ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT FOR CONSTRUCTION AND OPERATION OF A COPPER SMELTER PLANT AT WITVLEI –OMAHEKE REGION

ENVIRONMENTAL SCOPING REPORT (ESR)

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NEW HORIZON INVESTMENT GROUP NAMIBIA

CUVELPALM CONSULTING CC

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PROJECT NAME	**THE PROPOSED CONSTRUCTION AND OPERATION OF A COPPER SMELTER PLANT AT WITVLEI –OMAHEKE REGION**
REPORT TITLE	**ENVIRONMENTAL SCOPING REPORT: (ESR)**
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ACRONYMS

TERMS	DEFINITION
BID	Background Information Document
CPC	Cuvepalm Consulting cc
EAP	Environmental Assessment Practitioners
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA (R)	Environmental Impact Assessment (Report)
ESIA	Environmental and Social Impact Assessment
EMP	Environmental Management Plan
EMPr	Environmental Management Plan Report
GHGs	Greenhouse Gasses
ISO	International Organization for Standardization
I&Aps	Interested and Affected Parties
MAWF	Ministry of Agriculture Water and Forestry
MEFT: DEA	Ministry of Environment Forestry and Tourism's Directorate of Environmental Affairs
NHC	National Heritage Council
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change

DEFINITION OF TERMS

The **'Consultant'** – this refers to the team that is conducting the ESIA and the preparation of the EMP for the development

The **'Proponent** – this refers to the institutions/departments that are directly involved in the implementation of the project, i.e. MAWF.

The **'Stakeholders'** – this refers to the people, organisations, NGOs that are directly or indirectly affected and interested by the project.

The **'Environment'** – this refers to the ecology, economy, society and politics.

i. Purpose of This Environmental Impact Assessment Report

This Environmental Scoping Report (ESR) follows on the Scope of Work delineated by Ministry of Environment Forestry and Tourism (MEFT) and New Horizon Investment Group for the proposed construction and operation of the envisaged copper smelter plant at Witvlei Settlement in Omaheke region. Existing information and input from commenting authorities, Interested and Affected Parties (I&APs) were used to identify and evaluate potential environmental impacts (both social and biophysical) associated with the proposed project.

Environmental flaws associated with the proposed project were identified through the ESR. A conscious decision was made based on the recommendations and guidelines by the Directorate of Environmental Affairs EIA guidelines in order to assess both significant and less significant environmental impacts proposed by the development. The developed Environmental Management Plan (EMP) for this proposed activity will have to be effectively implemented by the client, to ensure that adverse environmental impacts are considered.

The detailed assessment of the anticipated impacts was undertaken with the purpose of highlighting any areas of concern regarding to the proposed project during its construction, and operation. In addition, an independent sensitivity analysis for air quality and hydrology was undertaken. This analysis characterised the development site on the significant environmental aspects in order to reflect the sites suitable and unsuitable (no-go) development footprint areas. This action guided the final footprint of the proposed cattle feedlot.

This ESR will also be used to motivate and define the previously identified, project alternatives (i.e. site, technology and layout) based on the findings of the environmental baseline study and the suitability of the site to the type of development. This ESR has been compiled in accordance with the regulatory requirements stipulated in the EIA Regulations (2012), promulgated in terms of the Namibian environmental legislation (Environmental Management Act (No. 7 of 2007))

The EIAR aims to:

- Provide an overall assessment of the social, physical and biophysical environments of the area affected by the proposed establishment of the cattle feedlot;
- Undertake a detailed environmental assessment, in terms of environmental criteria and impacts (direct, indirect and cumulative), and recommend a preferred location for the proposed plant (based on environmental sensitivity);
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive Public Participation Process (PPP)
- GIS sensitivity mapping was conducted to identify potential impacts, propose mitigation and inform the sensitivity analysis.

A systematic approach was adopted for the successful completion of the EIA in line with the regulated process.

ii. Assumptions and Limitations

The following assumptions and limitations underpin the approach to this EIA study:

- The information received from the stakeholders, desktop surveys and baseline assessments are current and valid at the time of the study;
- A precautionary approach was adopted in instances where baseline information was insufficient or unavailable;
- Mandatory timeframes will apply to the review and adjudication of the reports by the competent authority and other government departments; and
- No land claims have been registered for the proposed site at the onset and registration of the study.
- Mandatory Environmental compliance control and Reporting will be undertaken each month once project is operational and this ESIA Report will be upgraded if new project features are proposed.

NB: The EAP does not accept any responsibility in the event that additional information comes to light at a later stage of the process. All data from unpublished research utilised for the purposed of this project is valid and accurate. The scope of this investigation is limited to assessing the potential biophysical, social and cultural impacts associated with the proposed project.

EXECUTIVE SUMMARY

New Horizon Investment Group cc (NHIG) proposes to establish a copper smelting plant at Witvlei (Omaheke Region, Namibia). NHIG a private Namibian company with interest in industrial projects relating to mining. The proposed project site falls within an industrial area with a spatial foot print of 4.4 hectares. The project investment will be realized through a public private partnership arrangement between NHIG with 95% shareholding and the Witvlei Village Council with a 5% shareholding.

The copper smelting technology will be provided by EXRAM Technology, a South African company. involved in the design and supply of copper production technology. The 1 tonne cupola smelter is designed to facilitate the research and development phase of project. The technology will be state - of –the- art with a capacity of 556 t/a of blister copper ingots. The product shall serve the growing demand for copper regionally and globally.

To satisfy the requirements of Namibia's *Environmental Management Act No.7* of *2007* and to ensure that the natural environment is adversely affected by the proposed smelting operation NHIG appointed Cuvepalm Consulting cc(CPC) to conduct the Environmental Impact Assessment (EIA) of the proposed construction and operation of the smelting plant and apply for an Environmental Clearance Certificate. Based on the assessment method employed, air emissions from smelting processes were are regarded as of high significance as they can adversely affect ambient air quality at proposed site and surroundings. Based on the analysis most impacts are anticipated to be localized and can be effectively mitigated through the implementation of mitigation measures recommended in the Environmental Management Plan (EMP).

Observance of ultimate control measures in respect of environmental pollution that may manifest is paramount to ensuring environmental sustainability and particularly the welfare of the Witvlei community. With the correct implementation of the EMP i.e implementation of robust occupation health and safety program that includes regular occupational health surveys and comprehensive monitoring program, impacts of a "*high*" significance rating are not expected. The impacts that were rated "*medium*" before mitigation for both the construction and operational phase of the project are listed on the table below. This EIA report has been prepared for NHIG and forms part of an application for an Environmental Clearance Certificate submitted to the Ministry of Environment Forestry and Tourism (Office of Environmental Commissioner , Republic of Namibia) .

1. CHAPTER ONE: BACKGROUND

1.1. Overview

The proponent, New Horizon Investment Group (NHIG) is an indigenous Namibian enterprise that is involved in the mining sector since 2010. The company has identified potential copper deposits in Witvlei area. In this respect NHIG is in the process of planning bulk mineral exploration activities and potential copper mining activities. In this respect, a copper smelting plant is required for testing and smelting in proximity to the resource base.

In this respect, NHIG identified a need to establish and operate a copper smelting plant in the Witvlei area. The latter intervention forms part of the company's research and development efforts in establishing the viability of project in the long run. The Witvlei Village Council allotted (Annexure) an industrial zoned erf subject to NHIG meeting relevant statutory requirements. However, It is standard procedure and pre-requisite under the Environmental Management Act No.7 of 2007 and the Environmental Impact Assessment Regulations (GN 30 in GG 4878 of 6 February 2012 that the proponent (in this case NHIG) to first undertake an Environmental Impact Assessment, which is submitted to the Ministry of Mines And Energy (MME) and the Ministry of environment, Forestry and Tourism: Department of environmental Affairs (MEFT: DEA) for review.

Furthermore, as per the requirements of the Environmental Management Act No. 7 of 2007, Cuvepalm Consulting cc (CPC) were appointed by NHIG on 18 February 2021 to conduct an Environmental and Social Impact Assessment (ESIA) and develop an Environmental & Social Management Plan (ESMP) for the proposed project.

This has been followed by an application for Environmental Clearance Certificate (ECC) to the Ministry of Environment and Tourism (MET): Directorate of Environmental Affairs (DEA).

Subsequently, this document forms part of the application to be made to the DEA's office for an Environmental Clearance certificate for the proposed construction and operation of a copper smelting plant, in accordance with the guidelines an statutes of the Environmental Management Act No.7 of 2007 and the environmental impacts assessment regulations (GN 30 in GG 4878 of 6 February 2012).

1.2. Project Location

The smelter will be sited on Portion A of Farm Okatjirute No. 155, Witvlei. The site can be accessed by a 2 km road turn off from the National Road No. B 6 linking Windhoek and Gobabis. Adjacent to project is the Witvlei Meat Abattoir, and the Namchar Charcoal Processing Plant.

The site is zoned industrial and there are no household residents in immediate proximity to the site. The map below (Fig 1) and depicts the locality of the project area.

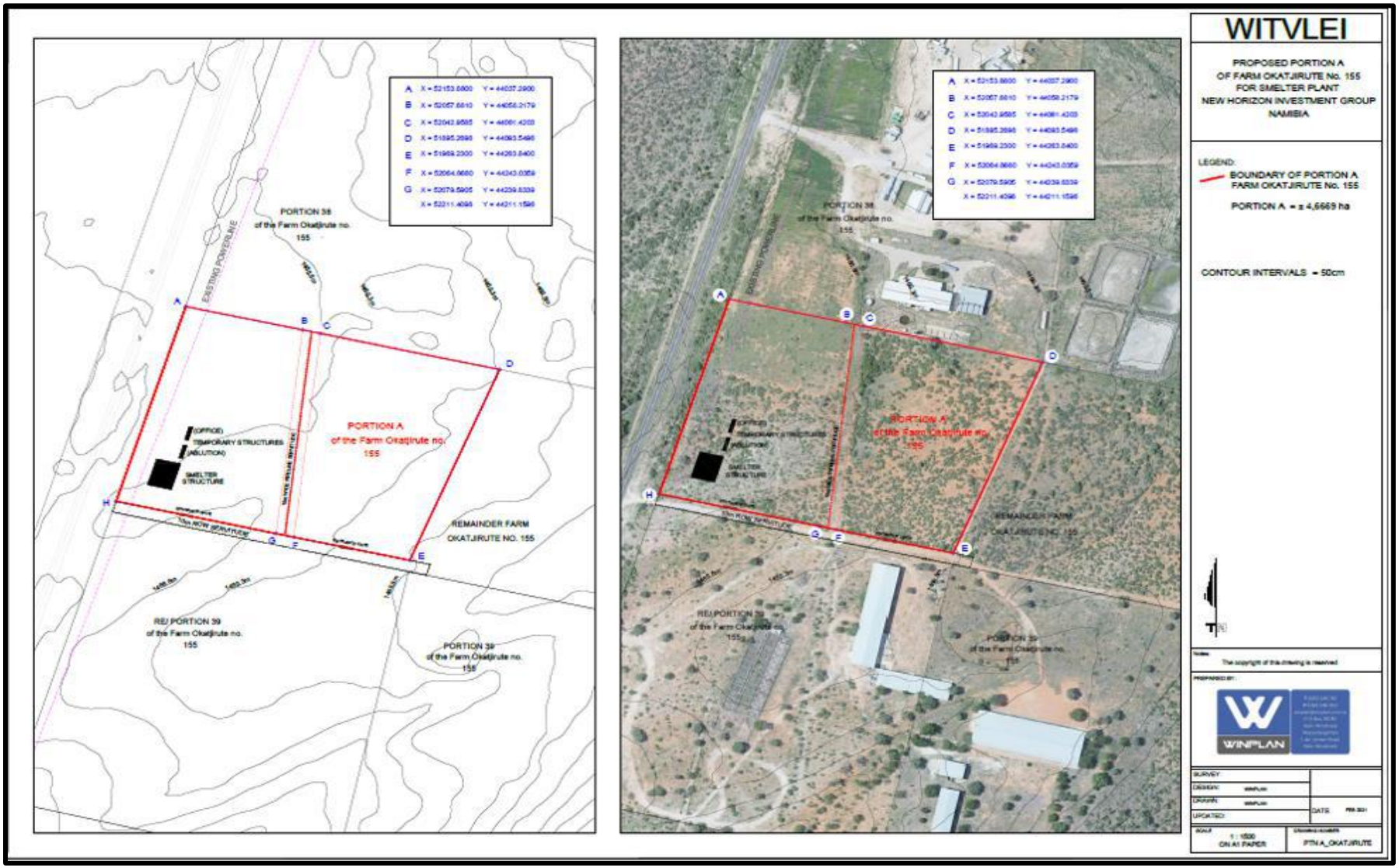

Figure 1: Overview of project area on Portion A of Farm Okatjirute No. 155, Witvlei.

1.3. Project Components

1.4. Overview

The copper smelting project will be composed of different components that will make up the complete copper smelting plant. For the purpose of this EIA, the components have been categorized to enable impact assessment and analysis. The different project sections are as follows:

a) Ore(concentrate) storage area
b) Crushing and separator plant
c) Shaft furnace and host building
d) Copper(blister) storage area
e) Slag storage area
f) Wastewater treatment and storage
g) Standby- Generator
h) Administration and ablution area

1.5. Process flow

1.5.1. Ore Supply

Exploration area

The predominate oxide copper minerals include: Malachite, Cuprite, Chrysocolla and Azurite. The ore containing 12-14% Cu is accomplished at the mine sites via crushing, grinding, and flotation. The ore processing plant is designed for 10 000 t/month run of mine (ROM) ore recovery. The ore recovered contains 1.35% Cu with a size distribution less than 300 mm. The ROM low grade ore is loaded by means of a Front-end Loader (FEL) and the low-grade ore is stockpiled.

The ore splitting ratio is 10%, resulting in 9000 t/month low grade ore to the low-grade stockpile. The 1000 t/month ore for smelting purposes by the cupola smelter, Figure 2 give an illustrative layout of the processing flow layout.

Crushing: At the mining site**,** a tertiary crusher unit and an ore screen will be installed on site. Pre-crushed mineral ore will with be further crushed to obtain a product of -150 mm and + 50mm to liberate the high-grade ore from the ROM.

Screening: After crushing, the ore is screened to obtain the desired size range. Rocks between 50 and 120 mm is transferred to the Belt Picking Lines for further processing whilst rocks less than 50 mm will be sent for low grade stockpile leaching / future electro winning plant. An estimated 9000 t/month is sent to stockpiling for future leaching. The leach pile contains approximately 0.5% Cu.

At the smelter plant the resulting "concentrate" is processed in a smelting furnaces to yield "matte" of as much as (>92% Cu) percent copper content.

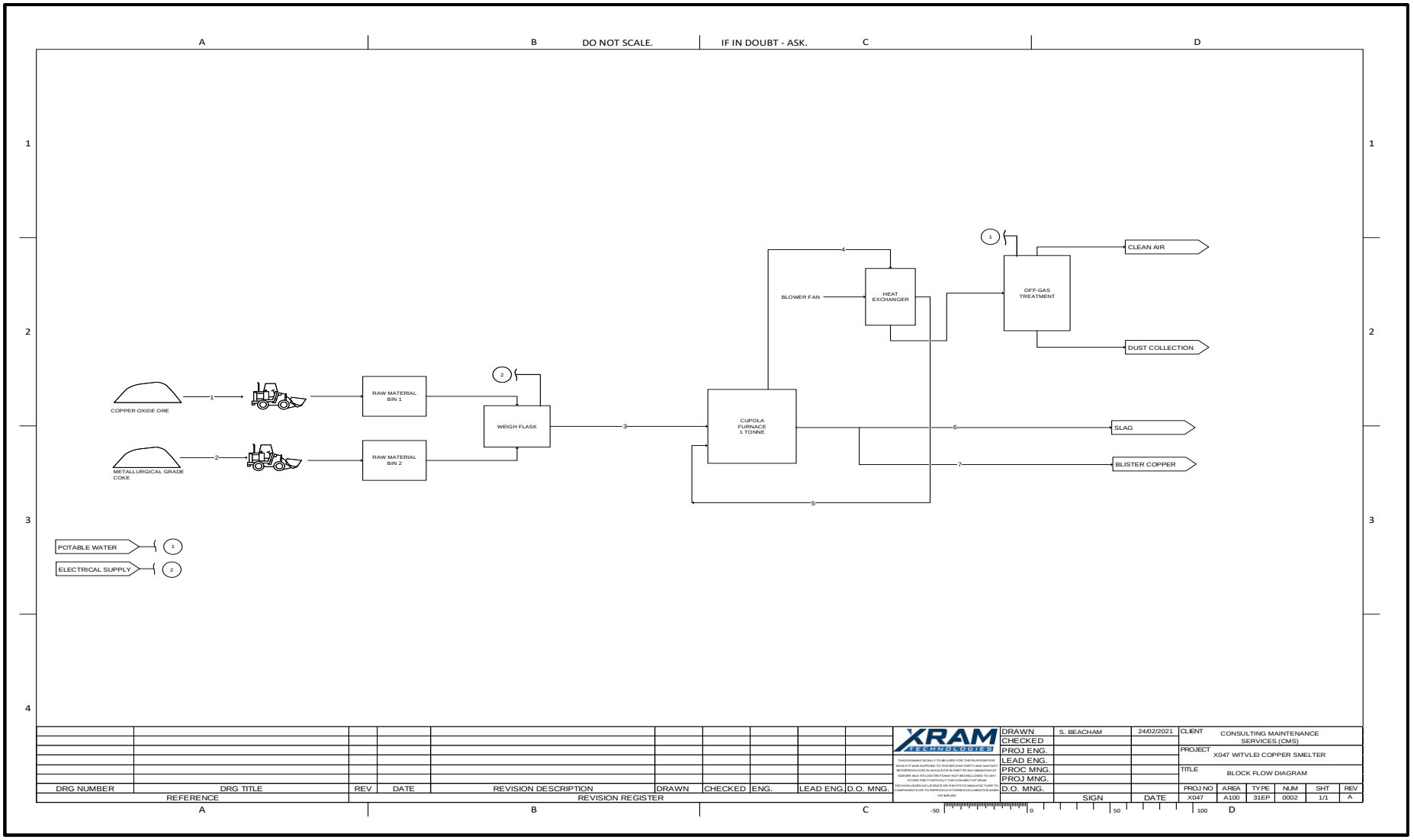

Figure 2: Ore Supply Flow Diagram

1.2 Smelting: Process Flow

Housing of Plant

The Cupola or shaft furnace smelter plant building will house the furnace and other smelter components that are critical to the smelting process.

The Shaft furnace is characterized by three major components:

1. Hot blast tuyers, four spaced around the furnace, through which pre-heated ambient temperature are blown into the furnace;
2. a central gas off-take through which the off gas is withdrawn for delivery to the boost combustion chamber for dust removal, and SO2 fixation systems if required; and
3. metal and slag tapholes through which the liquid products are periodically removed from the furnace.

The plant layout is illustrated below.

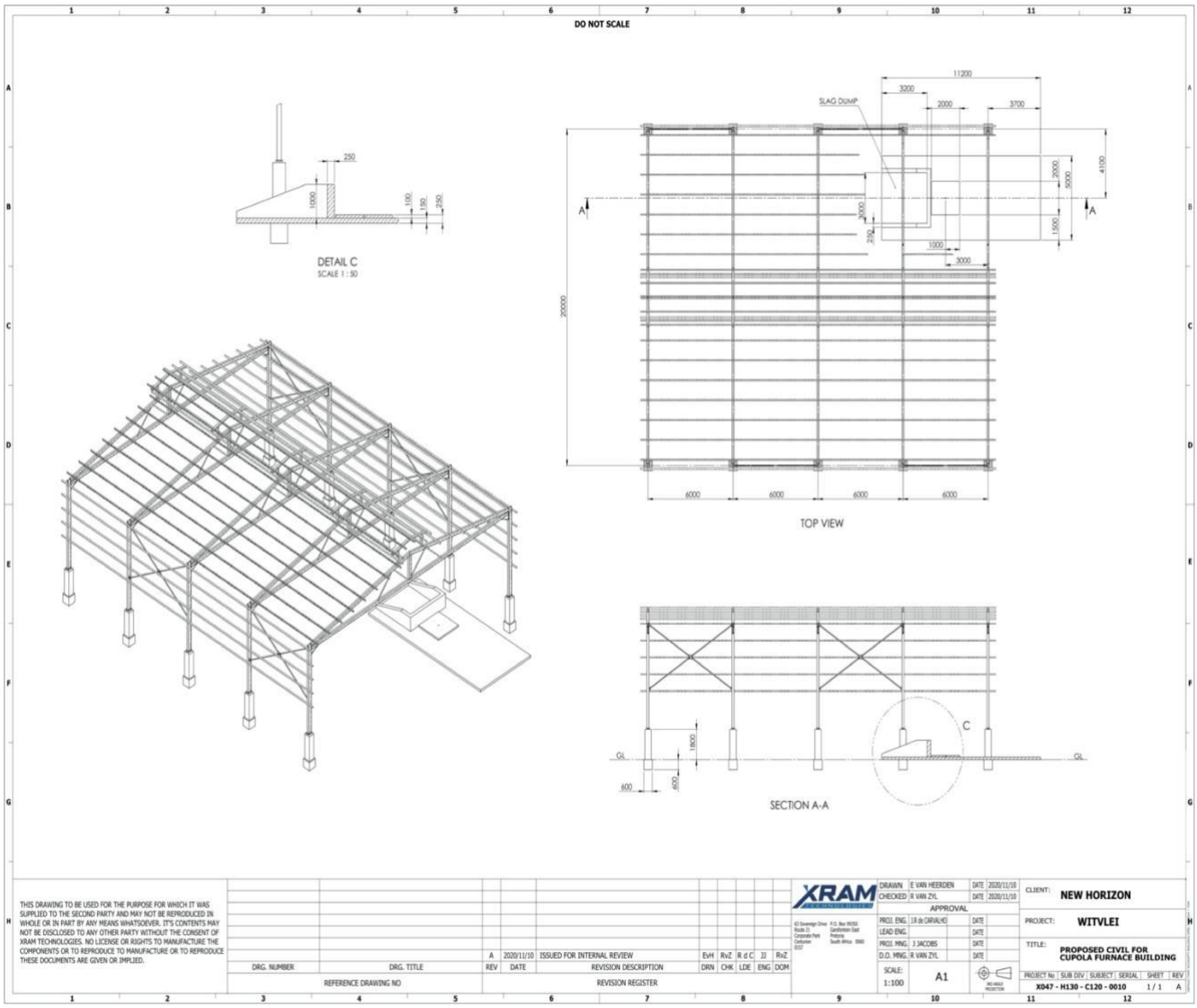

Figure 3: Smelter Plant Building

The principal smelting reactions are as follows:

- Malachite: $Cu_2(OH)_2CO_3 + 3C = 2Cu + H_2O_{(g)} + 4CO_{(g)}$
- Cuprite: $Cu_2O + C = 2Cu + CO_{(g)}$
- Azurite: $Cu_3(CO_3)_{2(}OH)_2 + 2C = 3CuO + H_2O_{(g)} + 4CO(g)$
- Chrysocolla: $Cu_2H_2Si_2O_5(OH)_4 + 2C = 2Cu + 2SiO_2 + 3H_2O(g) + 2CO(g)$
- Boudouard reaction: $C(s) + CO_2(g) \leftrightarrow 2CO(g)$

1. Raw Material Batching and Feed

The ore concentrate transferred from mining site by haulage trucks is offloaded at the plants ore storage area. The concentrate (Copper oxide ore) is stored in a surge bin or bunker, with a holding capacity for more than one shift. Equally the metallurgical grade coke nuts are stockpiled to sustain a continuous smelting process. The storing of these feed materials (copper oxide ore and metallurgical grade coke nuts) on site allow for a 1-month buffer capacity as follows:

- Screened and sorted lumpy ore from mine - 576 ton (10% Cu grade)
- Metallurgical coke nuts - 200 ton

The coke nuts and copper oxide ore are then batched to the correct predetermined recipe before being sequentially layered into the Shaft furnace.

2. Start-up & Preheating

Before the first start-up, as well as for start-ups after long shutdowns, the fluid bed furnace has to be preheated. The necessary combustion air is taken from an air blower. Start-up gases are withdrawn by a start-up fan and vented to the atmosphere provided after gas cleaning section.

3. Smelting

The batched concentrate (copper oxide and coke nuts) are chargedinto the shaft furnace to form a coke bed. In the furnace, the lumpy ore is exposed to the pre-heated air (hot blast into furnace maintained at approximately 1200 degrees Celsius. Entry of these materials into the hot furnace causes the oxide copper minerals to react rapidly with the coke and CO gasses. This leads to the controlled carbothermic reduction of the copper oxides and the melting of the solids.

Heat required for the melting process comes from the burning of fuel (coke). Impurities in the charge oxidize with the flux to form a layer of "slag," which floats on top of the molten blister copper.

4. Skimming & Tapping

The slag and blister copper is periodically tapped from furnace. The blister copper is tapped in batches to fill the ingots. The slag typically contains less than 0.5% copper and can be used as building aggregate, as feed to cement kilns and if milled as cement extenders. The shaft furnace off-gas contains predominantly N2, CO2 (g), O2 (g) and H2O (Steam).

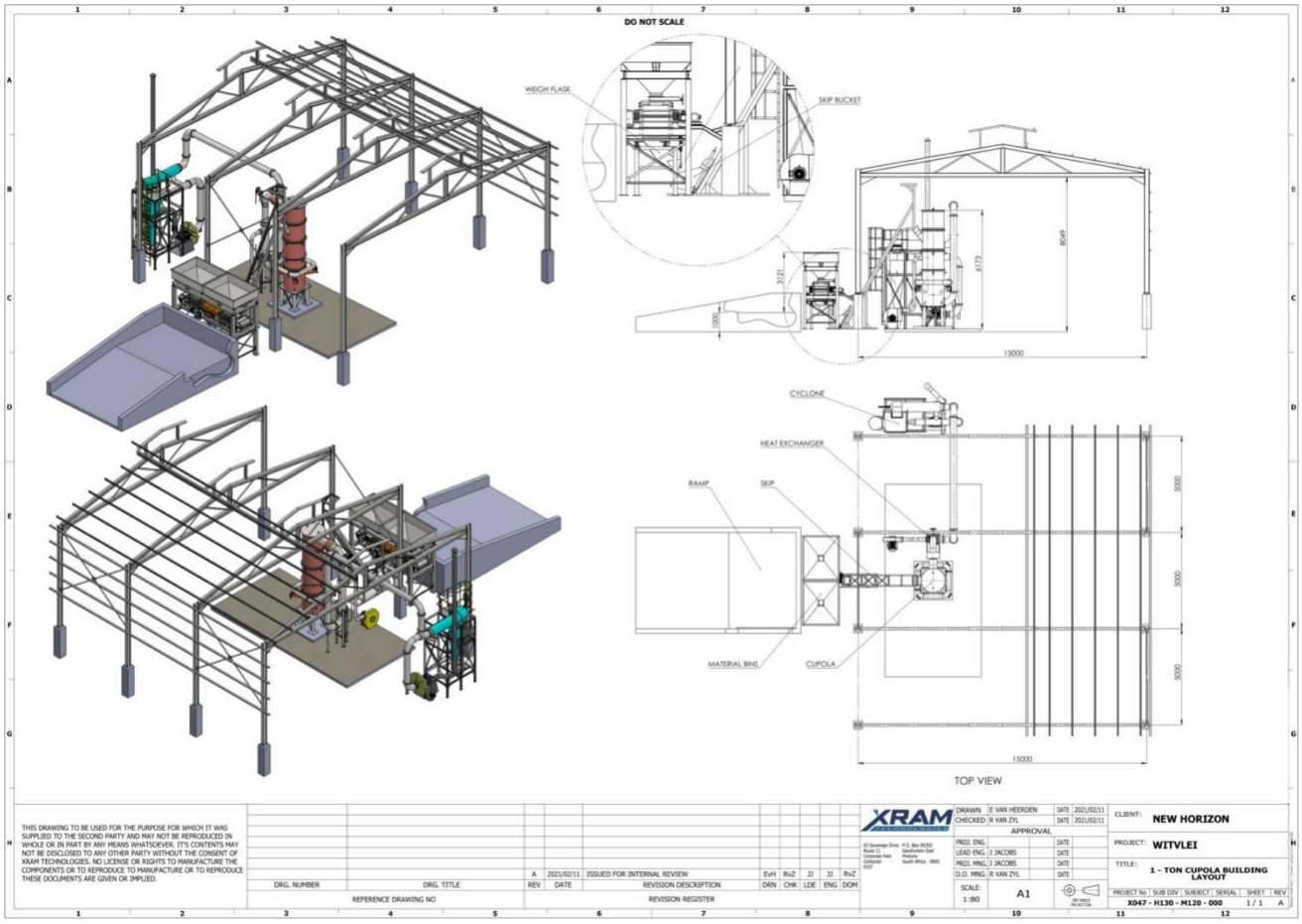

Figure 4: Cupola furnace layout

1.5.2. Production Estimates-Final Product

The production capacity of the 1-ton shaft furnace will be 56 ton per month of copper blister ingots. The blister copper is delivered to refineries for final processing. Impurities in blister copper may include gold, silver, antimony, arsenic, bismuth, iron, lead, nickel, selenium, sulfur, tellurium, tin, and zinc.

1.5.3. Off-Gas Treatment

Emissions from the cupola smelter is principally particulate matter and hot air containing carbon dioxide and steam. Fugitive emissions are generated during material handling operations. Fine copper minerals and fly ash are the primary constituents of the particulate matter. The off-gases from furnaces proceed to a high efficiency cyclone. Dust recovery of around 99% percent is achieved with the high efficiency cyclones. A demister eliminates water vapour from the off-gas stream. The furnace smelting operation is a continuous process.

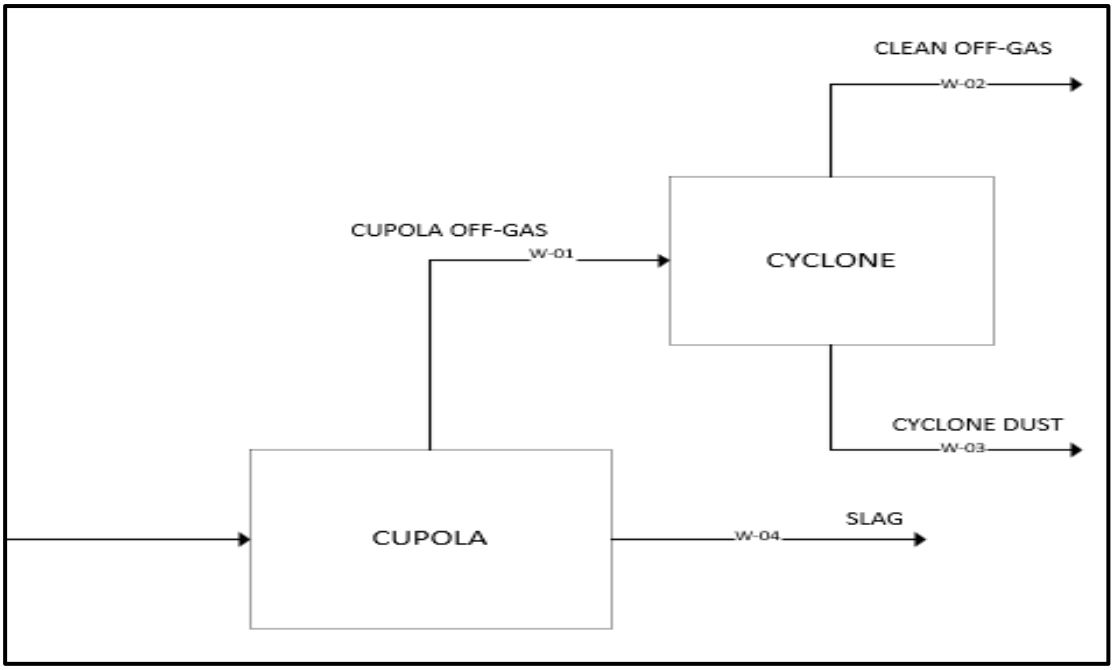

Figure 5: Emissions control and mitigation

1.6. Air Emission Control- includes Emission data, Emission Monitoring

A high efficiency cyclone is used for de-dusting of the off-gas. The unit is capable of de-dusting to ensure a particulate emission of less than 30mg/Nm3 of dust. Visual inspections will be performed, and isokinetic tests will be conducted by 3rd parties once per year. A detailed air emissions analysis is attached on Appendix C:3.

1.7. Waste Production & Treatment

The system will allow for dust collection, agglomeration and recycling to the furnace, however there will be comprehensive dust fallout monitoring within Witvlei up to 5km radius from the processing plant.

Initially the slag will be stockpiled until a sufficient quantity has been processed to allow for the economic resizing and recovering any entrapped copper metal. Again, the sized slag can be utilized by the building industry for aggregate or as additive feed to cement kilns, refer to Figure 3 below with an illustration of the waste block system.

1.8. Accessibility

An open road network is existing, and access will be obtained from the existing D1663 road that is west of proposed project site. The road width is adequate for services, pedestrians and two-way vehicular traffic.

1.9. Topography, Storm water and Existing usage

The area is relatively flat and undeveloped. Because of the landscape and surface terrain the storm water and floodwater flow channels flow from the east to west. With limited vegetation cover due to construction, the area can be prone to significant run-offs due to the amount of rain water expected to percolate at the proposed project site during the rainy season. Hence an adequate storm water control system will be designed and implemented.

1.10. Infrastructure and Services

1.10.1. Water Supply

It is assumed that operational water for both construction and operational phases will be sourced from NamWater, through Witvlei settlement office.

1.10.2. Electricity Supply

Electricity is supplied by CENORED. An arrangements will be made between the Proponent and CENORED to supply electricity for construction and operations by connecting the site to the nearest existing power grid.

1.10.3. Telecommunication Services

The project area is well connected to the rest of the country and world via local network service providers. The main providers of this service in the area are Telecom Namibia, Mobile Telecommunications Company (MTC Namibia) as well as satellite phones. Therefore, the site operations will be communicated smoothly between onsite and offsite project personnel using either of the communication services.

1.11. Waste Management Facilities

1.11.1. General and hazardous waste

A dedicated processing waste storage facility will be designed and constructed as part of the development. Non mineral waste will be separated from mineral related waste as their storage and disposal requirements and specifications will be different. Processing plant waste that cannot be dumped at the municipality waste site will be transported to the relevant and approved hazardous waste facilities in the country.

1.11.2. Sewage Management

During construction phase sufficient portable toilets will be provided on site for workers and appropriately emptied according to their manufacturer's operational standards and recommendations. Once in the operational phase, the site will be equipped with appropriate sewer reticulation and proper toilets that will be used during this phase.

1.12. Construction Work and Activities

Construction works will be outsourced to an appointed and experienced construction contractor(s).

The following activities are anticipated for the construction of the copper smelter plant:

1.12.1. Earthworks and Site clearing

Prior to construction works, bulk earthworks will be required on certain areas of the project site in order to erect the buildings foundations for offices and amenities, staff rooms and ablution facilities, bunding and drainage structures, drains, materials loading and offloading zones, roads, and holding ponds. All of these will require soil excavation within the construction site. Earthworks and overall construction works will also mean the presence of heavy construction vehicles and equipment moving around the site.

Based on site observation during site visits, the site is low to moderate vegetated, therefore vegetation that will be encountered in the footprints of the earthworks will be removed. With that said, minimal disturbance to vegetation is expected and advocated during this phase.

1.12.2. Construction Equipment, Materials and Services

Construction equipment will be sourced from the building material suppliers proximate to the project site and if necessary, and as required, equipment will need to be sourced from elsewhere in the country and/or abroad as per the required and approved operating standards.

In terms of construction materials such as sand and aggregate for concrete and site surfacing will be obtained from commercial sources, as approved by the Construction Engineer.

1.12.3. Employment Opportunities

Temporary employment opportunities will be created during the construction of the facility. The number of people to be employed cannot be provided now as construction works will be outsourced to contractors (to be appointed on tender), and therefore they (contractors) will determine the exact figure of the workers required. However, employment of locals is encouraged.

1.13. Need and Desirability

Namibia’s economic model has largely been based on exploitation of mineral deposits with limited value addition initiatives. Low levels of industrialization in particular has to a certain extent limited the economy’s capacity to create sufficient sustainable jobs. Services (tertiary industries) remain the key driver of growth and its contribution to Namibia’s Gross Domestic Product (GDP) rose from 50.4% in the 1980s to an average of 58% over the 2010-2018 period (ADB, 2020).The shift was driven by expansion in government services and financial intermediation. In contrast, the share of mining in GDP declined by about half to an average of 11.2% of GDP. Despite its reduced share in GDP, mining remains the largest earner of Namibia’s foreign exchange at about 45%. Projects that facilitate the downstream processing of natural resources can improve trade performance and speed up the structural transformation of the national economy.

Mineral processing is enshrined in National Development Plan (NDP V), Vision 2030. The Harambee Prosperity Plan II plan (Pillar 2) place emphasis on economic advancement with view to enhance the productivity of priority sectors such as mining (mineral processing). Hence the project in its self-promotes economic advancement of the sub-metal ore sector. The operation of copper smelters promotes downstream processing, enhancing value addition and thereby contributing to growth of country's GDP. A contribution to national income can determined through smelting operation and relative gainful employment through required services i.e. direct and indirect tax income (corporate, personal, VAT, secondary, others) levies and customs.

2. CHAPTER TWO: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1. Introduction

In order to ensure that the proposed development comply with the legal requirements for good practice and preservation of the environment, a review of applicable Namibian and international legislation, policies and guidelines have been consulted. This review serves to inform the project Proponent, Interested and Affected Parties and the decision makers at the DEA of the requirements and expectations, as laid out in terms of these instruments, to be fulfilled with regards to the development. The Witvlei copper smelter triggers the following Namibian legislations, policies and legal framework:

- The Constitution of the Republic of Namibia (1990);
- Environmental Assessment Policy of Namibia 1994;
- Environmental Management Act No. 07 of 2007;
- EIA Regulations GN 57/2007 (GG 3812);
- The Water Act 54 of 1956;
- The Water Resources Management Act No. 11 of 2013;
- Pollution Control and Waste Management Bill;
- Atmospheric Pollution Prevention Ordinance 11 of 1976;
- National Solid Waste Management Strategy;
- Soil Conservation Act 76 of 1969;
- Road Traffic and Transport Act, No. 22 of 1999;
- Forest Act 12 of 2001;
- National Policy on Climate Change for Namibia (2011);
- National Climate Change Strategy & Action Plan 2013 – 2020;
- Nature Conservation Ordinance (1996);
- National Biodiversity Strategy and Action Plan (NBSAP2) 2013 – 2022;
- Labour Act 11 of 2007;
- Health and Safety Regulations GN 156/1997 (GG 1617);
- Public Health Act 36 of 1919;
- Public and Environmental Health Act 1 of 2015; and
- National Heritage Act 27 of 2004.

These above-listed legislations and policies and their inclusion in the proposed project assessment are further presented in Table 2 below.

Table 1:Policies, legal and Administrative regulations

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
The Constitution of the Republic of Namibia (1990)	The articles 91(c) and 95 (i) commits the state to actively promote and sustain environmental welfare of the nation by formulating and institutionalising policies to accomplish the Sustainable objectives which include: • Guarding against overutilization of biological natural resources, • Limiting over-exploitation of non-renewable resources, • Ensuring ecosystem functionality, • Maintain biological diversity.	The construction and operation of the copper smelting plant can interfere with the ecosystem and overutilization of natural resources like water. Attention should be given to the state of water and other natural resources to avoid over exploitation. By developing and implementing the Environment Management Plan, NHIG is ensuring sustainable development. Ecological sustainability should guide operations of the proposed Witvlei copper smelter.
Environmental Assessment Policy of Namibia 1994	The Environmental Assessment Policy of Namibia states Schedule 1: Screening list of policies/ plans/ programmes/ projects subject to environment must be accompanied by environmental assessments. “The development activities" are on that list.	The establishment of the copper smelter project triggers the need for environmental assessments prior commencement of civil works particularly the construction of smelting plant.
	The policy provides a definition to the term “Environment” broadly interpreted to include biophysical, social, economic, cultural, historical and political components and provides reference to the inclusion of alternatives in all projects, policies, programmes and plans.	The development of the copper smelter requires the assessment of all possible environmental and social impacts in order to avoid, minimise or compensate environmental damage associated with the activities.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
Environmental Management Act No. 07 of 2007	Requires that activities with significant environmental impact are subject to an environmental assessment process (Section 27). Requires for adequate public participation during the environmental assessment process stakeholders to give their opinions about a project (Section 2(b-c)). According to Section 5(4) a person may not discard waste as defined in Section 5(1)(b) in any way other than at a disposal site declared by the Section 3 (2) (b) states that "community involvement in natural resources management and the sharing of benefits arising from the use of the resources, must be promoted and facilitated" is key.	The nature of the proposed Witvlei copper smelter plant and interrelated activities potentially causes environmental impacts to the surrounding environment. Activities such construction of drainage system, water network and copper smelting facility and processes can cause significant environmental impacts with some impacts reversable and avoided. Therefore, proper assessments should lead and advise the project before implementation. The EIA study considered full stakeholder participation. Stakeholder consultation was fully conducted.
	Section 3 (2) (e) states that "assessments must be undertaken for activities which may have a significant effect on the environment or the use of natural resources".	The proposed development is involving the utilisation of natural resources (water and land). Therefore, benefits from the implementation of the project must be shared equally.
EIA Regulations GN 57/2007 (GG 3812)	Details requirements for public consultation within a given environmental assessment process (GN No 30 S21). Details the requirements for what should be included in an Environmental Scoping Report (GN No 30 S8) and an EIA report (GN No 30 S15).	The implementation of the project triggers the need for consultation of all affected and interested stakeholders regarding the development at all project development phases from planning to operation of the facility. A public consultation meeting was held in respect to this and all the concerns and issues were noted and addressed in this report.
The Water Act 54 of 1956	The Act was formulated to consolidate and amend the laws relating to the control, conservation and use of water for domestic, agricultural, urban and industrial purposes; to make provision for the control, in certain respects, of the use of sea	The development of copper smelter plant will use water resources in the process. The activities directly affecting water conservation, management and use therefore,

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
	water for certain purposes; for the control of certain activities on or in water in certain areas.	requires the implementation of water conservation techniques.
Pollution Control and Waste Management Bill	The bill aims to "prevent and regulate the discharge of pollutants to the air, water and land" Of particular reference to the Project is: Section 21 "(1) Subject to sub-section (4) and section 22, no person shall cause or permit the discharge of pollutants or waste into any water or watercourse."	The construction and operation of the smelter plant activates section 21 and 22 of the bill. Project related activities like construction, crushing and smelting requires robust air quality management systems in place. Water: Water should be treated in accordance to the requirements of the water act. Groundwater level monitoring, groundwater quality and surface water quality monitoring should be conducted. Air: Flue gas and dust fall out monitoring should be implemented.
	Section 55 "(1) No person may produce, collect, transport, sort, recover, treat, store, dispose of or otherwise manage waste in a manner that results in or creates a significant risk of harm to human health or the environment."	Contractors of the civil works of the project should make it mandatory that they manage their waste in a manner that do not cause environmental threat and risk both to the surroundings and the local communities.
Atmospheric Pollution Prevention Ordinance 11 of 1976	The law act to provide for the prevention of the pollution of the atmosphere, and for matters incidental thereto. The law regulates and prohibit pollution from industries particularly smoke and dust from various activities. The ordinance considers air pollution from point sources but does not address air quality,	Construction, operational and fugitive dust from processes will most likely affect ambient air quality. Efforts to suppress and monitor dust from point source should be adopted as recommended in the EMP.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
National Solid Waste Management Strategy	The Strategy ensures that the future directions, regulations, funding and action plans to improve solid waste management are properly co-ordinated and consistent with national policy, and to facilitate co-operation between stakeholders The Strategy listed priorities for the strategy to address for effective solid waste management, the priorities given below are the most relevant to the WSSP:	The construction and operation of the copper smelter can potentially generate significant amount of solid waste that might need proper management by contractors to avoid pollution. Waste management plans should be generated and implemented prior the commencement of civil works and during operations.
	• Waste disposal is the main problem with the current solid waste management in Namibia. The top priority is to reduce risks to the environment and public health from current waste disposal sites and illegal dumping in many areas of Namibia.	Slag, crusher plant rock waste and other non-mineral waste should be stored and disposed in an environmental friendly manner and certified waste storage areas or approved waste disposal facilities.
Soil Conservation Act 76 of 1969	The Act established to consolidate and amend the law relating to the combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of the water sources in the Republic of Namibia.	Construction of auxiliary infrastructure related to the project should include systems and mechanism for preventing erosion.
Road Traffic and Transport Act, No. 22 of 1999	The Act provides for the establishment of the Transportation Commission of Namibia; for the control of traffic on public roads, the licensing of drivers, the registration and licensing of vehicles, the control and regulation of road transport across Namibia's borders; and for matters incidental thereto.	Mitigation measures should be provided for, if the roads and traffic impacts cannot be avoided. Should the proponent wish to undertake activities involving road transportation or access onto existing roads, the relevant permits will be required from the Ministry of Works and Transport and an Environmental Management plan for mineral transportation should be commissioned.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
Forest Act 12 of 2001	Section 10 (1) set out the aim of the forest management as to: The purpose for which forest resources are managed and developed, including the planting of trees where necessary in Namibia is to conserve soil and water resources, maintain biological diversity and to use forest produce in a way which is compatible with the forest's primary role as the protector and enhancer of the natural environment.	The proposed project development site for the copper smelter plant falls within an urban locale that is already affected by human activities. As such the site is already devoid of vegetation of conservation significance, with only grasses and sparse trees and shrubs.
	(a) vegetation which is on a sand dune or drifting sand or on a gully unless the cutting, destruction or removal is done for the purpose of stabilising the sand or gully; or (b) any living tree, bush or shrub growing within 100 metres of a river, stream or watercourse.	The project will not result in the removal of living trees, bushes and shrubs growing within 100m of a river, stream or watercourse
	(2) A person who wishes to obtain a licence to cut and remove the vegetation referred to in subsection (1) shall, in the prescribed form and manner, apply for the licence to a licensing officer who has been designated or appointed for the area where the protected area is situated.	The removal of trees in the above instances would require the contractors or sub-contractors to acquire necessary permits first.
National Policy on Climate Change for Namibia (2011)	The National Policy on Climate Change pursues constitutional obligations of the Government of the Republic of Namibia, namely for "the state to promote the welfare of its people and protection of Namibia's environment for both present and future generation."	The copper smelting technology that has been adopted by NHIG will ensure that there are minimal emissions into the atmosphere. Dust suppression and monitoring will be employed, to ensure that GHG aerosols are not generated.
National Climate Change Strategy & Action Plan 2013 - 2020	The Strategy outlines Namibia's response to climate change. The strategy aims to address and plan for action against climate change, both through mitigation and adaptation actions. In its adaptation	The development of the copper smelter plant should adopt measures that strengthen sustainable water resource base development of the country. The implementation should be very careful on not to cause harm to the available water

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
	strategy, the Strategy recognises the role of a **sustainable water resource base**.	resources but improve the management through various conservation technics.
	The Strategy proposed strategies that aim to: - Strategic Aim 1: Further improve the overall climate change understanding and related policy responses in water resources sector. - Strategic Aim 2: Monitoring and data collecting technologies of surface and underground water are developed and implemented at basin/watershed level.	The proponent should invest capital on strengthening climate change and adaptation through cleaner production systems implementation. Certification by international standards such as ISO14001 can help with climate sustainability and it is recommended.
Nature Conservation Ordinance (1996)	This ordinance relates to the conservation of nature; the establishment of game, parks and nature reserves; the control of problem animals; and highlights matters incidental thereto.	The activities of the project are highly localized therefore, there is no potential to interfere with parks, game, and nature reserves. However, there is need for proper designing and planning of the drainage and water network of the project to make sure that the infrastructure is not in conflict with the provisions listed in the Nature Conservation Ordinance.
National Biodiversity Strategy and Action Plan (NBSAP2) 2013 – 2022	The action plan was operationalised in a bid to make aware the critical importance of biodiversity conservation in Namibia, putting together management of matters to do with ecosystems protection, biosafety, and biosystematics protection on both terrestrial and aquatic systems.	The proposed project during construction and operation phases, potentially triggers ecosystem threats from pollution. As such mechanisms for environmental compliance and monitoring will be put in place, ultimately aimed at protecting biodiversity.
Labour Act 11 of 2007.	Empowers the minister responsible for labour to publish regulations pertaining to health and safety of labourers (S135). Details requirements regarding minimum wage and working conditions (S39-47).	The construction and operation of the smelter plant will invite significant amount of laborious work. Therefore, there is need to ensure that proponent without charge to employees provide a working environment that is safe, has

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
		adequate facilities and arrangement for the welfare of employees. The smelter plant will be registered as a processing and manufacturing entity with Ministry of Labour and a safety and health management policy will be drafted and instituted.
Health and Safety Regulations GN 156/1997 (GG 1617)	Details various requirements regarding health and safety requirements of the smelter plant.	-Occupational health and safety provisions during construction and operational phases should be clearly outlined. -Compliance monitoring and responsibilities for compliance monitoring should be clearly designated.
Public Health Act 36 of 1919	Section 119 states that "no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health."	Compliance to the Public health act will be ensured in relation to the following: -Ablution facilities -Showers and Changing rooms -Communicable diseases -Emergency healthcare provision
Public and Environmental Health Act 1 of 2015.	To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.	
National Heritage Act 27 of 2004	Section 48(1) states that "A person may apply to the (Heritage) Council for a permit to carry out works or activities in relation to a protected place or protected object" Protects and conserves cultural heritage and cultural resources with special emphasis on places and sources of National heritage including graves, artefacts and any objects older than 50 years.	The project constructions impacts are localized and there are no heritage or cultural artefacts identified in this area. However, if heritage resources (e.g. human remains etc.) discovered during constructions, guidelines dictate that a permit be acquired from the National Heritage Council of Namibia for relocation.

LEGISLATION/POLICY	PROVISION/SUMMARY	PROJECT APPLICABILITY
SANS 1929: 2005	Dust particulates from ore crushing and smelting that are smaller than 1mm are deemed dangerous to both plants and humans. As such a dust monitoring following the ASTM D1739 method should be used for monitoring dust emissions from crusher plans. Dust chemical analysis and fallout quantities are specified for industrial and residential environs.	A dust fallout monitoring cycle will be instituted around Witvlei and strictly adhered to.

3. CHAPTER THREE: RECEIVING ENVIRONMENT

3.1. Introduction

In this chapter, the findings of the Environmental and Social Assessment Baseline study, public consultation and desk reviews undertaken are in respect to the ecology, society, economy and geo-political set up of the proposed project area. The geological make up and meteorology of the project site will also be discussed in this chapter to give an in-depth understanding of the project area in question.

3.2. Socio-Economic status

Witvlei is historically significant as it is the place where the first battle (*Battle of Witvlei*) took place during the Herero-Nama War in March 1864. Witvlei is a village and district capital of the Okarukambe Constituency. Most of the inhabitants of Witvlei are of Damara descent, but there are Ovambo, Herero, Kavango, and inhabitants of mixed ethnicity.

Main source of water are from boreholes. A water reservoir with a capacity of 3000 m^3 store water. Safe drinking water is available to most households. A 66kv power substation is situated at Witvlei with electrical connections linked to formal housing. The provision of adequate sanitation remains a challenge especially in the informal area. The housing sector is likely to benefit from smelter operation as the proponent has provisional secured a piece of land for housing development. Access to basic sanitation is primarily associated with the formal housing segment. Firewood is a common source of energy especially among the low income groups.

The only road segment of bitumen standard is the Trans Kalahari passing through Witvlei, the remaining road network is gravel. Health services are available with one (1) clinic serves the local populace.

Witvlei is among local authorities with little development and a high unemployment rate. Major employment is primarily connected to the public service sector such as Education (primary school), Health (clinic), and Policing (police station, adult education office, Social Protection (Ministry of Gender Office), postal services (NamPost) and local administration (Witvlei Village Council).

Significant investments made in the in the past at Witvlei includes Meat (Abattoir), Leap clothing factory, Taxidermy, Charcoal processing plant have provided employment for the betterment of local community. The closure of the Witvlei Meat abattoir in November 2014 did not make matters any easier for the community as it could not sustain jobs with significant number of jobs lost.

3.3. Economic Impacts

3.3.1. Global

The global copper market continues to be influenced by high demand for the copper mineral. Notably copper production may contribute significantly towards job and wealth creation, poverty reduction and sustainable local economies. Enabling the availability of copper sources in combination of favourable prices worldwide has a positive effect on the world's economy. Several long-term trends are presently driving growth in copper demand and are expected to continue to do so in the coming decades. The multipurpose usage of industrial copper remains one of the factors driving demand globally. Trends indicate an increase in consumer use of electronics, wider uptake of electric vehicles, increased use of renewable energy sources and energy efficiency. All these require significant amounts of copper to function. According to the World Bank (2017), a ten-fold rise in demand for metals, including copper, by 2050 is anticipated as the world moves towards a low carbon energy future. Copper demand is expected to jump by as much as 50 percent over the next 20 years alone. The positive impact of copper based on new downstream sources is assessed to be positive of medium significance.

3.3.2. National

Namibia is well endowed with mineral deposits including those copper deposits found in close proximity to Witvlei. As stated earlier, Namibia's economic model has largely been based on exploitation of mineral deposits with limited value addition initiatives. Low levels of industrialization in particular has to a certain extent limited the economy's capacity to create sufficient sustainable jobs. Services (tertiary industries) remain the key driver of growth and its contribution to Namibia's Gross Domestic Product (GDP) rising from 50.4% in the1980s to an average of 58% over the 2010-2018 period (ADB, 2020).The shift was driven by expansion in government services and financial intermediation. In contrast, the share of mining in GDP decreased by about half to an average of 11.2% of GDP. Despite its reduced share in GDP, mining remains the largest earner of Namibia's foreign exchange at about 45%. Project that facilitates the downstream processing of natural resources can improve trade performance and speed up the structural transformation of the national economy. Mineral processing is enshrined in National Development Plan (NDP V) and Vision 2030.

The Haram bee Prosperity Plan II plan (Pillar 2) place emphasis on economic advancement with view to enhance the productivity of priority sector such as mining (mineral processing). Hence the project inherently promotes economic advancement of the sub-metal ore sector. The operation of copper smelters promotes downstream processing, enhancing value addition and thereby contributing to growth of country's GDP. The governmental income can be increased through the Smelter operation and relative gainful employment through required services i.e. direct and indirect tax income (corporate, personal, VAT, secondary, others) levies and customs. Based on the above, the **positive impact** of development of the growth of national economy is assessed to be of **low significance**.

3.3.3. Industrial Development

Industrialization is often essential for economic growth, and for long-run poverty reduction in the region. The location of an industrial facility can have an impact on poverty reduction and redress of income inequality. The location of project in close proximity to the beneficiating community can have far reaching impacts on poverty reduction at Witvlei. It is projected that the project can improve household income. Another positive impact of the smelter is the enhancement of the industrial landscape through the establishment of other support industries. Revenue enhanced at local level can improve both private and public sectors revenue. It is anticipated that the positive effects of the project will increase the revenues collection ability of the local authority and household's capacity to pay for local authority services is expected to improve. The **positive impact** of smelter and its contribution towards strengthening economic advancement preposition of the region and Witvlei in particular is regarded as of **high significance**.

The economy of Witvlei primarily centred on commercial production of livestock. The narrative may change as soon as industrial development is accelerated. Already, the proposal to establish an industrial innovative hub about one (1) km North West of proposed smelter plant is an attractive preposition. Notably, industrial facilities such as the abattoir (Fig 1) and charcoal processing plant (Fig 2) signify industrial development. One economic dimension that is likely to be enhance is manufacturing and production of bricks. The proponent intent to secure an erf for a housing development aimed at housing workers. The latter may trigger a demand for construction material (bricks), further enhance the potential for manufacturing. The contribution of smelter industrial development portrays a positive **impact** assessed as of **high significance.**

3.3.4. Informal Economy

Witvlei ranks low and falls within the category of least of developed local authorities in Namibia. Investments made in developing civil engineering infrastructure in recent years is enabling future investments and growth of local economy. Establishing the smelter plant can stimulate the Witvlei informal economy. Growth can excite economic policy reform. Policy reforms adopted at local level may influence the behavior and growth of informal economy e.g the conversion of informal enterprises into a formal enterprise. The development offers an opportunity in effecting growth of the informal economy (low-income activities) potentially benefiting the poor population segment of community or those who could not find stable work at Witvlei. The impact of development on the growth of informal businesses is thus is anticipated creating a favorable environment for transforming informal business into formal pre-entrepreneurial activities and sustainable micro enterprises.Furthermore a positive aspect anticipated is the improvement of societal welfare.

3.3.5. Employment creation

Operating the copper smelter plant presents an interesting prospect for expanding and diversifying the local economy. Living conditions are expected to increase tremendously through economic spinoffs/investments. The presence of a core of workers with somewhat higher incomes than

previously provides may drive consumer demand for goods. The latter should translate in additional jobs, as workers spend and give incomes to others. Equally the development can have an impact on direct and induced employment realized through the supply chain, and provision of support services. During the peak of the construction and operation phases, approximately 65 jobs will be. During the construction phase, job preference will be given to the unskilled or semi-skilled and youth. The duration will be short term with a maximum employment of approximately three (3) years.

The smelting operation phase requires 65 permanent employees. Indirect jobs will manifest due to the out-sourcing of short-term services (maintenance, transportation) to sub-contractors. Highly skilled workforce may be sourced from the broader region. An increase in number of those employed is anticipated together with corresponding increase in income levels for those employed in informal activities, as well as those number of indirect (e.g. in supplier companies) and induced jobs (e.g. in the various business that sell products and services to) created as a result of smelting activity. Under the assumption that the lifetime of the Smelter will be around 20 years, this can create sustainable additional income for the local community. However, the impact of smelter is expected to be felt at household level with people in fulltime employment by Proponent. The **positive impact** of job creation is assessed to be of **high significance** due to the high unemployment prevalence rate amongst unskilled or semi-skilled population group.

3.4. Climate

Classification of climate: The Witvlei is situated in a semi-arid climate that is associated high temperature during summer months, which are from December to February, and lowest temperature in winter months, which are from June to August.

Precipitation: Summer rainfall varies from 450 – 550 mm per year.

Temperature: Warm climate with Average maximum temperatures are between 32^{o} C and 34^{o} C, whilst average minimum temperatures are around 8^{o} C

Wind & Evaporation: High evaporation which peak in the windy months of September and October. Winds are however moderate and mostly from the east, throughout the year.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	25.5	25	24.5	23.6	20.4	17.6	17.4	20.1	24.3	26	26.1	25.7
Min. Temperature (°C)	19.2	19	18.1	16.1	11.5	8	7.5	10	14.8	17.8	18.9	19
Max. Temperature (°C)	31.8	31	31	31.1	29.4	27.3	27.4	30.3	33.8	34.3	33.4	32.4
Avg. Temperature (°F)	77.9	77.0	76.1	74.5	68.7	63.7	63.3	68.2	75.7	78.8	79.0	78.3
Min. Temperature (°F)	66.6	66.2	64.6	61.0	52.7	46.4	45.5	50.0	58.6	64.0	66.0	66.2
Max. Temperature (°F)	89.2	87.8	87.8	88.0	84.9	81.1	81.3	86.5	92.8	93.7	92.1	90.3
Precipitation / Rainfall (mm)	134	127	101	40	4	0	0	0	2	18	62	100

Figure 6: Average temperature and rainfall for Witvlei (Source: https://www.meteoblue.com/)

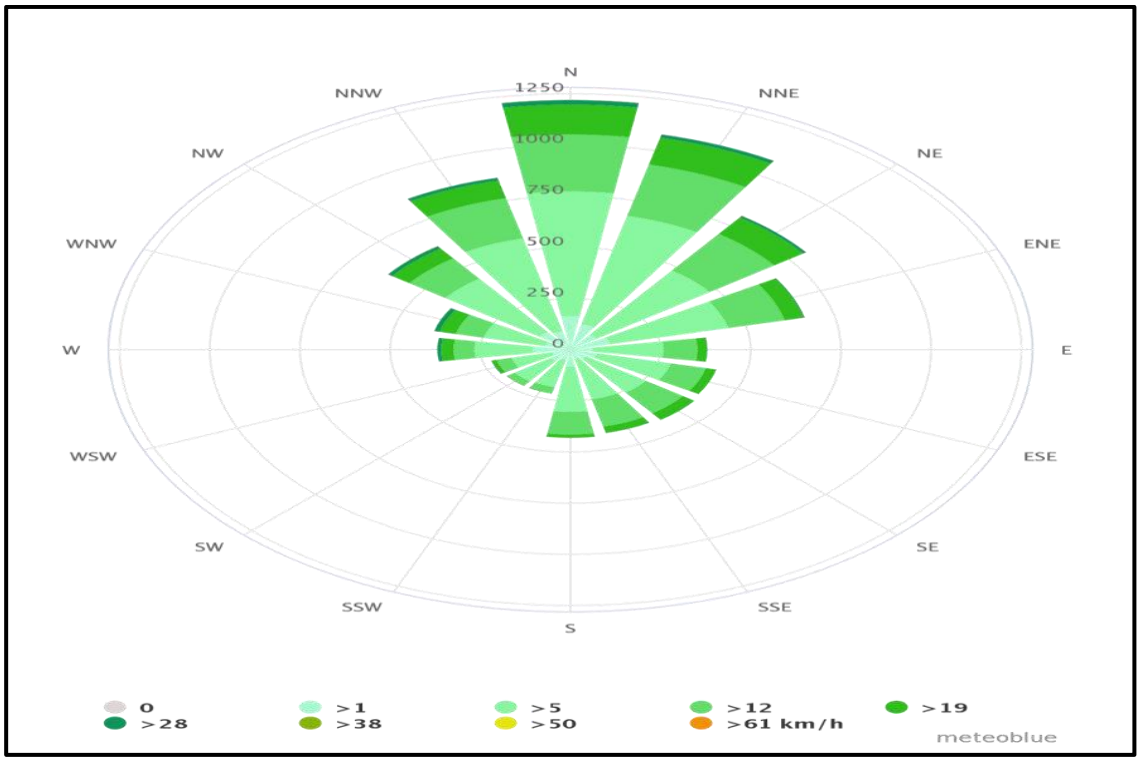

Figure 7: Witvlei Wind Rose (Source: https://www.meteoblue.com/)

3.5. Climate Sensitivity

The following is a depiction of the area's climatic condition as well as potential sensitivities and impacts associated with the identified features;

Table 2:Climate sensitivity index

Environmental Features	Description	Sensitivities	Potential impacts of features on project
Rainfall	• **450 – 550 mm per year.** Evaporation exceeds precipitation by approximately 93%. Typically, sporadic and unpredictable. Localized storm events.	Capacity of the environment to absorb impacts is lower than in wetter areas. Groundwater is an important source of water in Witvlei	• Industrial development causes an increase in water demand. • Run-off from paved and concrete areas as well as areas that have been cleared causes erosion and potential flooding problems downstream.
Temperature	• Summer, highest temperature range 32C° to 34C. • Winter temperatures, measured in July with an average daily maximum of 20°C and minimum of 8°C	• Contributes to high evaporation rate. • Semi-arid camel thorn savannah climate. • Water resource is a scarce commodity. • High temperatures in summer.	• Health and safety of the workforce. • Increased pressure on water resource.
Wind Direction	• Prevailing wind direction is easterly, but westerly winds are more significant in the months of August and early September.	• Dust and smells can be a nuisance to neighboring smallholdings and training center.	• Dust particles and nuisance

3.6. Ecological Environment

3.6.1. Flora

Witvlei is located in a camelthorn savannah vegetation type (Fig 9) .The area comprises a number of Acacia species and numerous species of perennial thorn trees in the bushes and shrubs. According to Mendelson et al. (2002) Witvlei is associated with large, open areas of grasslands and scattered thorny Acacia trees.

The biome has a high species diversity and endemic species. Some of the few species of plants found there are, *Acacia hereroensis Themeda triandra, A. hebeclada, Acacia mellifera, Catophractes alexandri*, *Brachiaria serrata* (Mendelsohn et al., 2009), the area is also has a presence of the

protected Aloe species. The area is also associated with grass species such as; *Stipagrostis uniplumis, Erasgrostis nindensis* and *Microchloa caffra* (Mendelsohn et al., 2009).

Plant diversity in the area is estimated to be 400 - 499 species (Mendelsohn et al, 2002. The dominant perennial grasses in the biome are *stipagrostis uniplumis* and *Eragrostis rigidior* which can be found in the project area. The exact project area is sparsely vegetated due to increased human activities in the industrial area. Eighteen unprotected trees (*Acacia tortilus* spp) were observed on the proposed site. The proposed site is infested with shrubs and grasses. . The dominant grasses observed include *stipagrostis uniplumis* and *Eragrostis rigidior* which can be found in the project area No protected trees species were observed in and around the facility.

The dominant species in the area, which are Black thorn (Acacia mellifera) and Red umbrella thorn (Acacia reficiens), are classified as encroacher bushes.

It is important to note that Witvlei has unique vegetation, however most of the species are not or necessarily threatened. The project site is located does not have much vegetation as illustrated of the vegetation figures below. This is because the project area is sited within an urban locale and development activities around this portion of land could have resulted in the area being cleared off vegetation.

Table 3:Common Plant Species occurring on the project area

SPECIE	COMMON NAME	STATUS
Acacia mellifera	Black thorn	Not threatened
Diospyrus chamaethanus	Dwarf jackal berry	Not threatened
Acacia karroo	Sweet thorn	Not threatened
Acacia tortolis	Umbrella thorn	Not threatened
Bauhinia petersia	Rag bush	Not threatened



Figure 8: Flora on Site

(The site is characterized by greater patches of bare and bushy land with occasional larger trees such as and Acacia nigrescens and Acacia tortilus as shown above.)

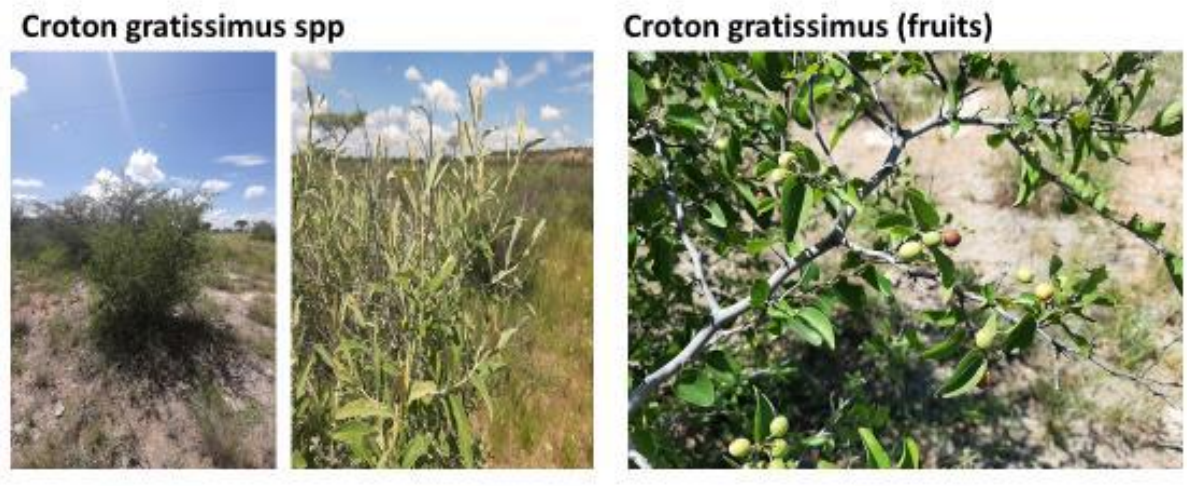

Figure 9: Grasses and bushes

(The project site is characterized by small bushes covering the project area as illustrated above. This is mainly as a result of land clearances that were conducted before. there is evidence of previous land clearing in the project area, and encroacher bushes such as Acacia reficiens can be seen on site.)

Figure 10: Existing disturbances to site vegetation

The site has experienced considerable human encroachment effects, as illustrated on the above images; -Left indicates existing access road, Right indicates past land clearances that occurred before the c proponent took over the land portion.

3.7. Fauna

The wildlife around the witvlei environs is comprised of birds, reptiles and amphibians with a limited number of mammals due to human; encroachment; Reduced vegetation around the project site and surrounding environs has resulted in habitat loss for most mammals that used to habit the area. Much of the wildlife that used to occur in Witvlei has now disappeared because so much of the natural vegetation has been cleared (Mendelsohn 2009). As a result, most remaining wildlife is now concentrated in the surrounding private farms. The project site does not have any unique fauna habitats of critical ecosystem importance, and there were no animals observed on the project site.

However, areas and farms in proximity to Witvlei are expected to have experienced an increase in species diversity which is closely coupled to shelter, food, and water availability and migration routes. There are no known species of rare or endemic status observed at the proposed site. Some fauna species that occur around Witvlei area such as Wildebeest (*Connochaetes taurinus albojubatus*), Springbok (*Antidorcas marsupialis*), Duiker (*Sylvicapra grimmia*), Black-backed jackal (*Lupulella mesomelas*), Eland (*Taurotragus oryx*), Hartebeest (*Alcelaphus buselaphus*), Black faced impala (*Aepyceros melampus*), Warthog (*Phacochoerus africanus*), Zebra (*Equus quagga*), and Steenbuck (*Raphicerus campestris*) (Environmental Compliance Consultancy, 2020). Birds species that are found there include, *Agapornis roseicollis* (rosy-faced lovebird) which is known to be endemic to the area, *Falco chicquero* (red necked falcon), *Apus coffer* (little swift), *Oena Namaqua* (Namaqua dove), *Falco rupicolis* (Rock kestrel) and *Vidua regio* (Shaft-tailed whydah). The area is also associated a high number of reptiles such as *Pseudaspis cono* (Mole snake), *Python notalensis* (Southern african python), *Heliobolus lugubris* (Bushveld lizard), *Pedioplanis nomaquensis* (Namaqua sand lizard) and *Bitis orietons (*Puff adder) (Environmental Compliance Consultancy, 2020).

Localised impacts to fauna and flora can be expected from the proposed project, however there are no fauna expected within the project site. However copper smelter operational activities may have impacts related to emissions, noise, vibrations and pollution. To ensure the safety of the ecological nexus in the area, a strict environmental compliance and monitoring program will be put in place, also to prevent and or minimize different forms of pollution as well as potential disturbances that may be detrimental to the biozone.

3.8. Topography and Elevation

Th Namibia is divided into three main topographic elements, (a) An extensive plateau, b) A narrow coastal plain and (c)An eroded escarpment that is characterized by dissected and rugged topography (Bee Pee & SRK).

Witvlei is a fall under the Khomas Hochland Plateau, which is the ridge of higher ground found in the center of Namibia. The altitudes in the plateau range between 1700 m to 2000 m above mean sea level. Witvlei is surrounded flatter topography compared to the western parts of the plateau. A trait that is believed to have been cause by erosion by glaciers 300-200 million years ago (Mendelsohn et. al. 2002).

The Witvlei area falls in the Hochfeld- Dordabis –Gobabis area. The area is characterized by a mountainous terrain from the eastern Khomas Region that stretches up to the Hosea Kutako International Airport and drainage in the easterly and south-easterly direction by the ephemeral rivers Seeis, White Nossob and the Black Nossob. The ephemeral rivers originate in the highlands of the east of Okahandja and Windhoek. (Christelis and Struckmeier, 2001).

The project site has a generally flat terrain, and the area drains towards the South East, hence pollution control and stormwater drainage design should take this into consideration. The storm water drainage network linked to project site should be complemented by a robust water quality monitoring plan.

3.9. Geology and Soil

Witvlei is found between the Witvlei and Gobabis synclines of the Damara supergroup, these rocks are overlain by a Karoo and Kalahari succession (Miller, 2008). The rocks of the Damara supergroup are formed because of a collision between the Kalahari and Congo Cratons approximately 800- 500 Ma. The Karoo and Kalahari Super groups formed between 300-200 million years ago and 70-65 million years ago respectively (Mendelsohn et. al.2002). The area is made up of Kamtsas quartzite and limestone of the Nosib Group and sediments of the Kuibis Subgroup (Nama Group), locally overlain by diamictites (tillites) and shale of the Dwyka Formation (Karoo Sequence) (Christelis & Struckmeier 2001).

The proposed project lies within Kalahari Copper Belt area which stretches discontinuously from western Namibia to northern Botswana for about 1000 km, and hosts significant stratabound copper-silver deposits such as Klein Aub, Oamites, Dordabis, Witvlei in Namibia (Anhaeusser and Button, 1973; Borg, 1987) and the ones along the Ghazi-Chobe belt in Botswana (Borg, 1987; Borg and Maiden, 1989, Figure 1). Copper deposits are hosted in Meso- to Neoproterozoic metasedimentary rocks that have been deformed and metamorphosed to greenschist facies during the Pan-African Damara Orogeny (Borg, 1987; Borg and Maiden 1989; Modie, 1996; Hitzman et al., 2005).

The general stratigraphy of the region is characterised by basement gneisses unconformably overlain by bimodal volcanics on which siliciclastic sediments and minor carbonates rest unconformably. All deposits along the Kalahari Copperbelt have been proven to have similar lithological features with respect to age, geotectonic position and depositional environment (Borg, 1987; Borg and Maiden, 1987) and they are thought to share similarities with the Kupferschiefer of Poland and Germany, and with the central African Copperbelt of Zambia and Democratic Republic of Congo (Borg, 1987; Modie, 2000; Hall, 2012; Hitzman et al., 2005).

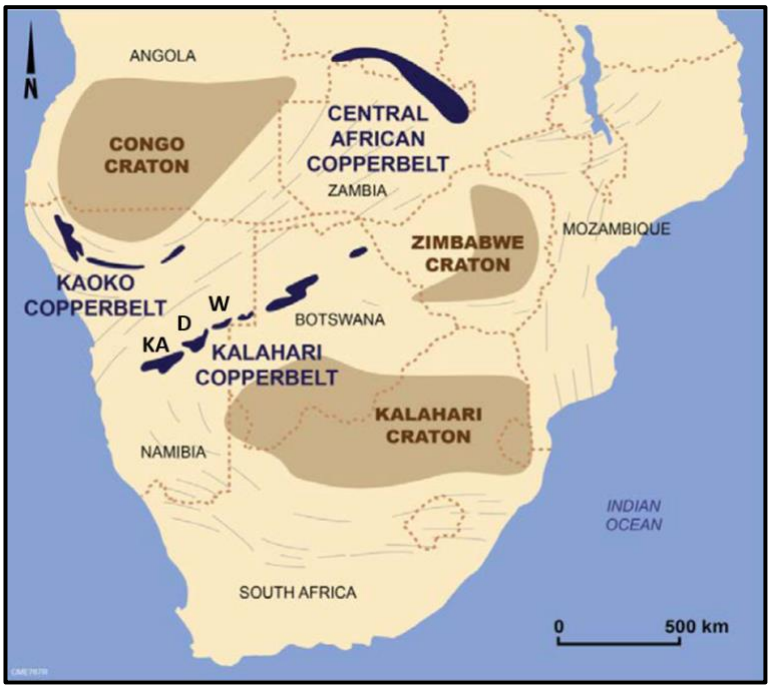

Figure 11: Regional geological setting of the Kalahari Copper Belt

(showing discrete copper deposits in Namibia (Klein Aub KA, Dordabis D and Witvlei W) and Botswana)

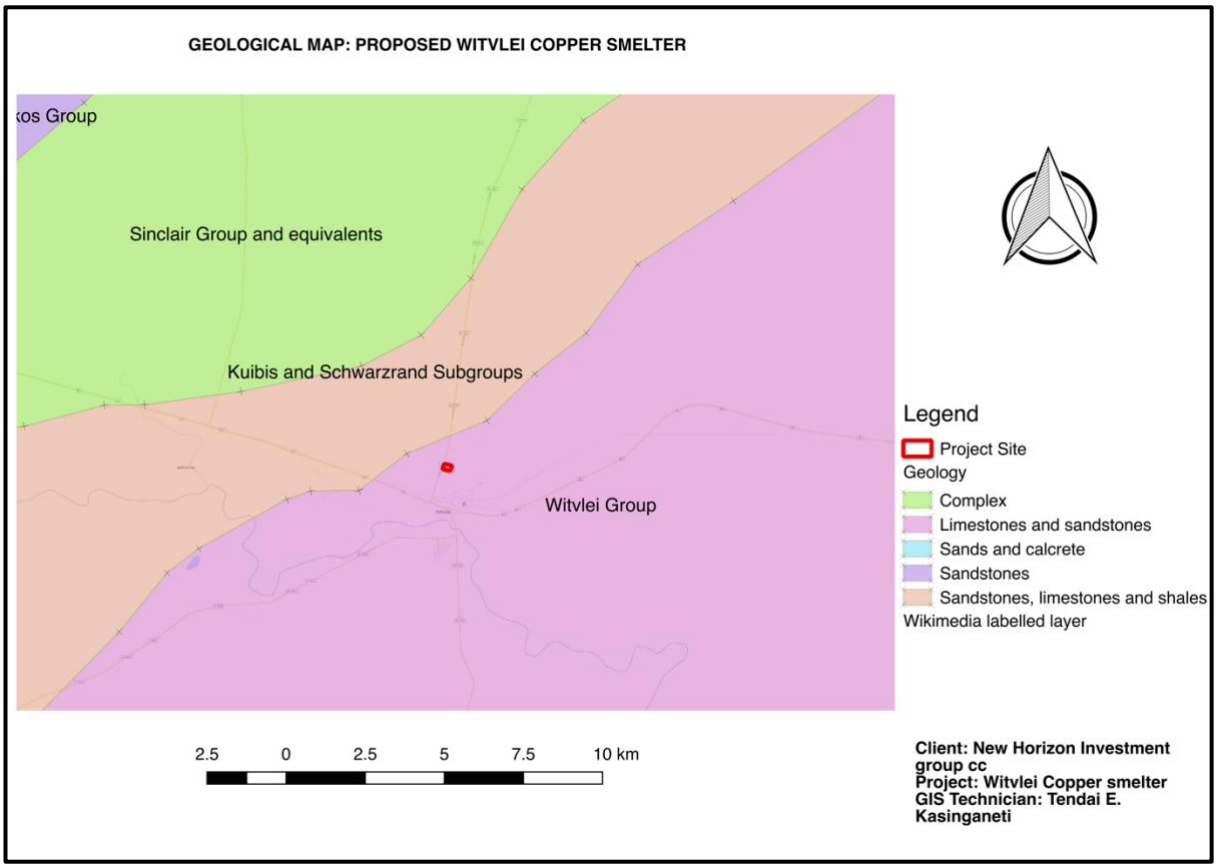

Figure 12: Witvlei Geology

Figure 13: Exposed weathered and fractured quartzite's at proposed site

Witvlei area shows that is characterized by young sand (alluvium and surficial deposits) Fig 13. The groundwater potential of the area is generally moderate to low (Figure 2). Sandy arenosols dominate the eastern part, while regosols (weakly developed mineral soils) are found in the area west of Witvlei. More fertile fluvisols are present along the main river courses, e.g. the Black Nossob.

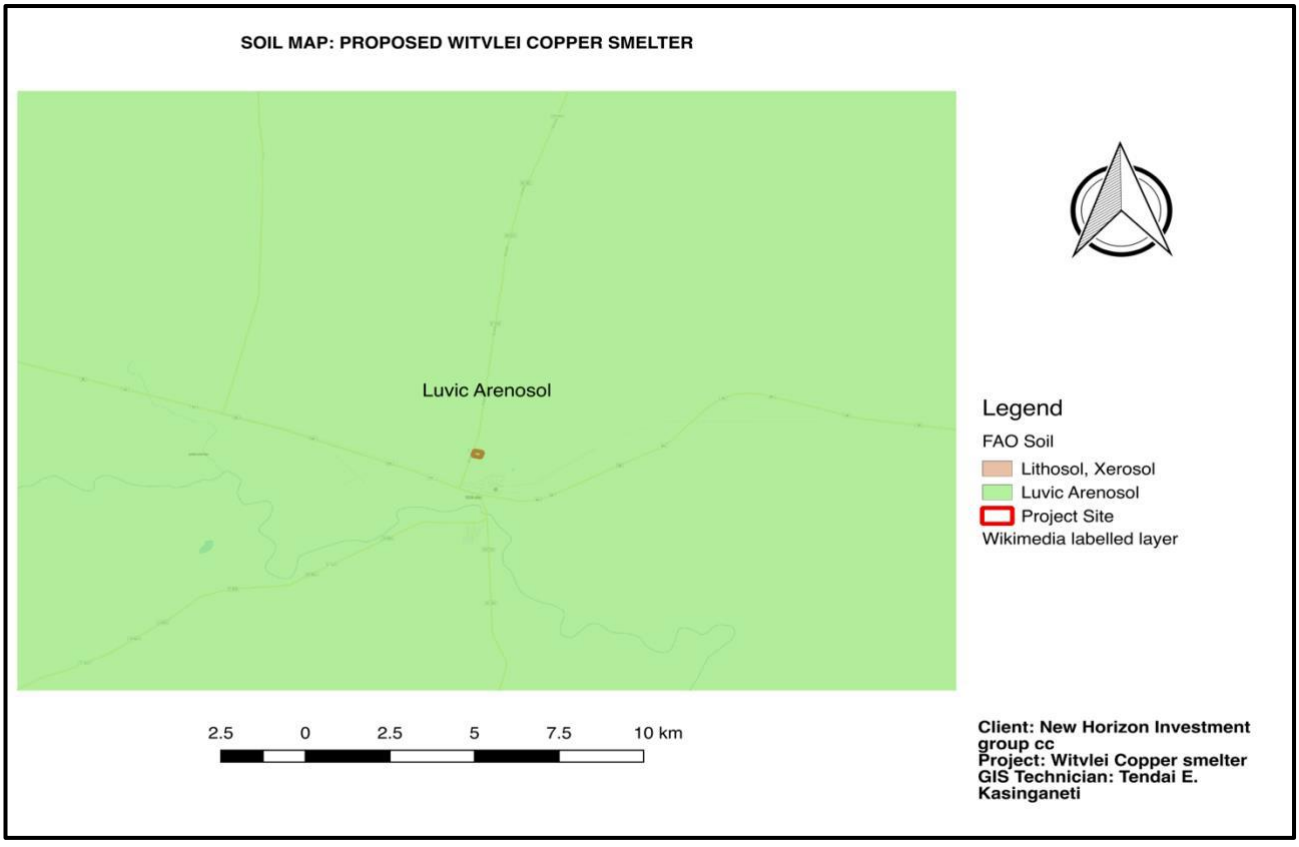

Figure 14: Witvlei Pedology

Witvlei has predominantly Arenosols and occasional fluvisols.

3.10. Geohydrology

3.10.1. Catchment Analysis

Witvlei falls in the Nossob catchment area, this catchment area starts from the Khomas Hochland highlands in Windhoek up to the Kalahari sands on the eastern Namibian border post of Buitepos, until it joins its confluence the Molopo River between Botswana and South Africa. The flat sandy Kalahari plateau, that start just before the Hosea Kutako Airport, yields very little to no runoff as the precipitation is absorbed by the thick layer of Kalahari sands (Strohbach, n.d).

Precipitation infiltrates in the Kalahari sands along the Nossob River and this recharges the fractured quartzite of the Kamtsas formation, groundwater in this area is of moderate potential as the hydrogeological map below suggests. Groundwater discharge in the area is mostly due to abstraction of water from boreholes and no natural discharge is observed in the area (Chistelis and Struckmeier, 2001).

Groundwater quality is a measure of the concentration of chemical elements in a sample of groundwater. Elements such as sulphates, nitrates, fluorine and other chemical compounds are tested for at an accredited testing laboratory, the results are compared with a standard and a conclusion about the quality is drawn. The water in the Witvlei area can be classified as a Group B quality according to the Namibian Water Quality Standards (NWQS) (Namwater, 2020).

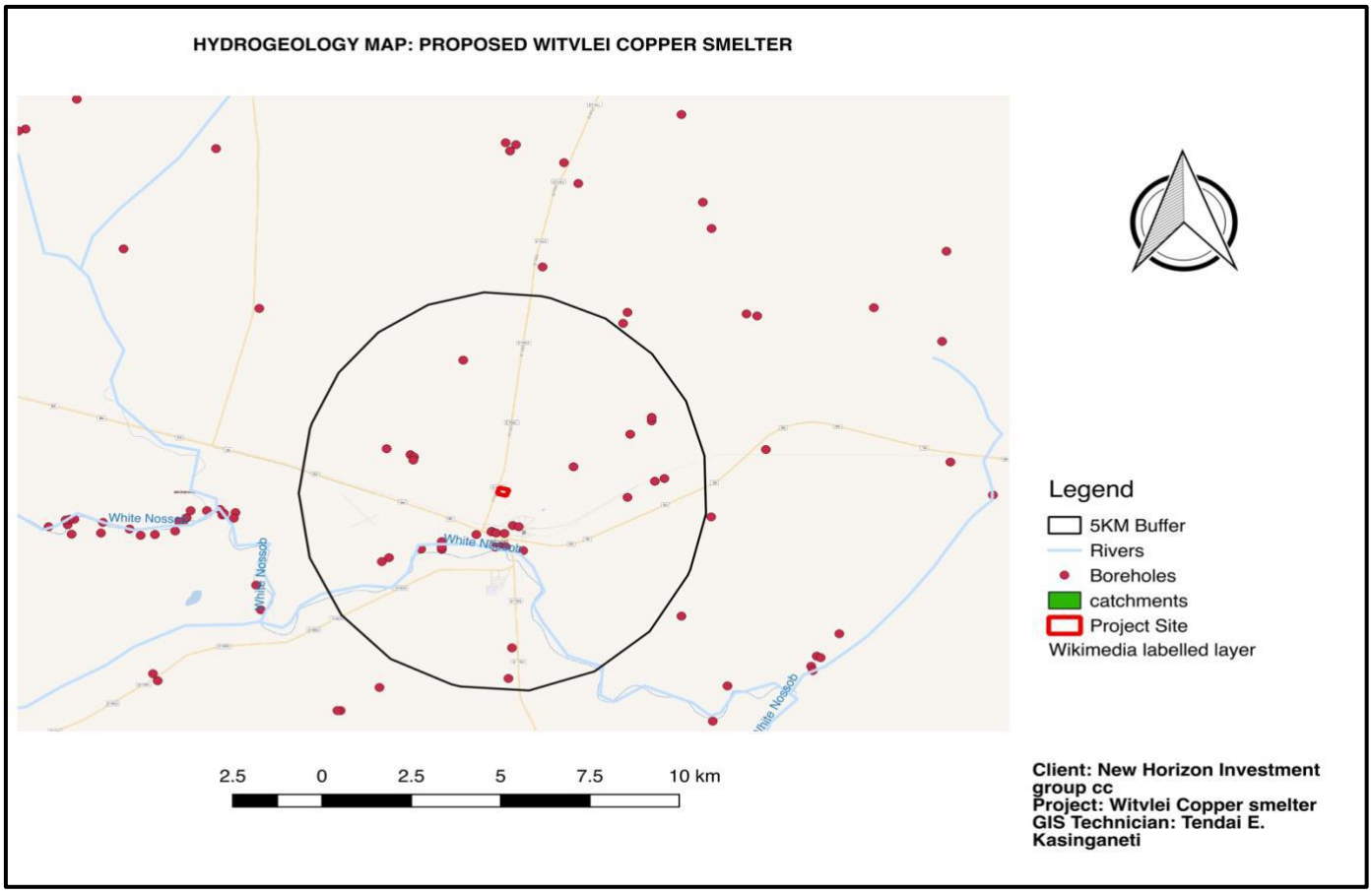

Figure 15: Witvlei hydrogeology

3.10.2. Hydrocensus

The Ministry of Agriculture, Water and Land Reform Namibia, has a database of drilled boreholes and chose monitoring boreholes around the country. **Table 5** shows a list of some of the boreholes, four of these boreholes are monitored, water levels are taken regularly. The last reading was taken in 2020. The other boreholes, water levels were taken from the groundwater archives and their state needs to be confirmed.Water levels taken when the boreholes were initially drilled range from 3- 32 meters, this shallow groundwater level is still observed in the recently measured boreholes (8-20meters).

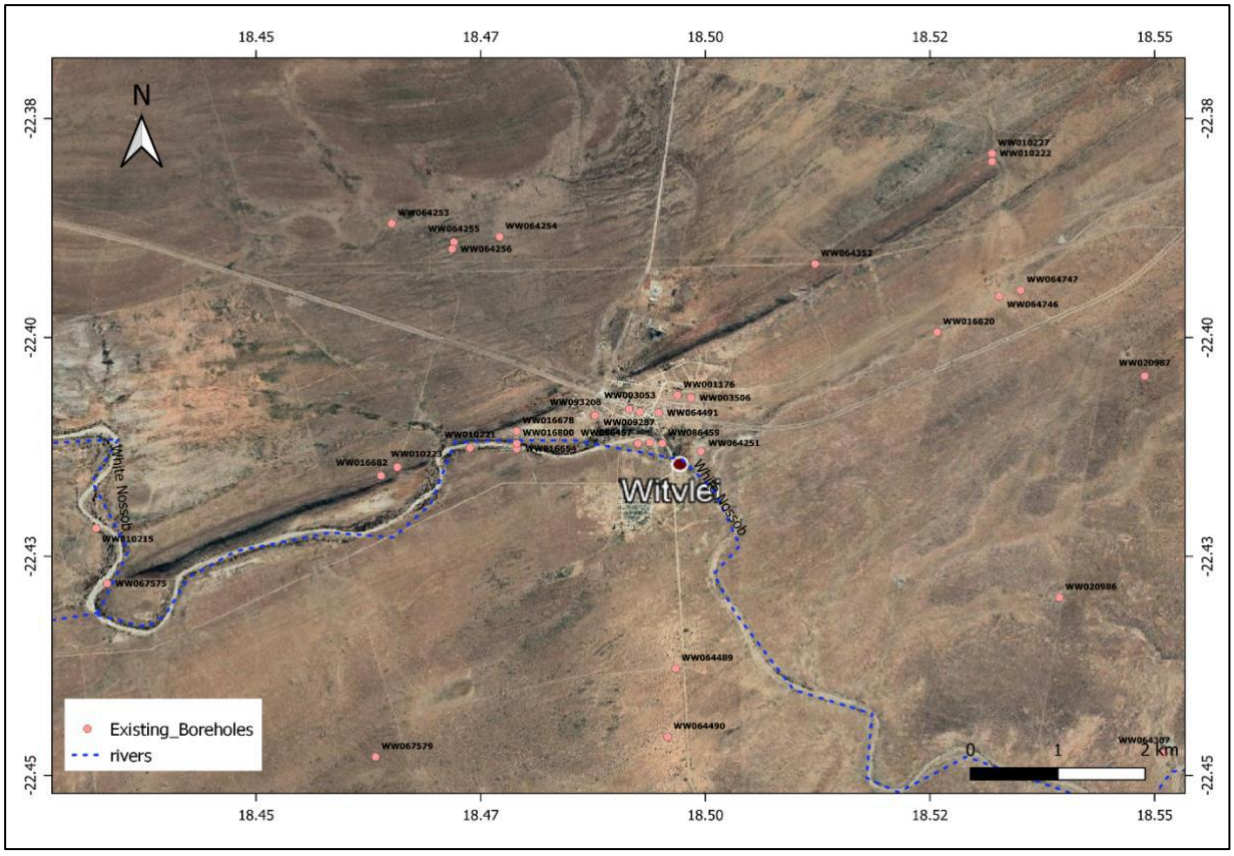

Figure 16: Boreholes around the site.

Aquifer with shallow water levels can be vulnerable to pollution, procedures on how to work with chemicals and hazardous substances need to be in place. No test pumping data is available to estimate the groundwater reserve, no estimate of the resource on the area has been made so far.

3.10.3. Pollution Sources Identification, Possible Migration Paths and Pollution Plume Development

Pollution sources of a smelter are mostly in the form of gases and liquid effluents from waste water treatment processes. In most cases Sulphur dioxide is used to make Sulphuric acid. The effluents from these processes have low pH levels, and will have a negative impact on the environment (World Bank Group, 1998). The plant is designed for non-electric smelting of copper oxide ore. The off-gas produced during the process in treated and cleaned before released into the atmosphere.

The aquifer that house the groundwater is covered by aeolian sand through which groundwater infiltration and therefore groundwater recharge takes place. Any liquid spilled on the formation will seep through the porous formation and eventually find its way to the water table. Groundwater flow in most cases flows in the direction of surface water flow, in the case of boreholes which are along the White Nossob river, the groundwater will flow following the river course. In cases where the boreholes are far from the river, the water will flow in the easterly direction until it finds its way to the lowest point where it discharges

Groundwater level and groundwater quality monitoring will form a critical component for environmental control and compliance monitoring during the implementation of the project. The pre-identified boreholes will be monitored based on the Water act statutory requirements and standards.

Table 4: Existing Boreholes –Witvlei Area

BOREHOLE_NO	LATITUDE	LONGITUDE	DATE_	ORIGINAL WATER LEVEL (M)	MONITORING WATER LEVEL (M)	INITIAL YIELD (M^3)
WW 025877	-22.50447	18.97939	Jan-81	26.0	18.2	3.6
WW 016919	-22.40757	18.38058	Jan-74	3.3	10.5	2
WW 010210	-22.33871	18.19221	Oct-72	19.2	19.8	6.2
WW 009854	-22.44621	18.97045	May-69	32.3	7.9	16.3
WW 001176	-22.40660	18.49690	Jan-27	10.6	-	22.2
WW 010228	-22.40850	18.39310	Jan-70	15.4	-	12
WW 010229	-22.40390	18.42370	Jan-70	11.7	-	14.7
WW 012704	-22.49390	18.45130	Jan-71	43.0	-	1.8
WW 016631	-22.40890	18.40670	Jan-73	5.5	-	4.1
WW 016678	-22.41070	18.47900	Jan-73	19.8	-	2.4
WW 009287	-22.40820	18.49150	Jan-67	9.7	-	12
WW 010223	-22.41480	18.46570	Jan-70	16.1	-	30
WW 093208	-22.40890	18.48770	Jan-73	21.0	-	4
WW 086441	-22.26440	18.40150	Jan-65	40.0	-	1.4

4. CHAPTER FOUR: PROJECT ALTERNATIVES

The following alternatives are considered for the project;

The analysis of alternatives of the project it is described here in short.

4.1. Industrial Zones

A number of factors were considered for the purpose of siting the proposed smelter plant. Several industrial nodes were identified for consideration. Judgement was based on two new industrial areas. The first was is the proposed and existing industrial site at Witvlei and the second is an Industrial site located at Gobabis (approximately 40 east of Witvlei). Another significant factor considered is the proximity of ore deposit in relation to the proposed smelting site. The latter is imperative given that transportation cost is an important and vital consideration for ensuring the financial viability of project (research and development phase). The ore envisaged is located approximately 25 km north of the proposed smelter site. The positive effects of reducing unemployment, bearing on the regional's industrial development goals, infrastructure potential and the broader developmental impact the project can have on the local communities. The latter preposition remain attractive to the local community, political leadership and favourable for advancing development agenda. The smelter would not warrant the expansion of auxiliary infrastructure but maximise on the already available electric, rail, roads and water reticulation networks.

4.2. 'No Go' Alternative

The no go alternative may negatively affect the local economic development. With limited investments, a less productive economy and lower levels of living standards is anticipated at Witvlei. Reducing the high un-employment rate, ensuring greater social cohesion and reduction in poverty levels shall remain a persistent challenge at Witvlei.

5. CHAPTER FIVE: PUBLIC CONSULTATION

5.1. Overview

Public and Stakeholder involvement is a key component of the EA process. The public consultation process, as set out in Section 21 of Regulation No 30 of EMA, has been followed during this assessment and the details thereof documented below.

5.2. Printed Media

5.2.1. Background Information Document

A Background Information Document (BID) was drafted at the onset of the EA process to act as a useful information handout about the proposed project. In addition, the BID provided details on the public consultation process with contact details for further information. This document was advertised for availability through various means of newspaper articles, Public meeting and electronic mail; see **Appendix A** of this document.

5.2.2. Newspaper Advertisements & Articles

Newspaper notices about the proposed project and related EA processes was circulated in two newspapers for two weeks. These notices appeared in the "Confidante" and "New Era" newspapers, shown in Appendix A.

Table 5: Newspaper & Site Notices

Newspaper	Area of Distribution	Language	Date placed
The New Era	Country Wide	English	01-03-2021 08-03-2021
Windhoek Observer	Country Wide	English	26-02-2021 05-03-2021
Site notice		English	25-02-2021
Preliminary Meeting with Village Head	Hoadadi Community Hall in Witvlei.	English/Afrikaans	16-03-2021

5.2.3. Site Notices

A site notice was placed at the project site and at Witvlei Village council office. These provided information about the project and related EA while providing contact details of the project team. Site Notices appendices are in Appendix A of this document.

5.2.4. Building a Stakeholder Database

A stakeholder database for the project was developed. During the advertisement of the project (though public notices in local newspapers and site-notices) the list was augmented as Interested & Affected Parties (I&AP) registered and contact information of stakeholders updated (Appendix A).

5.2.5. Stakeholder Meetings & Key Conversations

A public meeting was conducted on the 16th March 2021 at Hoadadi Community Hall. The meeting was represented with Witvlei Village Council, Omaheke Regional council, Residents, Government and Quasi-Government departments and Ministries. Meeting minutes were taken attached in Appendix A and pertinent issues relating to the projects were discussed and recorded. Below are pictures that relate to public meeting held.

Figure 17: Public Meeting Proceedings Hoadadi Community Hall

Figure 18: Public Meeting Proceedings at Hoadadi Community Hall

5.2.6. Comments and review period

From the onset of the public consultation process and the initial information sharing through the BID, newspaper and site notices, various stakeholders have registered and provided comments.

The public commenting period from the first Newspaper advert spanned for thirty (30) days and the Scoping Report and Environmental Management Plan was made available to the public and stakeholders for comment and review.

Attendance registers, comments and proof of stakeholder's engagement are attached in appendix A of this ESR. Key Issues raised during the consultative meeting are presented below:

THEME	COMMENT
ECONOMIC	▪ Employment of general labour: NHIG must consider employing local people particularly the youth. ▪ Improve the life being of the residents. ▪ The project should benefit all the community members citing lack of inclusivity when projects kick-off.
AMBIENT ENVIRONMENTAL QUALITY	▪ Dust emissions, suppression and monitoring measures were inquired
ENVIRONMENTAL	▪ Potential pollution from the smelting process was raised, citing groundwater sensitivity. ▪ Concerns regarding handling of wastewater from the processing plant were also raised. ▪ Resources such as air and water should not be polluted during operations because communities, wild animals and livestock rely on these resources. ▪ Solid waste management was emphasized as crucial to the project as the community does not have a functional and approved solid waste disposal site.

5.3. Conclusion

It is the opinion of CPC cc that the public participation was extensive and transparent enough to ensure any comments or issues regarding the proposed development to be addressed and to suggest possible mitigation measures. All issues cited in the public meeting are clearly articulated and addressed in the EMP for the project.

6. CHAPTER SIX: ASSESSMENT OF IMPACTS

6.1. Overview

Copper Smelting plants are associated with a wide array of potential environmental impacts, both positive and negative. The primary aim of an environmental assessment is to assess the potential negative impacts of a proposed development. This is done to ensure that the negative impacts that the project activities may have on the biophysical and social environments are adequately addressed so that an impact's significance is brought under control, while maximizing the positive impacts. The potential positive and negative impacts that have been identified from the proposed Plant activities are as follows:

NHIG has committed to sustainability and environmental compliance by coming up with a corrective action plan for all anticipated environmental impacts associated with the project. This is also in line with the Namibian Environmental Management legislation and International best practices. As proponent, NHIG will implement an Environmental Management Plan (EMP) in order to prevent, minimise and mitigate negative impacts. The environmental management plan is being developed to address all the identified expected impacts, the plan will be monitored and updated on a continuous basis with aim for continuous improvement to addressing impacts.

A number of specialist studies were conducted as part of the ESIA process. Specialists assessed potential impacts cumulatively to current baseline operational impacts. Specialist studies conducted are the following:

- Surface Water;
- Groundwater;
- Air Quality;

The main conclusion of the overall assessment was that the proposed project would result in environmental and social impacts, however management and monitoring measures will be put in place to minimise these impacts to insignificant levels. Summaries of the key findings of the specialist studies are provided below.

6.2. Impact Identification (Positive and Negative) and Description

The potential beneficial and adverse impacts stemming from the proposed development to the bio-physical and socio-economic environment during the two vital phases (construction and operations) are listed below and assessed.

Positive impacts

- Improvement the country's GDP through upscaling in mineral processing

- Socio-economic: The proposed development will create several employment opportunities for individuals and their families in the surrounding areas.
- Market development for contractors on the copper smelter construction and operation.
- Development of commodity value chains;

Negative impacts

- Potential of water resources and soil contamination (mainly during operational phase).
- Ambient air adversely affected by emissions.
- Waste generation and management in both phases
- Noise (both phases)
- Nuisance (during operations)
- Dust and decrease in surrounding air quality (both phases)
- Public and environmental Health impacts (both phases)
- Vehicular traffic impacts (both phases)
- Visual (during operations) and archaeological impact
- Social nuisance: Influx of people into the area (both phases).

Some of the potential negative impacts are anticipated to only occur in one phase, while others occur in both phases. In order to avoid repetition, impacts that occur in more than one phase will be described and assessed once. In other words, if for instance health and safety impact occurs in both the construction and operational phase, it will only be described and assessed once under the construction phase (since construction phase precedes the operational phase) and mitigation measures clearly provided.

The negative impacts are described below and assessed in detail under Table 7.

6.2.1. Waste Management

An assessment of potential waste generated and waste generating activities at the smelter was undertaken and various recommendations made for effective waste. The main findings were the need for a formal general waste landfill site and the need for waste segregation, given that some waste may be hazardous.

NHIG can primarily utilize the nearby Kupferberg landfill (about 150 West of Witvlei) for any hazardous waste, however it is recommended that the existing Witvlei waste disposal site be upgraded to take care of hazardous waste. With the limited potential for arsenic waste volumes to be produced and disposed, it is recommended that the landfill site should last for at least 20 years before an upgrade is required. A thorough investigation and verification of fall out dust should be conducted to ensure the safe disposal of hazardous dust.

6.2.2. Surface Water

There are no natural surface water sources within the smelter property and the assessment thus relates to stormwater runoff. The proposed smelter would result in slag material being produced, which could require a designated storage. Pollution sources of a smelter are mostly in the form of gases and liquid effluents from cooling processes. In most cases Sulphur dioxide is used to make Sulphuric acid (not within scope of project). The effluents from these processes have low pH levels, and will have a negative impact on the environment (World Bank Group, 1998).

Mitigation measures would thus be required in order to ensure that the stormwater system capacities would be sufficient to handle any additional contact runoff generated. The stormwater system should be designed such that the White Nossob River is not contaminated. Waste must be in a roofed and bunded areas with no external releases.

Stormwater channels should be lined with concrete and there should be need for a pollution control dam. With these measures in place, there should be only a small likelihood of any contact water leaving the site and reaching the White Nossob River. Key mitigation measures include the construction of infrastructure to manage contact water around the smelter expansion site and surface water monitoring at various sites along the White Nossob River in order to monitor pollution levels.

6.2.3. Groundwater

The geohydrology of the area shows that groundwater flow is in a westerly direction, however continuous monitoring for heavy metal and sulphate concentrations will determine groundwater contamination control requirements. Groundwater contamination can be minimized through improvement in drainage and erosion control, drilling of monitoring boreholes and undertaking regular monitoring of groundwater quality

6.2.4. AIR QUALITY STUDY

The production of copper involve crushing, screening , batching , smelting and release of gases and particulate matter into the atmosphere. Copper production causes environmental impacts at all stages of the process. These include emission of airborne pollution in the form of dust, gases mainly depending on the origin and the composition of the raw materials (ore concentrate used). Environmental regulations exist in many countries to limit these emissions .When air pollution began to have significant deleterious effects on human life, it become necessary to discover and understand the link between emission sources and the air quality deterioration and health effects they cause. Only after the impacts of sources have been assessed correctly will it be possible to devise and implement rational, convincing, and effective measures to improve air quality. Due to the continuous growth of industries the deterioration of air quality in urban areas has provided the impetus for comprehensive modelling of air quality. Emissions from industrial stacks are regulated to protect human and environmental health. The main emissions anticipated from the smelter site include Sulphur dioxide (SO2), sulphuric acid (H2SO4), particulate matter (PM10 and PM2.5).It is

expected that SO2 emissions will be experienced, although there has will be an effective method to capture SO2, any exceedances will be strictly monitored

Air Quality Modeling

As an air pollutant is transported from a source to a potential receptor, the pollutant disperses into the surrounding air so that it arrives at a much lower concentration than it was on leaving the source (Otaru et al,2013). Air pollution modelling helps to determine the mathematical relationship between the effects of source emission of the pollutant on ground level concentration. The copper production process (smelting plant) involve unloading or tipping of ore concentrate and mixing of ore with fuel. The process also include the release of airborne pollution in the form of dust and off-gases. Fugitive emissions are generated during material handling operations. The nature and characteristics mainly depend on the type of fuel and the composition of the raw materials (ore concentrate used). When air pollution began to have significant deleterious effects on human life, it become necessary to discover and understand the link between emission sources and the air quality deterioration and health effects they cause (Otaru et al,2013). Only after the impacts of sources have been assessed correctly will it be possible to devise and implement rational, convincing, and effective measures to prevent adverse impacts on air quality.

Emissions from the cupola copper smelters are principally particulate matter and oxides of sulphur (SOx). Emissions are generated from the smelting furnaces.. Copper and iron oxides are the primary constituents of the particulate matter, but other oxides such as arsenic, antimony, cadmium, lead, mercury and zinc, may also be present, along with metallic sulfates and sulfuric acid mist.

Because of considerable quantities of sulphur in the ores in which copper is found, significant emissions of sulphur dioxide occur from various processes associated with primary copper smelting. The amount of sulphur dioxide released will depend on the characteristics of the ore—complex. Ores may contain lead, zinc, nickel, and other metals— and on whether facilities are in place for capturing and converting the sulphur dioxide. According to the World Bank Group (1998), SO2 emissions may range from less than 4 kilograms per metric ton (kg/t) of copper to 2,000 kg/t of copper. Particulate emissions can range from 0.1 kg/t of copper to as high as 20 kg/t of copper. Fugitive emissions occur at furnace openings scoops carrying molten materials. Additional fugitive particulate emissions occur from materials handling and transport of ores and concentrates. The main emissions anticipated from the proposed cupola smelter site include Sulphur dioxide (SO2), particulate matter (PM10 and PM2.5).

An air quality modeling study (AQMS) was conducted forming part this EIA . The AQMS report is discussed in more detail (Appendix) of this report. Air pollution modelling is basically mathematical modelling used to estimate the downwind ambient concentration of air pollutants from sources such as industrial plants, vehicular traffic or accidental chemical release. Gaussian dispersion modelling is one of the most commonly used modelling methods which computed the theoretical

problems of air pollutant dispersion in terms of plotting the standard deviation and normal distribution. AERMOD Gaussian air dispersion model developed by the US Environmental Protection Agency (EPA) was preferred for the purpose of AQMS. AERMOD is a steady-state Gaussian plume model can simulate dispersion from multiple sources using up-to-date concepts regarding boundary layer characterisation and dispersion. Also model facilitated the understanding of the diffusion properties of plumes emitted from the stack of the proposed smelter plant.

The model was applied to calculate the maximum ground level impact of plumes and the distance of maximum impact from the source. Experimentally it described by plotting standard deviation of its concentration distribution, in both the vertical and horizontal direction, as a function of the atmospheric stability and downwind distance from the source. The simplified coordinate systems used for the development of the Gaussian model and air quality assessment process is depicted on Fig 19 below.

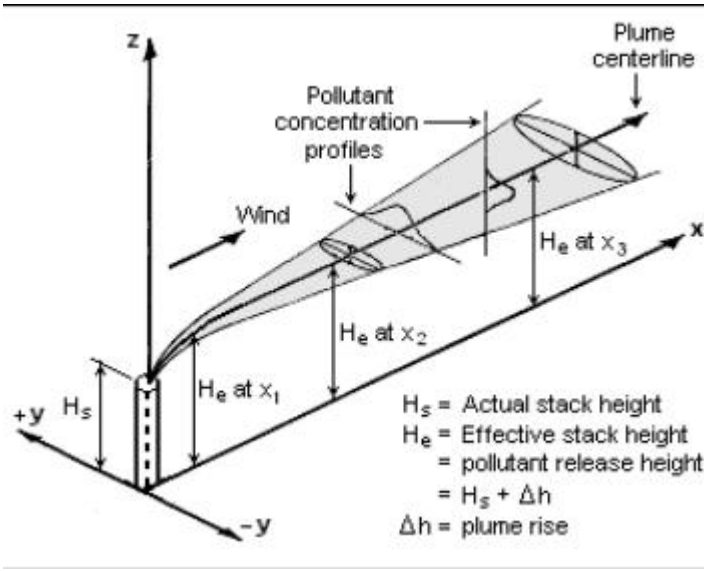

Figure 19: Gaussian air pollutant dispersion plume model (Source: Igbafe,2007)

Emission levels were evaluated against best practice guidelines. For nitrogen oxides, no data was found directly from processes associated with smelter. It can be assumed that these compounds are emitted from in-process heating units, but no quantitative data are available.

Cyclones are to be used to control particulate emissions with 98% efficiency. Dust that is captured but not recycled will need to be disposed of in a secure landfill or other acceptable manner. It can be assumed that this compound is emitted from in-process heating units, but no quantitative data are available. Most of the direction of the wind prevailed from the east and south west. The predicted ground level concentrations (GLC) at the sensitive receptors around the plant indicates insignificant impacts because of the emissions from the proposed smelter plant. Relatively, Abattoir in the north and Charcoal Processing plant in the south are receiving some impact otherwise the Witvlei village remains unaffected most of the time. Frequent sampling may be required during start up and upset conditions. Once a record of consistent performance has been established, sampling

for the parameters should form part of the monitoring program. Air emissions should be monitored continuously for sulphur dioxide and particulate matter. Other air emissions parameters should be monitored annually. No ambient air quality or emission standards exist for Namibia. Also no occupational exposure limits exist for SO2 emissions in Namibian environmental legislation. It can be anticipated that the results provided by the AQS will help to gain further insight into air quality associated with smelting operation. Based on the impact assessment, the abattoir in the north of smelter plant and charcoal processing plant in the south are receiving some impact otherwise the Witvlei village remains unaffected most of the time. Although there has will be an effective method to capture SO2, any exceedances will be strictly monitored. Despite the prescribed cyclones that are anticipated to be 98% effective, it is necessary to regularly conduct stack monitoring when the plant is operated. Supplementing the latter is a requirement for dust fallout monitoring framework based on pre-determined monitoring stations erected at carefully selected sites (sensitive receptor).

6.2.5. Noise

There are no identified sensitive noise receptors in the immediate environs, however once the project is operation, ambient noise monitoring will be conducted. Noise levels in Witvlei are greatly influenced by community activities and highly dependent on wind speed. Noise simulations are deemed not critical at the moment. In addition, no noise standards specific to Namibia exist.

6.2.6. Biodiversity: Fauna and Flora

The only animals that may be found around the site, are animals from the neighbouring farms grazing close to the site. These animals may only be impacted as a result of potential pollution or groundwater and surface water. However, this is unlikely as appropriate measures for pollution prevention will be implemented.

6.2.7. Health and Safety

Copper smelter plant employees may be susceptible to health and safety risks during construction and operation. Employees involved in the construction and operations phases may be exposed to health and safety risks, when they are not properly inducted or trained on how to use certain machinery or equipment.. To comply with legislation, an occupational health and safety plan (OHSP) for the smelter plant should be developed, and approved by Ministry of Labour, Industrial Relation and Employment Creation.

Community health concerns are potentially associated with the operational phases as there may be toxic releases into groundwater, soils and the air. A strict environmental quality monitoring procedure will be put in place and adhered to as required.

6.2.8. Vehicular Traffic Safety

The project works may potentially put pressure on the existing roads when construction materials and operational phase goods are delivered to and from the site. The construction of the facility and

its eventual presence will potentially increase traffic in the area. Ore transportation to the site will also impact traffic safety and flow, as such as soon as the project resumes, a traffic management plan should be developed.

6.2.9. Social Influx

- **Influx of people into the Area for a Better Life and Opportunities**

The news of projects as this may cause the immigration of people into the project area in search for economic opportunities. Given the current unemployment rate in Namibia, the project presence may attract many out of area people to come look for jobs in order to provide for themselves and their families. This influx of out-of-area people into the project area during the construction and operational phase may lead to social annoyance to the local community. Different people may come with different ways of living to the area, which could interfere with the local norms, culture and values. This would lead into social crashes between the locals and "outsiders".

The influx of people into the project area may also lead to sexual relations between contractors and the locals. This would lead to the spreading of sexual transmitted diseases (i.e. HIV/AIDS) and pregnancies when engaging in unprotected sexual intercourse. Not only would the general locals be engaged in sexual relations with the construction workers, but the school learners too. Some construction might take advantage of the young female and male school learners to be involved in romantic relationships and eventually engage in sexual activities with them.

- **Damage or Disturbance to neighbouring Private Properties**

The presence of out-of-area construction workers may lead to social annoyance to the local community. This could particularly be a concern when the project workers enter or damage properties of the locals. The locals' private properties could be homes, yards/fences, vegetation or domestic animals (livestock) or any properties of value to them.

6.3. Assessment of Impacts

This section sets out the overall approach that was adopted to assess the potential environmental and social impacts associated with the project. To fully understand the significance of each of the potential impacts each impact must be evaluated and assessed. The definitions and explanations for each criterion are set in **Table 6** below.

Table 6: Assessment Criteria

Duration – What is the length of the negative impact?	
None	No Effect
Short	Less than one year
Moderate	One to ten years
Permanent	Irreversible

Magnitude – What is the effect on the resource within the study area?	
None	No Effect
Small	Affecting less than 1% of the resource
Moderate	Affecting 1-10% of the resource
Great	Affecting greater than 10% of the resource
Spatial Extent – what is the scale of the impact in terms of area, considering cumulative impacts and international importance?	
Local	In the immediate area of the impact
Regional / National	Having large scale impacts
International	Having international importance
Type – What is the impact	
Direct	Caused by the project and occur simultaneously with project activities
Indirect	Associated with the project and may occur at a later time or wider area
Cumulative	Combined effects of the project with other existing / planned activities
Probability	
Low	<25%
Medium	25-75%
High	>75%

Table 7: Impact Significance

Class	Significance	Descriptions
1	Major Impact	Impacts are expected to be permanent and non- reversible on a national scale and/or have international significance or result in a legislative non- compliance.
2	Moderate Impact	Impacts are long term, but reversible and/or have regional significance.
3	Minor	Impacts are considered short term, reversible and/or localized in extent.
4	Insignificant	No impact is expected.
5	Unknown	There are insufficient data on which to assess significance.
6	Positive	Impacts are beneficial

Table 8: Environmental Impacts and Aspects Assessment

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
TOPOGRAPHY	Landscape Scenery	Visual aesthetic impact	Construction and Operation	Moderate	Moderate	Local	Direct	Medium 25 - 75%	Minor
	Topography and Landscape	Alternation of existing topography	Construction & operation	Short term	Small	Local	Direct	High>75%	Moderate
	Topography and Landscape	Topographic changes and Visual Impact	Construction &Operation	Medium term	Moderate	Local	Direct	High>75%	Moderate
SOIL	Soil	Contamination to soil from solid and effluent waste disposal	Construction and Operations	Moderate	Small	Local	Direct	Low <25%	Minor
	Soil	Spillages of fuel, oil and lubricants.	Construction	Short	Small	Local	Direct	Low <25%	Minor
	Soil	Erosion	Construction	Moderate	Small	Local	Direct	Low <25%	Minor
	Soil	Loss of usable topsoil material	Construction	Long term	Small	Local	Direct	High>75%	Moderate
	Soil	Soil contamination from fallout dust and smelting pollutants.	Operation	Long term	Small	Local	Direct	High>75%	Moderate
LAND CAPABILITY	Terrestrial ecology and aquatic ecosystems	Change in land use	Construction and Operations	Permanent	Great	Local	Direct	Low <25%	Moderate
	Terrestrial ecology and biodiversity	Decreased in vegetated land (biodiversity zones) around the project area.	Construction and Operations	Long term	Low	Local	Direct	High>75%	Low
WATER	Surface and ground water quality	Water pollution from oils and lubricants from vehicles and machinery.	Construction	Moderate	Moderate	Local	Direct	Medium 25 - 75%	Moderate

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
	Surface water quality	Turbidity and high sediment load	Construction	Moderate	Small	Local	Direct	Low <25%	Moderate
	Groundwater quality	Pollution of underground aquifers from smelter plant effluent	Operations	Long term	Great	Local	Direct	Medium 25 - 75%	Low
	Groundwater quality	Groundwater source and soil may be polluted by construction activities	Construction	Short term	Great	Local	Direct	Medium 25 - 75%	Moderate
	Groundwater quality	Groundwater source potentially contaminated by sewerage waste	Operations	Long term	Moderate	Local	Direct	Medium 25 - 75%	Low
	Groundwater quality	Potentially vulnerable groundwater source may be polluted by construction activities	Construction	Short term	Moderate	Local	Direct	Low <25%	Low
	Surface water quality	Eutrophication of nearby rivers	Long term	Moderate	Local	Direct	Medium 25 - 75%	Low	Long term
	Surface water quality	Increase in surface water run- off from a large open surface area on site because a stormwater drainage system.	Construction and operations	Short term	Moderate	Local	Direct	Low <25%	Low
AIR QUALITY	Noise Pollution	Noise -During Construction - Operation noise (ore crushing, vehicular noise)	Construction and Operations	Moderate	Moderate	Local	Direct	Medium 25 - 75%	Moderate
	GHGs	Copper smelting will result in CO2 and cu emissions	Operation	Long term	Moderate	Local	Direct	Medium 25 - 75%	Low

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
	Ambient Air Quality	The copper smelter plant will potentially release the following emissions; -PM2.5 -pm10 -SO2 -NOx -Fallout dust	Operations	Long Term	Moderate	Local	Direct	Medium 25 - 75%	Moderate
WASTE	Groundwater quality	Hazardous waste from the waste storage site	Operations	Long term (operation)	Small	local	Direct	Medium 25 - 75%	Low
	Topography and Landscape	Visual impacts due to infrastructure and unsustainable handling and disposal of waste.	Construction and Operations	Short	Small	Local	Direct	Low <25%	Minor
	Groundwater quality	Leaching of hazardous contaminants from tailings and slag storage and chemicals laden water into the sub-surface	Construction and Operations	Long term	Small	Local	Direct	Medium 25 - 75%	Low
	Topography and Landscape	-Visual impacts due to use of unsustainable disposal methods -The proposed wastewater ponds will pose a visual impact and complete change of scenery because of perennial green vegetation that will form around the ponds.	Construction and Operations	Long term	Small	Local	Direct	Medium 25 - 75%	Moderate

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
FAUNA	Aquatic life	-Construction antifouling paints and sedimentation of rivers -Operational dust fallout, soil contamination and wastewater deposition into the river may cause eutrophication and subsequent affecting of freshwater life.	Construction, Operations	Moderate	Small	local	Direct	Low <25%	Minor
	Terrestrial ecology and biodiversity	Destruction of vertebrate fauna (e.g. road kills; fence and construction /land clearing mortalities)	Construction and Operations	Long	Moderate	Local	Direct	Low <25%	Minor
FLORA	Terrestrial ecology and biodiversity	Proliferation of invasive species inland	Construction and Operations	Long	Moderate	Local	Direct	High >75%	Moderate
	Terrestrial ecology and biodiversity	Loss of unique flora and special habitats in the local environment because of general nuisance and animal migrate.	Construction and operations	None	Moderate	Regional	Direct	Low <25%	Moderate
	Terrestrial ecology and biodiversity	Dust fallout and emissions may	Construction and Operations	Long Term	Small	Local	Direct	Medium 25 - 75%	Low

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
		contaminate some sensitive animal and plant species and they may experience stunted growths.							
	Terrestrial ecology and biodiversity	Clearing of land may lead to destruction of protected vegetation and loss of biodiversity.	Construction	Long Term	Moderate	Local	Direct	High >75%	low
	Terrestrial ecology and biodiversity	Uncontrolled/accidental fires	Construction and Operations	Long Term	Great	Local	Direct	Medium 25 – 75%	Moderate
SOCIO-ECONOMIC	Noise Pollution	Increased noise levels	Construction, Operation	Moderate	Small	Local	Direct	Low <25%	Minor
	Socio Economic Activities	Temporary and permanent employment prospects.	Construction and operations	Long	Moderate	Regional	Direct	Medium 25 – 75%	Positive
	Community health and morals	Increased potential of social evils such as prostitution proliferation and abuse of the vulnerable groups (Children and women). Also potential for increased HIV infections;	Construction, Operation	Moderate	Small	Local	Direct	Low <25%	Minor

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
	Contribution to National Economy	Employment, local procurement, duties and taxes.	Construction and Operations	Short	None	Regional / National	Direct	Low <25%	Positive
HERITAGE/ARCHAEOLOGY	Artefacts, archaeological high value components	Destruction or affecting paleontological and archaeological artefacts	Construction and Operation	Moderate	Moderate	Local	Direct	Medium 25 – 75%	Moderate
HEALTH AND SAFETY	Health Sanitation	Poor ablution and waste management facilities may be detrimental to human health.	Construction and Operation	Moderate	Moderate	Local	Direct	Medium 25 – 75%	Moderate
	Employee Health and Safety	General smelting plant employee's hazards will be posed and standards will need to be put in place.	Operation	Moderate	Moderate	Local	Direct	Medium 25 – 75%	Moderate
CLIMATE	Greenhouse Gases	Copper smelting will result in release of GHGs such as CO2	Operation	Moderate	Great	Local	Direct	Medium 25 – 75%	Major
DISEASES AND PATHOGENS	Carcinogens	-Emissions and effluent from the copper smelter plant will have carcinogenic elements and exposure of the community through inadequate management can result in a cancerous illnesses.	Operation	Moderate	Moderate	Local	Direct	Medium 25 – 75%	Moderate

Environmental Impact	Valued Ecosystem Component	Impact	Project Phase	Duration	Magnitude	Extent	Type	Probability	Significance
	Respiratory illnesses	-Emissions such as PM10, PM 2.5 and PM 0.1 can be highly dangerous to the respiratory system and as such areas around will be strictly monitored dust fallout.	Operation	Moderate	Moderate	Local	Direct	Medium 25 – 75%	Moderate
TRAFFIC IMPACTS	Vehicular Movement	Increase in traffic movements can chase away local wild animals and cause nuisance to nearby homesteads	Operation	Moderate	Moderate	Local	Direct	Medium 25 – 75%	low

7. CONCLUSION

The proposed copper smelting plant is desirable and highly recommended because of the need for local economic advancement. Distant and proximate environs are less vulnerable and not likely to be immensely affected by the project as alluded in the Impact Assessment Matrix. The results of the public consultation process indicated that the Interested and Affected Parties welcome the proposed development. Attention was drawn to ensure that pollution prevention and local employment are taken seriously during the relevant phases of the project. Based on the results of the air quality study, apart from the Abattoir in the north and Charcoal Processing plant in the south that are to receive some impact ,the Witvlei village remains unaffected most of the time by emissions emanating from smelter. Also, potential project impacts during construction and operation phases can be minimized to an acceptable level when supported by effective the adoption of effective mitigation measures. An Environmental and Social Management Plan has been developed to ensure that it addresses all potential negative impacts anticipated from the project and enhance all positive impacts for a more beneficial impact. Based on the findings of the ESR, CPC cc recommends that MEFT (Department of Environmental Affairs) approve the Environmental Clearance Certificate Application on Basis of full compliance to the developed Environmental and Social Management Plan.

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