LESEGO PLATINUM UITLOOP: PROPOSED ZEBEDIELA NICKEL MINE PROJECT, MOGALAKWENA LOCAL MUNICIPALITY AND THE WATERBERG DISTRICT MUNICIPALITY, WESTERN CAPE PROVINCE

Integrated Heritage Impact Assessment Report

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Innovation in Sustainability

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INTEGRATED HERITAGE IMPACT ASSESSMENT (HIA) ON VARIOUS PORTIONS OF THE FARM UITLOOP 3 KS FOR THE PROPOSED ZEBEDIELA NICKEL MINE PROJECT, MOGALAKWENA LOCAL MUNICIPALITY AND THE WATERBERG DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

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DOCUMENT DISTRIBUTION LIST

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DOCUMENT HISTORY

Date	Version	Status
15 October 2020	1.0	Draft
5 November 2020	2.0	Final Draft

DECLARATION

I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Zebediela Nickel Mine Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, including the relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980), the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment (SAHRA, AMAFA and the CRM section of ASAPA), regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

Signature of Specialist
Company: Exigo Sustainability
Date: 5 November 2020

EXECUTIVE SUMMARY

This report details the results of an Integrated Heritage Impact Assessment (HIA) study subject to an Environmental Basic Assessment (BA) process for the proposed Zebediela Nickel Mine Project on Various portions of the Farm Uitloop 3KS in the Mogalakwena Local Municipality and the Waterberg District Municipality of the Limpopo Province. The proposed project entails the establishment of a nickel mine within a mining right area of approximately 4660ha, which is situated approximately 9km north-east of the town of Mokopane. The report includes background information on the area's archaeology, its representation in Southern Africa, and the history of the larger area under investigation, survey methodology and results as well as heritage legislation and conservation policies. A copy of the report will be supplied to the South African Heritage Resources Agency (SAHRA) and recommendations contained in this document will be reviewed.

Project Title	Zebediela Nickel Mine Project
Project Location	S24.126483° E29.037211°
1:50 000 Map Sheet	2429AA
Farm Portion / Parcel	Various portions of the Farm Uitloop 3KS
Magisterial District / Municipal Area	Mogalakwena Local Municipality and the Waterberg District Municipality
Province	Limpopo Province

A number of archaeological and historical studies have been conducted in the Mokopane area which points to a rich and diverse archaeological landscape. The heritage legacy of this area is mostly dominated by Stone Age, Herder and Colonial Period occurrences. Numerous sites, documenting Earlier, Middle and Later Stone Age habitation occur across the province, mostly in rock overhangs, shelter sites or in sediments alongside rivers or pans. Moving into recent times, the archaeological record reflects the development of a rich colonial frontier, characterised by, amongst others complex social developments related to the expansion of farms and towns in the area.

In terms of palaeontology, fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. The development will partly sit on the dolomite and chert of the Chuniespoort Group, Transvaal Supergroup and if there is the presence of sedimentary rocks the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, here locally **HIGH** for the Chuniespoort Group. Stromatolites are likely to be present in the dolomites. These structures range from a centimetre to several tens of metres in size. They are the result of algal growth in shallow water, indicating a very rich growth that would have caused an enrichment in the amount of oxygen in the atmosphere. Stromatolites are significant indicators of palaeoenvironments and provide evidence of algal growth between 2640 and 2432 million years ago. The following general observations and recommendations are made based on the fossil potential of the project area.

- Since the development will partly sit on the dolomite and chert of the Chuniespoort Group, Transvaal Supergroup. Alternative Options are proposed. Areas with dolomite present on the surface should be avoided if possible. There are two formations in the development area that contains chert and dolomite namely, the Malmani Subgroup and the Duitschland Formation.
- The impact of the development on fossil heritage is **HIGH** and therefore a field survey or further mitigation or conservation measures may be necessary for this development (according to SAHRA

protocol) if fossils are found during excavating, digging or blasting.

- Concerns/threats (**1g,1ni,1nii,1o,1p**) to be added to the EMP'r include earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction, digging of foundations, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, and human disturbance.
- The overburden and inter-burden must always be surveyed for fossils during construction or mining. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden during construction not to intrude upon fossiliferous layers. This should be overseen by an Environmental Control Officer.
- Care must be taken during the dolomite risk assessment according to SANS 1936-1 (2012) as stromatolites may be present.
- Mitigation may be needed if a fossil is found, in this case, the area must be fenced off with a no-go barrier of 30 m.
- As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to monitor the construction activities in line with the legally binding Environmental Management Programme (EMPr) so that when a fossil is unearthed they can notify the relevant department and specialist to further investigate. Therefore, the EMPr must be updated to include the involvement of a palaeontologist (for training of ECO and in an advisory capacity). The ECO together with the mine geologist must survey for fossils after blasting, digging and excavation (ground breaking).
- The development may go ahead with caution, if a fossil is found, all construction must stop, and SAHRA must be notified. The Environmental Control Officer must familiarise him- or herself with the Malmani Subgroup fossils.

In terms of archaeology, it has been noted that the farm Uitloop was portioned in the 1980's, but no particular reference to archaeological sites or features of heritage potential in the project area subject to this assessment were recorded during an examination of literature thematically or geographically related to the project area. A careful analysis of historical aerial imagery and archive maps indicate that portions of the project area have been altered and transformed by crop farming and this inference was confirmed during an archaeological site assessment. Heritage resources were nonetheless noted on some of the project target properties. Cognizant thereof, the following recommendations are made based on general observations in the proposed Zebediela Nickel Mine Project in terms of heritage resources management.

- A small number of Middle Stone Age (MSA) artefacts were noted at three localities in the project area (**Site Exigo-ZNM-SA01, Site Exigo-ZNM-SA02, Site Exigo-ZNM-SA03).** The fairly small numbers and disturbed context in which they were found means that these archaeological remains have been rated as having low archaeological significance. However, it is likely that *in situ* Stone Age remains might occur in previously untransformed and undetected contexts in the larger landscape. As such, it is recommended that these areas be monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains.
- Two Historical Period quarries and the remains of two Historical Period settlement areas (**Site Exigo-ZNM-HP01 - Site Exigo-ZNM-HP04)** in the project area might be older than 60 years and generally protected under the National Heritage Resource Act (NHRA 1999). The features are generally poorly preserved and notable heritage or historical associations to the sites could not be established. As such, these sites are rated as of low significate but it is recommended that these areas be monitored by an informed ECO in order to avoid the destruction of previously undetected

heritage remains. The necessary destruction permits should be obtained from the relevant Heritage Resources Authorities prior to site alteration or destruction. Generally, the sites should be closely monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains or human burial sites.

- At least 5 burial sites or possible burial sites / graves were noted on a number of farm portions in the project area (**Site Exigo-ZNM-BP01 - Site Exigo-ZNM-BP05)**. These receptors are of high significance for their heritage, social and cultural value. It is primarily recommended that a 50m conservation buffer be implemented around all the burial sites. In addition, infrastructure components proposed for the project should be designed in such a way as to avoid encroaching on the required 50m conservation buffer. It is further recommended that the burial sites be fenced off with wire, chicken wire or palisade fencing of a minimum height of 1.8m placed no closer than 2m from the burials. Each burial should have an access gate and access control should be applied to the site. A heritage Site Management Plan (SMP) should be compiled for each of the burials to stipulate conservation measures, responsible persons and chance find procedures for further heritage mitigation. The developer should carefully liaise with the heritage specialist, SAHRA as well as local communities and possible affected parties with regards to the management and monitoring of any human grave or cemetery in order to detect and manage negative impact on the sites. **Should impact on any of the burial sites prove inevitable, full grave relocations are recommended for these burial grounds. This measure should be undertaken by a qualified archaeologist, and in accordance with relevant legislation, permitting, statutory permissions and subject to any local and regional provisions and laws and by-laws pertaining to human remains. A full social consultation process with the descendant family and other affected parties should occur in conjunction with the mitigation of cemeteries and burials (see Addendum B).**
- It should be noted that the site survey of certain Portions of Uitloop (particularly Portions 51, 52 and Portion 0) proved to be highly constrained by dense and often impenetrable vegetation. Dense vegetation not only restricted free movement on the site but obstructed much of the farm in terms of surface visibility. As such, the possibility exists that individual sites could be missed and it recommended that the initial stages of the development be monitored to re-assess the presence of possible heritage resources in the project area.
- As burials have been located on the project property, it is recommended that the EIA public participation and social consultative process address the possibility of further graves occurring in the project area.
- Considering the localised nature of heritage remains, the general monitoring of the development progress by an ECO or by the heritage specialist is recommended for all stages of the project. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the Study Area along water sources and drainage lines, fountains and pans, which would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of

construction and development, including the operational phases of the development.

Zebediela Nickel Mine Project Heritage Sites Locations

Site Code	Coordinate S	Coordinate E	Short Description	Mitigation Action
Exigo-ZNM-BP01	-24.11819589	29.02046579	Burial Site / Potential Burial Site	**Avoidance:** Implement a heritage conservation buffer of at least 50m around the heritage resource, redesign the proposed project infrastructure to avoid the heritage resource and the proposed conservation buffer. **Site Management Plan:** Compile a heritage Site Management Plan (SMP) detailing a plan of action and measures for the long-term conservation and management of the heritage resource and its historical fabric. **Site Monitoring:** Strict weekly monitoring during construction by the heritage consultant or an ECO familiar with the heritage occurrences of the site. **Grave Relocation:** Legally compliant grave relocation of impact is foreseen.
Exigo-ZNM-BP02	-24.11648548	29.02092696		
Exigo-ZNM-BP03	-24.11626613	29.0230682		
Exigo-ZNM-BP04	-24.11906099	29.01328049		
Exigo-ZNM-BP05	-24.12028399	29.02022724		
Exigo-ZNM-HP01	-24.11647903	29.02882498	Historical Period Site / Quarry	**Site Monitoring:** Frequent monitoring during construction by the heritage consultant or an ECO familiar with the heritage occurrences of the site. **Destruction Permitting** prior to impact on the sites.
Exigo-ZNM-HP02	-24.117279	29.02177404	Historical Period Site / Structure	
Exigo-ZNM-HP03	-24.11782499	29.01964612	Historical Period Site / Quarry	
Exigo-ZNM-HP04	-24.11849622	29.02150934	Historical Period Site / Structure	
Exigo-ZNM-SA01	-24.12325077	29.02292722	Stone Age Site / Feature	**Site Monitoring:** Frequent monitoring during construction by the heritage consultant or an ECO familiar with the heritage occurrences of the site. **Destruction Permitting** prior to impact on the sites.
Exigo-ZNM-SA02	-24.13030372	29.02585284		
Exigo-ZNM-SA03	-24.1301	29.02232		
Exigo-ZNM-FT01	-24.11420301	29.02912203	Feature (Unknown)	**Site Monitoring:** Frequent monitoring during construction by the heritage consultant or an ECO familiar with the heritage occurrences of the site.

This report details the methodology, limitations and recommendations relevant to these heritage areas, as well as areas of proposed development. It should be noted that recommendations and possible mitigation measures are valid for the duration of the development process, and mitigation measures might have to be implemented on additional features of heritage importance not detected during this Phase 1 assessment (e.g. uncovered during the construction process).

NOTATIONS AND TERMS/TERMINOLOGY

Absolute dating: Absolute dating provides specific dates or range of dates expressed in years.

Archaeological record: The archaeological record minimally includes all the material remains documented by archaeologists. More comprehensive definitions also include the record of culture history and everything written about the past by archaeologists.

Artefact: Entities whose characteristics result or partially result from human activity. The shape and other characteristics of the artefact are not altered by removal of the surroundings in which they are discovered. In the Southern African context examples of artefacts include potsherds, iron objects, stone tools, beads and hut remains.

Assemblage: A group of artefacts recurring together at a particular time and place, and representing the sum of human activities.

Context: An artefact's context usually consists of its immediate *matrix*, its *provenience* and its *association* with other artefacts. When found in *primary context*, the original artefact or structure was undisturbed by natural or human factors until excavation and if in *secondary context,* disturbance or displacement by later ecological action or human activities occurred.

Cultural Heritage Resource: The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural landscape: A cultural landscape refers to a distinctive geographic area with cultural significance.

Cultural Resource Management (CRM): A system of measures for safeguarding the archaeological heritage of a given area, generally applied within the framework of legislation designed to safeguard the past.

Feature: Non-portable artefacts, in other words artefacts that cannot be removed from their surroundings without destroying or altering their original form. Hearths, roads, and storage pits are examples of archaeological features

Impact: A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Lithic: Stone tools or waste from stone tool manufacturing found on archaeological sites.

Matrix: The material in which an artefact is situated (sediments such as sand, ashy soil, mud, water, etcetera). The matrix may be of natural origin or human-made.

Midden: Refuse that accumulates in a concentrated heap.
Microlith: A small stone tool, typically knapped of flint or chert, usually about three centimetres long or less.
Monolith: A geological feature such as a large rock, consisting of a single massive stone or rock, or a single piece of rock placed as, or within, a monument or site.

Phase 1 CRM Assessment: An Impact Assessment which identifies archaeological and heritage sites, assesses their significance and comments on the impact of a given development on the sites. Recommendations for site mitigation or conservation are also made during this phase.

Phase 2 CRM Study: In-depth studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required. Mitigation / Rescue involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost as a result of a given development.

Phase 3 CRM Measure: A Heritage Site Management Plan (for heritage conservation), is required in rare cases where the site is so important that development will not be allowed and sometimes developers are encouraged to enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

Provenience: Provenience is the three-dimensional (horizontal and vertical) position in which artefacts are found. Fundamental to ascertaining the provenience of an artefact is *association,* the co-occurrence of an artefact with other archaeological remains; and *superposition,* the principle whereby artefacts in lower levels of a matrix were deposited before the artefacts found in the layers above them, and are therefore older.

Random Sampling: A probabilistic sampling strategy whereby randomly selected sample blocks in an area are surveyed. These are fixed by drawing coordinates of the sample blocks from a table of random numbers.

Scoping Assessment: The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision making is expected to focus and to ensure that only key issues and reasonable alternatives are examined. The outcome of the scoping process is a Scoping Report that includes issues raised during the scoping process, appropriate responses and, where required, terms of reference for specialist involvement.

Site (Archaeological): A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity. These include surface sites, caves and rock shelters, larger open-air sites, sealed sites (deposits) and river deposits. Common functions of archaeological sites include living or habitation sites, kill sites, ceremonial sites, burial sites, trading, quarry, and art sites,

Stratigraphy: This principle examines and describes the observable layers of sediments and the arrangement of strata in deposits

Systematic Sampling: A probabilistic sampling strategy whereby a grid of sample blocks is set up over the survey area and each of these blocks is equally spaced and searched.

Trigger: A particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an *issue* and/or potentially significant *impact* associated with that proposed development that may require specialist input. Legal requirements of existing and future legislation may also trigger the need for specialist involvement.

LIST OF ABBREVIATIONS

Abbreviation	Description
ASAPA	Association for South African Professional Archaeologists
AIA	Archaeological Impact Assessment
BP	Before Present
BCE	Before Common Era
BGG	Burial Grounds and Graves
CRM	Culture Resources Management
EIA	Early Iron Age (also Early Farmer Period)
EIA	Environmental Impact Assessment
EFP	Early Farmer Period (also Early Iron Age)
ESA	Earlier Stone Age
GIS	Geographic Information Systems
HIA	Heritage Impact Assessment
ICOMOS	International Council on Monuments and Sites
K2/Map	K2/Mapungubwe Period
LFP	Later Farmer Period (also Later Iron Age)
LIA	Later Iron Age (also Later Farmer Period)
LSA	Later Stone Age
MIA	Middle Iron Age (also Early later Farmer Period)
MRA	Mining Right Area
MSA	Middle Stone Age
NHRA	National Heritage Resources Act No.25 of 1999, Section 35
PFS	Pre-Feasibility Study
PHRA	Provincial Heritage Resources Authorities
SAFA	Society for Africanist Archaeologists
SAHRA	South African Heritage Resources Association
YCE	Years before Common Era (Present)

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1 BACKGROUND

1.1 Scope and Motivation

Exigo Sustainability (Pty) Ltd (Exigo) was commissioned by Lesego Platinum Uitloop (Pty) Ltd (LPU) to conduct an Integrated Heritage Impact Assessment (HIA) study subject to an Environmental Impact Assessment (EIA) process for the proposed Zebediela Nickel Mine Project in the Limpopo Province. The rationale of this HIA is to determine the presence of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance in previously unstudied areas; to consider the impact of the proposed project on such heritage resources, and to submit appropriate recommendations with regard to the cultural resources management measures that may be required at affected sites / features.

1.2 Project Direction

Exigo's expertise ensures that all projects be conducted to the highest international ethical and professional standards. As archaeological specialist for Exigo Sustainability, Mr Neels Kruger acted as field director for the project; responsible for the assimilation of all information, the compilation of the final consolidated HIA report and recommendations in terms of heritage resources on the demarcated project areas. Mr Kruger is an accredited archaeologist and Culture Resources Management (CRM) practitioner with the Association of South African Professional Archaeologists (ASAPA), a member of the Society for Africanist Archaeologists (SAFA) and the Pan African Archaeological Association (PAA) as well as a Master's Degree candidate in archaeology at the University of Pretoria.

1.3 Project Brief

Lesego Platinum Uitloop (Pty) Ltd (LPU) intends to develop a nickel mining operation near Mokopane in the Limpopo Province of South Africa. The Zebediela project is located in the Mogalakwena Local, and Waterberg District Municipalities, approximately 9 km north-east of city centre of the town of Mokopane and approximately 250 km north-northeast of Johannesburg. The proposed Zebediela Nickel mine will predominantly mine nickel and possibly platinum group minerals (PGM's) and associated minerals (platinum, palladium, rhodium, gold, ruthenium, iridium, osmium, copper, cobalt and chromite), iron ore and vanadium from magnetite. The Zebediela Nickel resource will be exploited by open pit mining methods. The proposed site is mostly located on privately owned land, but also on government owned land and is situated immediately east of the local settlements Mahwelereng and Ga-Madiba. The nearest settlement is Mahwelereng B, about 0.52 km from the western mining right boundary and 1.4 km from the edge of the open pit.

1.3.1 Mining Method

At full production, roughly 100 ktpm Run of Mine (RoM) material will be mined with a 0.34 stripping ratio from year 3 to year 12. The first two years will mainly consist of stripping at a rate of 1,237 ktpa, this will reduce to 480 ktpa up to year 12. Overburden stripping is limited to the Oxide Zone which is some 46.5m thick. The designed pit will be mined through conventional truck and shovel with partial backfill mining methods. Initially, mining will only be from one area of the pit with mining commencing from the north western sector of the mineral resource and will be develop across the full width of the pit in a south easterly direction along strike for a total length of 1,150 m. The overall pit slope will be 45°. The overburden and mineralised material will be loaded in pit with excavators with 26 m^3 buckets and transported by 225 t rigid body dump trucks to the overburden stockpile and ROM pad respectively. The overburden stockpile is estimated to be on average 0.9 km

from the pit ramp, whereas the ROM pad is proposed to be 2.4 km from the pit ramp. A 15 m bench height and mining blocks of 100 m by 50 m are planned for the overburden and mineralised material. Due to the proximity (1,400 m) of a built-up neighborhood it has been decided to use electronic detonators over pyrotechnic initiation systems (shock tube). Ore will be processed at an on-site crushing and screening plant before being loaded on trucks for transport to a nearby mine for further processing.

1.3.2 Life of Mine

The mineral resources included in this project are extensive, giving an overall life of mine in excess of 30 years. Although, for the mining right application only 30 years life of mine will be applied for. The geometry of the orebody allows for continuous mining via open pit mining up to a depth of 90 m. Production overburden stripping of 2.47 Mt takes place in year 0 to year 2 and continues concurrent with production operations between year 3 and year 12 at a stripping ratio of 0.34:1. Overburden removal at the current pit design will only be completed in year 13, after which no further overburden stripping will be required.

1.3.3 Surface Infrastructure

The proposed mining right area will be located on farms where LPU currently owns the three prospecting rights namely; Uitloop 3KS (1,925.29 ha), Amatava 41 KS and Bloemhof 4 KS (2620.34 ha), and Piet Potgietersrust Town and Townlands 44 KS (115.26 ha). The Mining Right Area covers a combined area of roughly 4,660.90 ha, measuring approximately 11.9 km from south to north and 7.3 km from east to west. Mine infrastructure is however only planned to be located on approximately 150 ha of the larger Mining Right Area.

The resource battery limit of the identified nickel resource comprises an intrusive pyroxenite-harzburgite-dunite body, approximately 8 km by 1.5 km in extent at outcrop, previously correlated with the Lower Zone of the Bushveld Complex and called Uitloop II. The intrusion strikes northwest and dips at 40° to the south west. It is truncated by the Mahopani Fault and estimated that the body attains a thickness of 600 m. Mining will be focused on the extraction of 28.8 Mt of sulphide-containing material using an open pit, conventional truck and shovel with partial backfill mining method. The top 40 m to 50 m of the disseminated sulphide material is oxidized (Oxide Zone) and will be stockpiled on an overburden facility. The overburden will be trucked out and hauled to the overburden facility. Concurrent backfilling will take place from year 10 once sufficient capacity exists in the open pit. The entire pit below the oxide zone is developed in mineralised material (Sulphide Zone) and ore would be trucked out and hauled to the processing plant of a nearby mine, between 7 and 25 km north-west of the open pit. The open pit design on surface has an approximate pit length of 800 m, with an average width of 500 m and a depth of 90 m. A 5 m high and 10 m wide berm will be constructed around the entire pit perimeter. The life of mine is planned for 30 years, but with the potential to continue mining due to the size of the deposit. The first 2 years will be used for construction of the access roads, plant infrastructure, fencing, stripping of the open pit and RoM stockpiling starting in year 1 with 100 ktpm. The mine will employ a total of 200 people during its LOM. The workforce will be divided into 4 shifts of 50 people per shift. Eleven hectares of initial clearing and grubbing of vegetation is required for the establishment of the mining operations. Initially, mining will only be from one area of the pit with mining commencing from the north western sector of the mineral resource and will develop across the full width of the pit in a south easterly direction along strike for a total length of 800 m. The overall pit slope will be 50°. The overburden and mineralised material will be loaded in pit with excavators with 26 m^3 buckets. The overburden will be transported by 225 t rigid body dump trucks to the overburden facility while the mineralised material will be transported by either truck or conveyor to the processing mine infrastructure footprint for primary and secondary crushing and screening. The overburden facility will be located directly adjacent and to the south-east of the open pit, whereas the RoM stockpile is

proposed to be approximately 500 m from the pit ramp. A 15 m bench height and mining blocks of 50 m by 20 m is planned for the overburden and mineralised material. Due to the proximity (1,400 m) of a built-up neighborhood it has been decided to use electronic detonators over pyrotechnic initiation systems (shock tube). Ore will be processed at an on-site crushing and screening plant before being loaded on trucks for transport to a nearby mine for further processing. The mineral resources included in this project are extensive, giving an overall life of mine in excess of 30 years. Although, for the mining right application only 30 years life of mine will be applied for. The geometry of the orebody allows for continuous mining via open pit mining up to a depth of 90 m. Production overburden stripping of 2.47 Mt takes place in year 0 to year 2 and continues concurrent with production operations between year 3 and year 12 at a stripping ratio of 0.34:1. Overburden removal at the current pit design will only be completed in the year 13, after which no further overburden stripping will be required

Envisaged infrastructure will comprise of the following:

- Primary and secondary crushing and screening plant
- Ore handling and storage facilities (RoM stockpiles)
- Administration building, security building, change house, messing and canteen facilities, mining and geology offices, maintenance and engineering workshops and offices, warehouse and offices, medical station, fire station, laboratory and satellite ablutions
- Potable water tank (120 m^3 combined capacity) and reticulation
    - Pipelines for the Potable water tank are designed for:
        - 155 mm diameter and 725 m length for surface pipes
        - 105 mm diameter and 6400 m for buried pipes.
- Raw Water Dam (24 793 m^3)
- Sewage reticulation
    - Pipelines for the Sewage reticulation are designed for:
        - 155 mm diameter and 725 m length for surface pipes
        - 105 mm diameter and 6400 m for buried pipes.
- Electricity distribution facilities (overhead powerlines, transformers and mini substations)
- Hydrocarbon storage facilities (Total Capacity of: 607 m^3);
- Waste water treatment works;
- Water treatment plant;
- Pollution Control Dam (PCD) for the plant area (19 094 m^3 capacity);
- PCD for the overburden facility (24 753 m^3 capacity);
- Haul and access roads and bridges;
- Perimeter and internal fencing;
- Overburden and topsoil storage facilities;
- Explosives Store

The open pit and mine infrastructure footprints are estimated at 40 Ha and 33 Ha respectively, in the larger proposed 4660 Ha mining right area.

Access to the mine infrastructure will be via an existing gravel road that connects to the Turfspruit gravel road. The proposed mine access road (max length of 1.1 km) will consist of a single lane road for traffic in both directions. Each lane is to be 3.6 m wide with a 1.4 m yellow lane shoulder. Other roads will include haul roads to the plant (approximately 500 m from pit ramp) and overburden facility (approximately 1.3 km from open pit) with a total width of 16 m for a two-lane haul road, which will form part of the internal road network.

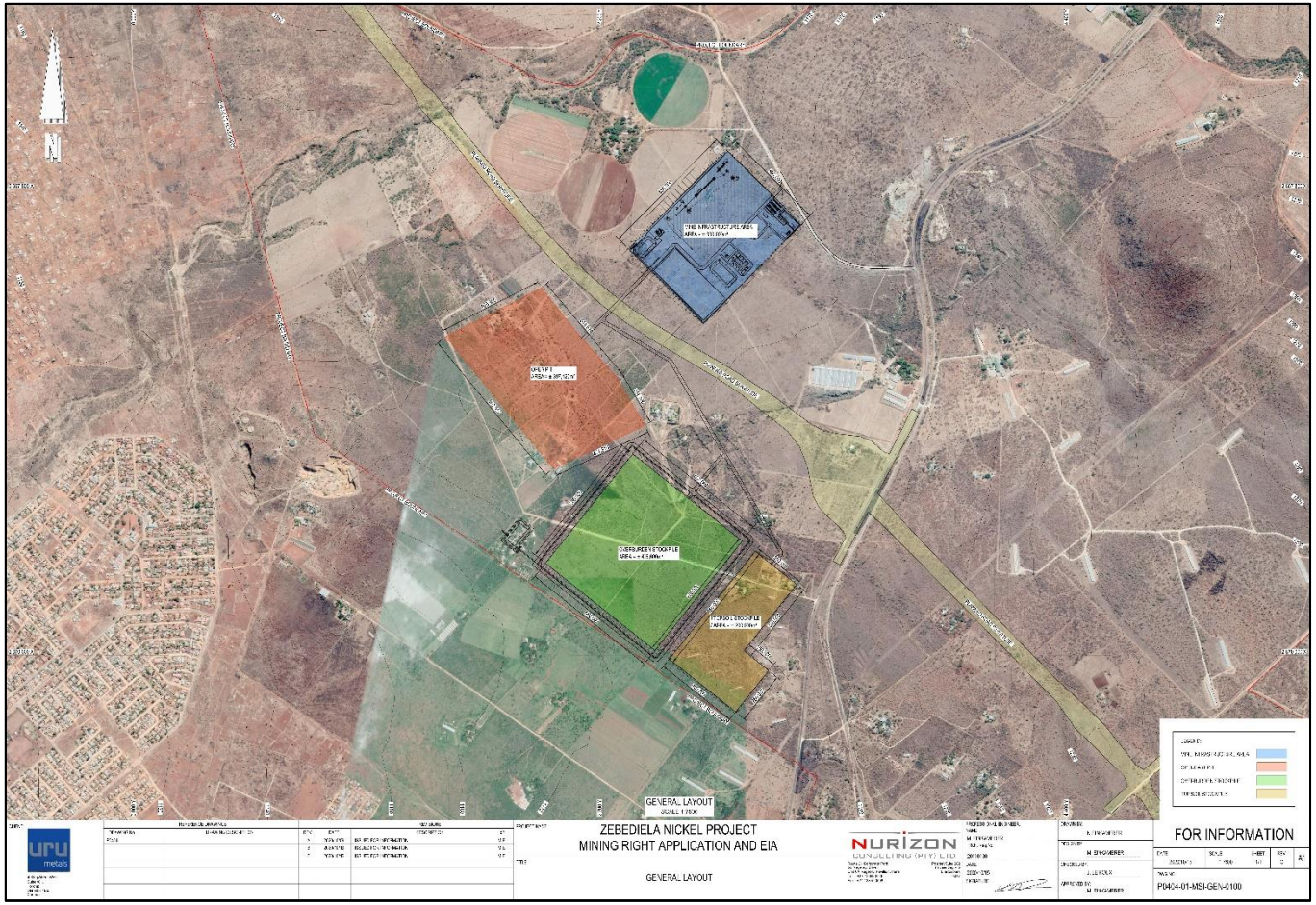

Figure 1-1: Aerial map indicating the localities of infrastructure components of the proposed Zebediela Nickel Mine Project.

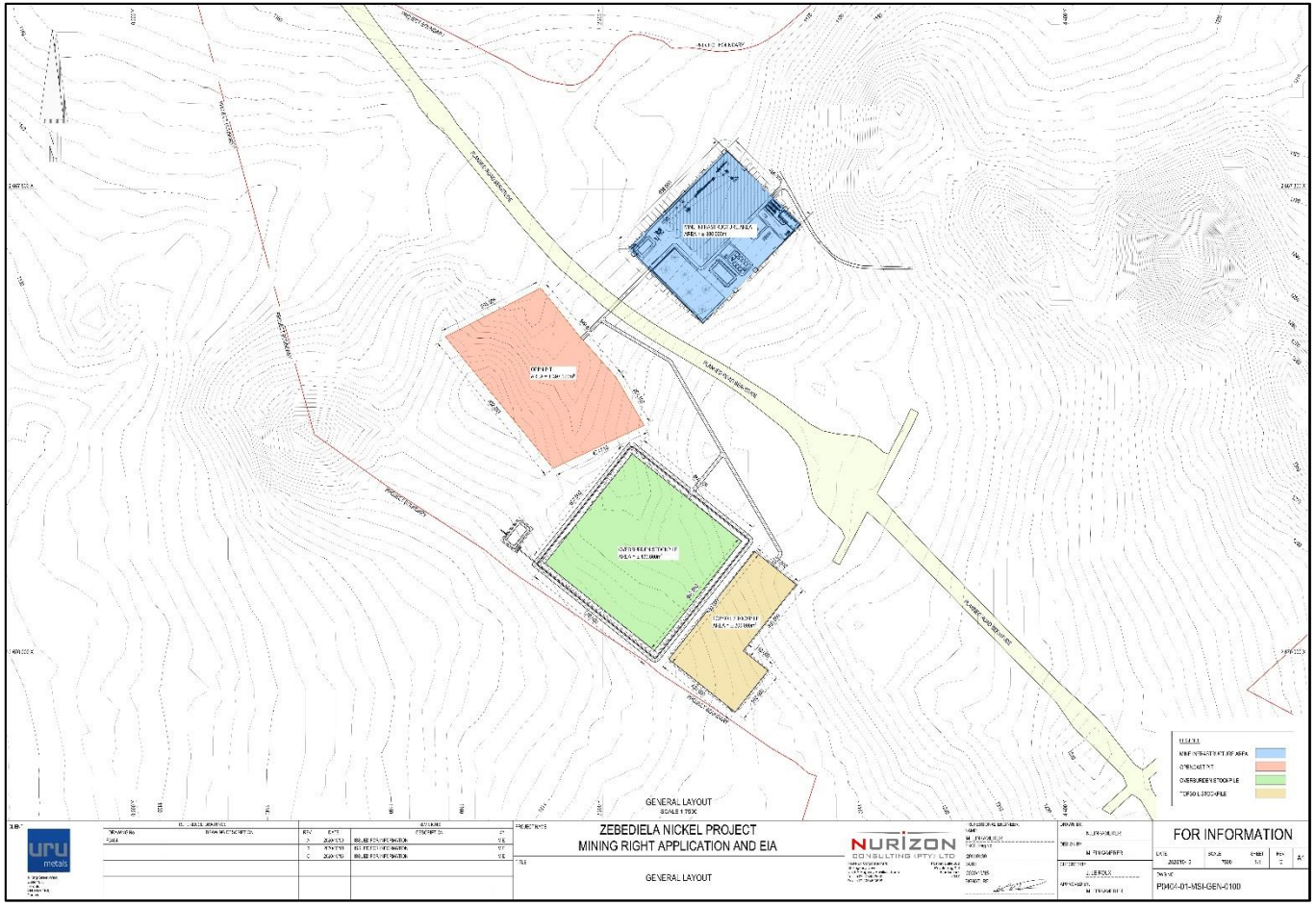

Figure 1-2: Project design map of the proposed Zebediela Nickel Mine Project.

1.4 Terms of Reference

Heritage specialist input into the Environmental Impact Assessment (EIA) process is essential to ensure that, through the management of change, developments still conserve our heritage resources. It is also a legal requirement for certain development categories which may have an impact on heritage resources. Thus, EIAs should always include an assessment of heritage resources. The heritage component of the EIA is provided for in the **National Environmental Management Act, (Act 107 of 1998)** and endorsed by section 38 of the **National Heritage Resources Act (NHRA - Act 25 of 1999)**. In addition, the NHRA protects all structures and features older than 60 years, archaeological sites and material and graves as well as burial sites. The objective of this legislation is to ensure that developers implement measures to limit the potentially negative effects that the development could have on heritage resources. Based hereon, this project functioned according to the following **terms of reference for** heritage specialist input**:**

- *Provide a detailed description of all archaeological artefacts, structures (including graves) and settlements as well as paleontological receptors which may be affected, if any.*
- *Assess the nature and degree of significance of such resources within the area.*
- *Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance.*
- *Assess and rate any possible impact on the archaeological and historical remains within the area emanating from the proposed development activities.*
- *Propose possible heritage management measures provided that such action is necessitated by the development.*
- *Liaise and consult with the South African Heritage Resources Agency (SAHRA).*

1.5 CRM: Legislation, Conservation and Heritage Management

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

1.5.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and its provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

a. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act No 25 of 1999 (section 35) the following features are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years

b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography

c. Objects of decorative and visual arts

d. Military objects, structures and sites older than 75 years

e. Historical objects, structures and sites older than 60 years

f. Proclaimed heritage sites

g. Grave yards and graves older than 60 years

h. Meteorites and fossils

i. Objects, structures and sites of scientific or technological value.

In addition, the national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance

b. Places to which oral traditions are attached or which are associated with living heritage

c. Historical settlements and townscapes

d. Landscapes and features of cultural significance

e. Geological sites of scientific or cultural importance

f. Archaeological and paleontological sites

g. Graves and burial grounds

h. Sites of significance relating to the history of slavery

i. Movable objects (e.g. archaeological, paleontological, meteorites, geological specimens, military, ethnographic, books etc.).

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

b. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves and burial grounds are commonly divided into the following subsets:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments.

c. National Heritage Resources Act No 25 of 1999, section 35

This act (Act 107 of 1998) states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made. Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

1.5.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

A detailed guideline of statutory terms and requirements is supplied in Addendum 1.

2 REGIONAL CONTEXT

2.1 Area Location

The proposed Zebediela Nickel Mine Project occurs on various portions of Uitloop 3KS in the Mogalakwena Local Municipality and the Waterberg District Municipality of the Limpopo Province. The farm is located directly south of the N1 road. The project site is located approximately 5km northeast of the Mokopane town centre within a predominantly rural landscape. The study areas appear on 1:50000 map sheet **2429AA** (see Figure 2-1) and coordinates for the proposed project are as follows:

Latitude: S24.126483°

Longitude: E29.037211°

2.2 Area Description: Receiving Environment

The proposed project is situated along the north-western fringes of Mokopane town in the Limpopo Province. within the Savanna biome which is the largest biome in Southern Africa. The project area sloped up to the foothills of the Waterberg and this section was previously exposed to intensive agricultural activities which have since stopped and pioneer plant growth with predominantly Sweet thorn (Acacia karroo), Sickle bush (Dichrostachys cinerea) and a variety of grasses made up most of the dense vegetation. Several small, seasonal streams cross the landscape. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The most recent classification of the area by Mucina & Rutherford is the mountainous areas to be part of the Mamabolo Mountain Bushveld, while a section forms part of the Polokwane Plateau Bushveld in the northwest, while the remainder of the plains and footslopes falls within the Makhado Sweet Bushveld vegetation type. The landscape features of the Makhado Sweet Bushveld vegetation type is slightly to moderately undulating plains, sloping generally down to the north, with some hills to the southwest, while the vegetation is characterised by short and shrubby bushveld with a poorly developed grass layer. The hills and low mountains embedded in this vegetation type are of the Mamabolo Mountain Bushveld. The Mamabolo Mountain Bushveld vegetation type is characterised by low mountains and rocky hills. The slopes are moderate to steep, and very rocky, covered by small trees and shrubs. The regional geology reflects the quartz-amphibolite schists which contain the quartzmagnetite horizons as “banded iron formations” as preserved in a complexly folded outlier, surrounded by tonalitic gneiss. Four deformational phases have been recognized which broadly correlate with those of the Southern Marginal Zone of the Limpopo Metamorphic Complex.

2.3 Site Description

The Zebediela Nickel Mine Project site is situated on mostly privately-owned land immediately east of the local settlements Mahwelereng and Ga-Madiba. The area situated within flatter land parcels is traversed by natural drainage lines created over time by the non-perennial Rooisloot River. Dense grass and other vegetation cover certain property portions but significant overgrazing and intensive crop cultivation areas along parts of the project footprint are vegetated by pioneering species. Erosion was noted at some properties especially along natural drainage lines. Some areas are utilized as crop and chicken farms. Neighboring farms are being used for livestock farming, chicken farming and localized crop cultivation. Certain areas remain undeveloped where pristine indigenous vegetation still occurs, especially in the mountainous regions.

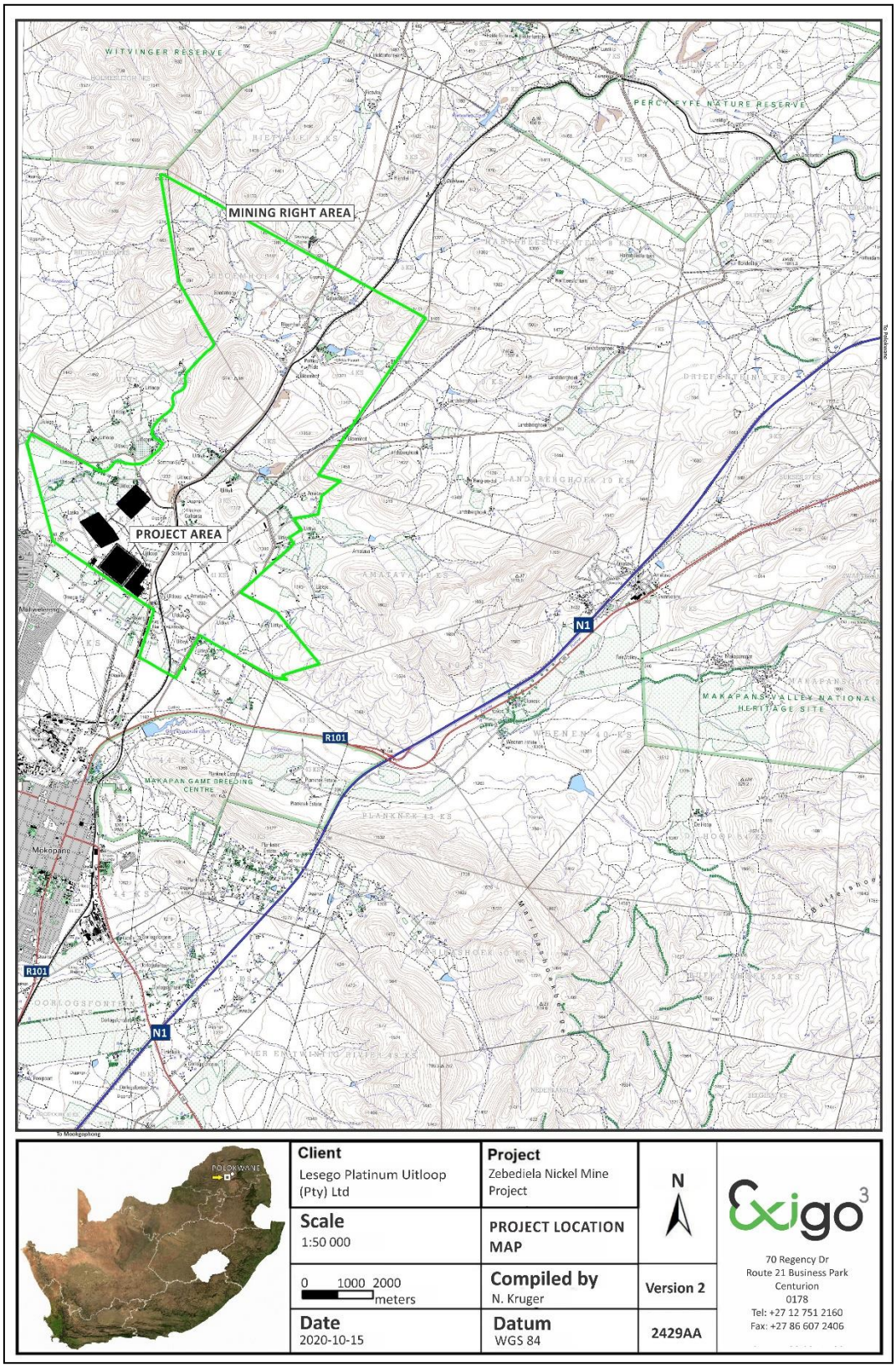

Figure 2-1: 1:50 00 Map representation of the location of the proposed Zebediela Nickel Mine Project (sheet 2429AA).

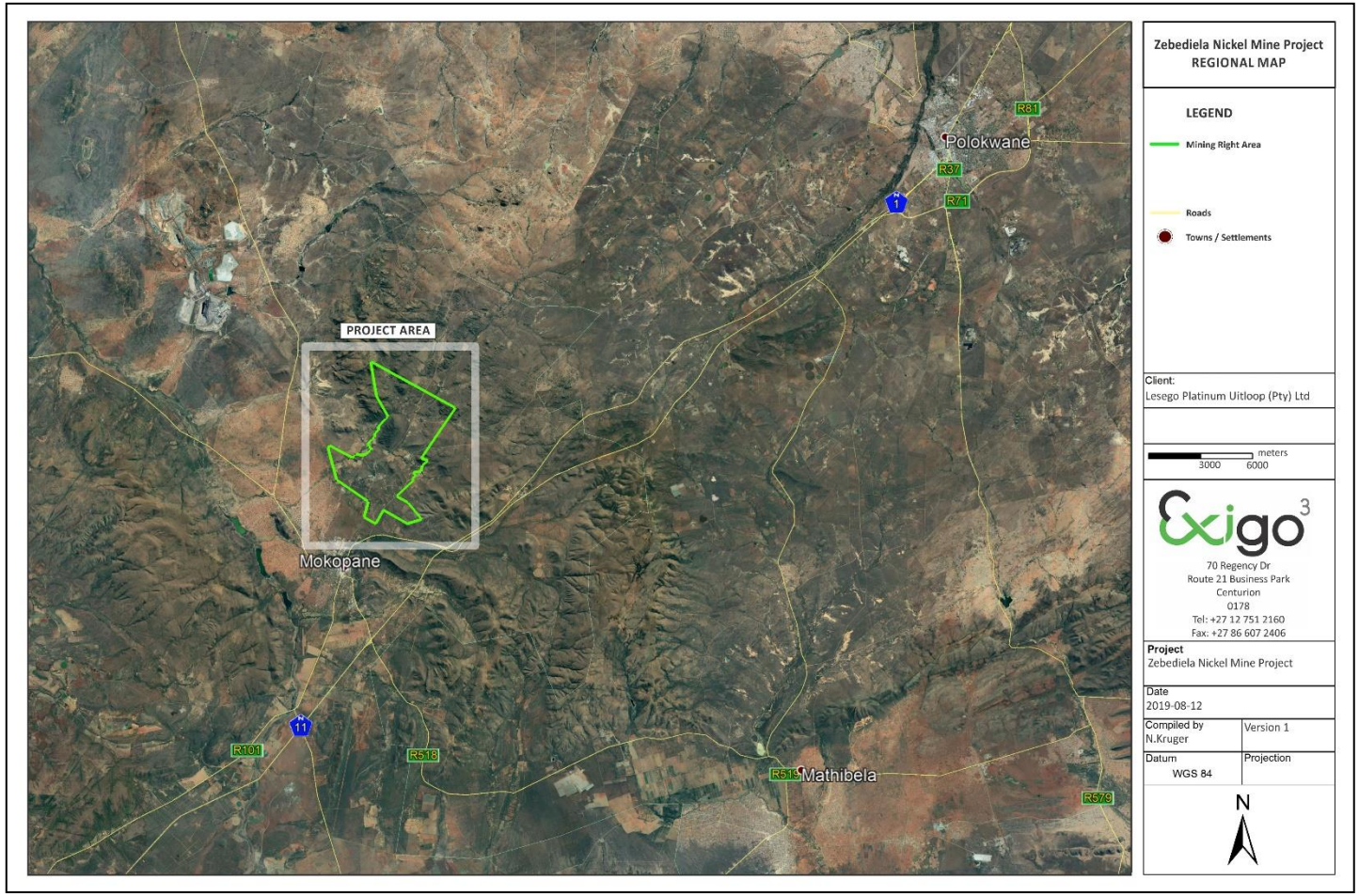

Figure 2-2: Aerial map providing a regional context for the proposed Zebediela Nickel Mine Project MRA area.

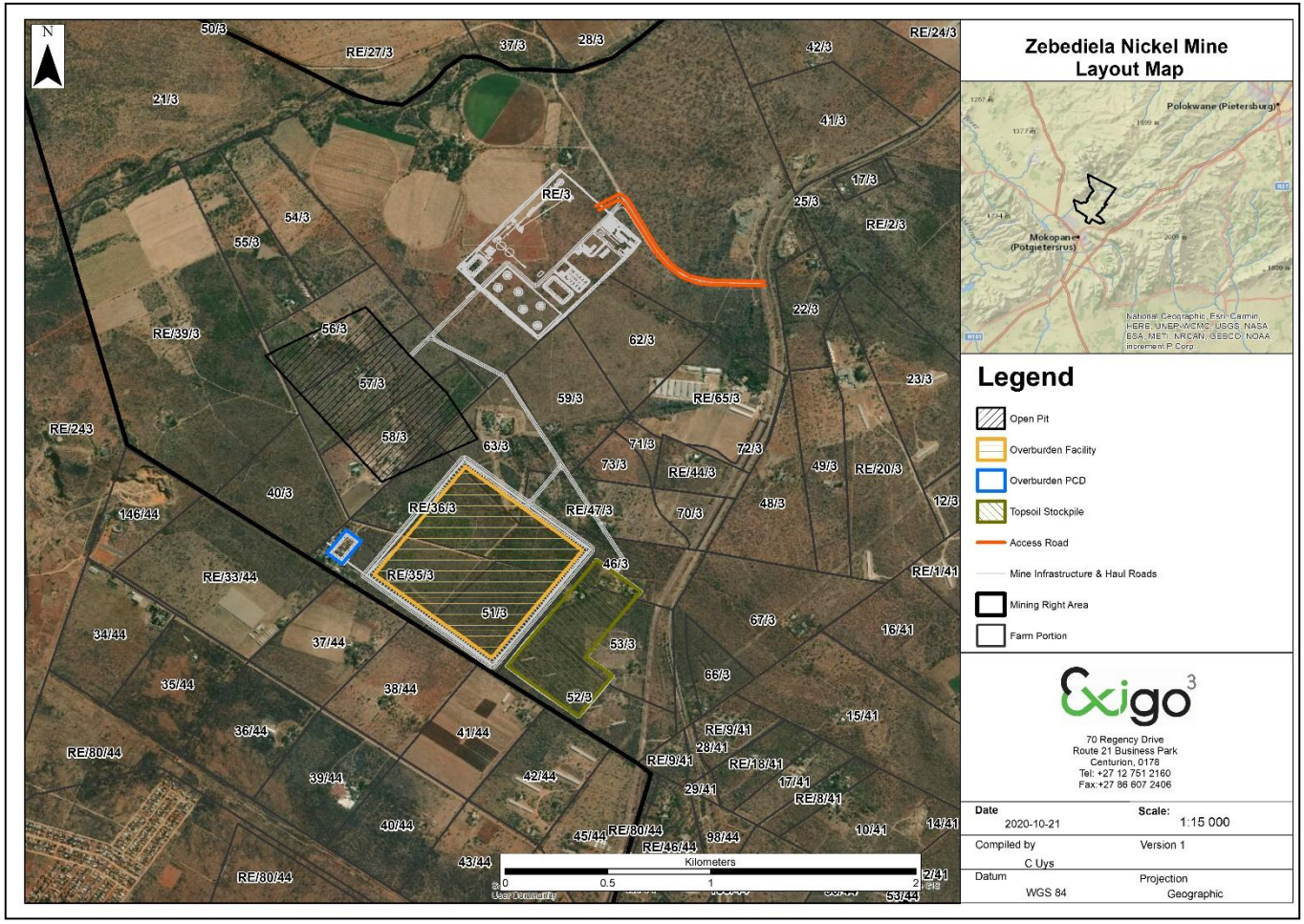

Figure 2-3: Aerial map indicating farm portions affected by the proposed mining establishment.

3 METHOD OF ENQUIRY

3.1 Sources of Information: PDA

Please refer to Fourie 2019[1] (see Addendum 4).

3.2 Sources of Information

Data from detailed desktop, aerial and field studies were employed in order to sample surface areas systematically and to ensure a high probability of heritage site recording.

3.2.1 Desktop Study

The larger landscape around Mokopane has been well documented in terms of its archaeology and history. Numerous academic papers and research articles supplied a historical context for the proposed project and archival sources, aerial photographs, historical maps and local histories were used to create a baseline of the landscape's heritage. In addition, the study drew on available unpublished Heritage Assessment reports to give a comprehensive representation of known sites in the study area.

3.2.2 Aerial Survey

Aerial photography is often employed to locate and study archaeological sites, particularly where larger scale area surveys are performed. This method was applied to assist the foot and automotive site surveys where depressions, variation in vegetation, soil marks and landmarks were examined. Specific attention was given to shadow sites (shadows of walls or earthworks which are visible early or late in the day), crop mark sites (crop mark sites are visible because disturbances beneath crops cause variations in their height, vigour and type) and soil marks (e.g. differently coloured or textured soil (soil marks) might indicate ploughed-out burial mounds). Attention was also given to moisture differences, as prolonged dampening of soil as a result of precipitation frequently occurs over walls or embankments. In addition, historical aerial photos obtained during the archival search were scrutinized and features flagged as important in terms of heritage value, were identified. Where these features were located within the boundaries of the project area, they were visited during the site survey in an effort to determine whether they still exist and in order to assess their current condition and significance. By superimposing high frequency aerial photographs with images generated with Google Earth as well as historical aerial imagery, potential sensitive areas were subsequently identified, geo-referenced and transferred to a handheld GPS device. These areas served as reference points from where further vehicular and pedestrian surveys were carried out.

3.2.3 Mapping of sites

Historical and current maps of the project area were examined. By merging data obtained from the desktop study and the aerial survey, sites and areas of possible heritage potential were plotted on these maps of the larger Mokopane area using GIS software. These maps were then superimposed on high definition aerial representations in order to graphically demonstrate the geographical locations and distribution of potentially sensitive landscapes.

3.2.4 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. Archaeological surveys of the Zebediela Nickel Mine Project area were conducted over two periods in July

[1] Fourie, H. 2019. Palaeontological Impact Assessment: Phase 1: Field Study for the Zebediela Nickel Mine Project, Mogalakwena Local Municipality, Waterberg District Municipality, Limpopo Province.

2019 and October 2020. The process encompassed a systematic field survey in accordance with standard archaeological practice by which heritage resources are observed and documented. During the site survey, particular focus was placed on proposed infrastructure footprint areas provided to the specialist. GPS reference points identified during the aerial survey were also visited and random spot checks were made (see detail in previous section). Using a Garmin GPS, the survey was tracked and general surroundings were photographed with a Samsung Digital camera. Real time aerial orientation, by means of a mobile Google Earth application was also employed to investigate possible disturbed areas during the survey.

3.3 Limitations

3.3.1 Access

Generally, the project area is accessed via the Percy Fyfe road as well as other regional roads providing thoroughfare to the properties. Access control is applied to most of the properties `and this proved to be a major constraint in certain instances (see Section 3.1.4) resulting in portions of the project area remaining uninvestigated.

3.3.2 Visibility

The surrounding vegetation in the project area mostly comprised out dense grasslands, bush and scrub cover and pioneering species. The general visibility at the time of the HIA survey (July 2019, October 2020) ranged from high in transformed areas to low in more pristine landscapes. As such, visibility and free movement on site were severely constrained, particularly on Portions 51, 52 and Portion 0 of the Farm Uitloop. In single cases during the survey sub-surface inspection was possible. Where applied, this revealed no archaeological deposits.

Figure 3-1: View of the project site on the Farm Uitloop.

Figure 3-2: View of dolomite inclusions in the local geology of the project. area.

Figure 3-3: View of general surroundings in the project area on a portion of Uitloop.

Figure 3-4: View of dense vegetation on a portion of Uitloop in dry months.

Figure 3-5: A large maze field in the project area on a portion of Uitloop.

Figure 3-6: View of general surroundings in the project area on a portion of Uitloop after winter months.

Figure 3-7: An old agricultural field and cleared surfaces on a portion of Uitloop.

Figure 3-8: View of general surroundings in the project area on a portion of Uitloop.

Figure 3-9: View of surface vegetation in the project area on a portion of Uitloop.

Figure 3-10: View of dense vegetation on a portion of the Farm Uitloop.

Figure 3-11: View of the project area, looking south towards a heavy equipment repairs facility on a portion of Uitloop.

Figure 3-12: View of a large cleared field in the project area on a portion of Uitloop.

Figure 3-13: View of a more sparsely vegetated section of Uitloop in the project area.

Figure 3-14: View of denser vegetation in the project area on a portion of Uitloop.

Figure 3-15: View of tall surface grasses in the project area on Uitloop.

3.4 Limitations: PDA

The accuracy and reliability of the report may be limited by the following constraints (Fourie, 2020):

- Most development areas have never been surveyed by a palaeontologist or geophysicist.
- Variable accuracy of geological maps and associated information.
- Poor locality information on sheet explanations for geological maps.
- Lack of published data.
- Lack of rocky outcrops.
- Inaccessibility of site.
- Insufficient data from developer and exact layout plan for all structures.

3.5 Summary: Limitations and Constraints

The site survey for the Zebediela Nickel Mine Project HIA primarily focused around areas tentatively identified as sensitive and of high heritage probability (i.e. those noted during the aerial survey) as well as areas of high human settlement catchment. In summary, the following constraints were encountered during the site survey:

- The surrounding vegetation in the project area is mostly comprised out of mixed grasslands, occasional trees and hilltop vegetation. The general visibility at the time of the site inspection ranged from high to low and visibility constrained site identification in the project area, particularly Portions 51, 52 and Portion 0.

It should be noted that, even though it might be assumed that survey findings are representative of the heritage landscape of the project area for the Project, it should be stated that the possibility exists that individual sites could be missed due to the localised nature of some heritage remains as well as the possible presence of sub-surface archaeology. Therefore, maintaining due cognisance of the integrity and accuracy of the archaeological survey, it should be stated that the heritage resources identified during the study do not necessarily represent all the heritage resources present in the project area. The subterranean nature of some archaeological sites, dense vegetation cover and visibility constraints sometimes distort heritage representations and any additional heritage resources located during consequent development phases must be reported to the Heritage Resources Authority or an archaeological specialist.

3.6 Impact Assessment

For consistency among specialists, impact assessment ratings by Exigo Specialist are generally done using the Plomp[2] impact assessment matrix scale supplied by Exigo. According to this matrix scale, each heritage receptor in the study area is given an impact assessment (see Section 6.1.2).

4 ARCHAEO-HISTORICAL CONTEXT

4.1 The Paleontological Landscape[3]

4.1.1 Regional Geological Setting

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng, Limpopo and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Chuniespoort, and Pretoria Groups as well as other smaller groups (Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

The Pretoria Group consists predominantly of quartzite and shale, together with a prominent volcanic unit, minor conglomerate, chemical and volcanic members. It comprises the Hekpoort Andesite, Dullstroom Basalt, Time Ball Hill, Silverton, and Magaliesberg Quartzite Formations as well as several smaller formations (in total 15) and overlies the Chuniespoort Group (Kent 1980). Both the shale and quartzite of the Pretoria Group are utilised in the building industry (Snyman 1996). The Time Ball Hill shale Formation is known to contain 'algal microfossils' diagenetic in origin. Stromatolites as they are known are preserved in the subordinate carbonate rocks (Kent 1980). The Pretoria Group is clastic sedimentary in nature (Eriksson 1999).

[2] Plomp, H.,2004

[3] Refer to Fourie 2020.

The pile of sedimentary rocks, mainly mudstones and quartzites with some basalt can collectively reach a thickness of up to 5 km (Visser 1989). The Rooihoogte Formation sits at the base of the Pretoria Group and is quite thin (10 – 150 m). The chert is present as boulders or a breccia. It is often lumped with the Time Ball Hill Formation (Visser 1989).

The Chuniespoort Group is made up of chemical and biochemical sediments such as dolomite, chert, limestone and banded iron formation, carbonaceous shale is also present. At the top of the Malmani Subgroup is the Duitschland Formation underlain by the Penge and Monte Christo Formations. Sandstone is mostly absent. It is this formation that has great economic value for its lead, zinc, dolomite, and manganese (Kent 1980, Snyman 1996). Fluorspar, concrete aggregate, iron ore and manganese is also mined from this formation. Cave formation in the dolomite is a major concern in developing areas, especially in the 1500 m thick dolomite of the Malmani Subgroup. Chemical sediments such as fine grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. The Malmani dolomites are home to most of the cave systems that has yielded hominin fossils such as those at Mokopane's cave. It is also home to Middle and Late Stone Age cultures. This cave and the caves in the Cradle of Humankind, near Johannesburg, provided a refuge for man's distant ancestors. The breccia yielded internationally renowned hominins. The Black reef Formation of the Transvaal Supergroup consists of quartzite with lenses of grit and conglomerate. Shale is always present, particularly near the top close to the contact with the overlying dolomite (Kent 1980). It is Vaalian in age and not very thick, only up to 500 m in the north-east. It contains a fair amount of gold and the limestone is mined (Snyman 1996). The Black Reef Formation is known for stromatolite carbonates and fossiliferous Late Cenozoic cave breccias similar to the Malmani dolomite. Algal microfossils are reported from shales and are probably from diagenetic origin. Stromatolites are preserved in the subordinate carbonate rocks.

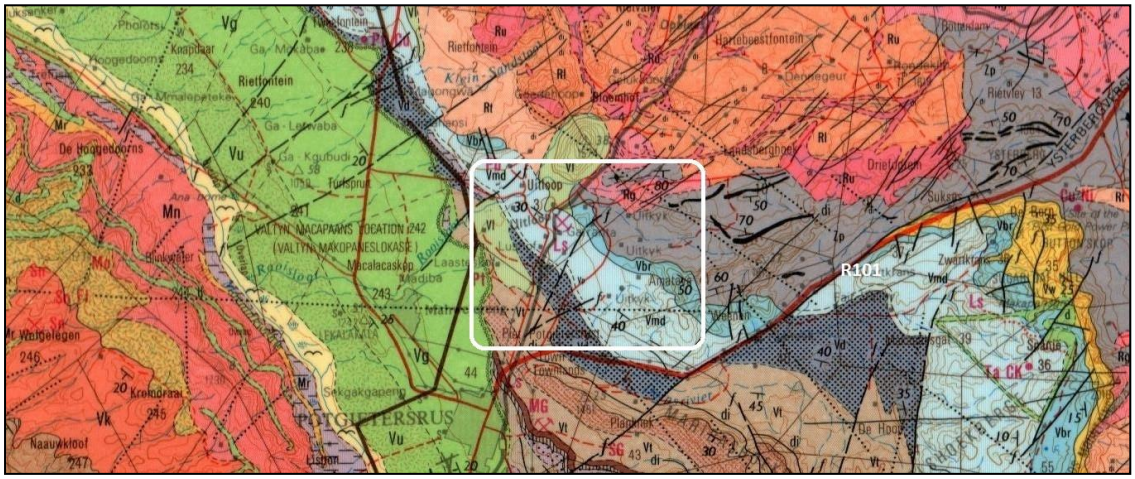

Figure 4-1: The geology of the development area (Du Plessis1978).

Legend to Map and short explanation.

Vl – Melanorite, pyroxenite, serpentinized harzburgite, chromite layer [·––·] (green). Lower zone, Rustenburg Layered Suite, Bushveld Complex. Vaalian.

Vt – Shale, hornfels, subordinate schist: [::] Nooitgedacht Quartzite Member (brown). Time Ball Hill, Pretoria Group, Transvaal Supergroup. Vaalian.

Vd – Limestone, dolomite, chert, shale, quartzite, diamictite, hornfels, and conglomerate (purple [::]). Duitschland Formation, Chuniespoort Group, Transvaal Supergroup. Vaalian.

Vmd – Dolomite, chert [=] (blue), Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup. Vaalian.

Vbr – Quartzite, shale, sandstone, volcanic rocks (dark blue). Black Reef Formation. Vaalian.

Rg – Leucocratic grey biotite granite-gneiss, leucocratic granite and pegmatite (pink). Randian.
Zp – Acid to intermediate lava, pyroclasts (dark purple). Zwazian.
---f--- – (black) Fault.
⊥ 30 - Strike and dip of bed.
------ - Concealed geological boundary.
□ – Approximate position of development (in white on the Figure).

4.1.2 Local Geology

The Zebediela Nickel Mine Project is located in an area where the thickness of the dolomite is 1500 m. and it is present on the surface in this area. The top 40 m to 50 m of the disseminated sulphide material is oxidized (Oxide Zone) and will be stockpiled on an overburden facility. Soil depth in the project area ranges between 50 mm and more than 1200 mm depending on the soil form. The opencast pit will be 90 m deep.

Depth is determined by the related infrastructure to be developed, and the thickness of the formation in the development area, such as foundations, footings and channels. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops.

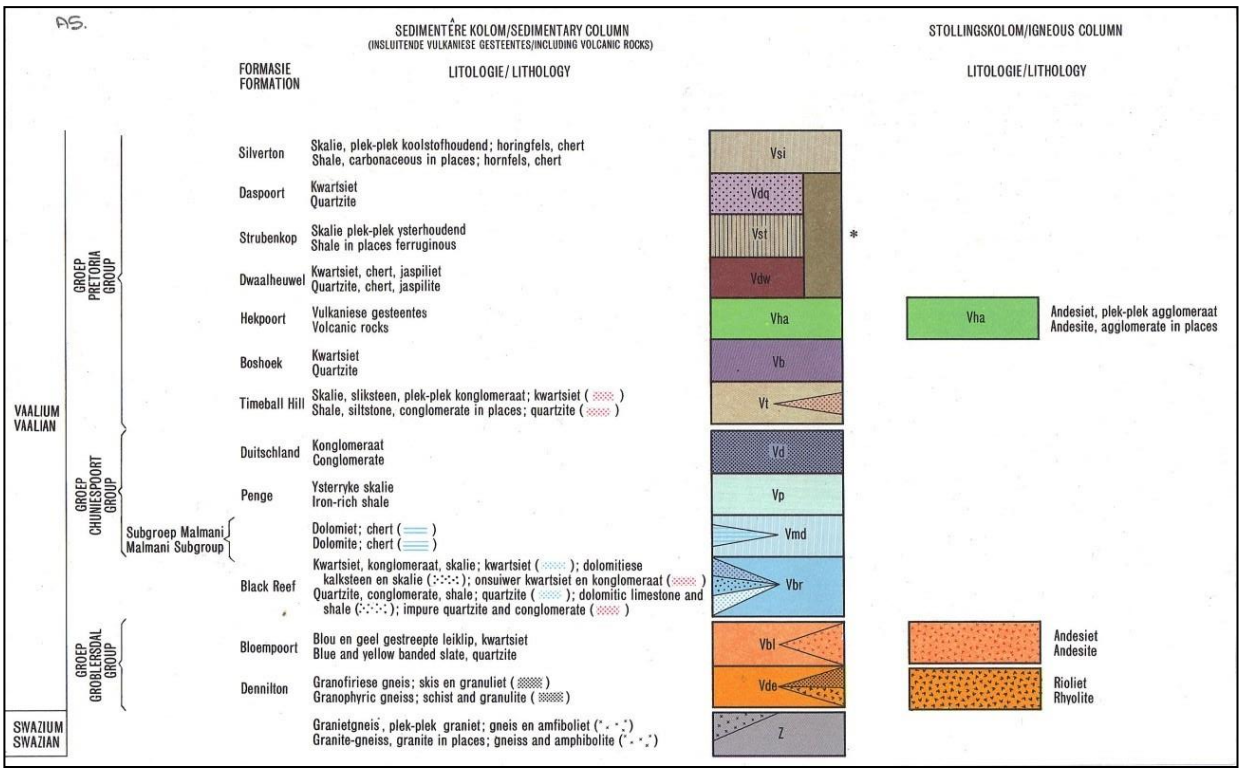

Figure 4-2: Lithostratigraphic column of the geology of the site (Muntingh 1992).

4.2 The Archaeological Landscape

Archaeology in Southern Africa is typically divided into two main fields of study, the **Stone Age** and the **Iron Age** or **Farmer Period**. The following table provides a concise outline of the chronological sequence of periods, events, cultural groups and material expressions in Southern African pre-history and history.

Table 4-1 Chronological Periods across Southern Africa

Period	Epoch	Associated cultural groups	Typical Material Expressions
Early Stone Age 2.5m – 250 000 YCE	Pleistocene	Early Hominins: *Australopithecines* *Homo habilis* *Homo erectus*	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First *Homo sapiens* species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	*Homo sapiens sapiens* including San people	Typically small to minute stone tools such as arrow heads, points and bladelets.
Early Iron Age / Early Farmer Period 300 – 900 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	First Bantu-speaking groups	Typically distinct ceramics, bead ware, iron objects, grinding stones.
Middle Iron Age (Mapungubwe / K2) / early Later Farmer Period 900 – 1350 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Bantu-speaking groups, ancestors of present-day groups	Typically distinct ceramics, bead ware and iron / gold / copper objects, trade goods and grinding stones.
Late Iron Age / Later Farmer Period 1400 AD -1850 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Various Bantu-speaking groups including Venda, Tsonga, Sotho-Tswana and Zulu	Distinct ceramics, grinding stones, iron objects, trade objects, remains of iron smelting activities including iron smelting furnace, iron slag and residue as well as iron ore.
Historical / Colonial Period ±1850 AD – present	Holocene	Various Bantu-speaking groups as well as European farmers, settlers and explorers	Remains of historical structures e.g. homesteads, missionary schools etc. as well as glass, porcelain, metal and ceramics.

4.3 Discussion: The Mokopane Heritage Landscape

The project area is situated in a landscape well-known for its Iron Age Farmer and Colonial Period frontier zones. As such, literature shows evidence of an archaeological heritage that spans from the Early Stone Age, to the Later Iron Age and the region bears significance historically as a frontier between hunter-gatherers and European explorers and settlers.

4.3.1 Early History and the Stone Ages

According to archaeological research, the earliest ancestors of modern humans emerged some two to three million years ago. The remains of Australopithecine and *Homo habilis* have been found in dolomite caves and underground dwellings in the Riverton Area at places such as Sterkfontein and Swartkrans near Krugersdorp. Homo habilis, one of the Early Stone Age hominids, is associated with Oldowan artefacts, which include crude implements manufactured from large pebbles. The Acheulian industrial complex replaced the Oldowan industrial complex during the Early Stone Age. This phase of human existence was widely distributed across South Africa and is associated with *Homo erectus*, who manufactured hand axes and cleavers from as early as one and a half million years ago. Middle Stone Age sites dating from as early as two hundred thousand years ago have been found all over South Africa. Middle Stone Age hunter-gatherer bands also lived and hunted in the Orange and Vaal River valleys. These people, who probably looked like modern humans, occupied campsites near water but also used caves as dwellings. They manufactured a wide range of stone tools, including blades and points that may have had long wooden sticks as hafts and were used as spears.

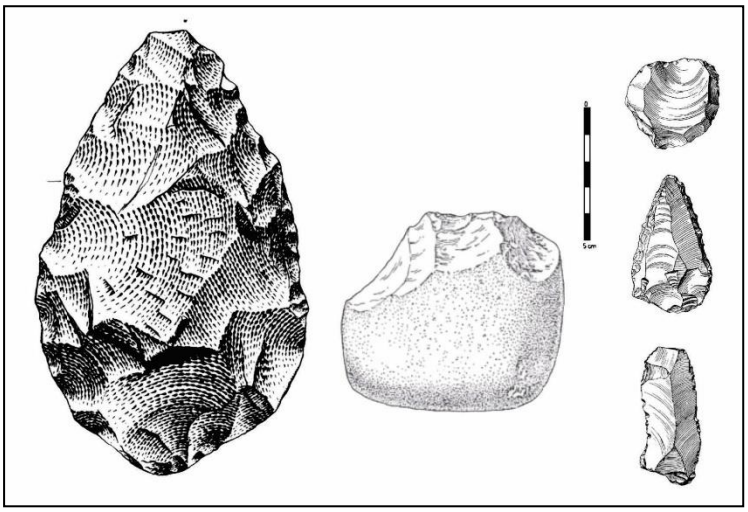

Figure 4-3: Typical ESA handaxe (left) and cleaver (center). To the right is a MSA scraper (right, top), point (right, middle) and blade (right, bottom).

The cultural historical landscape of the Polokwane area spans millions of years with evidence of hominin occupation, Stone Age traditions, Iron Age farmers and historical events. Makapansgat, a deep limestone cave near Mokopane has yielded remains of *Australopithecus africanus* that dates to more than 3 million years BP and also *Homo erectus*, dating to approximately 1 million years BP. However, Earlier Stone Age (ESA) material is scarce on the Waterberg plateau. The Middle Stone Age (MSA) is abundantly represented in the Waterberg area and archaeological excavations at sites such as the Olieboomspoort Shelter in the north-western part of the Waterberg have yielded rich MSA deposits which display a large degree of specialisation and skill in stone working (Van der Ryst 1996). These groups occupied open camps which were situated in the proximity of water sources such as pans, lakes or rivers. There is a noticeable gap in the area between MSA assemblages and material form the Later Stone Age (LSA), suggesting that the region may not have seen dense human occupation for a long period of time. However, Later Stone Age groups, including the San hunter gatherers and Khoi herders frequented the area in the last few millennia, and numerous LSA sites have been discovered and excavated. Similarly, LSA evidence such as stone implements, ceramics and a wealth of rock paintings and markings are scattered over the plateau.

4.3.2 The Iron Age Farmer Period

Within the last two thousand years, San and Khoi groups were displaced by Iron Age farming communities

moving into the Polokwane area, possibly prompted by the spread of tsetse fly into the lowveld areas. Three phases of Iron Age occupation are generally distinguished here (Aukema 1989). The first phase, known as the Eiland tradition, is characterised by herringbone decoration motives on pottery. Little to no stone walling occurs at sites dating to this phase. On the other hand, sites of the second phase of occupation dating to the Later Iron Age are commonly found on hilltops where they display elaborate stone walling. These settlements could be linked to the arrival of Nguni-speakers (Ndebele) in the region between the 16th and 17th centuries AD. The third phase of Iron Age settlement, dating to the 18th and early 19th century, contains bi and multi chrome (red and black) pottery commonly attributed to a Sotho-Tswana ceramic tradition known as Moloko (see *Sotho-Tswana History* section below). In the northern regions of South Africa at least three settlement phases have been distinguished for early prehistoric agropastoralist settlements during the Early Iron Age (EIA). Diagnostic pottery assemblages can be used to infer group identities and to trace movements across the landscape. The first phase of the Early Iron Age, known as Happy Rest (named after the site where the ceramics were first identified), is representative of the Western Stream of migrations, and dates to AD 400 - AD 600. The second phase of Diamant is dated to AD 600 - AD 900 and was first recognized at the eponymous site of Diamant in the western Waterberg. The third phase, characterised by herringbone-decorated pottery of the Eiland tradition, is regarded as the final expression of the Early Iron Age (EIA) and occurs over large parts of the North West Province, Northern Province, Gauteng and Mpumalanga. This phase has been dated to about AD 900 - AD 1200. These sites are usually located on low-lying spurs close to water. However, please note that there are no EIA sites in the Free State. The Late Iron Age (LIA) settlements are characterised by stone-walled enclosures situated on defensive hilltops c. AD 1640 - AD 1830). This occupation phase has been linked to the arrival of ancestral Northern Sotho, Tswana and Southern Ndebele (Nguni–speakers) in the northern and Waterberg regions, and dates from the sixteenth to seventeenth centuries AD. The terminal LIA is represented by late 18th/early 19th century settlements with multichrome Moloko pottery commonly attributed to the Sotho-Tswana. These settlements can in many instances be correlated with oral traditions on population movements during which African farming communities sought refuge in mountainous regions during the processes of disruption in the northern interior of South Africa, resulting from the so-called *difaqane* (or m*fecane*).

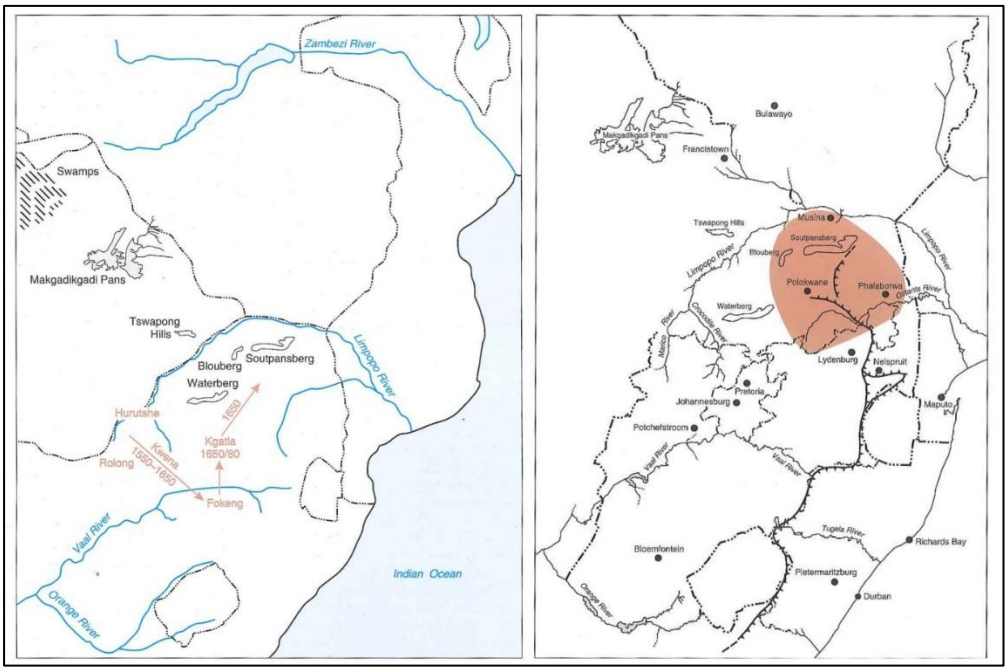

Figure 4-4: Maps detailing the early distribution of Sotho-Tswana speakers (left) and distribution of 16th century Moloko ceramics, specifically the Icon facies (right) (After Huffman 2007).

Figure 4-5: Ceramic decoration motives typical of the15th and 16th century Icon facies (After Huffman 2007).

Early Sotho-Tswana History

Within a larger archaeological context, the Iron Age settlement representations in the Mokopane area can be traced back to ancestral Sotho-Tswana occupation and developments from the sixteenth century AD onwards. As mentioned previously, diagnostic pottery assemblages are commonly used in the South African Iron Age to infer group identities and to trace movements across the landscape. Similarly, the migration of the Sotho-Tswana speakers in South Africa in the 16th century marked a new ceramic style, known as Moloko. The Moloko Tradition can be divided into two phases: an early phase (e.g. Icon) in which sites were usually located at the foot of hills and contained little or no stone walling; and a later phase characterised by extensive stone wall complexes which were often erected on hills. The early Later Iron age sites at Makotopong and Kalkfontein display ceramic characteristics similar to that of the Icon facies. Further afield, in the Waterberg area, the later Maloko phase manifested in the Madikwe ceramic facies with pottery typically displaying stab and fingernail impression decoration motives. Sites of this period display extensive stone walls, erected to construct stock byres and to demarcate residential units where pole-and-dagha (clay) huts were placed.

4.3.3 Later History: Colonial Period and the Anglo Boer War

Some of the early Voortrekkers such as Hans van Rensburg and Louis Trichardt and the Boer communities that travelled with them, traversed through the survey area on their way to the Soutpansberg Mountains, in April 1836.

- **Makapans Caves**

The Makapans Caves are situated approximately 20km to the north-east of Mokopane and comprise a series of caves with evidence of hominid occupation (Australopithecus africanus) from approximately 3.3 million years ago. The Makapansgat Lime works are the oldest of the sites, spanning over a time range of 3.32 million years ago to about 1.6 million years ago. The Lime works has yielded hundreds of thousands of fossil bones amongst which are the scant remains of the hominid Australopithecus africanus (Dart R, 1925).

- **The Cave of Hearths.**

In Africa, the ESA (Early Stone Age) spans the period of ± 2.5 million years to around 250,000 years ago, and the earliest bed at the Cave of Hearths preserved stone tools and associated debris from a date of around 400,000 years ago. The cave is situated in the Makapans Valley approximately 20km to the north-east of Mokopane. The overlying beds preserved an intermittent but very long record of human occupation during the Middle Stone Age from ± 110,000 -50,000 years ago, and again in the Late Stone Age from 10,000 -5,000 years ago, and from Iron Age times almost up to the present (McKee, J.K 1995).

- **Moorddrift**

The farm Moorddrift 289 KR is situated adjacent and to the south of the farm Lisbon 288 KR, directly south of the town of Mokopane. It was the scene of one of three attacks on Boer parties in this region during September/October of 1854. Twelve Boer pioneers were murdered here and a monument was erected in 1937 to commemorate this unfortunate incident. More attacks took place at Mapela and at Pruizen. The attack at Moorddrift was executed by subjects of Chief Mokopane under Headman Lekalekale who resided at Lekalekaleskop west of Mokopane. This spate of attacks forced the Z.A.R-government and its military forces to retaliate

- **Makapansgat**

This cave is most famous as the scene of a clash between the Boer Commando of Piet Potgieter and the local Langa- and Kekana Ndebele of the region. The Boer Commando was on a punitive expedition after the attacks on Boer pioneers and Chief Makapan (Mokopane) then fled to these caves to escape from them. Chief Makapan (Mokopane), his tribes' people and their livestock were besieged in the cave for nearly a month between 25 October and 21 November 1854. During this time, many hundreds died of hunger and thirst or were shot by Boers. Piet Potgieter was also killed by one of Mokopane's men during the siege. The cave was declared a National Monument in 1936.

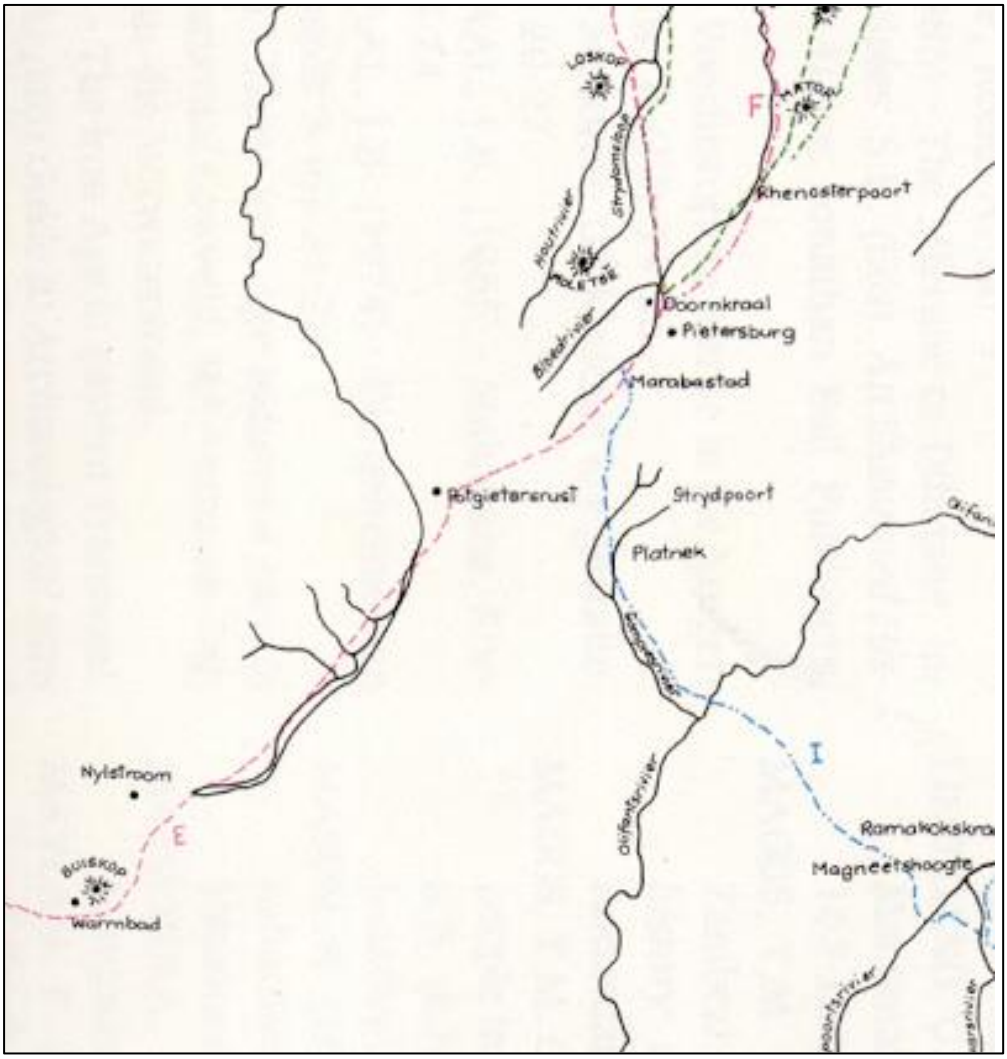

Figure 4-6: Early trek route (E) of Van Rensburg that was followed by Trichardt in 1836 (After De V. Pienaar 1990).

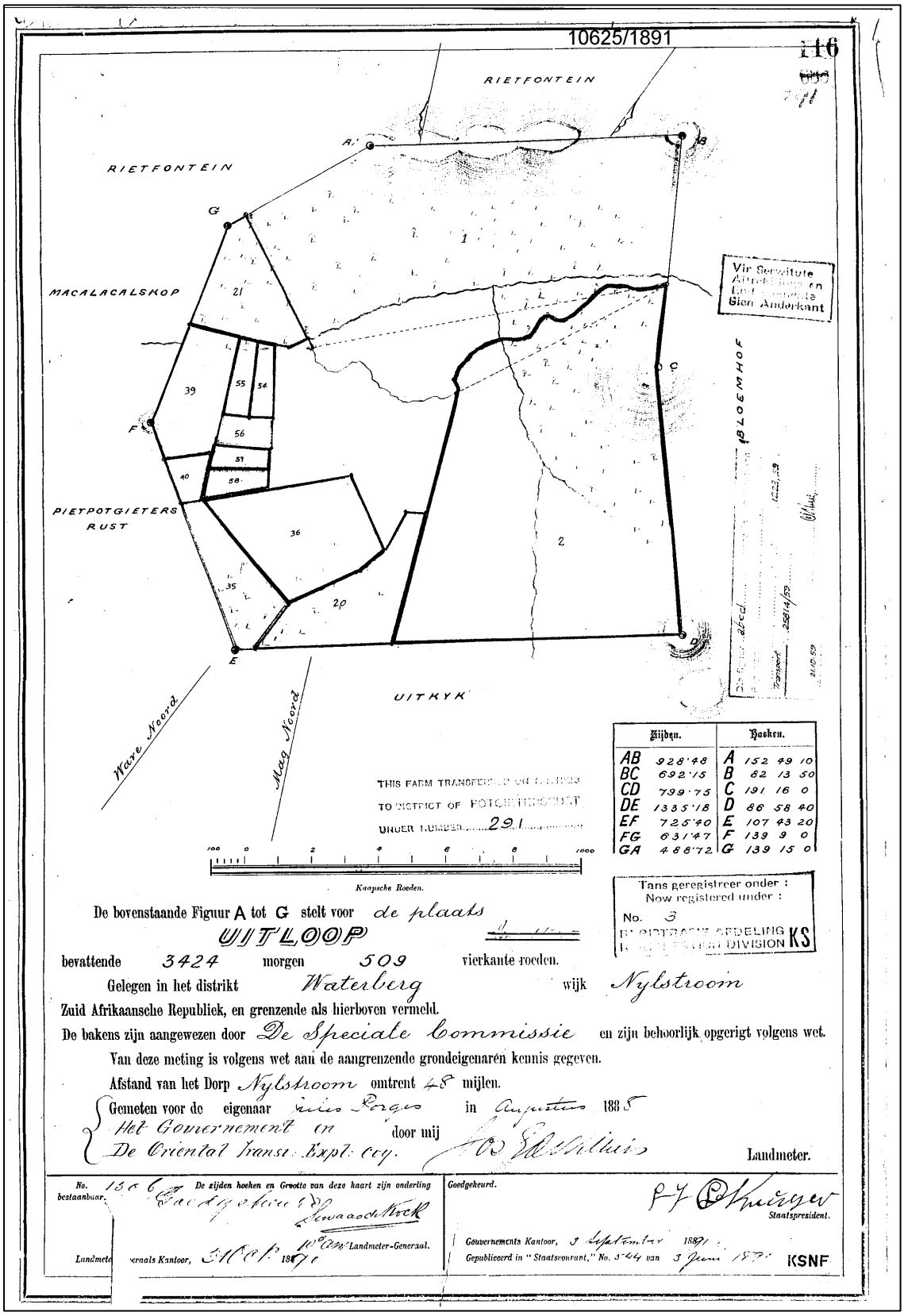

Figure 4-7: Title deed for the farm Uitloop dating to 1885.

5 RESULTS: THE PDA & AIA

5.1 Anticipated Paleontology[4]

5.1.1 Fossil Potential

Nickel sulphide will be mined from an intrusive pyroxenite-harzburgite-dunite body. It outcrops for 8 km by 1.5 km with a thickness of 600 m. The open pit design is considerably smaller than the mineralised zone with an approximate pit length of 1,150 m, with an average width on surface of 639 m and a depth of 220 m. The associated minerals will also be extracted. Mining will be via open pit mining methods.

The table below indicates the properties on which dolomite occurs.

Portion	Farm	Infrastructure
RE	Uitloop	Plants 1, 2, overburden 1
12	Uitloop	Overburden 4, TSF's 1, 4
49	Uitloop	Plant 1
48	Uitloop	Plant 1
20	Uitloop	Plant 1, Overburden 4, TSF 1
23	Uitloop	Plant 1
65	Uitloop	Plant 1
1	Amatava	Overburden 2, 4, TSF's 1, 3, 4
12	Amatava	TSF's 2, 3
14	Amatava	TSF's 2, 3
16	Amatava	Overburden 2, 4, TSF 3

Options that will have surface dolomite must be avoided if feasible.

Chemical sediments such as fine-grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.

Cyanobacteria have been described from the gold bearing conglomerates of the Witwatersrand Supergroup (MacRae 1999). These are significant recordings as it gives a possible indication of very early life forms, possibly ancient lichens that existed up to 2900 million years ago. These structures are for example associated with the Carbon Leader Seam in the Carletonville Goldfield, with native gold visible to the naked eye. Very large stromatolites can be found in the Campbell Rand Subgroup in the North West Province (Groenewald and Groenewald 2014).

Stromatolites are significant indicators of palaeoenvironments and provide evidence of algal growth between 2640 and 2432 million years ago (Groenewald and Groenewald 2014). Caves in the Malmani dolomite (Vmd) of the Transvaal Supergroup provided a refuge for man's distant ancestors (Norman and Whitfield 2006). These caves are also home to Middle and Late Stone Age cultures. The cave breccia in the

[4] Refer to Pether 2019

Cradle of Humankind, near Johannesburg, yielded internationally renowned hominins such as *Australopithecus africanus and robustus* and extinct mammals and other fauna. The caves are actively being researched and excavated and this has led to many international collaborations. The caves are filled with sediments from the Kalahari Group. The cave of Makapansgat is close by (20 km).

Figure 5-1: View of area containing Stone Age occurrences at Site Exigo-ZNM-SA01.

In the rocks overlying the Black Reef Formation there is evidence for life on an abundant scale as cyanobacteria came to dominate the shallow sea forming stromatolites of varying shapes. Large, elongate stromatolite domes can be seen at Boetsap in the North West Province (McCarthy and Rubidge 2005) and the algal microfossils reported from the Time Ball Hill Formation shales are probably of diagenetic origin (Eriksson 1999).

The Time Ball Hill Formation (Vt), Transvaal Supergroup is present in the Pretoria Group. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and may occur in the development area.

5.2 Anticipated Archaeology

5.2.1 The Off-Site Desktop Survey

In terms of heritage resources, the general landscape around the project area is primarily well known for its Stone Age, Iron Age and Colonial / Historical Period archaeology primarily related to prehistoric settlement and rural farming expansion. The larger landscape around Mokopane holds a rich history (see previous section) but no particular reference to archaeological sites or features of heritage potential were recorded during an examination of literature specifically related to the project area. A careful analysis of historical aerial imagery and archive maps reveals the following (see Figure 5-1 and Figure 5-2):

- Portions of Uitloop– and particularly areas subject to this assessment have been altered extensively by recent and historical farming, presumably during the 20th century.
- A number of farmsteads, so-called “huts” and man-made infrastructure occurred in the landscape of the project footprints by 1954.

Figure 5-2: An aerial image of proposed mining infrastructure on Uitloop dating to 1954, indicating the location of the project area (yellow outlines). Note the presence of agricultural lands (green arrows) and potential man-made structures (orange arrows).

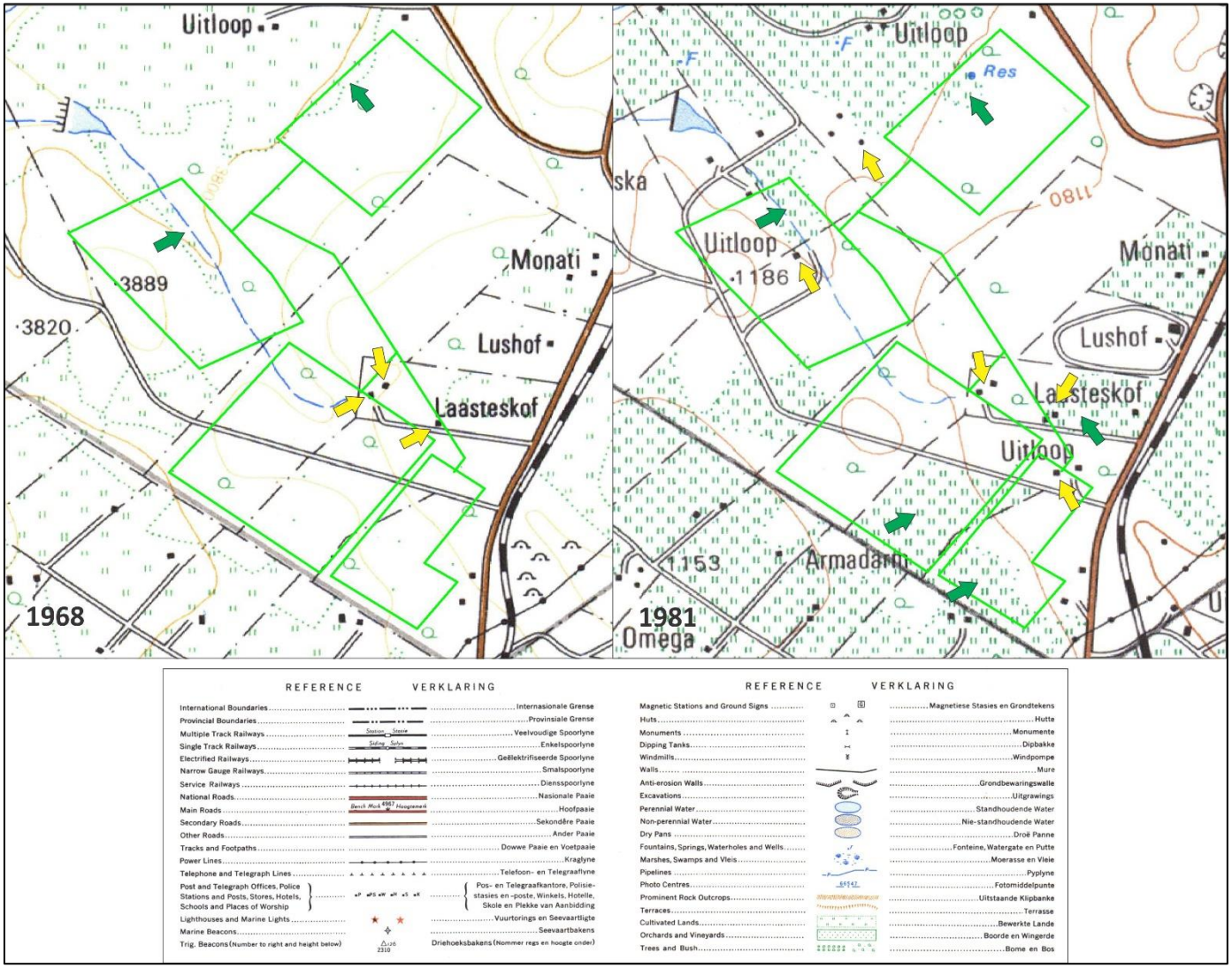

Figure 5-3: Historical topographic maps of Uitloop indicating the location of proposed mining infrastructure (green outline) in relation to indicated agricultural lands (green arrows) and man-made structures (yellow arrows).

5.3 The Archaeological Site Survey

An analysis of historical aerial imagery and archive maps of areas subject to this assessment suggests a varied landscape that ranges between densely vegetation natural habitats and areas which has been subjected to historical farming activities possibly sterilising the area of heritage remains. This inference was confirmed during archaeological site assessments where heritage remains were encountered across the project area. The following observations were made during the site survey.

5.3.1 The Stone Age

Out of context Stone Age archaeological material was noted in transformed areas of the project footprint. The density of the material scatter was arbitrarily estimated by placing a one-meter drawing frame, sub-divided into quadrants, on a randomly-selected area displaying higher amounts of surface lithics. By plotting the counts of all lithic elements present in the 1x1 metre square relative density per m^2 was established and rated on a scale of low (<10), medium (10-20) and high (>20). This method has been adapted as an expedient and non-invasive sampling technique that is particularly useful in value assessment of lithic occurrences during Phase 1 AIA's (see Van Der Ryst 2012).

- **Site Exigo-ZNM-SA01 Stone Age Scatter (-24.11819589 29.02046579)**
  Uitloop 3 KS Ptn 63
- **Site Exigo-ZNM-SA02 Stone Age Scatter (-24.11648548 29.02092696)**
  Uitloop 3 KS Ptn 51
- **Site Exigo-ZNM-SA03 Stone Age Scatter (-24.11648548 29.02092696)**
  Uitloop 3 KS Ptn 35

Stone Age remains occur abundantly in the larger Mokopane landscape where locally available raw material for the manufacture of stone tools is available in the geological landscape. Similarly, scatters of Stone Age artefacts were observed in low densities in the project area. Most of the artefacts are Middle Stone Age lithics such as blades and scrapers indicating various degrees of weathering and patination on the surface of the lithics. This might imply that they have been transported by water and have lain on the surface of the landscape for varying lengths of time. Hornfels is the predominant raw material used but quartzite and banded sandstone are also evident. No evidence of any factory or workshop site, or the result of any human settlement was identified in any of the project areas. The fairly small numbers and disturbed context in which they were found means that the archaeological remains in the Study Area have been rated as having moderate-low archaeological significance. It is highly likely that Earlier, Middle and possibly Later Stone Age scatters will occur in the area, specifically along drainage lines. The Stone Age sites are located within the demarcated footprint for the mine development and impact on the sites can be anticipated.

Figure 5-4: View of area containing Stone Age occurrences at Site Exigo-ZNM-SA01.

Figure 5-5: Highly weathered MSA tools from Site Exigo-ZNM-SA01.

Figure 5-6: View of densely vegetated area containing Stone Age occurrences at Site Exigo-ZNM-SA02.

Figure 5-7: Weathered MSA tools from Site Exigo-ZNM-SA02. Note the diagnostic broken blade on the left.

Figure 5-8: Decomposing calcrete exposures containing MSA tools at Site Exigo-ZNM-SA03.

Figure 5-9: A weathered MSA scraper from Site Exigo-ZNM-SA03.

Figure 5-10: Weathered MSA tools from Site Exigo-ZNM-SA03.

5.3.2 The Historical / Colonial Period

- **Site Exigo-ZNM-HP01 Historical Period Calcrete Quarry (-24.11647903 29.02882498)**
  Uitloop 3KS Ptn 0
- **Site Exigo-ZNM-HP03 Historical Period Calcrete Quarry (-24.11782499 29.01964612)**
  Uitloop 3KS Ptn 56

Two large open-air calcrete quarries probably dating to the recent Historical Period occurs on Portion 0 and Portion 56 of the farm Uitloop. The quarry at Site Exigo-ZNM-HP01 is approximately 30m long and in places more than 4m deep and heaps of large stones surround the open excavations. The quarry at Site Exigo-ZNM-HP03, excavated into calcrete is approximately 20m long and in places 2m deep. It seems that the quarries have been used until relatively recently based on excavations and material culture still visible at the sites. The sites are probably of limited research potential and they are rated as of low heritage significance.

Figure 5-11: View of Historical Period quarry site at Site Exigo-ZNM-HP01.

Figure 5-12: View excavated stone heaps at Site Exigo-ZNM-HP01.

Figure 5-13: View of Historical Period quarry site at Site Exigo-ZNM-HP03.

- **Site Exigo-ZNM-HP02 Historical Period Settlement Area (-24.117279 29.02177404)**
  Uitloop 3KS Ptn 0

A small settlement area consisting of the foundation remains of a rectangular stone building and material culture such as glass, metal, and plastic were noted on Portion 0 of the farm Uitloop. In addition, the remains of a stone-line footpath were noted. An absolute age for the structures could not be ascertained but an analysis of historical topographical maps and aerial photographs imply that the site was in use by around 1960 and it is likely that the site, along with Site Exigo-ZNM-HP04, formed a larger settlement complex. The site is probably around 60 years - and generally protected under the National Heritage Resource Act (NHRA 1999). The feature at the site are poorly preserved and of low heritage significance but there is a high risk that burials might be encountered around the settlement area.

Figure 5-14: View of a Historical Period settlement area at Site Exigo-ZNM-HP02. Note the occurrence of surface artifacts.

Figure 5-15: View of a Historical Period settlement area at Site Exigo-ZNM-HP02. Note stone-lined walkway.

Figure 5-16: View of a Historical Period settlement foundation at Site Exigo-ZNM-HP02.

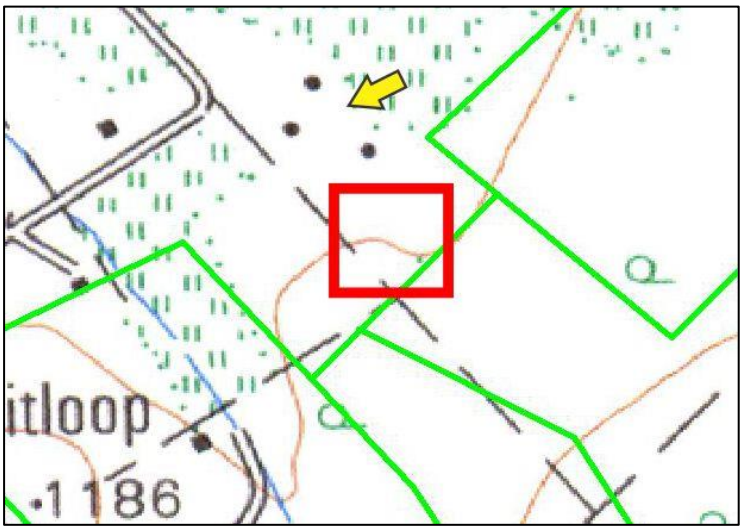

Figure 5-17: A topographic map of the project area around Site Exigo-ZNM-HP02 at around 1969. Even though no man-made structures are noted as Site Exigo-ZNM-HP02, so-called "huts" are indicated directly north of the site.

- **Site Exigo-ZNM-HP04 Historical Period Settlement Area (-24.11849622 29.02150934)**
  Uitloop 3KS Ptn 57

Another small settlement area consisting of the scattered remains of stones probably used for building as well as material culture such as glass, metal, and plastic were noted on Portion 57 of the farm Uitloop. An absolute age for the structures could not be ascertained but an analysis of historical topographical maps and aerial photographs imply that the site was in use by around 1960 and it is likely that the site, along with Site Exigo-ZNM-HP02, formed a larger settlement complex. The site is probably around 60 years - and generally protected under the National Heritage Resource Act (NHRA 1999). The feature at the site are poorly preserved and of low heritage significance but there is a high risk that burials might be encountered around the settlement area.

Figure 5-18: Dated glass and metal noted on the surface at Site Exigo-ZNM-HP04.

Figure 5-19: A metal tin can from Site Exigo-ZNM-HP04.

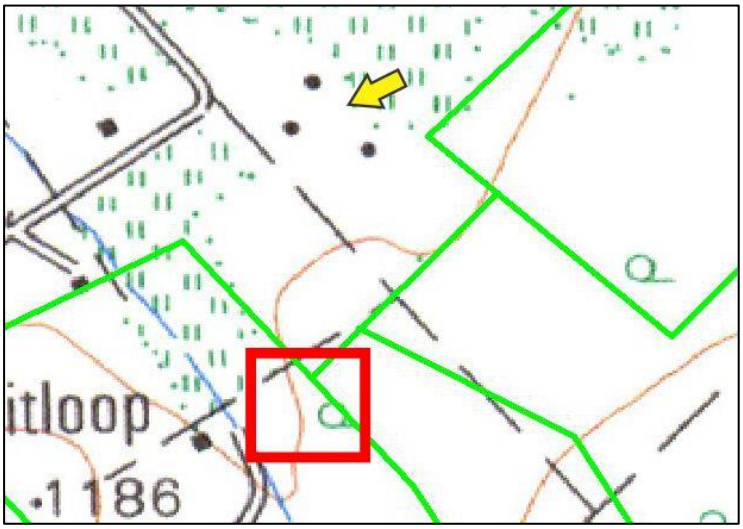

Figure 5-20: A topographic map of the project area around Site Exigo-ZNM-HP04 at around 1969. Even though no man-made structures are noted as Site Exigo-ZNM-HP02, so-called "huts" are indicated in the landscape north of the site.

5.3.3 Graves and Burials

At least 5 graves or potential burial sites were identified across the project area. The burial places hold various numbers of graves, a number of which might be older than 60 years or unmarked. In many instances, burial locations in this area follow a general (and fairly common) pattern where graves occur around the remains of historical house structures and homestead complexes.

- **Site Exigo-ZNM-BP01 Stone Cairn Burial (-24.11819589 29.02046579)**
  Uitloop 3KS Ptn 57

A square stone structure, probably indicating a grave was noted in association with Site Exigo-ZNM-HP04 on Portion 57 the farm Uitloop 3KS. The burial is indicated by a rectangular stone structure filled in with soil. The site is not fenced off and its condition of preservation is poor. No material culture was noted on the surface in association with the grave. The burial site, which is of high heritage significance, occurs in close proximity of the demarcated infrastructure footprints for the mine development and impact on the site can be anticipated.

Figure 5-21: View of the burial structure at Site Exigo-ZNM-BP01.

- **Site Exigo-ZNM-BP02 Stone Cairn Burials (-24.11648548 29.02092696)**

  Uitloop 3KS Ptn 0

A number of graves occur in a densely vegetated section of Portion 0 the farm Uitloop 3KS. The burials, which were first identified by Roodt in 2008[5] are indicated by crudely stacked stone cairns. The site is not fenced off and its condition of preservation is poor. No material culture was noted on the surface in association with the graves. The burial site, which is of high heritage significance, occurs in proximity of the demarcated footprint for the mine development and impact on the site might occur.

Figure 5-22: View of densely overgrown burial structures at Site Exigo-ZNM-BP02.

[5] Roodt. F. 2008. Heritage Resources Scoping Report N11 road re-alignment Mokopane : Limpopo. R&R Consultants

- **Site Exigo-ZNM-BP03 Stone Cairn Burials (-24.11648548 29.02092696)**
  Uitloop 3KS Ptn 0
- **Site Exigo-ZNM-BP04 Stone Cairn Burials (-24.11906099 29.01328049)**
  Uitloop 3KS Ptn 39
- **Site Exigo-ZNM-BP05 Stone Cairn Burials (-24.12028399 29.02022724)**
  Uitloop 3KS Ptn 57

A number of graves or presumed graves occur on various portions of Uitloop in densely vegetated sections of the project area. The possible burials are indicated by crudely stacked stone cairns. The sites are not fenced off and the condition of preservation of the burials is generally poor. The burial sites, which are of high heritage significance, occur within or in close proximity of the demarcated footprint for the mine development apart from Site Exigo-ZNM-BP04 which occurs in the larger project area and impact on the sites can be anticipated.

Figure 5-23: View of a potential burial cairn structure at Site Exigo-ZNM-BP03.

Figure 5-24: View of a potential burial cairn structure at Site Exigo-ZNM-BP04.

Figure 5-25: View of potential burial cairn structures at Site Exigo-ZNM-BP05.

5.3.4 Other sites / features.

- **Site Exigo-ZNM-FT01 Stone Features / Structures (-24.11420301 29.02912203)**
  Uitloop 3KS Ptn 0

An irregular stone structure or stone cairn was noted on Portion 0 of the Farm Uitloop in a densely vegetated section of the project area. The function of the feature is not known but it might indicate prehistoric or Historical Period burials. As such, the heritage significance of the feature remains to be established and is therefore unknown. The site is located within the demarcated footprint for the mine development and impact on the site can be anticipated.

Figure 5-26: View of an unidentified stone structure in the project area.

Figure 2-27: Aerial map indicating the locations of heritages sites discussed in the text.

6 RESULTS: STATEMENT OF SIGNIFICANCE AND IMPACT RATING

The following section provides a background to the identification and assessment of possible impacts and alternatives, as well as a range of risk situations and scenarios commonly associated with heritage resource management. A guideline for the rating of impacts and recommendation of management actions for areas of heritage potential within the study area is supplied in Section 10.2 of Addendum 3.

6.1 Impact Assessment: Palaeontology

6.1.1 Nature of the impact of development on fossils

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of sedimentary rock strata the palaeontological sensitivity is generally LOW to VERY HIGH, but here locally **HIGH** for the Chuniespoort Group, Transvaal Supergroup.

Table 1: Criteria used (Fossil Heritage Layer Browser/SAHRA).

Rock Unit	Significance/vulnerability	Recommended Action
Chuniespoort Group	High	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely. A Palaeontological Impact Assessment: Phase 1: Field Study was undertaken in July 2019.

6.2 Impact Assessment: Archaeology

6.2.1 General assessment of impacts on resources

Generally, the value and significance of archaeological and other heritage sites might be impacted on by any activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). Thus, the destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. However, in the long run, the proximity of operations in any given area could result in secondary indirect impacts. The EIA process therefore specifies impact assessment criteria which can be utilised from the perspective of a heritage specialist study which elucidates the overall extent of impacts.

6.2.2 Direct impact rating

Direct or primary impacts on heritage resources occur at the same time and in the same space as the activity, e.g. loss of historical fabric through demolition work. **Indirect impacts or secondary impacts** on heritage resources occur later in time or at a different place from the causal activity, or as a result of a complex pathway, e.g. restriction of access to a heritage resource resulting in the gradual erosion of its significance, which is dependent on ritual patterns of access (refer to Section 10.3 in the Addendum for an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected).

The significance of the impacts were determined through a synthesis of the criteria below:

Probability: This describes the likelihood of the impact actually occurring.	
Improbable:	The possibility of the impact occurring is very low, due to the circumstances, design or experience.
Probable:	There is a probability that the impact will occur to the extent that provision must be made therefore.
Highly Probable	It is most likely that the impact will occur at some stage of the development.
Definite:	The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.
Duration: The lifetime of the impact	
Short term:	The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
Medium term:	The impact will last up to the end of the phases, where after it will be negated.
Long term:	The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
Permanent:	Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.
Scale: The physical and spatial size of the impact	
Local:	The impacted area extends only as far as the activity, e.g. footprint
Site:	The impact could affect the whole, or a measurable portion of the above mentioned properties.
Regional:	The impact could affect the area including the neighbouring residential areas.
Magnitude/ Severity: Does the impact destroy the environment, or alter its function.	
Low:	The impact alters the affected environment in such a way that natural processes are not affected.
Medium:	The affected environment is altered, but functions and processes continue in a modified way.
High:	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.	
Negligible:	The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
Low:	The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
Moderate:	The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High:	The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The following weights were assigned to each attribute:

Aspect	Description	Weight
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4

	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8
Significance	**Sum (Duration, Scale, Magnitude) x Probability**	
	Negligible	<20
	Low	<40
	Moderate	<60
	High	>60

The significance of each activity is rated without mitigation measures and with mitigation measures for both construction and operational phases of the development.

The mitigation effect of each impact will be indicated without and with mitigation measures as follows:

- Can be reversed
- Can be avoided, managed or mitigated
- May cause irreplaceable loss of resources

The following table summarizes impacts to the **heritage receptors** within and in close proximity of the project areas:

	Impact	Without or With Mitigation	Nature (Negative or Positive Impact)	Probability		Duration		Scale		Magnitude/ Severity		Significance		Mitigation Measures	Mitigation Effect	Residual Impact
				Magnitude	Score	Magnitude	Score	Magnitude	Score	Magnitude	Score	Score	Magnitude			
Heritage Impact Assessment																
Planning Phase																
	Exigo-ZNM-SA01 (Stone Age) impacted by Open Pit	**WOM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible			No
1		**WM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible	Apply for destruction permits.	N/A	No
	Exigo-ZNM-SA02, Exigo-ZNM-SA03 (Stone Age) impacted by Overburden	**WOM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible			No
2		**WM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible	Apply for destruction permits.	N/A	No
	Exigo-ZNM-HP01 - Exigo-ZNM-HP04 (Historical Period) impacted by Mine Plant, Open Pit and Mine Roads	**WOM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible			No
3		**WM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible	Apply for destruction permits.	N/A	No
	Exigo-ZNM-BP01 - Exigo-ZNM-BP05 (Burials) impacted by Mine Plant, Open Pit and Mine Roads	**WOM**	Negative	Improbable	1	Short term	1	Local	1	High	8	10	Negligible	Plan a heritage conservation buffer of at least 50m around all graves. Redesign project layout and road alignments to avoid the burial sites and the proposed conservation buffers where possible, especially with regards to sites Exigo-ZNM-BP03 and Exigo-ZNM-BP01.		No
4		**WM**	Negative	Improbable	1	Short term	1	Local	1	Low	2	4	Negligible	Apply for permit to SAHRA for grave relocation where graves are impacted upon with regards to Site Exigo-ZNM-BP05 which is impacted by the open pit. Should sites Exigo-ZNM-BP03 and Exigo-ZNM-BP01 or their 50m conservation buffer be impacted by mining activities, grave relocations subject to permitting will have to be implemented for these sites as well.	Can be avoided, managed or mitigated	No
Construction Phase																
	Exigo-ZNM-SA01 (Stone Age) impacted by Open Pit	**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Low	2	36	Low	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
5		**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		N/A	No
6		**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Low	2	36	Low	No mitigation is required General site monitoring by informed ECO. Should any subsurface	N/A	No

	Exigo-ZNM-SA02, Exigo-ZNM-SA03 (Stone Age) impacted by Overburden	**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible	palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
	Exigo-ZNM-HP01 - Exigo-ZNM-HP04 (Historical Period) impacted by Mine Plant, Open Pit and Mine Roads	**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Low	2	36	Low	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
7		**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		N/A	No
	Exigo-ZNM-BP01 - Exigo-ZNM-BP05 (Burials) impacted by Mine Plant, Open Pit and Mine Roads	**WOM**	Negative	Highly Probable	4	Permanent	5	Regional	3	High	8	64	High	Implement a heritage conservation buffer of at least 50m around the grave. Erect a fence around the burial site and apply access control with signage to indicate visitation contacts. implementation of a site management plan detailing site management conservation measures. Strict and continuous monitoring of the heritage site during construction. Apply for permit to SAHRA for grave relocation where graves are impacted upon with regards to Site Exigo-ZNM-BP05 which is impacted by the open pit. Should sites Exigo-ZNM-BP03 and Exigo-ZNM-BP01 or their 50m conservation buffer be impacted by mining activities, grave relocations subject to permitting will have to be implemented for these sites as well. General site monitoring by informed ECO.		Yes
8		**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		Can be avoided, managed or mitigated	No
Operational Phase																
	Exigo-ZNM-SA01 (Stone Age) impacted by Open Pit	**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Low	2	36	Low	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during operational activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
9		**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		N/A	No
	Exigo-ZNM-SA02, Exigo-ZNM-SA03 (Stone Age) impacted by Over Burden	**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Low	2	36	Low	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during operational activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
10		**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		N/A	No
	Exigo-ZNM-HP01 - Exigo-ZNM-HP04 (Historical Period) impacted by Mine Plant, Open Pit and Mine Roads	**WOM**	Negative	Highly Probable	4	Permanent	5	Site	2	Low	2	36	Low	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during operational activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
11		**WM**	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible		N/A	No
12	Exigo-ZNM-BP01 - Exigo-ZNM-BP05 (Burials) impacted by Mine Plant, Open Pit and Mine Roads	**WOM**	Negative	Highly Probable	4	Permanent	5	Regional	3	High	8	64	High	Implement a heritage conservation buffer of at least 50m around the grave. Erect a fence around the burial site and apply access control with signage to indicate visitation contacts. implementation of a site management plan detailing site management conservation measures. Strict and continuous monitoring of the heritage site during	Can be avoided, managed or mitigated	Yes

		WM	Negative	Probable	2	Long term	4	Site	2	Low	2	16	Negligible	operations. Apply for permit to SAHRA for grave relocation where graves are impacted upon with regards to Site Exigo-ZNM-BP05 which is impacted by the open pit. Should sites Exigo-ZNM-BP03 and Exigo-ZNM-BP01 or their 50m conservation buffer be impacted by mining activities, grave relocations subject to permitting will have to be implemented for these sites as well. General site monitoring by informed ECO.		No
Closure and Decommissioning Phase																
	Exigo-ZNM-SA01 (Stone Age) impacted by Open Pit	WOM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during decommissioning activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
13		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible		N/A	No
	Exigo-ZNM-SA02, Exigo-ZNM-SA03 (Stone Age) impacted by Over Burden	WOM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during decommissioning activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
14		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible		N/A	No
	Exigo-ZNM-HP01 - Exigo-ZNM-HP04 (Historical Period) impacted by Mine Plant, Open Pit and Mine Roads	WOM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during decommissioning activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
15		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible		N/A	No
	Exigo-ZNM-BP01 - Exigo-ZNM-BP05 (Burials) impacted by Mine Plant, Open Pit and Mine Roads	WOM	Negative	Improbable	1	Short term	1	Site	2	High	8	11	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during decommissioning activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
16		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible		N/A	No
Post-Closure & Rehabilitation Phase																
	Exigo-ZNM-SA01 (Stone Age) impacted by Open Pit	WOM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during rehabilitation activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
17		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible		N/A	No
	Exigo-ZNM-SA02, Exigo-ZNM-SA03 (Stone Age) impacted by Over Burden	WOM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during rehabilitation activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
18		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible		N/A	No
19	Exigo-ZNM-HP01 - Exigo-ZNM-HP04 (Historical Period) impacted	WOM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	No mitigation is required General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials	N/A	No

	by Mine Plant, Open Pit and Mine Roads	WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	be exposed during rehabilitation activities, all activities should be suspended and the archaeological specialist should be notified immediately.		No
	Exigo-ZNM-BP01 - Exigo-ZNM-BP05 (Burials) impacted by Mine Plant, Open Pit and Mine Roads	WOM	Negative	Improbable	1	Short term	1	Site	2	High	8	11	Negligible	No mitigation is required		No
20		WM	Negative	Improbable	1	Short term	1	Site	2	Low	2	5	Negligible	General site monitoring by informed ECO. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during rehabilitation activities, all activities should be suspended and the archaeological specialist should be notified immediately.	N/A	No

The following table summarizes impacts to the **palaeontological receptors** within and in close proximity of the project areas:

No	Activity	Impact	Without or With Mitigation	Nature (Negative or Positive Impact)	Probability		Duration		Scale		Magnitude Severity		Significance		Residual Impact	Estimated size and scale of disturbance	Mitigtion Measures	Migitation Type	Mitigation Effect	Compliance with Standards
Palaeontological Impacts																				
Construction Phase																				
62	Construction of buildings, dams, roads, pylons. Exploration for mining	Destruction of stromatolites	WOM	Negative	Highly Probable	4	Permanent	5	Local	1	Low	2	32	Low	No	±140 ha	Palaeontological site visit must be done in areas earmarked for construction. Palaeontologist must be appointed if stromatolites are exposed.	Control measure	Can be avoided, managed or mitigated	NHRA
			WM		Highly Probable	4	Permanent	5	Local	1	Low	2	32	Low	No					
63	Construction of buildings, dams, roads, pylons. Exploration for mining	Destruction of fossils.	WOM	Negative	Highly Probable	4	Permanent	5	Local	1	High	8	56	Moderate	No		Palaeontological site visit must be done in areas earmarked for construction. Palaeontologist must be appointed if fossils are exposed.	Control measure	May cause irreplaceable loss of resources	
			WM		Probable	2	Permanent	5	Local	1	Low	2	16	Negligible	No				Can be avoided, managed or mitigated	
64	Construction of buildings, dams, roads, pylons. Exploration for mining	Preservation of fossils.	WOM	Positive	Improbable	1	Permanent	5	Local	1	Low	2	8	Negligible	No		Positive impact - no mitigation recommended.	Control measure	May cause irreplaceable loss of resources	
			WM		Highly Probable	4	Permanent	5	Local	1	Medium	6	48	Moderate	No				Can be avoided, managed or mitigated	

6.3 Evaluation Impacts

A number of archaeological and historical studies have been conducted in the Mokopane area which points to a rich and diverse archaeological landscape. The heritage legacy of this area is mostly dominated by Stone Age, Iron Age Farmer and Colonial Period occurrences. Numerous sites, documenting Stone Age habitation occur across the Waterberg and Iron Age Farmer sites are prevalent on hills or along arable sediments alongside rivers or water sources. Moving into recent times, the archaeological record reflects the development of a rich colonial frontier, characterised by, amongst others complex social developments related to the expansion of farms and towns in the area.

6.3.1 Palaeontology

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Stromatolites are likely to be present in the dolomites. These structures range from a centimetre to several tens of metres in size. They are the result of algal growth in shallow water, indicating a very rich growth that would have caused an enrichment in the amount of oxygen in the atmosphere (Groenewald and Groenewald 2014). Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to lush vegetation, thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. The threats are: earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance.

6.3.2 Archaeology

Stone Age remains occur abundantly in the larger Mokopane landscape where locally available raw material for the manufacture of stone tools is available in the geological landscape. Similarly, scatters of Stone Age artefacts were observed in low densities in the project area. The fairly small numbers and disturbed context in which they were found means that the archaeological remains in the Study Area have been rated as having moderate-low archaeological significance. However, *in situ* Stone Age remains might occur in untransformed contexts around the project area. Cognizant thereof, impacts on these archaeological receptors can be expected.

6.3.3 Built Environment

The project area is situated north of the town of Mokopane where a number of Historical Period buildings and features, monuments and heritage sites are to be found. In the immediate surroundings of the project area is a number of Colonial Period farmsteads and features of heritage value. Settlement area and the remains of Historical Period dwellings in the project area might be older than 60 years and generally protected under the National Heritage Resource Act (NHRA 1999), but the features are generally poorly preserved and notable heritage or historical associations to the sites could not be established. As such, these sites are rated as of moderate-low significate. A Historical Period farmhouse in the project area is older than 60 years and generally protected under the National Heritage Resource Act (NHRA 1999). The structure is well preserved and it might be of heritage or historical value in terms of its architectural representation within the larger landscape. As such, the site is rated as of moderate significate and the receptor might be impacted on by the project.

6.3.4 Cultural Landscape

The larger Mokopane area comprises a rich pre-colonial and colonial cultural landscape but, in many instances, properties demarcated by the project area have been transformed by agriculture and rural

expansion. The larger region has seen urban development and dense settlement in recent years and the landscape in all its variation stretches over many kilometres, where the proposed project might add to a change in this rapidly developing landscapes' sense of place.

6.3.5 Graves / Human Burials Sites

At least 5 burial sites or possible burial sites / graves were noted on a number of farm portions in the project area. These receptors are of high significance for their heritage, social and cultural value. The potential impact on the resources is regarded as HIGH but this impact rating can be limited to a NEGLIBLE impact by the implementation of mitigation measures (avoidance, site management, site monitoring / grave relocation) for the sites, if / when required. In the rural areas of the Limpopo Province, graves and cemeteries often occur around farmsteads in family burial grounds but they are also randomly scattered around archaeological and historical settlements. The probability of informal human burials encountered during development should thus not be excluded. In addition, human remains and burials are commonly found close to archaeological sites; they may be found in "lost" graveyards, or occur sporadically anywhere as a result of prehistoric activity, victims of conflict or crime. It is often difficult to detect the presence of archaeological human remains in the landscape as these burials, in most cases, are not marked at the surface. Human remains are usually observed when they are exposed through erosion. In some instances, packed stones or rocks may indicate the presence of informal pre-colonial burials. Where human remains are part of a burial sites, it would need to be exhumed under a permit from either SAHRA (for pre-colonial burials as well as burials later than about AD 1500). Should any unmarked human burials/remains be found during the course of excavation/construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). Under no circumstances may burials be disturbed or remains removed until such time as necessary statutory procedures required for grave relocation have been met.

Figure 6-1: Aerial map indicating heritages sites and relevant conservation buffers discussed in the text.

6.4 Management actions

Recommendations for relevant heritage resource management actions are vital to the conservation of heritage resources. A general guideline for recommended management actions is included in Section 10.4 of Addendum 3.

OBJECTIVE: ensure conservation of heritage resources of significance, prevent unnecessary disturbance and/or destruction of previously undetected heritage receptors.

6.4.1 Palaeontology

The following procedures have been made with regards to palaeontology:

- The overburden and inter-burden must always be surveyed for fossils during construction or mining. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden during construction not to intrude upon fossiliferous layers. This should be overseen by an Environmental Control Officer.
- Care must be taken during the dolomite risk assessment according to SANS 1936-1 (2012) as stromatolites may be present.
- Mitigation may be needed if a fossil is found, in this case, the area must be fenced off with a no-go barrier of 30 m.
- As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to monitor the construction activities in line with the legally binding Environmental Management Programme (EMPr) so that when a fossil is unearthed they can notify the relevant department and specialist to further investigate. Therefore, the EMPr must be updated to include the involvement of a palaeontologist (for training of ECO and in an advisory capacity). The ECO together with the mine geologist must survey for fossils after blasting, digging and excavation (ground breaking).
- If a fossil is found, all construction must stop, and SAHRA must be notified. The Environmental Control Officer must familiarise him- or herself with the Malmani Subgroup fossils

6.4.2 Archaeology

No specific action in terms of mitigation is required for the feature of unknown provenance (Exigo-ZNM-FT01) in the footprint areas of the Zebediela Nickel Mine Project.

For the Stone Age Occurrences (Exigo-ZNM-SA01, Exigo-ZNM-SA02, Exigo-ZNM-SA03) and Historical Period sites and features (Exigo-ZNM-HP01 - Exigo-ZNM-HP04) within or near the footprint areas of the Zebediela Nickel Mine Project) the following are required in terms of heritage management and mitigation:

PROJECT COMPONENT/S	All phases of construction and operation.		
POTENTIAL IMPACT	Damage/destruction of sites.		
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.		
MITIGATION: TARGET/OBJECTIVE	To locate previously undetected heritage remains / graves as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.		
MITIGATION: ACTION/CONTROL		**RESPONSIBILITY**	**TIMEFRAME**
Fixed Mitigation Procedure (**required**)			
Site Monitoring: Regular examination of trenches and		ECO	Monitor as

excavations. **Destruction Permitting:** Application for a destruction permit prior to impact on the sites.			frequently as practically possible.
PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.		
MONITORING	Successful location of sites by person/s monitoring.		

For the highly significant single burial sites (Exigo-ZNM-BP01 - Exigo-ZNM-BP05) occurring within the footprint areas of the Zebediela Nickel Mine Project the following are required in terms of heritage management and mitigation:

PROJECT COMPONENT/S	All phases of construction and operation.		
POTENTIAL IMPACT	Damage/disturbance to subsurface burials and surface burial features.		
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.		
MITIGATION: TARGET/OBJECTIVE	To locate human burials as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.		
MITIGATION: ACTION/CONTROL		**RESPONSIBILITY**	**TIMEFRAME**
Preferred Mitigation Procedure			
Avoidance: Implement a heritage conservation buffer of at least 50m around the grave, redesign project layout and road alignments to avoid the heritage resource and the proposed conservation buffer. Erect a fence around the burial site and apply access control with signage to indicate visitation contacts. Strict and continuous monitoring of the heritage site during construction, implementation of a site management plan detailing site management conservation measures.		DEVELOPER QUALIFIED HERITAGE SPECIALIST	Prior to the commencement of construction and earth-moving.
Alterative Mitigation Procedure (**if preferred mitigation procedure is not feasible**)			
Grave relocation: relocation of the burial to the nearby cemetery, documentation of site, full social consultation with affected parties, possible conservation management and protection measures. Subject to authorisations and relevant permitting from heritage authorities and affected parties		QUALIFIED HERITAGE SPECIALIST	Prior to the commencement of construction and earth-moving.
Fixed Mitigation Procedure (**required**)			
Site Monitoring: Regular examination of trenches and excavations in this area in order to avoid the destruction of previously undetected burials or heritage remains.		ECO	Monitor as frequently as practically possible.
PERFORMANCE INDICATOR	Burials and archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.		
MONITORING	Successful location of sites by person/s monitoring.		

7 RECOMMENDATIONS

The larger landscape around the project area indicate a rich heritage horizon encompassing Stone Age, Herder and Colonial / Historical Period archaeology primarily related to the development of agriculture resulting in farm occupation and realization. Cognisance should thus be taken of archaeological material that might be present in surface and sub-surface deposits along drainage lines and in pristine areas.

In terms of palaeontology, fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. The development will partly sit on the dolomite and chert of the Chuniespoort Group, Transvaal Supergroup and if there is the presence of sedimentary rocks the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, here locally **HIGH** for the Chuniespoort Group. Stromatolites are likely to be present in the dolomites. These structures range from a centimetre to several tens of metres in size. They are the result of algal growth in shallow water, indicating a very rich growth that would have caused an enrichment in the amount of oxygen in the atmosphere. Stromatolites are significant indicators of palaeoenvironments and provide evidence of algal growth between 2640 and 2432 million years ago. The following general observations and recommendations are made based on the fossil potential of the project area.

- Since the development will partly sit on the dolomite and chert of the Chuniespoort Group, Transvaal Supergroup, areas with dolomite present on the surface should be avoided if possible. There are two formations in the development area that contains chert and dolomite namely, the Malmani Subgroup and the Duitschland Formation.
- The impact of the development on fossil heritage is **HIGH** and therefore a field survey or further mitigation or conservation measures may be necessary for this development (according to SAHRA protocol) if fossils are found during excavating, digging or blasting.
- Concerns/threats to fossils include earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction, digging of foundations, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, and human disturbance.
- The overburden and inter-burden must always be surveyed for fossils during construction or mining. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden during construction not to intrude upon fossiliferous layers. This should be overseen by an Environmental Control Officer.
- Care must be taken during any dolomite risk assessment according to SANS 1936-1 (2012) as stromatolites may be present.
- Mitigation may be needed if a fossil is found, in this case, the area must be fenced off with a no-go barrier of 30 m.
- As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to monitor the construction activities in line with the legally binding Environmental Management Programme (EMPr) so that when a fossil is unearthed they can notify the relevant department and specialist to further investigate. Therefore, the EMPr must be updated to include the involvement of a palaeontologist (for training of ECO and in an advisory capacity). The ECO together with the mine geologist must survey for fossils after blasting, digging and excavation (ground breaking).
- The development may go ahead with caution, if a fossil is found, all construction must stop, and SAHRA must be notified. The Environmental Control Officer must familiarise him- or herself with the Malmani Subgroup fossils.

In terms of archaeology, it has been noted that the proposed project area has seen significant transformation as a result of historical and recent agricultural practices risking the sterilization of these zones of heritage

remains. As such, single areas of heritage potential were identified during the site survey and the following general recommendations are made based on general observations in the proposed Zebediela Nickel Mine Project area:

- A small number of Middle Stone Age (MSA) artefacts were noted at three localities in the project area (**Site Exigo-ZNM-SA01, Site Exigo-ZNM-SA02, Site Exigo-ZNM-SA03).** The fairly small numbers and disturbed context in which they were found means that these archaeological remains have been rated as having low archaeological significance. However, it is likely that *in situ* Stone Age remains might occur in previously untransformed and undetected contexts in the larger landscape. As such, it is recommended that these areas be monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains.
- Two Historical Period quarries and the remains of two Historical Period settlement areas (**Site Exigo-ZNM-HP01 - Site Exigo-ZNM-HP04)** in the project area might be older than 60 years and generally protected under the National Heritage Resource Act (NHRA 1999). The features are generally poorly preserved and notable heritage or historical associations to the sites could not be established. As such, these sites are rated as of low significate but it is recommended that these areas be monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains. The necessary destruction permits should be obtained from the relevant Heritage Resources Authorities prior to site alteration or destruction. Generally, the sites should be closely monitored by an informed ECO in order to avoid the destruction of previously undetected heritage remains or human burial sites.
- At least 5 burial sites or possible burial sites / graves were noted on a number of farm portions in the project area (**Site Exigo-ZNM-BP01 - Site Exigo-ZNM-BP05)**. These receptors are of high significance for their heritage, social and cultural value. It is primarily recommended that a 50m conservation buffer be implemented around all the burial sites. In addition, infrastructure components proposed for the project should be designed in such a way as to avoid encroaching on the required 50m conservation buffer. It is further recommended that the burial sites be fenced off with wire, chicken wire or palisade fencing of a minimum height of 1.8m placed no closer than 2m from the burials. Each burial should have an access gate and access control should be applied to the site. A heritage Site Management Plan (SMP) should be compiled for each of the burials to stipulate conservation measures, responsible persons and chance find procedures for further heritage mitigation. The developer should carefully liaise with the heritage specialist, SAHRA as well as local communities and possible affected parties with regards to the management and monitoring of any human grave or cemetery in order to detect and manage negative impact on the sites. **Should impact on any of the burial sites prove inevitable, full grave relocations are recommended for these burial grounds. This measure should be undertaken by a qualified archaeologist, and in accordance with relevant legislation, permitting, statutory permissions and subject to any local and regional provisions and laws and by-laws pertaining to human remains. A full social consultation process with the descendant family and other affected parties should occur in conjunction with the mitigation of cemeteries and burials (see Addendum B).**
- It should be noted that the site survey of certain Portions of Uitloop (particularly Portions 51, 52 and Portion 0) proved to be highly constrained by dense and often impenetrable vegetation. Dense vegetation not only restricted free movement on the site but obstructed much of the farm in terms of surface visibility. As such, the possibility exists that individual sites could be missed and it recommended that the initial stages of the development be monitored to re-assess the presence of possible heritage resources in the project area.

- As burials have been located on the project property, it is recommended that the EIA public participation and social consultative process address the possibility of further graves occurring in the project area.
- Considering the localised nature of heritage remains, the general monitoring of the development progress by an ECO or by the heritage specialist is recommended for all stages of the project. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the Study Area along water sources and drainage lines, fountains and pans, which would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development.

In addition to these site-specific recommendations, careful cognizance should be taken of the following:

- As Palaeontological remains occur where bedrock has been exposed, all geological features should be regarded as sensitive.
- Water sources such as drainage lines, fountains and pans would often have attracted human activity in the past. As Stone Age material occur in the larger landscape, such resources should be regarded as potentially sensitive in terms of possible subsurface deposits.

8 GENERAL COMMENTS AND CONDITIONS

This HIA report serves to confirm the extent and significance of the heritage landscape of the proposed Zebediela Nickel Mine Project area. The larger heritage horizon encompasses rich and diverse archaeological landscapes and cognisance should be taken of heritage resources and archaeological material that might be present in surface and sub-surface deposits. If, during construction, any possible archaeological material culture discoveries are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find. Such material culture might include:

- Formal Early Stone Age stone tools.
- Formal Middle Stone Age stone tools.
- Formal Late Stone Age stone tools.
- Potsherds.
- Iron objects.
- Beads made from ostrich eggshell and glass.
- Ash middens and cattle dung deposits and accumulations.
- Faunal remains.
- Human remains/graves.
- Stone walling or any sub-surface structures.
- Historical glass, tin or ceramics.
- Fossils.

If such sites were to be encountered or impacted by any proposed developments, recommendations contained in this report, as well as endorsement of mitigation measures as set out by AMAFA, SAHRA, the National Resources Act and the CRM section of ASAPA will be required. It must be emphasised that the conclusions and recommendations expressed in this archaeological heritage sensitivity investigation are based on the visibility of archaeological sites/features and may not therefore, represent the area's complete archaeological legacy. Many sites/features may be covered by soil and vegetation and might only be located during sub-surface investigations. If subsurface archaeological deposits, artefacts or skeletal material were to be recovered in the area during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately **(*cf*. NHRA (Act No. 25 of 1999)**, Section 36 (6)). It must also be clear that Archaeological Specialist Reports will be assessed by the relevant heritage resources authority (SAHRA).

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10 ADDENDUM 1: HERITAGE LEGISLATION BACKGROUND

10.1 CRM: Legislation, Conservation and Heritage Management

The broad generic term Cultural Heritage Resources refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

10.1.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and their provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

d. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act of 1999 a historical site is any identifiable building or part thereof, marker, milestone, gravestone, landmark or tell older than 60 years. This clause is commonly known as the "60-years clause". Buildings are amongst the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Iron Age settlements. "Tell" refers to the evidence of human existence which is no longer above ground level, such as building foundations and buried remains of settlements (including artefacts).

The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects, meteorites and rare geological specimens
- visual art objects
- military objects
- numismatic objects
- objects of cultural and historical significance
- objects to which oral traditions are attached and which are associated with living heritage
- objects of scientific or technological interest
- any other prescribed category

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(d) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(e) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(f) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(g) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58).”

and

“No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(h) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(i) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(j) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60).”

e. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and the Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

10.1.2 Background to HIA and AIA Studies

South Africa’s unique and non-renewable archaeological and palaeontological heritage sites are ‘generally’ protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

The National Heritage Resources Act (Act No. 25 of 1999, section 38) provides guidelines for Cultural Resources Management and prospective developments:

“38. *(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a*

development categorised as:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site:

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(k) The identification and mapping of all heritage resources in the area affected;

(l) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(m) an assessment of the impact of the development on such heritage resources;

(n) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(o) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(p) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(q) plans for mitigation of any adverse effects during and after the completion of the proposed development (38. [3] 1999:64)."

Consequently, section 35 of the Act requires Heritage Impact Assessments (HIAs) or Archaeological Impact Assessments (AIAs) to be done for such developments in order for all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual, linguistic or technological value or significance to be protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60

years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects. Heritage resources management and conservation.

10.2 Assessing the Significance of Heritage Resources

Archaeological sites, as previously defined in the National Heritage Resources Act (Act 25 of 1999) are places in the landscape where people have lived in the past – generally more than 60 years ago – and have left traces of their presence behind. In South Africa, archaeological sites include hominid fossil sites, places where people of the Earlier, Middle and Later Stone Age lived in open sites, river gravels, rock shelters and caves, Iron Age sites, graves, and a variety of historical sites and structures in rural areas, towns and cities. Palaeontological sites are those with fossil remains of plants and animals where people were not involved in the accumulation of the deposits. The basic principle of cultural heritage conservation is that archaeological and other heritage sites are valuable, scarce and *non-renewable.* Many such sites are unfortunately lost on a daily basis through development for housing, roads and infrastructure and once archaeological sites are damaged, they cannot be re-created as site integrity and authenticity is permanently lost. Archaeological sites have the potential to contribute to our understanding of the history of the region and of our country and continent. By preserving links with our past, we may not be able to revive lost cultural traditions, but it enables us to appreciate the role they have played in the history of our country.

- Categories of significance

Rating the significance of archaeological sites, and consequently grading the potential impact on the resources is linked to the significance of the site itself. The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences. The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3 are used when determining the cultural significance or other special value of archaeological or historical sites. In addition, ICOMOS (the Australian Committee of the International Council on Monuments and Sites) highlights four cultural attributes, which are valuable to any given culture:

- *Aesthetic value:*

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria include consideration of the form, scale, colour, texture and material of the fabric, the general atmosphere associated with the place and its uses and also the aesthetic values commonly assessed in the analysis of landscapes and townscape.

- *Historic value:*

Historic value encompasses the history of aesthetics, science and society and therefore to a large extent underlies all of the attributes discussed here. Usually a place has historical value because of some kind of influence by an event, person, phase or activity.

- *Scientific value:*

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality and on the degree to which the place may contribute further substantial information.

- *Social value:*

Social value includes the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a certain group.

It is important for heritage specialist input in the EIA process to take into account the heritage management structure set up by the NHR Act. It makes provision for a 3-tier system of management including the South Africa Heritage Resources Agency (SAHRA) at a national level, Provincial Heritage Resources Authorities (PHRAs) at a provincial and the local authority. The Act makes provision for two types or forms of protection of heritage resources; i.e. formally protected and generally protected sites:

Formally protected sites:

- Grade 1 or national heritage sites, which are managed by SAHRA
- Grade 2 or provincial heritage sites, which are managed by the provincial HRA (MP-PHRA).
- Grade 3 or local heritage sites.

Generally protected sites:

- Human burials older than 60 years.
- Archaeological and palaeontological sites.
- Shipwrecks and associated remains older than 60 years.
- Structures older than 60 years.

With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise and if the significance of the site is rated high, the significance of the impact will also result in a high rating. The same rule applies if the significance rating of the site is low. The significance of archaeological sites is generally
ranked into the following categories.

Significance	Rating Action
No significance: sites that do not require mitigation.	None
Low significance: sites, which may require mitigation.	2a. Recording and documentation (Phase 1) of site; no further action required 2b. Controlled sampling (shovel test pits, auguring), mapping and documentation (Phase 2 investigation); permit required for sampling and destruction
Medium significance: sites, which require mitigation.	3. Excavation of representative sample, C14 dating, mapping and documentation (Phase 2 investigation); permit required for sampling and destruction [including 2a & 2b]
High significance: sites, where disturbance should be avoided.	4a. Nomination for listing on Heritage Register (National, Provincial or Local) (Phase 2 & 3 investigation); site management plan; permit required if utilised for education or tourism
High significance: Graves and burial places	4b. Locate demonstrable descendants through social consulting; obtain permits from applicable legislation, ordinances and regional by-laws; exhumation and reinternment [including 2a, 2b & 3]

Furthermore, the significance of archaeological sites was based on six main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter),
- Social value,
- Uniqueness, and
- Potential to answer current and future research questions.

11 ADDENDUM 2: CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE

11.1 Site Significance Matrix

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these. The following matrix is used for assessing the significance of each identified site/feature.

2. SITE EVALUATION			
2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.			
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.			
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.			
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.			
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.			
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.			
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			
It has significance relating to the history of slavery in South Africa.			
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.			
2.2 Field Register Rating			
National/Grade 1 [should be registered, retained]			
Provincial/Grade 2 [should be registered, retained]			
Local/Grade 3A [should be registered, mitigation not advised]			
Local/Grade 3B [High significance; mitigation, partly retained]			
Generally Protected A [High/Medium significance, mitigation]			
Generally protected B [Medium significance, to be recorded]			
Generally Protected C [Low significance, no further action]			
2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local			
Specific community			

11.2 Impact Assessment Criteria

The following table provides a guideline for the rating of impacts and recommendation of management actions for sites of heritage potential.

Significance of the heritage resource

This is a statement of the nature and degree of significance of the heritage resource being affected by the activity. From a heritage management perspective, it is useful to distinguish between whether the significance is embedded in the physical fabric or in associations with events or persons or in the experience of a place; i.e. its visual and non-visual qualities. This statement is a primary informant to the nature and degree of significance of an impact and thus needs to be thoroughly considered. Consideration needs to be given to the significance of a heritage resource at different scales (i.e. site-specific, local, regional, national or international) and the relationship between the heritage resource, its setting and its associations.

Nature of the impact

This is an assessment of the nature of the impact of the activity on a heritage resource, with some indication of its positive and/or negative effect/s. It is strongly informed by the statement of resource significance. In other words, the nature of the impact may be historical, aesthetic, social, scientific, linguistic or architectural, intrinsic, associational or contextual (visual or non-visual). In many cases, the nature of the impact will include more than one value.

Extent

Here it should be indicated whether the impact will be experienced:

- On a site scale, i.e. extend only as far as the activity;
- Within the immediate context of a heritage resource;
- On a local scale, e.g. town or suburb
- On a metropolitan or regional scale; or
- On a national/international scale.

Duration

Here it should be indicated whether the lifespan of the impact will be:

- Short term, (needs to be defined in context)
- Medium term, (needs to be defined in context)
- Long term where the impact will persist indefinitely, possibly beyond the operational life of the activity, either because of natural processes or by human intervention; or
- Permanent where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Of relevance to the duration of an impact are the following considerations:

- Reversibility of the impact; and
- Renewability of the heritage resource.

Intensity

Here it should be established whether the impact should be indicated as:

- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way; and
- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

Probability

This should describe the likelihood of the impact actually occurring indicated as:

- Improbable, where the possibility of the impact to materialize is very low either because of design or historic experience;
- Probable, where there is a distinct possibility that the impact will occur;
- Highly probable, where it is most likely that the impact will occur; or
- Definite, where the impact will definitely occur regardless of any mitigation measures

Confidence

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of the nature and degree of heritage significance and the nature, duration, intensity, extent, probability and confidence of impacts and can be described as:

- Low; where it would have a negligible effect on heritage and on the decision
- Medium, where it would have a moderate effect on heritage and should influence the decision.
- High, where it would have, or there would be a high risk of, a big effect on heritage. Impacts of high significance should have a major influence on the decision;
- Very high, where it would have, or there would be high risk of, an irreversible and possibly irreplaceable negative impact on heritage. Impacts of very high significance should be a central factor in decision-making.

11.3 Direct Impact Assessment Criteria

The following table provides an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected

	TYPE OF DEVELOPMENT			
HERITAGE CONTEXT	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
CONTEXT 1 High heritage Value	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected	Very high heritage impact expected
CONTEXT 2 Medium to high heritage value	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected
CONTEXT 3 Medium to low heritage value	Little or no heritage impact expected	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected
CONTEXT 4 Low to no heritage value	Little or no heritage impact expected	Little or no heritage impact expected	Minimal heritage value expected	Moderate heritage impact expected

NOTE: A DEFAULT "LITTLE OR NO HERITAGE IMPACT EXPECTED" VALUE APPLIES WHERE A HERITAGE RESOURCE OCCURS OUTSIDE THE IMPACT ZONE OF THE DEVELOPMENT.

HERITAGE CONTEXTS

Context 1:
Of high intrinsic, associational and contextual heritage value within a national, provincial and local context, i.e. formally declared or potential Grade 1, 2 or 3A heritage resources

Context 2:
Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources.

Context 3:
Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources

Context 4:
Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.

CATEGORIES OF DEVELOPMENT

Category A: Minimal intensity development
- No rezoning involved; within existing use rights.
- No subdivision involved.
- Upgrading of existing infrastructure within existing envelopes
- Minor internal changes to existing structures
- New building footprints limited to less than 1000m2.

Category B: Low-key intensity development
- Spot rezoning with no change to overall zoning of a site.
- Linear development less than 100m
- Building footprints between 1000m2-2000m2
- Minor changes to external envelop of existing structures (less than 25%)
- Minor changes in relation to bulk and height of immediately adjacent structures (less than 25%).

Category C: Moderate intensity development
- Rezoning of a site between 5000m2-10 000m2.
- Linear development between 100m and 300m.
- Building footprints between 2000m2 and 5000m2
- Substantial changes to external envelop of existing structures (more than 50%)
- Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 50%)

Category D: High intensity development
- Rezoning of a site in excess of 10 000m2
- Linear development in excess of 300m.
- Any development changing the character of a site exceeding 5000m2 or involving the subdivision of a site into three or more erven.
- Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 100%)

11.4 Management and Mitigation Actions

The following table provides a guideline of relevant heritage resources management actions is vital to the conservation of heritage resources.

No further action / Monitoring

Where no heritage resources have been documented, heritage resources occur well outside the impact zone of any development or the primary context of the surroundings at a development footprint has been largely destroyed or altered, no further immediate action is required. Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage\ remains are destroyed.

Avoidance

This is appropriate where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. Mitigation is not acceptable or not possible. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources.

Mitigation

This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated to a degree of medium to low significance, e.g. the high to medium impact of a development on an archaeological site could be mitigated through sampling/excavation of the remains. Not all negative impacts can be mitigated.

Compensation

Compensation is generally not an appropriate heritage management action. The main function of management actions should be to conserve the resource for the benefit of future generations. Once lost it cannot be renewed. The circumstances around the potential public or heritage benefits would need to be exceptional to warrant this type of action, especially in the case of where the impact was high.

Rehabilitation

Rehabilitation is considered in heritage management terms as a intervention typically involving the adding of a new heritage layer to enable a new sustainable use. It is not appropriate when the process necessitates the removal of previous historical layers, i.e. restoration of a building or place to the previous state/period. It is an appropriate heritage management action in the following cases:

- The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
- Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
- Where the rehabilitation process will not result in a negative impact on the intrinsic value of the resource.