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REPORT:

CONSTRUCTION AND OPERATION OF THE HEJA LIFESTYLE ESTATE, KHOMAS REGION, NAMIBIA – FINAL SCOPING WITH IMPACT ASSESSMENT

PROJECT NUMBER: ECC-62-571-REP-10-D

REPORT VERSION: REV 01

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COMPLIANCE CONSULTANCY

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EXECUTIVE SUMMARY

Project overview:
Heja Game Lodge (Pty) Ltd (the Proponent) proposes the construction and operation of the Heja Lifestyle Estate, a phased, mixed-use residential and lifestyle development located on a portion of Farm Hoffnung No. 66, approximately 10 km east of Windhoek, within the Khomas Region, Namibia, and inside the municipal boundary of the City of Windhoek.

The Project will be developed over an area of approximately 328 hectares and will comprise up to 1 200 residential erven, including single residential units, townhouses, apartments and mixed-use structures. Supporting land uses and infrastructure include commercial facilities, educational and medical facilities, recreational amenities, internal road networks, bulk services and a dedicated wastewater treatment plant (WWTP) designed to treat domestic effluent to Namibian special standards, with the intention of reusing the treated effluent for irrigation purposes in the estate, as far as possible and once adequate quantities of effluent are reached.

The Project will be implemented in multiple phases, allowing infrastructure provision, environmental management and mitigation measures to be aligned with development demand. The development aims to contribute meaningfully to addressing housing demand in Windhoek while promoting integrated and well-planned urban expansion.

Purpose and scope of the assessment:
This report presents the findings of a scoping with impact assessment, undertaken in accordance with the Environmental Management Act, No. 7 of 2007 (EMA) and the Environmental Impact Assessment Regulations, 2012.

Following screening of the proposed activities, it was determined that a combined scoping and impact assessment is appropriate due to:

- The Project's location within a previously disturbed environment;
- The absence of irreplaceable or highly sensitive ecological features;
- The predictable and manageable nature of anticipated impacts; and
- The availability of targeted specialist studies addressing key environmental risk pathways, including traffic, hydrology, groundwater and flood risk.

The objectives of the assessment were to describe the proposed Project and development phases, establish the biophysical and socio-economic baseline, identify and assess potential environmental and social impacts, define appropriate mitigation and management measures, and inform the Environmental Commissioner's decision regarding the issuing of an Environmental Clearance Certificate.

The draft scoping with impact assessment report and draft ESMP was submitted to the competent authority of the Ministry of the Urban and Rural Development (MURD), the environmental commissioner (EC) at the Ministry of Environment, Forestry and Tourism (MEFT), City of Windhoek and the registered interested and affected parties (I&APs) for their review from 27 March 2026 to 07 April 2026. The scoping with impact assessment has been finalised and will be submitted to the competent authority, MURD and the EC at MEFT for a record of decision.

Legal and policy context:
The Project triggers several listed activities under the EMA, including land rezoning, bulk infrastructure development, wastewater treatment, water abstraction and waste management activities.

Key legislation and policies applicable to the Project include:

- Environmental Management Act, 2007;
- Water Resources Management Act, 2013 and associated Regulations (2023);
- Forestry Act, 2001;
- Town Planning Ordinance, 1954;
- Electricity Act, 2007; and
- National policies including Vision 2030 and Namibia's Sixth National Development Plan (NDP6).

The Project is subject to multiple permitting and licensing requirements, including an Environmental Clearance Certificate, wastewater treatment, discharge and reuse licences, borehole registration and abstraction licences, land-clearing permits, and electrical connection and generation approvals.

Receiving environment:
The Project area is characterised by a semi-arid climate, with low to moderate rainfall and periodic drought conditions, gently undulating terrain intersected by non-perennial watercourses draining toward the Hoffnung Dam, and underlying geology dominated by Kuiseb Formation schists, which function primarily as an aquitard.

Vegetation within the Project footprint is representative of modified savanna typical of the Khomas Hochland, with no protected areas located within the development area. The socio-economic context is defined by rapid urbanisation, a housing shortfall and high unemployment within Windhoek and the wider Khomas Region.

A fenced and demarcated cemetery located within the Project area constitutes the only identified cultural heritage feature and has been incorporated into the development layout and design.

Key environmental and social impacts:
The assessment identified both beneficial and adverse impacts associated with the construction and operational phases of the Project.

Key beneficial impacts include employment creation and local economic stimulation, particularly during construction, with approximately 90–103 direct construction workers per phase and an estimated 135–200 additional indirect employment opportunities through supply chains, logistics and local services.

The Project will contribute to the formal housing supply, support national development objectives, and improve local infrastructure provision, including roads and bulk services. Long-term socio-economic benefits are anticipated through mixed-use development and service provision.

Key adverse impacts identified prior to mitigation include community health and safety risks associated with construction activities and increased traffic volumes, particularly along the B6 and D1527 corridors. Localised visual, noise and air quality impacts are expected during construction. Potential risks to groundwater and surface water resources are associated with wastewater treatment infrastructure, while cumulative pressures related to regional development and infrastructure demand were also identified.

Mitigation and residual significance:
A comprehensive Environmental and Social Management Plan (ESMP) has been prepared and accompanies this report. Mitigation measures have been developed in accordance with the mitigation hierarchy of avoidance, reduction, management and rehabilitation.

Key mitigation measures include phased development aligned with infrastructure capacity, traffic management and occupational health and safety controls, design and operation of the WWTP to Namibian special standards with effluent reuse once volumes increase, flood-risk avoidance through compliance with 1-in-50-year and 1-in-100-year floodlines, ongoing stakeholder engagement and grievance mechanisms, and monitoring and adaptive management throughout the Project lifecycle.

With the implementation of these measures, all identified impacts are reduced to low or acceptable significance levels, and no residual impacts are expected to pose unacceptable environmental or social risk.

Cumulative and climate considerations:
A rapid cumulative impact assessment was undertaken in line with IFC guidance. While other developments and activities occur within the broader region, no cumulative impacts of

unacceptable significance were identified, provided that the proposed mitigation measures and phased implementation approach are adhered to.

The Project design incorporates climate resilience considerations, including water reuse, flood protection infrastructure and flexible phasing to respond to climate variability and drought risk.

Conclusion and recommendation:
The assessment of the Project indicates that it may result in low to minor adverse impacts on the receiving environment. During construction, potential impacts relate primarily to community and worker health and safety risks, as well as equitable access to employment opportunities for women and unemployed youth. Low adverse impacts are also anticipated in relation to visual intrusion, noise, air quality, and traffic. Similarly, low adverse effects may occur on soil, surface water, groundwater, and certain components of local biodiversity. However, the Project is also expected to generate beneficial biodiversity outcomes through the establishment of green spaces and landscaping. In addition, positive socio-economic impacts are anticipated through job creation and sustained long-term employment, thereby contributing to local economic growth.

The assessment concludes that the Heja Lifestyle Estate Project is environmentally and socially acceptable, provided that the mitigation measures and management commitments contained in this report and the ESMP are fully implemented.

The Project aligns with national development objectives, avoids irreversible environmental impacts and delivers substantial socio-economic benefits. It is therefore recommended that the environmental clearance certificate be granted, subject to appropriate conditions relating to environmental management, wastewater treatment licensing, traffic management and compliance monitoring.

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ABBREVIATIONS

Abbreviation	Description
%	percentage
°	degree(s)
°C	degrees Celsius
AADD	average annual daily demand
BID	background information document
BOD	biological of oxygen demand
CIA	cumulative impact assessment
CO	carbon monoxide
COD	chemical oxygen demand
CoW	City of Windhoek
DEAF	Directorate of Environmental Affairs and Forestry
DSM	Directorate of Survey and Mapping
DWA	Department of Water Affairs
ECB	Electricity Control Board
ECC	Environmental Compliance Consultancy (Pty) Ltd.
ED	Executive Director
EIA	environmental impact assessment
EMA	Environmental Management Act, No. 7 of 2007
EMP	environmental management plan
ESIA	environmental and social impact assessment
ESMP	environmental and social management plan
GAC	granular activated carbon
GDP	gross domestic product
GIS	geographic information system
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
Ha	hectare(s)
HIV	human immunodeficiency virus
HKIA	Hosea Kutako International Airport
H_2S	hydrogen sulfide
I&APs	interested and affected parties
IFC	International Finance Corporation
ITS	Innovative Traffic Solutions
Km	kilometre(s)
km^2	square kilometre(s)
kV	kilovolt(s)

Abbreviation	Description
kWh/m^2	kilowatt hour(s) per square metre
LED	light emitting diode
Ltd.	limited
LTHP	low-temperature-high pressure
M	metre(s)
m/s	metre(s) per second
m^3	cubic metre(s)
m^3/d	cubic metre(s) per day
m^3/h	cubic metre(s) per hour
m^3/a	cubic metre(s) per annum
$m^3/100m^2/day$	cubic metre(s) per 100 square metres per day
Ma	million years
mamsl	metres above mean sea level
MAP	mean annual precipitation
MAT	mean annual temperature
MAFWLR	Ministry of Agriculture, Fisheries, Water and Land Reform
mm	millimetre(s)
MEFT	Ministry of Environment, Forestry and Tourism
CH_4	methane
MIME	Ministry of Industries, Mines and Energy
MoL	Ministry of labour
MoHSS	Ministry of Health and Social Services
MoWT	Ministry of Works and Transport
MSME	micro, small and medium enterprise
MURD	Ministry of Urban and Rural Development
N	north
NE	northeast
N$	Namibian dollar
NamPower	Namibia Power Corporation (Pty) Ltd.
NamWater	Namibia Water Corporation Ltd.
NAMCOR	National Petroleum Corporation of Namibia
NGTF	new generation trickling filters
NH_3	ammonia
NMS	Namibia Meteorological Service
No.	number
NO_x	nitrogen oxides

Abbreviation	Description
NSA	Namibia Statistics Agency
NSS	Namibia Scientific Society
NSRs	noise sensitive receptors
NTB	Namibia Tourism Board
NW	northwest
pH	potential of hydrogen
PM	particulate matter
PHC	primary healthcare
Pty	proprietary
PV	photovoltaic
RA	Roads Authority
Rem	remainder
RoD	record of decision
STP	sewage treatment plant
SZ	southern zone
SMZ	southern margin zone
SO_x	sulphur oxides
T	tonne
TSP	total suspended particles
TB	tuberculosis
TIA	transport impact assessment
ToR	terms of reference
TransNamib	TransNamib Holdings Ltd.
VOCs	volatile organic compounds
WMP	waste management plan
WRMA	Water Resources Management Act, No. 11 of 2013
WWF	World Wildlife Fund
WWTP	wastewater treatment plant

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Environmental Compliance Consultancy (Pty) Ltd (ECC) has been engaged by Heja Game Lodge (Pty) Ltd (Herein referred to as "Heja" or "the Proponent") to conduct a scoping with impact assessment for the proposed Heja Lifestyle Estate (herein referred to as the Project) development. The scoping with impact assessment report forms part of the environmental clearance certificate application for the Project, which will be submitted to the Executive Director (ED) at the Ministry of Urban and Rural Development (MURD) as the competent authority and the Environmental Commissioner (EC) at the Ministry of Environment, Forestry and Tourism (MEFT) for a record of decision (RoD).

Previously, Heja Game Lodge operated as a popular game viewing and tourist destination for many years, until its sale to the new and current owner, Heja Game Lodge (Pty) Ltd. As of 15 July 2023, the lodge ceased its lodging and game viewing operations. The site is currently undergoing transformation into the proposed Heja Lifestyle Estate, a mixed-use development comprising approximately 1 200 residential erven, which will include single residential, townhouse, apartment and mixed-use structures. This development aims to meet the growing demand for diverse housing types in the greater Windhoek area.

The proposed Project site is situated on a portion of Hoffnung Farm No. 66 in the Windhoek Rural Constituency, Khomas Region, Namibia (Figure 1). The D1527 road will serve as the main access road to the development and will have to be upgraded to an acceptable standard to meet the traffic volumes associated with the proposed development.

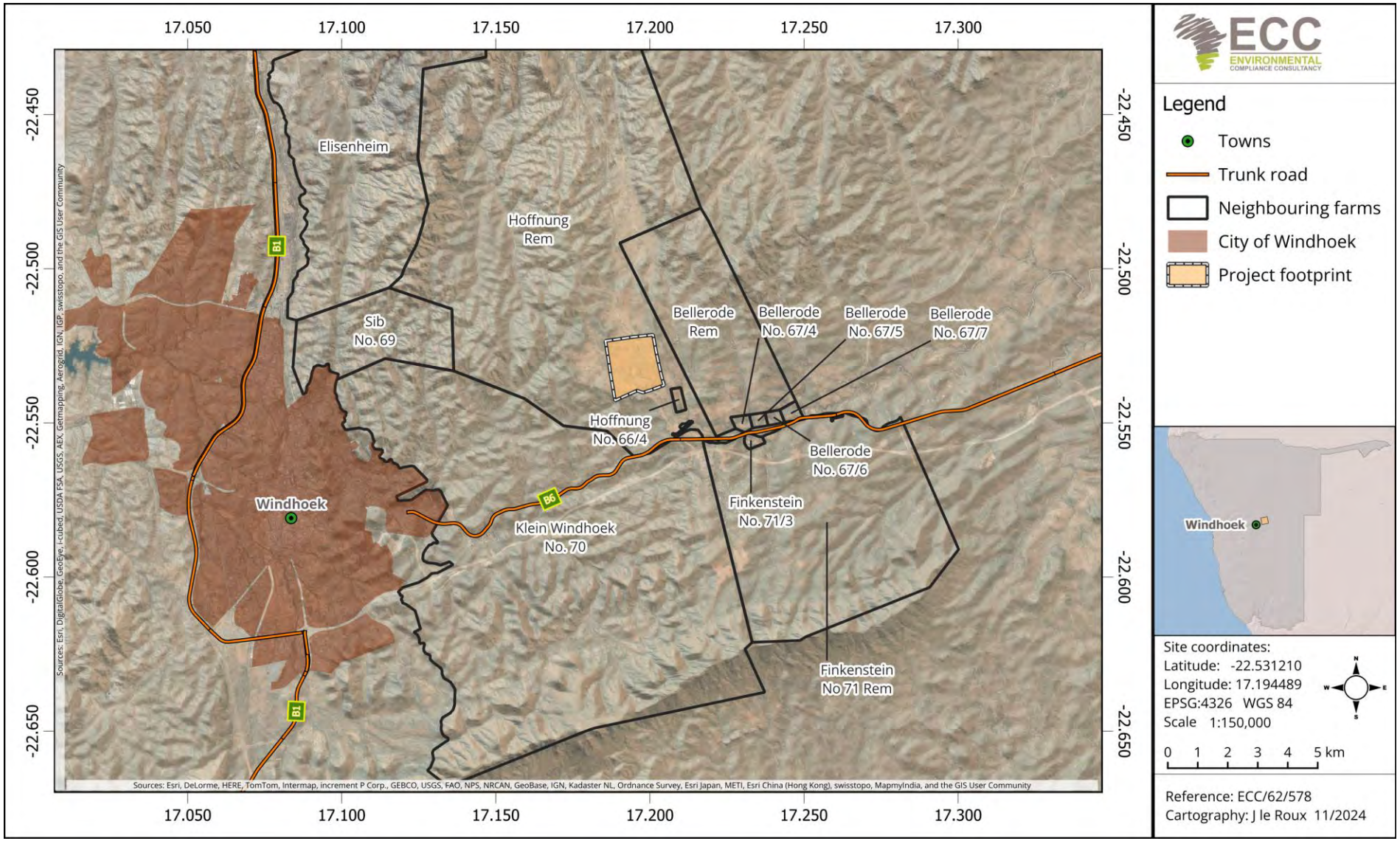


Figure 1 - Project location within Khomas Region, Namibia

1.2 PURPOSE OF THE SCOPING WITH IMPACT ASSESSMENT REPORT

As per the Environmental Management Act, No. 7 of 2007 (EMA), and its 2012 Regulations any project, whose activities trigger the listed activities requiring an environmental clearance certificate must conduct an environmental impact assessment. The environmental impact assessment process must be conducted as per the EMA and its associated Regulations. As part of the assessment process, a scoping report is required to develop the terms of reference (ToR) for the impact assessment, which is submitted to the Department of Environmental Affairs and Forestry (DEAF) for approval. Thereafter, the impact assessment is conducted and an ESIA report is developed.

Post screening of the Project activities, a scoping with impact assessment report (not two separate reports) was deemed sufficient for this environmental clearance certificate application. Based on the Project's location within a previously disturbed footprint, absence of irreplaceable biodiversity, and the availability of detailed specialist studies addressing key risk pathways (traffic, hydrology, groundwater), a combined scoping with impact assessment is considered sufficient.

The purpose of this final report is to provide information on the ESIA process, the background and details of the proposed Project, describe the baseline of the receiving biophysical and socio-economic environment. The report further outlines the methodology of the assessment and assesses the identified potential impacts that are deemed to be significant (beneficial or adverse), thereafter mitigation or management measures are developed to be included in the environmental and social management plan (ESMP), which forms Appendix A to this report.

The draft report and its appendices were submitted to the ED at the MURD (the competent authority), MEFT: DEAF and registered interested and affected parties (I&APs) for their review for a period of seven (7) days from 27 March 2026 – 07 April 2026. Thereafter, their feedback, comments and inputs have been incorporated into the final report (i.e. this report), which will be submitted to the competent authority MURD and the EC at MEFT: DEAF for a RoD.

1.3 THE PROPONENT OF THE PROPOSED PROJECT

The Proponents' details are provided in Table 1 below:

Table 1 - Proponent details

Company representative:	Contact details:
Mr. Lappies Laubscher Group Operations Manager Gondwana Collection Namibia (Pty) Ltd	Heja Game Lodge (Pty) Ltd Farm Hoffnung No. 66, Windhoek District info@hejalodge.com +264 61 257 151

1.4 ENVIRONMENTAL REQUIREMENTS

The EMA and its 2012 Regulations stipulates that an environmental clearance certificate is required prior to undertaking any of the listed activities that are identified in the Act and its Regulations.

The listed activities triggered by the proposed Project are summarised in Table 2.

Table 2 - Listed activities triggered by the proposed Heja Lifestyle Estate Project

Listed activity	As defined by the Regulations of Act	EIA screening finding
Energy generation and transmission and storage activities	(1) The construction of facilities for: a) generation of electricity; b) the transmission and supply of electricity.	– Energy will be supplied to the development by NamPower via a new reticulation system. – Photovoltaic (PV)-battery systems may be built to generate additional energy for the development. Excess energy generated could be supplied back to the NamPower grid.
Waste management, treatment, handling and disposal activities	(2.1) The construction of facilities for waste sites and the treatment and disposal of waste. (2.3) The import, processing, use and recycling, temporary storage, transit or export of waste.	– Waste generated onsite, including construction waste will be removed and disposed of at a registered waste disposal/landfill. – Private service providers, such as Rent-A-Drum, may be contracted to aid in managing solid waste collection, removal and recycling during the construction and operation phases of the Project.
Mining and quarrying activities	(3.2) Other forms of mining or extraction of any natural resource whether regulated by law or not. (3.3) Resource extraction, manipulation, conservation and related activities.	– Extraction of loose material to be used during construction of the lifestyle estate for the foundation of the buildings and houses.
Forestry activities	(4) The clearance of forest areas, deforestation, afforestation, timber harvesting, or any other related activity that requires	– An already disturbed area will be cleared. Landscaping of the green spaces will be conducted to enhance the visual appeal of the Project site. – A land clearing permit must be obtained for the

Listed activity	As defined by the Regulations of Act	EIA screening finding
	authorisation in terms of the Forest Act, 2001 (Act No. 12 of 2001) or any other law.	removal of any protected plant species or relocation during the construction phase, in accordance with the Forest Regulations, 2015 (No. 170 of 2015).
Land use and development activities	(5.1) The rezoning of land from: (a) Agricultural use to industrial use; and (d) Use for nature conservation or zoned open space to any other land use.	– The Project area is located on Farm Hoffnung No. 66 and will be rezoned from agricultural use to residential use.
Tourism development activities	(6) The construction of resorts, lodges, hotels or other tourism and hospitality facilities.	– Potential establishment of a tourism and hospitality academy. – Potential establishment of a hotel.
Water-resource development	(8.1) The abstraction of ground or surface water for industrial or commercial purposes. (8.4) Construction of canals and channels including the diversion of the normal flow of water in a riverbed and water transfer schemes between water catchments and impoundments. (8.5) Construction of dams, reservoirs, levees and weirs. (8.6) Construction of industrial and domestic wastewater treatment plants and related pipeline systems. (8.8) Construction and other activities within watercourses within flood lines.	– Water storage sites will be developed on higher-lying hilltops within the development. – A wastewater treatment facility will be constructed in phases. Average daily wet weather sewage flow for Phase 1 of the Project is approximately 405 cubic metres per day (m^3/d), which includes allowance for 20% rainwater infiltration. The fully developed estate (all phases) is estimated to ultimately generate approximately 1500 m^3/d of sewage. The raw sewage will be treated to the required special standard of the Water Resources Management Act (WRMA), No. 11 of 2013 (Annexure 11), using new generation trickling filters to be re-used as grey water to irrigate the development's green spaces, as far as possible, and

Listed activity	As defined by the Regulations of Act	EIA screening finding
	(8.9) Construction and other activities within a catchment area.	once sufficient volumes of effluent are generated by the development. A wastewater treatment, effluent discharge and reuse licence issued by the Department of Water Affairs (DWA) will be required for this biological treatment system. – The wastewater treatment plant will be designed to incorporate modern technologies so that any potential impact(s) on the receiving environment is minimised. – The Project surrounds the Hoffnung Dam. – The Hoffnung Dam requires registration with MAWFLR's DWA in terms of the WRMA. – A land clearing permit must be obtained for any riparian zone vegetation removal, relocation, fill or excavation within the riparian zone or erection of structures within the riparian zone during the construction phase, in accordance with the Forest Regulations, 2015 (No. 170 of 2015).
Other activities	(11.2) Construction of cemeteries, camping, leisure and recreation sites.	– Potential to construct leisure and recreation sites to serve the lifestyle estate residents.

2 APPROACH TO THE ASSESSMENT

2.1 SCOPE OF THE SCOPING WITH IMPACT ASSESSMENT

This scoping with impact assessment aims to determine the spatial and temporal scale and scope of the Project activities, identify which potential impacts are likely to be significant, scope the available data and identify any gaps that need to be filled and to identify the assessment methodology.

The scope of the assessment was determined by undertaking a preliminary assessment of the impact of the proposed Project activities against the receiving biophysical and socioeconomic environment. This was obtained through a desktop review and available site-specific literature.

2.2 THE ESIA ASSESSMENT PROCESS

The ECC ESIA methodology applied to this assessment has been developed using the International Finance Corporation (IFC) standards and models, in particular, Performance Standard 1, 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017) (International Finance Corporation, 2012), which establishes the importance of:

- Integrated assessment to identify the environmental and social impacts, risks and opportunities of projects;
- Effective community engagement through disclosure of Project-related information and consultation with local communities on matters that directly affect them; and
- The Proponent's management of environmental and social performance throughout the life of the Project.

Furthermore, the Namibian Draft Procedures and Guidance for ESIA and EMP (Republic of Namibia, 2008), as well as international and national best practice, and over 25 years of combined environmental and social impact assessment (ESIA) experience, were also drawn upon in the assessment process. This impact assessment is a formal process in which the potential effects of the Project on the biophysical, social and economic environments are identified, assessed and reported so that the significance of potential impacts can be taken into account when considering whether to grant approval, consent, or support for the proposed Project.

2.2.1 SCREENING OF THE PROJECT

The first stage of the ESIA process is to register the Project with the MEFT: DEAF (completed) and undertake a screening exercise to determine whether the Project activities are considered listed activities under the EMA and the 2012 Regulations requiring an environmental clearance certificate (completed). The full scoping with impact assessment process is discussed in Figure 2.

1. Project screening

Complete

The first stages in the ESIA process are to undertake a screening exercise to determine whether the Project triggers listed activities under the Environmental Management Act, 2007, and its regulations. The screening phase of the Project is a preliminary analysis, to determine ways in which the Project might interact with the biophysical, social, and economic environments.

Stakeholder engagement:
- Registration of the project
- Preparation of the BID

2. Establishing the assessment scope

Complete

Where an ESIA is required, the second stage is to scope the assessment. The main aim of this stage is to determine which impacts are likely to be significant; to scope the available data and any gaps that need to be filled; to determine the spatial and temporal scope; and to identify the assessment methodology.

The scope of this assessment was determined through undertaking a preliminary assessment of the proposed Project against the receiving environment. Feedback from consultation with the public and the Proponent informs this process. The following environmental and social topics were scoped into the assessment, as there was the potential for significant impacts to occur. Impacts that are identified as potentially significant during the screening and scoping phase are taken forward for further assessment in the ESIA process. These are:

SOCIAL AND SOCIOECONOMIC ENVIRONMENT
- Employment
- Infrastructure
- Visual
- Tourism
- Traffic
- Noise
- Air quality, including dust emissions

BIOPHYSICAL ENVIRONMENT
- Surface water and groundwater

The following topics were scoped out of the ESIA, and they are therefore not discussed further in this report.
- An assessment of safety impacts or risks associated with construction and operation activities are not included within the scope of this assessment and will be addressed by the Proponent in a site-specific safety management plan.

3. Baseline studies

Complete

A robust baseline is required, to provide a reference point against which any future changes associated with a Project can be assessed, and to allow suitable mitigation and monitoring to be identified.

The region and general area have been studied for various projects and assessments. This literature was available to be referenced. The Project site-specific area has been studied as part of the ESIA process, and the following has been conducted as part of this assessment:
- Field surveys
- Desktop studies
- Consultation with stakeholders
- Specialist field visits, and studies

The environmental and social baselines are provided in this scoping with impact assessment study.

4. Draft scoping report with impact assessment and ESMP

Current stage

This draft scoping with impact assessment report focuses on describing the scoping with impacts assessment process, project description, baseline description. The key stage of the scoping with impact assessment process is the impact identification and evaluation stage. This stage is the process of bringing together project characteristics with the baseline environmental characteristics and ensuring that all potentially significant environmental and social impacts are identified and assessed in chapter 8. It is an iterative process that commences at project inception and ends with the final design and project implementation.

The scoping with impact assessment report documents the findings of the current process and provides stakeholders with an opportunity to comment and continue the consultation that forms part of the environmental assessment. The ESMP provides measures to manage the environmental and social impacts of the proposed Project, and outlines the specific roles and responsibilities required to fulfil the plan.

The final design of the proposed Project will be assessed, along with alternatives that were considered during the design process in accordance with the Environmental Management Act, of 2007. Chapter 6 in this report sets out the assessment methodology to be used to assess the Project against the environmental and social baselines that would be affected.

This report will be issued to stakeholders and I&APs for consultation, for a period of 7 days, meeting the mandatory requirement as set out in the Environmental Management Act, 2007. The aim of this stage is to ensure that all stakeholders and I&APs have an opportunity to provide comments on the assessment process, and to register their concerns, if any.

5. Final scoping report with impact assessment and ESMP

Future Stage

All comments received during the I&AP public review period will be collated in an addendum report, which will accompany this scoping report when submitted to the MEFT: DEAF. All comments will be responded to, either through providing an explanation or further information in the response table, or by signposting where information exists, or where new information has been included in the scoping with impact assessment report or appendices. Comments will be considered, and where they are deemed to be material to the decision-making or might enhance the scoping with impact assessment report will be incorporated.

The final scoping with impact assessment report, appendices, and the addendum report, will be available to all stakeholders, and all I&APs will be informed of its availability for statutory review period of 21 days.

The scoping with impact assessment report, appendices and addendum will be formally submitted to the competent authority MEFT: DEAF as part of the application for an environmental clearance certificate.

6. Monitoring and auditing

Future Phase

In addition to the ESMP being implemented by the Proponent, a monitoring strategy and audit procedure will be determined by the Proponent and competent authority. This will ensure key environmental receptors are monitored over time to establish any significant changes from the baseline environmental conditions, caused by Project activities

7. Authority assessment and decision

Future Stage

The Environmental Commissioner, in consultation with other relevant authorities, will assess if the findings of the scoping with impact assessment presented in the report are acceptable. If deemed acceptable, the Environmental Commissioner will revert to the Proponent with a record of decision and recommendations.

Figure 2 - Scoping with impact assessment process

2.3 SCOPING AND THE ENVIRONMENTAL ASSESSMENT

The final scoping with impact assessment for the Project has been carried out to determine ways in which the Project interacts with the biophysical and socio-economic environment. Potential impacts are then identified, and the significance is assessed during the impact assessment phase. The assessment methodology is discussed in chapters 6 and is assessed in chapter 7 of this scoping with impact assessment report. The following environmental and socioeconomic aspects were considered in the final scoping with impact assessment process:

2.3.1 SOCIO-ECONOMIC ENVIRONMENT

- Air quality;
- Ambient noise;
- Community health, safety and security (on and off-site);
- Employment and livelihoods;
- Local community demographics;
- Infrastructure;
- Land use;
- Socio- economic;
- Tourism;
- Traffic and transport (off site); and
- Visual.

2.3.2 BIOPHYSICAL ENVIRONMENT

- Avifauna;
- Ecosystem services;
- Groundwater;
- Soils;
- Surface water; and
- Topography and landscape.

2.3.3 CUMULATIVE IMPACTS

- Intra-project impacts; and
- Inter-project impacts.

2.4 BASELINE STUDIES

Baseline studies involve collecting all pertinent information about the status of the receiving biophysical and socioeconomic environment. This provides a baseline against which changes that occur as a result of the proposed Project activities can be measured. For the proposed Project, baseline information was obtained through a desktop study, consultation and engagement with stakeholders (Appendix B).

Field surveys and specialist studies were also conducted to assess traffic and road conditions (Appendix C), Flood line assessment (Appendix Dand ground and surface water assessment (Appendix E). This aids in identifying the environmental receptors that could be affected by the proposed Project and is verified through site-specific information. The baseline environment is detailed in chapter 5.

2.5 PUBLIC CONSULTATION

Public participation and consultation are a requirement of an ESIA as stipulated in the Environmental Impact Assessment Regulations (Regulations 21 and 23) of the EMA for any project undertaking a listed activity which requires an environmental clearance certificate. Consultation is a compulsory and critical component of the assessment process for achieving transparent decision-making and can provide many benefits. Consultation is ongoing during the assessment process.

The objectives of the public participation and consultation process are to:

- Provide information on the Project, introducing the overall Project concept and planning in the form of a background information document (BID) (Appendix B);
- Determine the relevant governmental, regional and local regulating authorities;
- Listen to and understand community issues, record concerns and questions;
- Explain the process of the assessment along with the timeframes involved; and
- Establish a platform for ongoing consultation.

2.5.1 IDENTIFICATION OF KEY STAKEHOLDERS AND INTERESTED AND AFFECTED PARTIES

A stakeholder mapping exercise was undertaken to identify individuals or groups of stakeholders that could be interested in or affected by the Project shown in Figure 3.

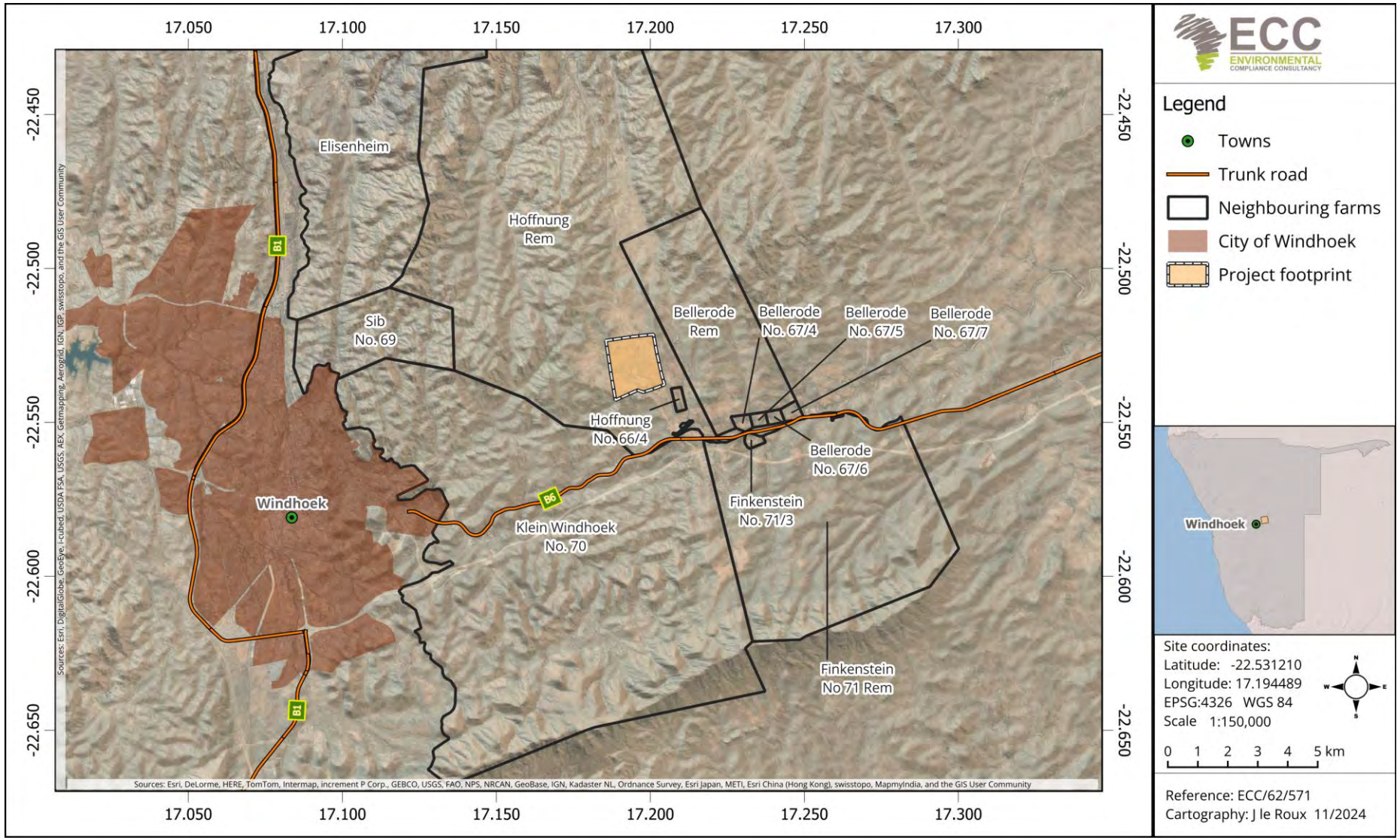


Figure 3 - Project stakeholders

The methods by which they were engaged during the assessment process is outlined in sections 2.5.2 to 2.5.5. Additionally, stakeholders were also approached through direct communication (letters and phone calls) and via email.

A summarised list of stakeholders for this Project is given below:

- Roads Authority (RA);
- TransNamib Holdings (TransNamib);
- Namibia Water Corporation (Pty) Ltd (NamWater);
- Namibia Power Corporation (Pty) Ltd (NamPower);
- Ministry of Works and Transport (MoWT);
- Ministry of Environment, Forestry and Tourism (MEFT);
- Namibia Traffic Police;
- Ministry of Urban and Rural Development (MURD);
- Khomas Regional Council (KRC);
- City of Windhoek Municipality (CoW).
- Surrounding farm owners; and
- Finkenstein Estate, Manor and Village.

The records of the public consultation process in the form of an I&AP comments and responses report (Appendix B) provides a list of registered interested and affected parties (I&APs), evidence of consultation, including the BID, a record of the public meeting held, advertisements in national newspapers, erection of site notices and a summary of the comments or questions raised by the public to date.

2.5.2 BACKGROUND INFORMATION DOCUMENT (BID)

The BID (Appendix B) presents a high-level description of the proposed Project, sets out the scoping with impact assessment process and outlines when and how consultation will be undertaken. It also provides contact details for further Project-specific inquiries to all registered I&APs.

2.5.3 NEWSPAPERS AND ADVERTISMENTS

Newspaper adverts informing the public of the proposed Project were circulated on 21 October 2025 and 28 October 2025 in three (3) national newspapers, namely:

- The Namibian Sun,
- The Republikein and
- The Allgemeine Zeitung

The newspaper adverts enable I&APs to register their interest and submit their comments for the proposed Project and invited interested members of the public to attend the public consultation meeting that was held at the Namibia Scientific Society (NSS) on 06 November 2025 at 18h30.

2.5.4 SITE NOTICES

A site notice ensures the neighbouring properties and stakeholders are made aware of the proposed Project. Two (2) site notices were erected at the boundary of the site, shown in the I&AP comments and responses report (Appendix B).

2.5.5 PUBLIC MEETING

A public consultation meeting was held at the NSS on 06 November 2025. A summary of the meeting, including the details of the power point presentation presented and comments submitted by attendees can be found in the I&AP comments and responses report (Appendix B).

2.5.5.1 Summary of the concerns raised during the public consultation process

The summary of comments received during the public meeting presented useful and valuable input in setting out the environmental clearance certificate application scope and assessment through questions asked and points raised. From an overall review of the recorded statements, the key common themes of concern that were raised can be summarised in the following categories:

- **Electricity demand and potential impacts on neighbouring communities:** questions were raised by an attendee as to how the new Heja Lifestyle development would impact electricity service to the neighbouring communities such as the Finkenstein Nature Estate, specifically:
    - Whether the NamPower's bulk supply line has the capacity to supply electricity to the new development;
    - Who would be financially responsible for required capacity improvements for the new development; and
    - Whether electrical faults at the new development could potentially impact electrical supply and infrastructure at neighbouring communities.

- **Water supply demand and potential impacts on the underlying groundwater availability:** questions were raised by an attendee as to how the new Heja Lifestyle Estate development would impact groundwater supply in the area, particularly during drought periods.

- **Waste management and collection:** questions were raised by an attendee as to how the new Heja Lifestyle development would manage its various waste streams. The primarily concern raised was how building construction rubble and garden refuse would be managed as transporting such waste is presently costly and is a major challenge for neighbouring communities.

- **Public transportation concerns and opportunities for improvement:** the lack of existing public transport options in the form of City of Windhoek public bus routes was raised as a major concern and is presently a challenge experienced by the existing communities.

- **Impact of the neighbouring Otjihase Mine on the Heja Lifestyle Estate and neighbouring communities;** the potential impact of the re-starting Otjihase Mine on the proposed Heja Lifestyle Estate and neighbouring communities was raised as a concern.

2.6 DRAFT SCOPING WITH IMPACT ASSESSMENT REPORT AND DRAFT ESMP

The draft scoping with impact assessment report and draft ESMP was submitted to the environmental commissioner (EC) at the MURD as the competent authority and registered I&APs for their review and commentary prior to submission of the final report to the competent authority for a RoD. The report was submitted for public review from 27 March2026 to 07 April 2026. This report documents the findings of the assessment process, provides stakeholders with the opportunity to comment on those findings, continuing the consultation engagement process and forms part of the environmental clearance application.

The preliminary ESMP provides measures to manage or mitigate the potential environmental and socioeconomic impacts identified and assessed in chapter 7. The preliminary ESMP outlines specific roles and responsibilities to fulfil the plan.

2.7 FINAL SCOPING WITH IMPACT ASSESSMENT REPORT AND FINAL ESMP

The draft scoping with impact assessment report and supporting appendices has now been finalised and no comments or feedback was received from the review period requiring any updates or changes to the draft scoping with impact assessment report. The comments and responses report (or addendum report0 (Appendix B) was updated to incorporate the single comment received from and I&AP during the public review period and will be submitted as an attachment to this final scoping with impact assessment report for a RoD.

3 REVIEW OF THE LEGAL FRAMEWORK

As previously stated, an environmental clearance certificate is required for any activity listed in the EMA and its associated Regulations. A thorough review of relevant national legislation has been conducted for the proposed Project.

Table 3 below identifies relevant legal requirements specific to the Project. Table 4 specifies permits, certificates and licenses relevant to the Project. This chapter outlines the regulatory framework applicable to the proposed Project. Table 5 identifies the relevant national policies and plans that are applicable to the proposed Project.

3.1 NATIONAL REGULATORY FRAMEWORK

Table 3 - Details of the regulatory framework as it applies to the proposed Project

National regulatory regime	Summary	Applicability to the Project
Constitution of the Republic of Namibia (1990)	The constitution defines the country's position in relation to sustainable development and environmental management. The constitution refers that the state shall actively promote and maintain the welfare of the people by adopting policies aimed at the following: "Maintenance of ecosystems, essential ecological processes and biological diversity of Namibia, and the utilisation of living, natural resources on a sustainable basis for the benefit of all Namibians, both present, and future."	The Proponent will ensure the sustainable use of the environment and has aligned the company's corporate mission, vision and objectives with the Constitution of the Republic of Namibia (1990).
Environmental Management Act, 2007 (Act No. 7 of 2007) and its Regulations (2012), including the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2011)	The Act aims to promote sustainable management of the environment and the use of natural resources. The Act requires certain activities to obtain an environmental clearance certificate prior to Project development. The Act states that an environmental impact assessment (EIA) should be undertaken and submitted as part of the environmental clearance certificate application process. The MEFT is responsible for the protection and management of Namibia's natural environment. The	This scoping with impact assessment report documents the findings of the scoping phase of the environmental assessment undertaken for the proposed Project and includes the impact assessment (chapter 7 in this report). The process has been undertaken in line with the requirements under the EMA and its 2012 Regulations.

National regulatory regime	Summary	Applicability to the Project
	DEAF, under the MEFT, is responsible for the administration of the EIA process.	
The Regional Councils Act (No. 22 of 1992)	This Act sets out the conditions under which Regional Councils must be elected and administer each delineated region. From a land use and project planning point of view, their duties include, as described in section 28 "to undertake the planning of the development of the region for which it has been established with a view to physical, social, economic characteristics, urbanisation patterns, natural resources, economic development potential, infrastructure, land utilisation pattern and sensitivity of the natural environment. The main objective of this Act is to initiate, supervise, manage and evaluate development.	The construction of the Heja Lifestyle Estate falls within the Khomas Region, of which the Khomas Regional Council has been identified as a key stakeholder and will therefore be consulted during the assessment process. The Project also falls within the boundaries of the Windhoek and falls under the administrative jurisdiction of the City of Windhoek (CoW).
Soil Conservation Act, No. 76 of 1969	This Act makes provision for the prevention and control of soil erosion, for the protection, improvement and conservation of soil and vegetation.	The Project site is located in an already disturbed environment. It is anticipated that there will be minimal disturbance to the soil profile and horizon during surface preparation.
National Heritage Act 27 of 2004	The Act provides for the protection and conservation of places and objects of heritage significance and the registration of such places and objects with the National Heritage Council (NHC). It also makes provision for archaeological "impact assessments".	Heritage artefacts buried in the subsurface may be discovered or unearthed during site preparation. The relevant regulations stipulated in the Act will be adhered to. The chance find procedure will be incorporated in the ESMP.
Labour Act (No. 6 of 1992)	The Ministry of Labour (MoL) is aimed at ensuring harmonious labour relations through promoting social	The Proponent should ensure the safety and welfare of employees throughout the

National regulatory regime	Summary	Applicability to the Project
	justice, occupational health and safety and enhanced labour market services for the benefit of all Namibians. This ministry insures effective implementation of the Labour Act No. 6 of 1992.	construction phase and operational phase (i.e. during any mechanical repair works).
Water Resource Management Act, No. 11 of 2013 and the Water Resource Management Regulations of 2023	This Act provides for the control, conservation and use of water for domestic, agricultural, urban and industrial purposes. The Act also make provision for the control of certain activities on or in water. The DWA within the MAFWLR is responsible for the administration of the Act.	The Project falls within a water-controlled area, where water is controlled and managed by the MAFWLR. The Act stipulates obligations to prevent pollution of water resources. A licence will be required for the construction, operation of the wastewater treatment facility, including effluent discharge and/or re-use. Pollution control measures are set out in the ESMP. If any abstraction of water from existing boreholes is required for the development's water supply, an abstraction licence must be obtained from the MAFWLR. A licence is required in terms of the Water Resources Management Act No. 11 of 2013 for the removal of riparian species, excavation and erection of permanent

National regulatory regime	Summary	Applicability to the Project
		structures within the riparian zone.
Forestry Act No. 12 of 2001 as amended by the Forest Amendment Act No. 13 of 2005	The Act makes provision for the protection of natural vegetation (protected, endemic or threatened). Section 21 states that no person shall cut, destroy or remove vegetation that is within 100 m of a river, stream or watercourse.	The Project will require the removal of vegetation. The Proponent will ensure that all land clearing permits (including the removal of protected plant species) are obtained from Directorate of Forestry (DoF) prior to the removal of vegetation. These permits shall be renewed as required.
Town Planning Ordinance No. 18 of 1954 and the Amendments of 2000 Building Regulations of the City (Municipality) of Windhoek, promulgated in the Government Notice No. 57 of 1969	The ordinance provides guidelines for the zoning, land use and planning of urban areas, including the requirement for approval of building plans (architectural drawings) by the local authorities. Section 6 of the Regulations stipulate the need for approval of building plans before construction can commence. This ensures that developments adhere to building codes, legal and technical standards to promote safety, sustainability and the orderly growth of the city.	Prior to any construction works, the Project's Enigneering and architectural drawings require approval by the CoW Council, as mandated under the Local Authority Act.
Land Survey Act No. 33 of 1993	The Act regulates land surveying practices to ensure developments are properly streamlined and regulated to meet the technical and development standards of the country. The Directorate of Survey and Mapping (DSM) within the MAFWLR is the custodian responsible for national surveying and mapping in Namibia and is mandated to	The Proponent is cognisant of the Act's provisions. The Project requires approval from the Surveyor General's office for the rezoning, reclamation and development of the land.

National regulatory regime	Summary	Applicability to the Project
	provide professional services to government institutions, the private sector and the general public.	
Roads Act No. 4 of 2025	This Act regulates the ownership and classification of roads and establishes the powers and functions of roads boards. It defines the roles and responsibilities of the Minister, the Roads Authority, and local authorities in the planning, construction, management, control, maintenance, and rehabilitation of roads. The Act further provides for the identification and proclamation of road routes, regulates activities within road reserves, and controls building restrictions and advertising along roads. It also governs access to land, encroachment, land acquisition, and compensation, and sets out provisions relating to liability, enforcement, appeals, and other matters incidental to road administration	The Project may require the realignment and upgrade of various roads to support Project traffic.

3.2 RELEVANT PERMITS, CERTIFICATES AND LICENCES

Table 4 - Relevant permits, certificates and licences required for the Project

Permit/licence	Act/Regulation	Related activities requiring permits	Relevant authority
Environmental clearance certificate	Environmental Management Act, No. 7 of 2007	Required for all listed activities that may not be undertaken without an environmental clearance certificate. An environmental clearance certificate is issued by the DEAF.	MEFT
Approval for the rezoning, reclamation and use of municipal land	In terms of Section 3 of the Land Survey Act, No. 33 of 1993	Approval from the General Surveyor's office is required for the rezoning, reclamation and development on municipal land.	Surveyor-General's office, MAFWLR
Wastewater treatment, discharge and re-use licence	In terms of Section 72 of the Water Resources Management Act, No.11 of 2013	A licence is required to construct and operate a wastewater treatment plant. This also includes the discharge and re-use of treated wastewater.	DWA, MAFWLR
Borehole registration	In terms of the Water Act, No. 11 of 2013 and the Water Resource Management Regulations of 2023	Mandates the registration of all boreholes (used, unused, dry) with the MAFWLR to ensure sustainable management and protection of water resources.	DWA, MAFWLR
Licence for water abstraction from boreholes	A licence is issued under the Water Act, No. 11 of 2013 and the Water Resource Management Regulations of 2023	Required before the groundwater can be abstracted from registered boreholes.	DWA, MAFWLR

Permit/licence	Act/Regulation	Related activities requiring permits	Relevant authority
Land clearing permit	The Forest Act, No. 12 of 2001 as amended by the Forest Amendment Act, No. 13 of 2005	This Act governs the removal of protected plant species and vegetation within 100 m of a water course (riparian zone), or removal of more than 15 hectares (ha) of woody vegetation.	DoF, MEFT
Licence for the development of permanent structures within 100 m of a riverbank (riparian zone)	In terms of Section 110 of the Water Resources Management Regulations of 2023.	A licence is required for the development of permanent infrastructure within 100 m of a riverbank.	DWA, MAFWLR
Transmission connection agreement	Technical Regulations (guidelines) of the Electricity Control Board (ECB), the Electricity Act, No. 4 of 2007, Namibia Transmission Grid Code and the National Connection Charge Policy	The Project will be connected to the NamPower grid. Prior to this, it is required that the Proponent sign a contractual agreement with Namibia Power Corporation (NamPower) (the national utility supplier).	NamPower
Electricity transmission and supply licence	Electricity Act, No. 4 of 2007	A 66 kV/11 kV substation, with a maximum total of three (3) transformer bays is proposed. The development is to be completed in phases.	ECB
Energy generation licence	Electricity Act, No. 4 of 2007	Individual homeowners, residents, businesses or the Heja Lifestyle and Country Estate Development may decide to install solar PV-	ECB

Permit/licence	Act/Regulation	Related activities requiring permits	Relevant authority
	NB: a person is exempted from holding a licence for the generation and/or distribution of electricity if the plant's capacity is less than (<) 500 kVA and generation is for own consumption by the person in control of such plant and on premises owned and occupied by that person.	battery systems on individual properties to generate on-site electricity for their personal or business use. Such electricity could also be sold back to the NamPower electrical grid.	
Certificate of Registration	Namibia Tourism Board Act No. 21 of 2000	Should a hotel be established during the phased development of the Project, this Act mandates the registration of all "accommodation establishments" including hotels. A certificate of registration will be provided upon approval.	Namibia Tourism Board (NTB)
Certificate of Registration	Hospitals and Health Facilities Act, No. 36 of 1994	Should a private medical facility be established during the phased development of the Project, this Act mandates that a private health facility licence (in the form of a certificate of registration) must be obtained to establish, conduct or maintain any private health facility (such as a clinic or consulting room).	Ministry of Health and Social Services (MoHSS)

3.3 NATIONAL POLICIES AND PLANS

Table 5 - Details of the national policies and plans that apply to the proposed Project

Policy	Summary	Applicability to the Project
6th National Development Plan (NDP) and Vision 2030	Namibia's overall long-term development ambitions are provided in the National Vision 2030, which is implemented by five-yearly national development plans (NDP's). NDP6 is the current development plan. NDP6 has set ambitious housing goals to address the significant national housing backlog and to promote inclusive and sustainable development.	NDP6 has targeted the servicing of at least 10 000 erven (plots of land) and construction of 10 000 affordable housing units each year from 2025 to 2030. This aims for a total of 50 000 serviced plots and 55 000 houses over the plan's duration. The proposed Project would contribute approximately 1 200 dwellings to the NDP6 target.
The National Environmental Health Policy (2002)	The Policy provides a framework and guidelines to prevent and control environmental health hazards and risks that may adversely affect health and quality of life for all the people in Namibia.	The Policy has been used to influence the design of the proposed Project, taking into consideration the policies and objectives. Measures set out in the Policy to manage hazards such as wastewater treatment and re-use have been considered in the identification of mitigation measures described in this report and the ESMP.
National Policy on Tourism for Namibia	Provides a framework for the mobilisation of tourism resources to realise long term national goals defined in Vision 2030 and the more specific targets of the NDP, namely, sustained economic growth, employment creation, reduced inequalities in income, gender as well as between the various regions, reduced poverty and the promotion of economic empowerment.	The policy was reviewed during the preparation of the ESIA process and the evolution of the proposed Project design. The proposed Project aligns with the policy, in particular, the development may provide tourism amenities and services, creating a competitive business environment that is market driven and meets required standards.

4 PROJECT DESCRIPTION

4.1 INTRODUCTION

This chapter presents a detailed description of the proposed Project and outlines the nature and purpose of the development. This chapter describes the key components and activities associated with the Project. This chapter includes information on the Project location, the proposed layout and design concept, development components and infrastructure and the main activities anticipated during the construction and operational phases. This chapter also identifies the Project alternatives where applicable aligning the Project with relevant policies, plans and regulatory requirements. This information is used to inform the identification and assessment of potential biophysical and socioeconomic impacts in chapter 7.

The Heja Lifestyle Estate Project is a proposed mixed-use development intended to provide a high-quality residential and lifestyle offering within a natural, semi-rural setting. The Project comprises a lifestyle estate concept that integrates residential erven, lifestyle amenities, supporting infrastructure, and associated services, designed to respond to growing demand for secure, well-planned living environments.

4.2 PROJECT SITE AND SURROUNDINGS

4.2.1 ENVIRONMENTAL SURROUNDINGS

The Project site is located approximately 10 km (along the B6 trunk road) east (E) of Namibia's capital city, Windhoek, on a portion of Hoffnung Farm No. 66 in the Windhoek Rural Constituency of the Khomas Region (see Figure 1). This development aims to address the increasing demand for various residential housing options within Windhoek and its surrounding areas.

The main features of the proposed site area include its proximity to major transport routes, providing easy access to Windhoek, as well as its relatively flat terrain, which is ideal for large-scale residential development. The site also benefits from its location near essential services and infrastructure, such as water, electricity and road networks, making it a strategic location for the proposed development. Additionally, the area's natural landscape and proximity to key amenities offer the potential for a balanced living environment, combining urban convenience with the benefits of a scenic and aesthetically pleasing environment.

4.2.2 PROPOSED PROJECT SITE

The proposed Project site is approximately 320 ha in size and can be accessed via the B6 highway and the D1572 district road, which leads to the Otjihase Copper Mine. It should be notes that this district road has since been deproclaimed to Farm Road F1527 status, falling under the jurisdiction of the Ministry of Works and Transport.

The greater project area is governed by the City of Windhoek (municipality), Windhoek Rural Constituency and the Khomas Regional Council.

The proposed Project will be developed on a 320-hectare site designated for the development, comprising Portion 6 and Portion 12 of Farm Hoffnung No. 66., situated ~10 km east of Windhoek along the B6 road, within the municipal boundary of City of Windhoek. The Project site's central geographic coordinates expressed in decimal degrees (latitude, longitude) and referenced to the WGS 84 datum and EPSG:4326 coordinate system are (-22.531210, 17.194489) (see Figure 1).

The Proponent, Heja Game Lodge (Pty) Ltd., proposes to establish a housing and lifestyle estate with Hoffnung Dam as a central, shared aesthetic feature. The Project will involve the construction of approximately 1 200 residential erven, including single residential, townhouses, apartment and mixed-use structures, along with the required amenities, which are listed in section 4.4.2 below.

4.3 LAND OWNERSHIP AND ZONING

4.3.1 PROPOSED PROJECT SITE OWNERSHIP

The Project is owned by Heja Game Lodge (Pty) Ltd, which as previously stated owns Portion 6 and Portion 12 of Farm Hoffnung No. 66., which will be transformed into a residential development to cater for the housing shortage in Windhoek and neighbouring areas. Controlling the land provides a strong basis for the proposed investment through the enhancement of planning for land use, infrastructure development and the overall sustainability of the investment. In addition, ownership by a private business strengthens the possibilities of both creative and effective Project design and execution that meets residential, commercial and environmental demands.

4.3.2 REZONING

The current land use zoning status of the Project area land is listed as "tourist establishment" and "agriculture." Therefore, rezoning of the Project land to "residential" and "commercial" status with the local municipal authority will likely be required.

Furthermore, the development's potential scope encompasses different zoning categories, including low-density single residential, medium-density townhouses, high-density apartments, commercial spaces, educational facilities and mixed-use areas.

4.3.3 ADJACENT AREAS

The land ownership and zoning of adjacent areas are not expected to be influenced or altered by the proposed Project. The surrounding privately owned farms of Sib No. 69, Belrode No. 67, Klein Windhoek No. 70 and Elisenheim No. 68 do not form part of the proposed Project site.

4.4 PROJECT PROPOSALS

4.4.1 DESIGN PHILOSOPHY

Due to the growing demand for diverse types of residential housing in and surrounding Windhoek, developing a well-planned suburban node would be highly beneficial to the Khomas Region. The Project intends to be a mixed-use development, incorporating essential amenities such as a potential school, medical facility and even a commercial component, which would offer families a unique living environment.

A mixed-use development outside the Windhoek city centre could also help alleviate the growing traffic congestion within the municipality. The Heja Lifestyle Estate, designed to harmonise with Namibia's natural beauty, would fill a gap in Windhoek's current residential market while providing various other offerings.

4.4.2 PROJECT COMPONENTS

The proposed Project could include the provision of several types of infrastructure and multiple land uses within the proposed site. The following components will potentially constitute the proposed Project.

- Single residential houses;
- Townhouses;
- Apartments;
- Commercial blocks;
- Corporate offices;
- Medical facility;
- Restaurants;
- Common area facilities for the residents;
- School and/or training facilities;
- Business hotel and/or conference facilities; and
- Waste water treatment facility.

Concept images for some of the above land uses can be seen in Figure 4 below:

Figure 4 - Concept images of the development's proposed land uses (Heja Game Lodge (Pty) Ltd, 2024)

Between the subdivisions, along the dam and areas that will not be developed, green spaces will be established. These green spaces will consist of trees, grasses, various plants and shrubs. These areas will be set aside for recreational use and aesthetics. This will aid in improving air quality within the development, mitigating urban heat island effects by cooling surrounding areas through shade and evapotranspiration, reduce surface runoff, improve water infiltration and mitigate the risk of flooding. This will also protect and promote biodiversity by providing habitats for various species.

4.4.3 ENHANCEMENT MEASURES

To enhance the experience for both tourists and the local community, education facilities might be provided, including notice boards in community spaces that will display local environmental information and data obtained during regular monitoring of the environment.

The Project architects have taken the micro-climate and its harsh weather conditions into account and envision a design that would portray elements comparable to the conditions experienced in Windhoek. The following features may be included in the design (embedded design measures):

- Dam utilisation as a shared aesthetic feature and green space;
- Existing palm trees or established vegetation will be removed during site preparation, retained and re-established into the final layout of the proposed Project;
- Locally sourced materials such as marble and stone may be used for the construction of buildings; and

- Medium to high-density residential areas may be provided access to potential sporting facilities.

4.5 SITE PREPARATION AND CONSTRUCTION

4.5.1 SCHEDULE, SEQUENCING AND DESIGN

The mixed-use lifestyle development will be developed in multiple phases, with each phase also potentially being constructed in a phased manner, as described below. The timing of each phase's development, as well as the final mix of structures built, will largely depend on demand so the needs of the market are continually complemented.

4.5.1.1 Phase one (1) construction

Phase one (1) (subdivided into sub-phases 1A, 1B and 1C) will focus on the development of mixed low, medium and high-density residences, as well as potential retirement housing within the Phase 1B subdivision.

4.5.1.2 Phase two (2) construction

Phase 2 (subdivided into 2A and 2B) will focus on the potential development of educational facilities (within 2A), as well as potential hotel, leisure, restaurant, sport, clubhouse, office, training and conference facilities (within 2B) but always depending on the market demand at the actual time of Phase two (2) development.

4.5.1.3 Phase three (3) construction

Phase three (3) (subdivided into 3A and 3B) will focus on the potential development of additional mixed low, medium and high-density residences. Potential medical facilities may also be considered for construction depending on the needs and demands of the Heja Lifestyle Estate community during Phase three (3) development.

The current Heja Lifestyle Estate masterplan is shown in Figure 5, with each subdivision labelled respectively.

Figure 5 - Heja Lifestyle Estate Project site masterplan showing the phased development (Source: WCE, 2026)

4.5.2 CONSTRUCTION WORKFORCE

Workforce requirements for the proposed Project will be similar for all phases, although each phase will require some specialisation. The estimated workforce is approximately 90–103 direct construction workers who will be contracted onto the Project. The role types expected for the proposed Project are as follows:

- General labourer's, truck drivers, machinery operators and crane operators;
- Trade qualified labourers;
- Senior contract workers (these workers would include Project managers, foremen and other contract workers); and

- Specialists for example, water reticulation construction specialists.

The use of local resources, which includes Namibian workers and contractors, is a pre-agreed principle of the Proponent. An estimated 60 to 80% of workers will be sourced from the local community.

4.5.3 CONSTRUCTION WORKING AREAS

All construction activities will take place within the 320-hectare site designated for the development, comprising Portion 6 and Portion 12 of Farm Hoffnung No. 66. The development will be divided into distinct sections to align with the various phases outlined in Figure 5. This will ensure a systematic approach to the construction process.

This phased approach will allow for careful management of labour, resources and infrastructure, facilitating efficient progress and minimising disruptions. The entire site offers ample space for the planned mixed-use residential and infrastructure development while maintaining adequate space for future growth and expansion.

Each phase of the Project will involve site clearing, bulk earthworks, construction of roads and infrastructure (civil works), stormwater management and the installation of water and sewage systems, including flood protection measures and environmental safety protocols, followed by the treatment and reuse of effluent water for irrigation.

4.5.3.1 Relocation and demolition of existing facilities

It is planned that the existing bulk stormwater infrastructure (such as the concrete drifts on the main ring road) will be replaced and upgraded to allow for safe passage and access during flood events of minimum 1-in-50-year return period, between villages.

4.5.3.2 Site preparation

The site preparation for the Project will be the site clearance and bulk earthworks to enable the installation of bulk services and internal infrastructure for the development. This will include construction of road layer works where ground level needs to be raised or lowered to the desired vertical alignments for safe traversing. Roads will either be surfaced to bitumen standard or paved with interlocking road paving blocks.

4.5.3.3 Main construction

The Project will be carried out in multiple stages, starting with site clearing and bulk earthworks to prepare for the installation of essential services and internal infrastructure as discussed in section 4.5.3.2. The next phases will focus on constructing internal streets, road markings, signage, sidewalks and installation of stormwater infrastructure.

This will include a combination of natural open stormwater flow paths and formal underground systems, along with culverts where roads cross over major watercourses.

Special attention will be given to erosion control at discharge points to protect the infrastructure, informed by detailed flood line studies that have been conducted (Appendix D) to ensure that all erven are constructed outside the 1-in-50 year flood zone and the finished floors of all buildings and infrastructure constructed exist 250 mm above the 1-in-100 year flood elevation.

Following the stormwater infrastructure, the development will proceed with the construction of water reticulation systems, which will include bulk water storage in elevated reservoirs. The water network will consist of fire hydrants, isolating valves and underground pressure pipelines. The sewage system will also be constructed, featuring a gravity-based network with concrete manholes and uPVC sewer pipes. Sewage from the gravity network will be collected at pump stations and transported to the wastewater treatment plant (WWTP). Special measures, including encasement in concrete and protective materials will be taken for pipes crossing river courses to ensure environmental safety. Erosion protection will be incorporated in high-flow areas and erodible soils. The fully developed estate's average sewage flow is estimated at 1500 m³/d, which will be treated and pumped back for irrigation purposes (once generated quantities are reached) complying with the Water Resources Management Act (WRMA), No. 11 of 2013 and licence requirements special standards. Necessary licences and approvals will be obtained from the DWA and the CoW. The approximate average annual daily demand (AADD) of water required per type of land use for the Project is shown in Table 6 below.

Table 6 - Land use zoning and appropriate average annual daily demand (AADD) for water for phase 1 (Source: WCE, 2026)

Phase	Residential typologies	AADD for water (L/day)	Total (m^3/Day)
Phase 1A	Type A1	-	286.40
	Type A2	-	
	Type A	42 000.00	
	Type B	58 000.00	
	Type C	104 000.00	
	Type D	30 600.00	
	Type E	8 000.00	
	Type F	43 800.00	
	Type G	-	
Phase 1B	Type A1	-	141.00
	Type A2	-	
	Type A	16 000.00	
	Type B	6 000.00	
	Type C	35 100.00	
	Type D	27 900.00	
	Type E	8 000.00	

Phase	Residential typologies	AADD for water (L/day)	Total (m^3/Day)
	Type F	48 000.00	
	Type G	-	
Phase 1C	Type A1	45 000.00	100.10
	Type A2	30 000.00	
	Type A	-	
	Type B	-	
	Type C	6 500.00	
	Type D	-	
	Type E	-	
	Type F	18 600.00	
	Type G	-	
Total for Phase 1			**527.50**

As mentioned above, the mixed-use lifestyle development will be built in multiple phases, with each phase potentially further subdivided and constructed based on market demand. While Phase one (1) will focus on the construction of low to high density residential and potential retirement housing, Phase two (2) will focus on the potential development of educational, hotel and recreational facilities. Phase three (3) will see the development of additional residential areas and possibly medical facilities, depending on community needs at that time. The estate will be flexible and responsive to the needs of the market at each phase of development.

This involves ongoing property and facility management from phase 1, such as regular inspections of residential, business and community areas and the upkeep of common areas like parks, sports facilities and recreational spaces. The timeframe also covers infrastructure and utilities for the efficient operation of roads, water, sewage, power and telecommunications. Safety and security are also prioritised with fencing closing the entire development, guard houses at the development entrance and exit gates, security patrols and regular maintenance. In addition, the financial and legal management of the estate ensures that the development is sustainable in the long run.

4.5.4 OPERATIONAL LIGHTING

A residential estate development would require street and roadway lighting, pedestrian and pathway lighting, exterior building and entrance lighting, and security lighting along perimeters and access points to ensure safety and visibility. Common areas and recreational facilities would require dedicated lighting, while emergency and backup lighting systems may be installed.

4.5.5 TRAFFIC ACCESS MANAGEMENT

A transport impact assessment (TIA) was required, along with the engagement of the relevant stakeholders (i.e. RA, TransNamib, CoW, Ministry of Works and Transport etc). A TIA has been undertaken and completed by the Proponent's Project team (Appendix C).

Although the TIA determined that the existing traffic network operates efficiently, the Phase 1 development will ultimately require a 25 to 45% build out of the required traffic network upgrades to achieve an efficiency of 550 peak-hour trips. The remaining build out of the traffic network upgrades will be done as needed to support Phases two (2) and three (3) of the development construction.

At present, the RA is upgrading the B6-D1527 intersection and the portion of the D1527, which will include deceleration lanes from both directions of the B6 and will serve all initial phases of the development. Closer to the full build-out of the estate, potential further intersection upgrade designs will be assessed, if traffic volumes generated by the development necessitate them. There is no anticipated need for these further upgrades during the early development phases. These potential upgrades are shown in Figure 6 (i.e. slip lane and D1527 stop sign intersection upgrade design), Figure 7 (i.e. traffic signal alternative intersection upgrade design) and Figure 8 (i.e. roundabout alternative intersection upgrade design). Approval by the Roads Authority (RA) and the Ministry of Works and Transport (MWT) would be required before any such intersection upgrade construction could begin.

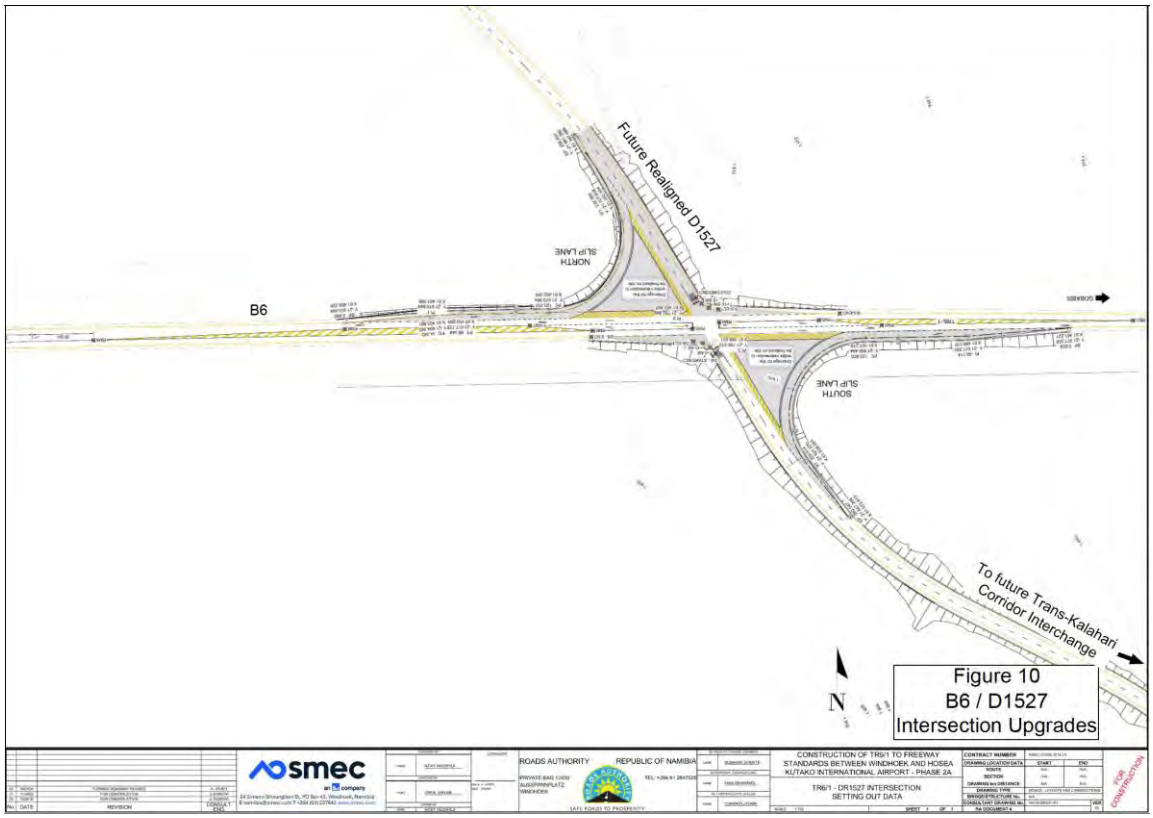


Figure 6 – Possible Slip Lane and D1527 stop sign intersection upgrade design plan (Source: (Innovative Transport Solutions (ITS), 2025)

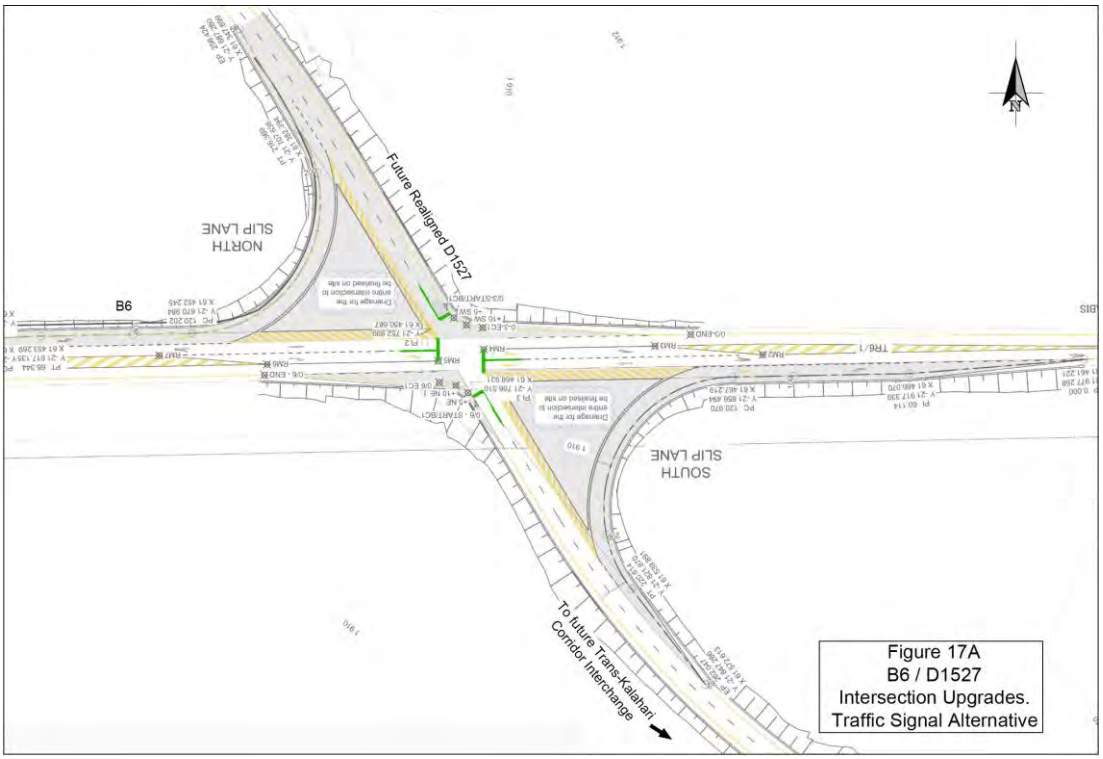


Figure 7 – Possible traffic signal alternative intersection upgrade design plan (Source: (Innovative Transport Solutions (ITS), 2025)

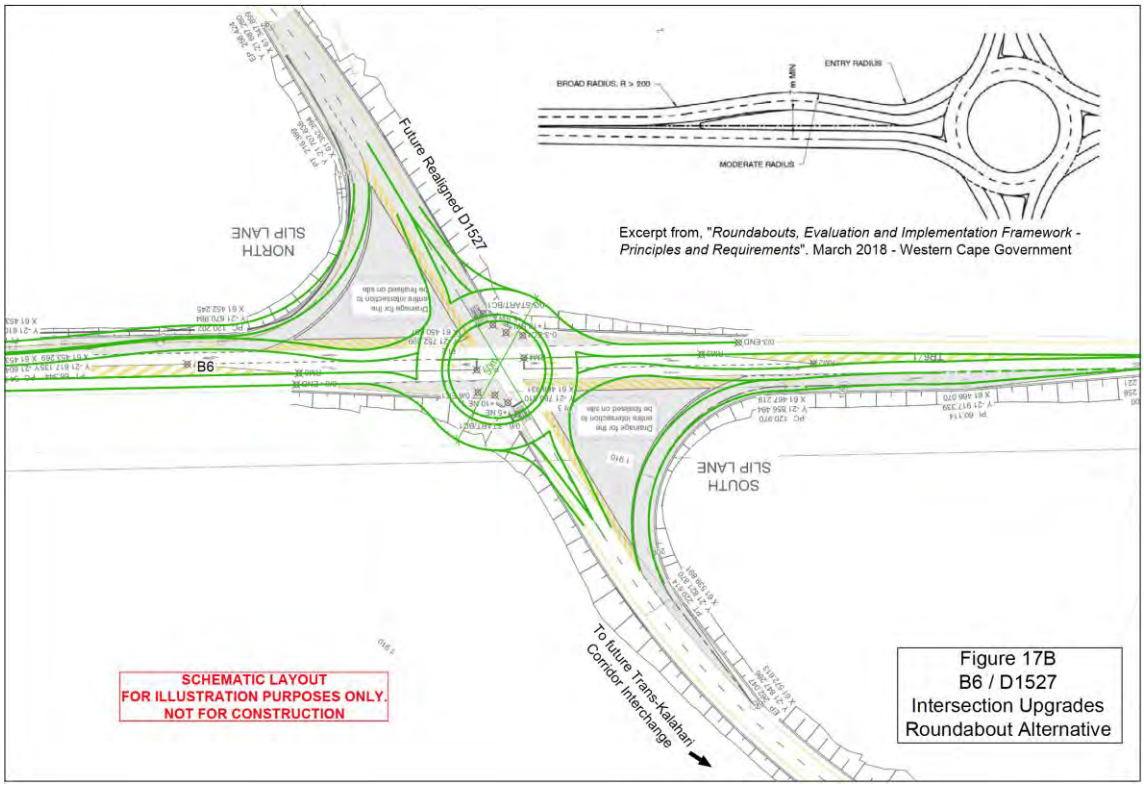


Figure 8 – Possible roundabout intersection upgrades alternative design plan (Source: (Innovative Transport Solutions (ITS), 2025)

4.5.6 VEHICLE TYPES AND MOVEMENTS

Based on the schedule and type of activities, it is estimated that the proposed Project will involve the following vehicle types:

4.5.6.1 Bulk earthworks vehicles:

- Excavators;
- Tipper trucks;
- Roller compactors;
- Graders;
- Bakkies; and
- Fuel trailer/s.

4.5.6.2 Building construction vehicles:

- Backhoe loaders;
- Skid-steer loaders;
- Ride-on rollers;
- Bakkies;
- Tipper trucks; and
- Piling rig/s and supporting crane/s.

4.5.6.3 Road upgrade vehicles:

- Grader;
- Vibratory steel drum roller;
- Bitumen sprayer;
- Paver;
- Roller; and
- Water truck.

4.5.7 ROAD NETWORK UPGRADES

Windhoek Consulting Engineers (WCE) received a master drawing from the RA on 13 May 2024 of the new B9, Hage G. Geingob Freeway, which connects Windhoek directly with the Hosea Kutako International Airport (HKIA) and runs directly south (S) of Project site, in parallel with the existing B6 trunk road and provides a freeway offramp and onramp to connect the B9 and B6 motorways. The B9 officially opened on 10 November 2025 and is shown in below. The RA indicated that slip lanes for deceleration purposes will be introduced at the B6-D1527 intersection under the current construction contract. WCE was not able to confirm with the RA whether a TIA was completed for this intersection. The Proponent is currently in consultation with the RA to determine the road upgrade's current timeline and expected completion date.

All roads within the development are assumed to be built up to either 19 mm Cape Seal standard or paved standard. Internal streets will have lane widths of 3.0 m, while major roads will have lane widths of 3.5 m. The construction will include the lower subgrade, upper subgrade (depending on the road classification), subbase, basecourse and Cape Seal surfacing or interlocking concrete pavers directly on the subbase. Road markings and signs will be designed as per the Road Traffic and Transport Act No. 22 of 1999 and its associated Road Traffic and Transport Regulations of 2001. Where required, sections of the road with gradients exceeding 15% may incorporate SA 35 MPa pavers for added traction and stability. Additionally, the roads will have sidewalks with a two percent slope and equipped with mountable and barrier kerbs.

4.5.8 CONSTRUCTION MATERIAL

Materials used to construct the proposed development will potentially include the following:

- Locally sourced granite (tiles and/or slabs);
- Natural stone sourced locally;
- Aluminium and stainless steel;
- Roof aluminium sheeting;
- Locally sourced cement;
- Timber;
- Locally sourced rocks and cobbles; and
- General construction material.

Materials will be brought to the site as and when required, thus stockpiling will be minimised.

4.5.9 WASTE MANAGEMENT: GENERAL CONSTRUCTION WASTE

The control and management of waste will be undertaken in accordance with the Project's ESMP (Appendix A). A waste management plan (WMP) will be developed before the start of works to set out how building materials and resulting waste are to be managed. The WMP will set out plans for materials and waste minimisation and management in line with the waste hierarchy (avoid, reduce, reuse, recycle, recover, final disposal) and will include the following details:

- Waste types;
- Quantities;
- Waste handling and disposal companies; and
- Identified disposal site(s).

4.5.10 CONSTRUCTION PHASE SITE DE-MOBILISATION

Upon completion of the development's multiple construction phases, the site will be cleared of all construction vehicles, plant and equipment and the site construction office compound will be removed. The removal will be done in accordance with a staged approach and where plant and equipment are no longer used, it will be removed from the site.

4.6 CONSULTATION FEEDBACK

Consultation feedback from I&APs that has influenced the methodology includes the following topics:

- Waste management collection;
- Emergency water supply;
- Lack of public transport;
- Impact of re-opening Otjihase Mine on the Project and surrounding communities; and
- Construction crew and potential security issues.

4.6.1 EMPLOYMENT OPPORTUNITIES

To manage the proposed Project under Heja Game Lodge (Pty) Ltd, a trained workforce will be required, which will include various roles for the standard operating activities associated with a development of this nature. The following employment opportunities can be expected for the type and scale of a project such as this; management and supervisors (skilled), unskilled and contract staff. Local workforce will be procured and where skill sets are lacking, national or international workforce will need to be employed. A breakdown of possible employment numbers is provided in Table 7.

Table 7 - Employment opportunities

Employment type	Appropriate number of workers
Construction phase	
Management and supervision (Include project managers, site supervisors and specialist engineers overseeing activities.)	5-8
Civil & earthworks (Skilled heavy-equipment operators, foremen, surveyors etc.)	15-25
Building contractors	50
Finishing and landscapers (Includes tilers, painters, plasterers, finish carpenters and landscapers.)	20
Operational phase:	
Property and estate management (Permanent workers needed to maintain, secure and support residents and facilities.)	1-2
Security and maintenance (Entrances and perimeter, night & roving patrol shifts, general fix, plumbing, electrical and estate grounds)	10
Facility personnel	
School (Teachers and admin depending on school size)	~ 30
Clinic (Nurse(s), receptionist, auxiliary)	3-6

Employment type	Appropriate number of workers
Restaurants and offices (Dependent on how many restaurants/shops and their operating hours; and depending on the types of businesses)	Unknown

4.6.2 TRAFFIC

Although a detailed TIA has been completed for the proposed development, the B6/D1527 intersection is currently being upgraded by the Roads Authority Namibia as part of the Dr. Hage G. Geingob Freeway project. According to the Traffic Impact Assessment (TIA), under Scenario 4 (45% build-out), the upgraded road network is expected to provide sufficient capacity to accommodate projected traffic volumes. However, at full development (Scenario 5), additional improvements to the B6/D1527 intersection may be required, potentially in the form of a roundabout or a signalised intersection to maintain acceptable levels of service and operational safety. It is therefore recommended that the TIA be updated to reflect the final approved township layout and confirm the long-term intersection requirements, as discussed in section 4.5.5. The completed transport impact assessment (Appendix C) also considered the D1527 railway crossing and highlights the need for safety and operational upgrades at the existing road-over-rail level crossing to support long-term development traffic. The anticipated upgrades at the road-over-rail crossing include signage and road marking enhancements, rail and slab section reconstruction, vegetation clearance and advance warning measures.

It should be noted that the Road over Rail crossing is located on the Farm Road F1527. This road was previously proclaimed as a public district and has since been de-proclaimed to Farm Road status. Any upgrading works at this level crossing will be subject to the approval of the Roads Board Committee under the Ministry of Works and Transport and TransNamib. Responsibility for funding, implementation, and maintenance of this crossing upgrade will have to be agreed between relevant stakeholders.

4.6.3 ACCESS AND PARKING

The D1527 will serve as the main access road to the development and will need to be upgraded to an acceptable standard. This will include a material investigation to determine the extent of the required upgrade/rehabilitation of the road.

It should be noted that the D1527 was previously proclaimed as a public district road and has since been de-proclaimed to Farm Road F1527 status. Farm Roads fall under the jurisdiction of the Ministry of Works and Transport. Any proposed upgrading of a Farm Road requires a formal application to be submitted to the Roads Board Committee.

As part of this application, the Developer is required to provide a letter outlining their intentions and clearly stating the specific approval the Developer wishes the Roads Board to

grant. Responsibility for the funding, implementation, and maintenance of this road will have to be agreed between the relevant stakeholders.

Two (2) new intersections on the D1527 are anticipated into the development, namely the southern public access at Phase 2A, and the northern access at Phase 1B at the current main gate to the Heja Lodge. These (2) main accesses are shown on the concept masterplan in Figure 5.

4.6.4 LIFESPAN, CARE AND MAINTENANCE

Durable materials should be used to withstand the moderate climate conditions with low to average rainfalls and moderate temperatures. This will ensure the buildings remain structurally sound after 30 - 40 years, which should not require significant care and maintenance. Low-maintenance and robust materials are proposed for the exterior facades and public areas, which will stand the test of time and be more sustainable in the long run. Passive design and energy efficiency principles, combined with the use of appropriate building materials, are means in which to achieve a more sustainable development.

4.6.5 ARCHITECTURE AND LANDSCAPE DESIGN

The layout has been designed around the way many Namibians live and socialise outdoors throughout the year. Open green spaces form the heart of the development, with buildings arranged to face outward onto these areas rather than turning inward. This creates a natural flow between indoor and outdoor spaces and makes it easy for residents to step directly into parks and communal areas.

Restaurants, cafés, small shops and a multi-use auditorium may be positioned around the central open space, forming an active and accessible core. From here, residents can comfortably walk between green areas, social spaces and amenities, creating a lively and connected central hub within the development.

4.6.6 LIGHTING DESIGN

Street lighting for the development will be installed in accordance with SANS 10098-1/2. For residential roads (servitudes up to 15 m), light poles will be positioned 1 m from the erf boundary with a mounting height of 7.5 m. For connecting roads (servitudes up to 30 m), poles will be placed approximately 5.5 m from the erf boundary (or 3 m from the road edge) at a height of 10.65 m. LED luminaires will be used, providing lighting performance equivalent to 100W High Pressure Sodium (HPS) units on 7.5 m poles and 150W HPS units on 10.65 m poles. Amenity street lighting will be considered for community spaces and walkways.

4.6.7 BULK SERVICES

To develop concepts for the bulk infrastructure, the Proponent evaluated what bulk service infrastructure would be required to service the proposed development fully. The following services and infrastructure were identified:

- Bulk water supply and storage;
- Bulk sanitation and treatment infrastructure – gravity sewer networks to convey sewage;
- Sewage treatment plant (STP);
- Bulk electrical connection and distribution;
- Bulk stormwater infrastructure;
- Site access and bulk roads; and
- High-level water, sewer and electrical services.

4.6.8 ENERGY

The current GIS information regarding the bulk electrical infrastructure in the vicinity of Farm Hoffnung No. 66 and surrounding areas was obtained from NamPower. NamPower has confirmed that bulk electrical supply for Phase 1 is available, following completion of a network study. The proposed internal electrical infrastructure will consist of a medium voltage ring network, low voltage network, service connections, street and area lighting and provision of critical sleeves for telecommunication services. Provision has been made in the layout for a dedicated 33/11 kV load center as well as the placement of internal minisubstations on municipal zoned erven (Figure 9). The bulk electrical supply for the development will comply with NamPower standards, regulations and grid-code requirements as set by the Electricity Control Board of Namibia. Internal electrical reticulation will follow industry standards. Overall, the design of the electrical infrastructure will adhere to the standards, regulations, and by-laws of NamPower, the Electricity Control Board of Namibia and industry standards.

4.6.8.1 Bulk supply and switching infrastructure

The proposed township development will be supplied with bulk electricity from the Finke Substation, operated by NamPower, located southeast of the site across the B6 road, adjacent to the Finkenstein Development. To ensure that supply meets the projected growth of the township, the bulk supply will be implemented in a phased approach. In Phase 1, the Finke Substation will be upgraded and a new 33 kV overhead line constructed to the township's 33 kV/11 kV substation, providing an initial capacity allocation of 1.5 MVA. Phase 2 will provide additional capacity via the installation of a planned 5 MVA transformer by Nampower at Finke Substation to accommodate increased load. In Phase 3, should the capacity requirement of Heja Lifestyle Estate increase to beyond 6.5 MVA, further upgrades will be required at Finke Substation, ensuring that the township's electrical requirements are fully met.

The switching substations will be equipped with indoor withdrawable circuit breakers arranged on 2 or 3 busbars separated by a bus section to maintain operational flexibility and reliability. A 110V DC system will provide emergency lighting and supply power to Intelligent Electronic Devices (IEDs) within the switchgear. The substations will be supplied through 185 mm², 3-core PILC-DSTA cables configured in a ring supply to provide redundancy and enhance supply reliability.

4.6.8.2 Medium and low voltage distribution

Medium Voltage (MV) distribution will primarily use PILC-DSTA cables in accordance with SANS 97 although XLPE cables may be considered in special cases where environmental or technical conditions require alternatives. The use of outdoor Ring Main Units (RMUs) will be minimized; however, where required, they will be oil-insulated Lucy type or similar approved.

Miniature substations will be strategically located on dedicated erven throughout the township to ensure that the electrical load of each area is adequately supported. These substations will serve as step-down points between the MV network and Low Voltage (LV) distribution. LV distribution kiosks, sized either as 12-way or 18-way units, will be installed at the corners of erf boundaries to facilitate safe and efficient distribution to individual erven. Underground LV cables will connect the kiosks to erven, extending approximately 1 m inside each erf boundary to minimize exposure and maintain the visual aesthetics of the township.

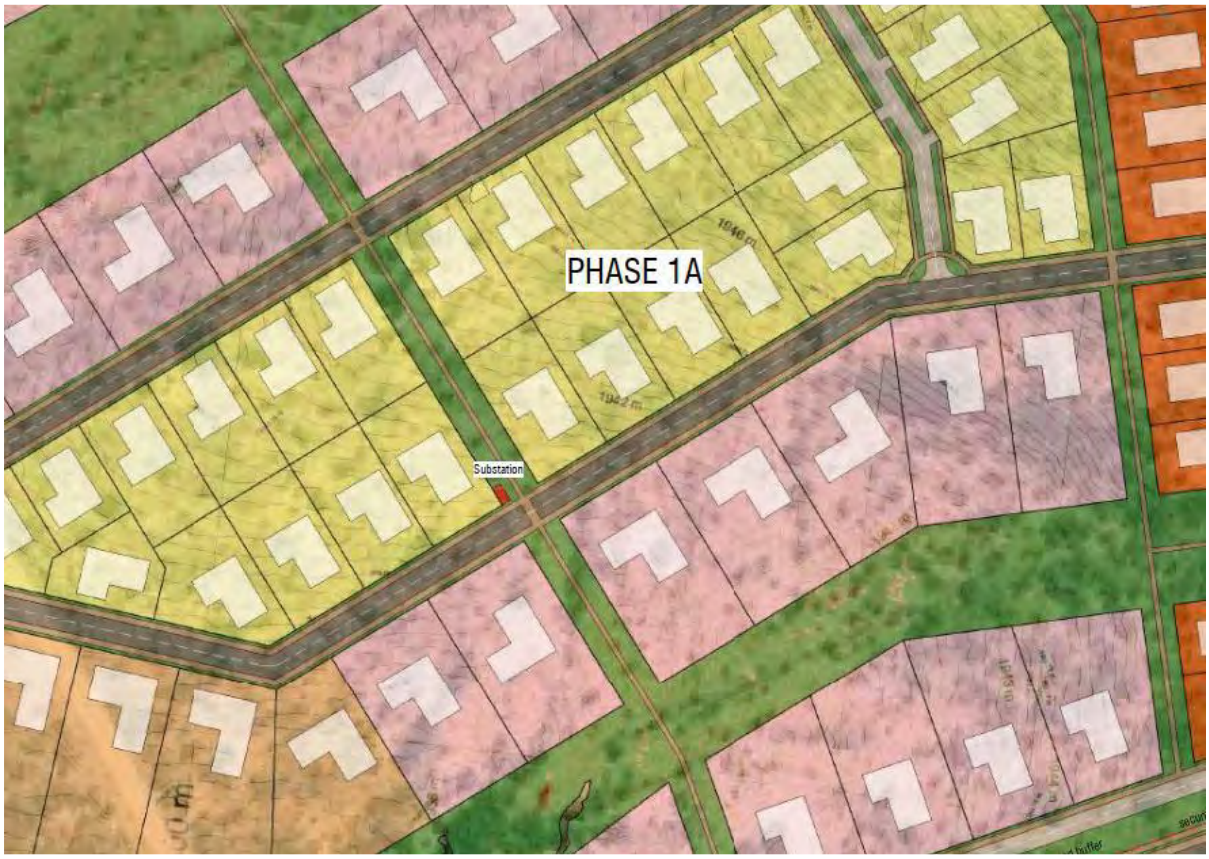


Figure 9 - Miniature Substation Placement Provisions

4.6.8.3 Electrical demand and internal network

The electrical demand for the township has been calculated using the After Diversity Maximum Demand (ADMD) methodology (Table 8). The township will include a variety of erf sizes, ranging from small erven of approximately 200 m² to larger erven exceeding 2,500 m². Benchmarking against existing Windhoek developments indicates ADMD allowances of 2.5 kVA per erf for small erven (Elisenheim), 3.0 kVA per erf for medium erven (Auasblick), and 3.5 kVA per erf for large erven (Eros). This approach ensures that the internal electrical network will be capable of supporting projected residential consumption while allowing for future growth.

The internal network of the township will comprise an 11 kV switching station adjacent to the bulk supply substation, MV ring cables running throughout the development, strategically located miniature substations, LV distribution kiosks, and underground LV cables extending to erven (Figure 10). Street and area lighting will also form part of the network, ensuring safe and well-illuminated public spaces throughout the township.

Figure 10 - Plot Allocated for Estate 33kV/11kV Intake Substation (Boogertman & Partners, 2025)

Table 8 – Electrical: ADMD Load Calculation

Erf Type	Erf Size (m²)	Quantity	ADMD (kVA)	Total Diversified Load (kVA)
Type A	2500+	34	4.0	136
Type B	2000-2500	53	4.0	212
Type C	1000-1999	97	3.5	339.5
Type D	500-999	76	3.0	228
Type E	450-499	1	2.5	2.5
Type F	250-449	152	2.5	380
Type G	200-249	41	2.5	102.5
Business	2496	2	100.00	200.0
Civic	561	8	5.0	40
POS	4925	34	0	0
Total				**1640.5**

4.6.8.4 Information and telecommunication infrastructure

All critical sleeves for electrical and possible future telecommunications road crossings will be designed and installed at intersections and necessary positions along roads.

4.6.9 WATER SUPPLY

Since the Project is situated within the municipal boundaries of the CoW ideally, potable water would be supplied from the City's water distribution network; however, the existing infrastructure does not extend to the eastern extent of the Project. Consequently, water will need to be sourced from NamWater's bulk water supply network. Early engagement with NamWater was initiated to assess the capacity, condition and upgrade requirements of the existing infrastructure, ensuring long-term reliability and sustainability of water supply for both the initial and future phases of the Project.

4.6.9.1 Bulk water assessment

NamWater, in collaboration with WCE, conducted a comprehensive investigation of bulk water supply requirements. The assessment addressed Phase 1 of the township east of the dam, as well as potential future phases west of the dam and a commercial node south of the dam.

The study evaluated the feasibility of supplying water via the Von Bach – Booster 2 – Otjihase – Airport / Finkenstein scheme. Water from the Von Bach Water Treatment Plant is pumped via booster stations along the A1 Okahandja–Windhoek corridor to terminal reservoirs in Windhoek. At the VFO pump station (located next to the Booster 2 pump station), water is pumped 13.5 km via an above-ground pipeline to the Otjihase Reservoirs, from which it gravitates to the Otjihase Mine Pump Station and onwards to existing supply networks serving the Airport and Finkenstein areas.

Phase 1 demand was calculated at 527.5 m³/day (≈193,000 m³/year), with sufficient short-term capacity at the VFO pump station to meet the Phase 1 water requirements by extending operating hours of the pumps at VFO pump station.

4.6.9.2 Phase 1 bulk water infrastructure

To meet Phase 1's requirements, the proposed infrastructure comprises the following:

- A 750 m above-ground steel pipeline from Otjihase Reservoirs to a new booster pump station at the Otjihase Mine PS site;
- A dedicated booster pump station configured 2 + 1 (duty and standby) with a capacity of 180 m³/h at 140 mWH. It must be noted that this capacity is to supply the full Heja Lifestyle Estate development including both this Phase 1 and future Phases 2 and 3. The Developer may consider equipping the pump station with pumps sufficient for the supply of Phase 1 only at first and upgrade the pumps in future when future phases are commissioned.
- A ±12 km Ø315 mm Class 16 uPVC pipeline connecting the booster station to the Lifestyle Estate. It must be noted that this size pipe is required to supply adequate flow for the entire Heja Lifestyle Estate including this Phase 1 and future phases 2 and 3. The Developer may consider installing a smaller pipeline (subject to confirmation by the appointed Engineer during the Design Development Stages), adequate to supply

Phase 1 only initially and then in future construct a parallel pipeline to this one to supply the future phases of the Development.
- Construction of terminal reservoirs on site; and
- A possible proportional emergency groundwater backup scheme to ensure supply reliability.

This configuration is designed to meet immediate water demands while providing a phased approach to accommodate future expansion.

4.6.9.3 Proposed medium to long-term infrastructure upgrades

For medium-term development, with water demands between 200,000–500,000 m³/year, Phase 2 infrastructure upgrades are required, including:
- Upgrading the VFO pump station to 220 m³/h with two operational pumps;
- Enhancing the chlorination system at Otjihase Reservoirs; and
- Incremental expansion of the emergency groundwater supply, if the Okavango Link project has not yet augmented the Von Bach Dam.

Phase 3, designed to meet long-term demands of 500 000 m³/year – 940 000 m³/year, may involve one of three options: upgrading the existing Booster 2 – Otjihase pipeline with new pump stations, constructing a parallel 13.5 km Ø250 mm pipeline with pumping scheme, or replacing the existing pipeline with a larger Ø500 mm pipeline to accommodate additional commercial or mining off-take.

NamWater's recommendations assume continuous operation of the Booster 2–Otjihase scheme and sufficient water availability at Von Bach Dam. Given the historical low levels of the dam and potential delays in the Okavango Link project, groundwater emergency schemes remain essential for supply security.

As the development lies within CoW's jurisdiction, formal authorisation from the City is required for NamWater and the developer to proceed with detailed design and construction of the bulk water supply scheme. Groundwater emergency schemes will be implemented in phases, aligned with increasing water demand, to ensure a resilient and sustainable water supply for the Project.

4.6.10 WASTEWATER MANAGEMENT

The wastewater treatment plant (WWTP) will be located off site, on Farm Hoffnung No. 66; farm portion 11 as shown in Figure 11.

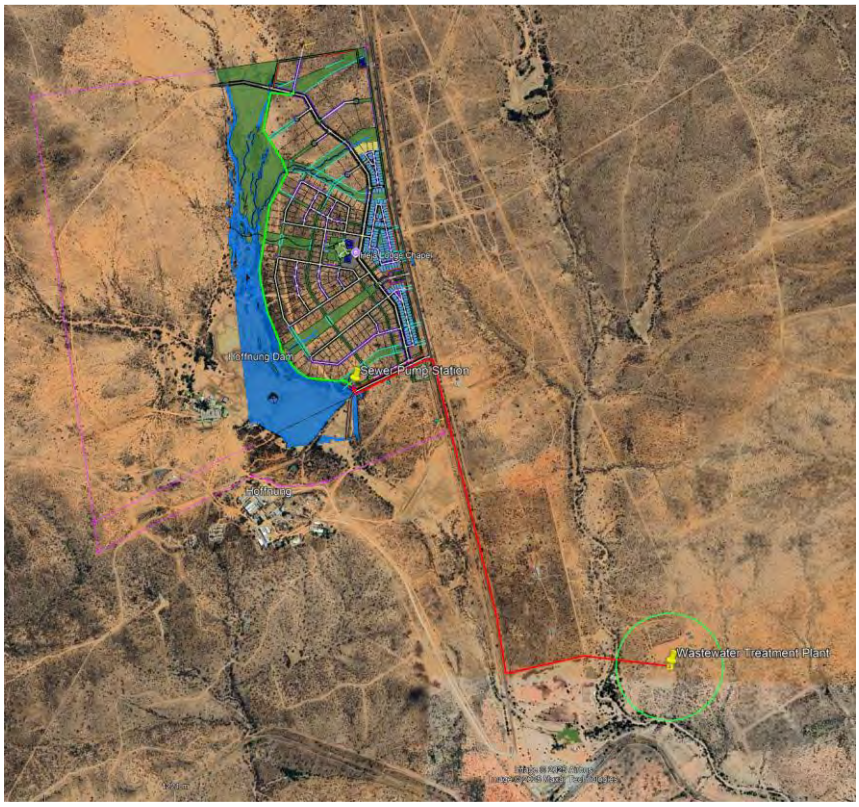


Figure 11 - Phase 1 Bulk Sewer Infrastructure (Source: WCE, 2026)

During the detailed design phase, an alternative option for bulk sewage conveyance will be explored. This involves pumping the development's sewage along the B6 road reserve to connect with the nearest City of Windhoek (CoW) gravity sewer lines near the Namib Dairies facility in Avis. However, this approach will require a thorough assessment of the capacity of the existing CoW gravity lines and any potential downstream upgrades that may be necessary at the connection point.

4.6.10.1 Conceptual Sewage Design Flow

The estimated water demand for the different land uses and erf sizes in Phase 1 was used to determine the daily sewage design flow. Percentage allocations for each category were applied based on the Redbook (2019) to calculate the average daily dry weather flow (ADDWF). An additional 20% was included to account for rainwater ingress and groundwater infiltration, as the development is located adjacent to a water body, where the groundwater table is expected to be shallow on the portions of the development immediately next to the dam, when the dam is full. Phase 1 of the Project is projected to generate approximately 405.3 m³ of sewage per day shown in Table 9.

Table 9 - Sewage Demand Calculations for Phase 1

Phase	Residential Typologies	Area (m^2)	Number of Units	AADD (L/day)	Total (m^3/day)	% AADD contributing to sewage volume	Sewer Demands (ADDWF) (m^3/day)	Rainwater infiltration (% added to DDWF)	Sewer Flow incl. Rainwater infil. (ADWWF) (m^3/day)
Phase 1A	Type A1	10000ave	-	-	286.40	55%	-	20%	-
	Type A2	5000ave	-	-		55%	-	20%	-
	Type A	2500	21.00	42,000.00		55%	23.10	20%	27.72
	Type B	2000-2500	29.00	58,000.00		55%	31.90	20%	38.28
	Type C	1000-1500	80.00	104,000.00		60%	62.40	20%	74.88
	Type D	500-750	34.00	30,600.00		70%	21.42	20%	25.70
	Type E	450-500	10.00	8,000.00		80%	6.40	20%	7.68
	Type F	250-300	73.00	43,800.00		80%	35.04	20%	42.05
	Type G	Appartments	-	-		80%	-	20%	-
Phase 1B	Type A1	10000ave	-	-	141.00	55%	-	20%	-
	Type A2	5000ave	-	-		55%	-	20%	-
	Type A	2500	8.00	16,000.00		55%	8.80	20%	10.56
	Type B	2000-2500	3.00	6,000.00		55%	3.30	20%	3.96
	Type C	1000-1500	27.00	35,100.00		60%	21.06	20%	25.27
	Type D	500-750	31.00	27,900.00		70%	19.53	20%	23.44
	Type E	450-500	10.00	8,000.00		80%	6.40	20%	7.68
	Type F	250-300	80.00	48,000.00		80%	38.40	20%	46.08
	Type G	Appartments	-	-		80%	-	20%	-
Phase 1C	Type A1	10000ave	18.00	45,000.00	100.10	55%	24.75	20%	29.70
	Type A2	5000ave	12.00	30,000.00		55%	16.50	20%	19.80
	Type A	2500	-	-		55%	-	20%	-
	Type B	2000-2500	-	-		55%	-	20%	-
	Type C	1000-1500	5.00	6,500.00		60%	3.90	20%	4.68
	Type D	500-750	-	-		70%	-	20%	-
	Type E	450-500	-	-		80%	-	20%	-
	Type F	250-300	31.00	18,600.00		80%	14.88	20%	17.86
	Type G	Appartments	-	-		80%	-	20%	
				Total AADD for Phase 1	527.50			Total Sewer (m^3/day)	405.34

4.6.10.2 Sewage infrastructure overview

The Phase 1 development will be serviced by a comprehensive sewage system comprising internal and bulk pipelines, a pump station and a dedicated wastewater treatment plant (WWTP).

Internal gravity sewer pipelines will be installed within the road reserves at the lower ends of erven. In areas where topography limits gravity flow, mid-block gravity sewers will be used to maintain efficient conveyance. All internal sewers will connect to the bulk collector pipeline.

A bulk gravity collector pipeline will run along the western edge of Phase 1, adjacent to the dam, in a north-to-south direction. This pipeline will convey sewage from all internal sewers to the proposed pump station. Due to the site's topography and the location of the neighbouring sewer treatment plant, a pump station is required on the southern side of Phase 1. This station will collect all sewage from the development and pump it to the STP.

It will be designed to handle peak inflow volumes, with two pumps installed for redundancy (one duty, one standby) and standby power to reduce overflow risk.

4.6.10.3 Wastewater treatment plant

Since the City of Windhoek's sewer network does not extend this far east, connecting to the municipal system is impractical. Therefore, the development will construct its own STP. The STP will treat sewage to special effluent standards to allow safe discharge and/or reuse for irrigation of green areas and gardens.

An application for wastewater and effluent discharge licence to the CoW has been submitted. The ESMP (Attachment A) will provide guidance on odour control, safety measures and buffer distances.

The ultimate treatment capacity of the STP which will serve Phase 1 will be at least 405.3m^3 of sewage per day as per the calculations. The Developer will construct and expand the treatment capacity in phases, as the development expands and sewage generated increases.

Figure 11 Illustrates the boundaries of Phase 1 of the development, with the bulk gravity collector pipeline shown in green along the western side. The sewer pump station, located on the southern edge, conveys sewage via the Red Rising Main to the proposed STP situated southeast of the Project.

4.6.10.4 Effluent reuse for irrigation

The Proponent intends to reuse treated effluent from the STP for irrigating green spaces and gardens within the development as far as possible and once effluent volumes increase. The STP will treat effluent to a special standard, allowing safe discharge and suitability for irrigation throughout the site. The release of this water will require approval to specific standards specified in the wastewater treatment, discharge and re-use licence, once approved, in line with the requirements of the Water Resource Management Act, No. 11 of 2013 and associated 2023 Regulations.

4.6.10.5 Semi-purified water reticulation network

To distribute the treated effluent within the development for irrigation purposes, a semi-purified (grey water) reticulation network will need to be installed alongside the domestic potable water network. Provisions include:

- Placement of semi-purified water pipes within road reserves.
- Dedicated semi-purified reservoir/s on site.
- A pump station at the STP to transfer treated effluent to the storage reservoir/s.

4.6.10.6 Storage reservoirs

For Phase 1, approximately 50% of the sewage inflow is assumed to be available for irrigation, with storage allocated in the layout at the following positions:

- Phase 1 Central Eastern Storage Site - (Figure 12).
- Phase 1 Northeastern Storage Site – (Figure 13).

Additional reservoirs will be added in future phases as the development grows and more sewage is treated.

Figure 12 – Proposed central eastern water storage site – smaller reservoir to the south is dedicated for semi-purified water (Boogertman & Partners, 2025)

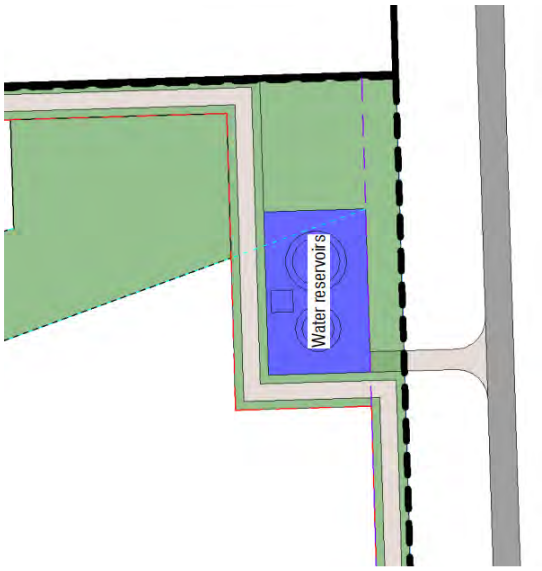


Figure 13 – Proposed north-eastern water storage site – smaller reservoir to the south is dedicated for semi-purified water; access to the storage site from road to Otjihase Mine (Boogertman & Partners, 2025)

All sewer infrastructure will comply with the Red Book (2019).

5 CONSIDERATION OF ALTERNATIVES

5.1 INTRODUCTION

In accordance with the requirements of the Environmental Management Act, No. 7 of 2007 (EMA) and recognised international good practice for environmental assessment, reasonable project alternatives have been considered as part of this Scoping with Impact Assessment. The purpose of considering alternatives is to demonstrate that the selected Project configuration represents the most environmentally, socially and technically appropriate option, taking into account feasibility, environmental risk, stakeholder concerns and regulatory requirements.

Alternatives were assessed at a strategic level commensurate with the scope of a combined scoping and impact assessment and focused on those options that were considered reasonable, feasible and relevant to the potential environmental and social impacts of the Project.

The alternatives considered include:

- The no-go alternative;
- Project location alternatives;
- Layout and design alternatives;
- Wastewater treatment plant location alternatives;
- Water supply alternatives; and
- Development phasing alternatives.

5.2 NO-GO ALTERNATIVE

The no-go alternative assumes that the proposed Heja Lifestyle Estate development does not proceed and that the site remains in its current state.
Under the no-go alternative:

- No additional housing would be provided to address the growing demand in Windhoek and the Khomas Region;
- Employment opportunities associated with construction and operation of the development would not materialise;
- Investment in bulk infrastructure, roads and services would not occur; and
- The site would remain underutilised, with ongoing modified land use associated with historical lodge and agricultural activities.

From an environmental perspective, the no-go alternative would avoid the Project's direct impacts. However, it would also forego opportunities for planned, serviced urban development, potentially increasing pressure on informal or unplanned settlement expansion elsewhere.

The no-go alternative was therefore not selected, as the proposed Project aligns with national development objectives, addresses identified housing needs and is considered environmentally acceptable subject to appropriate mitigation and management measures.

5.3 PROJECT LOCATION ALTERNATIVES

The proposed development is located on a portion of Farm Hoffnung No. 66, land which is under the ownership and control of the Proponent. The site benefits from proximity to Windhoek, access to existing and planned transport infrastructure, and the availability of bulk services.

Alternative greenfield locations outside the Windhoek municipal boundary were not considered reasonable due to:

- Increased travel distances and traffic generation;
- Greater infrastructure and service provision requirements;
- Higher environmental risk associated with development in less disturbed areas; and
- Reduced alignment with municipal planning frameworks.

The selected site represents a strategic infill and edge-of-urban development location, allowing for integrated planning, efficient infrastructure provision and reduced environmental footprint compared to more remote alternatives.

5.4 LAYOUT AND DESIGN ALTERNATIVES

The Project layout has evolved through iterative planning informed by environmental constraints, specialist studies and stakeholder engagement. Design alternatives considered included variations in:

- Density distribution;
- Road alignment and access points;
- Placement of open spaces and green corridors; and
- Infrastructure routing.

Higher-density development nodes were preferentially located to optimise land use efficiency, reduce sprawl and improve infrastructure efficiency. Open spaces and green corridors were retained along drainage lines and sensitive areas to reduce environmental disturbance and manage flood risk.

The selected layout was chosen as it:

- Avoids development within identified floodlines;
- Minimises disturbance to watercourses and riparian zones;
- Allows phased infrastructure provision; and
- Integrates environmental considerations into the overall design.

5.5 WASTEWATER TREATMENT PLANT LOCATION ALTERNATIVES

The location of the wastewater treatment plant (WWTP) was a key design consideration due to potential groundwater, surface water and odour impacts, as well as regulatory buffer requirements.

Two principal alternatives were considered:

1. Placement of the WWTP within the development footprint; and
2. Placement of the WWTP at an alternative location outside the main development area.

The initially proposed location within the development footprint was considered on operational efficiency, reduced pipeline lengths and minimisation of additional environmental disturbance. However, buffer requirements in relation to watercourses and boreholes necessitated further assessment and approvals.

An alternative location on an adjacent property was considered and chosen. This option however includes the following:

- Increased pipeline lengths and associated construction disturbance;
- Additional land access requirements (Land access agreement in place); and
- Higher capital and operational costs.

Based on specialist groundwater and hydrological assessments, engagement with the Department of Water Affairs, and consultation with the neighbouring farmer, as well as the need to comply with strict regulations requiring buffer zones near watercourses, which would have significantly reduced the developable area within the project site, the preferred WWTP location was selected off-site. This location allows for compliance with wastewater treatment, discharge, and reuse licence conditions while ensuring implementation of appropriate mitigation measures.

5.6 WATER SUPPLY ALTERNATIVES

Water supply alternatives considered for the Project included:

- Exclusive reliance on groundwater abstraction;
- Exclusive reliance on bulk water supply from NamWater; and
- A combined bulk water supply with limited emergency groundwater abstraction.

Exclusive reliance on groundwater was not considered sustainable due to the semi-arid climate, drought risk and the need to protect regional aquifers. Exclusive reliance on groundwater was therefore rejected.

The preferred alternative is a bulk water supply from NamWater, supplemented by an emergency groundwater supply during extreme drought conditions, subject to abstraction

licensing. This approach reduces pressure on groundwater resources while providing resilience to water supply interruptions.

Effluent reuse for irrigation further reduces potable water demand and supports sustainable water management.

5.7 DEVELOPMENT PHASING ALTERNATIVES

The Project will be implemented in multiple development phases, allowing infrastructure provision, environmental management and mitigation measures to be aligned with demand. An accelerated single-phase development was considered but rejected due to:

- Increased short-term pressure on infrastructure and services;
- Higher construction-phase environmental and social impacts; and
- Reduced ability to adapt to changing market and environmental conditions.

The phased development approach was selected as it:

- Allows incremental infrastructure upgrades;
- Reduces peak construction impacts;
- Facilitates adaptive management; and
- Improves regulatory oversight and compliance monitoring.

5.8 PREFERRED ALTERNATIVE

Based on the assessment of reasonable alternatives, the proposed Project configuration, including the selected site, layout, infrastructure design, wastewater treatment approach, water supply strategy and phased implementation is considered the preferred alternative.

The preferred alternative achieves an appropriate balance between environmental protection, social benefit, technical feasibility and economic viability, and is capable of being implemented in compliance with applicable legislation and licence conditions.

6 ENVIRONMENTAL AND SOCIAL BASELINE

6.1 BASELINE DATA COLLECTION

This section sets out the findings from the desktop study and specialist studies, which involved reviewing the existing literature, spatial data and publicly available reports on the receiving biophysical and socio-economic environment, along with various field assessments carried out in the Project area. It is an important part of the scoping component of the assessment as it determines whether any knowledge gaps require additional information prior to the assessment phase (chapter 8 of this report), where it will serve as the foundation for impact analysis and mitigation planning.

6.2 DESKTOP STUDIES AND FIELD SURVEYS

Field-based studies were conducted and completed in 2024 as part of the impact assessment to supplement and validate desktop studies and publicly available information. The hydrological field-based work was completed in 2024, and the traffic studies were completed in 2025.

6.3 SPECIALIST STUDIES

The specialist studies outlined in Table 10 were commissioned to fill the gap not filled through desktop reviews of publicly available reports. All specialist reports listed in Table 10 are included as appendices to this final scoping with impact assessment report.

Table 10 - Specialist studies for the scoping with impact assessment

Study area	Purpose	Specialists
Traffic	– The transport impact assessment reviewed the potential traffic impacts and loading on routes associated with the construction and development activities; – Assessing the capacity and safety of road infrastructure; and – Assessing the need for an intersection upgrade at the construction site entrance and providing a concept layout plan if necessary.	– Innovative Traffic Solutions (ITS), 2025 (Appendix C)
Flood line assessment	– Map the 1-in-50-year and 1-in-100-year flood inundation areas of the rivers flowing through the site; – Ensure compliance with the Local Authorities Act 23 of 1992, which prohibits development within the 1-in-50-year flood zone;	– Chris Muir Consulting Engineer (Appendix D)

Study area	Purpose	Specialists
	– Inform and guide the layout and planning of the estate development, including the positioning of plots, roads, services and infrastructure; and – Support phased development planning, starting with high-level flood line modelling for initial layouts, followed by more detailed modelling to refine designs and ultimately assess post-development impacts.	
Hydrology	– Water supply; – Storm protection and river diversion; – Impact on heritage aspects; and – Clean and dirty water management systems.	– ECC, 2025 (Appendix E)
Geohydrology	– Assess the potential for contamination of aquifers from the WWTP; – Provide a model to determine impacts of drawdown; and – Assess the sustainability of boreholes for water supply.	– ECC, 2025 (Appendix E)
Bulk water supply	– To assess whether NamWater's existing and planned bulk water supply systems can reliably supply the proposed Project; – To evaluate the impact of the Project's phased water demands on regional water resources and infrastructure; – To identify infrastructure upgrades, alternative supply options and associated costs required to ensure a secure and sustainable water supply; and – To provide recommendations to guide NamWater and the Proponent's decisions on bulk water supply arrangements going forward.	– Namibia Water Corporation (Pty) Ltd (NamWater) (Appendix F)

6.4 LAND USE

The day-to-day activities of neighbouring residents mainly involve farming. To the north of the proposed Project is the Otjihase copper mine, which is currently under care and maintenance. The Finkenstein Residential Estate is located to the southeast of the proposed Project and is similar in nature to the proposed development. The proposed Project site was previously used as a lodge and recreational resort.

The proposed Project footprint (see Figure 1) occupies a portion of Farm Hoffnung No. 66 of 328 ha, situated approximately 10 km east (E) of Windhoek, along the B6 road, within the municipal boundary of CoW. The proposed Project will involve the construction of approximately 1 200 residential erven, including single residential, townhouses, apartment and mixed-use structures. Central site coordinates are provided in the legend of Figure 1.

6.5 CLIMATE

The climate of the area is comparable to conditions experienced in Windhoek, although Windhoek is situated at ~200 m lower in elevation. The region experiences moderate temperatures and low to average rainfalls. Average annual rainfall ranges between 300 - 350 mm (Shikangalah and Mapani (2019). This is supported by long-term rainfall data from the Windhoek weather station (Figure 14). The Windhoek weather station has a 30-year climate normal mean annual precipitation (MAP) of 368 mm for the previous climate normal cycle from 1961 to 1990. Modelled data for the greater Windhoek area (based on SM2RAIN-ASCAT, IMERG, CHELSA Climate, and WorldClim models; Hengl, 2018a) indicates higher rainfall, with a MAP reaching between 400 - 420 mm. Differences can exist between modelled and measured data due to boundary conditions causing imperfections in the modelled output (Kim *et al.,* 2017).

The area receives summer rains between October and April (~55%), while the winter months are relatively dry (May to August; ~1%). This rainfall seasonality is clearly shown in Figure 15. March to May are the region's autumn months, receiving the second highest rainfall (~32% of MAP), while spring (September to November) receives the second lowest rainfall (~12% of MAP). Figure 14 shows four (4) drought events (below MAP rainfall for three (3) or more consecutive years) for the period 1950 to 2018 (red bars). Specifically, these drought events were 1958 - 1962, 1980 - 1985, 1991 - 1996 and 2015 - 2018. The regularity of low rainfall events suggests vulnerability of surface water supply.

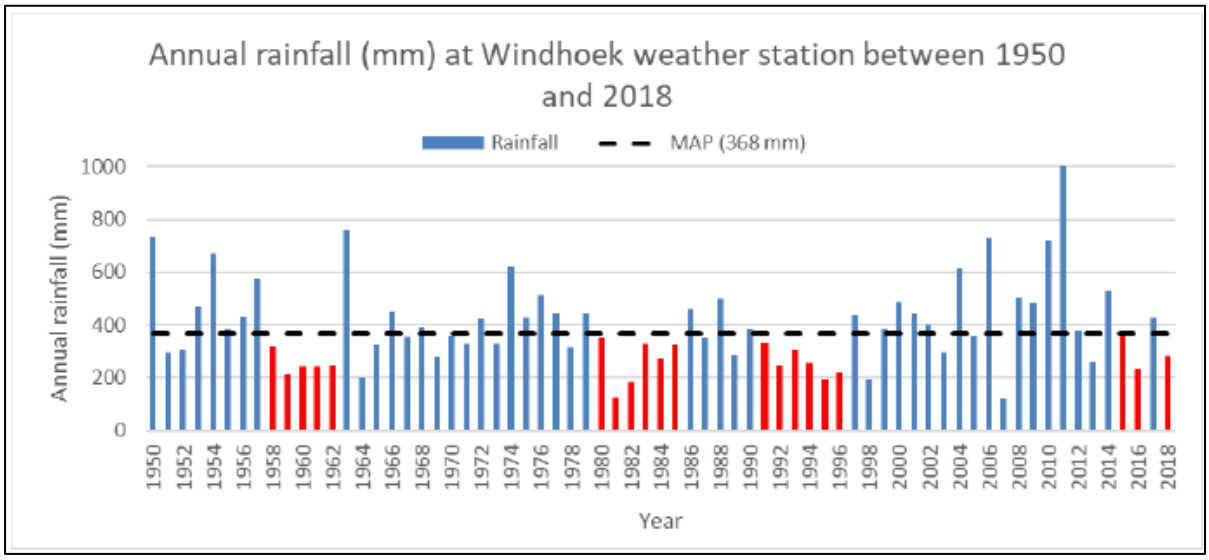


Figure 14 - Annual rainfall (mm, blue bars) at Windhoek weather station between 1950 and 2018 (Source: NMS, 2021)

High evapotranspiration rates occur in summer when temperatures peak above 30°C and rainfall provides adequate water for the evapotranspiration process, while the reverse stands for winter when temperatures fall below 10°C and rainfall is at its annual lowest.

The mean annual temperature (MAT) for the Khomas Region (within which the development is situated) is 20°C (as provided by the World Bank Group [2021] for the 30-year climate normal period cycle of 1991 to 2020), with average temperatures ranging between 14 - 25°C. The World Bank Group (2021) records average maximum temperature reaching as high as 33°C in summer (December and January) and average minimum temperatures reaching as low as 6°C in winter (June and July) (Figure 15).

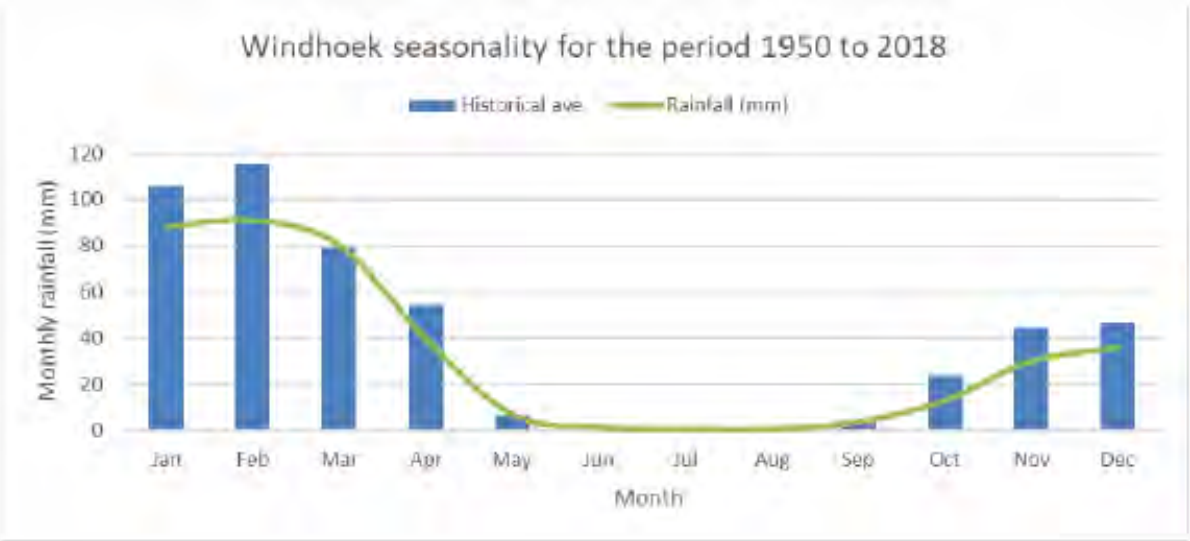


Figure 15 - Windhoek region seasonality for the period 1950 - 2018 (green line; Namibia Meteorological Service [NMS], 2021) compared to the historical average provided by the Climate System Analysis Group (CSAG, 2021; blue bars) for 1998 – 2012

A 15-year (2005 to 2020) long-term observational dataset shows the wind direction and speeds at Windhoek Eros Airport (~15 km southwest (SW) of the development site). The data shows a slight bipolar dominance of northerly and southerly winds with the major wind vector being southerly/south-southeasterly (20%) and speeds mostly ranging between 1 - 4 m/s up to a maximum of 12 m/s (Figure 16).

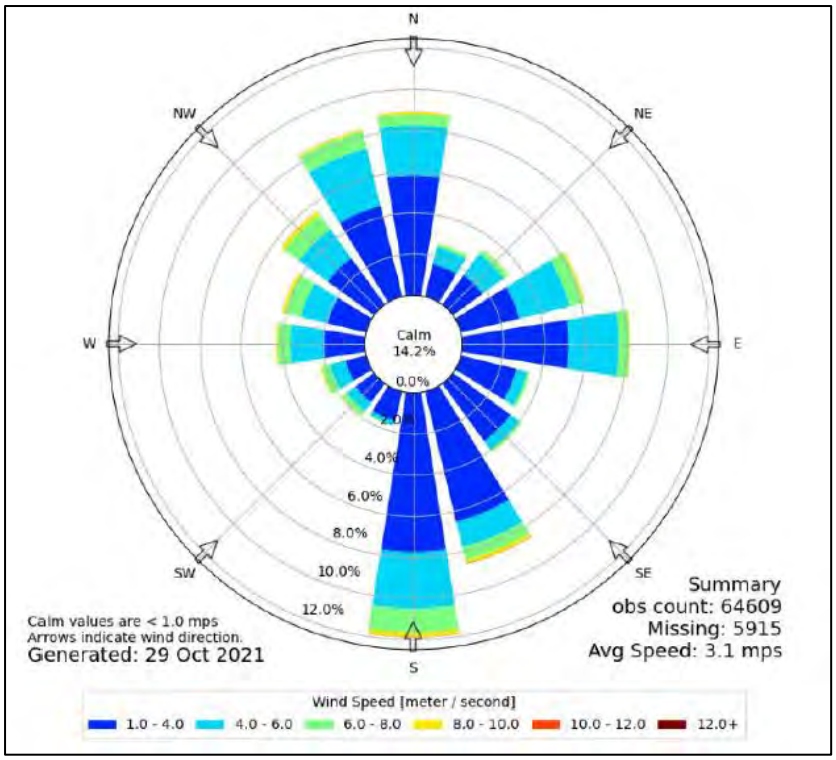


Figure 16 - Wind rose at Windhoek Eros Airport from 2005 - 2020 showing the distribution of wind direction (arrows) and wind speed (m/s) (Source: Umvoto, 2023)

The secondary wind is northerly (N)/north-north-westerly (NNW) (17%) with lower maximum wind speeds of 10 m/s. Westerly and easterly winds, though to a lesser frequency, do provide balance to the north-south dominance providing a well-balanced four-quarter (Q4) wind direction which can be expected in locations removed from oceanic influence. The wind direction is also influenced by topography. The Windhoek Eros Airport is located in a generally north-south (N-S) low-level valley with a northeast (NE) – southwest (SW) orographic barrier to the south (S) which may impact wind directions. Average wind speeds for the 15-year time period are 3.1 m/s with calms (winds <1 m/s) at 14%.

6.6 SOILS, GEOLOGY AND TOPOGRAPHY

Geologically, the greater Windhoek region (including the proposed development site) is dominated by the pre-Damaran gneissic basement and Damara Supergroup metasediments (Miller, 2008a and 2008b). Both were subjected to polyphase deformation (i.e. multiple deformation events) and metamorphism during the Pan African Damara Orogen (peak orogenesis at 550 million years (Ma); Mapani *et al.,* 2014) as a result of the collision between the Congo (to the north) and Kalahari Cratons (to the south). The regional study area straddles the low-temperature-high pressure (LTHP) stratotectonic southern zone (SZ) and southern margin zone (SMZ) of the Damara Belt (Miller, 2008a).

The stratigraphy of the greater Windhoek region is summarised in Table 11, as described in Miller and Grote (1988), Miller (2008a, 2008b and 2008c), Umvoto (2023) and the 1:50 000 2217CA geological map of the Windhoek area (see Figure 17) after Hoffmann and Schreiber, 2011). In the development study area, a portion of the SZ is observed, which includes the Kuiseb and Kleine Kuppe formations of the Neoproterozoic Khomas Complex (~600-620 Ma; see Table 11 and Figure 18, consisting of both spreading phase sediments and syntectonic sediments associated with the closure of the Khomas Ocean (Miller, 2008a and 2008b).

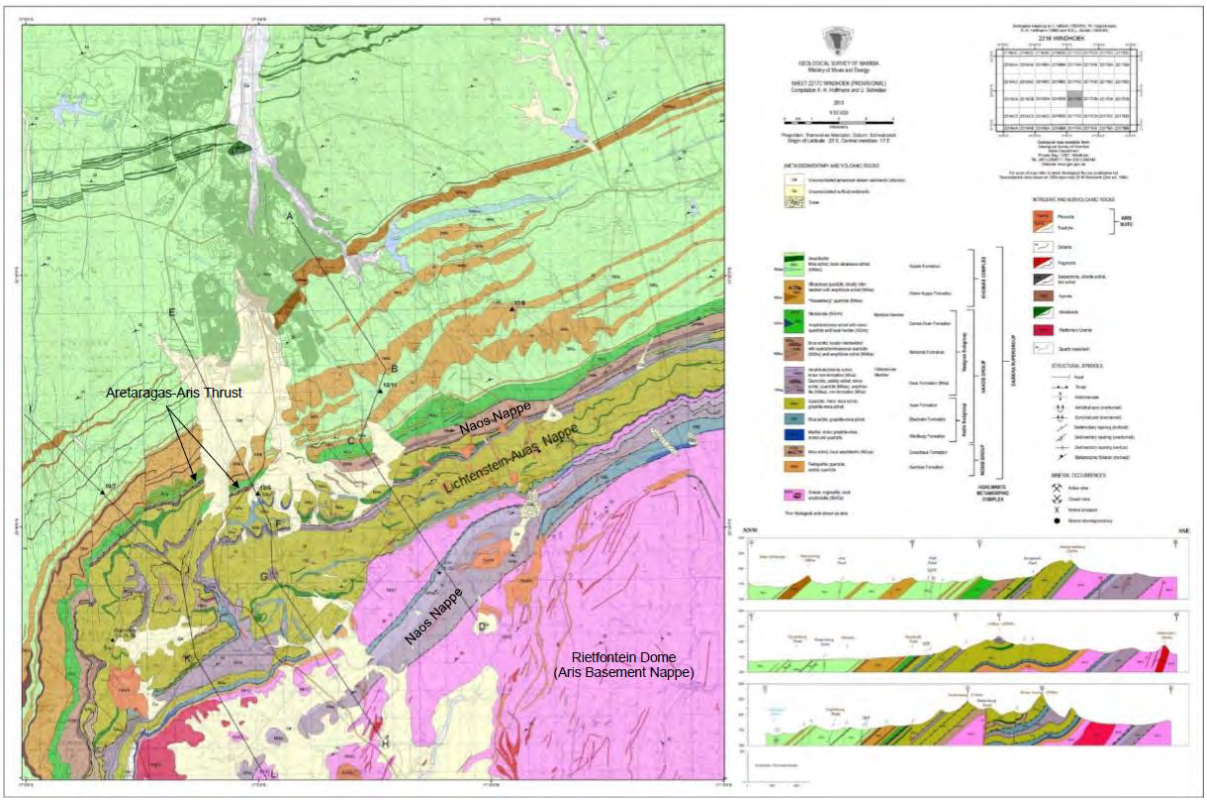


Figure 17 - 1:50 000 2217CA Windhoek geological map and cross sections (after Hoffmann and Schreiber, 2011)

Table 11 - An overview of the stratigraphy and hydro stratigraphy of the Windhoek region (modified after Miller *et al.*, 2018, Umvoto, 2023 and the 1:50 000 2217CA Windhoek geological map)

Age		Stratigraphy					Hydrostratigraphy		
		Supergroup	Group	Subgroup	Formation	Description	Super Unit	Unit	Subunit
52 Ma		Aris Suite (TsARo, TsARt)				Trachyte (pipes, sills, dykes, plugs) and phonolites	-	-	-
610 Ma	Southern Zone	Damara Supergroup	Khomas Complex		Kuiseb (NKs)	Amphibolite (NbML); Mica schists, local calcareous schist (NKssc)	-	Kuiseb Aquiclude (Matchless Member)	-
					Kleine Kuppe (NKk)	Micaceous quartzite; locally interbedded with ampibole schist (NKka). Includes Wasserberg quartzite (NKkw)	Windhoek Aquifer	Kleine Kuppe Subaquifer	-
	Southern Margin Zone		Hakos	Vaalgras	Gomab River (NGr)	Amphibolite/mica schist with minor quartzite and local marble (NGrm). Thin metafelsite (NGrHl)		Vaalgras Aquitard/Aquifer	Gomab River aquitard/aquifer
					Mahonda (NMh)	Mica schist; locally interbedded with quartzites/micaceous quartzite (NMhq) and amphibolite schist (NMha). Water strikes encountered in quartzites.			Mahonda aquitard/aquifer
> 635 Ma					Naos (NNa)	Amphibolite/chlorite schist, minor iron formation (NNai). Diamictite, pebbly schist; minor schist, quartzite (NNaq); amphibolite (NNaa), iron formation (NNai).			Naos aquitard/aquifer
				Kudis	Auas (NAu)	Turbiditic quartzite fan deposit. Minor mica schist, graphite-mica schist. Thickest in Auas Mountains. Duplicated by thrusting and fractured by Windhoek Graben faulting.		Auas Subaquifer	-
					Blaukrans (NBl)	Interbedded with Auas and Waldburg Fms. Mica schist, graphite-mica schist. Variably pyritic.	-	Waldburg Aquitard	Blaukrans Subaquitard
>750 Ma					Waldburg (NWb)	Marble; minor graphite-mica schist and quartzite. Strongly tectonised dark grey and white dolomitic to calcitic marbles. Water strikes encountered in dolomitic marbles.			Waldburg Subaquitard
			Nosib		Duruchaus (NDu)	Mica schist, local amphibolite (NDua)			Duruchaus Subaquitard
> 780 Ma					Kamtsas (NKa)	Feldspathic quartzite, pebbly quartzite			Kamtsas Subaquitard
> 1000 Ma	~~~~~ Major unconformity ~~~~~						~~~~~ Major unconformity ~~~~~		
~1750 Ma	Hohewarte Metamorphic Complex (MHO)					Granitic gneisses, migmatites, metasedimentary and basic metavolcanic rocks. Amphibolites (MHOa)	-	Basement Aquiclude	-

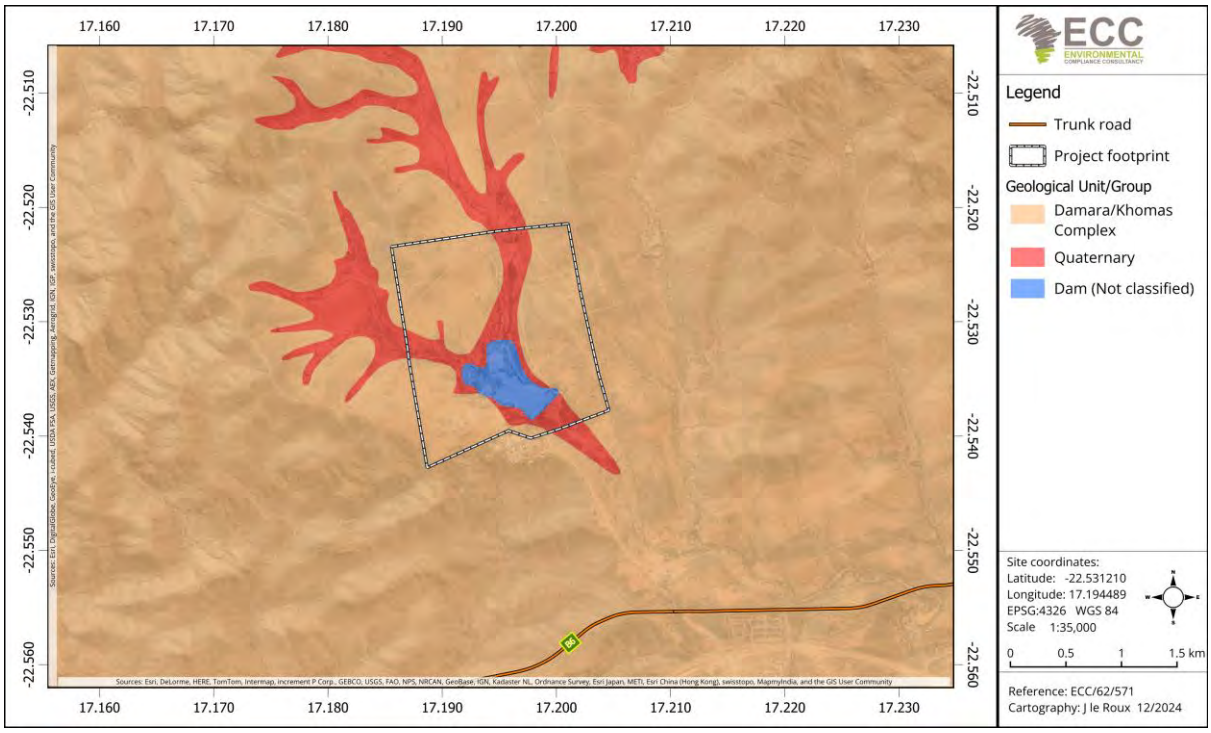


Figure 18 - Lithostratigraphy of the proposed development site

The Project site is at an elevation between 1 920 and 1 970 metres above mean sea level (mamsl), gently sloping to the south, with a relatively flat relief surrounded by undulating hills, typical of the Khomas Hochland (Figure 19). Topography is incised in areas where drainage occurs, creating valleys in the terrain with drainage lines showing relatively narrow and straight (non-meandering) courses, indicative of intermittent, moderate to high-velocity flow during sufficiently wet periods.

The Project site is located in the western headwaters of the Seeis River catchment (approximately 34.8 km^2 in area), draining via four (4) distinct valleys toward the southeast (Figure 19). Two (2) water courses, contributing to a tributary of the Seeis River, converge at the Hoffnung dam and crosscuts the development site area. The catchment size of these two (2) western valleys draining through the development area is approximately 9.2 km^2. Hoffnung dam occurs in an erosional peneplain formed by its contributing water courses within the development's footprint. The existing Heja Lodge is within 100 m of the riparian zone, along the SW bank of the dam, while the NE bank remains undeveloped except for a gravel road. Upstream of the dam, the water courses and riparian zones are crosscut in places by gravel farm roads with concrete drifts, with no other structures within 100 m of the riparian zone. The spillway for the dam occurs in the SE corner of the dam.

The water course down stream of Hoffnung dam has been extensively disturbed and is unlikely to contribute significant flow to another dam located further downstream near the local railway siding.

Any potential discharge or overspill from Hoffnung dam is expected to be detained by a secondary embankment and associated borrow pit that has excavated material from the water course approximately 500 m downstream of the Hoffnung dam wall. Another southward flowing water course approximately 700 m from the development's eastern most boundary, on the remaining portion of Farm Bellerode, restricts flow from headwaters by two (2) earthen dams along the course of the riverbed, further reducing contributions from the headwaters of the catchment into the non-perennial tributary of the Seeis River. The terrain map is presented in Figure 19.

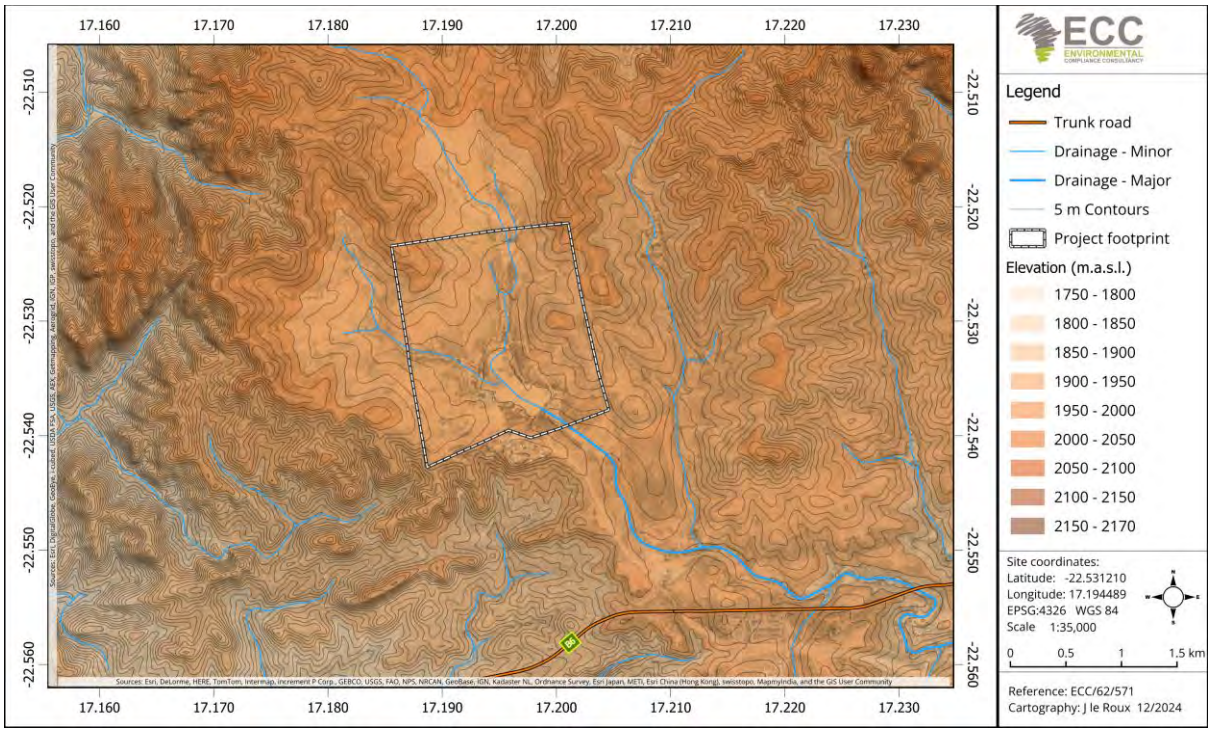


Figure 19 - Terrain map of the proposed development area

6.7 HYDROLOGY AND HYDROGEOLOGY

The Kleine Kuppe Formation occurs at the base of the Kuiseb Formation (Hoffmann, 1983). It consists of quartzites (Wasserberg quartzites) that have interbeds of quartz and mica schists, as well as amphibolites but are also interbedded with the Kuiseb schists (Miller, 2008a). These quartzites pinch out towards the west (W) but have the thickest development in the Windhoek area (approximately 8 km) (Miller, 2008b). The quartzites form a major secondary fractured aquifer and groundwater reservoir due to their lateral extent, thickness and fractured nature (Murray, 2002). Targeting this formation within the southern area of the development's footprint would require drilling depths between 100 - 250 m, however more precise measurements can only be confirmed through field mapping / geophysical surveys.

The overlying and interfingering Kuiseb Formation (surface geology underlying the development site) is distinct from the schists of the Kleine Kuppe Formation as the Kuiseb schists are coarse-grained (Miller, 2008b). The rocks are strongly tectonised and have alternating layers of foliated semi-pelitic to pelitic schists (Miller, 2008b).

The Kuiseb Formation has been subject to LTHP metamorphism indicated by the primarily chlorite-muscovite-biotite-plagioclase schists with garnet, staurolite and kyanite (Miller, 2008b). Once graded distal greywackes, the Kuiseb Formation includes the metavolcanic Matchless Amphibolite Member which represents the mid-ocean ridge or ocean floor basalts of the Khomas Sea that lay between the Congo and Kalahari Cratons prior to closure during the Damara Orogen (Finnemore, 1978).

Sediments of the Damara Supergroup have been subject to polyphase deformation and associated metamorphism, primarily related to intracontinental rifting and continent-continent collision during the Pan African Damara Orogen (Miller, 2008b). Additionally, the area has been subject to brittle faulting by both Damara- and Cretaceous-aged faults (Tankard *et al.,* 1982; Carr Barbour and Associates, 1999). Despite the complex folding and thrusting in the area, the Damara Supergroup succession generally dips gently (20° to 35°) to the northwest (NW) (Miller *et al.,* 2018). Variations in dip occur due to folding, but due to the pervasive nature of the regional structure, it is thought that the faulting extends to depth. A large N-S trending fault is mapped approximately 1 km from the development's eastern most boundary, and a NW-SE trending fault approximately 3.5 km from the western most boundary. These faults are variably annealed or cemented, affecting the openness of the fractures, with important implications for groundwater flow (Murray, 2002; Miller *et al.,* 2018). Less competent units, such as the schists, are more susceptible to shearing and ductile deformation, resulting in an increase in closed fractures/faults, whereas the quartzites typically have open faults and fracture networks allowing for improved groundwater flow (Murray, 2002). No further structures have been mapped in the immediate vicinity of the development.

The division and sub-division of the litho/tectono-stratigraphy into hydrostratigraphic units is shown in Table 11, and the aquifer type as mapped on the 1:1 000 000 hydrogeological map of Namibia in Figure 20.

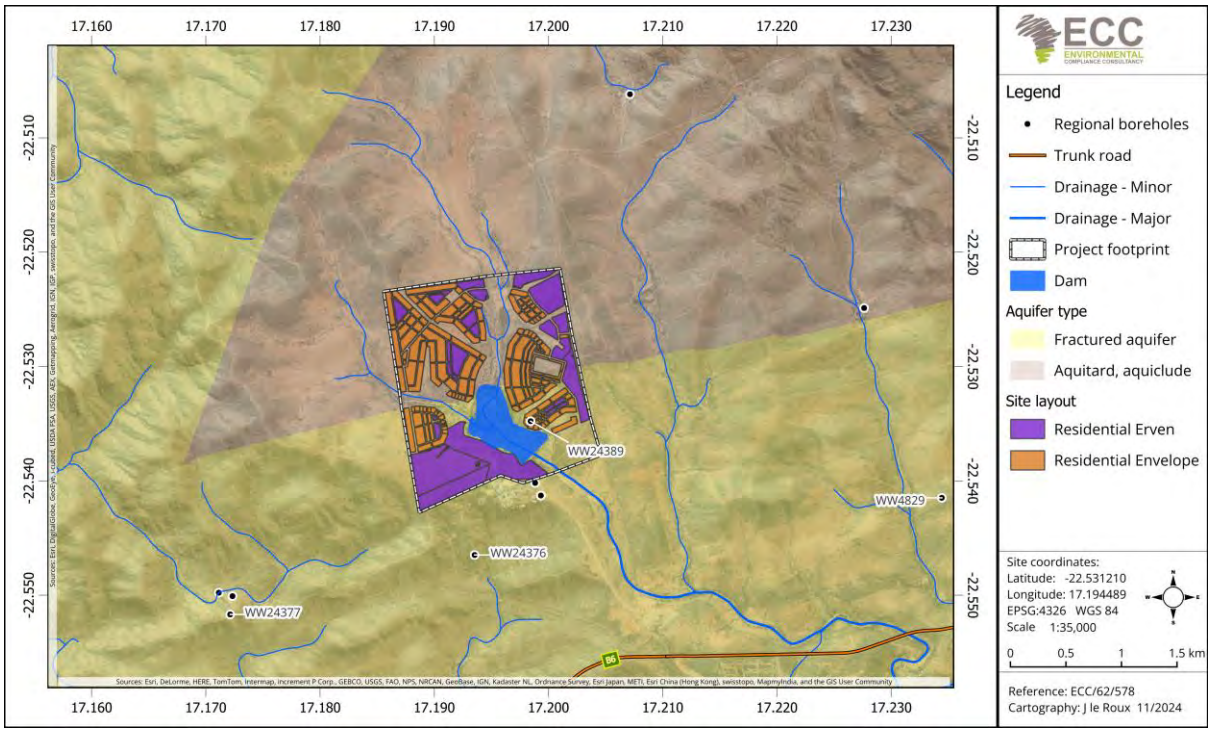


Figure 20 - Aquifer type underlying the development site based on the 1:1 000 000 scale hydrogeological map of Namibia

The hydrogeological map closely relates to the geology of the area, with the Kuiseb Formation representing an aquitard or aquiclude and the quartzites of the Kleine Kuppe Formation forming a fractured aquifer (Figure 21). Although the schists of this Kuiseb aquiclude are folded and faulted, they respond in a ductile manner to stress and therefore have poorly developed secondary porosity (Murray *et al.,* 2016) and are hence less transmissive in terms of groundwater flow. The micaceous quartzites of the Kleine Kuppe fractured aquifer are in parts interfingered with the schists of the Kuiseb aquitard, reducing the permeability of the Kleine Kuppe aquifer in the region.

The Project site is located approximately 5 km NE of the Windhoek aquifer system boundary and while some hydrogeological features and characteristics are comparable (e.g. Kleine Kuppe aquifer), the Project site does not interact with the greater Windhoek aquifer due to the presence of the Kuiseb aquiclude that bounds the aquifer (Figure 21). The development site is directly underlain by the Kuiseb aquiclude, which may be deemed advantageous in that groundwater contamination risk is reduced due to the low transmissivity of the schists. Support for this determination stems from the principal that the tightly packed parallel mineral arrangement impedes groundwater flow perpendicular to this, thus reducing permeability. Any faults that extend into the Kuiseb aquiclude are blocked by the highly altered clays of the Kuiseb schists, resulting in a loss of permeability. This is evident in pumping test curves in Kuiseb aquiclude boreholes, which indicate that flow is along fractures, but flow boundaries are encountered, therefore the hydraulic link to productive aquifers is poor (Murray, 2002).

Another verification of low permeability in the Kuiseb aquiclude is from historical literature sources describing the presence of springs arising from the fractures in the Kuiseb aquiclude, indicating that permeability of the fracture zones at depth drop to such an extent that subsurface flow is (was) no longer possible (Gevers, 1932; Murray, 2002).

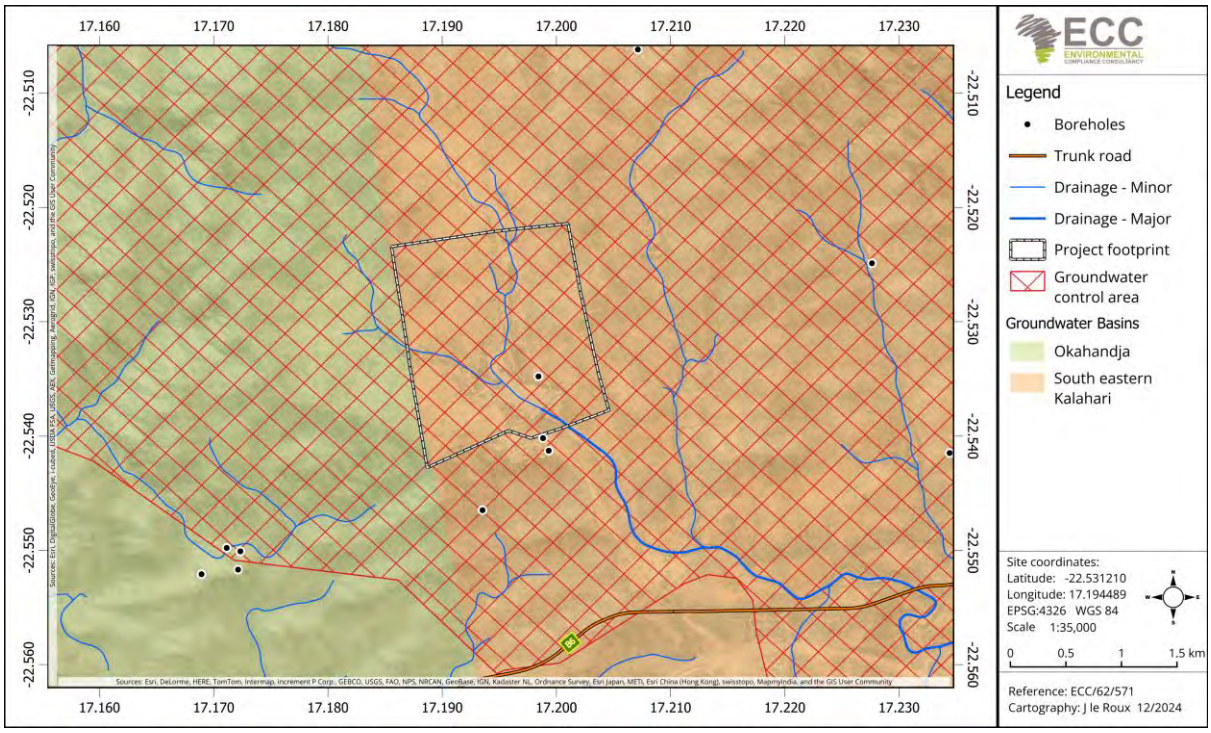


Figure 21 - Hydrology of the proposed Project area

6.8 BIODIVERSITY BASELINE

6.8.1 GENERAL BIOME CHARACTERISTICS AND FLORA

The proposed Project area lies on the eastern outskirts of CoW and has similar general biome characteristics and flora patterns. The Project area falls within a semi-arid climate, which is characterised by various biome characteristics and types of flora. The vegetation zone is considered the Namibian savanna (central highland thornbush savanna), with a mix of sparse tree cover and shrubland (Kruger, *et al.,* 2012). The Project area vegetation coverage map is shown in Figure 22.

Plant species found in this area are well adapted to drought and heat and feature species that are well suited to conserve water. Common types of trees and woody shrubs are Acacia/Vachellia species, *Terminalia sericea*, *Boscia albitrunca* and *Commiphora* species. Species of grasses commonly found are *Themeda triandra*, *Eragrostis* species, *Pennisetum* species and *Setaria* species. Shrubs and groundcover complete the flora within this area, specifically *Euphorbia* species, *Salsola* species and *Clematis* species.

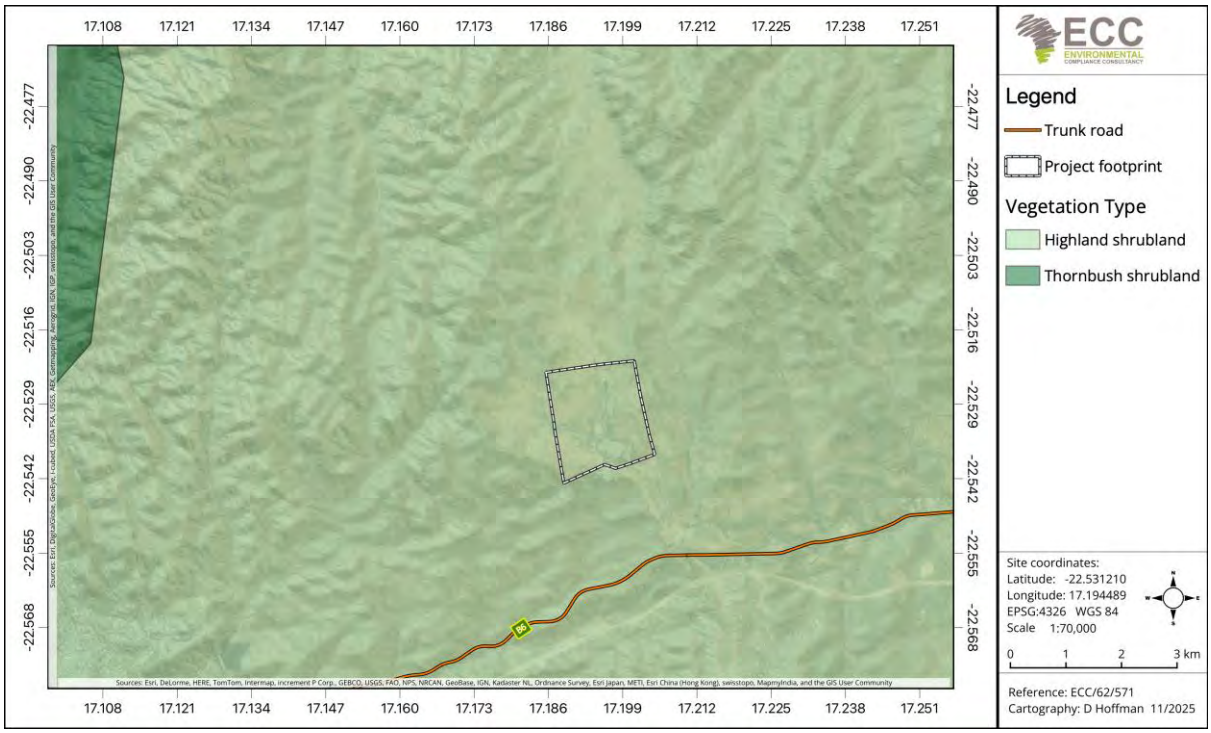


Figure 22 - Project area vegetation coverage map

6.8.2 FAUNA

According to Branch *et al.* (1998), the central Namibia region where the site is situated, boasts significant faunal biodiversity, with a wide variety of reptiles, amphibians, mammals and birds. The fauna species that may be found in the Project area and its general surroundings are discussed in the sections below.

6.8.2.1 Mammals

Griffin (1998) suggests that around 75 mammal species could be present in the area and its vicinity, including zebras, jackals, springboks and three (3) families of rodents' endemic to the region: *Petromuridae* (Dassie rat), *Petromyscus* and *Gerbillurus*. Overall, the Windhoek region is estimated to host between 61 and 75 mammal species, with approximately five (5) to six (6) endemic species (Atlas of Namibia Team, 2022; Mendelsohn et al., 2002).

6.8.2.2 Reptiles

Reptile diversity in the Khomas Hochland is relatively high due to rocky substrates and warm climatic conditions. Desktop sources indicate that 30–45 reptile species may occur in the broader area, with 20–30 species potentially present within the Project site. The abundance of reptiles is generally low to moderate and is highly seasonal and weather dependant. The following species are likely to be found in the area: Namaqua chameleon (*Chamaeleo namaquensis*), Common rock agama (*Agama planiceps*), Cape skink (*Trachylepis capensis*), Husab sand lizard (*Pedioplanis husabensis*), Puff adder (*Bitis arietans*), Boomslang (*Dispholidus typus*) and Leopard tortoise (*Stigmochelys pardalis*) (Atlas of Namibia Team, 2022; Mendelsohn et al., 2002).

6.8.2.3 Amphibians

Due to arid climatic conditions, amphibian diversity is low and dependent on ephemeral water bodies following rainfall events. Desktop data suggest that three (3) to six (6) amphibian species may occur opportunistically within the Project area. The abundance of amphibians is highly variable and episodic, often linked to rainfall events and are generally absent during dry periods. The following amphibian species are likely to be found in the Project area: African clawed frog *(Xenopus laevis*), Giant bullfrog (*Pyxicephalus adspersus*) and Raucous toad (*Sclerophrys capensis*) (Atlas of Namibia Team, 2022; Mendelsohn et al., 2002).

6.8.2.4 Birds (avifauna)

The Khomas Hochland supports a moderately high diversity of birds, particularly species associated with open savanna, rocky hills and human-modified landscapes. Desktop data indicate that approximately 120–160 bird species may occur within the broader area, with 40–70 species in the Project area. Small passerines are common and locally abundant; raptors are often in low abundance and ground-nesting species are present but vulnerable to disturbances that often occur during construction activities. The following avifauna species are likely to be found in the area: Sociable weaver (*Philetairus socius*), White-browed sparrow-weaver (*Plocepasser mahali*), Southern yellow-billed hornbill (*Tockus leucomelas*), African hoopoe *(Upupa africana*), Pied crow (*Corvus albus*), Lappet-faced vulture (*Torgos tracheliotos*) (occasional overflight) and the Secretary bird (*Sagittarius serpentarius*) (low-density, regionally sensitive) (Atlas of Namibia Team, 2022; Mendelsohn et al., 2002).

6.8.2.5 Bats

Bats form an important part of the fauna within the Khomas Hochland area as they provide ecological services such as insect control and pollination. The semi-arid savanna landscape, with scattered trees, rocky outcrops and buildings offers roosting and foraging habitats for approximately 8–12 species, including the Egyptian fruit bat (*Rousettus aegyptiacus*), Cape serotine (*Neoromicia capensis*) and Schreibers' long-fingered bat (*Miniopterus schreibersii*). Roosting occurs in trees, rock crevices and structures, while foraging is concentrated along tree lines and open areas, peaking in warmer months. Most species are common, though some, such as *Rousettus aegyptiacus*, are regionally sensitive. Abundance is expected to be moderate (Atlas of Namibia Team, 2022; Mendelsohn et al., 2002).

6.9 SOCIAL AND SOCIO-ECONOMIC BASELINE

6.9.1 GOVERNANCE

The proposed Project site is located within the CoW rural constituency boundaries. The Khomas Region is found in the central area of Namibia covering approximately 36 964 km^2 and comprises 4.5% of Namibia's total geographical footprint. The Khomas Region is primarily under private ownership, with 94.2% of the land being controlled by private individuals and companies who hold freehold title to the land.

This means that most of the land in the region is owned privately, rather than by the government or other entities (Khomas Regional Council, 2015).

Windhoek is the capital city of Namibia and forms the legislative, administrative and judicial centre of the country, with a population representing approximately 13% of the total population of Namibia. It is a centre for transport (air, road and rail), education, culture and important business (Khomas Regional Council, 2015). Windhoek hosts majority of the national head offices as well as the head of the Khomas Regional Council. Townlands are governed through local authorities in the form of municipalities. Development within the peri-urban areas of Windhoek is complex and is influenced by a range of interconnected factors such as rapid of urbanisation, increased demand for housing, infrastructure and services, increased occupation of un-serviced land and sporadic conversion of agricultural land into residential land.

The majority of Namibia's manufacturing industries are based within this region, although Windhoek is not considered a fully-fledged industrial centre. There is a strong relationship between the farming community and the vast hinterland of Windhoek. Most farming products are marketed in and through Windhoek and it is the most important farming supply centre. The general rural district of Windhoek is predominantly focused on cattle and game farming, tourism and hospitality activities.

6.9.2 POPULATION AND GROWTH RATE

According to the 2023 Namibia Population and Housing Census, Namibia's population has reached 3 022 401, nearly doubling from the 1.4 million recorded in the 1991 census. This growth reflects a significant increase over the past three (3) decades. The first main population increase in 1994 was noted due to the inclusion of Walvis Bay into Namibia from South Africa. The increase between 2001 and 2011 can be attributed to the increase in industrialisation in the coastal towns and mining activities. Windhoek is experiencing high rates of urbanisation since the influx of people continues to soar. This is to be expected due to the recent shift of population from rural areas into the urban areas which leads to various challenges. This rapid increase consequently overburdens its efforts in providing municipal services (Tjipetekera *et al.,* 2022).

As of the 2023 Namibia Population and Housing Census, the Windhoek Rural constituency in the Khomas Region has a population of 30 079. This reflects an increase from 19 143 in the 2011 Census. Between 2011 and 2023, this represents a growth rate of approximately 57.1% over 12 years, averaging about 4.76% per year. This is higher than the previously reported annual growth rate of 3.8% between 2011 and 2023. The discrepancy may arise from differences in data sources or methodologies. In terms of population density, the Windhoek Rural Constituency spans an area of approximately 36 418.14 km², resulting in a density of about 0.8259 people per km² (Namibia Statistics Agency, 2024).

6.9.3 POVERTY AND UNEMPLOYEMENT

According to the Namibia Statistics Agency's 2023 Namibia Population and Housing Census, the industries which employ the most Namibians are as follows:

- Agriculture, forestry and fishing (88 277 people or 16.1%);
- Wholesale and retail trade (54 618 people or 10.0%);
- Manufacturing (54 491 people or 9.8%); and
- Administrative and support service activities (50 884 people or 9.3%).

Namibia's largest industry as measured by gross domestic product (GDP) is the mining and quarrying sector, however by measure of employment, the sector only employs 12 337 people or 2.6% of the country's workforce.

In 2025, it was reported by the Namibia Statistics Agency (NSA) that the unemployment rate for the 867 247 individuals who comprise the country's labour force stood at 36.9% (or 320 442 persons) based on the most recent 2023 Namibia Population and Housing Census report. The employed population decreased by 178 937 people from 725 742 persons to 546 805 persons since the last survey was conducted in 2018. Out of the 546 805 persons employed (or 63.1% of the labour force), 55% were male and 45% were female. The largest share of the employed population (21.8%) works in elementary occupations', 16.1% works in agriculture, forestry and fisheries, 10% in wholesale, retail trade and repair of vehicles, 9.8% in manufacturing and 9.3% in administrative and support services (Namibia Statistics Agency, 2025). Salaries and/or wages were reported as the main income source for 46.6% of households in Namibia.

Youth unemployment, defined for individuals aged between 15 and 24, is approximately 38.03%. Furthermore, the 2023 Namibia Population and Housing Census reveals that 41.9% of youths aged between 15 and 34 are neither employed nor engaged in formal education or training. Regarding educational attainment, the Namibia Statistics Agency's 2023 report indicates that 32% of the population's highest level of education is junior secondary school (Namibia Statistics Agency, 2024).

In 2018, it was reported that 53.4% of employed Namibians work in the private sector and 21.5% are employed by the state (Namibia Statistics Agency, 2019).

The problem within the CoW area is amplified by the fact that many people who migrate to Windhoek find it difficult to get employment opportunities within the formal sector, resulting in many experiencing poverty within the informal settlements. This inflicts pressure on the provision of properly planned townships which are expected to be accompanied by road infrastructure, sanitation, health care facilities and other service utilities.

6.9.4 ECONOMIC ENVIRONMENT

6.9.4.1 Infrastructure

Windhoek is the economic hub of the county as it plays a pivotal role in the nation's financial landscape. The Khomas Regional Council has invested over N$25.8 million to support over 1 500 micro, small and medium enterprises (MSMEs) with the sole purpose of stimulating development and economic growth in the region. The Kokerboom electricity transmission Project aims to enhance the electricity transmission network between //Kharas and Khomas Region. The project involves the construction of high-voltage transmission lines and associated infrastructure to improve the supply of electricity between these two (2) regions. With an investment of N$660 million, the project commenced in 2022 (African Development Bank, 2022).

6.9.4.2 Tourism

The hospitality and tourism industry in Namibia contributed N$5.2 billion directly to the GDP, which is equivalent to 3.5% of the total GDP and is responsible for 44 700 direct employments in the sector, including over 2 900 tourism-based jobs created in community conservation areas in 2018 (GIZ, 2022).

High urbanisation rates have led to a substantial informal housing sector, with approximately 67% of the urban population residing in informal settlements. There is a wide range of tourist hotspots within the Khomas Region as Windhoek is a key destination on a national and international scale. A variety of tourist attractions include Daan Viljoen Game Park, GocheGanas Private Wildlife Reserve, Gross Barmen Hot Springs, Namibia National Gallery, The Heroes' Acre Memorial, Okapuka Ranch and the Alte Feste (Old Fortress) (Namibia Tourism Board, 2025).

6.9.4.3 Energy and sustainable practices

Energy demand is continuously increasing and plays a vital role in all developed and developing countries. In Namibia, there is heavy reliance on fossil fuels which accounts for approximately 63% of the total energy consumption (WWF Namibia, 2023).

Currently, Namibia is not an oil-producing country and at present does not possess the capacity to refine crude oil for petrol and fuel production (Institute for Public Policy Research, 2023). Fuels are imported from international markets and lubricants are imported from South African refineries via the Walvis Bay harbour. However, Namibia is continuously encouraging efforts to find oil and gas reserves to increase economic growth and lessen its reliance on imports (WWF Namibia, 2023). Exploration for oil and gas is underway under the oversight of the National Petroleum Corporation of Namibia (NAMCOR) and the Ministry of Industries, Mines and Energy (MIME). The Khomas Region does not currently serve as the primary site for oil and gas activities. Instead, the most recent discoveries and primary prospect areas in for oil and gas production are based offshore in the Orange, Lüderitz and Walvis basins, with potential for future petroleum refinement in either the Walvis Bay or Lüderitz port areas.

Various renewable energy initiatives have been implemented within the Khomas Region. This contributes to Namibia's efforts to enhance energy sustainability. Windhoek has observed the installation of photovoltaic (PV)-battery systems on both commercial and residential buildings. The country experiences 3 000+ hours of sun per year, which results in annual solar irradiation reaching values from 2 200 to 2 400 kWh/m^2 (Shefeni, 2024). These solar projects help contribute to reduced grid dependency and lower carbon emissions.

Green hydrogen has also become a potential fuel source with projects currently underway in Namibia by companies as Cleanergy Solutions Namibia (Pty) Ltd, in which hydrogen molecules are separated from water with electrolysis powered by renewable energy. Green hydrogen has the potential to reduce the use of fossil fuels, especially in the transport sector, while mitigating climate change. This ultimately reduces reliance on imported fuel and secure economic growth in Namibia (WWF Namibia, 2023).

6.9.5 COMMUNITY HEALTH

Namibia's health services are twofold: private (serving ~18% of the population with medical aid) and public (serving the remaining 82%) (Christians, 2020). Public health falls under the MoHSS, which operates a four-tiered health system, consisting of primary healthcare (PHC) sites, district hospitals, intermediate hospitals and referral hospitals (Christians, 2020). Overcrowding is common at hospitals due to the higher quality of care compared to rural clinics. (Namibia Ministry of Health and Social Services , 2017).

The CoW presents a high burden of human immunodeficiency virus (HIV), with studies indicating that high HIV prevalence and incidence are concentrated in the north-western part of the city. This area of the city has lower HIV knowledge, higher HIV risk perception and lower per-capita consumption (Aulagnier *et al.,* 2011). Namibia has one of the highest HIV prevalence rates globally, with approximately 11.8% of adults ages 15 and over living with HIV as of 2021 (The National Archives, 2020). Nationally, for urban areas, the 45 - 49 age group had the highest prevalence rate, whereby in rural areas, the 35 - 39 age group had the highest prevalence rate. In addition, Namibia has one of the highest tuberculosis (TB) incidence rates worldwide. There are currently significant efforts underway to ensure the protection of healthcare workers and reduce TB transmission.

6.10 CULTURAL HERITAGE

Information from the Namibian GIS data, Atlas of Namibia and other sources, suggests that although the CoW is rich in history, the Project area itself shows limited evidence of heritage sites. A fenced off and marked cemetery is located next to a chapel within the Project area, a photo of which is shown in Figure 23.

A chance finds procedure will be incorporated into the ESMP, should heritage remains be discovered or unearthed throughout the Project lifespan.

Figure 23 - The cemetery within the Project area is located on a hill next to the Heja Lodge chapel and is clearly demarcated by a red fence

The existing cemetery has been incorporated into the design of the development to not only preserve the site, but to also provide easement access to the families of the deceased laid to rest within the cemetery. A zoomed in view of the development's concept map showing the location of the cemetery (marked as a red outline with checkered pattern infill) within a green space area of the development is shown in Figure 24.

Figure 24 - Zoomed in view of the development's concept map showing the location of the cemetery within a green space area of the development (Source: WCE 2026)

7 IMPACT IDENTIFICATION AND EVALUATION METHODOLOGY

7.1 INTRODUCTION

Chapter 2 provides an overview of the approach used in this final scoping with impact assessment process and details each of the steps undertaken to date. Prediction and evaluation of impacts is a key step in the assessment process. This chapter outlines the methods that will be followed, to identify and evaluate the impacts arising from the proposed Project, as determine in chapter 7 of this report.

This chapter provides comprehensive details of the following:

- The assessment guidance that will be used to assess the impacts;
- The limitations, uncertainties and assumptions regarding the assessment methodology;
- How impacts will be identified and evaluated and how the level of significance will be derived;
- How mitigation will be applied in the assessment and how additional mitigation will be identified; and
- The cumulative impact assessment (CIA) method that will be used.

This assessment will aim to determine which impacts are likely to be significant, to scope the available data and identify any gaps that need to be filled, to determine the spatial and temporal scope and to identify the assessment methodology.

The scope of the assessment was determined by undertaking a preliminary assessment of the proposed Project against the receiving environment and was obtained through a desktop review of available site-specific literature, monitoring data and site specialist reports (where required), as set out in this final scoping study with impact assessment report.

7.2 ASSESSMENT GUIDANCE

The following principal documents will be used to inform the assessment method:

- International Finance Corporation (IFC) standards and models, in particular Performance Standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2012 and 2017).;
- International Finance Corporation Cumulative Impact Assessment and Management Good Practice Handbook (International Finance Corporation, 2013); and
- Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008).

7.3 LIMITATIONS, UNCERTAINTIES AND ASSUMPTIONS

The following limitations and uncertainties associated with the assessment methodology were considered:

- Topic-specific assessment guidance has not been developed in Namibia. A generic assessment methodology will be applied to all topics using IFC guidance and professional judgement; and
- Guidance for CIA has not been developed in Namibia, but a single accepted state of global practice has been established. The IFC's guidance document (International Finance Corporation, 2013) will be used for the CIA.

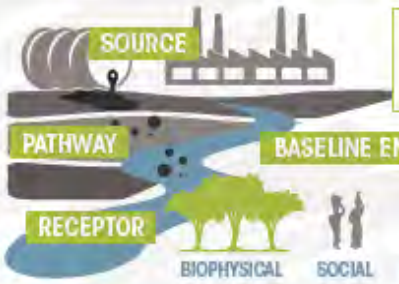
7.4 ASSESSMENT METHODOLOGY

The assessment methodology applied has been developed by ECC using the IFC standards and models, in particular Performance Standard 1: 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017); Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008); international and national best practice; and over 25 years of combined ESIA experience. The ESIA methodology is set out in Figure 25.

The evaluation and identification of the environmental and social impacts require the assessment of the Project characteristics against the baseline characteristics, ensuring that all potentially significant impacts are identified and assessed.

The significance of an impact is determined by taking into consideration the combination of the sensitivity and importance/value of environmental and social receptors that may be affected by the proposed Project, the nature and characteristics of the impact (either beneficial or adverse), and the magnitude of any potential change. The magnitude of change (the impact) is the identifiable changes to the existing environment that may be negligible, low, minor, moderate, high, or very high. The duration of an impact is defined as either temporary, short-term, long-term or permanent.

ECC IMPACT PREDICATION AND EVALUATION METHODOLOGY



ECC ESIA METHOD

- Predication and evaluation of impacts is a key step in the EIA process.
- The methods ECC follows to identify and evaluate the impacts arising from projects is outline in this diagram.

THE FOLLOWING PRINCIPLES ARE USED BY ECC FOR ASSESSMENTS

- International Finance Corporation standards and models, in particular Performance Standard 1, 'Assessment and management of environmental and social risks and impacts' (International Finance Corporation, 2017) (International Finance Corporation, 2012);
- International Finance Corporation EIA and Management Good Practice Handbook (International Finance Corporation, 2013) and,
- Namibian Draft Procedures and Guidance for EIA and EMP (Republic of Namibia, 2008).

DETERMINE THE SIGNIFICANCE OF AN IMPACT

SENSITIVITY AND VALUE OF A RECEPTOR

The sensitivity and value of a receptor is determined by identifying how sensitive and vulnerable a receptor is to change, and the importance of a receptor (internationally, nationally, locally)

NATURE AND CHARACTERISTICS OF THE IMPACT

The nature and characteristics of the impact is determined through consideration of the frequency, duration, reversibility and probability of the impact occurring.

MAGNITUDE OF CHANGE

The magnitude of change measures the scale or extent of the change from the baseline condition, irrespective of the value. The magnitude of change may alter over time, therefore temporal variation is considered (short-term, medium-term, long-term, reversible, reversible environmental assessment methodology.

ECC – NATURE OF IMPACT

BENEFICIAL (POSITIVE)
An impact that is considered to represent an improvement on the baseline or introduces a positive change.

ADVERSE (NEGATIVE)
An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor.

ECC – TYPE OF IMPACT

DIRECT
Impacts causing an impact through direct interaction between a planned project activity and the receiving environment/ receptors.

INDIRECT
Impacts that result from other activities that are encouraged to happen as a result / consequence of the Project. Associated with the project and may occur at a later time or wider area

CUMULATIVE
Impacts that arise as a result of an impact and effect from the project interacting with those from another activity to create an additional impact and effect

REVERSIBILITY

REVERSIBLE
Impacts are reversible and recoverable in the future

PARTLY REVERSIBLE
Some parts of the impact can be reversed while others remain

IRREVERSIBLE
Impacts which are not reversible and are permanent

DURATION

TEMPORARY
Transient; a period of less than 1 year

SHORT TERM
Impacts that are likely to last for the duration of the activity causing the impact and are recoverable (1-5 years)

MEDIUM TERM
Impacts that are likely to continue after the activity causing the impact and are recoverable (5-15 years)

LONG TERM
Impacts that are likely to last far beyond the end of the activity causing the damage (greater than 15 years with impact ceasing after decommissioning of the project)

PERMANENT

MAGNITUDE OF CHANGE

VERY HIGH / UNKNOWN	Loss of resource, significantly affecting the long term quality and integrity of a resource; irreparable damage or loss of key characteristics, features or elements; or the magnitude is too great to quantify as it is unknown.
HIGH / MAJOR	Loss of resource, and quality and integrity of resource; severe damage to key characteristics, features or elements; or Large scale or major improvement of resources quality; extensive restoration or enhancement; major improvement of attribute quality.
MODERATE	Loss of resource, but not adversely affecting its integrity; partial loss of/damage to key characteristics, features or elements; or Benefit to, or addition of, key characteristics, features or elements; improvements of attribute quality.
LOW / MINOR	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (or maybe more) key characteristic, feature or element; or Minor benefit to, or addition of, one (or maybe more) key characteristic, feature or element; some beneficial effect on attribute quality or a reduced risk of a negative effect occurring.
NONE / NEGLIGIBLE	Very minor loss or detrimental alteration to one (or maybe more) characteristic, feature or element; or Very minor benefit to, or positive addition of, one (or maybe more) characteristic, feature or element.

SCALE OF CHANGE - EXTENT / GEOGRAPHIC SCALE

ON-SITE
Impacts that are limited to the boundaries of the proposed project site

LOCAL
Impacts that occur in the local area of influence, including around the proposed site and within the wider community

REGIONAL
Impacts that affect a receptor that is regionally important by virtue of scale, designation, quality or rarity.

NATIONAL
Impacts that affect a receptor that is nationally important by virtue of scale, designation, quality or rarity.

INTERNATIONAL
Impacts that affect a receptor that is nationally important by virtue of scale, designation, quality or rarity.

PROBABILITY

IMPROBABLY (RARE)
The event may occur in exceptional circumstances yet; rarely occurs in the industry. The event could occur once every 100 years

LOW PROBABILITY (UNLIKELY)
The event has happened elsewhere yet, is unlikely to occur. The event could occur once every 10 years

MEDIUM PROBABILITY (POSSIBLE)
The event could occur under some circumstances. The event could occur once every 5 years.

HIGH PROBABILITY (LIKELY)
The event is expected to occur. The event could occur twice per year

DEFINITE (ALMOST CERTAIN)
The event will occur. The event could occur once per month

- The significance of impacts has been derived at by applying the identified thresholds for receptor sensitivity and magnitude of change, as well as the definition of significance. Moderate and major adverse impacts are considered as significant.
- The following thresholds were therefore used to double check the assessment of significance had been applied appropriately; a significant impact would meet at least one of the following criteria:
- It exceeds widely recognized levels of acceptable change;
- It threatens or enhances the viability or integrity of a receptor or receptor group of concern; and
- It is likely to be material to the ultimate decision about whether or not the environmental clearance certificate is granted.

				SIGNIFICANCE OF IMPACT			
			Significance of Impact	Impacts are considered to be local factors that are unlikely to be critical to decision-making	Impacts are considered to be important factors but are unlikely to be key decision-making factors. The impact will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value. Impacts are considered to be short-term, reversible and/or localized in extent.	Impacts are considered within acceptable limits and standards. Impacts are long-term, but reversible and/ or have regional significance. These are generally (but not exclusively) associated with sites and features of national importance and resources/ features that are unique and which, if lost, cannot be replaced or relocated.	Impacts are considered to be key factors in the decision-making process that may have an impact of major significance, or large magnitude impacts occur to highly valued/sensitive resources/receptors. 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.
	Biophysical	*Social*		*Low*	*Minor (2)*	*Moderate (3)*	*Major (4)*
SENSITIVITY	A biophysical receptor that is protected under legislation or international convention (CITIES) listed as rare, threatened or endangered IUCN species. Highly valued/ sensitive resource/ receptors.	Those affected people/ communities will not be able to adapt to changes or continue to maintain pre-impact livelihoods.	*High (3)*	**Minor (3)**	**Moderate (6)**	**Major (9)**	**Major (12)**
	Of value, importance/ rarity on a regional scale, and with limited potential for substitution; and/or not protected or listed (globally) but may be a rare or threatened species in the country; with little resilience to ecosystem changes. Important to ecosystem functions, or one under threat or population decline.	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support	*Medium (2)*	**Low (2)**	**Minor (4)**	**Moderate (6)**	**Major (8)**
	Not protected or listed as common/abundant; or not critical to other ecosystems functions.	Those affected are able to adapt with relative ease and maintain pre-impact status. There is no perceptible change to people's livelihood.	*Low (1)*	**Low (1)**	**Low (2)**	**Minor (3)**	**Moderate (4)**

SENSITIVITY AND VALUE

Low
Of value, importance or rarity on a local scale; and/or not particularly sensitive to change or has considerable capacity to accommodate a change.

Medium
Of value, importance or rarity on a regional scale, and with limited potential for substitution; and/or moderate sensitivity to change, or moderate capacity to accommodate a change.

High
Of value, importance or rarity on an international and national scale, and with very limited potential for substitution; and/or very sensitive to change or has little capacity to accommodate a change.

MITIGATION

Mitigation comprises a hierarchy of measures ranging from preventative environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement. The mitigation hierarchy is avoidance; reduction at source; reduction at receptor level; repairing and correcting; compensation; remediation; and enhancement.

Mitigation measures can be split into three distinct categories, broadly defined as:

- Standard practices and other best practice measures for avoiding and minimizing environmental impacts. These are considered as good practice measures.
- Actions undertaken by the EIA process that influence the design process, through implementing design measures that would entirely avoid or eliminate an impact or modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered as embedded mitigation.
- Specified additional measures or follow-up action to be implemented to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered as additional mitigation.

The EIA is an iterative process whereby the outcomes of the environmental and social assessments inform the project.

The EMP provides the good practice mitigation measures and specified additional measures or follow-up action ECC has recommended for the project.

SIGNIFICANCE DESCRIPTION

Low - Major Beneficial (All Scores)
Impacts are considered to be beneficial to the environment and society.

Low (negative) 0 - 25
Impacts are considered to be local factors that are unlikely to be critical to decision-making.

Minor (negative) 25 - 50
Impacts are considered to be important factors but are unlikely to be key decision-making factors. The impact will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value. Impacts are considered to be short-term, reversible and/or localized in extent.

Moderate (negative) 50 - 75
Impacts are considered within acceptable limits and standards. Impacts are long-term, but reversible and/ or have regional significance. These are generally (but not exclusively) associated with sites and features of national importance and resources/ features that are unique and which, if lost, cannot be replaced or relocated.

Major (negative) 75 - 100
Impacts are considered to be key factors in the decision-making process that may have an impact of major significance, or large magnitude impacts occur to highly valued/sensitive resources/receptors. 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.

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Figure 25 - ECC's impact prediction methodology based on IFC standards

7.5 CUMULATIVE IMPACT ASSESSMENT METHODOLOGY

Cumulative impacts may arise as a result of other Project activities, or due to the combination of two (2) or more projects in the Project area. A CIA was undertaken by applying the IFC CIA Good Practice Handbook (International Finance Corporation, 2013), which recommends that a rapid CIA is undertaken.

A rapid CIA takes into consideration the challenges associated with a good CIA process, which include a lack of basic baseline data, uncertainty associated with anticipated development, limited government capacity, and the absence of strategic regional, sectoral, or integrated resource planning schemes.

The following five-step rapid CIA process was followed:

Step 1: Scoping – determine spatial and temporal boundaries.
Step 2**:** Scoping – identify valued environmental and social receptors and identify reasonably foreseeable developments.
Step 3**:** Determine the present condition of valued environmental and social receptors (i.e. the baseline).
Step 4: Evaluate the significance of the cumulative impacts.
Step 5**:** Identify mitigation measures to avoid or reduce cumulative impacts.

The following information will be applied to the assessment in line with the above steps and IFC guidance:

- The spatial and temporal boundaries of the CIA are the extent of the development boundaries and the duration of the construction and operation phases of the proposed Project;
- Valued environmental and social receptors that may be affected;
- A review of existing and reasonable, anticipated and/or planned developments has been undertaken, which is based on the information presented in chapter 4;
- The predicted future conditions of sensitive and common environmental and social receptors have been taken into consideration in the assessment;
- The assessment findings will be presented in the assessment chapter and will have the CIA applied in combination with professional judgment and published environmental assessment reports; and
- A review of mitigation and monitoring measures will be undertaken, with any additional measures identified.

7.6 MITIGATION

Impacts that are identified throughout the assessment process will be subjected to a process of impact mitigation, which is inherent in all aspects of the assessment system. Embedded mitigation and good practice mitigation will be considered in the assessment. Additional

mitigation measures will be identified when the significance of an impact requires it and causes the impact to be further reduced.

The principal of impact mitigation comprises a hierarchy of measures ranging from preventative environmental impacts by avoidance, to measures that provide opportunities for environmental enhancement and will be applied to all impacts associated with the proposed Heja Lifestyle Estate Project. The mitigation hierarchy is:

- Avoidance;
- Reduction at source;
- Reduction at receptor level;
- Repairing and correcting;
- Compensation;
- Remediation; and
- Enhancement.

The ESMP for the Project provides good practice measures of the impact mitigation and specifies additional measures or follow-up action, where required. The ESMP is appended to this final report (Appendix A).

Public involvement and review is crucial to the assessment process, comments and responses received from the review of the draft scoping with impact assessment report were reviewed and any relevant considerations were incorporated into the ESMP, which forms as Appendix A of this final scoping with impact assessment report that will be submitted to the CA and MEFT for a RoD.

Mitigation measures can be split into three (3) distinct categories, broadly defined as:

- Actions undertaken by the assessment process that influence the design process, through implementing design measures that would entirely avoid or eliminate an impact, or, modifying the design through the inclusion of environmental features to reduce the magnitude of change. These are considered embedded mitigation;
- Standard practices or other best practice measures for avoiding and minimising environmental impacts. These are considered good practice measures; and
- Specified additional measures or follow up actions to be implemented, to further reduce adverse impacts that remain after the incorporation of embedded mitigation. These are considered additional mitigation measures.

The assessment is an iterative process whereby the outcomes of the environmental assessments inform the environmental management of the proposed Project through the ESMP. Once approved by the CA and MEFT, the ESMP becomes a legal binding document.

8 IMPACT ASSESSMENT FINDINGS AND PROPOSED MITIGATION MEASURES

This chapter presents the findings of the environmental impact assessment for the proposed Project, with a focus on significant potential impacts. The design of the proposed Project (as discussed in chapter 4) and best practice measures were considered during the assessment to identify likely significant impacts and recommend mitigation measures. This chapter aims to focus on potential significant impacts, however impacts deemed as non-significant are listed in Table 12 and are not discussed further in this report.

The proposed construction and operational activities are expected to be low intrusive activities. Therefore, the potential environmental and social effects are expected to be moderate to minor, before mitigation.

Mitigation measures will focus on reducing the effects of the potential impacts and ensure that an acceptable measure of operation can be maintained when an impact cannot be avoided completely. The ESMP has been finalised to accompany this scoping with impact assessment report, which sets out the management and mitigation measures for the Project.

The impacts deemed as not significant are discussed in section 8.1 whereas the potential environmental and social risks associated with the proposed Project are discussed in detail in section 8.2.

8.1 IMPACTS DEEMED AS NOT SIGNIFICANT

Impacts that have been assessed as not being significant are summarised in Table 12 and are not discussed further in this report. The listed impact(s) are non-significant and do not render any threat to the environment in a way that adversely challenges its resilience to continue in its modified form.

Table 12 - Table of non-significant impacts

Environmental and social topic	Potential impact	Summary of preliminary assessment findings
Land use	The modified land may no longer be suitable for future development projects.	– The Project site is within an agricultural zone with an existing lodge (Heja Lodge) – The site is already disturbed due to anthropogenic activities (farming and lodging activities). – Continuous monitoring, management and planning will ensure the sustainability, environmental restoration and revitalisation of the

Environmental and social topic	Potential impact	Summary of preliminary assessment findings
		land. It is anticipated that through these measures, the land will remain in good condition and suitable for future development projects.

8.2 SIGNIFICANT IMPACTS

8.2.1 SOCIO-ECONOMIC ENVIRONMENT: ECONOMIC (CONSTRUCTION PHASE)

This section assesses the potential socio-economic impacts associated with the construction and operation of the proposed Project. The assessment considers both beneficial and adverse impacts on workers, service providers, residents and other affected stakeholders. The impact assessment is informed by baseline socio-economic conditions in Windhoek and the wider Khomas Region.

An overview of the significant socio-economic impacts that have specific interest to the community and stakeholders before mitigation are shown in Figure 26. Each specific impact is discussed further in this section.

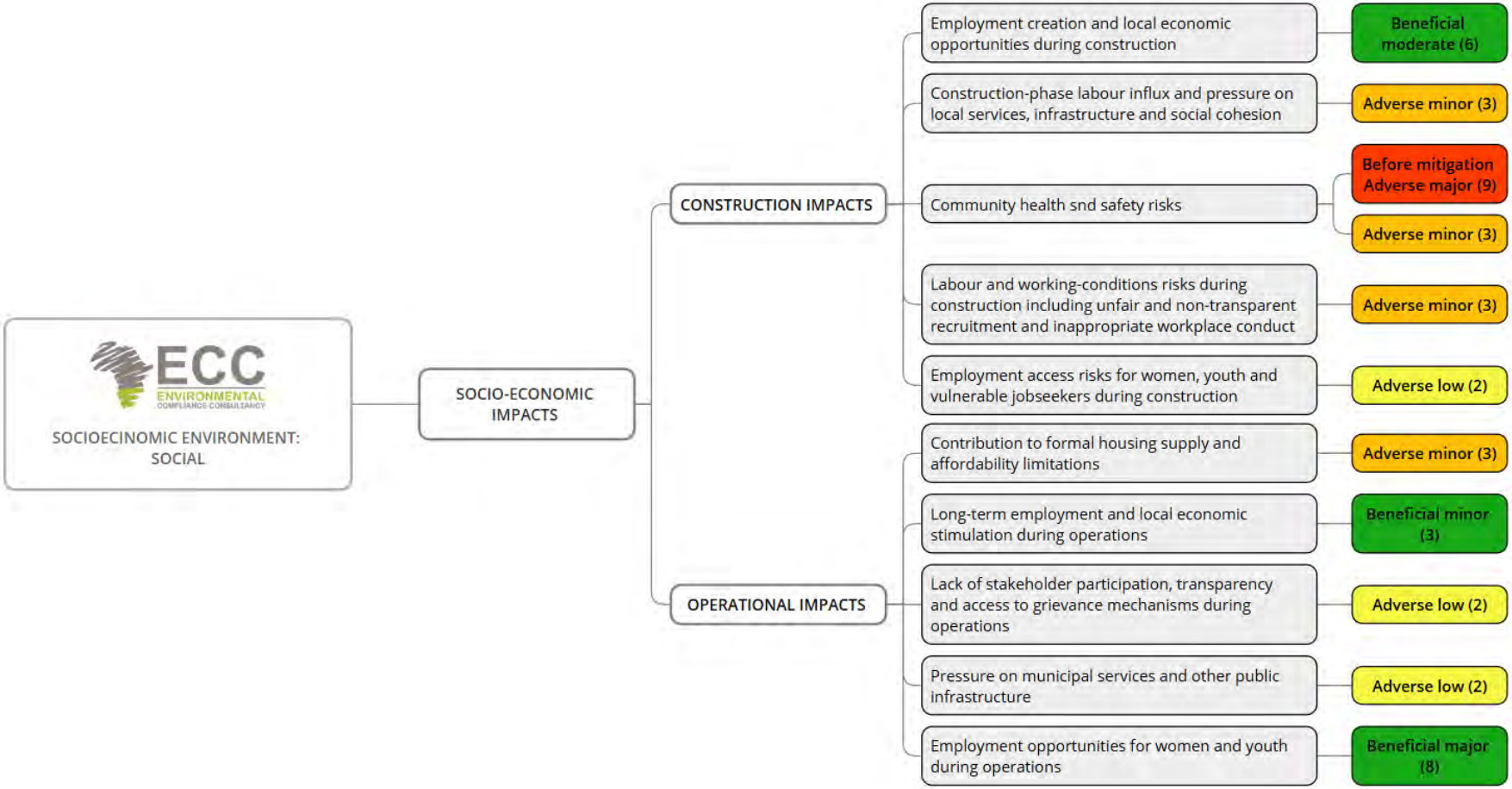

Figure 26 - Overview of the socio-economic impacts

8.2.1.1 Employment creation and local economic opportunities during construction

The construction phase of the proposed Project is expected to generate positive socio-economic impacts through employment creation associated with activities such as site preparation, infrastructure installation and building works. Approximately 90–103 direct construction workers are expected to be employed at peak per phase, spanning management, civil and earthworks, building contractors, and finishing and landscaping trades, with an estimated 60%–80% sourced locally from Windhoek and the wider Khomas Region. The primary receptors of this impact are local jobseekers, construction workers and service providers within Windhoek and the wider Khomas Region, including economically vulnerable groups.

The nature of the impact is classified as beneficial and direct as employment opportunities will arise immediately from Project construction activities. The impact is assessed as beneficial, given the positive contribution that employment opportunities will create in a national context that is characterised by high unemployment. The impact is reversible, as construction-related employment ceases once activities are completed and labour demand returns to baseline levels. The magnitude of the impact is assessed as medium due to the scale of employment required and the range of skill levels involved and the fact that employees will be sourced from the wider Khomas Region. Construction personnel will likely be employed through reputable contractors and subcontractors. The duration of the impact is assessed as long-term (>15 years) as these job opportunities will be limited to the duration of the construction phase. The spatial extent of the impact is rated regional as it is expected that construction personnel will likely be sourced from Windhoek and the wider Khomas Region. The probability of occurrence is likely, as labour inputs are integral to Project implementation. The magnitude of change is rated low as income earned by workers will allow them to improve their household livelihoods throughout the construction phase. The receptor sensitivity is assessed as medium as a limited workforce will be required and the benefits will be short-term. However, it is expected that workers will be able to seek employment elsewhere (i.e. from other construction projects within the broader region) once the construction phase concludes. Overall, the significance of the impact is rated as beneficial moderate (Table 13).

8.2.1.2 Daily commuting of the construction workforce and pressure on local services, infrastructure and social cohesion

During the construction phase, the engagement of a large, contractor-based workforce, estimated at approximately 90–103 workers per day commuting from Windhoek and surrounding areas, may result in a significant labour influx into the Project area. While no temporary on-site accommodation is planned, the daily movement of workers can create pressure on local services and infrastructure, including retail outlets, food and fuel services, public amenities and emergency response facilities.

The influx may also increase demand for local healthcare and sanitation services, particularly if minor injuries, illness, or health incidents occur among workers. Beyond infrastructure, there are potential social impacts. The presence of a large workforce may increase interactions with local communities, farmers, and businesses, which could heighten risks related to workplace safety, accidents involving pedestrians or livestock.

The nature of the impact is adverse, direct and reversible, arising from construction-related labour requirements and subsiding once construction activities are completed. The magnitude of change is assessed as low and the duration is short-term as impacts will subsidies once the construction phase is completed. The impact is local in extent, primarily affecting transport corridors and service areas between Windhoek and the Project site. The probability of occurrence is rated possible as there will a need for worker commuting daily. The receptor sensitivity rated low in the absence of residential communities on the Project site. The receptors will likely be farms that are adjacent to the Project site. These receptors are likely expected to adapt to Project activities, provided that the Project schedule is communicated in timely manner. Collectively, these factors result in an adverse minor impact significance, before mitigation (Table 13). Standard good-practice labour, transport and worker code of conduct measures are recommended. Further mitigation measures are included in the preliminary ESMP (Appendix A).

8.2.1.3 Community health and safety risks associated with construction activities and traffic

During the construction phase, increased traffic, the presence of a large construction workforce and the operation of heavy machinery may create a range of community health and safety risks. With approximately 90–103 workers commuting daily from Windhoek and surrounding areas, the movement of vehicles, including trucks and construction equipment, is likely to increase congestion and the potential for accidents on the B6 and district access roads. Road users, including local residents, public transport operators and service providers, may experience delays, heightened risk of collisions and reduced pedestrian safety. The construction workforce itself is also exposed to occupational hazards such as vehicle collisions, equipment accidents and interactions with the public. Additionally, the daily commuting of workers and delivery trucks may strain local infrastructure and emergency services and may lead to increased traffic noise and that dust could negatively affect nearby communities.

The nature of the impact is adverse, direct and irreversible, arising from construction-related activities. The magnitude of change is assessed as high as there is potential for both minor and major injuries to be sustained, which could result in permanent disabilities or in a worst-case scenario, loss of life. The severity of the impact on the receptors is considered long-term, depending on the nature and extent of the injuries. Therefore, the duration of impact is rated long term (>15 years). The spatial extent of the impact is considered local as the impact may either occur on site or between Windhoek and the Project site.

This also affect transport corridors between Windhoek and the Project site. Although safety measures will likely reduce the likelihood of accidents, accidents could still occur due to mechanical failures, unpredictable interactions (unexpected behaviours from other road users) or adverse environmental conditions (e.g. poor visibility due to rainfall). Therefore, the probability of occurrence is rated possible (medium). The receptor sensitivity is assessed as high as there is potential for major injuries or loss of life, which have little potential for substitution. The significance of the impact is rated adverse major (before mitigation) (Table 13). Post mitigation, the impact has been rated adverse minor.

The following mitigation measures are also included in the preliminary ESMP (Appendix A).

- Develop and implement standard good-practice labour management measures;
- Ensure compliance with labour legislation;
- Develop and implement occupational health and safety standards;
- Fair recruitment practices; and
- Worker induction and grievance mechanisms.

8.2.1.4 Unfair recruitment practices and inappropriate workplace code of conduct

During construction, employing a contractor-based workforce may result in inadequate working conditions. This may be triggered by aspects such as long working hours, limited facilities and difference in benefits between employees of various contractors, which may lead to dissatisfaction and tensions. Approximately 90–103 local workers per phase across various skill levels will be employed, therefore these will be the primary receptors.

The nature of the impact is classified as adverse, direct and reversible, arising from construction-related employment practices and ceasing once construction activities are completed. The magnitude of the impact is assessed as low, reflecting the scale of the workforce and reliance on contractors. The duration of the impact is deemed short-term (1-5 years) as the impact will last throughout the construction phase. The extent of the impact is rated regional as the workforce recruited will likely be from Windhoek and the wider Khomas Region. The probability of occurrence is assessed as likely, as labour-related risks are inherent to construction projects of this nature. The receptor sensitivity is assessed as medium, given the economic vulnerability of jobseekers and the importance of fair and safe working conditions. Therefore, the significance of the impact is rated adverse moderate (before mitigation) (Table 13). Mitigation measures have been listed below and have been included in the preliminary ESMP (Appendix A).

Mitigation measures:

- Develop and implement standard good-practice labour management measures;
- Ensure compliance with labour legislation;
- Ensure occupational health and safety standards;
- Fair recruitment practices; and

- Worker induction and grievance mechanisms.

8.2.1.5 Potential barriers to employment for women, youth and vulnerable jobseekers during construction

Gender and social vulnerability considerations have been integrated across the assessment of construction and operational phase impacts. During construction, women, youth and economically vulnerable jobseekers may face barriers to accessing employment due to social and gender norms, skills and experience gaps, unequal access to recruitment information. This group is more sensitive to risks related to unfair recruitment practices, unsafe working conditions and workplace harassment. These risks are addressed through the application of fair, non-discriminatory recruitment practices, occupational health and safety standards, worker codes of conduct and accessible grievance mechanisms.

The nature of the impact is adverse, direct and is reversible as fair recruitment processes, safe working conditions and effective grievance mechanisms can prevent, correct, or remedy these risks over time. The magnitude of change is rated low because of minor, measurable changes to employment access and workplace conditions for vulnerable groups. Without causing substantial or widespread loss of key social or labour characteristics, these changes can be effectively managed and corrected through standard mitigation measures. The duration of the impact is long term (>15 years) for the duration of the construction phase. The extent of the impact is rated regional as the construction workforce will commute from Windhoek and surrounding areas, meaning the effects on employment access, labour practices and associated social risks will not be limited to the immediate Project site. The probability of the impact occurring is possible (medium). Although mitigation measures such as fair recruitment, safety standards and grievance mechanisms are planned, there is a reasonable chance that some women, youth or vulnerable jobseekers could face barriers to employment or experience unsafe or unfair conditions during construction. The sensitivity is medium as the impact is of importance on a regional level. The overall significance of the impact is rated adverse low (before mitigation) (Table 13). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.2 SOCIO-ECONOMIC ENVIRONMENT: ECONOMIC (OPERATIONAL PHASE)

8.2.2.1 Contribution to formal housing supply and affordability limitations

The operation of the Heja Lifestyle Estate will contribute to the supply of formal housing in the greater Windhoek area through the development of approximately 1 200 residential erven across a range of housing typologies. While this may positively respond to demand for formal housing, the development is not targeted at low-income or informal settlement households and may therefore have limited influence on addressing broader housing affordability and spatial inequality challenges in Windhoek.

During the operational phase, the Project will generate long-term social impacts related to housing availability and spatial development patterns through the establishment of a mixed-

use lifestyle and residential estate. The development includes a range of residential types, supported by commercial, hospitality and social infrastructure, located on the eastern periphery of Windhoek within an area identified as suitable for urban expansion. The primary receptors are current and prospective residents of Windhoek, property market participants, and municipal authorities responsible for spatial planning and service provision.

The nature of the impact is adverse as low-income earners may not be able to afford these residential units and houses, indirect and largely irreversible, as the development will result in a permanent change in land use and contribute to long-term (> 15 years) urban growth patterns. The magnitude of the change is rated moderate, reflecting the scale of the development and its contribution to formal housing supply. The spatial extent of the impact is rated local, as the Project will provide housing to the growing Windhoek residents. The probability of occurrence is likely, as the housing and land-use outcomes are intrinsic to Project operations. It is also noted that the Project will be completed in phases, based on market performance. The receptor sensitivity is assessed as low, as the impact is local and has the capacity to accommodate change. Therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 13). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.2.2 Long term employment and local economic stimulation

The operation of the Heja Lifestyle Estate will generate long-term employment opportunities and indirect economic benefits through ongoing estate management, retail, hospitality, education, maintenance and service-related activities. This is expected to positively contribute to household incomes and economic activity within Windhoek and the wider Khomas Region.

Direct jobs may be created during operations, with additional indirect employment generated through downstream services and supply chains. The primary receptors are employees, local service providers and businesses within Windhoek and the greater Khomas Region.

The nature of the impact is beneficial, direct, largely irreversible and long term (>15 years), as operational employment and associated economic activities are intended to persist over the life of the Project. The magnitude of the impact is assessed as high due to the scale and diversity of employment opportunities, while the extent is local to regional. The probability of occurrence is likely as employment generation is intrinsic to Project operations. The receptor sensitivity is assessed as medium considering the prevailing unemployment levels and economic vulnerability within the region. Therefore, the significance of the impact is rated as beneficial minor (Table 13).

8.2.2.3 Lack of continuous stakeholder participation, transparency and access to grievance mechanisms

The operation of the Heja Lifestyle Estate will involve ongoing interaction between estate management, residents, commercial tenants, service providers and municipal authorities. Effective management will require transparent decision-making, clear and timely communication and accessible grievance mechanisms to address concerns and maintain positive stakeholder relationships. If not adequately managed, limitations in access to information or participation processes could affect trust, accountability and perceptions of fairness over time, thus causing reputational damage due to lack of transparency and communication. The primary receptors are estate residents, employees, commercial tenants, service users and relevant municipal stakeholders.

The nature of the impact is adverse, indirect and reversible, as it relates to governance processes and can be addressed through appropriate management systems. The magnitude of change is assessed as low, reflecting the availability of established estate management models throughout the Project lifespan (>15 years). The spatial extent of the impact is rated local as conflict scenarios will likely be confined to the Project area and neighbouring stakeholders (i.e. neighbouring farmers, businesses and neighbouring communities). The probability of the impact occurring is assessed as unlikely, as governance-related risks may emerge over time if participation and communication mechanisms are not effectively implemented. The receptor sensitivity is assessed low as multiple avenues will be available for stakeholder engagement and grievance resolution. Overall, the significance of the impact is rated as adverse low (before mitigation).

8.2.2.4 Pressure on municipal services and infrastructure

The operation of the Heja Lifestyle Estate may increase demand for municipal services and infrastructure, including water supply, sanitation, electricity, road networks and social services, as a result of the permanent residential population and associated commercial activities, that fall under the administration of CoW. If not adequately planned and coordinated, this increased demand could place pressure on existing municipal systems serving Windhoek and the surrounding areas.

Although bulk infrastructure and service provision are addressed elsewhere in the ESIA, the social dimension of service demand relates to the capacity, reliability and accessibility of municipal services for both Project users and the wider urban population. The primary receptors are estate residents and users, the CoW and municipal service providers.

The nature of the impact is adverse, indirect and largely irreversible, as it is linked to long-term population growth and urban expansion. The magnitude of the impact is assessed as low, reflecting the scale of the development and planned infrastructure provision. The duration of the impact is rated long-term (>15 years) while the spatial extent is rated local.

The probability of occurrence is assessed as possible, (medium) as increased service demand is inherent to Project operations. The receptor sensitivity is assessed as low, given existing service capacity constraints and growth pressures within Windhoek. Therefore, the significance of the impact is rated adverse low (before mitigation) (Table 13). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.2.5 Employment of women, youth and vulnerable jobseekers (unskilled and semi-skilled workers)

During operations, the Project is expected to generate employment opportunities in sectors that traditionally employ higher numbers of women and youth, including retail, hospitality, education and estate services. This will contribute positively to household incomes. Ongoing stakeholder engagement and inclusive governance mechanisms will support equitable access to information regarding job opportunities, particularly pools of individuals within this labour category.

The nature of the impact is beneficial, direct but is reversible. The Project will create employment opportunities for women and youth, boosting incomes, but these benefits can change over time if operations or policies are altered. The magnitude of change is moderate because the Project provides tangible benefits by creating employment opportunities and improving household incomes, enhancing key social and economic attributes without completely transforming them. The duration of the impact is long term (>15 years), lasting throughout the Project's operational phase. The spatial extent of the impact is considered local as pools of jobseekers from the broader Khomas Region will have opportunities to secure employment. The probability of the impact occurring is rated high (likely) as recruitment mechanisms and policies will be developed and implemented to ensure fair and equitable hiring of different labour categories across various operational roles. The sensitivity of the receptor is rated low because the impact is of local importance and the receptor has the capacity to adapt to change. Therefore, the significance of impact has been rated beneficial major (Table 13).

Table 13 - Socio-economic impacts

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Construction phase						
Construction	Employment	Employment creation and local economic opportunities	Beneficial Direct Reversible Long-term Regional Likely	Medium	Low	Beneficial Moderate (6)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Labourers commuting to the Project site	Local services and social cohesion	Pressure on local services, infrastructure and social cohesion	Adverse Direct Reversible Long-term Local Likely	Low	Low	Adverse minor (3)
Construction traffic	Community health and safety	Risks associated with construction activities	Adverse Direct Irreversible long term Local Possible	High	High	Adverse Major (9)
Construction	Employees and contractors	Unfair recruitment practices, inadequate health and safety measures, poor working conditions and inappropriate workplace code of conduct	Adverse Direct Reversible Short-term Regional Possible	Medium	Low	Adverse moderate (6)
	Women, youth and vulnerable jobseekers	Employment access risks, workplace harassment and unsafe working conditions	Adverse Direct Reversible Long term Regional Possible	Medium	Low	Adverse minor (4)
Operational phase						
Operations	Low-income earners	Housing provisions and spatial inequality	Adverse Indirect Reversible Long term Local Likely	Low	Moderate	Adverse Minor (3)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Business centre and recreational and leisure business	Local economy and employees	Long-term employment and local economic stimulation	Beneficial Direct Reversible Long term Local Likely	Low	High	Beneficial Minor (3)
Operations	Residents and community members	Lack of stakeholder participation, transparency and access to grievance mechanisms	Adverse Indirect Reversible Long-term Local Unlikely	Low	Low	Adverse Low (2)
	Municipal services and infrastructure	Pressure on municipal services and infrastructure	Adverse Indirect Irreversible Long term Local Possible	Low	Low	Adverse Low (2)
Business centre and recreational and leisure business	Women and youth (unskilled and semi-skilled)	Increased employment opportunities	Beneficial Direct Reversible Long term Regional Likely	Medium	Moderate	Beneficial Major (8)

8.2.3 SOCIO-ECONOMIC ENVIRONMENT: SOCIAL

Social impacts include effects on people's livelihoods, work, comfort, well-being, safety and social interactions. The social impacts, per respective Project phase are discussed in the section below.

8.2.3.1 Visual impacts: construction phase

The Project is located in an area where development already exists, including Kapps Farm and Finkenstein Estate and will therefore not be unique within the surrounding landscape. However, the proposed lifestyle estate will result in a large-scale transformation of the landscape, which may potentially affect the sense of place of nearby farms and residents.

Three (3) roads in the area provide potential viewpoints of the site, namely the D1527, the B6 highway and the newly constructed Dr. Hage Geingob freeway. As a result, the site may be visible to passing motorists, who may experience visual amenity impacts during both the construction and operational phases of the development.

The site is located relatively close to Windhoek and some level of visual change is therefore expected, many residents and landowners in surrounding estates and farms have chosen these areas to escape the urban environment and maintain a stronger connection with the natural landscape. Consequently, visual impacts may still be perceived as significant by these receptors.

The primary visual receptors are likely to be neighbouring farm owners and nearby residents. However, as the landscape is characterised by numerous hills and valleys, visual impacts are expected to be limited and variable. With appropriate design measures, such as ensuring that buildings, infrastructure and lighting are designed and positioned to blend with the surrounding environment, overall visual impacts are expected to be minimal.

During the construction phase, communities and residents within and around the proposed development may experience a loss of sense of place due to accelerated landscape transformation. Construction activities may be visible to nearby residents, roads and neighbouring farms. Potential visual disturbances include landscape transformation, dust generation, vehicle movement and increased nighttime illumination from construction lighting. These changes may affect the visual amenity of the area and alter its aesthetic appeal.

presents an overview of the visual impacts associated with the construction phase of the Project, before mitigation. The impacts are discussed further in this section.

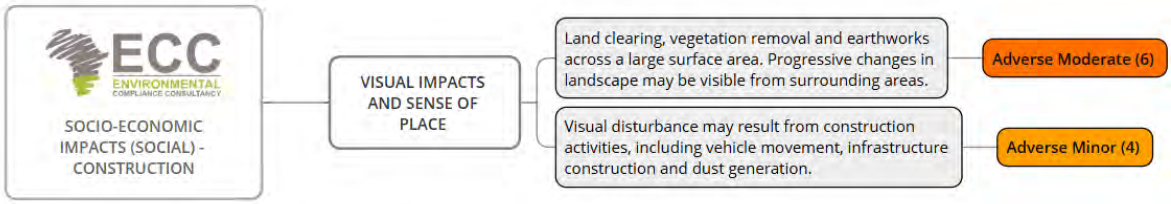

Figure 27 - Overview of the visual impacts during the construction phase

8.2.3.1.1 Land clearing, vegetation removal and earthworks activities may result in visible changes/alteration of the landscape

During construction, extensive land clearing, vegetation removal and earthworks will occur. These activities will progressively alter the natural landscape and result in noticeable changes of the landscape.

The impact is assessed as direct, partly reversible, permanent and local as approximately 320 ha of land will be cleared for the development of the Project. However, land clearing will be staggered, occurring in phases. Thus nearby farms, residents and road users travelling on district roads will be mainly affected by the visual changes or alterations to the landscape. Protected trees will be preserved where possible, however where that is not possible they will be relocated and the Proponent will be required to obtain a land clearing permit for the removal and relocation of these trees from MEFT: DoF, prior to their removal. The magnitude of change is considered high / major, and the sensitivity of the receptors is medium, resulting in an adverse moderate impact (before mitigation) (Table 14). This represents a significant alteration to the landscape and may lead to a potential loss of sense of place for farms and residents in and around the proposed site. Mitigation measures are included in the Projects ESMP (Appendix A).

8.2.3.1.2 Construction activities and vehicle movements onsite may generate dust that could result in visual disturbance

The presence of temporary infrastructure onsite, the movement of construction vehicles and machinery use onsite during the construction phase will potentially cause visual disturbance to nearby receptors. Visual disturbance will likely be a result of reduced air quality from dust generation and dispersion. These effects, while temporary, may still diminish the natural character of the area, particularly when observed from surrounding residents, farms and roads.

The impact is assessed as direct, partly reversible, short-term and local in extent. Dust generation is primarily limited to the construction phase of the lifestyle estate. This is expected to impact the surrounding farms and residents. The probability of occurrence is likely (high probability), as these activities are required for the construction and installation of the estate infrastructure and associated earthworks.

The magnitude of change is rated as moderate and the sensitivity of the receptor as medium, mainly due to the sensitivity of receptors surrounding the site, including nearby farms and residents, which may be affected by the sudden alteration of their surroundings and the resulting loss of sense of place caused by the introduction of machinery, man-made infrastructure and dust generation. The impact is assessed as adverse minor (before mitigation) (Table 14). Mitigation measures have been included in the preliminary ESMP (Appendix A).

Table 14 - Visual impacts during the construction phase

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Construction (landscape change)	Farmers Residents Motorists	Land clearing, vegetation removal and earthworks activities may result in visible changes to the landscape of the surrounding areas.	Adverse Direct Partly reversible Permanent Local Definite	Medium	High / Major	Adverse Moderate (6)
Construction (activities)	Farmers Residents Motorists	Visual disturbance may result from construction activities, including vehicle movement, infrastructure construction and dust generation.	Adverse Direct Partly reversible Short term Local High probability	Medium	Moderate	Adverse Minor (4)

8.2.3.2 Visual impacts: operational phase

The operational phase, following the completion of all construction activities, will cover an area of approximately 320 ha that will be permanently altered. Although some infrastructure already exists on the remaining portion of Farm Hoffnung No. 66, large portions of relatively undisturbed open spaces are also present within this footprint. As shown in Figure 5 the Project design is planned to cover the majority of the 320 ha.

The significance of the visual impact is expected to decrease over time as the farming community and nearby residents adjust to the changes. Due to the varied landscape, with numerous hills and valleys, visual impact will differ between locations, some areas will have limited visibility, while other sections will be clearly visible. The main receptors are farm owners, nearby residents and road users who may potentially experience visual nuisance from permanent infrastructure and lighting on the site.

An overview of the potential visual impacts related to the operational phase can be seen in Figure 28 and are discussed in the section below. The impact assessment ratings are summarised in Table 15.

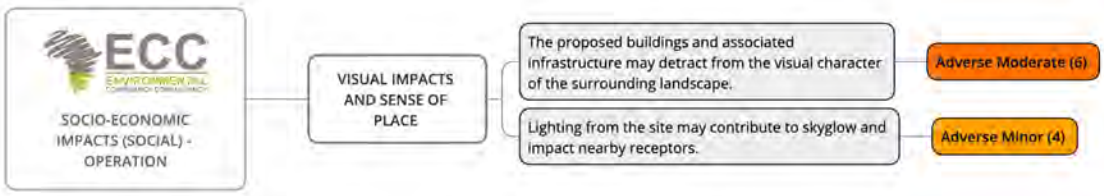

Figure 28 - Visual impacts during operations

8.2.3.2.1 The proposed buildings and associated infrastructure may detract from the visual character of the surrounding landscape

A relatively large area, approximately 320 ha, is planned for construction. As a result, some infrastructure is expected to be visible from the D1527 and B6 roads, as well as from the newly constructed Dr. Hage Geingob freeway. However, the surrounding landscape is characterised by numerous hills and valleys, which are likely to partially screen development in certain areas. Consequently, visibility of the proposed infrastructure will vary depending on location. Areas at higher elevation, including surrounding farms, are expected to experience the most significant visual change. This can potentially result in a loss of sense of place.

The development will significantly alter the natural landscape and reduce its overall visual quality. The proposed infrastructure will form strong contrasts with the surrounding environment and may be visible from several nearby viewpoints, although visibility from greater distances will be limited by the surrounding topography.

The impact is assessed as direct, long term and local, reflecting the long-lasting nature of the landscape changes. The likelihood of this impact is considered likely (high probability), as operational activities will occur throughout the 320-ha footprint. However, visibility may be partially reduced by intervening topography or vegetation (landscaping) and by careful siting and designing Project infrastructure to blend with the surrounding. The magnitude of change is rated high / major as the landscape will be permanently altered. The sensitivity of receptor is rated medium due to the exposure of nearby farms, residents and adjacent roads. It is expected that these receptors will adapt to the modified environment/landscape over time.

Overall, the impact is assessed as adverse moderate, before mitigation (Table 15). Mitigation measures are provided below and are included in the preliminary ESMP (Appendix A).

Mitigation measures:

- Avoid placing visually prominent structures on high points or ridge crests that would increase skyline intrusion.
- Design infrastructure forms and layouts to follow the natural contours of the landscape, avoiding rigid, linear or geometric layouts that contrast with surrounding landforms.
- Break up large built elements into smaller, visually coherent components where possible to reduce visual dominance.
- Use low-reflectivity, muted colours and finishes that reflect the surrounding arid landscape (e.g. earth tones, greys, browns.
- Avoid bright colours, high-gloss finishes and reflective surfaces that would increase visual contrast and glare when viewed from roads or elevated viewpoints.
- Use downward-directed, shielded lighting to reduce night-time visual intrusion and glare visible from nearby farms and road corridors

8.2.3.2.2 Lighting from the onsite infrastructure may contribute to skyglow and impact nearby receptors

Night-time illumination from operational areas could result in increased light pollution, disrupting dark sky conditions and impacting the visual experience for surrounding farm owners and residents. However, this is expected to be of low significance, as the site is situated approximately 10 km from Windhoek, which already contributes substantial light pollution. The main potential impact from operational lighting is the potential improper placement of outdoor and security lighting, which could directly affect surrounding farms and residents.

The impact is assessed as direct, reversible as lighting will be required for the safety and security of the residents but can be limited during certain times of the night, long-term and local in extent. The likelihood of the impact is rated medium (possible) as there are already other light pollution sources in the broader region.

The magnitude of change is rated low / minor and the receptor sensitivity is rated medium, as surrounding farm owners and residents may experience a potential loss of sense of place due to the development and associated lighting. These receptors are expected to adapt to the disturbed night skies over time, considering that the greater region is already disturbed by existing developments. Overall, the significance of the impact is rated adverse minor, before mitigation (Table 15). Mitigation measures are included in the preliminary ESMP (Appendix A).

Table 15 - Visual and sense of place impacts – operational phase

Activity	Receptor	Impact	Nature of impact	Value & sensitivity	Magnitude of change	Significance of impact
Operations (structures)	Farmers Residents Motorists	The proposed buildings and associated infrastructure may detract from the visual character of the surrounding landscape.	Adverse Direct Partly reversible Long-term Local High probability	Medium	Major	Adverse Moderate (6)
Operations (lighting)	Farmers Residents Motorists	Lighting from the site may contribute to skyglow and impact nearby receptors.	Adverse Direct Reversible Long term Local Medium probability	Medium	Moderate	Adverse Minor (4)

8.2.3.3 Noise impacts: construction phase

The proposed development is situated approximately 10 km east of Windhoek, in an area predominantly influenced by natural ambient sounds. Existing noise sources include intermittent agricultural machinery and regular traffic movement associated with access routes to HKIA, the Finkenstein Estate and the Otjihase community village.

The Project site falls within the central Namibian savanna and semi-arid bushland, characterised by dense natural vegetation and limited, dispersed development. Ambient noise levels are generally low and largely facilitated by favourable climatic conditions. Notable nearby commercial activity includes the Dresselhouse workshop (heavy vehicle maintenance) located south (S) of the Project site. Dresselhouse workshop is located approximately 500 m away from the Project site.

Identified noise-sensitive receptors (NSRs) include members of the surrounding farming community, road users (including motorists, pedestrians, runners and cyclists), employees and occupants of nearby commercial properties, residents of the Finkenstein Estate and the Otjihase community village, situated > 10 km north (N) of the Project site.

Figure 29 provides an overview of the noise impacts. The impacts are discussed in detail in the sections below and the impact assessment ratings are summarised in Table 16.

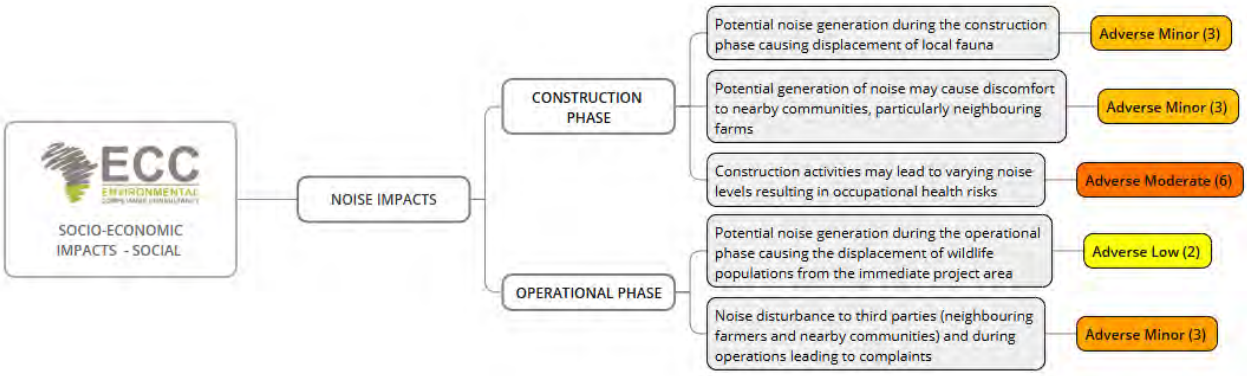

Figure 29 – An overview of the noise impacts

8.2.3.3.1 Potential noise generation during the construction phase may result in the displacement of local fauna

The local fauna consists of small to medium sized mammals (scrub hares, ground squirrels, mongoose species and porcupines), nocturnal species (bats, genets and rodents) and wildlife (springbok, kudu, steenbok and warthog), depending on fencing and surrounding land use practices. During construction, fauna may be exposed to elevated noise levels generated by earthworks, haul trucks, construction vehicles, equipment used for soil compaction and concrete mixing activities. Consequently, this will potentially result in temporary behavioural changes, habitat avoidance, short-term displacement and interference with animal communication.

The impact is considered adverse and directly impacting the sensitive receptors mentioned above. Faunal displacement is expected to be partially reversible, as sensitive species are likely to relocate permanently to quieter areas, while less sensitive animals (i.e. large-bodied mammals) are expected to develop tolerance within the surrounding environment. The impact is expected to occur during the construction phase (>15 years), therefore the duration of the impact is rated long-term. The likelihood of the impact is considered likely (high) as sensitive animals will most likely migrate to more suitable habitats. As a result, the magnitude of the impact on the biophysical environment is considered minor, with displacement effects largely confined to the initial phases of construction. However, behavioural changes, habitat avoidance and communication impacts may persist. The sensitivity of the impact is considered low due to the local scale of the impact. The significance of impact is expected to

be adverse minor, before mitigation (Table 16). Mitigation measures are included in the preliminary ESMP (Appendix A).

8.2.3.3.2 Noise generated by construction activities may cause a nuisance to nearby communities and neighbouring farmers

The Project is nestled in a predominantly rural area, characterised by a mix of commercial and small-scale farming units, low population density and generally low ambient noise. Existing background noise typically consists of natural sounds, occasional farming machinery and frequent traffic to/from HKIA (east), the Finkenstein Estate (south) and Otjihase community village, located approximately ten (10) km north of the Project site. Elevated noise levels may cause disturbance, annoyance and discomfort to nearby communities. Early morning or late afternoon construction activities may interfere with rest periods, causing stress, communication disruptions and lead to negative attitudes toward the developer due to the loss of rural tranquillity.

Noise impacts during the construction phase are assessed as adverse and will directly impact NSRs in the immediate Project area (neighbouring farms and businesses). Additionally, noise generated during construction is reversible as all construction related noise generating activities will cease upon completion of the construction phase long term term (>15 years)). Noise impacts will impact the NSRs, particularly nearby communities and businesses. Therefore, the extent of the impact is rated local. The impact is likely to occur as noise nuisance are generally experienced during the construction of a large development of this type.

The magnitude of change minor as the noise pollution is mainly a disturbance, however, no chronic health effects such as hearing loss from extreme noise exposure are expected, at least under controlled Project activities. The sensitivity of the impact is considered low due to the local scale of the impact. It is also planned that there will be no nightwork construction activities will be conducted. Therefore, there will be minimal disruption of sleeping patterns and community nuisances will be minimal. The significance of impact, before mitigation is expected to be adverse minor (Table 16). Mitigation measures are included in the preliminary ESMP (Appendix A).

8.2.3.3.3 Construction activities may generate varying levels of noise that can cause occupational health and safety impacts

Construction workers will operate in a highly variable acoustic environment, with background noise levels fluctuating depending on the intensity of construction activities, number of operation machines, duration of exposure and the proximity from noise sources. Primary noise sources include earthmoving equipment, compactors and rollers, concrete mixers and batching equipment, power tools, heavy vehicles and on-site generators and compressors. Contractor working in close proximity to sources of noise may experience temporary hearing effects, hearing impairment and increased stress and fatigue. It should be noted that

construction workers tend to receive health and safety training as well as mandatory personal protective equipment (PPE) as preventative measures.

Noise impacts are assessed as adverse and are directly associated with construction related activities. Short-term effects, such as fatigue and temporary hearing impairment, are partly reversible with adequate rest and reduced exposure. However, the effects could last beyond the Project activities and may be deemed irreversible and permanent, if it leads to permanent hearing loss or impairment. The impact will occur on-site. The potential for occupation health risk as a result of noise exposure is deemed possible due to the nature of the construction activities. This may also be a result of other factors such as inaccurate use of PPE or negligence. The magnitude of change is rated moderate as severe incidents could lead to long-term hearing impairment. The sensitivity of the receptor is deemed medium due to the discomfort of employees during noisy activities of the Project. However, employees would be able to adapt to these noise levels through rest and use of appropriate PPE. Overall, the significance of the of the impact prior to mitigation is rated adverse moderate (Table 16).

Mitigation measures are listed below and are included in the preliminary ESMP (Appendix A):

- Use well-maintained equipment, fitted with effective silencers and mufflers;
- Select low-noise machinery and tools, where feasible;
- Install acoustic enclosures or barriers around stationary noisy equipment (e.g., generators, compressors);
- Restrict access to designated high-noise zones to essential personnel only;
- Provide appropriate hearing protection (earplugs, earmuffs, or dual protection for very high noise areas);
- Ensure mandatory use of hearing protection in areas exceeding safe noise levels, which is >85 dB(A) on an eight (8)-hour work shift according to IFC general EHS guidelines;
- Train workers on the correct fitting, use and maintenance of hearing PPE;
- Conduct induction training covering noise hazards and hearing protection requirements;
- Educate workers to recognise early symptoms of hearing damage (e.g., ringing ears, temporary hearing loss); and

8.2.3.4 Noise impacts: operational phases

8.2.3.4.1 Potential noise generation during the operational phase may lead to the displacement of wildlife populations from the immediate project area

The Project is located within a semi-arid savanna environment, which typically support faunal species that have adapted to relatively low and intermittent noise levels. Wildlife most sensitive to operational noise include small to medium mammals, nocturnal species, ground nesting and low canopy birds. During the operational phase, noise will be generated primarily from domestic activities (vehicular movement, household appliances), human presence, recreational activities, service and maintenance, occasional use of generators or alarms and

increased traffic. Operational noise will hardly contribute to displacement of certain wildlife species from the immediate Project footprint. Less sensitive and noise tolerant fauna may return to the Project area.

The impact is rated adverse and directly impacting fauna. Impact is partly reversible and long term (>15 years) for the life of the Project. The likelihood of continued displacement is unlikely particularly for nocturnal and ground dwelling species; however, some may return to the Project area, reducing the magnitude to negligible. The sensitivity of the impact low due to the effect on local fauna. Overall, the significance of the impact during operations are considered adverse low, prior to mitigation (Table 16). Mitigation measures are included in the preliminary ESMP (Appendix A).

8.2.3.4.2 Noise disturbance to third parties (neighbouring farmers and nearby communities) and during operations leading to nuisance and complaints

During the operational phase, noise will be generated from routine residential activities. Typical sources include vehicle movements (residents, visitors, service providers), operation of maintenance equipment (e.g., lawnmowers, pumps and generators) and recreational activities. Noise disturbance may affect residential receptors by causing annoyance and interfering with normal daily activities.

The nature of the impact is adverse, directly impacting sensitive receptors such as the local community, and is expected to be partly reversible as preventative measures can be put in place to ensure a peaceful living environment. The impact is expected to occur over long term (>15 years) while people will be living on the Heja Estate. The impact is likely to occur locally as daily residential living, vehicle movements and routine maintenance will generate noise, although not expected to be constant. The magnitude of the change is considered low as noise from vehicles, maintenance equipment and daily residential activities will increase ambient noise levels above the naturally quiet areas. However, noise levels are expected to lower than those generated during the construction phase. Therefore, it is expected that noise will not propagate from noise sources and impact the offsite NSRs. As a result, community complaints would be minimal. The sensitivity of the receptor is deemed low as the NSRs are expected to adapt to the noise levels over time. Overall, the significance of the impact is rated adverse minor, before mitigation (Table 16

Table 16). Mitigation measures are outlined in the preliminary ESMP (Appendix A).

Table 16 - Noise quality impacts assessment ratings

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Construction phase	Residents, third party communiti	Potential noise generation	Adverse Direct	Low	Minor	Adverse Minor (3)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
	es and neighbouring farmers	during the construction phase causing displacement of local fauna	Partly reversible Long term Local Likely			
		Potential generation of noise may cause discomfort to nearby communities, particularly neighbouring farms and businesses	Adverse Direct Reversible Long term Local Likely	Low	Minor	Adverse Minor (3)
		Construction activities may generate varying noise levels, resulting in occupational health risks	Adverse Direct Irreversible Permanent On-site Possible	Medium	Moderate	Adverse Moderate (6)
Operations		Potential noise generation during the operational phase causing the displacement of wildlife populations from the immediate project area	Adverse Direct Party reversible Long term Local Possible	Low	Minor	Adverse Low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		Noise disturbance to third parties (neighbouring farmers and nearby communities) leading to nuisance and complaints	Adverse Direct Partly reversible Long-term Local Likely	Low	Minor	Adverse Minor (3)

8.2.3.5 Air quality impacts: construction phase

The construction of internal access roads within the estate, together with vehicle emissions, bulk earthworks, excavation activities and the construction of associated infrastructure, is expected to generate dust and exhaust emissions during the construction phase. Overall, the Project is anticipated to result in adverse, localised air quality impacts, affecting the surrounding community, which is already subject to existing disturbances.

Figure 30 represent an illustrated overview of the air quality impacts assessed. Each specific impact is discussed in detail in the sections below. The impact assessment ratings are summarised in Table 17.

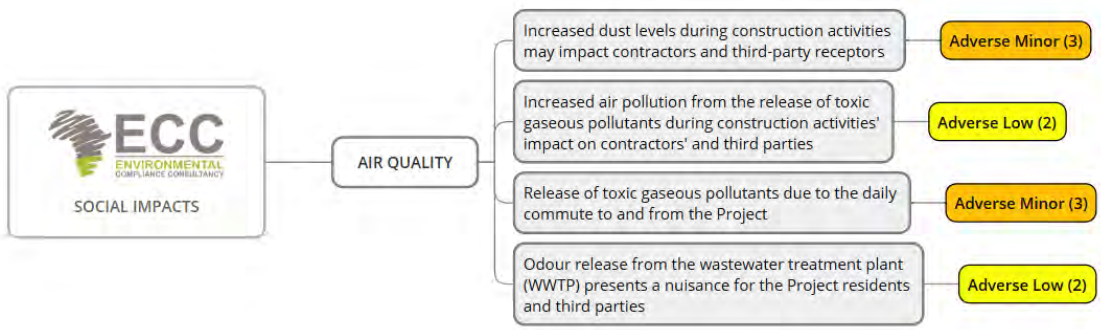

Figure 30 - An overview of the air quality impacts

8.2.3.5.1 Increased dust levels during construction activities may impact contractors and third-party receptors

Construction activities associated with the development are expected to result in elevated dust levels, primarily due to vegetation clearing, earthworks, vehicle movement on unpaved surfaces, the handling and transport of construction materials. Pollutants such as particulate

matter (PM_{10} and $PM_{2.5}$) and total suspended particles (TSP) may temporarily affect nearby sensitive receptors, including residents, contractors, workers, pedestrians, cyclists and adjacent farming communities, especially under calm wind conditions or temperature inversions, common along the B6 area.

The impact is assessed as adverse and directly impacting sensitive receptors within the immediate boundary of the Project site. The impact is considered partly reversible as dust will be generated over a short term (<5 years) throughout the construction phase and will subside once activities cease. Dust generation is highly likely during earthmoving, vehicle movements, and material handling, particularly under dry and windy conditions. There, the impact is expected to affect sensitive receptors on a local scale.

The magnitude of change is rated minor as dust may cause temporary nuisance and minor health irritation. The sensitivity of the impact is expected to be low due to the temporary effects on sensitive receptors and no respiratory health effects will be expected. The overall significance of the impact is rated adverse minor, before mitigation (Table 17). Mitigation measures are outlined in the ESMP (Appendix A).

8.2.3.5.2 Potential impacts of increased air pollution from the release of toxic gaseous pollutants during construction activities on contractors and third-party receptors

Transport and delivery of construction equipment, materials and machinery generate exhaust emissions from diesel and petrol-powered vehicles. These emissions typically include nitrogen oxides (NO_x), carbon monoxide (CO), sulphur oxides (SO_x) and fine particulate matter ($PM_{2.5}$). Prolonged or repeated exposure to these pollutants can have adverse health effects on workers, nearby communities and other third-parties, particularly if sensitive individuals, such as children, the elderly and those with pre-existing respiratory conditions are exposed.

The impact is assessed as adverse and directly impacting sensitive receptors such contractors, residents, workers and other third-party communities. The impact is considered partly reversible, as pollutant emissions cease once transport activities ceases and ambient air quality typically recovers over time. The duration of the impact is rated short-term as these pollutants are expected to be generated throughout the construction phase (<5 years). The impact will affect people on site as well as beyond the Project footprint. Therefore, the spatial extent of the impact is rated as local. Exhaust emissions are likely to be generated due to the movement of construction vehicles and machinery, especially under continuous delivery schedules and high traffic intensity.

The magnitude of change is rated minor as emissions may cause temporary respiratory discomfort, eye irritation, and nuisance to nearby communities. However, no long-term environmental or human health risks are expected. The sensitivity of the impact is expected to be low due to temporary effects on sensitive receptors. The overall significance of the

impact is rated adverse minor, before mitigation (Table 17). Mitigation measures are outlined in the ESMP (Appendix A).

8.2.3.6 Air quality impacts: operational phase

8.2.3.6.1 Release of toxic gaseous pollutants due to daily commuting of residents to and from Heja Lifestyle Estate

The daily commute of residents between the Project and Windhoek is expected to contribute to localised and regional air quality impacts due to vehicle emissions along the route. Combustion of petrol and diesel fuels by private vehicles, minibuses and trucks releases nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$) and volatile organic compounds (VOCs).

Traffic volumes and congestion at peak commuting hours may temporarily elevate concentrations. The primary receptors are nearby communities along the routes that will be frequently used.

Air quality impacts are assessed as adverse. Daily commuting associated with the development represents a direct source of air pollution and is considered partly reversible, as some residual effects are likely to persist. The impact is expected to occur over a long-term (>15 years) as the development provides permanent residence to people. Vehicle emissions contribute incrementally to local air pollution levels. The daily commuting is routine and occurs consistently, therefore, the impact is likely to occur.

The magnitude of change is rated minor due to emissions that are limited to vehicle exhaust from private cars and small service trucks. Air quality impacts will be confined to roads and adjacent areas. The sensitivity is expected is rated low due to the local scale of the impact. It is anticipated that the vehicle exhaust emissions will be tolerable at the receptors. The overall significance of the impact is rated adverse minor, before mitigation (Table 17). Mitigation measures are described in the ESMP (Appendix A).

8.2.3.6.2 Potential impacts of increased air pollution from the release of toxic gaseous pollutants during operational activities on contractors and third-party receptors

The proposed WWTP is an advanced trickling filter (ATF) system that will be designed to treat approximately 2 130 m³/d of domestic sewage from the mixed-use residential development. Odorous compounds and gases include hydrogen sulfide (H_2S), ammonia (NH_3), methane (CH_4), and volatile organic compounds (VOCs). These emissions may cause nuisance odours, which can affect the comfort and well-being of nearby residents, workers and visitors. Elevated concentrations of H_2S and NH_3 can also have health implications at higher exposure levels, including respiratory irritation and headaches. Methane and other VOCs contribute to greenhouse gas emissions, impacting climate change.

The impact is adverse, directly impacting residents and third parties. The impact is expected to be partly reversible as odours will be generated during specific processes (influent, sludge handling) and will disperse naturally. Air quality impacts are primary expected to be localised and associated with odorous emissions (hydrogen sulfide, ammonia, and volatile organic compounds) from primary and biological treatment units, as well as PM from sludge handling and dewatering processes. The integrated odour control via biological scrubbing beneath the filter media, significantly reduces potential odour during operation. Malfunctions of the WWTP could occur over a long term (>15 years). Therefore, the duration of the impact is assessed as long-term. odour is expected to be more pronounced during peak flow periods, and the resulting nuisance may affect nearby residents and receptors. Therefore, the likelihood of the impact occurring is rated unlikely since the AFT system is more advanced compared to conventional systems reducing the likelihood of the impact.

The magnitude of change is rated minor as odours may cause nuisance and minor health discomfort. However, advanced ATF systems significantly reduce odour compared to conventional systems. The sensitivity of the impact is low due to the local sporadic releases (i.e. residents will only be susceptible to odour exposure during malfunction events). The overall significance of the impact is rated adverse minor, before mitigation (Table 17). Mitigation measures are outlined in the ESMP (Appendix A).

Table 17 - Air quality impacts

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Construction phase	Residents, third party communities and the public	Increased dust levels during construction activities may impact contractors and third-party receptors.	Adverse Direct Partly reversible Short-term Local Likely	Low	Minor	Adverse minor (3)
		Increased air pollution from the release of toxic gaseous pollutants during construction activities' impact on contractors	Adverse Direct Partly reversible Short-term Local Unikely	Low	Minor	Adverse low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		and third-party receptors.				
Operations		Release of toxic gaseous pollutants due to the daily commute to and from Heja Lifestyle Estate.	Adverse Direct Party reversible Long-term Local Likely	Low	Minor	Adverse minor (3)
		Odour released from the wastewater treatment plant (WWTP) presents a nuisance for the Heja Lifestyle Estate residents and nearby communities.	Adverse Direct Partly reversible Long-term Local Unlikely	Low	Minor	Adverse low (2)

8.2.4 TRAFFIC IMPACTS

The Traffic Impact Assessment (TIA) was undertaken to evaluate the potential traffic and transport implications associated with the proposed Project on Farm Hoffnung. The assessment considered existing traffic conditions, projected background traffic growth, and incremental Project development-generated traffic up to full development, with specific focus on the B6, D1527, associated access roads, and the railway crossing. The study assessed the capacity, level of service (LOS), and safety performance of the surrounding road network under different development scenarios and identified infrastructure and operational measures required to maintain acceptable traffic conditions.

The assessed impacts and the significance of these impacts have been illustrated in Figure 31, Figure 32, Figure 33, Figure 35 and Figure 39. This image is for illustrative purposes only and the comprehensive explanation of each impact is outlined in section 8.2.4 and Table 18.

Figure 31 - Traffic impacts (Construction phase)

Construction phase

8.2.4.1 *Construction-related vehicle movements may result in temporary increases in traffic volumes on the B6, D1527, and associated access roads during peak and off-peak periods.*

During the construction phase, traffic volumes on the B6, D1527, and the existing Heja access road will increase due to the movement of construction vehicles, delivery trucks, and contractor vehicles. Although the TIA baseline assessment indicates that the surrounding road network currently operates at acceptable Levels of Service (LOS A–B), the introduction of construction traffic represents a temporary deviation from surveyed traffic conditions (Figure 32). These increases are expected to be intermittent and time-bound but may affect peak and off-peak traffic flow near site access points.

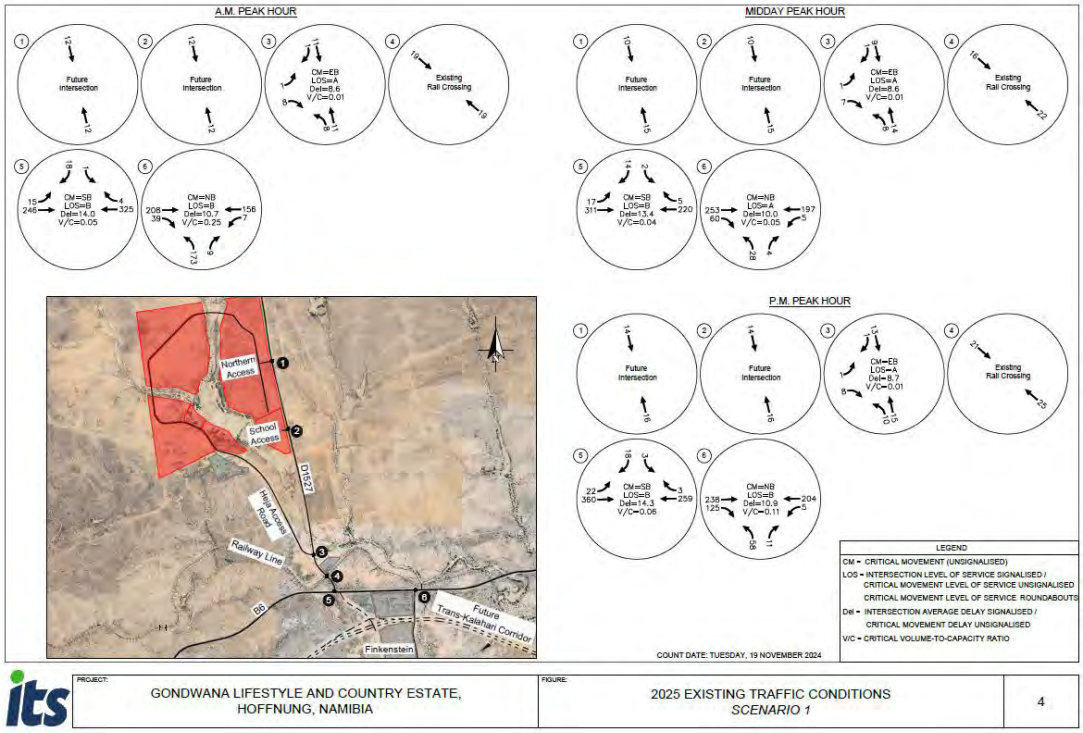

Figure 32 - 2025 existing traffic conditions (Scenario 1) (Innovative Transport Solutions (ITS), 2025)

Although temporary, construction related traffic presents a heightened risk profile due to increased heavy vehicle movements, interaction with high-speed trunk roads, and proximity

to a rail level crossing. Without effective management, these impacts could result in safety risks that are disproportionate to the duration of the construction phase.

The nature of the impact is adverse and direct because construction vehicle movements during the development of the Project will increase the presence of slow-moving vehicles and slowing traffic on the B6 and D1527 roads. The impact is reversible because once construction ceases the traffic volumes will go back to normal.

The duration of the impact is long term, the construction period of multiple phases will last for approximately >15 years. The scale of the impact is local as the roads impacted are located around the Project site, travelling from Windhoek to the Project site. The magnitude of change is low because the introduction of the additional construction vehicles will only slightly raise the baseline traffic levels and will not decrease the acceptable LOS. While the probability of the impact occurring is possible, as the Project will be developed in stages so there won't be a significant increase in the number of vehicles on the road all at once. Furthermore, the sensitivity of the impact is low because the impact only affects local roads and has the capacity to accommodate changing levels of traffic. Therefore, the significance of this impact has been rated adverse minor (before mitigation) (Table 18), and the mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.2 Road surface deterioration associated with heavy construction vehicles

Heavy vehicle traffic associated with construction activities may affect the condition of existing gravel and paved road sections, particularly along the D1527 and the Heja access road. The TIA identifies the D1527 as a rural arterial road with limited shoulders and no sidewalks, making it sensitive to increased heavy vehicle loading. Accelerated wear of road surfaces may influence road maintenance requirements during the construction period.

The nature of the impact is adverse and direct because the increased movement of heavy construction vehicles may deteriorate the road conditions resulting in potholes and road surface wear. The impact is reversible with maintenance. The duration of the impact is long term (>15 years) as the impact will last for the duration of construction of the Project over the multiple phases. The extent of the impact is local as the construction vehicles move between Windhoek and the Project site. The magnitude of change is low as there is some changes in the road surface quality but there isn't a loss of the utility of the road. Furthermore, the probability of the impact occurring is likely as heavy vehicles are known to cause deterioration of road networks. While the sensitivity of the impact is low because the impact only affects local roads and has the capacity to accommodate changing road surface quality. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18) and the mitigation measures have been included in the preliminary ESMP (Appendix A).

Phase one (1) of the Project *(Initial residential development and early access formation*)

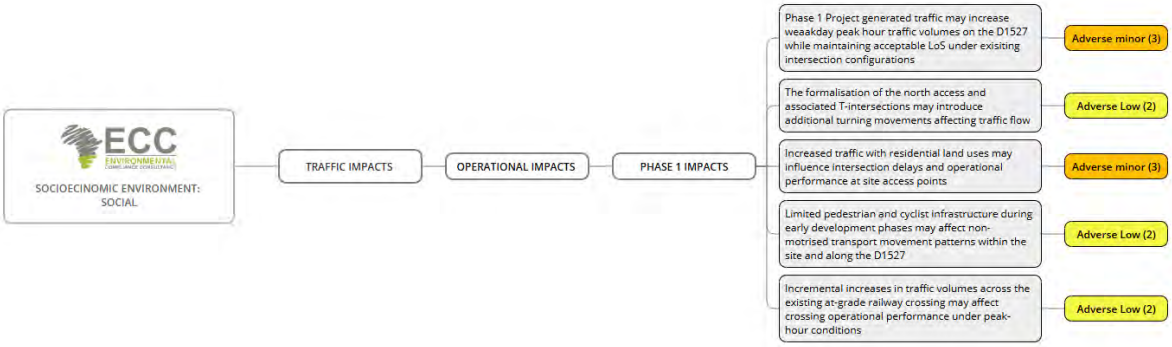

Figure 33 - Traffic impacts (Phase one (1) development

8.2.4.3 Phase one (1) Project-generated traffic may increase weekday peak-hour traffic volumes on the D1527 while maintaining acceptable levels of service under existing intersection configurations.

Phase one (1) of development will generate additional weekday peak-hour vehicle trips associated primarily with residential land uses. According to the TIA trip generation calculations, this phase can be accommodated within existing road network capacity, provided that access intersections are formalised. Approximately 300 peak-hour development trips (approximately 25% of full development) can be accommodated while maintaining acceptable LOS at the B6/D1527 intersection.

The nature of the impact is adverse and direct because phase one (1) of the Project will increase traffic on the D1527 especially during peak hour periods (6 am-8 am) and (4 pm-6 pm). The reversibility of the impact is reversible as the impact only occurs during peak hours. The duration of the impact is temporary (<1 year) as it only lasts during the activity (peak hours) causing the impact. The extent of the impact is on site affecting the southern access to the Project site. The magnitude of change is negligible because the impact will not affect the acceptable LOS of the road. While the probability of the impact occurring is likely as with phase one (1) of the Project there will be an increase in Project-generated traffic on the D1527 road. Furthermore, the sensitivity of the impact is low as the impact is on site and the road has capacity to accommodate the increased traffic volumes. Therefore, the nature of the impact is adverse minor (before mitigation) (Table 18), and the mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.4 The formalisation of the north access and associated T-intersections may introduce additional turning movements affecting traffic flow.

The formalisation of the north access and other Phase one (1) access points will introduce additional turning movements along the D1527 affecting traffic flow, may cause delays or reduce the intersections performance. However, the TIA confirms that proposed access spacing complies with Road Access Guidelines (RAG 2002) and that T-intersection

configurations with one lane per direction are sufficient to maintain acceptable operational performance during early development phases (Figure 34).

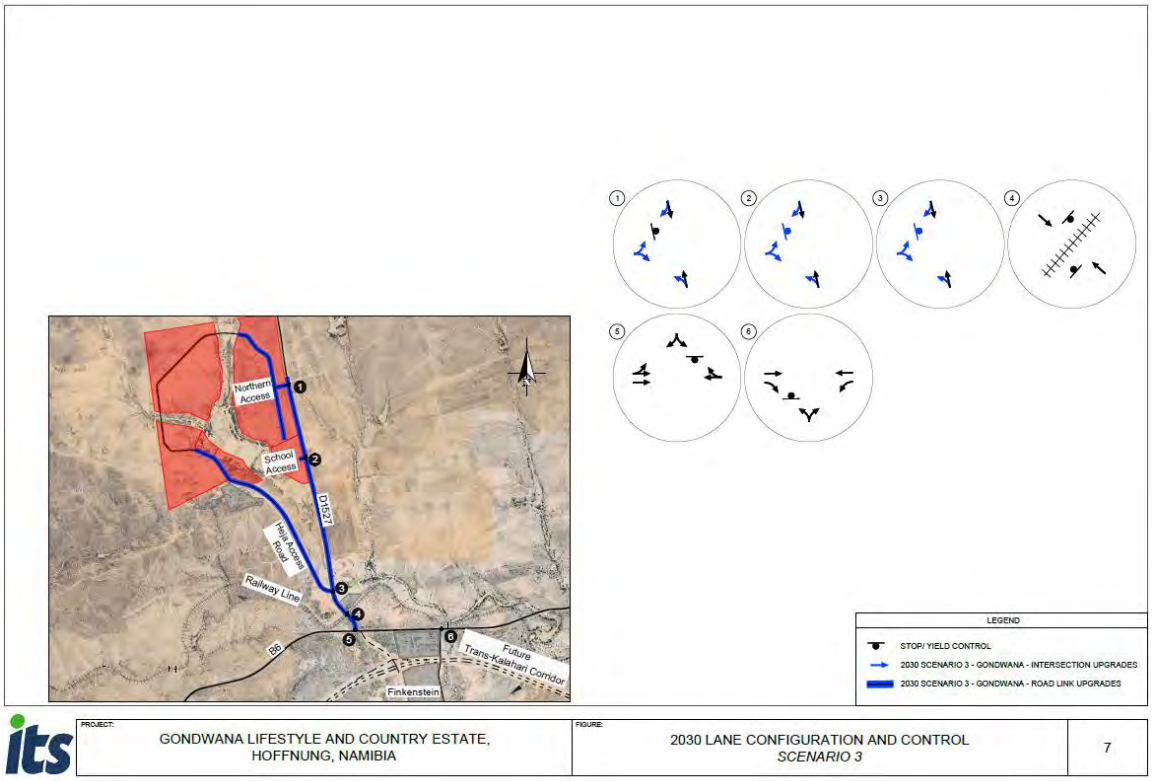

Figure 34 - 2030 lane configuration and control (Scenario 3) (Innovative Transport Solutions (ITS), 2025)

The nature of the impact is adverse and direct because the development of the second access to the north of the Project site introducing additional turning movements (meaning increasing the number of vehicles turning left or right) may delay traffic flow pattern, decrease intersection performance and increase safety risks. The impact is reversible as upgrades or changes to the northern access can remove this impact. The duration of the impact is long term (>15 years) as it is likely to last for the lifetime of the Project. The extent of the impact is on site as it will only affect that Project access site. The magnitude of change is negligible because the road access aligns with guidelines and maintains acceptable operational performance. While the probability of the impact occurring is unlikely as the intersection will be developed in a manner that prevents delays and congestion. Furthermore, the sensitivity of the impact is low as the impact is onsite and the access point will have the capacity to accommodate change.

Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18), and the mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.5 Increased traffic due to residential land uses may influence intersection delays and operational performance at site access points.

Phase one (1) traffic increases will result in higher vehicle usage of the existing railway crossing and other access points. While capacity analysis indicates acceptable LOS under Scenario three (3) conditions, increased traffic volumes contribute to cumulative risk, reinforcing the need for the safety upgrades identified through the SANS 3000 assessment. As development intensity increases, the at grade rail crossing represents a cumulative safety risk due to increased vehicular volumes, queuing potential, and interaction with heavy vehicles. This risk will require reassessment in consultation with TransNamib as development progresses.

The nature of the impact is adverse and direct because increased traffic may result in congestion and delays. The impact is reversible as the impact occurs depending on the number residing on the estate at any given moment. The duration of the impact is long term (>15 years), as the impact is likely to last for the lifetime of the Project/Estate. The extent of the impact is on site as the access points only affect the Project area. The magnitude of change is low as the impact does not affect the LOS but is not negligible as there is a safety risk and safety upgrades of the current proposed access points especially the railway crossing is required. The probability of the impact occurring is possible as increased traffic does create a safety risk especially if safety upgrades are not implemented at the railway crossing. The sensitivity of the impact is low as the impact is on site and the access points have the capacity to accommodate the increased traffic levels. Therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 18). The mitigation measures have been implemented in the preliminary ESMP (Appendix A).

8.2.4.6 Limited pedestrian and cyclist infrastructure during early development phases may affect non-motorised transport movement patterns within the site and along the D1527.

During Phase one (1), the absence of dedicated pedestrian and cyclist infrastructure within the site and along the D1527 may influence non-motorised transport movement patterns, as the TIA confirms that the D1527 currently has no sidewalks or surfaced shoulders and that no formal pedestrian or cyclist facilities exist in the study area. While baseline surveys recorded low pedestrian and cyclist volumes, the introduction of residential land uses will incrementally increase local non-motorised movements under Scenario three (3), resulting in pedestrians and cyclists sharing road space with vehicles. The TIA therefore identifies the phased provision of internal sidewalks and shoulders along the D1527 as necessary to accommodate non-motorised users as development progresses.

The nature of the impact is adverse and direct because the absence of pedestrian and cyclist infrastructure could result in safety risks between pedestrians and cyclists and vehicles as pedestrians and cyclists will have to use the road or jay-walk. The impact is reversible with the creation of pedestrian and cyclist infrastructure. The duration of the impact is short term (1-

5 years) as the lack of pedestrian and cyclist infrastructure is likely to last during the construction and completion of the first (1st) phase of the Project. The extent of the impact is on-site as the impact is confined to the Project site. The magnitude of change is negligible as the impact is an inconvenience to pedestrians and cyclists. The probability of the impact is possible depending on the development of roads, sidewalks and bicycle lanes in relation to the houses and when residents are allowed to move -in. The sensitivity of the impact is low as the impact is on site and there is a high capacity to accommodate the lack of sidewalks and bicycle lanes for the duration of the construction and completion of phase one (1) of the Project. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18). The mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.7 Incremental increases in traffic volumes across the existing railway crossing may affect crossing operational performance under peak-hour conditions.

During Phase one (1), Project-generated traffic will result in incremental increases in vehicle movements across the existing road-over-rail level crossing on the D1527. The TIA confirms that, under baseline conditions, the level crossing operates at acceptable LOS during peak periods based on capacity analysis undertaken in accordance with the Highway Capacity Manual methodology. However, the SANS 3000 Risk Assessment identifies the crossing as sensitive to increases in traffic volumes, indicating that additional vehicle crossings during peak hours may influence operational performance and reinforce the need for the signage, road marking, visibility, and safety upgrades recommended for phased implementation as traffic demand increases.

The nature of the impact adverse and direct because increased volumes of traffic will increase safety risks. The impact is reversible depending on peak on off-peak hour traffic volumes, while the duration of the impact is long term (>years) during as the impact may last the entire life cycle of the Project. The extent of the impact is on site at the railway crossing and the magnitude of change is negligible as there is very minor loss or alteration of safety risks but no loss of changes to the operation of the railway crossing. The probability of the impact occurring is possible as the increased integration of vehicles and the railway crossing increases the chances of safety risks. The sensitivity of the impact is low as the impact is onsite and therefore, the significance of the impact is adverse low (before mitigation) (Table 18). The mitigation measures have been included in the preliminary ESMP (Appendix A).

Phase two (2) of the Project (*Educational facilities and mixed-use components*)

Figure 35 - Traffic impacts (Phase two (2) - Educational facilities and mixed-use components)

8.2.4.8 Traffic generated by the primary and high school components may increase morning and afternoon peak-hour traffic demand on the D1527 and site access intersections.

The inclusion of primary and high school land uses in phase two (2) introduces concentrated morning and afternoon peak-hour traffic demand. The TIA applies school drop off and pick-up-specific trip generation rates and identifies school access intersections as requiring formalisation to accommodate increased turning movements and maintain acceptable intersection LOS (Figure 36).

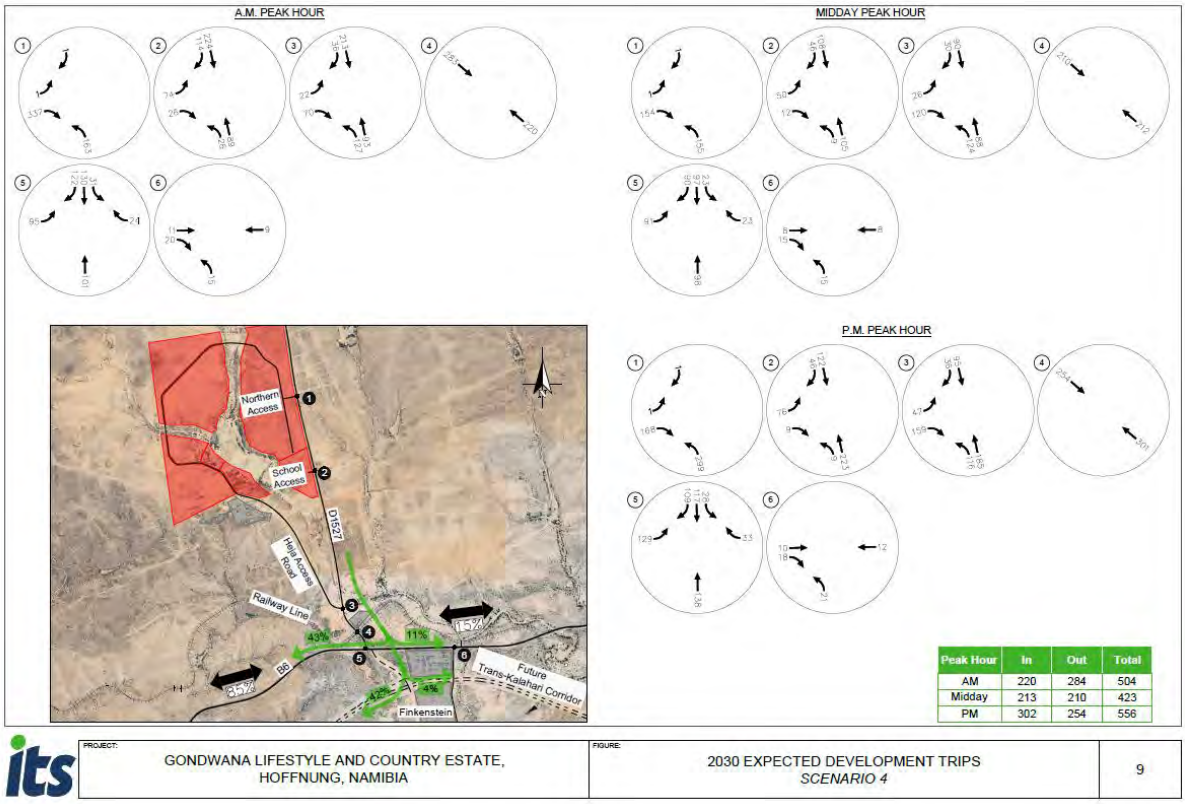

Figure 36 - 2030 expected development trips (Scenario 4) (Innovative Transport Solutions (ITS), 2025)

The nature of the impact is adverse and direct because congestion is known to occur around schools during peak-hour traffic, drop off (06:30-07:30) and pick up (12:30-14:00). Therefore, congestion and traffic can be expected to occur around the schools during drop-off and pick-up times on the D1527 and other site access points. The impact is reversible and the duration is temporary (<1 (one) year) as it only occurs during the duration of the activity causing the impact and ceases once the impact has occurred. The extent of the impact is on-site as it will only occur around the proposed schools. The magnitude of change is negligible as the impact is more a nuisance and does not cause any losses or deterioration or degradation in the quality or integrity of the road network. The probability of the impact occurring is likely to occur as seen in many other suburbs in Windhoek around various schools. The sensitivity of the impact however is low because the impact is onsite and the road network has capacity to accommodate change. Therefore, the significance of the impact is adverse minor (before mitigation) (Table 18). The mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.9 *Increased Project traffic volumes and turning movements may affect B6/D1527 intersection capacity and level of service if recommended upgrades are not implemented.*

Scenario 4 analysis demonstrates that approximately 45% of full development traffic can be accommodated following the implementation of the current B6/D1527 intersection upgrade by RA. Without these upgrades, increased traffic volumes and turning movements associated with Phase two (2) may reduce intersection capacity and LOS below acceptable thresholds (Figure 37 and Figure 38).

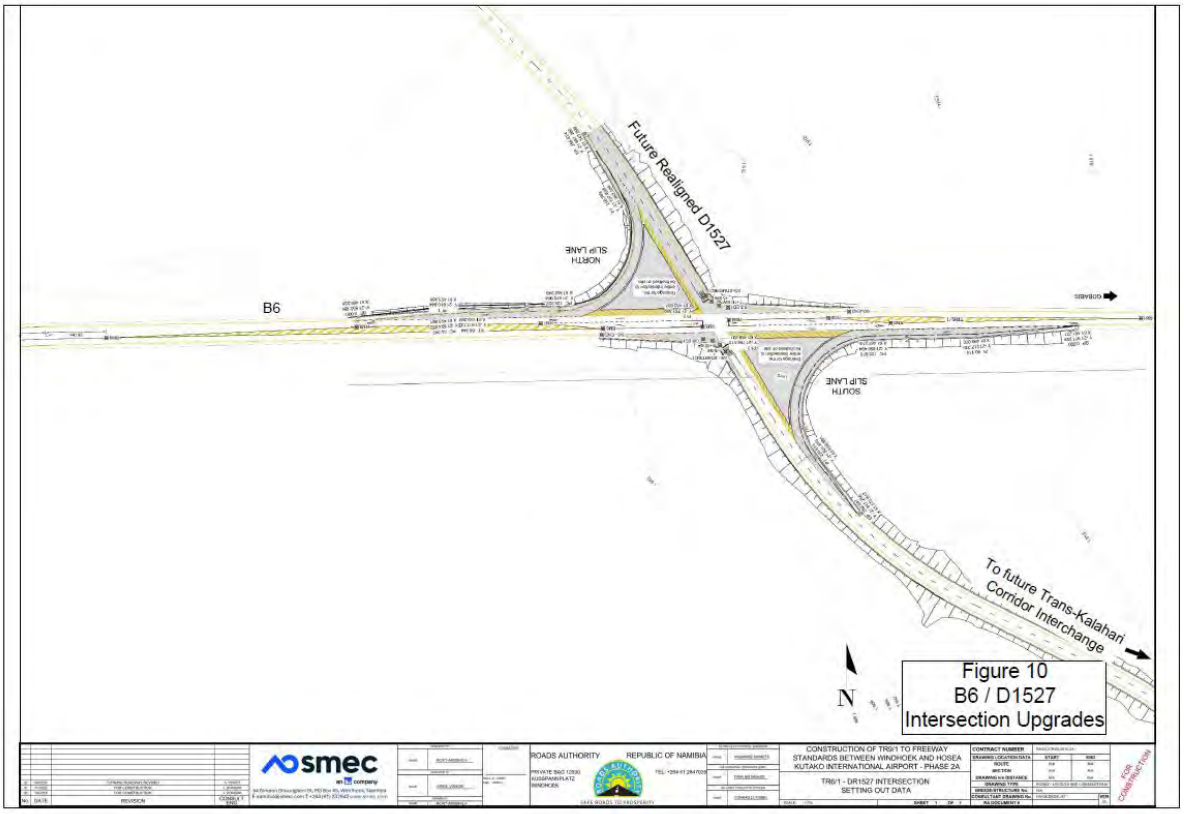

Figure 37 -B6/D1527 intersection upgrades (Innovative Transport Solutions (ITS), 2025)

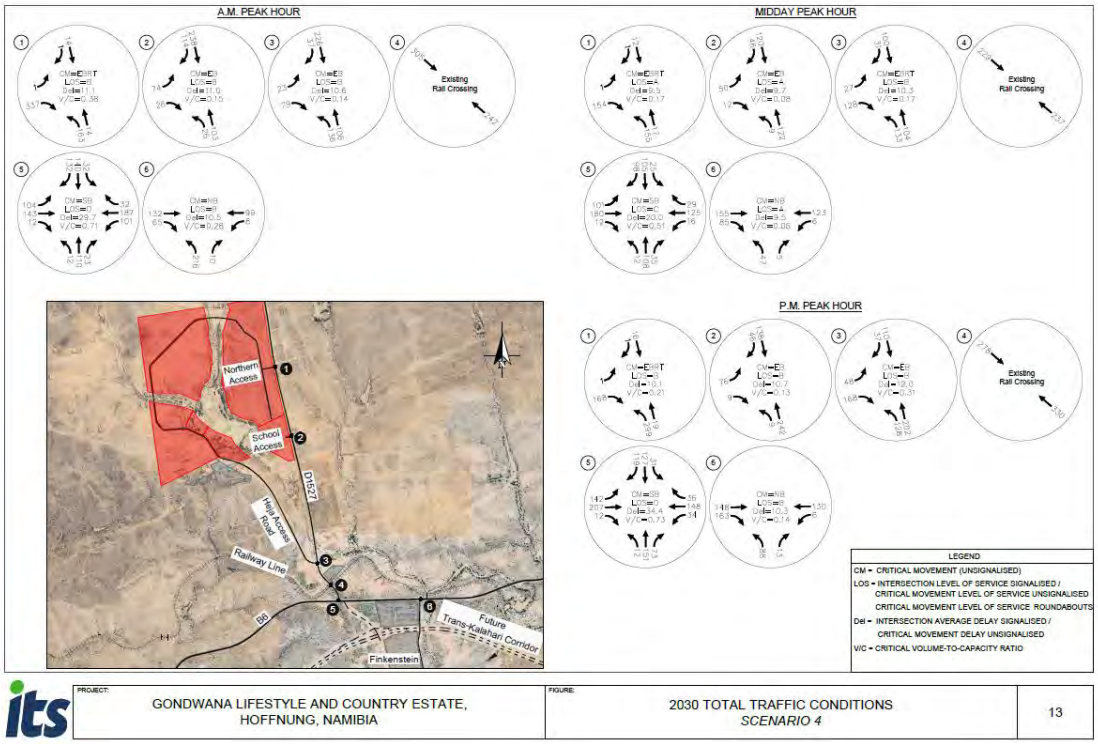

Figure 38 - 2030 total traffic conditions (scenario 4) (Innovative Transport Solutions (ITS), 2025)

The nature of the impact is adverse and direct as increased traffic volumes will result in decreased intersection capacity and LOS on the B6 and D1527 intersection. The impact is reversible as it may be relieved by intersection upgrades. The duration of the impact is long term (>15 years) lasting the duration of the Project unless the intersection is upgraded to accommodate the increased traffic volumes. The extent of the impact is local as the B6 road at B6/D1527 access point into the proposed Project is a national road affecting local users. The magnitude of change is negligible as their will be minor loss of time and a nuisance due to delays and congestion. The probability of the impact occurring is likely unless upgrades to the intersection occurs. The sensitivity of the impact is low as the impact will occur locally. Therefore, the significance of the impact is adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.10 Pedestrian activity associated with schools and communal recreational spaces may increase interactions between vehicular traffic and non-motorised users.

During Phase two (2), the introduction of schools and communal recreational spaces will increase pedestrian movements within the Project and at access points connecting to the D1527. The TIA identifies that no formal pedestrian facilities currently exist within the site vicinity and that the D1527 functions as a rural arterial road with no sidewalks and limited road reserve space. Scenario 4 traffic modelling indicates increased peak-hour traffic volumes associated with school-related trips, which coincide with periods of heightened pedestrian activity.

The nature of the impact is adverse and direct because the presence of communal and academic institutions will result in the direct interaction between pedestrians and vehicles especially during peak hour periods (06:30-07:30, 12:00-14:00 and 16:30-18:00). The impact is reversible and temporary (<1 (one) year) as the activity causing the impact will only occur during peak hours. The extent of the impact is onsite as the impact will only occur on the D1527 road within the Project area. The magnitude of change is low as there will be increased interaction between pedestrians and vehicles however there is unlikely to be any losses or changes in quality of traffic. The probability of the impact occurring is unlikely as the Project developers are expected to create proper pedestrian infrastructure along the D1527 road and other roads within the estate. The sensitivity of the impact is low as it occurs on site, therefore the significance of the impact has been rated adverse minor (before mitigation) (Table 18). the mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.11 Public transport pick-up and drop-off activity may influence traffic operations along the B6 in the absence of formal embayments.

During Phase two (2), the introduction of schools, communal and recreational, and mixed-use land uses is expected to increase demand for public transport services accessing the site. The TIA confirms that no formal public transport facilities currently exist within the site vicinity and that observed passenger pick-up and drop-off activity presently occurs informally along the road network. Traffic surveys recorded low taxi volumes but higher bus volumes along

the B6, with limited activity along the D1527 under baseline conditions. Increased traffic volumes during peak periods (06:30-08:00 and 17:00-18:00), and in the absence of designated public transport embayments, stopping and queuing associated with passenger pick-up and drop-off along the B6 may affect traffic flow and operational performance. Increased traffic demand at the railway crossing may result in higher delays and influence safety performance during peak periods.

The nature of the impact is adverse and direct as non-dedicated pick up and drop of points and the lack of access to adequate public transport systems have been known to lead to congestion and antisocial driving by taxis and buses. The impact is reversible with the introduction of formal embayments, and the duration of the impact is temporary (<1 (one) year) only lasting during peak hours. The extent of the impact is local affecting the B6 road outside of the Project area and the magnitude of change is low as there will be minimal loss or alteration to quality or integrity of the road network. The probability of the impact occurring is possible in the absence of formal embayments and the sensitivity of change is low as the impact is local and the B6 road has a considerate capacity to accommodate change. Therefore, the significance of the impact is adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

Phase three (3) of the Project (*Full development build-out*)

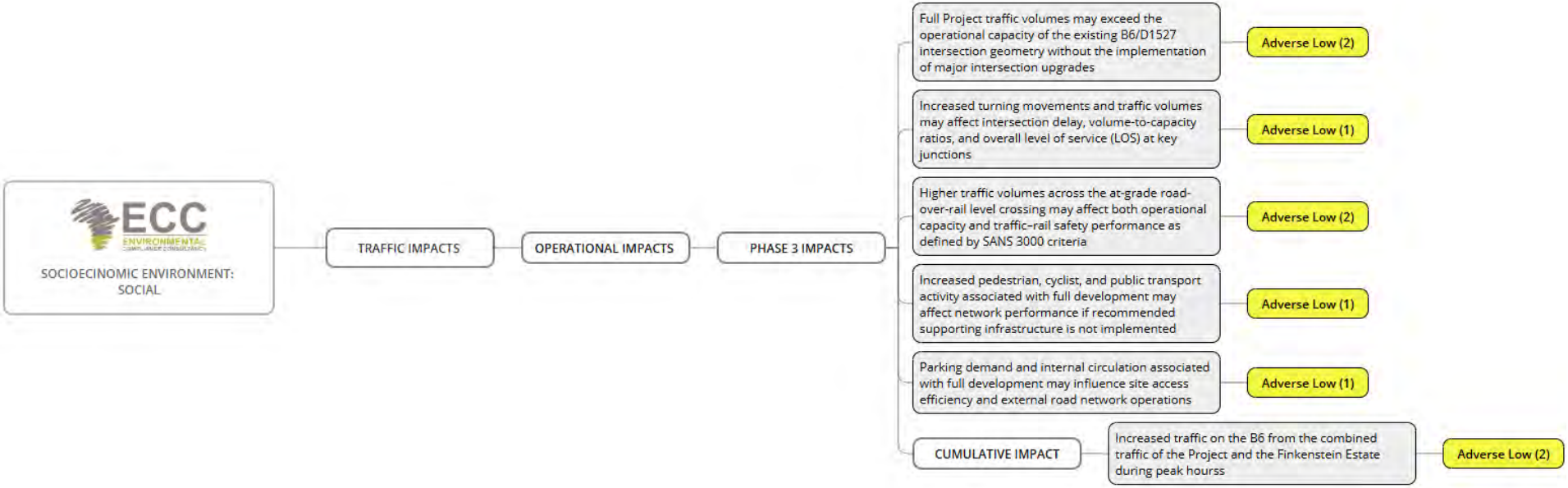

Figure 39 - Traffic impacts (Phase 3 - Full development)

8.2.4.11.1 Full Project traffic volumes may exceed the operational capacity of the existing B6/D1527 intersection geometry without the implementation of major intersection upgrades.

Under Scenario 5 (full Project development), subject to confirmation through an updated TIA, the existing intersection geometries may be insufficient to accommodate projected traffic volumes. Capacity analyses show that major upgrades, including a roundabout at the B6/D1527 intersection, may then be required to maintain acceptable LOS during peak period (Figure 40 and Figure 41).

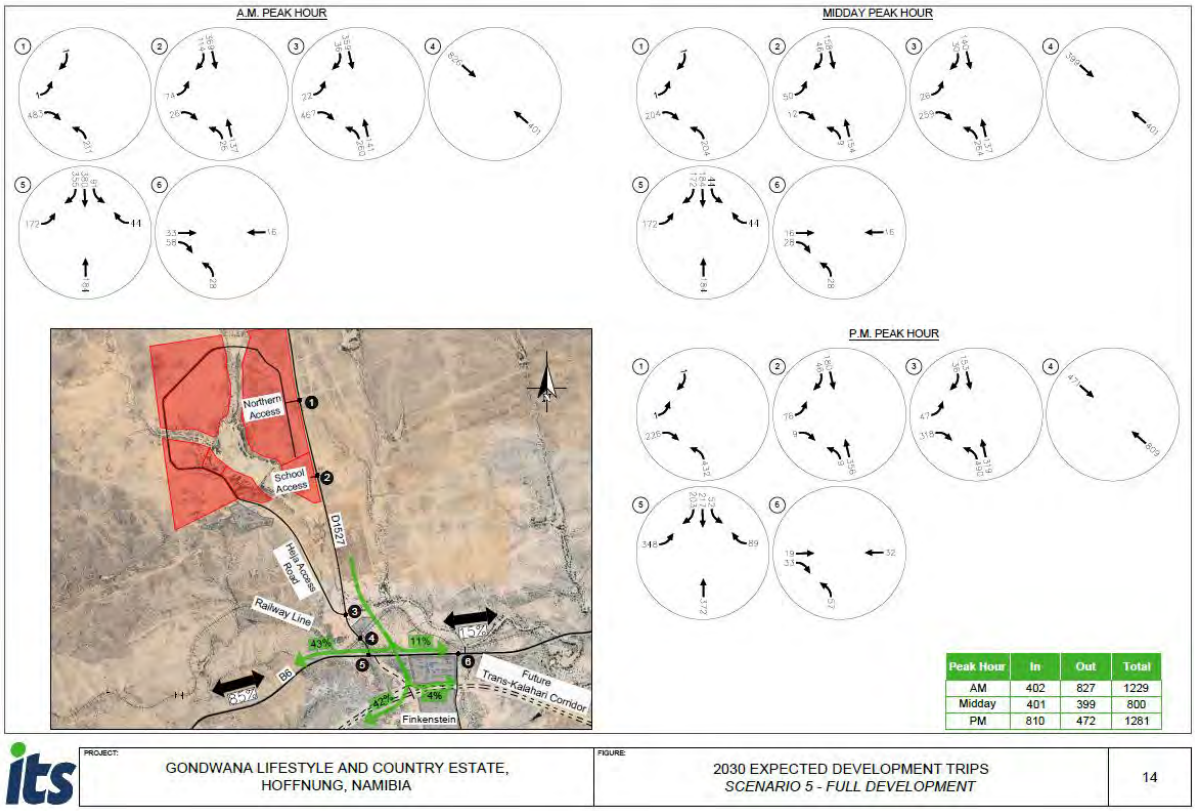

Figure 40 - 2030 expected development trips (Scenario 5 - full development) (Innovative Transport Solutions (ITS), 2025)

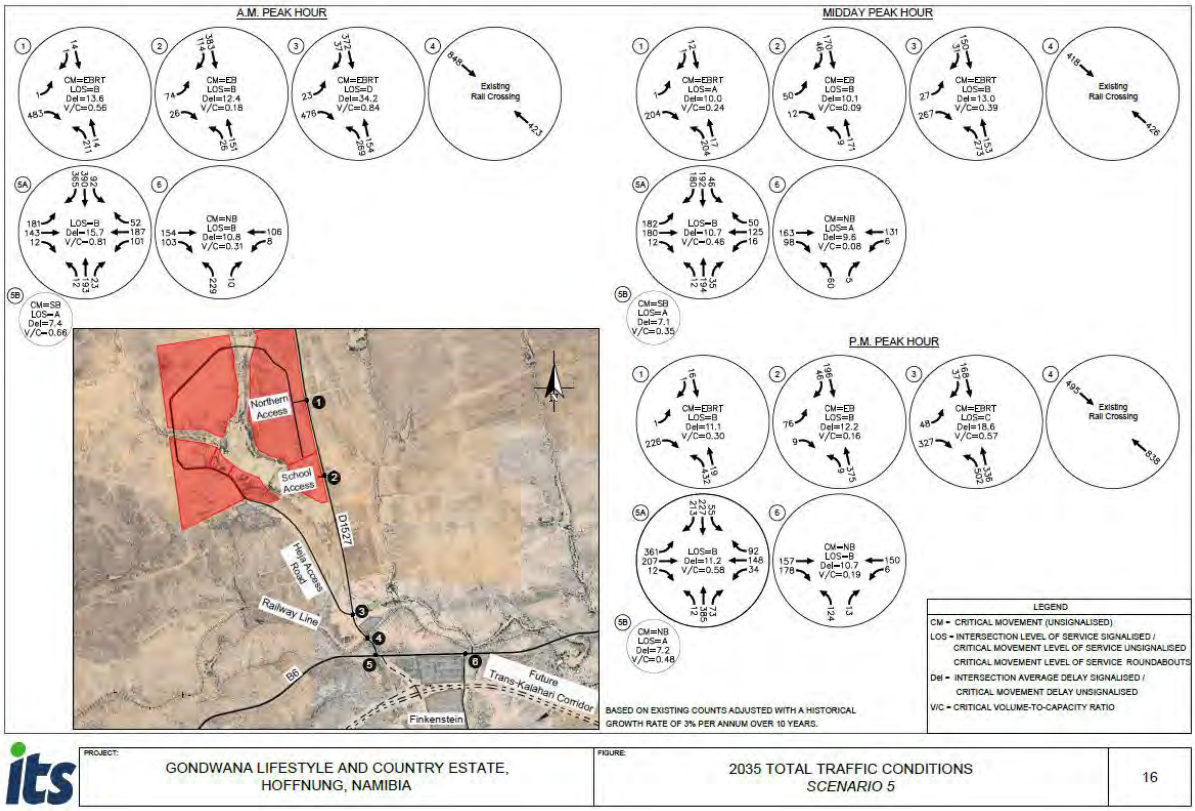

Figure 41 - 2030 total traffic conditions (Scenario 5) (Innovative Transport Solutions (ITS), 2025)

The nature of the impact is adverse and direct as the current road characteristics and intersections are insufficient for the projected levels of traffic caused by the Project development which would result in congestion and delays on at the B6/D1527 intersection. The impact is reversible depending on the times of day and population of the development at any given time. The duration of the impact is long term (>15 years), the projected life of the Project. The extent of the impact is local as it affects the B6 road which is used by local communities The magnitude of change is low as there will be some measurable changes in traffic flow. However, the probability of the impact occurring is unlikely as current B6 upgrades along with the completion of the Dr Hage G Gaingob Freeway connects all three roads and may alleviate most of the congestion at that intersection. The sensitivity of the impact low as the impact is of value on a local scale. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.11.2 Increased turning movements and traffic volumes may affect intersection delay, volume-to-capacity ratios, and overall level of service (LOS) at key junctions.

Project-generated traffic volumes are expected to increase substantially, resulting in higher through and turning movements at key intersections, particularly the B6/D1527 intersection and site access intersections along the D1527.

The TIA evaluates these conditions, which demonstrates that existing intersection geometries and controls are insufficient to accommodate projected peak-hour traffic volumes while maintaining acceptable intersection delay, volume-to-capacity ratios, and LOS. Capacity analyses indicate that without major intersection upgrades, including additional turning lanes and the implementation of a roundabout or signalised intersection at the B6/D1527 junction, operational performance would deteriorate during peak periods. Projected ultimate traffic volumes will be confirmed during the design development stages of the development and the TIA updates in future.

The nature of the impact is adverse and direct as the current road characteristics and intersections are insufficient for the projected levels of traffic caused by the Project development which would result in congestion and delays on at the B6/D1527 intersection. The impact is reversible depending on the times of day and population of the development at any given time. The duration of the impact is long term (>15 years), the projected life of the Project. The extent of the impact is local as it affects the B6 road which is used by local communities The magnitude of change is low as there will be some measurable changes in traffic flow. However, the probability of the impact occurring is unlikely as current B6 upgrades along with the completion of the Dr Hage G Gaingob Freeway connects all three roads and may alleviate most of the congestion at that intersection. The sensitivity of the impact low as the impact is of value on a local scale. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.11.3 Higher traffic volumes across the road-over-rail level crossing may affect both operational capacity and traffic–rail safety performance as defined by SANS 3000 criteria.

Scenario 5 traffic volumes significantly increase utilisation of the railway crossing. The TIA's SANS 3000 assessment confirms that without comprehensive upgrades, including signage, markings, and potential active warning systems (e.g flashing lights and boom gates), traffic–rail operational and safety performance may be adversely affected.

The nature of the impact is adverse and direct as increased traffic volumes using the railway crossing results in increased interactions which increases safety risks. The impact is reversible with the implementation of warning signs and managing traffic volumes by having alternative access routes and points. The extent of the impact is on site as the impact occurs with the

Project site. The duration of the impact is long term (>15 years) as it continuous daily as long as the development is operational. The magnitude of change is low as increased traffic causes only minor measurable changes to the railway crossings safety and operational performance. The crossings core function and physical integrity remain intact with no major loss or alteration. The probability of the impact is possible as the increased traffic volumes at the railway crossing does not guarantee an incident will occur but the condition increase safety and operational risks and could occur once in every five (5) years.

The sensitivity of the impact is low as the impact is of local importance. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.11.4 Increased pedestrian, cyclist, and public transport activity associated with full development may affect network performance if recommended supporting infrastructure is not implemented.

Increased residential, educational, commercial, and community land uses will result in higher levels of pedestrian, cyclist, and public transport activity across the development and along the D1527. The TIA confirms that no formal pedestrian, cyclist, or public transport facilities currently exist within the site vicinity and that full Project development traffic volumes assessed will substantially increase overall transport demand. In the absence of the supporting infrastructure recommended in the TIA, including sidewalks, shoulders for cyclists, public transport embayments, and a public transport hub, non-motorised and public transport activity may interact with vehicular traffic in a manner that influences traffic flow, intersection operations, and overall network performance.

The nature of the impact is adverse and direct because increased pedestrians, cyclists and public transport activity interactions with vehicular traffic may result in interruptions in traffic flow decreasing road network performance. The impact is reversible as these impacts are heaviest during peak hours (06:30-08:00, 12:30-14:00 and 16:30-18:00) and can be reduced by the implementation of pedestrian, cyclist and public transport infrastructure. The duration of the impact however is long term (>15 years) as the as it continuous daily as long as the development is operational. The extent of the impact is onsite as it does not expand beyond the Project site boundaries. The magnitude of change is low because increased non-motorised and public transport activity only causes minor measurable changes to traffic flow and interactions, without affecting the overall functionality of the road network. The probability of the impact occurring is unlikely because the Proponent will ensure that non-motorist and public transport embayments are implemented into the Project. The sensitivity of the impact is low as the impact is onsite and the development has considerable capacity to accommodate changes. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.11.5 Parking demand and internal circulation associated with full development may influence site access efficiency and external road network operations.

The scale and mix of land uses will generate substantial parking demand and internal vehicle circulation within the site. The TIA sets out recommended parking provision rates for each land use and assesses full development traffic conditions under Scenario 5. If parking supply, internal road layouts, and access management are not implemented in accordance with these recommendations, internal circulation inefficiencies may occur, potentially resulting in queuing at site access points and spill-back effects onto the D1527 and nearby intersections. The impact is adverse because inadequate parking and internal circulation could cause congestion and delays at site access points and internal estate roads and is a result of the estates design and vehicle movements. The impact is reversible but long term (>15 years) as traffic congestion and circulation inefficiencies can be corrected if proper parking provision and access management is improved in future. However once constructed traffic and parking arrangements are likely to operate in that format for many years until mitigation measures are implemented or the internal road network is redesigned. The extent of the impact is onsite, and the magnitude of change is low because while the development may cause some measurable traffic congestion resulting in minor alterations to the site internal circulation and parking efficiency rather than major or permanent disruptions. The probability of the impact occurring is unlikely. The sensitivity of the impact is low due to the fact that the impact is only of importance on Project site level. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.2.4.12 Cumulative impacts – Intraspecific

8.2.4.12.1 Increased traffic on the B6 from the combined traffic of the Project and the Finkenstein Estate during peak hours

The intraspecific cumulative traffic impact results from the combined traffic generated by the proposed Estate/Project and Finkenstein Estate on the opposite side of the B6 within the Windhoek road network. While each development can individually be accommodated within acceptable operational limits, the cumulative effect of peak-hour residential, school-related, service, and public transport trips is additive on shared infrastructure, particularly along the B6 corridor and at B6 access points serving both developments. The overlap of morning and afternoon peak periods may increase traffic volumes, turning movements, queue lengths, and delays, with potential spill-back effects affecting through-traffic on the B6 if access management and capacity enhancements are not coordinated. Increased cumulative traffic may also elevate safety risks associated with higher vehicle interactions, informal public transport stopping activity, and pedestrian movements adjacent to the B6, as well as contribute to accelerated road surface wear over time.

The impact is adverse because combined traffic increases on the B6 may cause increased traffic volumes, additional delays and safety risks, and cumulative because traffic from both developments adds together on the same road during peak periods, resulting in greater effects than either development alone. The impact is reversible because traffic-related effects

can be reduced through infrastructure upgrades, access management, and operational controls, allowing traffic conditions to return to acceptable levels. It is long term (>15 years) because the traffic is generated will persist for the operational life of the estates. The extent of the impact is local as it extends beyond the Project boundaries, and the magnitude of change is low because even though there will be some measurable changes in traffic volumes which may result in congestion and delays the road network is neither lost nor is the quality of the network or road surface and its integrity compromised or damaged. The probability of the impact occurring is possible because with the operation of the Hage Geingob Freeway, this and other upgrades coming to the B6/D1527/Dr Hage Geingob Freeway, this should relieve any possible congestion, easing traffic. The sensitivity of the impact is low as the impact is local and therefore the significance of the impact has been rated adverse low (before mitigation) (Table 18). Mitigation measures have been included in the preliminary ESMP (Appendix A).

Key mitigation measures include:

- Construction Traffic Management Plan (CTMP) to be approved prior to works.
- Designated haul routes avoiding sensitive receptors where feasible.
- Speed limits for construction vehicles on public roads and internal access roads.
- Advance warning signage at B6 and D1527 intersections.
- Coordination with RA and traffic police during peak works.

Table 18 - Traffic impacts

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
Movement of construction vehicles	Traffic	Temporary increase in traffic volumes on the B6, D1527 and associated access roads	Adverse Direct Reversible Long term Local Possible	Low	Low	Adverse low (2)
	Road surface	Road surface deterioration associated with heavy construction vehicles	Adverse Direct Reversible Long term Local Possible	Low	Low	Adverse low (2)
Phase one (1) operations	Traffic	Phase one (1) Project generated traffic may	Adverse Direct Reversible	Low	Low	Adverse minor (3)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
of the Project		increase weekday peak hour traffic volumes on the D1527	Temporary Local Likely			
	Traffic	The formalisation of the north access and associated T-intersections may introduce additional turning movements affecting traffic flow	Adverse Direct Reversible Long term On site Unlikely	Low	Negligible	Adverse low (2)
Phase one (1) operations of the Project	Traffic	Increased traffic with residential land uses may influence intersection delays and operational performance at site access points	Adverse Direct Reversible Long term On site Likely	Low	Low	Adverse minor (3)
	Pedestrians, cyclists and vehicles	Limited pedestrian and cyclist infrastructure during early development phases may affect non-motorised	Adverse Direct Reversible Short-term On site Unlikely	Low	Negligible	Adverse Low (1)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		transport movement patterns within the site and along the D1527				
	Railway crossing	Incremental increases in traffic volumes across the existing at-grade railway crossing may affect crossing operational performance under peak-hour conditions	Adverse Direct Reversible Long term On site Possible	Low	Low	Adverse Low (2)
Phase two (2) operations of the Project	Traffic	Traffic generated by the primary and high school components may increase morning and afternoon peak hour traffic demand on the D1527 and site access intersections	Adverse Direct Reversible Temporary On site Likely	Low	Low	Adverse minor (3)
		Increased Project traffic	Adverse Direct	Low	Low	Adverse low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		volumes and turning movements may affect intersection capacity and level of service if recommended upgrades are not implemented	Reversible Long term On site Possible			
Phase two (2) operations of the Project	Pedestrians, non-motorised users and vehicles	Pedestrian activity associated with schools and communal recreational spaces may increase interactions between vehicular traffic and non-motorised users	Adverse Direct Reversible Temporary On site Likely	Low	Low	Adverse low (2)
	Traffic	Public transport pick-up and drop-off activity may influence traffic operations along the D1527 in the absence of	Adverse Direct Reversible Temporary On site Unlikely	Low	Low	Adverse low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		formal embayments				
Phase three (3) operations of the Project		Full Project traffic volumes may exceed the operational capacity of the existing B6/D1527 intersection geometry without the implementation of major intersection upgrades	Adverse Direct Reversible Long term Local Unlikely	Low	Low	Adverse low (2)
Phase three (3) operations of the Project	Traffic	Increased turning movements and traffic volumes may affect intersection delay, Volume to capacity ratios and overall levels of service at key junctions	Adverse Direct Reversible Long term On site Unlikely	Low	Low	Adverse low (1)
	Railway crossing	Higher traffic volumes across the at-grade road-over-rail level crossing may affect both operational capacity and	Adverse Direct Reversible Long term Onsite Possible	Low	Low	Adverse low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
		traffic–rail safety performance as defined by SANS 3000 criteria				
	Pedestrians, cyclists, public transport and vehicles	Increased pedestrian, cyclist, and public transport activity associated with full development may affect network performance if recommended supporting infrastructure is not implemented	Adverse Direct Reversible Long term On site Unlikely	Low	Low	Adverse low (1)
	Traffic	Parking demand and internal circulation associated with full development may influence site access efficiency and external road network operations	Adverse Direct Reversible Long term On site Unlikely	Low	Low	Adverse low (1)
Phase three (3)		Increased traffic on the	Adverse Cumulative	Low	Low	Adverse low (2)

Activity	Receptor	Impact	Nature of impact	Value and sensitivity	Magnitude of change	Significance of impact
operations of the Project		B6 from the combined traffic of the Project and the Finkenstein Estate during peak hours	Reversible Long term Local Possible			

8.3 BIOPHYSICAL ENVIRONMENT

8.3.1 SOIL IMPACTS

Soils are a fundamental component of the terrestrial environment, providing the medium for vegetation growth, supporting ecosystems, and regulating water infiltration and storage. The proposed development has the potential to both negatively and positively affects soil quality and function through activities such as construction, landscaping, vehicle movement, waste handling, and irrigation. This section identifies and evaluates key impacts on soil, including compaction, contamination, alterations in soil chemistry, changes in infiltration and moisture regimes, and potential improvements in soil health from landscaped and "green" areas.

Figure 42 below provides an overview of the identified impacts and their corresponding significance ratings. This figure is intended for illustrative purposes only; a full understanding requires reference to the detailed explanations of each impact and its assessment in sections 8.3.1.1 to 8.3.1.6.

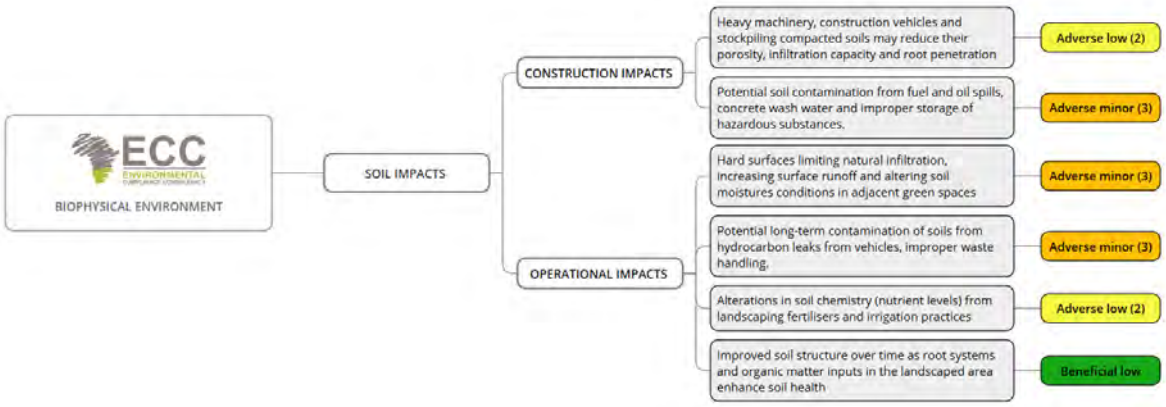

Figure 42 - Soil impacts

Construction phases

8.3.1.1 Heavy machinery, construction vehicles and stockpiling compacted soils may reduce their porosity, infiltration capacity and root penetration.

Heavy machinery, construction vehicles and the stockpiling of materials exert significant pressure on the soil surface. This pressure compresses soil particles, reducing the spaces (pores) between them. As a result, the soil becomes compacted. Compacted soils have lower porosity, which limits the movement of air and water through the soil profile, reducing the soils infiltration capacity, causing rainfall runoff rather than soak into the ground, which can increase erosion and reduce groundwater recharge. Additionally, compacted soils restrict root penetration, making it difficult for vegetation to establish or regenerate, which it turns can lead to reduced plant cover and soil stability in disturbed areas, which is vital for the proposed green spaces in this Project.

The nature of the impact is adverse and direct as compaction reduces the infiltration capacity of the soil. The impact is reversible over time through biological activity, weathering, and organic matter buildup, but recovery is slow and limited in heavily compacted soils. The duration of the impact is long term (>15 years) as the impact is likely to last after the activity causing the impact has ceased but is recoverable. The magnitude of change is moderate the use of heavy machinery and soil stockpiling partially damages key soil characteristics such as porosity, infiltration, and root penetration but does not destroy the soil's overall function or integrity. The probability of the impact occurring is possible depending on how and when machinery is used. The sensitivity of the impact is low as the impact occurs on site and the soil has the capacity to accommodate change. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 19). The mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.1.2 Potential soil contamination from fuel and oil spills, concrete wash water and improper storage of hazardous substances.

Potential soil contamination may occur if fuel and oil spills, concrete wash water or hazardous substances are not properly managed during construction activities. Accidental leaks, spills or improper storage can alter soil function. Contaminants may also migrate vertically through the soil profile, increasing the risk of groundwater pollution, particularly among permeable soils. Once contaminated, soils may require remediation and natural recovery can be slow if contamination is not properly contained and cleaned up.

The nature of the impact is adverse and direct because it negatively affects the soils quality and function reducing its ability to support vegetation and store water. The impact is partly reversible natural processes like microbial breakdown and leaching can reduce contamination concentrations allowing the soil to recover some function, however hydrocarbons or heavy metals may persist in the soil for a long time resulting in soil never fully returning to its original condition. The duration of the impact is long term (> 15 years) lasting long after the activity causing the impact has ceased but is recoverable. The extent of the impact is on site and the magnitude of change is moderate because the soil contamination

would partially damage key soil characteristics (such as nutrient balance, structure, or permeability) but would not destroy the soil's integrity or functionality. The probability of the impact occurring is likely construction activities involve frequent handling and storage of fuels, oils, concrete, and other hazardous substances, so there is a high chance that accidental spills or leaks could happen if strict management measures are not in place. The sensitivity of the impact is low as the impact is on site and is recoverable therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 19). The mitigation measures have been included in the preliminary ESMP (Appendix A).

Operational phase

8.3.1.3 Hard surfaces limiting natural infiltration, increasing surface runoff and altering soil moisture conditions in adjacent green spaces.

The introduction of hard, impermeable surfaces such as roads, parking areas and building foundations limits the natural infiltration of rainfall into the soil. As a result, a greater proportion of surface water becomes runoff rather than soaking into the ground. Increased runoff can lead to localised erosion and may alter natural drainage patterns. At the same time, reduced infiltration lowers soil moisture levels in adjacent green spaces, which can negatively affect vegetation health and soil biological activity. Changes in soil moisture conditions may also reduce the ability of these areas to support natural or landscaped vegetation, particularly during dry periods.

The nature of the impact is adverse and direct because the creation of hard surfaces negatively affects the natural soil functions, such as water infiltration and moisture retention, which can stress vegetation, increase erosion, and alter local hydrology.

The impact is reversible as while some recovery of soil infiltration and moisture conditions can occur naturally or through landscaping, permanent changes may remain, for example, compaction below hard surfaces or altered drainage patterns. The duration of the impact is long term (>15 years) because the estate development is a semi-permanent land use, meaning that changes to soil structure, infiltration, and moisture conditions will persist for the entire operational life of the estate, which is likely to span many decades. The extent of the impact is on site and the magnitude of change is moderate as the creation of hard surfaces partially alters key soil characteristics, such as infiltration, moisture retention, and aeration but does not destroy the soil's overall function or integrity, meaning the soil is affected but still retains some ability to support vegetation and ecological processes. The probability of the impact occurring is possible while conditions exist for reduced infiltration and altered soil moisture, it depends on the Project layout and extent of hard surface coverage and the sensitivity of the impact is low since the impact is onsite and therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 19). The mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.1.4 Potential long-term contamination of soils from hydrocarbon leaks from vehicles, improper waste handling.

Long-term soil contamination may result from ongoing hydrocarbon leaks from vehicles and machinery, as well as from improper handling or disposal of wastes containing oils, fuels or other hazardous substances. Small but repeated leaks and spills can accumulate over time, allowing hydrocarbons to penetrate the soil and persist in the environment. This can degrade soil quality by altering soil chemistry, reducing microbial activity and limiting the soil's ability to support vegetation. In permeable soils, contaminants may migrate deeper into the soil profile, increasing the risk of groundwater contamination. Because hydrocarbons can remain in soils for extended periods, recovery may be slow without active remediation, making this a potentially long-term impact if not effectively managed.

The nature of the impact is adverse and direct because long-term soil contamination negatively affects soil quality and function, including soil chemistry, microbial activity, and the soil's ability to support vegetation. The impact is partly reversible because, over time, natural processes like microbial degradation, dilution, volatilization, and leaching can reduce hydrocarbon concentrations in the soil, allowing some recovery of soil function but limited because hydrocarbons and other hazardous substances can persist for long periods, so full recovery to pre-contamination conditions is unlikely without active cleanup. The duration of the impact is long term (>15 years) because while natural processes like microbial breakdown, leaching, and dilution can gradually reduce hydrocarbon contamination, complete recovery of soil function without active remediation is slow, meaning the soils may remain partially degraded for several years before noticeable improvement occurs.

The extent of the impact is on site and the magnitude of change is moderate because hydrocarbon contamination partially damages key soil characteristics, such as chemistry, microbial activity, and fertility but does not destroy the soil's overall integrity or ability to function, meaning the soil is affected but not entirely lost or rendered unusable. The probability of the impact occurring is possible because hydrocarbon leaks or improper waste handling could occur during construction or operation. The sensitivity of the impact is low because the impact is confined to the Project's sites boundaries and the significance of the impact has been rated adverse minor (before mitigation) (Table 19). The mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.1.5 Alterations in soil chemistry (nutrient levels) from landscaping fertilisers and irrigation practices

The repeated application of fertilisers can increase nutrient concentrations in the soil, particularly nitrogen and phosphorus, which may disrupt the natural nutrient balance of the soil. Over-irrigation can further influence soil chemistry by leaching nutrients beyond the root zone or mobilising salts, especially in arid and semi-arid environments such as the Khomas Highlands. These changes can reduce soil health by affecting microbial activity and soil structure, and may favour certain plant species over others, potentially altering the

composition and condition of adjacent green spaces. Soil stabilisation in green spaces as vegetation cover reduces erosion and improve soil stability.

The nature of the impact is adverse and direct because repeated fertiliser application and over-irrigation negatively affect soil health, altering nutrient balance, microbial activity, and soil structure, which can reduce the soil's natural function and change vegetation composition in adjacent green space. The impact is partly reversible as natural processes such as nutrient leaching, microbial uptake, and plant absorption can gradually restore soil nutrient balance, and soil structure and microbial activity can recover naturally once fertiliser application is reduced or stopped. However, recovery may be slow and incomplete in areas with persistent nutrient buildup or salinisation, especially in arid and semi-arid environments. The extent of the impact is on site, and the magnitude of change is moderate as repeated fertiliser application and over-irrigation partially alter key soil characteristics, such as nutrient balance, microbial activity, and structure but do not destroy the soil's overall integrity or ability to support vegetation, meaning the soil is affected but remains partly functional. The duration of the impact is medium term (5-15 years) because, although natural processes like nutrient leaching, plant uptake, and microbial activity can gradually restore soil health, recovery of soil structure, nutrient balance, and vegetation composition takes several years, particularly in arid and semi-arid environments like the Khomas Highlands. The probability of the impact occurring is possible because impact depends on how fertiliser is applied. If it is applied carefully, at appropriate rates and intervals, the risk of altering soil nutrient balance is low; but if it is applied excessively, repeatedly, or unevenly, the risk of adverse soil changes increases.

The sensitivity is low as the impact occurs on site and the significance of the impact is adverse low (before mitigation) (Table 19). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.1.6 Improved soil structure over time as root systems and organic matter inputs in the landscaped area enhance soil health

Over time, landscaped areas can improve soil structure and overall soil health. The growth of plant root systems naturally aerates the soil and creates channels that enhance water infiltration and root penetration. The addition of organic matter from compost, mulch, or decaying plant material increases nutrient content and supports soil microbial activity, which further improves soil fertility and structure. As a result, the soil becomes more resilient, better able to retain moisture, and more supportive of healthy vegetation growth, contributing to the long-term ecological quality of the landscaped area.

The nature of the impact is beneficial and direct because the landscaping activities enhance soil health, improving structure, aeration, nutrient content, microbial activity, moisture retention, and overall fertility, which supports healthy vegetation and long-term ecological quality. The impact is reversible because if inputs or maintenance stop, the soil may slowly lose some of these benefits. The duration of the impact is long term (>15 years) because the

improvements to soil structure, fertility, and ecological function from landscaping persist for many years, especially in well-managed green spaces, and the benefits continue to support vegetation growth and soil health throughout the life of the Project. The extent of the impact is on site and the magnitude of change is moderate because landscaping results in a clear benefit and improvement to key soil structure, fertility, infiltration, and biological activity, enhancing soil quality. Probability of the impact occurring is likely because landscaping to create green spaces and planting are integral components of the Project and where vegetation is established and maintained, root growth and organic matter inputs will almost certainly occur over time, making improvements in soil structure and soil health expected. The sensitivity is low because the impact is on site, therefore, the significance of the impact is beneficial low (Table 19).

Table 19 - Soil impacts

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
Construction	Soil	Heavy machinery, construction vehicles and stockpiling compacted soils may reduce their porosity, infiltration capacity and root penetration	Adverse Direct Reversible Long term On site Possible	Low	Moderate	Adverse Low (2)
	Soil	Potential soil contamination from fuel and oil spills, concrete wash water and improper storage of hazardous substance	Adverse Direct Partly reversible Long term On site Likely	Low	Moderate	Adverse minor (3)
Operations		Hard surfaces limiting natural infiltration,	Adverse Direct Irreversible Long term	Low	Moderate	Adverse minor (3)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
		increasing surface runoff and altering soil moistures conditions in adjacent green spaces	On site Likely			
		Potential long-term contamination of soils from hydrocarbon leaks from vehicles, improper waste handling.	Adverse Direct Partly reversible Long term On site Possible	Low	Moderate	Adverse minor (3)
		Alterations in soil chemistry (nutrient levels) from landscaping fertilisers and irrigation practices	Adverse Direct Partly reversible medium term On site Possible	Low	Moderate	Adverse low (2)
Operations	Soil	Improved soil structure over time as root systems and organic matter inputs in the landscaped area enhance soil health	Beneficial Direct Reversible Medium term On site Possible	Low	Moderate	Beneficial low (2)

8.3.2 BIODIVERSITY IMPACTS

The biodiversity impact assessment addresses the potential impacts to fauna, flora and avifauna. These impacts typically involve aspects such as the alteration or disturbance of

habitats and ecosystems. Most of these aspects will be triggered by the Project despite the site being already disturbed.

Figure 43 and Figure 44 below provides an overview of the identified impacts and their corresponding significance ratings. This figure is intended for illustrative purposes only; a full understanding requires reference to the detailed explanations of each impact and its assessment in sections 8.3.2.1 to 8.3.2.17.

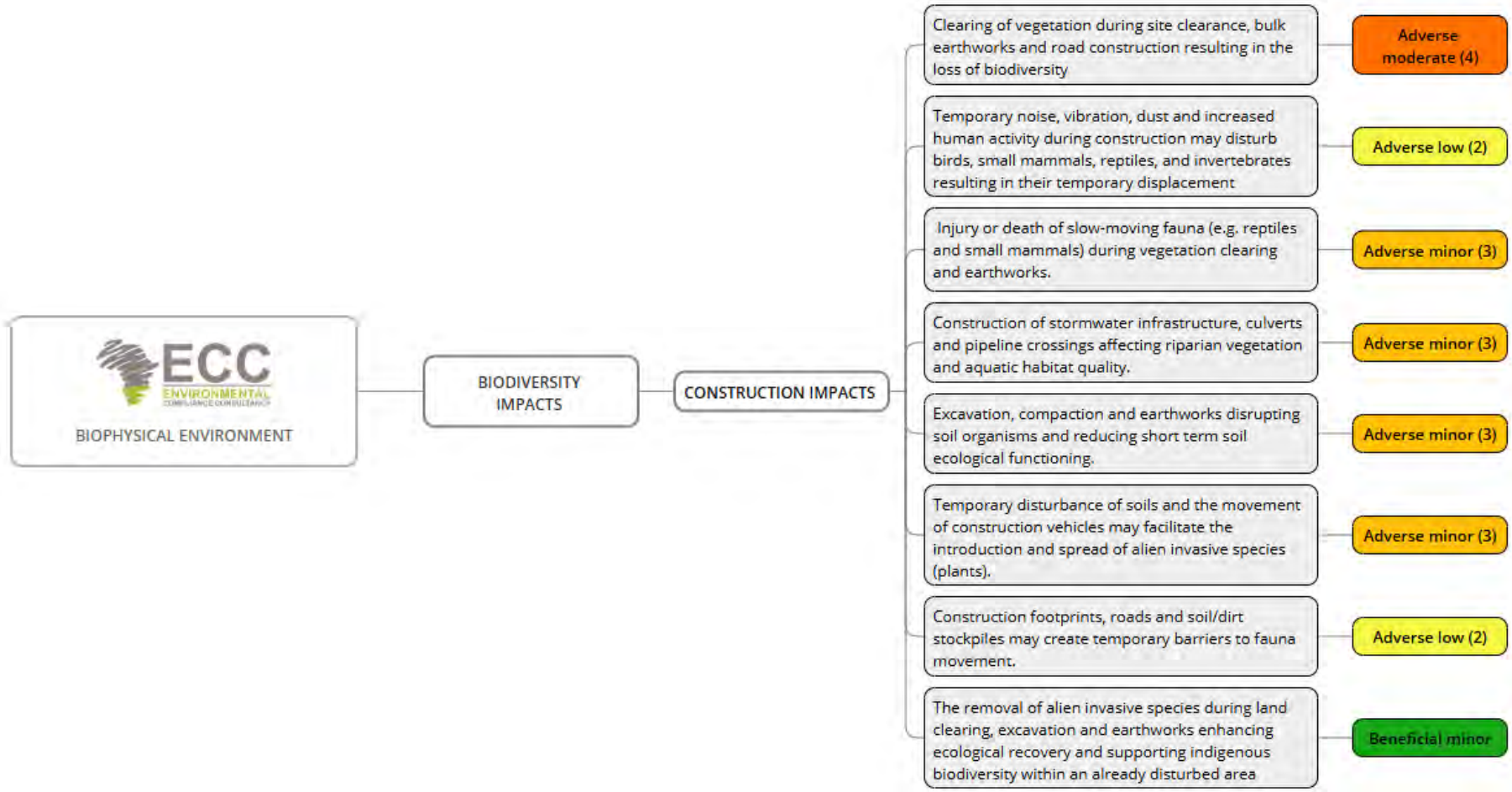

Figure 43 - Biodiversity impacts from the construction phases

Construction phases

8.3.2.1 Clearing of vegetation during site clearance, bulk earthworks and road construction resulting in the loss of biodiversity

Vegetation clearing during site clearance, bulk earthworks, and road construction will result in a localised and loss of already disturbed vegetation. As the area has been previously impacted by human activities, biodiversity value and habitat sensitivity are low. Some displacement of common, disturbance-tolerant fauna may occur, and less mobile species may be affected within the footprint.

The nature of the impact is adverse and direct because vegetation clearing during construction causes an immediate loss of habitat and disturbance to fauna within the project footprint, even though the area is already disturbed and of low biodiversity value. The impact is irreversible because once vegetation is cleared and habitats are removed within the Project footprint, the original ecological conditions and species composition cannot be fully restored to the pre-construction state, even if rehabilitation is undertaken. vegetation clearing results in a partial loss of ecological resources and damage to key characteristics of the site but does not compromise the overall integrity of the area, as it is already disturbed and has low biodiversity value. The duration of the impact is permanent because the vegetation within the Project footprint will be permanently removed or transformed by the Project, and the land use change prevents the area from returning to its original ecological state. The extent of the impact is on-site and the probability of the impact occurring is definite, while the sensitivity of the impact is low as the impact occurs on a local scale. Therefore, the significance of the impact has been rated adverse moderate (before mitigation) (Table 20). The mitigation measures are listed below and have been included in the preliminary ESMP (Appendix A).

Mitigation measures:

- Clearly demarcate construction and road corridors prior to works and restrict vegetation clearing strictly to the authorised Project footprint to avoid unnecessary disturbance of adjacent areas.
- Conduct a pre-construction walk-through by an environmental officer to identify any fauna, nests, burrows, or sensitive micro-habitats within the clearing area and implement avoidance where feasible.
- Undertake vegetation clearing in a phased manner, allowing mobile fauna to naturally disperse from the area ahead of earthworks.
- Where less mobile fauna (e.g. reptiles, small mammals) are encountered during clearing, implement capture and relocation procedures to suitable nearby habitats outside the construction footprint.
- Where practical, schedule major vegetation clearing outside peak breeding seasons to reduce impacts on nesting or sheltering fauna.

- Implement progressive rehabilitation of disturbed areas not required for ongoing construction, using indigenous or locally adapted species appropriate to the disturbed urban setting.
- Prevent the spread of invasive species by cleaning construction equipment, managing disturbed soils, and removing invasive plants during rehabilitation.
- Provide all contractors with environmental awareness training highlighting vegetation clearing limits, fauna protection procedures, and reporting requirements.
- Regularly inspect cleared and rehabilitated areas to ensure compliance with approved clearing boundaries and the effectiveness of rehabilitation measures.

8.3.2.2 Temporary noise, vibration, dust and increased human activity during construction may disturb birds, small mammals, reptiles, and invertebrates resulting in their temporary displacement.

Temporary noise, vibration, dust generation, and increased human activity during construction may cause short-term disturbance to fauna within the project area, resulting in the temporary displacement of birds, small mammals, reptiles, and invertebrates. Given that the area is already disturbed, fauna present are likely to be disturbance-tolerant species accustomed to human activity.

The impact is adverse and direct because construction activities will disturb and temporarily displace fauna within the Project area. The impact is reversible because once construction ceases, noise, vibration, dust, and human activity stop, allowing fauna to return to the area and resume normal behaviour. The magnitude of change is low because construction-related disturbance causes only minor, temporary displacement of fauna and does not significantly alter key ecological characteristics or the overall quality of the already disturbed habitat. The duration of the impact is long term (>15 years) lasting on during the construction phase of the Project. The extent of the impact is on site and the probability of the impact occurring is possible. The sensitivity of the impact is low as the impact occurs on site and therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 20). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.3 Injury or death of slow-moving fauna (e.g. reptiles and small mammals) during vegetation clearing and earthworks.

Vegetation clearing and earthworks may result in the injury or death of slow-moving fauna, such as reptiles and small mammals, that are unable to escape active construction areas. As the site is already disturbed, the likelihood of encountering sensitive or high-value species is low, and fauna present are expected to be common, disturbance-tolerant species.

The nature of the impact is adverse and direct because construction activities may injure or result in the death of slow-moving fauna. The impact is irreversible because any fauna that are injured or killed during construction cannot be restored or replaced.

The magnitude of change is low because only a small number of common, disturbance-tolerant species are likely to be affected, resulting in minor loss of fauna without significantly altering the overall ecological characteristics of the already disturbed area. The duration of the impact is long term (>15 years) during the construction phase and the extent of the impact is on site. The probability of the impact occurring is possible and the sensitivity of the impact is low as the impact occurs on site. Therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 20). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.4 Construction of stormwater infrastructure, culverts and pipeline crossings affecting riparian vegetation and aquatic habitat quality.

The construction of stormwater infrastructure, culverts, and pipeline crossings may result in disturbance to riparian vegetation and temporary degradation of aquatic habitat quality due to excavation, altered flow patterns, and increased sedimentation. Given that affected drainage lines and riparian areas are already disturbed or modified, ecological sensitivity is low.

The nature of the impact is adverse and direct because construction of pipelines and culverts may disturb the riparian vegetation and aquatic habitat with the Project footprint. The impact is partly reversible because once construction is complete, some riparian vegetation can regrow and sediment levels may return to normal over time, but the original structure, composition, and ecological functioning of the aquatic habitat may not be fully restored to its pre-disturbance state. The magnitude of change is moderate because construction partially alters riparian vegetation and aquatic habitat but does not fully compromise the integrity of the already disturbed areas. The duration of the impact is long term (>15 years) because disturbance to riparian vegetation and aquatic habitats occurs only during construction activities, and natural recovery or rehabilitation processes can restore much of the affected areas within a few years after construction is completed and the extent of the impact is on site. The sensitivity of the impact is low as the impact occurs on site and therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 20). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.5 Excavation, compaction and earthworks disrupting soil organisms and reducing short term soil ecological functioning.

Excavation, compaction, and earthworks during construction will cause disturbance to soils, disrupting soil organisms and temporarily reducing soil ecological functioning. As the Project area is already disturbed, soil biodiversity and structure are already compromised, limiting the severity of the impact.

The nature of the impact is adverse and direct because excavation, compaction, and earthworks disrupt soil structure and organisms, causing a negative effect on soil ecological functioning within the construction footprint. The impact is partly reversible because once construction ends, soil structure and ecological functioning can recover over time, but some changes, such as loss of certain soil organisms or compaction in heavily trafficked areas may not be fully restored. The magnitude of change is moderate because construction partially alters soil structure and function without fully compromising its integrity. The duration of the impact is long term (>15 years) because soil disturbance from construction activities occurs only during the active construction period, and soils can gradually recover or stabilise once these activities cease and the extent of the impact is on site. The probability of the impact occurring is possible as excavation, compaction, and earthworks may disturb soils and soil organisms, but the effect is not guaranteed at all locations, especially where soils are already degraded or less sensitive. While the sensitivity of the impact is low as the impact occurs on site and therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 20). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.6 Temporary disturbance of soils and the movement of construction vehicles may facilitate the introduction and spread of alien invasive species (plants).

Temporary soil disturbance and the movement of construction vehicles may facilitate the introduction and spread of alien invasive plant species, particularly in disturbed areas created during construction. Given that the site is already disturbed, the risk is present but limited, as invasive species are more likely to establish in open, disturbed soils.

The nature of the impact is adverse and direct construction activities creating disturbed soil can be colonised by invasive plant species. The impact is reversible because the spread of invasive plants can be controlled or eradicated, allowing the affected areas to recover over time and reducing the long-term ecological impact. The magnitude of change is low because the area is already severely disturbed by the presence of invasive species. The duration of the impact is long term because the potential for invasive plant establishment is linked to construction disturbances, and with timely management or natural succession, affected areas can recover within a few years after construction ends and the extent of the impact is on site. The sensitivity of the impact is low because the impact is on site and the significance of the impact has been rated adverse minor (before mitigation) (Table 20). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.7 Construction footprints, roads and soil/dirt stockpiles may create temporary barriers to fauna movement.

Construction footprints, access roads, and soil or dirt stockpiles may create temporary physical barriers to fauna movement within and across the project area. As the site is already

disturbed, fauna presents are likely to be common, disturbance-tolerant species with alternative movement routes available in surrounding modified habitats.

The impact is adverse and direct because construction activities create physical barriers that restrict the movement of fauna within the Project footprint, negatively affecting their behaviour and access to resources, even though the species affected are common and disturbance tolerant. The impact is partly reversible because once construction ends and access roads or stockpiles are removed, fauna can regain movement through the area. The magnitude of change is low because the physical barriers affect only a small portion of the Project area at a time, and the fauna present are common, disturbance-tolerant species with alternative movement routes in the surrounding modified habitats. The duration of the impact is long term (>15 years) lasting the duration of the construction phase and the extent of the impact is on site. The probability of the impact occurring is possible while construction footprints, access roads, and stockpiles may temporarily block fauna movement, not all animals will be affected, and some species can easily bypass or avoid the barriers. The sensitivity of the impact is low because the impact occurs on site and therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 20). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.8 The removal of alien invasive species during land clearing, excavation and earthworks enhancing ecological recovery and supporting indigenous biodiversity within an already disturbed area.

The removal of alien invasive species during land clearing, excavation, and earthworks will have a positive ecological impact by reducing competition with indigenous vegetation and improving conditions for ecological recovery within an already disturbed area. This will support the re-establishment of indigenous plant species, enhance habitat quality for fauna, and reduce the risk of further invasive spread.

The nature of the impact is beneficial and indirect because the removal of alien invasive species improves ecological conditions within the Project footprint, promoting the recovery of indigenous vegetation and enhancing habitat quality for fauna. However, the impact is reversible because although removing invasive species benefits the ecosystem, the site could be recolonised by invasive plants in the future if management is not maintained. The magnitude of change is moderate because the removal of invasive species improves key ecological characteristics, such as native vegetation cover and habitat quality but the area is already disturbed, so the improvement enhances attributes without fully restoring the ecosystem to its original, undisturbed state.

The duration of the impact is short term (1-5 years) because the ecological benefits from invasive species removal, such as improved vegetation growth and habitat quality, occur relatively quickly after removal, but ongoing maintenance is needed to sustain these benefits over the longer term, and the extent of the impact is on site. The probability of the impact

occurring is possible because while invasive species removal can improve ecological conditions, the extent of the benefit depends on effective implementation and follow-up management, while the sensitivity of the impact is low because it occurs on site. Therefore, the significance of the impact has been rated beneficial minor (Table 20).

Table 20 - Biodiversity impacts from construction activities

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
Clearing of vegetation during site clearance, bulk earthworks and road construction	Biodiversity and terrestrial ecology	Loss of biodiversity	Adverse Direct Irreversible Permanent On site Definite	Low	Moderate	Adverse moderate (4)
Construction activities		Temporary noise, vibration, dust and increased human activity during construction may disturb birds, small mammals, reptiles, and invertebrates resulting in their temporary displacement	Adverse Direct Reversible long term On site Possible	Low	Low	Adverse low (2)
vegetation clearing and earthworks		Injury or death of slow-moving fauna (e.g. reptiles and small mammals)	Adverse Direct Irreversible Permanent On site Possible	Low	Low	Adverse minor (3)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
Construction of stormwater infrastructure, culverts and pipeline crossings		Affecting riparian vegetation and aquatic habitat quality	Adverse Direct Partly reversible Long term On site Possible	Low	Moderate	Adverse minor (3)
Excavation, compaction and earthworks		Disrupting soil organisms and reducing short term soil ecological functioning	Adverse Direct Partly reversible Long term On site Possible	Low	Moderate	Adverse minor (3)
Movement of construction vehicles		Temporary disturbance of soils and introduction and spread of alien invasive species (plants)	Adverse Direct Reversible Long term On site Likely	Low	Low	Adverse minor (3)
Construction footprints, roads and soil/dirt stockpiles		Temporary barriers to fauna movement	Adverse Direct Irreversible Long term On site Possible	Low	Low	Adverse low (2)
The removal of alien invasive species during land clearing, excavation and earthworks		Enhancing ecological recovery and supporting indigenous biodiversity within an already	Beneficial Indirect Reversible Long term On site Possible	Low	Moderate	Beneficial minor (3)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
		disturbed area				

Operational phases

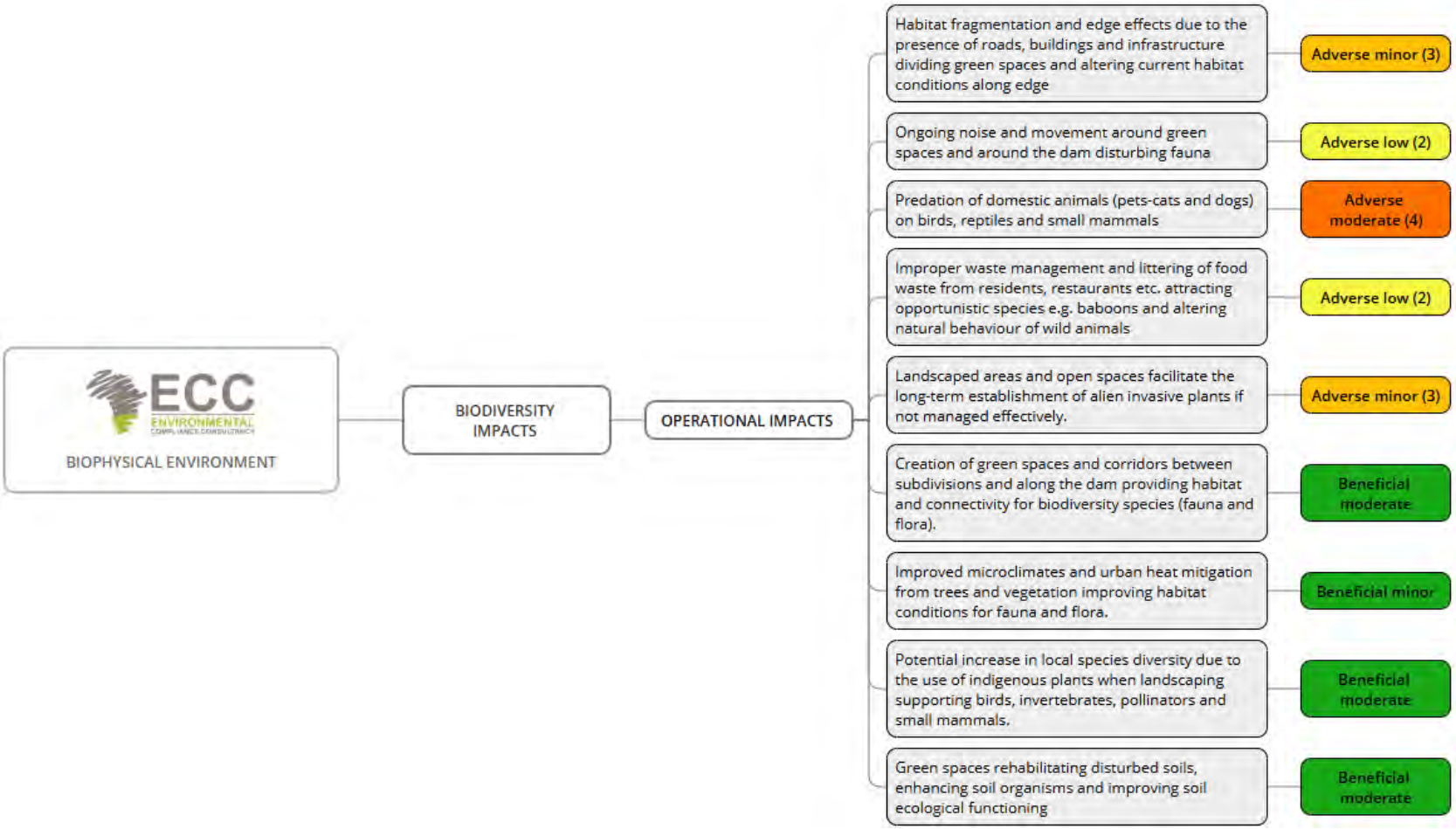

Figure 44 - Biodiversity impacts during operation

8.3.2.9 Habitat fragmentation and edge effects due to the presence of roads, buildings and infrastructure dividing green spaces and altering current habitat conditions along edges

The presence of roads, buildings, and associated infrastructure may result in habitat fragmentation and edge effects, dividing remaining green spaces and altering habitat conditions along their boundaries (e.g. increased light, wind, and human disturbance). Given that the area is already disturbed and fragmented, the extent of new fragmentation is limited and adds only a small additional change to conditions that are already altered.

The nature of the impact is adverse and direct because the presence of roads, buildings, and infrastructure during operation continues to fragment habitats and alter edge conditions, negatively affecting ecological quality and connectivity. The impact is irreversible because once habitats are fragmented by the presence of roads, buildings, and operational infrastructure, the ecological structure and connectivity cannot be fully restored to their original state. The magnitude of change is low because the area is already disturbed, and the operational impact adds only a small additional effect. The impact is long-term (>15 years) because the presence of roads, buildings, and operational infrastructure continues indefinitely, maintaining habitat fragmentation and edge effects for as long as the infrastructure exists and the extent of the impact is on site. The probability of the impact occurring is possible while habitat fragmentation and edge effects can occur, their extent may vary depending on management, species presence, and human activity. Moreover, the sensitivity of the impact low because the impact occurs on site and therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 21). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.10 Ongoing noise and movement around green spaces and around the dam disturbing fauna

Ongoing noise and human movement around green spaces and the dam may cause continued low-level disturbance to fauna, potentially altering behaviour and resulting in avoidance of high-activity areas. Given that these areas are already exposed to regular human presence, fauna is expected to be habituated and disturbance-tolerant species.

The nature of the impact is adverse and direct because ongoing noise and human activity immediately disturb wildlife, causing changes in behavior and avoidance of certain areas, which negatively affects ecological functioning, even if the fauna is somewhat habituated. The impact is reversible because the effects are not permanent and can be undone if the disturbance is removed or controlled. The magnitude of change is low because the wildlife in the area is already accustomed to human activity, so ongoing noise and movement cause only minor behavioural changes without significantly affecting populations or ecosystem integrity. The duration of the impact is long term (> 15 years) lasting for the life of the Project and the extent of the impact is on site.

The probability of the impact is unlikely as ongoing human activity and noise may disturb some fauna because the fauna in the area are conditioned to human presence and activity since the area used to be a tourist attraction and accommodation. and the sensitivity of the impact is low because the impact occurs on site and the receptors (wildlife) have the capacity to accommodate change and are not particularly sensitive to the impact. Therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 21). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.11 Predation of domestic animals (pets-cats and dogs) on birds, reptiles and small mammals

The presence of domestic animals, particularly cats and dogs, may result in predation and disturbance of birds, reptiles, and small mammals within surrounding green spaces. In an already disturbed and urbanised environment, affected fauna are expected to be common, disturbance-tolerant species, and the extent of predation is likely to be limited.

The nature of the impact is adverse and direct as the presence of domestic animals may result in predation and disturbance to wildlife, negatively affecting individual animals and local ecological interactions. The impact is reversible if domestic animals are controlled or excluded from green spaces (e.g., through fencing, leashing, or access restrictions), wildlife populations can recover and return to the green spaces, allowing predation and disturbance effects to be undone over time. The magnitude of change is moderate because domestic animals cause noticeable predation and disturbance to wildlife, affecting key species without eliminating them. The duration of the impact is long term (>15 years) for the life of the Project, and the extent of the impact is onsite. The probability of the impact occurring is likely because domestic animals are frequently present in and around residential areas, making predation and disturbance to wildlife a regular and expected occurrence and the sensitivity of the impact is low because the impact will occur on site. Therefore, the significance of the impact has been rated adverse moderate (before mitigation) (Table 21). Mitigation measures have been listed below and included in the preliminary ESMP (Appendix A).

Recommended mitigation measures:

- Implement and enforce a site-specific pet management policy requiring all domestic dogs to be leashed at all times in communal green spaces and prohibiting free-roaming pets
- Encourage or require residents to keep cats indoors, within enclosed yards, or in purpose-built outdoor cat enclosures to limit hunting of birds, reptiles, and small mammals.
- Install fencing, signage, and controlled access points around sensitive green spaces to restrict entry of domestic animals into areas where wildlife activity is most likely.
- Provide clearly demarcated pet exercise areas away from green spaces to reduce pressure on fauna-use areas and discourage off-leash activity elsewhere on site.

- Conduct awareness campaigns (signage, welcome packs, notices) informing residents of the ecological value of green spaces and the impacts of pet predation on local wildlife.
- Prohibit outdoor feeding of pets and wildlife in green spaces, as this can attract animals and increase predator–prey interactions.
- Include pet-related environmental controls within site rules and body corporate or management agreements, with penalties for repeated non-compliance.
- Periodically monitor wildlife disturbance incidents and review mitigation effectiveness, adjusting controls if predation pressure increases.

8.3.2.12 Improper waste management and littering of food waste from residents, restaurants etc. attracting opportunistic species e.g. baboons and altering natural behaviour of wild animals

Improper waste management and littering of food waste from residents, restaurants, and other activities may attract opportunistic wildlife species, such as baboons, to the area. This can lead to altered natural foraging behaviour, increased human–wildlife interactions, and potential conflict. Given that the area is already disturbed and influenced by human activity, such behaviour is likely to be an extension of existing conditions.

The nature of the impact is adverse and direct because improper waste management alters wildlife behavior, causing animals like baboons to rely on human food sources, which negatively affects their natural foraging patterns and increases the risk of human–wildlife conflict. The impact is reversible because if waste management is improved and food waste is properly contained or removed, wildlife can return to natural foraging behavior, and the increased human–wildlife interactions can be reduced. The magnitude of change is negligible as the impact causes only very minor alterations to wildlife behavior (e.g., slight shifts in foraging patterns or occasional presence near waste) without significantly affecting populations, ecological functions. The duration of the impact is long term (> 15 Years) as long the Project is operational, and the extent of the impact is on site. The probability of the impact occurring is possible because while improper waste and litter can attract wildlife, some animals may ignore the waste and improper waste management is not guaranteed. The sensitivity of the impact is low as the impact occurs on site and therefore the significance of the impact has been rated adverse low (before mitigation) (Table 21). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.13 Landscaped areas and open spaces facilitate the long-term establishment of alien invasive plants if not managed effectively.

Landscaped areas and open green spaces may facilitate the long-term establishment and spread of alien invasive plant species if not effectively managed, particularly where soil disturbance and irrigation occur. In an already disturbed environment, invasive species pressure is an existing risk and may be incrementally increased if inappropriate species are used or maintenance is inadequate.

The nature of the impact is adverse and direct because landscaped areas and green spaces create conditions (soil disturbance, irrigation, planting) that allow invasive plants to establish and spread, which negatively affects native biodiversity and ecosystem integrity. The impact is partly reversible because while invasive plant species can be controlled or removed through active management, complete restoration to the original plant community is unlikely once invasives have established and altered soil conditions or competitive dynamic. The magnitude of change is low because the area is already disturbed and subject to existing invasive species pressure, so landscaping is likely to cause only a small, incremental increase in alien plant establishment. Native ecosystem integrity is not substantially altered, and any spread is expected to be localised and manageable. The duration of the impact, however, is likely to be long term (> 15 years) because once alien invasive plant species establish within landscaped and green areas, they can persist and spread over many years, requiring ongoing management. Without continuous control, invasive species remain part of the vegetation structure for the entire operational life of the Project. The extent of the impact is onsite and the probability of the impact occurring is possible since invasive plant establishment may occur if landscaping and maintenance are inadequate, but effective management can prevent it. Sensitivity is low because the impact is onsite and therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 21). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.2.14 Creation of green spaces and corridors between subdivisions and along the dam providing habitat and connectivity for biodiversity species (fauna and flora).

The creation of green spaces and corridors between subdivisions and along the dam will have a positive ecological impact by providing habitat and movement corridors for flora and fauna within an otherwise disturbed landscape. These areas can enhance local biodiversity, habitat connectivity, and ecological functioning, particularly for common and disturbance-tolerant species.

The nature of the impact is beneficial and indirect because creating green spaces and corridors does not immediately alter existing species, but over time it supports wildlife movement, habitat connectivity, and biodiversity, improving ecological conditions in the surrounding disturbed landscape.

The impact is reversible if green spaces or corridors are removed, neglected, or altered, the benefits to habitat, connectivity, and biodiversity would be lost. The magnitude of change is high since the creation of green spaces and corridors significantly enhances habitat availability, connectivity, and ecological function in an otherwise disturbed landscape. These changes add important ecological features and substantially improve environmental quality. The duration of the impact is long term (>15 years), for the length of the Project and the extent of the impact is on site. The probability of the impact occurring is possible the ecological benefits from green spaces and corridors depend on proper design, planting, and ongoing

management. The sensitivity of the impact is low as the impact is on site and therefore, the significance of the impact has been rated beneficial minor (Table 21).

8.3.2.15 Improved microclimates and urban heat mitigation from trees and vegetation improving habitat conditions for fauna and flora.

The establishment of trees and vegetation will contribute to improved microclimates and mitigation of urban heat, creating cooler, more stable habitat conditions for flora and fauna within the development area. In an otherwise disturbed and modified environment, increased shade, moisture retention, and temperature regulation can enhance habitat quality and support biodiversity.

The impact is beneficial and indirect because planting trees and vegetation does not immediately change existing species or conditions, but over time it improves microclimate, temperature regulation, and habitat quality, creating a positive effect on flora and fauna in the surrounding disturbed environment. The impact is reversible because if the trees and vegetation are removed, die, or are poorly maintained, the microclimate and habitat benefits would be lost. The magnitude of change is low, while the establishment of trees and vegetation improves microclimate and habitat conditions, the effect is incremental and localized. In an already disturbed environment, these improvements benefit mainly common and disturbance-tolerant species without dramatically altering overall ecosystem structure or function. The duration of the impact is long term (>15 years) because once trees and vegetation are established, they continue to influence microclimate, shade, moisture retention, and habitat quality over many years, providing ongoing ecological benefits for the operational life of the development and the extent of the impact are on site. The probability of the impact is possible because the positive effects on microclimate and habitat depend on successful establishment, growth, and maintenance of the vegetation. The sensitivity is low because the impact is on site and therefore, the significance of the impact has been rated beneficial minor (Table 21).

8.3.2.16 Potential increase in local species diversity due to the use of indigenous plants when landscaping supporting birds, invertebrates, pollinators and small mammals.

The use of indigenous plant species in landscaping may lead to a potential increase in local species diversity by providing appropriate food sources, shelter, and breeding habitat for birds, invertebrates, pollinators, and small mammals. Within an already disturbed environment, indigenous planting can enhance ecological value and support the return or persistence of native species.

The impact is beneficial and indirect because planting indigenous species does not immediately change existing wildlife, but over time it provides food, shelter, and breeding habitat, supporting native species and increasing local biodiversity in the surrounding disturbed environment. The impact is reversible if indigenous plants are removed, die, or are replaced with non-native species. The magnitude of change the impact is major improvement

to local biodiversity and ecological function in an otherwise disturbed environment. The duration of the impact is long term (> 15 years) for the life of the Project and the extent of the impact is on site. The probability occurring is possible depend on successful establishment, growth, and ongoing maintenance of indigenous plants; if planting or management is suboptimal, the ecological benefits may not fully materialize. The sensitivity is low because the impact is on site and the overall significance of the impact has been rated beneficial minor (Table 21).

8.3.2.17 Green spaces rehabilitating disturbed soils, enhancing soil organisms and improving soil ecological functioning

The establishment of green spaces will contribute to the rehabilitation of previously disturbed soils, promoting the recovery of soil organisms and improving overall soil ecological functioning. In an already disturbed environment, vegetation cover can enhance soil stability, organic matter content, and biological activity over time. The impact is beneficial, long-term, and of moderate positive significance, with improvements increasing as green spaces become established and are effectively managed.

The nature of the impact is beneficial and indirect because establishing green spaces does not immediately restore soil organisms or function, but over time, vegetation cover enhances soil stability, organic matter, and biological activity, gradually improving soil ecological health in the surrounding disturbed environment. The impact is reversible because if green spaces are removed, poorly maintained, or degraded, the soil improvements would be lost. The magnitude of change is high as establishing green spaces substantially improves soil ecological functioning, including stability, organic matter content, and the recovery of soil organisms, representing a major enhancement to previously disturbed soils in the area. The duration of the impact is long term (> 15 years) lasting the life of the Project and the extent of the impact is on site.

The probability of the impact occurring is likely because once green spaces are established and properly maintained, the improvements in soil stability, organic matter, and biological activity are expected to occur consistently, making the positive impact highly probable. The sensitivity of the impact is low as it occurs on site and the significance of the impact has been rated beneficial moderate (Table 21).

Table 21 - Biodiversity impacts from Project operations

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
Presence of roads, buildings and infrastructure dividing	Biodiversity and terrestrial ecology	Habitat fragmentation and edge effect	Adverse Direct Irreversible Long term On site	Low	Low	Adverse minor (3)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
green spaces and altering current habitat conditions along edges			Possible			
Ongoing noise and movement around green spaces and around the dam		Disturbing fauna and temporary displacement	Adverse Direct Reversible Long term On site Unlikely	Low	Low	Adverse low (2)
Pet ownership		Predation of domestic animals (pets- cats and dogs) on birds, reptiles and small mammals	Adverse Indirect Reversible Long term On site Likely	Low	Moderate	Adverse moderate (4)
Improper waste management and littering of food waste from residents, restaurants etc.		Attracting opportunistic species e.g. baboons and altering natural behaviour of wild animals	Adverse Indirect Reversible Long term On site Possible	Low	Negligible	Adverse low (2)
Landscaped areas and open spaces		long-term establishment of alien invasive plants	Adverse Direct Reversible Long term On site Possible	Low	Low	Adverse minor (3)
Creation of green spaces and corridors		Habitat and connectivity for	Beneficial Indirect Reversible	Low	High	Beneficial minor (3)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
between subdivisions and along the dam		biodiversity species (fauna and flora	Long term On site Possible			
Planting of trees and vegetation		Improved microclimates and urban heat mitigation	Beneficial Indirect Reversible Long term On site Possible	Low	Moderate	Beneficial minor (3)
Use of indigenous plants when landscaping		Potential increase in local species diversity, supporting birds, invertebrates, pollinators and small mammals	Beneficial Indirect Reversible Long term On site Possible	Low	High	Beneficial minor (3)
Green spaces rehabilitating disturbed soils		Enhanced soil organisms and improving soil ecological functioning	Beneficial Direct Reversible Long term On site Likely	Low	High	Beneficial moderate (3)

8.3.3 SURFACE WATER IMPACTS

This section assesses the potential impacts of the proposed Project on surface water courses within the Project area and the downstream Seeis River catchment, taking into account both construction and operational phases (Figure 45). The final flood line assessment for the Project conducted by Chris Muir Consulting Engineer (Appendix D), which shows the presence of natural watercourses traversing the site and the estate's proximity to existing dams and downstream infrastructure. This comprehensive flood evaluation was undertaken to determine statutory floodlines and assess hydraulic impacts associated with the proposed development. In parallel, a bulk water supply situation assessment was conducted by NamWater to determine the availability of regional water resources and the capacity of existing bulk infrastructure to supply the development sustainably. The flood evaluation was

undertaken to ensure compliance with the Local Authorities Act (No. 23 of 1992), which prohibits development within the 1:50-year flood line of a river system.

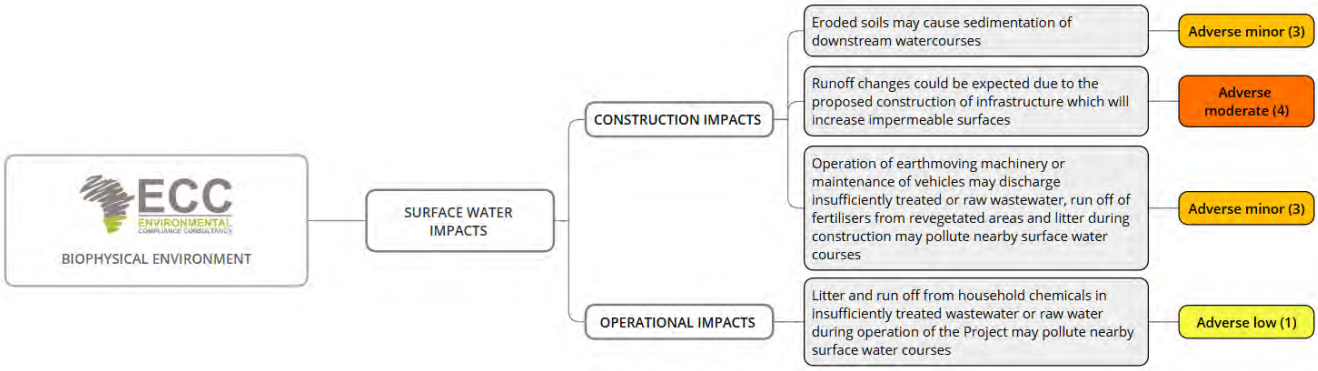

Figure 45 - Surface water impacts

Construction phases

8.3.3.1 Eroded soils may cause sedimentation of downstream watercourses

Soil disturbance from land clearing, earthworks and construction activities may increase erosion during rainfall events. Mobilised sediments may be transported along ephemeral drainage lines and flood pathways into downstream watercourses and Hoffnung Dam. Flood modelling indicates that parts of the site fall within the 1 in 50-year flood zone and experience elevated flow velocities during major storm events. These conditions may exacerbate sediment transport and deposition. Resulting sedimentation may reduce channel and dam storage capacity, increase turbidity, alter floodplain functioning, and degrade surface water quality and aquatic habitats within the Seeis River catchment.

The nature of the impact is adverse and direct, because soil disturbance from construction directly increases erosion and sediment transport, resulting in adverse effects on downstream water quality, aquatic habitats, and dam storage capacity. The impact is partly reversible because natural stabilisation of soils and sediment reworking by flow processes can occur over time, but residual sediment deposition and altered habitats may still remain.

The magnitude of change is moderate because sedimentation causes partial degradation of water quality and habitat features without compromising the overall integrity of the watercourse or dam system. The impact is long term (>15 years) because increased erosion and sediment transport are primarily linked to the active construction phase, after which soil disturbance ceases, and sediment mobilisation naturally declines once surfaces stabilise and construction activities end. The impact is local because erosion and sedimentation originate on-site and primarily affect nearby drainage lines, downstream watercourses, and Hoffnung Dam within the immediate Seeis River catchment, without extending to regional or catchment-wide systems. While the probability of the impact to occur is likely as land clearing and earthworks will inevitably disturb and expose soil and rainfall events, particularly within

the 1:50-year flood zone with high flow velocities are expected to occur during construction, making erosion and sediment mobilisation a foreseeable outcome. The sensitivity is low because the impact is local and therefore, the significance of the impact has been rated adverse minor (before mitigation) (Table 22). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.3.2 Runoff changes could be expected due to the proposed construction of infrastructure which will increase impermeable surfaces

The construction of roads, buildings and associated infrastructure will increase impermeable surface areas, altering natural infiltration and runoff patterns, which may result in higher volumes and velocities of surface runoff during rainfall events, increased erosion of drainage lines, reduced groundwater recharge, and greater pressure on downstream watercourses and Hoffnung Dam within the Seeis River catchment.

The impact is adverse and direct because impermeable surfaces increase runoff and erosion and reduce groundwater recharge, and direct because these effects occur immediately as a result of construction activities. The impact is irreversible because permanent infrastructure replaces natural surfaces, causing lasting changes to runoff and infiltration patterns. The magnitude of change is low because the increase in impermeable surfaces causes only minor, measurable changes to runoff and infiltration patterns, resulting in limited alteration to hydrological characteristics without significantly affecting the overall functioning or resilience of the downstream watercourse or dam system. The impact is long term (>15 years) because the most noticeable changes in runoff, erosion, and pressure on drainage lines occur during the active construction phase when surfaces are being cleared and compacted, and these effects stabilise once construction activities are completed. The impact is local because changes in runoff and erosion arise from on-site construction activities and primarily affect nearby drainage lines, adjacent watercourses, and Hoffnung Dam within the immediate Seeis River catchment, without extending to wider regional hydrological systems. The probability of the impact is definite as the creation of impermeable surfaces will inevitably alter runoff and infiltration patterns once construction occurs. The sensitivity of the impact is low as the impact is local and therefore, the impact has been rated adverse moderate (before mitigation) (Table 22). Mitigation measures have been listed below and have been included in the preliminary ESMP (Appendix A).

The following measures are to be implemented:

- Implement a stormwater management plan.
- Establish 1:5, 1:10, 1:50 and 1:100 return interval flood lines and potential volumes.
- Ensure suitable and safe dam wall and embankments along with keeping spillways and flow paths unobstructed and maintained.
- Assess downstream ecological water requirements and need for intervention/ periodic releases (dam or groundwater).

- The minimal extent of watercourses/flow paths reasonably possible should be disturbed.
- Altered watercourses should be modified in such a way that allows upstream areas to route back into the natural watercourse downstream of such or facilitate flow (e.g., culverts).

8.3.3.3 Operation of earthmoving machinery or maintenance of vehicles may discharge insufficiently treated or raw wastewater, run off of fertilisers from revegetated areas and litter during construction may pollute nearby surface water courses

The operation and maintenance of earthmoving machinery and construction vehicles, together with inadequate management of construction-related wastewater, fertiliser runs off from revegetated areas and improperly handled solid waste, may result in the release of hydrocarbons, nutrients, suspended solids and litter into nearby ephemeral watercourses, leading to surface water pollution, reduced water quality, eutrophication risks in Hoffnung Dam. Resulting in adverse effects on downstream aquatic and riparian ecosystems within the Seeis River catchment.

The impact is adverse and direct because construction-related activities can immediately introduce hydrocarbons, nutrients, suspended solids and waste into nearby ephemeral watercourses and Hoffnung Dam, degrading water quality and causing harmful effects on downstream aquatic and riparian ecosystems within the Seeis River catchment. The impact is partly reversible because water quality and aquatic habitats can recover over time through natural dilution, flushing during flow events once pollution sources are controlled, but some effects, such as nutrient accumulation in sediments, altered species composition and episodic damage to sensitive biota, may persist beyond the construction period. The magnitude of change is low as the anticipated impacts are limited in extent and duration, causing only short-term increases in nutrients, suspended solids or hydrocarbons, without fundamentally altering the key hydrological or ecological characteristics of the ephemeral watercourses, Hoffnung Dam or the broader Seeis River catchment.

The duration of the impact is long term (>15 years) because potential surface water pollution is largely confined to the construction and early operational phase, with impacts diminishing once earthworks are completed, disturbed areas are stabilised and rehabilitated, and effective wastewater, runoff and waste management measures are implemented, allowing natural recovery processes to restore water quality over time. The extent of the impact is local because potential surface water pollution would be confined to nearby ephemeral watercourses, Hoffnung Dam and immediately downstream sections of the Seeis River catchment, with limited volumes of runoff, intermittent flow conditions and natural attenuation processes preventing the pollutants from dispersing widely beyond the Project's immediate area of influence. The sensitivity of the impact is low because the impact is local and therefore, the impact has been rated adverse minor (before mitigation) (Table 22

). Mitigation measures have been included in the preliminary ESMP (Appendix A).

Operational phase

8.3.3.4 Litter and run off from household chemicals in insufficiently treated wastewater or raw water during operation of the Project may pollute nearby surface water courses

During the operation of the Project, litter generation and runoff containing household chemicals from insufficiently treated wastewater or accidental releases of raw sewage may enter nearby ephemeral watercourses and the Hoffnung Dam, leading to the deterioration of surface water quality, increased nutrient and chemical loading, potential eutrophication, health risks to downstream users. Resulting in adverse effects on aquatic and riparian ecosystems within the Seeis River catchment.

The impact is adverse and direct because it degrades water quality, pollute surface water, harming ecosystems and posing health risks. The impact is partly reversible because water quality can improve once pollution sources are removed and proper waste and wastewater management are implemented, but some ecological effects, such as nutrient enrichment of sediments or loss of sensitive species, may persist for a period of time. The magnitude of change is moderate because pollution results in a partial deterioration of surface water quality and associated aquatic and riparian features, causing a loss in water quality and ecosystem function, but not to the extent that the overall integrity of the water resource or catchment system is compromised, allowing continued function and recovery over time. The impact is long term because repeated pollution can cause persistent water quality degradation and lasting ecological effects. The impact is local because it affects only nearby watercourses and the Hoffnung Dam, and rare because it would occur mainly during accidental releases or system failures rather than normal operations. The sensitivity of the impact is low because it is local and therefore, the significance of the impact is adverse low (before mitigation) (Table 22). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.3.5 Alteration of flood behaviour

Although hydraulic modelling using HEC-RAS indicates that the final layout of the Project site avoids encroachment into the statutory 1:50-year flood line, a minor residual impact on flood behaviour within the site is theoretically possible. Roads, culverts, building platforms and increased impervious surfaces may slightly alter natural drainage patterns or redirect flows temporarily. However, this impact is considered unlikely because culverts (CA1, CA2, and CA12) have been designed to accommodate anticipated flows, routine maintenance can prevent blockages, and the downstream dam provides adequate freeboard to manage flows within the design standard. Consequently, while extreme events exceeding the 1:50-year assumptions or severe infrastructure failures could potentially cause localised ponding, overtopping, or erosion, such occurrences are expected to be rare, and the estate's design and management measures substantially reduce the likelihood of property damage or safety risks.

The impact is adverse because it could cause property damage, flooding and safety risks; direct as it arises from the development's infrastructure altering natural drainage; and partly reversible since maintenance or mitigation can restore drainage, though some minor physical changes may persist. The duration of the impact is temporary (>1 year) because it may occur intermittently during extreme storm events but can be managed and largely restored through maintenance and mitigation measures. The magnitude of change is low as because any alterations to flood behaviour are minor, localised and does not significantly affect the site's key features or overall function. The impact is on-site because it arises directly from the estate's own infrastructure, roads, culverts, building platforms and increased impervious surfaces, affecting drainage and flood behaviour within the development boundaries. It is considered unlikely to occur because the hydraulic design meets the 1:50-year flood standard, culverts are sized for expected flows, the downstream dam has adequate freeboard and routine maintenance can prevent blockages or failures. The sensitivity of the impact is low as because the site is of local value and can accommodate minor changes in drainage without significant consequences and therefore, the significance of the impact has been rated adverse low (before mitigation) (Table 22). Mitigation measures have been included in the preliminary ESMP (Appendix A).

Table 22 - Surface water impacts

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
Construction	Surface water	Eroded soils have the potential to cause sedimentation of downstream watercourses.	Adverse Direct Partly reversible Long term Local Likely	Low	Moderate	Adverse minor (3)
		Runoff changes could be expected due to the proposed construction of infrastructure which will increase impermeable surfaces	Adverse Direct Irreversible Long term Local Definite	Low	Low	Adverse moderate (4)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
		Operation of earthmoving machinery or maintenance of vehicles may discharge insufficiently treated or raw wastewater, run off of fertilisers from revegetated areas and litter during construction may pollute nearby surface water courses	Adverse Direct Partly reversible Long term Local Likely	Low	Low	Adverse minor (3)
Operations	Surface water	Litter and run off from household chemicals in insufficiently treated wastewater or raw water during operation of the Project may pollute nearby surface water courses	Adverse Direct Partly reversible Long term Local Rare	Low	Moderate	Adverse low (1)
		Alteration of flood behaviour	Adverse Direct Partly reversible	Low	Low	Adverse low (1)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
			Temporary On site Unlikely			

8.3.4 GROUNDWATER IMPACTS

This section evaluates the potential effects of the proposed Project on local groundwater resources, taking into account site-specific hydrogeological conditions and the scale of planned activities (Figure 46). The Project area is underlain predominantly by the Kuiseb Formation, which acts as a low-permeability aquiclude, resulting in very limited groundwater movement and near-zero natural recharge. Productive groundwater occurs only at greater depths within the Kleine Kuppe fractured aquifer, which is not hydraulically connected to the development footprint or the greater Windhoek Aquifer system.

Existing groundwater use in the area is limited, with a small number of boreholes used mainly for domestic purposes, and groundwater quality is generally fresh with low nitrate levels, indicating minimal baseline contamination.

Given the naturally constrained groundwater system, the assessment focuses on potential impacts from wastewater management, land-use change, and limited groundwater abstraction.

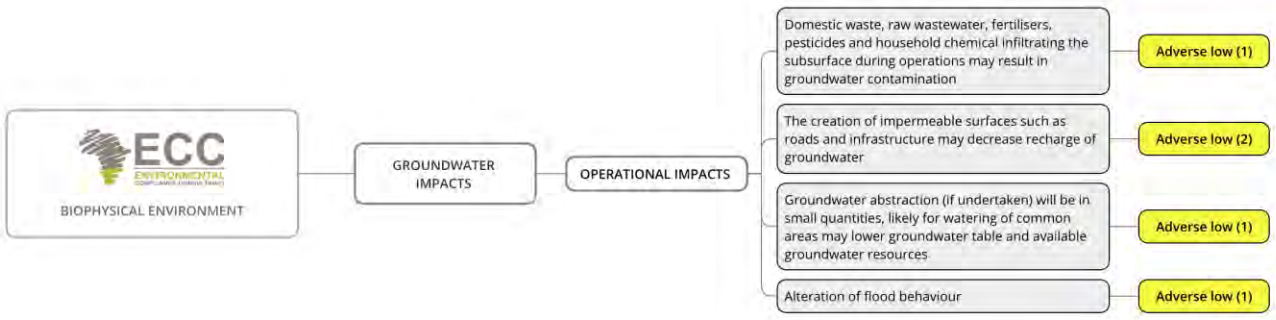

Figure 46 - Groundwater impacts

8.3.4.1 Domestic waste, raw wastewater, fertilisers, pesticides and household chemical infiltrating the subsurface during operations may result in groundwater contamination

The risk of groundwater contamination from domestic waste, wastewater, fertilisers, pesticides and household chemicals during operations is low since the development is directly underlain by the Kuiseb Aquiclude, which consists predominantly of schistose rocks with low permeability and poor hydraulic connectivity. This geological unit significantly

restricts vertical groundwater movement, thereby reducing the likelihood that contaminants infiltrating from the surface would migrate to deeper, productive aquifers such as the Kleine Kuppe fractured aquifer at depth. Recharge rates within the Kuiseb schists are near zero, further limiting contaminant transport.

The impact is adverse because any groundwater contamination would degrade water quality, and direct because it would originate directly from Project-related operational activities, even though the risk is low due to geological conditions. The impact is partly reversible because groundwater quality could improve over time if contamination sources are removed and natural attenuation occurs, but any pollutants that do enter fractures or persist in the subsurface may remain for long periods due to low recharge and slow groundwater movement. The magnitude of change is moderate because any contamination would cause a partial loss or degradation of groundwater quality without compromising the overall integrity of the regional aquifer system, as the low permeability Kuiseb Aquiclude restricts contaminant migration and limits impacts to key characteristics rather than causing widespread or irreversible damage. The impact is long term (>15 years) because groundwater systems respond and recover very slowly, and any contaminants that enter the subsurface may persist for extended periods due to low recharge rates and limited natural flushing within the Kuiseb Aquiclude and underlying aquifers.

The impact is local because it would be limited to the immediate project area, and rare because geological conditions and normal operational controls make contamination unlikely except during abnormal events. The sensitivity of the impact is low because the impact is local and therefore, the overall significance of the impact has been rated adverse low (below mitigation) (Table 23). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.4.2 The creation of impermeable surfaces such as roads and infrastructure may decrease recharge of groundwater

The creation of impermeable surfaces such as roads and infrastructure is expected to have a low impact on groundwater recharge, as natural recharge within the development footprint is already very limited due to the presence of the Kuiseb Aquiclude, low-permeability clay-rich soils, and low regional recharge rates.

The impact is adverse because the creation of impermeable surfaces can further reduce already limited groundwater recharge, potentially diminishing groundwater availability, and direct because this reduction occurs as a result of Project-related construction of roads and infrastructure that physically block infiltration. The impact is partly reversible because groundwater recharge conditions can improve if impermeable surfaces are removed, reduced, or replaced with permeable materials and natural drainage patterns are restored, although full recovery may be limited by the inherently low recharge rates and underlying low-permeability geology. The magnitude of change is low because the introduction of

impermeable surfaces would cause only a minor, measurable reduction in already limited groundwater recharge, resulting in a small alteration to infiltration characteristics without significantly changing groundwater quality, availability, or the overall functioning of the groundwater system. The impact is long term because impermeable surfaces remain in place for the life of the Project, causing a sustained but minor reduction in infiltration. It is local and rare because the effect is limited to the project footprint and occurs infrequently due to already very low natural recharge rates. The sensitivity of the impact is low because the impact is local and therefore, the significance of the impact is adverse minor (before mitigation) (Table 23). Mitigation measures have been included in the preliminary ESMP (Appendix A).

8.3.4.3 Groundwater abstraction (if undertaken) will be in small quantities, likely for watering of common areas may lower groundwater table and available groundwater resources

Potential groundwater abstraction for irrigating common areas is expected to have a low impact, as abstraction volumes would be small and intermittent, groundwater recharge in the area is naturally limited, and the hydrogeological setting restricts large-scale drawdown. The impact is adverse because groundwater abstraction reduces available groundwater resources, and direct because any change in groundwater levels would occur immediately due to Project-related abstraction.

The impact is reversible because groundwater levels can recover naturally once abstraction stops, as pumping is small-scale and intermittent, allowing the aquifer to return to baseline conditions over time. The magnitude of change is low because abstraction volumes are small and intermittent, resulting in only minor, short-range fluctuations in groundwater levels without causing measurable long-term depletion or altering the overall functioning of the groundwater system. The impact is short term because groundwater levels recover once abstraction stops, local because effects are limited to the immediate area, and rare/improbable because abstraction is small-scale and infrequent. The sensitivity of the impact is low because it is local and the significance of the impact has been rated adverse low (before mitigation) (Table 23). Mitigation measures have been included in the preliminary ESMP (Appendix A).

Table 23 - Groundwater impacts

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
Operations	Groundwater	Domestic waste, raw wastewater, fertilisers, pesticides and household	Adverse Direct Partly reversible Long term Local	Low	Moderate	Adverse low (2)

Activity	Receptor	Impact	Nature of Impact	Value and Sensitivity	Magnitude of Change	Significance of Impact
		chemical infiltrating the subsurface during operations may result in groundwater contamination	Rare			
		The creation of impermeable surfaces such as roads and infrastructure may decrease recharge of groundwater	Adverse Direct Partly reversible Long term Local Unlikely	Low	Low	Adverse low (2)
		Groundwater abstraction (if undertaken) will be in small quantities, likely for watering of common areas may lower groundwater table and available groundwater resources	Adverse Direct Reversible Short term Local Rare	Low	Low	Adverse low (2)

9 CONCLUSION

A scoping report with impact assessment has been undertaken for the proposed Project to identify the potential impacts and evaluate their severity and significance. The potential impacts likely to be triggered by the Project include impacts related to employment creation, noise impacts, occupational health and safety risks, visual impacts, air quality impacts (dust), socio-economic impacts, and impacts to biodiversity. The scoping study with impact assessment report identified that no major potential risks required specialist studies apart from the transport impact assessment, geohydrological impact assessment and flood evaluation study that were conducted. However, the areas of concern will need to be carefully monitored and managed according to the ESMP to ensure that the significance of these impacts are reduced as far as reasonably possible.

Based on the assessment undertaken, and subject to the implementation of the mitigation measures contained in the ESMP and compliance with Roads Authority and TransNamib requirements, the residual traffic impacts associated with the proposed development are considered acceptable and manageable within the receiving environment.

Table 24 summarises the impacts after mitigation. On a scale of 1 to 12, low to high, the beneficial (B) and negative (N) impact significance is stated.

Table 24 - Summary of the significance rating after mitigation for the expected impacts

Socioeconomic environment: economic		Socioeconomic environment: social		Biophysical environment	
Employment creation during construction phase	B6	Visual impacts	N2	Soil impacts	N2
Influx of workers during construction	N2	Noise impacts	N2	Biodiversity impacts	N2
Community health and safety risks during construction	N3	Air quality impacts	N2	Surface water impacts	N2
Employee health and safety risks during construction	N2	Traffic impacts	N2	Groundwater impacts	N1
Equitable access to jobs for women, youth and vulnerable groups during construction	N1				
Contribution to housing and affordability limitations	N2				

Socioeconomic environment: economic		Socioeconomic environment: social	Biophysical environment
Long term employment and local stimulation during operations	B3		
Employment for women and youth during operations	B9		

The assessment of this Project on the receiving environment has shown that the Project may have adverse low to minor impacts concerning community and employee's health and safety risks during construction along with impact on equitable job access to women and unemployed youth. The Project is likely to have adverse low impacts when it comes to potential visual, noise, air quality and traffic impacts. Similarly, the Project is likely to have adverse low impacts on soil, surface water and groundwater and certain aspects of biodiversity of the area but is also likely to have many beneficial biodiversity impacts with the creation of the green spaces and landscaping. Further addition benefits that can be expected are the creation of jobs and long-term employment thus stimulating and contributing to the local economy (Table 24).

These various aspects should be managed as per the commitments outlined in the ESMP (Appendix A). This will ensure that the Project remains compliant with the relevant legislation and environmental best practices.

10 REFERENCES

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APPENDIX A – ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

APPENDIX B – I&AP COMMENTS AND RESPONSES REPORT

APPENDIX C – ITS TRANSPORT IMPACT ASSESSMENT

APPENDIX D – CHRIS MUIR CONSULTING ENGINEER FLOOD EVALUATION REPORT

APPENDIX E – ECC GROUNDWATER ASSESSMENT REPORT

APPENDIX F – NAMWATER BULK WATER SUPPLY ASSESSMENT

APPENDIX G – EAP CVS