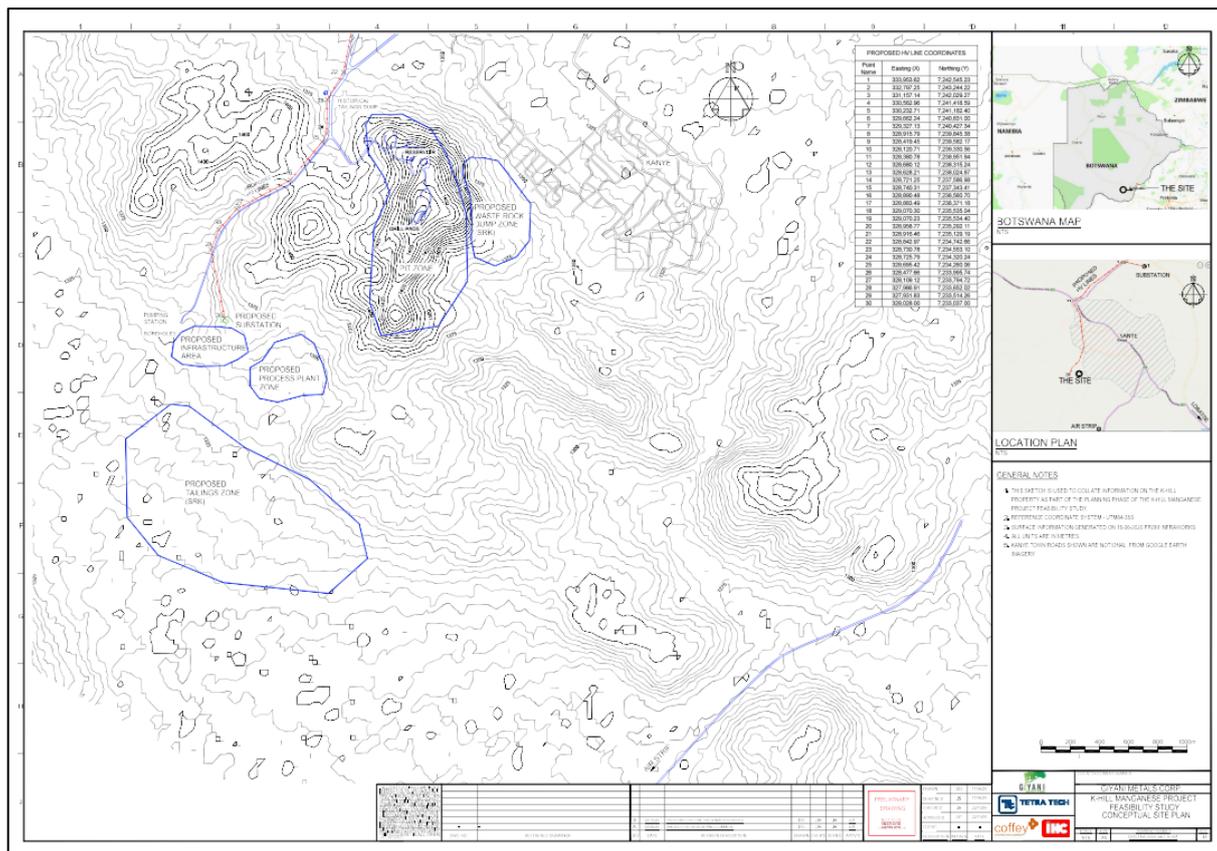
Figure 18-3:   A general site plan

18.3   Port Facilities

Botswana is a landlocked country that relies on ports in South Africa, Mozambique and Namibia for shipping. The nearest deep-water ports are shown in Table 18-1. There are no navigable rivers in Botswana.

Table 18-1:   Deep Water Ports in Southern Africa

Port	Location	Distance to Site (km)	Max Draft (m)	Max Vessel Size (dwt)	Cranage (t)
Durban	South Africa	925	11	230,000	>100
Richards Bay	South Africa	960	14	67,000	<100
Walvis Bay	Namibia	1,420	11	150,000	>100
Maputo	Mozambique	870	6.4	120,000	<100

18.4   Rail

The Botswana Railways system consists of approximately 888 km (552 mi) of 1,067 mm (3 ft 6 in) Cape gauge track. The main line runs through the south-eastern region of Botswana from Mafikeng in South Africa through Lobatse, Gaborone, Mahalapye, Palapye and Francistown to Plumtree in Zimbabwe.

There is a main line rail network access and freight terminal in Lobatse.

18.5   Air Transport

The nearest commercial airstrip is approximately 5 km from the mine site. Most commercial air traffic uses the Sir Seretse Khama International Airport in Gaborone.

18.6 Power Supply

Power is supplied and distributed in Botswana by the Botswana Power Company (BPC). Approximately 70% of the electricity is generated in the local Morupule A and B power stations and the rest is imported.

The electricity network in southern Botswana is well-developed and the existing 132 kV substation just outside Kanye, which is a node on the same network feeding Jwaneng diamond mine, will be the point of supply for the mine site.

Figure 18-4:   Kanye 132 kV Substation

It is assumed that BPC will provide medium voltage (MV) power at a location adjacent to the mine site from where it will be taken and distributed using mine infrastructure. The cost of a new overhead line from the mine site to the substation is amortised in the electricity tariff.
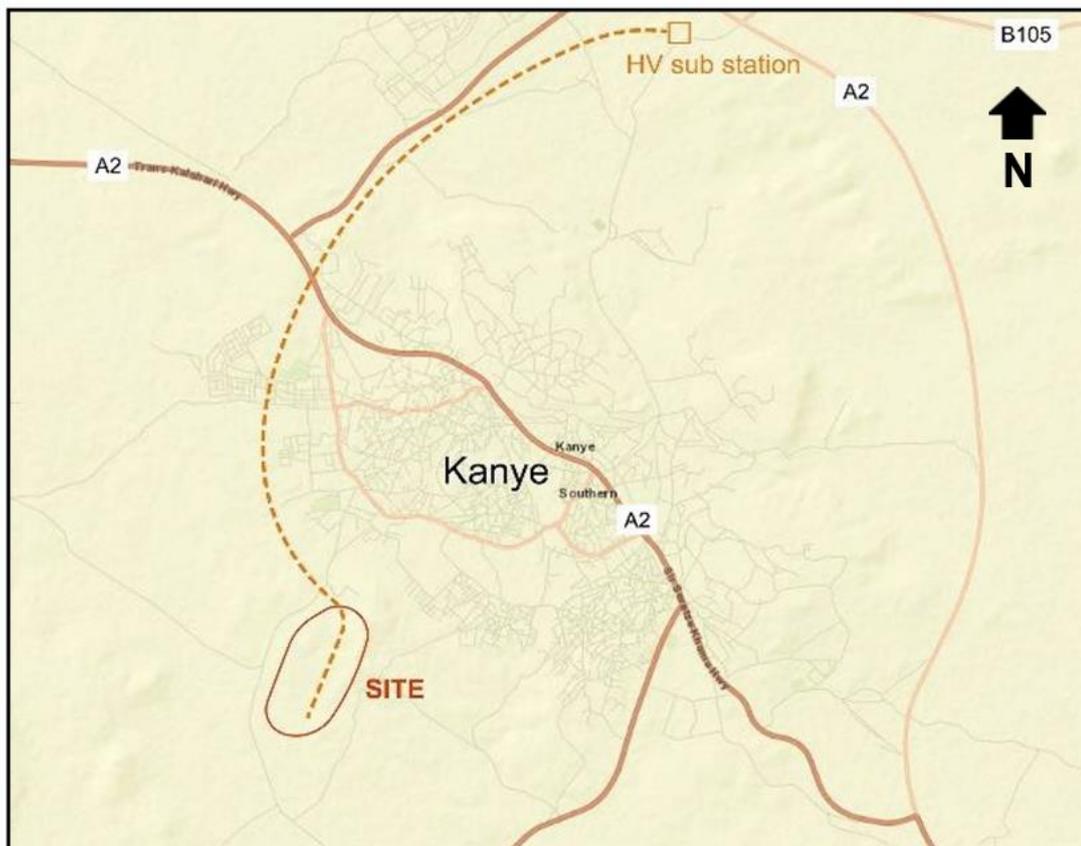
Figure 18-5:   High Voltage Line Route

The electrical power requirements are estimated at 22 MW. Table shows a breakdown of the main power users. The most prominent demand is from the crystalliser.

Table 18-2:   Electrical Power Requirements

Area	Consumption(kW)
Plant	21,510
Comminution	850
Extraction	200
Production	20,050
Water Services	325
Tailings	85
Mine	-
Administration	150
Total	**21,660**

Giyani has completed conceptual level investigations into the viability of solar power generation through photovoltaic arrays as a means to offset the fossil fuel-based electricity supply from the BPC network. The latitude, semi-arid climate and the relatively flat terrain make this proposition viable and moreover it is in keeping with the Botswana government's strategy to use solar power to service remote regions. This option should be investigated further and will be part of the ongoing Feasibility Study scope of work.

18.7 Water Supply

Apart from bottled drinking water that will be brought to the mine from Kanye, the mine will depend mainly from nearby boreholes wit the possibility of water supply from the local town of Kanye. The town currently obtains water from some boreholes but mainly relies on a water pipeline coming from the north of Botswana where there are some large sources.

Raw water supplied to the plant site from the boreholes or Kanye will be received in raw water tanks on the plant site where it will be treated as required.

During steady state operation, the majority of the process water requirements will be met by the recycled water through the water treatment plant. Process water will be stored in large steel tanks at the water treatment plant.

The sewage treatment plant will be located with the plant site. The facilities will consist of a packaged Sewage Treatment Plant (STP) unit and will remain on site to provide short-term sewage treatment requirements during operations. The removed sludge will be disposed of in the municipal sewage facility in Kanye.

Any water that is discharged to the environment will be treated to meet the minimum local water quality requirements.

18.8 Process Plant

18.8.1 Basis of Design

The basis of the design includes:

- Plant capacity of 200 ktpa

- Modular off-site fabrication, assembly, and commissioning where possible

- Off-the-shelf equipment

- Design for a plant life up to 15 years

- Open plant architecture with shelter only provided where exposure to the elements affect performance

- A fully automated hydrometallurgical process plant

18.8.2 Earthworks

The main infrastructure facilities will be located on a levelled earthwork pads and located adjacent to access roads and within easy access to the processing plant and accommodation but screened from the main highway. Where possible, clean surface water run-off will be diverted from mine infrastructure to avoid contamination from the on-site activities. Any contaminated water will be collected and stored for re-use or treatment if required before any potential release to the environment is considered.

18.8.3 Plant Areas

Communication

ROM ore will be delivered to the ROM pad outside the process plant fenced area, by the mining haul trucks. Ore will be dumped onto the stockpile from where it will be extracted and fed to the comminution circuit that consists of a three-stage crushing circuit and a single stage grinding circuit with a thickener.

A primary jaw crusher followed by two closed circuit cone crushers reduces the F80 of 400 mm to a P80 of 10 mm. The small capacity offers an opportunity to use modular integrated off-the-shelf crushing plants.

This crushed product is ground in a 3.0 m diameter x 3.7 m long, 450 kW ball mill that is in closed circuit with a hydro cyclone cluster. The overflow, set to a P80 of 300 mm, is thickened before being discharged to extraction and the underflow returned to the mill.

Extraction

Extraction comprises whole ore leaching in sulphuric acid, using SO2 as reductant, followed by a two-step purification and solvent extraction. SO2 is produced in a sulphur burner and injected into the leach tanks.

Throughout mild steel vessels are specified with a corrosion allowance to account for the accelerated deterioration in the low pH environment. All extraction areas are contained in acid resistant bunds. Tanks are enclosed to protect against splashing and spillage and to collect and recycle SO2 gas. Ample access with at least one alternative exit is provided in all areas.

Purified leach solution at a slightly acidic pH is concentrated in a conventional three stage loading, two stage stripping solvent extraction circuit using D2EPHA modified kerosene as the organic phase. The concentrated strip solution is transferred to the product area. The SX area is separated from the rest of the plant to guard against the impact of a kerosene fire.

Crystallisation and Product Handling

An evaporative crystalliser and rotary dryer will be used to produce a dry, crystalline high purity manganese sulphate monohydrate (MnSO4.H2O) product which will be shipped in drums. The crystallisation accounts for 90-93% of the entire electrical load of the mine site and as such will require substantial electrical switchgear.

Water Services

The process plant is a net consumer of water. Both make-up borehole and plant water are to be neutralised and treated where required before use in the process circuit. Lime will be slaked on site and used to neutralise effluent from the process. Water treatment removes particulates using a combination of sieves, filters and clarification before chemical treatment using ion exchange.

Tailings Disposal

Thickened tailings is pumped from the plant to the conventional slurry tailings storage facility (TSF) that is planned to be approximately 700 m south of the plant (Section 18.24). The TSF is slightly below the plant site but the terrain generally flat over the entire area, so the pipeline will follow a relatively level downhill gradient. Return water will be collected using a pontoon style floating pump station.

Reagents

The main reagents include:

- Sulphuric acid. Supplied in bulk tankers by road from South Africa

- Elemental sulphur. Supplied in bulk by road from South Africa

- NaHS. Supplied in bulk bags by road from South Africa

- Limestone. Sourced locally and supplied by road truck

- Lime. Sourced locally and supplied in powder form by truck

18.9   Ancillary Buildings

Administration Office and Change House

Prefabricated modular units will be used for office administration buildings and gate houses, situated at or near the mine site entrance. Offices will be provided for the mine manager, engineers, geologists and clerks. It is anticipated that certain operational support functions not directly involved with the mine production will reside in an office in Kanye.

It is assumed that all workers will live locally and arrive on site in their personal protective equipment (PPE). A meeting room and ablutions building will include limited male and female showers, bathrooms, and a changing room with lockers. A muster area is located on the parking area at the entrance to side, adjacent to the administration buildings.

Emergency Response

A fire truck manned with trained personnel will be on standby 24 hours per day. High risk areas such as solvent extraction and the fuel farm will be equipped with a fire suppression system. The emergency response unit will include a clinic that will contain equipment to treat minor ailments and first response treatment. The primary facility for medical care will be the local hospital in Kanye.

Stores and Workshops

The stores and workshops complex will provide day-to-day service facilities for the mining and processing equipment, including:

- Heavy vehicle repair bays

- Light vehicle repair bays

- Mechanical and electrical workshop

- Wash and tyre change bay

- Spares and consumables warehouse

Extensive repair will be outsourced to workshops in Kanye and Gaborone.

Vehicle maintenance workshops will be created from light steel structures that provide shelter and light lifting equipment. Effluent from the workshop and vehicle wash areas will be collected in bunded areas and mechanically treated and recycled. Hydrocarbon waste will be disposed of either via the local waste management facility at Kanye or outsourced to a third party for responsible disposal.

Stores will consist of a light steel and clad structure and contain an office for the store man and assistant and will also include a fenced yard for larger equipment, laydown and lubricant storage.

Fuel Farm

Mine and light vehicles will be refuelled in a dedicated fuel storage area near the ROM pad. Fuel will be stored in horizontal fuel tanks and contained in a covered, bunded area.

Assay Laboratory

An analytical laboratory will provide support to the process plant control and optimisation and also provide assaying services as part of grade control and exploration. The laboratory will be a prefabricated modular unit complete with sample preparation area, sample storage and consumables store.

Ancillary Vehicle

It is anticipated that the mine will require light utility vehicles, a crew bus, mobile crane, skid steer and FEL.

18.10 Communications

Cellular communication on site is reliable and fast. Giyani will secure a dedicated internet connection from the local tower and associated data provider. An existing cell phone tower needs to be relocated prior to construction and an allowance has been made in the cost estimate.

A Very Small Aperture Terminal ("VSAT") antenna will provide broadband data access for the project. The broadband data access will also be utilised to provide telephone communication, utilising over Internet Protocol ("IP") telephones.

Central communications consisting of access and control, intrusion and detection alarms will be located at the administration offices. General mine and plant communications will be delivered by Ultra High Frequency ("UHF") mobile radio, local and repeater channels. An existing cell phone tower needs to be relocated prior to construction and an allowance has been made in the cost estimate.

18.11 Mobile Equipment Workshop, Tyre Change and Washing

The mining and ancillary vehicles workshop will service the mining mobile equipment fleet and ancillary equipment. The activities will include: maintenance, tyre change, and vehicle wash-down. After vehicle washing the water will be mechanically treated and recycled. The infrastructure maintenance facility will also include containers for spares storage. The workshop building will be constructed of containers with fabricated roof, with a tyre yard, change area and wash area located beside the workshop. Wash-bays for mining and ancillary vehicles will consist of concrete aprons with pollution control point and raised sides.

18.12 Fuel and Lubricant Storage, Dispensing

The primary method of refuelling for mining and ancillary vehicles is anticipated to be by "mobile bowser". The fuel storage and dispensing unit will have a self-bunded fuel tank with appropriate dispensing equipment. Lubricants will be stored in a secure warehouse adjacent to the vehicle maintenance workshop. Heating fuel oil will also be stored in the fuel storage area.

18.13 Warehouses & Facilities Maintenance

Lockable TEU / FEU containers will provide storage for general items. An integrated workshop warehouse area with concrete loading and unloading apron will house larger spares. The workshop building will be constructed of containers with fabricated roof.

18.14 Ancillary Vehicles

The Project will require ancillary vehicles such a 4x4 vehicles for operatives, crew buses, equipment for maintenance team (truck, excavator, roller, FEL etc.). An allowance for these for is incorporated into the mining fleet and owner's costs.

18.15 Water Treatment and Water Supply Facilities

The required water supply facilities are described in Section 18.7. The raw water will be pumped to central storage tanks. A proportion of the raw water will be sent to a vendor packaged treatment plant.

18.16 Waste Disposal

A septic system will be utilized for sewage disposal. Septic tanks (ST) will be located at the main infrastructure facility, accommodation camps and near the open pit for mining operations. The septic tank sludge will be removed by vacuum truck at regular intervals. Exact location of septic tanks and sludge dumping and disposal options will be defined at the detailed design stage.

A management area for waste streams from the workshops is positioned next to the workshop. Materials (such as tyres, used oil, batteries) shall be stored, sorted and periodically emptied to go to a local landfill and approved safe disposal areas off-site in accordance with local regulation and / or international standards.

Used oils will be temporarily stored in a temporary storage area within the industrial site for subsequent handing over to the local certified companies, dealing with the treatment of these industrial waste categories in accordance with the regulations of Botswana. In case there are no local certified companies, it is recommended to consider options of installation of an incinerator at site for burning of wastes.

18.17 Earthworks

The main infrastructure facilities will be located on a levelled earthwork pads and located adjacent to access roads and within easy access to the processing plant and accommodation but screened from the main highway. An allowance of USD0.5 M is included for this item. The earthworks and civils for the processing plant and any earthworks required for pre-stripping, waste dump and tailings development are assumed to be incorporated into these cost items respectively.

18.18 Internal Roads

Based on the preliminary site layout, around 5 km of site roads are required excluding plant internal roads. The following site roads are envisaged:

- Main access and plant to mining area access for 1,500 m

- Other site roads such as plant perimeter road and access tailings facility, camp and support infrastructure for 3,500 m

- Access and site roads comprise assumed as unbound pavement, minimal drainage and no requirement for bridges or significant culverts

At this stage it is assumed that there is no requirement to modify or upgrade any surrounding national roads.

18.19 Fire Response / Emergency Industrial Medical

Given the location and complexity of the processing, a dedicated fire depot will provide fire-response services to the Project and consists of a building for fire engine vehicles with training facilities. The main clinic will be equipment with medical equipment to manage industrial accidents and emergencies.

18.20 Plant Infrastructure

Miscellaneous buildings are also required for the processing plant such as:

- Gatehouse and security

- Plant change-house and ablutions

- Laboratory

- Plant workshop and reagent store

- Plant administration and training building

- Plant weighbridge

This costs for main plant facilities; plant control room, are assumed to be covered within the overall processing plant capital cost with operating costs captured in either plant operating costs or general and administration.

18.21 Accommodation

There is a well-developed local hotel sector in the adjacent town; there are likely to be opportunities to rent rooms in private houses. The Company expects this to be sufficient for construction and operations. Any additional accommodation required for construction workers would be provided by the Contractors.

18.22 Power Supply

18.22.1 Strategy

The installed capacity is estimated to be 45 MW for production of HPEMM. SRK understands that the EW and ER processes will be run sequentially so that the maximum power demand will be no more than 45 MW. The Company's preference is to connect to the national grid operated by the Botswana Power Corporation (BPC). The nearest point of access is a 132-kV substation around 15 km from the Project site.

18.22.2 Botswana National Grid

The national grid is concentrated in the southeast of the Botswana with transmission voltages of 132kV, 220 kV and 400 kV. A literature review confirms that energy demand has grown in Botswana and demand is met by imports from Electricity Supply Commission (Eskom) in South Africa, Namibia Power Corporation (Nam-power), Zambia Electricity Supply Corporation (ZESCO) and Southern African Power Pool (SAPP). The country is liable to experience load shedding (power black-outs) as a result of power supply shocks in exporting countries although is currently rehabilitating current generation capacity and extending this capacity.   SRK understands that the BPC has informed the Company that the national grid can supply the requested power although point of access hasn't been confirmed in detail.

18.22.3 Required Power Supply Infrastructure

On the basis that the nearest point of access is a 132-kV substation around 15 km from the Project site and demand is 45 MW, which the existing substation and connecting line can provide, the following infrastructure will be required:

- Connection works at the existing substation

- 132 kV double circuit overhead line for 15 km

- Project Substation 110 kV step down to the plant distribution voltage

- Site electrical distribution (assumed to primarily be within the fence-line of the plant / refinery area) with some eternal distribution for support infrastructure

- Back-up power generators for camp, security infrastructure and critical loads in the plant. 1.5 MW has been assumed

18.22.4 Power Cost

SRK understands that the BPC has informed the Company that the cost of power via the national grid, and which has been used in the operating cost is USD0.06 /kWh (BWP0.634).

18.23 Product Logistics

Product will be loaded to barrels or bulk bags and placed in twenty-foot equivalent unit (TEU) and transported by road to a port in Mozambique or South Africa; the transport distance will be in the order of 900-1000 km along national roads and highways. The product has a density of 7 t/m³ and TEUs will carry a 27 t payload.

For this PEA study, it has been assumed that insurance, transport and port costs will be USD60 /t of HPMSM product and these have been deducted from the selling price.

18.24 Tailings Storage

18.24.1   Introduction

The tailings storage facility (TSF) for Kgwakgwe Hill will be constructed south of proposed plant location as shown in Figure 18-6. The TSF is expected to be built using the downstream technique utilizing the north hill and south dam as containments. The tailings slurry will be pumped downhill from elevation 1332 m to elevation 1315 m. The general characteristics of tailings disposal are listed below.

Table 18-3:   Tailings Details

Characteristics	Value	Comments
Total tonage of tailings	1.2 Mt	Assuming 75 % of mined RoM will be deposited in form of tailings
Number of years of production	8 years	
Yearly production	0.15 Mtpa	
S.G.	2.3	assumed
Unit density of placed tailings	1 to 1.1 t/m3	assumed
Required volume of tailings to store	1.2 Mm3	

Other assumptions used in the PEA study:

• The TSF is not lined because the tailings are assumed to be non-acid and/or metal leaching

• Foundations are suitable for construction of TSF (no geotechnical site investigation has yet been performed but is in progress for the FS)

• All clean surface water will be diverted around TSF and only precipitation falling directly on the TSF is to be stored and pumped back to the Plant

• Water from TSF is suitable for recycling in the plant (no need for water treatment)

18.25 Construction of Containment

The containment dam was assumed with a crest width of 8 m and 2H:1V upstream and downstream slopes. For the final crest at 1315 m, the capacity of TSF was calculated to be 1,200,000 m³ assuming 3 m of the freeboard. An additional volumetric capacity could be achieved in the future by raising the facility. For example, by raising the TSF additional 1 m, an extra capacity of 250,000 m³ can be achieved.

The total volume of the containment dam to the final elevation 1315 m is 394,456 m3. The distance from TSF to the plant is 600 m as shown in Figure 18-6.

The TSF will be built in two stages:

- Starter facility

- Final facility

The starter TSF will be built to elevation 1310 m and it will involve a construction volume of 131,000 m^3 of fill material. This will allow for storage of 358,000 m^3 of tailings (roughly 2 years).

The initial and final TSF containment dam will be built using the mine waste materials whenever possible. Assuming that the water reclaim pool will be away from the dam containment, the mine waste material which will consists of clay shale could be used for construction. The TSF will be homogeneous, without core and core filters because of low height and water pool situated away from the containment dam. The fill material must be conditioned for the suitable moisture content and compacted in 0.3 m lifts using a sheepsfoot roller or other similar compaction device.

18.25.1   Transport of Tailings and Water Return

The tailings slurry will be transported using the PVC pipeline (6-inch diameter). Because of downhill gradient (30 m) between the plant and TSF, the tailings slurry will be transported by gravity. The return water will be pumped back to the plant from the TSF using a floating barge through a 4-inch diameter water line.
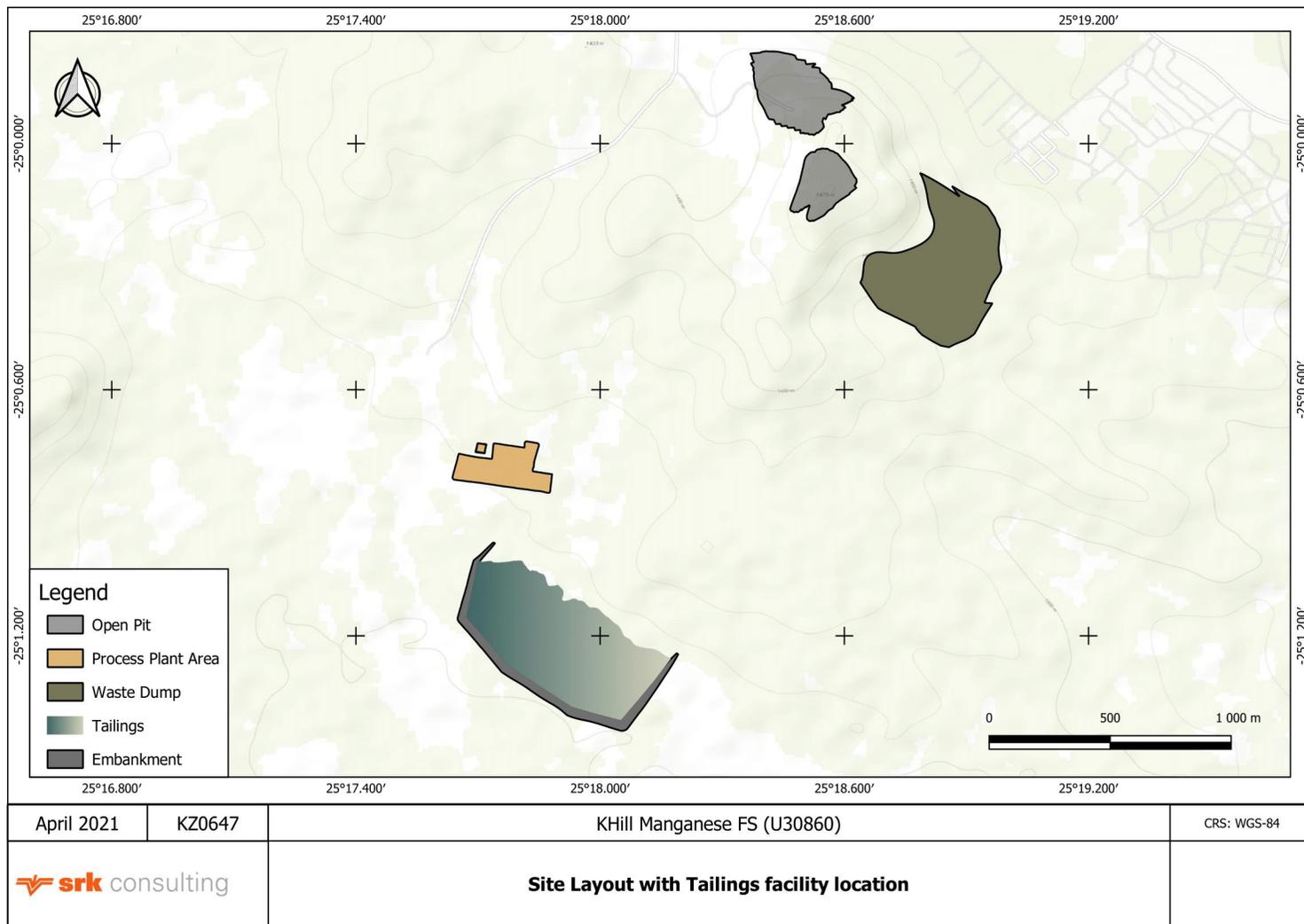
Figure 18-6:   TSF location south of proposed plant showing plant location and open pits

19   MARKET STUDIES AND CONTRACTS

A market study has been commissioned by Giyani and it was completed in August 2020 by Benchmark Mineral Intelligence. This pricing study was used for the HPMSM price forecast used in this PEA.

The Benchmark Minerals market study assessed the supply and demand dynamics of the HPMSM market based on projected consumption by the EV battery market versus known and estimated sources of future production to determine a long-term average price for HPMSM.

Benchmark estimate that nickel-cobalt-manganese formulations will continue to dominate EV cathodes through to 2040 and the anticipated deficit will exceed 800,000 tonnes per annum contained metal over the same period. With limited new projects in development and technical and financial constraints on increasing existing capacity, it is not clear how the large increase in HPMSM demand will be met.

Based on the close correlation of HPMSM prices both to manganese ore conversion costs and the marginal conversion cost from High Purity Electrolytic Manganese Metal (HPEMM), Benchmark's analysis projects that current prices of around USD1,250/t (CFR Japan / South Korea as at August 2020) will rise to a long-term, stable average of USD1,588/t by 2024, but with some short term spikes related to tight supply / demand balance.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

20.1 Introduction

SRK was not mandated to review the Environmental and Social (E and S) issues related to the Project as part of this PEA but notes that the Client has been working closely with the Government of Botswana in recent years and has taken a responsible approach to the Project. A key part of this has been the development of a local Environmental Management Plan (EMP) for the exploration work carried out to date at the Project. The EMP was formally approved by the Department of Environmental Affairs in Botswana in 2019 and was prepared by Loci Environmental consultants, a Botswana based environmental consulting services firm. The following section summarizes the EMP based on input from Loci.

20.2 EMP

The purpose of the EMP study was to examine the potential environmental and social effects (both positive and negative) of the proposed exploration activities, as well as the "No Development" alternative, and outline appropriate mitigation or optimisation measures. Mitigation or optimisation measures are procedures or protocols that will be employed to ensure that negative effects are minimised, and positive effects are maximised during the development of the project. Additional options identified during the environmental assessment process may be considered as applicable. Following the assessment studies, a written report was submitted for review by the Department of Environmental Affairs Botswana (DEA). The report addressed all phases of the project and included an Environmental Management Plan and Monitoring Plan.

The aim of the EMP report was to manage and protect the environment by ensuring that when the DEA decides to grant planning permission for a project, does so in the full knowledge of the likely effects. The Environmental Assessment (EA) Regulations (2012) in Botswana set out a procedure for identifying those projects which should be subject to an Environmental Assessment. They also outline procedures for assessing, consulting, managing and reporting of the environmental impacts, and establish a structure for management and decision making on those projects which are likely to have significant environmental effects. The majority of the mitigation measures that will be required by the EMP are applicable to the drilling activities at the site, excavation and processing of the dumps, and will require staff in charge of environmental management to be available on site and to assign a qualified/experienced person (in the fields of environment, health, safety, and quality), to be responsible and able to confidently and holistically implement the requirements of the EMP on site during all phases of the Project. It is expected that external auditors and environmental monitors, as well as representatives from the DEA and Department of Mines will inspect and follow up on the successful implementation of the project EMP and its requirements at the Project site.

20.2.1 Potential impacts

The review of the technical project scope/detail, site visit and desktop research in relation to the proposed project has resulted in the identification of the following possible impacts:

- Loss of vegetation:

    o Drill sites

    o Tracks

    o Processing areas and site offices

- Spread of alien species

- Loss and disturbance of fauna:

    o Loss of habitat

    o Risk of increased poaching

    o Fauna disturbance by exploration activities

- Loss of soil due to erosion

- Risk of disturbance of archaeological sites

- Soil and water contamination (hydrocarbon contamination)

- Depletion of ground water

- Air pollution due to dust and emissions

- Increased waste quantities:

    o General

    o Human waste

- Risk of injuries to staff due to wildlife/human encounters

- Occupational health and safety related impacts

- Risk of injuries due to traffic accidents

- Poor relations and social disruption

- Improved livelihood of the neighbouring communities due to employment

- Improved understanding of the local geology and possible development of future mine(s) if economical manganese deposits are found

- Possible impacts emanating from the proposed exploration activities are briefly described and illustrated in the following sections. The description includes a scale of change, severity level and duration for each identified impact

Loss of vegetation

Vegetation will need to be removed at:

- Drill sites

- Processing area and site offices

The drill sites clearances require an area of approximately 20 m x 20 m maximum, which are required to set up the drilling rigs, and allow for access support vehicles and equipment such as water bowsers, trucks with drill rods and casing, a small (lined) water sump and core trays for collection of the core. Access tracks are available from previous exploration activities and some have been created by the WUC during constriction of their water reservoir on top of the K-Hill. Given the type of equipment that will be used onsite, such as dump trucks, haulage trucks, and front-end loaders, these tracks will have to be widened in some areas. Various open spaces are available in the Project site due to disturbance by previous mining activities. As such, minimal vegetation clearance will be required.

Native vegetation can also be lost if alien species would be introduced to the area, which may grow aggressively and suppress the local species. The Client therefore has to vigilantly monitor the introduction of alien invasive plant species.

Overall, the impact of loss of vegetation is predicted to be negative, moderate and short term because vast areas are already devoid of vegetation and rehabilitation will be undertaken at the end of exploration. The impact is expected to be for a short term because the exploration activities will take less than a year.

Spread of alien species

With the movement of people in and out of site from Kanye, and the movement of equipment to the site, there is a risk that seeds from plants will be tracked into the site, and alien species introduced into the Project area. The alien species may overtake local plant species found in the Project area, and impact grazing activities. Species such as *Prosopis juliflora* and *Cenchrus biflora* are commonly found in Botswana, and therefore possible tracking into the Project area is a risk. The impact is predicted to be negative, moderate and long term

Loss and disturbance of fauna

The loss of fauna and avifauna habitat is related to the loss of vegetation resulting from clearance activities. As the vegetation and habitat at the site is not unique, and the vegetation outside of the affected area is similar, the relative loss of habitat is very small. The re-generation of vegetation in the area after the exploration activities are completed is expected to occur naturally. Disturbance of the fauna in the area is expected to be caused by the exploration activities, the smaller species are expected to avoid the areas with activities due to noise and presence of equipment and people, and move to other areas in the in the Project area. The impact is predicted to be **negative, slight and temporary.**

The presence of a workforce within an area with wildlife, could cause a temptation by some of the workers to engage in poaching of animals. The impact of poaching is therefore predicted to be **negative, moderate** (without mitigation) and **temporary.** As soon as the workers are done with the exploration activities and no longer at the site, the impact will also be eliminated.

Loss of topsoil due to soil erosion

Areas where vegetation is removed in order to make space for exploration equipment, are at risk to become susceptible to erosion. This is mainly caused by the loosening and stockpiling of the soils. The impact of erosion is applicable to every project/site area but is generally increased when the topography includes slopes with steeper gradients. The area for the proposed exploration has some slopes. Also considering the total area that will be affected (relatively small), this impact is expected to be negative **moderate**, and **temporary**, as it is assumed that vegetation will re-establish after exploration is completed and areas have been rehabilitated.

Risk of disturbance of archaeological sites

The archaeological report completed for the Project revealed that it is unlikely there will be archaeological material in the Project area. However, there always remains a small risk of presence of archaeological sites in the area. The impact is predicted to be **negative, slight** to **negligible** and **permanent**. This impact is expected to occur during the clearance and the company would instigate a 'chance find procedure' should a site be encountered.

Soil and water contamination (hydrocarbon contamination)

Hydrocarbon contamination of surface and ground water can be expected to occur if equipment and machinery have diesel/oil leakages from poor maintenance, breakdowns and on-site maintenance. Fuelling of non-mobile equipment will be done using a diesel bowser, and minor repairs to such will be done on site. The impact of contamination is therefore more significant for the non-mobile equipment at the exploration sites, compared to the more mobile equipment.

The impact is classified as **negative** because hydrocarbons have the potential to kill micro-organisms and cause pollution, **slight** as maintenance will not be carried out often and fuel spillage is only related to risks when normal preventative measures fail. The impact of pollution is only applicable to the period when equipment is operating at site and is therefore considered **temporary**.

For the drilling consumables/fluids, the products are not considered harmful, especially when diluted with water, as is procedure during the drilling activities. When spilled in concentrated form on surface, they may have a negative impact on vegetation. To manage this impact, it is standard procedure for drilling works to put temporary plastic sheeting in the temporary sump at the drilling site. This way water can also be retained and recycled, and in addition to containing the diluted chemicals, overall water consumption is also minimised. The impact from the drilling consumables on the groundwater quality is considered **negative, slight to negligible** and **temporary.**

Depletion of water

The diamond core drilling requires water for operating of the drilling rigs. Water will also be required on site for washing some of the materials recovered from the dumps. Water can be obtained from the dam in Kanye and several other boreholes in the region. Up to 30% of water will also be recovered from the TSF. The impact is therefore classified as **negligible.**

Air quality pollution due to dust and emissions

There are two aspects to the predicted air quality impacts from the proposed project:

- Increased dust production

- Gaseous emissions from machinery and vehicles and equipment

The increased dust will be mainly caused by the excavation, crushing, and screening of materials from the dumps. Some dust will also be produced from movement of equipment and vehicles and haulage of supplies and water along the access tracks. A second aspect which is expected to cause increased dust generation, is possible wind erosion from the cleared areas and disturbed dumps. These areas will require dust suppression to be done. The impact of the dust from the activities is expected to be moderate in terms of quantities of dust generated. There also exists a wind shield of vegetation in the area to reduce the spread of dust.

Diamond core drilling requires circulating water at all times to cool the rotating drill bit. There is no dust generated by this drilling method and the fine ground rock which is not retrieved as drill core settles in the surface drilling sump which is usually ~1 m deep for each hole drilled.

RC drilling requires compressed air to operate the drill bit which results in drill chips (small rock fragments) and finely ground rock (dust) brought to surface. Samples of drill chips and ground rock will be collected on surface in a portable cyclone then stored either in sample bags (later removed from site) or in small depressions dug on the surface to enable the samples to dry. As the samples are required to be dry, water cannot be used for suppression of dust. All sample sites are then rehabilitated and naturally re-vegetated.

Any dust generated by the RC drilling dissipates over a small area around the drill site. The drilling contractors will have dust masks which will be used if wind is not blowing dust away from the work areas.

The dust impact has been classified as **negative, moderate and temporary.** It is important to minimise the vegetation clearance within the Project area and to minimise speeds along the access road to minimise the dust caused by the operation.

The second impact in relation to air quality is the air quality pollution from emissions from equipment operated in the area (SOx, NOx CO, and CO2). The equipment will include dump trucks, generators, front end loaders, screens and crushers, drill rigs(s), and haulage trucks. As the overall fleet and number of engines is relatively small (compared to for example traffic in the general surrounding area), the impact of the emissions from the equipment at the drilling area is therefore also classified as **negative, slight and temporary.**

Increased waste streams

Due to the fact that the number of people in the Project area will increase during time of drilling, waste generated from human activity will also increase. Waste issues that could be applicable are:

- Green waste from vegetation clearing

- General waste and littering

- Human waste (sewage)

- Waste from repairs and maintenance of equipment

The vegetation clearing activities are expected to create waste mainly related to vegetation (and some soil) cleared from site. The vegetation waste and will be disposed of at the site in piles for natural decomposition and regeneration. The volume of the cleared vegetation is expected to be relatively low. Some of this material from the piles will be re-used for rehabilitation. For example, tree branches can be used to cover a bare area to minimise erosion and to keep cattle away while grass re-establishes.

Human waste (sewage) will be collected in portable toilets provided at the sites and will be removed to the nearest suitable disposal area. Other waste will be removed from drill sites regularly as and when required to the nearest licensed landfill. With these measures the waste impacts are expected to be **negative, slight and temporary.**

Risk of injuries to staff due to wildlife/human encounters

Sightings of snakes have been reported at the Project site. No other predators are being reported, mainly because of human encroachment which has led to predators moving to other remote areas. Communities are aware of such dangers of snakes, but some of the staff from the exploration contractor may not be used to the possibility of presence of such animals. The impact is predicted to be **negative, slight and temporary.**

The increased use of vehicles during the exploration work will increase the risks of vehicle/wildlife collision, this is especially relevant to haulage trucks transporting material off-site. This impact could cause injury and/or fatality to both humans and wildlife. It is anticipated that the impact will be **negative, slight and temporary**.

Occupational health and safety related impacts

Potential environmental health and safety effects expected to be yielded by the exploration activities are mainly related to risks likely posed by moving parts on the drill rigs, processing plant, and transport/haulage activities. The use of machinery and vehicles are the primary hazards that will need to be addressed within the EMP to ensure occupational safety is addressed comprehensively during all phases of the proposed project. The main occupational health and safety impacts include:

- Health impacts related to noise and dust

- Workers getting injured from moving equipment parts

- Collision of equipment and people

- Wildlife encounters (e.g. risk of snake bites).

This Environmental Management Plan will provide some general recommendations in addressing the above, with further and specific risk assessments, training and management to be implemented by the drilling contractor in line with the Client's health and safety policy. Due to the number of workers involved, the period of operation and the type of work the impacts are classified as **negative, moderate to severe** and **temporary to permanent**.

Risk of injuries due to traffic accidents

This impact mainly relates to employees moving to and from work, as well as to those employees involved in haulage of the product from the site.

This impact is therefore expected to be **moderate** as this will put an increase to the number of traffic movements in the area, **negative** in that it has the potential to increase traffic accidents and **temporary** in duration.

Poor relations with landowners and social disruption

The exploration activities may have an impact on community relations between the Client and both communities and landowners in the vicinity, if not managed properly. Communities can be affected by the traffic on the access tracks, accidental damage to fences and property and collisions with cattle.

Staff employed by the drilling contractor may be visiting the communities for purchase of goods in local shops, or to bars for entertainment. This will lead to interaction with locals residing in the communities. There are documented examples from exploration activities at other areas in Botswana where this has led to social stress and disruption, with unexpected pregnancies causing family strains and spread of HIV/AIDS and other communicable diseases.

Without management this impact is predicted to be **negative, moderate** and **temporary**, although some consequences can be long term.

Improved livelihood of the neighbouring communities due to employment

Considering the scale of the exploration works, the activities are expected to result in substantial number of short-term jobs. Taking note of this, local hiring would have positive, moderate and temporary impacts on local communities. This impact will be experienced during the operational/exploration phase of the project and few job opportunities are expected during the rehabilitation and demobilisation phase of the Project. The impact has been summarised as **positive, significant** and **temporary**.

Influx of people at the study area

Some in-migration by opportunity seekers may occur into the local communities. Due to the scale of the proposed development and the small population size of some of the affected villages, this is expected to have a slight impact. The impact will increase in significance during further project stages when the project moves towards full scale mining (which will be assessed in the relevant studies at that stage. The impact of the exploration is predicted to be **negative, moderate** and **short term.**

Disturbance to agricultural activities

The exploration activities may cause a temporary disturbance of community farming activities. However, there is no drilling directly near the community residences and the disturbance will be related to noise, dust, traffic and disturbance of cattle. The extra activities and movement of vehicles will also affect the condition of the access tracks used by the communities.

Noise is expected to be produced by the engines from the exploration equipment in general. The noise includes two main components. As the community residences are located some distance from the exploration sites, and drilling is only undertaken during daytime, the impact is classified as **negative, slight** and **temporary.**

20.2.2 Stakeholder Consultation

This section contains the summary of the consultations undertaken with relevant institutions who may possibly be affected and interested affected parties (IAPs) in relation to the activities of the proposed Project. The objective of the consultations was to seek the views and concerns of the consulted parties, regarding the activities associated with the proposed Project.

Stakeholder consultation methodology and plan

The Stakeholder Consultation Plan (SCP) discussed herein was designed to guide consultations with the Project stakeholders in accordance with the EA Act No.10 of 2011.

Objectives of the Project consultations

The aims of stakeholder consultations are to:

- Promote the development of courteous and open relationships between the Project stakeholders (IAPs) and the Client

- Provide stakeholders with an opportunity (through consultation and other feedback mechanisms) to express their opinions and concerns in relation to the Project, and for these to be reflected in the EMP report as well as decisions made about the Project activities, where possible

- Provide stakeholders with timely information about the Project activities and the EMP process

Stakeholder mapping analysis

For project consultations to be effective, it is important to determine who the Project stakeholders are. A key element in this process includes identification of individuals and groups who may be affected by the Project, due to their status (IFC, 2012).

For the purpose of this Project, a stakeholder is defined as any individual or group of people affected by a project or who may have an interest in, or influence over it. During the stakeholder mapping exercise, it was also important to understand how each stakeholder may be affected, or views the project, in order to design a consultation process that will appropriately inform them, as well as enable the consulting team to understand their views and concerns.

Summary of key informant consultation

A number of consultations were undertaken with all the project stakeholders. Governmental (Botswana) departments (at local, district and national level) and Non-Governmental structures (VDCs) were interviewed to gather more insight into the issues and concerns in relation to the project. The key issues raised by the key informants in relation to the proposed development were as follows:

Water related impacts:

- Pollution of underground water probabilities due to exploration activities and hydrocarbon leakage from vehicle and equipment

- Ensure the integrity of the WUC reservoir is not affected

- To avoid groundwater contamination, therefore exploration workers must not use pit latrines which can contaminate groundwater

Land related issues:

- Socioeconomic activities practiced within the PL areas should be mapped and affected parties should be consulted where required, any directly affected activities or damage to property due to the prospecting activities must be compensated by the Client

- The proposed project may adversely affect land used for agricultural activities

Socioeconomic issues:

- Influx of people to the study area in search of employment and entrepreneurship opportunities

- Employment opportunities must be localised to avoid influx of people

- Implementation of Social responsibility initiatives by the Client

- HIV and AIDS awareness must be conducted for the project employees. The District AIDS Coordinator is concerned, the drillers who move around will increase HIV and AIDS prevalence at the study area

- Access to health needs to be addressed, as the drilling location is remote. Drilling contractor could work with local health officials to provide services, which can then also benefit the local communities

- Appropriate waste management measures should be put in place at the exploration site

- Possibilities of noise from Project activities disturbing fauna of the study area

- Existing exploration legislation in Botswana and international framework should be enforced to guide the exploration activities

- The Client will be required to rehabilitate the site after completion of the exploration activities

- Appropriate safety equipment must be provided for the Project staff

- Possibilities of noise from project activities disturbing fauna of the study area

- An AIA clearance must be obtained from DNMM prior to the Project implementation (already completed)

- The major issue that came from most respondents were related to employment and that locals should be prioritised

The Client intends to continue this approach of working closely with the Botswana DEA.

20.2.3 Environmental and Social Impact Assessment

In early January 2020, the Client appointed Loci to undertake a full environmental and social impact assessment (ESIA) for the KHill Project. .

The first step was to undertake a scoping exercise; the findings were included in a Scoping and Terms of Reference report was submitted to the DEA (Loci, August 2020). In a letter dated 03 December 2020, the DEA authorised Giyani to proceed with the detailed EIA in accordance with Section 8 (4) of the EA Act No. 10 (2020); the authorisation is valid for two years. The structure and content should be accordance with Form E Regulation 8 of the EA Regulations of 2012.

The ESIA is documented in an Environmental Impact Statement (ESIS) which has minimum contents as follows:

- Name of applicant and consulting team

- Executive summary (non-technical summary)

- Introduction

- Policy, legal and administrative framework

- Project description

- Baseline environment

- Public consultation

- Identification and assessment of environmental impacts

- Consideration of transboundary impacts

- Analysis of alternatives

- Mitigation measures

- Archaeological impact assessment

- Environmental management plan (EMP)

- Conclusions and recommendations

- References

- Appendices

The KHill ESIA contains systematic analysis of information about the environmental effects, presented in a clear and knowledgeable way. Findings will be based on site survey and comprehensive information such as drawings and technical details of the proposed Project. The analysis will:

(1) Examine the existing environmental (baseline) character of the area likely to be affected by the development, through in-depth baseline studies, including inter alia review of maps and aerial photography; databases; environmental reports; and historic documents

(2) Identify relevant natural and manmade processes which may already be changing the character of the site

(3) Consider the possible interactions between the proposed development and both existing and future site conditions

(4) Predict the possible effects, both beneficial and adverse, of the proposed development on the environment

(5) Introduce design and operational modifications or other measures to avoid, minimise or mitigate adverse effects and enhance positive effects (to ensure compliance with Botswana legislation, IFC guidelines and Equator Principles)

Each environmental specialist study will be written up following the same general format:

- An Introduction describing the purpose of each section/parameter of the report

- A description of the methodology used (I.e., desktop studies, scoping, field studies, analysis, impact assessment and reporting)

- An assessment of the Impact of the proposed development on the environmental topic

- Recommendations for mitigation measures to reduce or eliminate any significant negative impacts and enhance positive impacts (as required by Botswana legislation, IFC Performance Standards and guidelines and Equator Principles)

- An assessment of the residual impacts that will remain, assuming that the recommended mitigation measures are fully and successfully implemented

The specialist studies that have been identified to be part of the completed ESIA are:

- Biodiversity assessment

- Landscape and visual assessment

- Archaeological Impact assessment

- Hydrogeology and geochemical assessment

- Hydrology study

- Air quality assessment

- Noise assessment

- Waste and waste management assessment

- Health Impact Assessment

- Traffic Assessment

- Closure plan and cost estimate

- Socio economic impact assessment

SRK notes that the Project is located in an area where there are some receptors and a careful approach will be required to managing E and S issues. However, SRK considers that with the appropriate management measures during the planning stages there is no reason why a 'Social Licence to Operate' cannot be obtained.

20.3   Closure

For the PEA, SRK has assumed some closure costs of USD5 M for the Project and notes that the impacts on the environment should be able to be mitigated through a range of measures including water treatment and progressive closure during operations (i.e., co-rehabilitation).

21   CAPITAL AND OPERATING COSTS

21.1   Mine Capital Costs

Almost the entire capital expenditure needs to take place in the first year. One articulated dump truck purchase can be postponed until Year 4. The capital schedule in USD is shown in Table 21-1 below.

Table 21-1:   Mine Capital Schedule

Equipment	QTY	Year 1	Year 2	Year 3	Year 4
Excavator 2,1BCM - Kobelco SK380LC	1	260,880			
Backhoe TLB - BELL 315SL	1	90,887			
Articulated Dump Truck - Bell B30E	4	1,113,592			371,197
Track Dozer - Bell 850J	2	715,768			
FEL 2,3 BCM - Bell L1506E	1	181,977			
Epiroc ROC D65 Drill	1	780,000			
Water Bowser - 18kl	1	284,890			
Light Vehicles	4	200,000			
Motor Grader - Bell 770G	1	319,383			
Lighting plants, radios, misc	1	80,000			
Total USD		**4,027,376**	**-**	**-**	**371,197**

21.2   Mining Operating Costs

Mining operating costs have been estimated using various operations around the world with similar operating procedures and similar annual production size. The sources for these were the S&P global database for mining operations, as well as actual costs from other operations known to SRK. A total of 6 operations were used to calculate an average mining cost to be expected, utilising a weighting system that gave more weight to costs of operations in Africa.

The mining costs were escalated by bench height to simulate longer haulage distances using USD0.01 /m. This higher incremental cost is considered appropriate considering the small scale of the mining operation. The total mining operating cost is a small part of the total cash cost.

21.3   Process Plant Capital Estimate

21.3.1 Basis of Estimate

The direct capital costs were estimated from the primary equipment list for the conceptual process flow sheet, using the 2013 edition of Infomine USA's Mine and Mill Equipment Cost Guide. The American consumer price index (US CPI) was used to escalate the cost from 2013 to 2021. It is important to note that, these costs were then adjusted to suit the heavy chemical duty nature of the plant using appropriate factors and by reference to Tetra Tech's internal cost database. This is appropriate for PEA purposes, where the cost estimate is typically within the range of AACE Class 5 (+/-35%). The base currency of the cost estimate is United States Dollars (USD).

Where relevant data was not available from the guide, other estimates such as budget prices provided by equipment suppliers were used.

Once the basic equipment cost was calculated, standard estimating factors were applied to estimate direct construction capital costs and indirect costs, the appropriateness of the factors were assessed and adjusted as required by comparison with projects in similar locations and similar operating environments (southern Africa).

The battery limits of the capital cost estimate are from the crusher feed bin to a flange end connection at the tailings pump station.

The factors used for the cost estimate and the typical Lang factors used in the industry are shown in Table 21-2.

Table 21-2:   Factors Applied to Estimate the Indirect Costs and the Typical Lang Factors

Allowances	Factor Used for Estimation (%)	Typical Factors		
		Mineral Processing (%)	Hydrometallurgical Processing (%)	Chemical Processing (%)
Civils	33	17	27	38
Structural Steel	20	26	24	21
Piping & Valves	34	14	35	59
Electrical & Instrumentation	40	36	45	62
Erection of Items	15	11	17	11
Commissioning	14	10	15	19
Transport	35	40	40	40
Vendor Services	3	3	3	3
First Fills	3	3	3	3
Total	**197**	**160**	**209**	**256**

21.3.2 Capital Cost Estimate Results

The estimated initial capital cost for the process plant was USD118 million. Table 21-3 shows the initial process plant capital cost breakdown.

Table 21-3:   Process Plant Capital Cost Estimate

Description	Cost Estimate (USD)
Comminution	3,937,775
Leaching	2,840,602
Iron & Aluminium Purification	4,095,004
Base Metal Purification	2,087,046
Solvent Extraction	13,968,661
Crystallisation	2,716,000
Miscellaneous	1,754,950
Primary Equipment Cost	31,400,038
Allowances	
Civils	10,299,528
Structural Steel	6,388,573
Piping & Valves	11,119,983
Electrical & Instrumentation	13,902,923
	Table continues…
Description	**Cost Estimate (USD)**
Commissioning	1,186,901
Transport	2,512,003
Erection of Items	4,306,926
Vendor Services	942,001
First Fills	942,001
Subtotal - Allowances	51,600,839
Site preparation & Construction Management	12,450,132
Nominal capital cost estimate	95,451,009
Contingency	22,620,400
Total Initial Capital Cost USD	**118,071,409**

The breakdown of the capital cost estimate is shown in Figure 21-1.
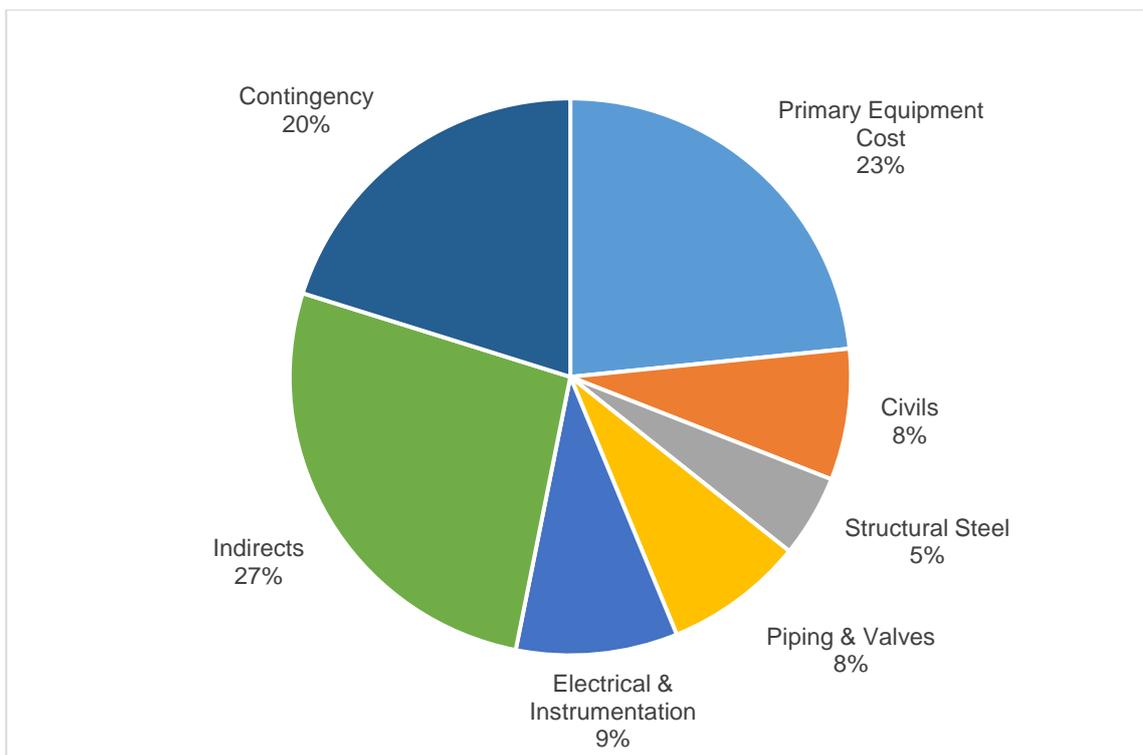
Figure 21-1: **Breakdown of Capital Cost Estimate**

Indirect costs include, commissioning, transport, erection, vendor services & first fills.

21.4   Processing Plant Operation Cost Estimate

The process operating cost estimate includes:

- Labour (operations and maintenance)

- Reagents and consumables (plant)

- Maintenance and spares

- Power

Labour was estimated by creating a labour schedule Table 21-4 with appropriate allowances for plant operations and maintenance labour. The estimated annual labour cost was USD942,000.

Reagent consumptions were estimated from first principles based on process chemistry, and assuming 120% stochiometric consumption, as well as other conventional industry standard assumptions. Maintenance spares were calculated assuming 10% of the process plant capital cost. Power costs were calculated based on an estimate of absorbed power requirements and an assumed power cost of USD0.06 per kilowatt hour (/kWh), which assumes main grid power.

The total plant operating cost for the proposed flowsheet is estimated at USD213 per tonne of material processed.

Table 21-4:   Labour Schedule

Role	Type of Shift	No. on Shift	No. Employed
General / Plant Manager	Manager	1	1
Plant Superintendent	Day shift	1	1
Metallurgists	Day shift	4	4
Metallurgical Clerk	Day shift	2	2
Laboratory Clerk	Day shift	1	1
Assayer	Day shift	1	1
Laboratory Technicians	Day shift	2	2
Laboratory General Hand	Day shift	2	2
Services Foreman	Day shift	1	1
Services Operator	Day shift	3	4
Services General Hand	Day shift	3	3
Shift Boss Extraction	Shift	1	4
Plant Foreman	Day shift	1	1
Shift Boss Comminution	Shift	1	2
Shift Boss Leach	Shift	1	4
Shift Boss Extraction	Shift	1	4
Operators	Shift	3	12
Operator General Hand	Shift	3	12
Resident Engineer	Day shift	1	1
Maintenance Foreman	Day shift	1	1
Maintenance Clerk	Day shift	1	1
Electrician	Day shift	2	2
Control and Instrumentation Technician	Day shift	2	2
Fitter	Day shift	2	2
Boiler maker	Day shift	1	1
Assistant	Day shift	5	5
General Hand	Day shift	5	5
Subtotal		**52**	**81**

The summary of process plant operating cost is presented in Table 21-5.

Table 21-5:   Process Plant Operating Cost

Description	Cost (USD/t)
Consumables & Reagents	76.21
Power	61.40
Labour	5.17
Maintenance & Spares	66.65
Miscellaneous	3.76
Total Process Operating Cost	**213.2**

The breakdown of the primary components of the operating cost is shown in Figure 21-2.
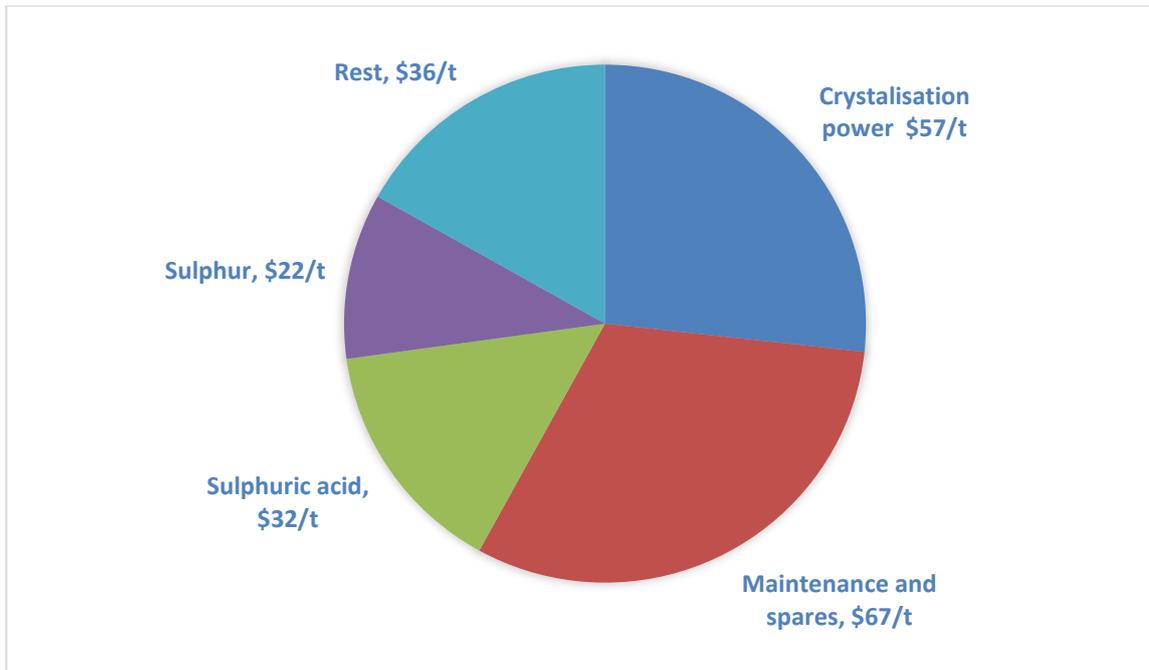
Figure 21-2:   Process Operating Cost Breakdown

Note: Maintenance and spares cost reflects heavy chemical plant duty.

21.5 Infrastructure Capital Costs

An indicative cost estimate has been completed using benchmark, historical or in-house database rates and costs for the infrastructure required to support the mining and processing operations. The cost estimates are based on the PEA level definitions and resulting costs are to an accuracy of +50/-30%. The cost estimates are considered to include direct element only. Indirect costs and contingency have been added at project level.

The power supply capital cost is provided for by the Botswana Power Corporation. The capital is estimated at USD7.1 M. This capital will need to be repaid over the life of mine. SRK has calculated that the kWh price, normally BWP0.634 per unit as mentioned above, will rise to BWP 0.669.

Table 21-6:   Estimated capital cost total –infrastructure (*1)

Area	Total (USDm)
Project Infrastructure Facilities	1.9
Accommodation (not required)	-
Utilities	0.7
Bulk Earthworks	0.5
Site Roads	1.2
On-Site Primary Distribution (main subst to facilities) and 1.5 MW Emergency Power (*2)	2.0
Total	6.3

(*1) Excluded from the capital estimate in this section is: water supply infrastructure, plant support infrastructure, processing plant including civils and earthworks, contingency and Owner's costs.

(*2) The Company has confirmed that the capital costs for bulk power supply connection works will be met by the BPC and subsequently recouped within the supply tariff in the early years of operation. These connection costs are estimated to include the connection works at the assumed existing substation, a 32 kV double circuit overhead line for 15 km, and the main Project Substation 132 kV step down to the site and plant distribution voltage. These costs are expected to be in the order of USD 7.1 M.

21.6   Infrastructure Operating Costs

Operating costs for maintenance of building and civil construction are covered under the G&A costs for the Project. Maintenance of bulk power and water supply infrastructure are assumed to be incorporated into the supply cost.

21.7   Tailings Capital Cost Estimate

The following in Table 21-7 are the main capital costs for the Tailings Storage Facility (TSF) which at this stage amount to USD2.738 M.

Table 21-7:   Capital Cost Estimate for TSF

Item	Unit Cost (USD)	Quantities	Subtotal (USD)	Remarks
Site Clearing and grubbing	$1/m^2	30,000	300,000	
Excavation of topsoil TSF	$3/m^3	150,000	450,000	Storage of topsoil
Dam construction (starter dam)	$3/m^3	131,0000	393,000	Mine waste could be used – to be confirmed
Dam construction (final dam)	$3/m^3	265,000	795,000	
Tailings slurry line including utilities corridor	$100/m	1000	100,000	
Floating barge	$200k	1 barge	200,000	
Water return line	$100/m	1000	100,000	
Power line	$100k/km	1 km	100,000	
Clean water ditches	$100/m	3,000	300,000	
Total			**2,738,000**	

21.8   Tailings Operating Cost Estimate

The operating costs for the TSF will include everyday operation of such as discharge point changes, line changes, power for water barge, maintenance, and other costs. It is assumed that these costs will be at USD0.5 /t of tailings, totalling USD0.6 M.

21.9   Overall Operating Costs

Table 21-8 summarises the expected operating costs based on the PEA level work completed for this study.

Table 21-8:   Summary of Unit Operating Costs

Operating Costs	LoM (USD/t milled)
Mining	16.73
Rehandle	0.04
Processing	213.19
G&A	20.00
MSM Transport Cost	31.56
Royalty	25.06
Total Operating Costs	**306.6**

21.10 Overall Capital Costs

Total capital costs are estimated to amount to USD153.0 M over the Life of Project. Mining capital costs are estimated at USD4.4 M. Processing capital costs amount to USD95.5 M. Infrastructure capital amounts to USD6.3 M. Sustaining capital and closure cost provisions amount to USD10.1 M and USD5 M respectively. Contingency has been included at 24% and amounts to USD28.3 M. Table 21-9 summarises the indicative capital costs over the Project life.

Table 21-9:   Summary of Life of Mine Capital Costs

Capital Costs	LoM (USDM)
Mining	4.4
Processing	95.5
Tailings	3.4
Infrastructure	6.3
Sustaining Capital	10.1
Contingency - Capital	28.3
Closure Costs	5.0
Total Capital	**153.0**

22   ECONOMIC ANALYSIS

22.1   Introduction

This section represents a financial evaluation of an inferred resource, which are too speculative geologically to be categorised as mineral reserves. The reader is warned that mineral resources that are not mineral reserves do not have demonstrated economic viability.   The following general assumptions have been applied to the Technical Economic Model (TEM) for the Project:

- is expressed in real terms

- is presented at 2021 money terms for Net Present Value (NPV) calculation purposes

- applies a Base Case discount rate of 10%

- is based on long term manganese price of USD1,588 /t of HPMSM product provided by the Client. This has been taken from Benchmark Mineral intelligence's August 2020 pricing forecast

- is expressed in post-tax and pre-financing terms and assumes 100% equity

- note the Client's tax advisers have indicated that they consider it likely that, instead of using the mining corporate tax formula, the flat Botswanan corporate tax rate of 22% can be applied due to the fact that the Company will be refining the extracted manganese ore into HPMSM through a manufacturing process, accordingly a base corporate tax rate of 22 % has been used

- Government royalties have been applied at 3% of revenue; and

- for tax purposes capital investments are depreciated immediately and unredeemed capital is carried forward indefinitely as allowed for mining projects in Botswana

- the production ramp up in the SRK model assumes that the ongoing 2021 Feasibility Study for K-Hill will be completed by 1st October 2021. At this point Giyani will complete the detailed engineering for the long lead time items so that contracts for their construction can be awarded in December 2021 or January 2022. Construction of these modules can then take place in Q1 and Q2 2022 while on-site permitting is finalised. The modules can then be shipped to site in Q3 and assembled in Q4 2022 ready for production in Q1 2023. In Q3 2022 while the modules are being shipped, the on-site enabling and preparation works will be undertaken for the utilities and project infrastructure

22.2   Economic Potential of the RoM material

The manganese market has changed in recent years, with the advent of more advanced battery technology. In previous eras, manganese was virtually only used to increase the melting point of steel and also as an alloying element for hardening steel. For that purpose, only high-grade manganese deposits (over 45% MnO) were considered economical. The RoM material at K-Hill is of low quality for the purpose of steel making, with an average grade of around 30%. However, it is considered viable for production of Electrolytic Manganese Metal (EMM) based on the work carried out for this study. EMM historically grades at 99.7% purity and is used as a starting material for the production of $MnSO_4$ (manganese sulphate) production for battery cathodes. However, it should be noted that based on additional research completed since the 2020 PEA for K-'hill, High Purity Electrolytic Manganese Metal (HPEMM) is no longer the target product for the Project.

Giyani in now targeting the production of High Purity Manganese Sulphate Monohydrate (HPMSM) at the mine site which can be sold directly to battery manufacturers. This makes sense because to produce HPMSM from HPEMM takes additional steps which incur additional costs.

The increased demand for Li-Ion batteries has seen a sharp increase for battery metals such as cobalt and lithium. Whilst manganese is lagging behind somewhat, it is starting to become more important. Roskill, a UK-based research company, has predicted that manganese demand will grow at a compounded annual rate of 23% from 2019 till 2029. This is largely underpinned by demand for Nickel-Manganese-Cobalt (NMC) cathodes. As stated the intention for the K-Hill plant is to produce an HPMSM product. The pricing assumed for HPMSM is USD1,588 /t in this PEA based on the research carried out by Benchmark Mineral Intelligence and reported in their August 2020 report for Giyani Metals. This price is a 'Real terms' prices and a transport cost of USD60 /t of product has been included in the TEM to account for transport to China where the price is fixed.

22.3 Results

22.3.1 Cash Flow

The net cash flow is presented Figure 22-1 and Table 22-2 with key life of project parameters presented in Table 22-1.
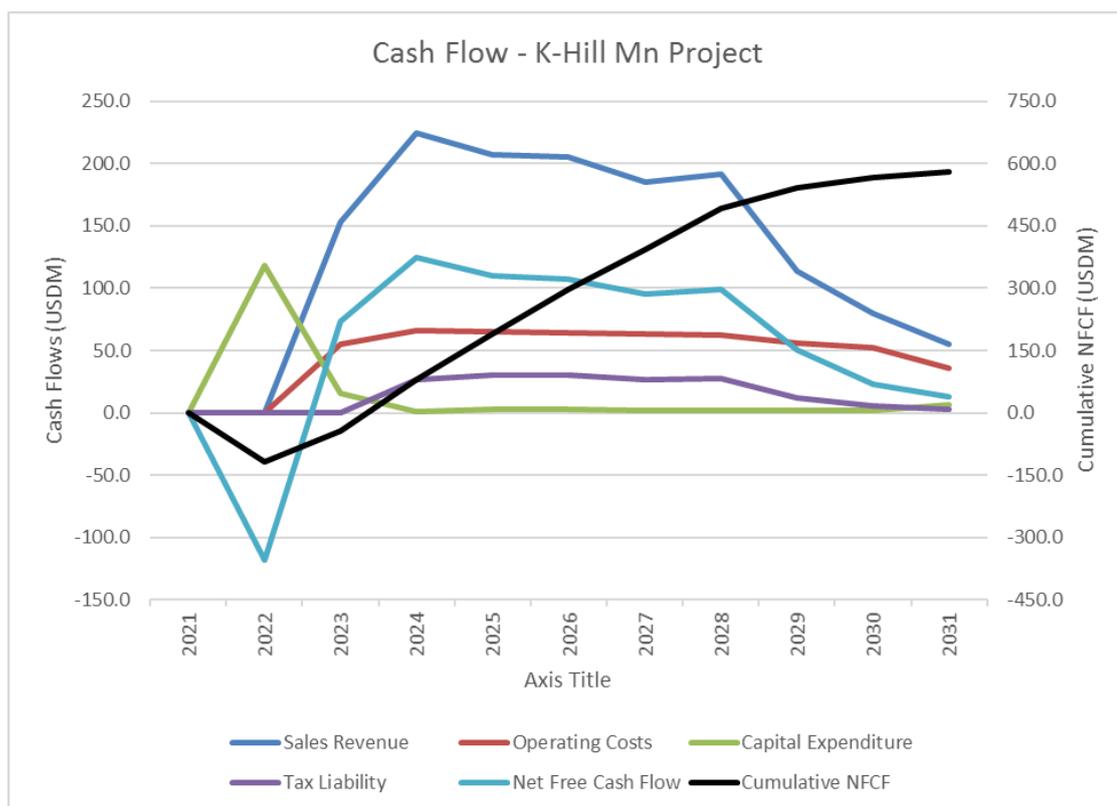
Figure 22-1:   **Net Cash Flow**

Table 22-1:   **Summary of Key Life of Project Parameters**

Summary of Key Parameters		
Revenue	(USDM)	1,414
Operating Costs	(USDM)	519
Operating Profit	**(USDM)**	**895**

Tax Liability	(USDM)	163
Capital Expenditure	(USDM)	153
Cash Flow	**(USDM)**	**579**
RoM Mined	(kt)	1,693
Waste Mined	(kt)	6,492
RoM Processed	(kt)	1,693
MnO Content	(kt)	412
MnO Recovered	(kt)	374
HPMSM Tonnes Produced	(kt)	890
Revenue	(USD/t HPMSM)	1,588
Operating Costs	(USD/t HPMSM)	583
Operating Profit	**(USD/t HPMSM)**	**1,005**

Table 22-2:   PEA Cash Flow Summary

Year			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
2021 Update	Units	Total/Ave											
Production													
O/P													
Waste Mined	(kt)	6,492	0	0	1,120	1,070	1,106	1,112	1,119	702	264	0	0
RoM Mined	(kt)	1,693	0	0	205	273	255	282	282	305	90	0	0
Total Material Moved	(kt)	8,185	0	0	1,325	1,343	1,361	1,394	1,401	1,007	354	0	0
Stripping Ratio	(tw:to)	3.84	0.00	0.00	5.46	3.93	4.33	3.94	3.96	2.30	2.95	0.00	0.00
Rehandled	(kt)	474	0	0	0	0	0	0	0	0	137	200	137
RoM MnO Grade	(%)	24.34%	0.00%	0.00%	23.92%	27.15%	26.20%	24.73%	22.56%	22.34%	22.73%	0.00%	0.00%
MnO Content in RoM Mined	(kt)	412.0	0.0	0.0	49.1	74.0	66.9	69.8	63.7	68.2	20.4	0.0	0.0
Processing													
RoM Processed	(kt)	1,693	0	0	171	198	199	196	196	196	200	200	137
MnO Grade Processed	(%)	24.34%	0.00%	0.00%	26.09%	33.01%	30.22%	30.41%	27.59%	28.47%	16.56%	11.69%	11.69%
MnO Content	(kt)	412.0	0.0	0.0	44.5	65.4	60.3	59.7	53.9	55.7	33.1	23.4	16.0
MnO Process Recovery	(%)	90.7%	0.0%	0.0%	90.7%	90.7%	90.7%	90.7%	90.7%	90.7%	90.7%	90.7%	90.7%
MnO Recovered	(kt)	373.7	0.0	0.0	40.4	59.3	54.7	54.2	48.9	50.5	30.0	21.2	14.5
HPMSM Tonnes Produced	(kt)	890.4	0.0	0.0	96.1	141.3	130.3	129.1	116.6	120.4	71.6	50.5	34.6
Macro Economics													
HPMSM Product Price	(USD/t)	1,588	0	0	1,588	1,588	1,588	1,588	1,588	1,588	1,588	1,588	1,588
Revenue													
HPMSM Revenue	(USDM)	1,414.0	0.0	0.0	152.7	224.3	206.9	204.9	185.1	191.3	113.7	80.2	54.9
Total Revenue	**(USDM)**	**1,414.0**	**0.0**	**0.0**	**152.7**	**224.3**	**206.9**	**204.9**	**185.1**	**191.3**	**113.7**	**80.2**	**54.9**
OPERATING COSTS, Real													
Mining	(USDM)	28.3	0.00	0.00	4.58	4.65	4.71	4.82	4.85	3.48	1.22	0.00	0.00
Rehandle	(USDM)	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.02
Processing	(USDM)	360.8	0.00	0.00	36.35	42.22	42.53	41.86	41.69	41.74	42.64	42.64	29.18
G&A	(USDM)	33.9	0.00	0.00	3.41	3.96	3.99	3.93	3.91	3.92	4.00	4.00	2.74
HPMSM Transport Cost	(USDM)	53.4	0.00	0.00	5.77	8.48	7.82	7.74	6.99	7.23	4.29	3.03	2.07
Royalty	(USDM)	42.4	0.00	0.00	4.58	6.73	6.21	6.15	5.55	5.74	3.41	2.41	1.65
Total Operating Costs	**(USDM)**	**518.9**	**0.0**	**0.0**	**54.7**	**66.0**	**65.3**	**64.5**	**63.0**	**62.1**	**55.6**	**52.1**	**35.7**
CAPITAL COSTS, Real													
Mining	(USDM)	4.4	0.0	0.0	4.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Processing	(USDM)	95.5	0.0	95.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tailings	(USDM)	3.4	0.0	0.0	2.4	0.0	0.6	0.4	0.0	0.0	0.0	0.0	0.0
Infrastructure	(USDM)	6.3	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sustaining Capital	(USDM)	10.1	0.0	0.0	0.0	1.1	1.4	1.4	1.4	1.4	1.3	1.3	0.9
Subtotal Capital	(USDM)	119.6	0.0	95.5	12.7	1.1	2.0	2.1	1.4	1.4	1.3	1.3	0.9
Contingency - Capital	(USDM)	28.3	0.0	22.6	3.0	0.2	0.5	0.5	0.3	0.3	0.3	0.3	0.2
Contingency Rate	(%)	24%	0%	24%	24%	24%	24%	24%	24%	24%	24%	24%	24%
Closure Costs	(USDM)	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
Total Project Capital	**(USDM)**	**153.0**	**0.0**	**118.1**	**15.7**	**1.3**	**2.5**	**2.6**	**1.7**	**1.7**	**1.6**	**1.6**	**6.1**
Economics, Real													
Sales Revenue	(USDM)	1,414	0.0	0.0	152.7	224.3	206.9	204.9	185.1	191.3	113.7	80.2	54.9
Operating Costs	(USDM)	519	0.0	0.0	54.7	66.0	65.3	64.5	63.0	62.1	55.6	52.1	35.7
Operating Profit - EBITDA	(USDM)	895	0.0	0.0	98.0	158.3	141.7	140.4	122.1	129.2	58.1	28.1	19.2
Tax Liability	(USDM)	163	0.0	0.0	0.0	26.7	30.6	30.3	26.5	28.0	12.4	5.8	2.9
Capital Expenditure	(USDM)	153	0.0	118.1	15.7	1.3	2.5	2.6	1.7	1.7	1.6	1.6	6.1
Working Capital	(USDM)	0	0.0	0.0	8.9	5.3	-1.4	-0.1	-1.6	0.6	-6.2	-2.6	-2.8
Net Free Cash Flow	**(USDM)**	**579**	**0.0**	**-118.1**	**73.3**	**125.0**	**110.0**	**107.6**	**95.5**	**98.8**	**50.3**	**23.3**	**13.0**

22.3.2 Net Present Value

Net Present Values (NPV) of the cash flows are shown in Table 22-3 using discount rates from 0% to 15% in a post-tax context. SRK notes that at A 10% discount rate the post-tax NPV for the Project is USD 332 M. NPV's in a pre-tax context are shown in Table 22-4. The Project IRR is 80% with payback in year 3.

Table 22-3:   Summary of NPV's – Post Tax pre-finance

Base Case Summary of NPV's						
Discount Rate	0%	5%	8%	10%	12%	15%
NPV (USDM)	579	435	370	332	299	256

Table 22-4:   Summary of NPV's – Pre-Tax pre-finance

Base Case Summary of NPV's						
Discount Rate	0%	5%	8%	10%	12%	15%
NPV (USDM)	742	561	478	431	389	335

22.3.3 Sensitivity Analysis

Figure 22-2 shows an NPV sensitivity chart for the Project for changes in operating costs, capital expenditure and revenue (grade or commodity price) over a range of plus/minus 25%. The Project's NPV is most sensitive to revenue as illustrated by the blue line in Figure 22-2. Note the commodity price range at plus/minus 25% will be from USD1,191 to USD1,985/t HPMSM with a base price of USD1,588/t HPMSM. The Project has lower sensitivity to operating costs and is least sensitive to capital as indicated by the red line and green lines in Figure 22-2.
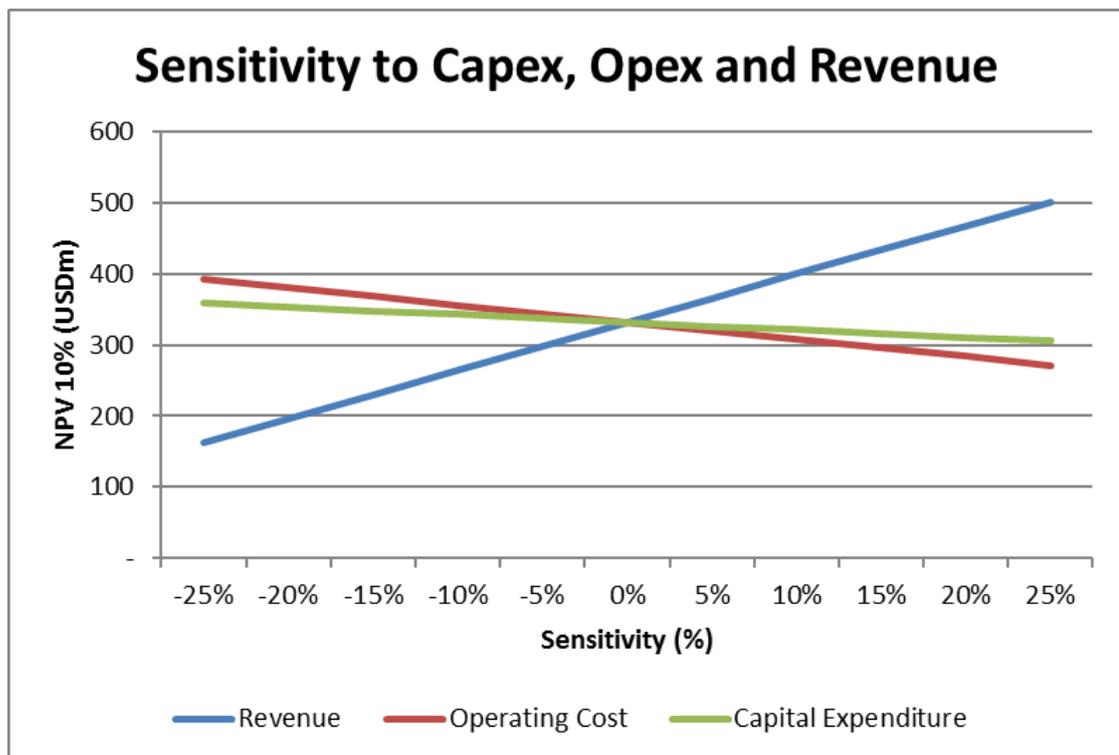
Figure 22-2:   NPV Sensitivity

23   ADJACENT PROPERTIES

Not applicable.

24 OTHER RELEVANT INFORMATION

24.1 Geotechnical Studies

24.1.1 Data Received

There are no holes with geotechnical logging at K-Hill at this stage.

24.1.2 Site Visit Observations

Onno ten Brinke, Principal Consultant (Mining Engineering) at SRK visited the site on 20th of March 2019. Observed wall stability for the long-exposed walls at K-Hill has been very good. The exposed shale wall that must have been mined around 1971, still stands without any visible problems. The hanging wall, although fractured, also stands up stable.

The pit designs generated in this study have shown that the steepest walls, mined into the hill, require a ramp for access and as such the overall slope angle for the highest walls is reduced.

Source: SRK 2019

Figure 24-1: Long-standing wall of Manganiferous shale (i.e. potential ore), ca. 12m high

Source: SRK 2019

Figure 24-2:   Typical fractures on hanging wall at K-Hill

24.1.3 Recommended Slope Configuration

Based on the on-site observations, the low annual rainfall, and the relative low height of the permanent walls that are expected, an inter-ramp angle of 45^0 can be assumed to be easily achievable, despite the lack of concrete data. In future pre-feasibility or feasibility studies, a steeper wall is likely to be possible using more accurate data to support this.

Considering the low mining rate and the accompanying small equipment, a bench height of 4 m is recommended, to be mined in two flitches, each 2 m in height. The onsite observations support a 70^0 batter angle. Using an overall inter-ramp slope angle of 45^0, and a bench height of 4 m, this results in a berm width of 3.2 m.

Table 24-1:   PEA Level Slope Configuration

Description	Value
Inter-ramp angle	45^0
Bench height	4 m (mined in 2m flitches)
Batter Angle	70^0
Berm width	3.18 m

24.2 Hydrology and Hydrogeology

24.2.1 Data received

There are no groundwater monitoring boreholes at K-Hill deposit at this stage and SRK is not aware of any hydrogeological investigation being carried out in the past. No hydrogeological information is available at this stage of the Project, other than water levels measured by Loci located over 1km from the deposit.

24.2.2 Hydrogeology and Groundwater

The hydrogeology of a mine can exert certain constraint on the project development, related to the following aspects:

- **Water inflow into the mine**: which can have impact on mine production. considering the geology of the site and limited catchment, it is likely that water inflows into the pit will be manageable. Field data should be collected from hydrogeological boreholes in the next stage of the Project to predict the potential inflows and specify dewatering system for the mine

- Pore pressure in the pit walls and impact on pit slope stability. considering the rock strength and arid climate, as reported in the geotechnical section of this report, it is likely that pore water pressure would have limited (or negligible) control on the pit stability. Such hypothesis should be confirmed in the next stage of the Project with field data and due analysis and modelling

- Impact on water resources: depending on the mineralogy and groundwater quality in the area, the development of the mine may lead to impact on water resources in the area, and downstream if contaminants are present and not controlled during mine operation and closure. Therefore, detailed studies of such aspect will likely be required to obtain relevant environmental and water use permits for the project development

- Water supply for the Project. The Project water balance depends on the availability of water within the site (inflows of groundwater and surface water within the Project site). If enough water is available within the site, limited or no water supply will be required. Considering the climate of the region however, water supply will likely be needed. The availability of groundwater in the mine area will need to be assessed in detail and based on field data in the next phase of the Project.

24.2.3 Surface Water

As shown in Figure 24-3 and Figure 24-4, K-Hill site is located along a hydrological catchment divide. The Project catchment surface water drains into streams that flow into the Taung river, at a close distance downstream of the Mogobane reservoir.
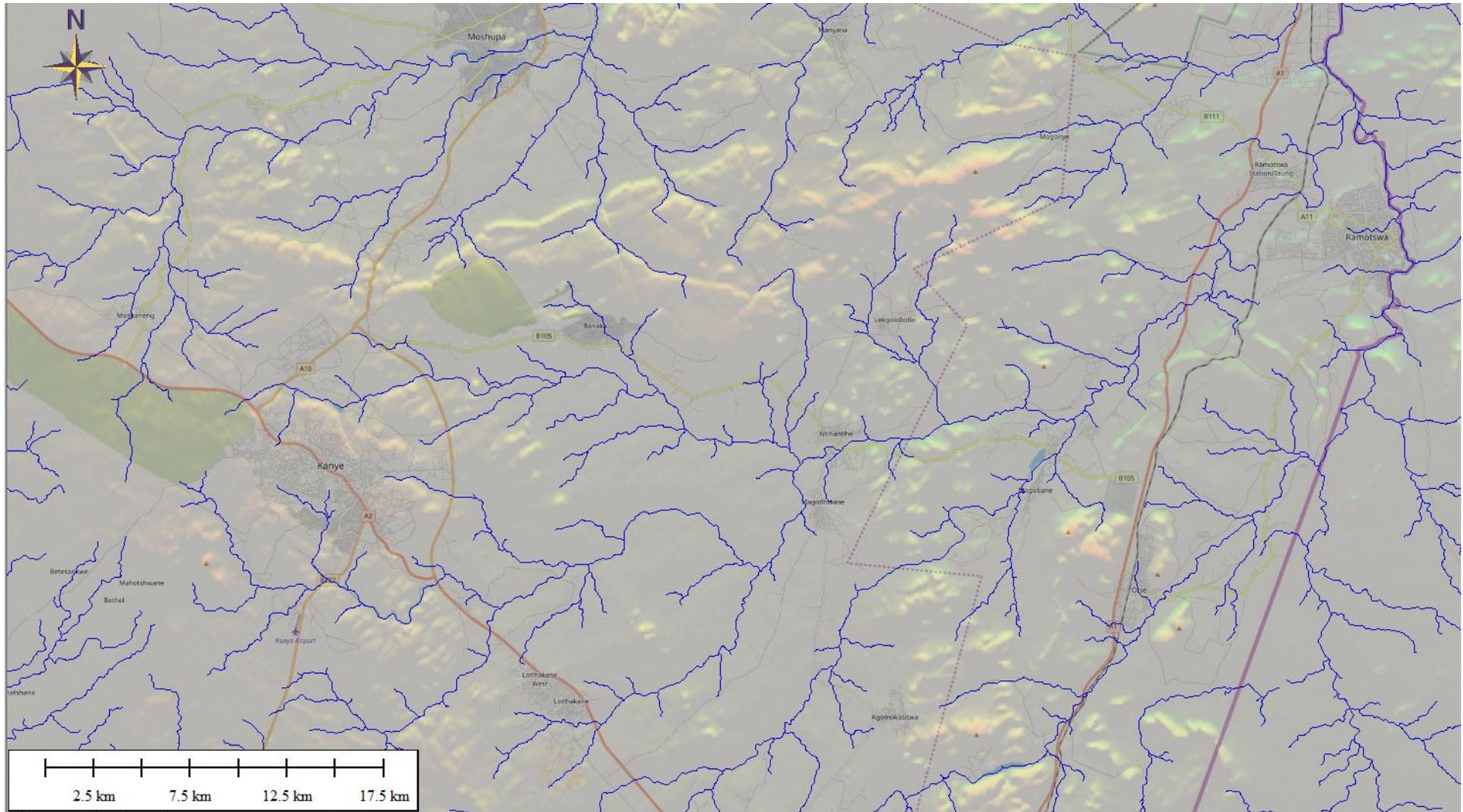
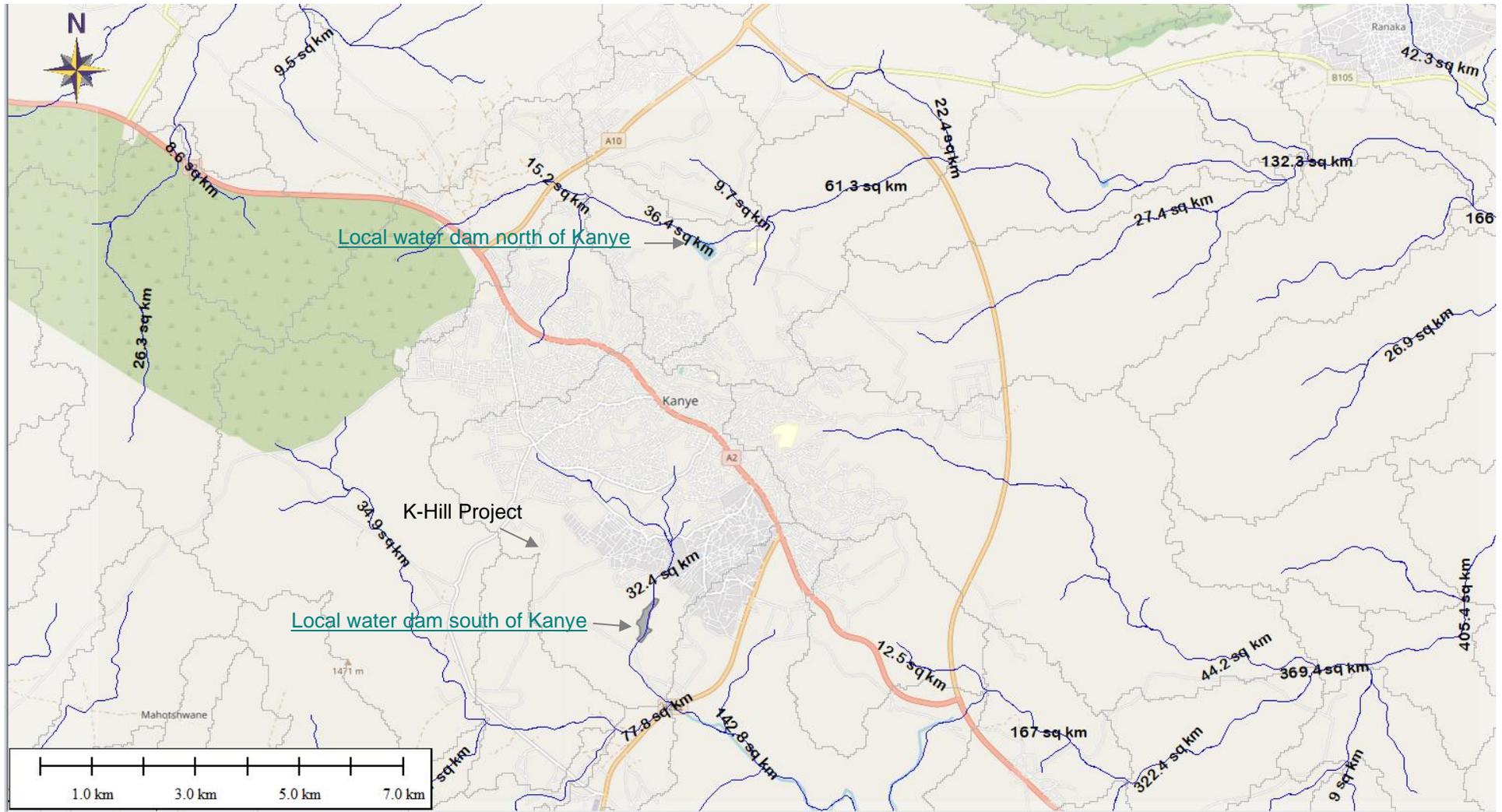**Figure 24-3:   Regional Hydrological Catchments and Streams**

Figure 24-4:   Local Streams and Hydrological Catchments

The Taung river flows northerly to join the Ngotwane river which feeds and flows through the Gaborone reservoir, just south of the Capital city (Gaborone) of Botswana. The Ngotwane river originates in South Africa and flows along the border between the two countries before reaching the Capital of Botswana. Downstream (north) of the latter it flows northerly within Botswana before joining the Limpopo river that flows along the border between the two countries for more than 50 km before reaching Zimbabwe. The Limpopo River continues its journey along the border between Zimbabwe and South Africa then through Mozambique toward the sea (Mozambique channel).

Therefore, water drainage from the propose K-Hill Project site is part of a complex trans-boundary surface water drainage system, which feeds several reservoirs and eco systems. Due to such hydrological setting, it is likely that detailed environmental and social impact assessment will be required in the next stage of the project development, especially if international funding is needed for the Project. The Project should therefore target zero water discharge policy by making maximum use and recycling of water within the Project area.

Source: SRK 2019

Figure 24-5:   View of the local surface water reservoir south of Kanye, 2.5 km from K-Hill

24.2.4 Project Water Supply

It is understood that a relatively limited amount of water is needed for processing at K-hill site. At the proposed production rate of 200 ktpa, this equates to about 56 m^3/hr total water demand for processing. It is expected that at least 50% of water will be recycled, therefore make up water will be around 25 m^3/hr for steady state operation.

The option of water supply from local reservoirs has been envisaged in project team discussions, however, it appears that water from the reservoir is limited, and this is confirmed from the limited hydrological catchments of the streams as illustrated in Figure 24-4, which show that the area of the catchment for both reservoirs ranges between 32 and 36 km^2.

Considering the relatively limited amount of water required for the Project, it is envisaged to use local pumping wells possibly augmented by the town water supply if required.

25   CONCLUSIONS

- The manganese mineralization at K-Hill occurs primarily in two supergene enriched manganiferous shales (the Upper and Lower Mn-Shale) occurring in the upper portion of a larger shale package within the Black Reef Quartzite Formation of the Transvaal Supergroup. The Mn-Shale is overlain by, and in places eroded away by a hard chert breccia unit

- In plan, the K-Hill deposit is approximately kidney shaped, forming a gently sloping hill. The Upper and Lower Mn-Shales, which hosts the mineralisation, varies between approximately 2 m and 12 m thick with an average thickness in the order of 4 m. The unit dips shallowly (5 to 10°) towards the NW, and has a delineated extent of approximately 900 m N-S and 350 m E-W

- The Upper Mn-Shale can be divided into a continuous high-grade portion with discontinuous lower-grade margins in the immediate hangingwall and footwall

- A total of 18 diamond drillholes were drilled by Giyani between April and June 2018. Of these holes, 15 are interpreted to have intersected the Mn-Shale unit. Three of these have holes have no core recovery at the anticipated depth of the Mn-Shale. This is interpreted to be a result of either poor drilling practice, or the holes intersecting voids relating to the historical underground mining. A further 11 diamond drillholes were completed as part of the latest drilling phase. These holes provided lithological logging data to guide the geological model, but due to submission of whole core for geotechnical assessment, were not available for assay. In addition, 96 RC holes (including 6 re-drills) have been drilled as part of the most recent drilling program. All of these holes have geological logging and laboratory analytical data available to help guide the location and thickness of the mineralisation and waste geology domains

- A survey of artisanal mining workings by Terravision in 2020 allowed the block model to be depleted.

- SRK considers that the quantity and quality of data collected in the K-Hill drilling programme is sufficient to support the reporting of a Mineral Resource estimate. That said, some concerns have been identified, most notably the limited quantity of reliable density data

- The current updated Mineral Resource estimate totals 1.6 Mt of Indicated Resources at 22.0% MnO and 1.4 Mt of Inferred Resources at 13.9% MnO. This represents an overall 75% increase in tonnage and 29% decrease in MnO grade, relative to the March 2021 SRK Mineral Resource estimate

- Changes to the geological model can be attributed to a significant increase in the quantity of assayed drillhole intervals, including the addition of the lower grade Lower Mn Shale horizon (B domain). The inclusion of this horizon has resulted in a significant increase in tonnes and reduction in average grade. A small decrease in tonnage in the high-grade core (A2 domain) has been offset to a certain extent by an increase in the tonnage of the low-grade footwall (A3 domain), resulting in a slight lowering of tonnage and average grade for the Upper Mn shale

- The planned open pit mining of the K-Hill deposit is a relatively straightforward operation, with no known or expected issues. Blasting has been assumed to be required and a drilling rig has been budgeted

- Mining conditions in terms of geotechnical and hydrogeological issues are simple and no major challenges are expected from the work completed to date. The open pit will be almost dry and it is relatively shallow

- The PEA level design for the TSF (not including the plant tailings costs) are assessed at USD2.738 M in capital costs, and USD0.6 /t for operating costs

- The Project is located in an area that is well served with roads, power and other infrastructure. No significant infrastructure issues have been identified in the PEA study that present significant risk or cost to the Project. Short gravel access roads will link the project to the biutment highway that is located < 1 km from the site. A number of water sources have been identified which will be studied in the FS. Electricity will be sourced from the National Grid with an option for solar power being considered in the FS

- Process testwork has been carried out for the PEA that demonstrates that a viable process flowsheet can be achieved produce the required product for sale to battery producers

- Technical work completed by SRK and others has planned for a self-sufficient mine site with its own accommodation, offices and supporting infrastructure

- Studies have been undertaken by the Client that demonstrate that there is a market for the anticipated HPMSM which is planned to be produced from K-Hill

- Environmental and social studies are well advanced for the Project and from the work carried out to date by Giyani and its sub-contractors, widespread support is apparent for the planned operation both among local people and government

- The Project reflects a positive NPV of USD332 M at a 10% discount rate. Further investment and technical studies are therefore warranted

- Average operating costs have been estimated at USD306 /t milled

- Total life of mine capital expenditure has been estimated at USD153 M

- The Project NPV is most sensitive to revenue (grade or commodity price) but has lower sensitivity to operating costs and is least sensitive to capital costs

25.1 Risks

Asides from the usual cyclical price risks associated with the mining industry, a number of significant risks have been identified for the Project:

- Market risk.

  o The Project is predicated upon marketing manganese from the K-Hill Project to the HPMSM market. Although results of the PEA test-work have been encouraging, the capital costs of a plant to produce this high-purity product have not been verified. More work is required to reduce uncertainty related to this cost estimate

- Mineral Resource Risk.

  o The currently defined Mineral Resource is limited to the K-Hill topographic high. It is a relatively small deposit and has limited upside potential

  o Core recovery is poor, particularly within the Mn Shale unit that is host to the MnO mineralisation. At this stage there is no clear relationship between core recovery and grade. It is possible that additional drilling may yield a more definitive relationship between MnO grade and recovery, either positive or negative

  o The extent of known historical underground mining excavations has been interpreted based on a survey of workings by Terravision completed in 2020. The survey used ground penetrating radar and direct laser distometer surveys within the voids. It is likely that additional artisanal mining voids with obscured, collapsed entrances exist, which have not been identified to date

- o Channel structures interpreted in the base of the overlying CDB unit that erode the Upper Mn-Shale horizon may be more persistent and interconnected than is currently modelled. The total volume of the Mn Shale model could be reduced in the order of up to 15%

- o The density database used to provide average densities for each domain in the block model are taken from a small database of wax coated core samples. Although of a high quality, the quantity of data presents a significant risk for the project. SRK notes the close correlation with the much larger density database of "wet" density readings (with the 10% reduction factor applied), where the samples were not dried prior to measurements being taken. The wet density values have not been used in this MRE due to uncertainties about the moisture content.

- Future Mining Risk

  - o A portion of the Mineral Resource underlies a municipal water reservoir that is under construction. Although the reservoir overlies a small portion of the Mineral Resource (<5%), the potential impact of this reservoir to the Project has not been fully ascertained in terms of the cost of relocating it. Initial discussions regarding the relocation of the reservoir have been positive, although no formal agreement has yet been mad

26 RECOMMENDATIONS

The following recommendations are provided to assist in progressing the delineation and understanding of the K-Hill Mineral Resources:

- Giyani should construct a detailed geological map of the in-situ outcrops of the Mn Shale unit at K-Hill, including observed footwall and hangingwall contacts and associated contact dip and strike data

- SRK suggests that Giyani undertake further diamond drilling to generate core for density analysis using wax coated core samples. Although SRK considers the current database of density samples generated suing this method to be of high quality, it contains a very limited number of samples and further density data needs to be collected

- Current exploration to define extensions to the known deposits is continued to fully define the potential of the area. The total expected cost inclusive of all ancillary work including access clearing, data collection and incorporation of data into the geological and block models, is expected to be approximately CAD3,250,000

- A demonstration plant to produce pilot-scale production of final product based on the final optimised metallurgical process flow sheet should be constructed to support the FS work. SRK estimates that the cost of engineering and construction is approximately CAD6,300,000

- As part of the FS, the following should be undertaken (which is in progress):

  o A geotechnical study is required to investigate the validity of the assumed pit wall slopes

  o A detailed water supply study should be carried out to determine the optimal water source for the Project

  o Further detailed test work to be completed to support the product specification, recoveries, operating costs, plant flowsheet and capital costs

  o Further metallurgical testing to firm up the process route and challenges with upscaling to industrial scale should be addressed with follow up metallurgical test work. The sample material should be collected from different parts of the orebody to ensure that the variability of the deposit can be accounted for

  o The design of the TSF assumes the downstream construction of the containment with the mine waste material and no lining of the TSF to prevent any fugitive seepage. The need for lining should be assessed

  o Develop an implementation schedule with associated timing and dates for all project related infrastructure and investment. The estimated capital expenditure should then be updated within the financial model to reflect the implementation schedule

  o As the Project progresses commence negotiation with the GoB to confirm the applicable tax regime for the Project

The total expected outstanding cost, inclusive of all ancillary work, for the above updated FS program is expected to be approximately CAD1,500,000 from an aggregate global budget for the program of around CAD4,900,000.

- Following completion of the FS, Giyani should commence preparations for commercial-scale production through the contracting of front end engineering and design (FEED) studies and procurement of long-lead mine and plant items. SRK estimates that FEED studies will cost approximately CAD2,500,000 and prepayments on critical long-lead equipment will be approximately CAD4,000,000

For and on behalf of SRK Consulting (Kz) Limited
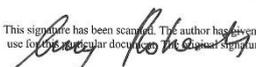
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Glossary

Adit	An entrance to an underground mine which is horizontal or nearly horizontal.
masl	Metres above mean sea level.
alkaline rocks	Rocks containing an excess of sodium and or potassium.
Archaean	The oldest rocks of the Precambrian era, older than about 2,500 million years.
basement	The igneous and metamorphic crust of the earth, underlying sedimentary deposits.
breccia	An intensely fractured rock.
braunite	a brown or black mineral that consists of manganese oxide and silicate and is a source of manganese.
carbonate	A rock, usually of sedimentary origin, composed primarily of calcium, magnesium or iron and CO_3. Essential component of limestones and marbles.
Certified Reference Material	Standards used to validate analytical measurement methods and calibration of instruments.
chip channel sampling	This method is used to take samples from an outcrop. The tools are used hammer and chisel.
conglomerate	A rock type composed predominantly of rounded pebbles, cobbles or boulders deposited by the action of water.
diamond drilling	Method of obtaining cylindrical core of rock by drilling with a hollow diamond set or diamond impregnated bit.
dolomite	A calcium magnesium carbonate with a chemical composition of $CaMg(CO_3)_2$.
facies	A rock or sediment unit that reflects its environment of deposition and allows it to be distinguished from rock or sediment deposited in an adjacent environment.
fault	A fracture or fracture zone, along which displacement of opposing sides has occurred.
felsic	Light coloured rocks containing an abundance of feldspars and quartz.
felsite	A fine grained volcanic extrusive rock, generally light in colour, composed mainly of feldspar and quartz.
ferruginous	Contains a substantial proportion of an iron compound.
fold	A planar sequence of rocks or a feature bent about an axis.
glauconite	An iron potassium phyllosilicate (mica group) mineral of characteristic green colour with very low weathering resistance and very friable.
granite	A light-coloured igneous rock composed mainly of quartz and feldspar with minor amounts of mica, amphiboles, and other minerals.
gravity survey	Recording the specific gravity of rock masses in order to determine their distribution.
ground magnetic surveys	Surveys carried out on the ground using a handheld device to measure the magnetic susceptibility of rocks at or near the earth's surface.
induced polarization surveys	A geophysical imaging technique used to identify the electrical chargeability of subsurface materials.
intrusive	An igneous rock formed from magma forced into older rocks at depths within the Earth's crust, which then slowly solidifies below the Earth's surface.
IP/DC	Induced polarization performed with a direct current resistivity.
Joint set	A regular planar set of fractures set in massive rocks along which no relative displacement has occurred.
kutnohorite	A rare calcium manganese carbonate mineral with magnesium and iron that is a member of the dolomite group.

limestone	A sedimentary rock containing at least 50% calcium carbonates.
littoral	Beach or shoreline environment.
Ma	Million years.
manganese	The chemical element of atomic number 25, a hard, grey metal of the transition series.
manganite	A metallic grey to black mineral MnO(OH) that is a hydroxide
meta-	Used to denote change, transformation, or metamorphism.
metallurgical test-work	Metallurgical response of mineralisation as indicated by laboratory tests on samples, often from drill core or bulk samples.
MnO	Manganese oxide
montmorillonite	A very soft phyllosilicate group of minerals that form when they precipitate from water solution.
Precambrian	Pertaining to all rocks formed before Cambrian time (older than 545 million years).
Proterozoic	An era of geological time spanning the period from 2,500 to 545 million years before present.
psilomelane	Barium-manganese hydroxides that do not form in visible crystals.
quartzite	A non-foliated metamorphic rock composed almost entirely of quartz. It forms when a quartz-rich sandstone is altered by the heat, pressure and chemical activity of metamorphism.
sandstone	A sedimentary rock composed of cemented or compacted detrital minerals, principally quartz grains.
satellite positioning system (global positioning system GPS)	An instrument used to locate or navigate, which relies on three or more satellites of known position to identify the operators location.
shale	A laminated, fine-grained, clastic sedimentary rock composed that is a mix of flakes of clay minerals and tiny fragments (silt-sized particles) of other minerals.
silicified	The introduction of, or replacement by, silica, generally resulting in the formation of fine-grained quartz, chalcedony, or opal, which may fill pores and replace existing minerals.
siltstone	A rock intermediate in character between a shale and a sandstone. Composed of silt sized grains.
tectonic	Pertaining to the forces involved in, or the resulting structures of, movement in the earth's crust.
unconformably	Consisting of a series of younger strata that do not succeed the underlying older rocks in age or in parallel position, as a result of a long period of erosion or non-deposition.
wad	A general term for any black manganese oxide or hydroxide mineral-rich rock in the oxidized zone.