REPORT

Environmental and Social Impact Assessment for the Proposed Neo I 20 MWac Solar PV Power Plant to Supply the LEC Ramarothole Substation in the Mafeteng District, Lesotho

Client: Neo I Pty Ltd

Reference: MD4071

Status: 0.1/Final

Date: 29 November 2019

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Classification
Project related

MANAGEMENT SYSTEM CERTIFICATION
DNV·GL
ISO 9001 ISO 14001
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APPENDICES

ACRONYMS

AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
BH	Borehole
CC	Community Council
CHSS	Community Health, Safety and Security
CIA	Cumulative Impact Assessment
CLO	Community Liaison Officer
CR	Critical
CSI	Corporate Social Investment
DA	District Administrator
dBA	Decibels
DCS	District Council Secretary
DE	Department of Environment
DV	Habitat Diversity
EC	Ecological Category
EC	Electrical Conductivity
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIS	Ecological Importance Sensitivity
EN	Endangered
ESIA	Environmental and Social Impact Assessment
ESHS	Environmental, Social, Health and Safety
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FEPA	Freshwater Ecosystem Priority Areas
GHG	Green House Gases
GOL	Government of Lesotho
GIIP	Good International Industry Practice
HIV	Human Immunodeficiency Virus
IFC	International Finance Corporation
ILO	International Labour Compensation
IPP	Independent Power Producer
KM	Kilometre
LEA	Lesotho Environmental Authority
LEC	Lesotho Electricity Corporation
LEWA	Lesotho Electricity and Water Authority
LMS	Lesotho Meteorological Services
LMTEC	Lesotho Ministry of Tourism, Environment and Culture
LN	Habitat Linkage
MAP	Mean Annual Precipitation
MEM	Ministry of Energy and Meteorology

Ms	Mispah
MW	Megawatt
NASA	National Aeronautics and Space Administration
NAPA	National Adaptation Plan of Action
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NES	National Environmental Secretariat
NEMP	National Electrification Master Plan
NFEPA	National Freshwater Ecosystem Priority Areas
NGO	Non-Governmental Organisation
NSDP	National Strategic Development Plan
OM	Operation and Maintenance
PAP	Project Affected Population
PES	Present Ecological State
PFD	Process Flow Diagram
PPA	Power Purchase Agreement
PS	Performance Standards
PV	Photovoltaic
RAP	Redress Action Plan
RD	Red Data
REU	Rural Electrification Unit
RoD	Record of Decision
SABAP	Southern African Bird Atlas Project
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SEP	Stakeholder Engagement Plan
SLUP	Simplified Land Use Plan
SMP	Social Management Plan
SN	Habitat Sensitivity
SPV	Special Purpose Vehicle
ST	Habitat Status
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
ToR	Terms of Reference
VU	Vulnerable

1 INTRODUCTION

1.1 Background

In response to the Request for Proposals MEM/SOL-001/2016/17 issued by the Government of Lesotho, OnePower assembled a consortium (Scatec Solar, Norfund and Sotho Solar Special Purpose Vehicle (SPV) consisting of Neo I and Power Consult)(later to become Neo I SPV and referred to as Neo I hereafter) to develop a project and to perform the technical planning and implementation of an inaugural 20MW solar PV Generating station, to be constructed and operated from a proposed 66 hectare site in proximity to the villages of Ha Ramarothole, Ha Lempetje and Ha Raliemere under the Tšana-Talana Community Council in the Mafeteng District (**Figure 1**). The point of delivery for interconnection with the off-taker, the Lesotho Electricity Company (LEC), is the 132kV-33kV substation located at Lat -29.807601° Long 27.335344° approximately 1km south of the prospective site. OnePower's consortium was awarded the Tender in February 2017.

The Government of Lesotho (GoL), under the Ministry of Energy and Meteorology (MEM), has engaged Neo I Consortium to implement the NEO I 20MW Photovoltaic Power (PV) Generation Development Project (henceforth the Project). Neo I Pty Ltd has received a project preparation grant (PPG) from the African Development Bank (AfDB) for the development of the project. The project, once underway, will be the first utility-scale solar PV project in Lesotho. The power will feed into the national grid in the Mafeteng Province.

Royal HaskoningDHV has been assigned to support this development by performing, amongst others, a Gap Analysis, including a Redress Action Plan, on previous environmental and social work performed in relation to the Project, and the Environmental and Social Impact Assessment (ESIA) for the Project, following national legislation and IFC Performance Standards (IFC PS) and AfdB's Operational Safeguards.

For the socio-economic baseline study and stakeholder engagement, Neo I appointed a Lesotho based consultant, namely, Puisano Communications (henceforth Puisano).

1.2 Broader Description of the Study Area

The country of Lesotho consists of ten Districts namely Butha Buthe, Leribe, Makhotlong, Berea, Maseru, Mafeteng, Thaba Tseka, Qachas Nek, Quthing and Mohale's Hoek. **Mafeteng District** is located in the south-west region of Lesotho. The District is bordered by Maseru on the north-east which is also the capital of the country and Mohale's Hoek in the south-east. (Refer to **Figure 2)**.

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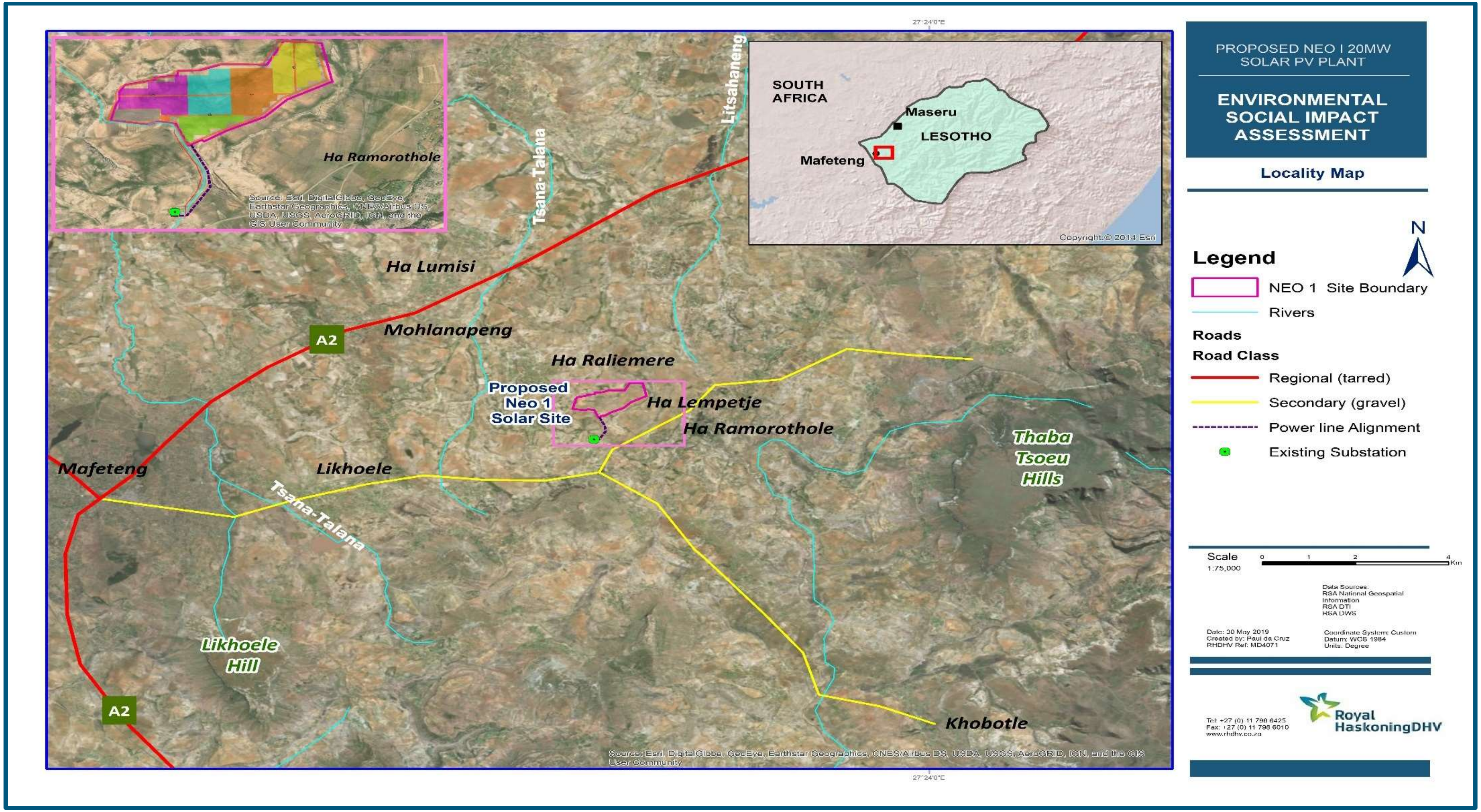

Figure 1: Location of the Study Area

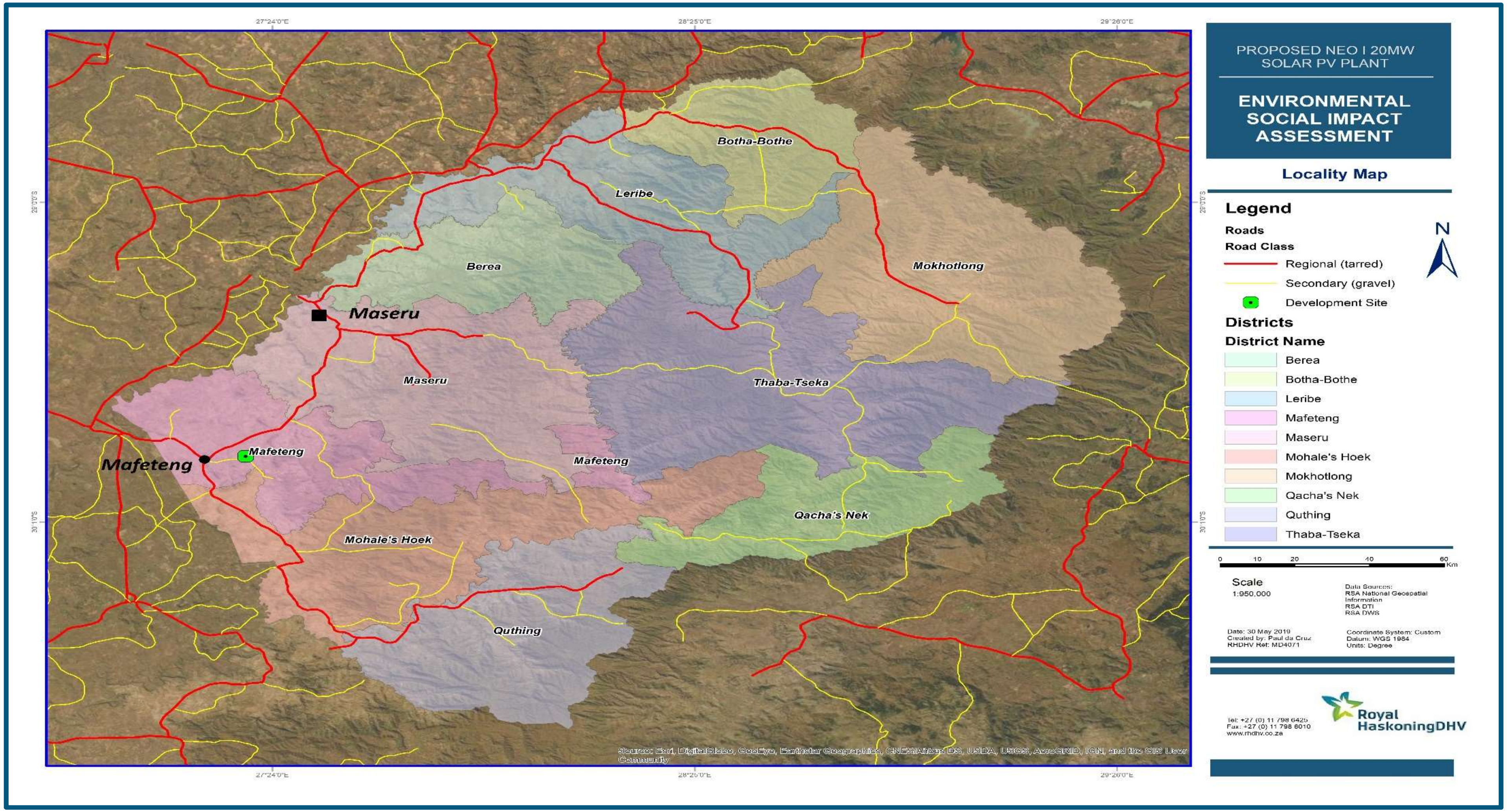

Figure 2: Lesotho District Map

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1.3 Purpose of the ESIA Process

The purpose of the ESIA is to identify the potential positive and adverse environmental and socio-economic effects that may arise from the Project, identify the measures to be used to manage, mitigate, and monitor the impact of those effects, and to assess the net impact following mitigation. Impacts are to be assessed using the environmental and social baseline conditions as a point of departure.

In addition to identifying and assessing impacts, measures required to avoid, prevent, mitigate or compensate significantly adverse impacts and enhance beneficial impacts have also been included as an integral part of the ESIA. Reference is made to plans to monitor, manage and evaluate the implementation of mitigation measures and the Project's performance in terms of environmental and social baseline conditions.

The ESIA serves the following purposes:

- To allow policy makers to appreciate the extent and significance of any potential impacts associated with the Project, and take these into consideration while planning the execution of the Project;
- To provide basic information to the competent authorities in accordance with legally defined and regulatory procedures; and
- To provide clear instructions to works supervisors and contractors with regards to any measures that need to be implemented to limit any potential negative impacts to acceptable levels.

1.4 Details of the Project Developer

The Developer is Neo I and the details of the responsible person are listed in **Table 1** below.

Table 1: Developer Details

DEVELOPER	NEO I
Contact Persons	Matthew Orosz
Postal Address	P O Box 2092, Maseru 100, Lesotho
Telephone	+266 57755402/3
E-Mail	mso@1pwrafrica.com

1.5 Details of the ESIA Team

- Henk Blok: Environmental Expert and Team Leader;
- Kim Moonsamy: Environmental, Social Planning & Management Resettlement Expert;
- Malcolm Roods: Project Director, EIA Specialist;
- Ntseketsi Lerotholi: Project Deputy, Stakeholders Engagement;
- Henk Oosterdijk: Solar Power & Renewable Energy Expert;
- Martine Leman: ESIA Expert;
- Violeta Paginu: Environmental and Social Management Plan Expert; and
- Sibongile Gumbi: Project Manager, Environmental and Social Management Expert.

1.6 Specialist Assessment

To ensure the scientific vigour of the ESIA study, as well as a robust assessment of impacts, Royal HaskoningDHV commissioned the following specialist's studies to comprehensively identify both potentially

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positive and negative environmental impacts (social and biophysical), associated with the project, and where possible provide mitigation measures to reduce the potentially negative impacts and enhance the positive impacts.

Table 2: Team of Specialist's

SUB-CONSULTANT	COMPANY NAME
Garry Patterson Soils and Agriculture	Agricultural Research Council
Stuart Thompson Air Quality	EBS Advisory
Riaan Robbeson Biodiversity	Bathusi Environmental Consulting
Gerard van Weele Climate Change	Royal HaskoningDHV
Johan van Schalkwyk Heritage	Independent
Kobus Troskie Geotech and Hydrogeology	GCS Pty Ltd
Barend van der Merwe Noise	dBAcoustics
Paul da Cruz Surface and Wetlands	Royal HaskoningDHV

1.7 Report Structure

Table 3: Report Structure

CHAPTER	DESCRIPTION
1-Introduction	Introduction – Provides the background to the project as well as details of the specialist studies conducted and contact details for the project developer and ESIA team.
2-Policy, Legal and Administrative Framework	Environmental Legislative Context – Describes the national and international environmental legislative requirements applicable to the Project.
3-Project Context and Motivation	Describes the proposed scheme, including the site selection alternatives, plant design, development processes (i.e. construction details) and details the future operations (as far as currently known).
4-Description of the Environmental and Social Parameters	Briefly documents current knowledge regarding the existing environment, sensitive receptors, potential impacts for each environmental parameter.
5-Environmental and Social Impact Assessment	Describes the ESIA process and methodology for assessing the environmental impacts as well as a brief summary of mitigation measures.
6-Consultation and Public Engagement	Describes the consultation that has occurred during the ESIA and how stakeholder and public engagement for the

	whole project lifecycle will be dealt with to ensure it is compliant with both Lesotho law and IFC / WB requirements as well as AfdB operational Safeguards.
7-Conclision and Recommendations	This section provides a conclusion and recommendations of the project as well as the impact assessment process undertaken.
8-List of References	Provides the references used to inform the report.

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2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The purpose of this section is to demonstrate how the development will be undertaken to meet the requirements of the Lesotho approval process, the IFC Performance Standards (PS) and AfdB's Operational Safeguards. Therefore, there are two approval routes which the project must follow:

- The Lesotho domestic regulatory route, which must be satisfied for the development to gain the necessary permits to undertake the construction and operational activities.
- The international investment route to secure international finance by following the IFC PS, World Bank Environmental, Health and Safety (EHS) Guidelines and AfdB's Operational Safeguards (see below).

This section provides details regarding the requirements of both routes, as well as how these have and will be achieved through the ESIA process.

2.1 Lesotho Legal and Administrative Framework

2.1.1 Lesotho Constitution of 1993 (as amended in 1998)

The Constitution of Lesotho is the basic law governing the Kingdom of Lesotho. Section 36 of the Constitution relates to the protection of the environment, and further states that Lesotho shall adopt policies designed to protect and enhance the natural and cultural environment of Lesotho for the benefit of both present and future generations. It shall endeavour to assure all citizens a sound and safe environment, adequate for their health and wellbeing. Several subsequent pieces of legislation have been enacted to uphold this commitment.

2.1.2 The Environmental Act of 1999

Established the Lesotho Environment Authority (LEA) to provide environment and natural resources management in Lesotho. This Act was the first to mention the idea of Environmental Impact Assessment (EIA). This was followed by the 2008 Environmental Act which updated and codified the environmental protections and the specific requirements of the current EIA process.

2.1.3 Environment Act (Act No. 10 of 2008)

The aim of the Environment Act of 2008 is to provide a framework environmental law for the implementation of the National Environment Policy. The Act is founded on principles of environmental management. It further provides power to the Minister to make Regulations on EIAs. To date no Regulations to this effect have been made. However, in 2002 EIA Guidelines were drafted and formalised in 2009. These guidelines set out steps that need to be carried in the undertaking of the EIA process.

2.1.3.1 Lesotho EIA Procedure

According to the Environment Act (Act No 10 of 2008), the construction of a PV Power Plant is an activity which may have a significant detrimental impact on the environment. Thus, an ESIA must be conducted prior to the issuing of the EIA Licence by the Lesotho Ministry of Tourism, Environment and Culture (LMTEC) for project implementation. The Lesotho EIA procedure consists of the following main steps (see **Figure 3**):

- Consultation meeting with LMTEC: Identifies the triggering of the EIA process of the proposed development and steps to be undertaken.

- A consultation meeting between LMTEC and Royal HaskoningDHV was conducted on the **30th of August 2018**. The purpose of the meeting was to understand the process that needs to be followed for the ESIA process and associated timeframes regarding the review and approval of the ESIA as well as the issuance of the EIA Licence.

- Project brief: This is a document that contains information regarding the proposed development submitted to the authorities (LMTEC) for approval. The authorities, through the review process, determines a need for a full EIA process and advises the developer accordingly.
  - A project brief for the 20MW PV Plant was compiled and submitted to the LMTEC (EIA unit) for approval by Puisano Communications on behalf of Neo I. A Record of Decision (RoD) dated **17 March 2017** was issued to Neo I allowing them to implement the project within a period of two years. However, due to the project being funded by an International Financing Institution (AfDB), an ESIA study was required which needs to comply with the IFC standards and AfdB Operational Safeguards. The project description contained in the Project Brief has been superseded by the project description in this report.
  - It must be noted that the RoD for the Project Brief expired on **17 March 2019** and thus, Neo I sent a letter dated **April 2019** to LMTEC requesting for the renewal of the RoD. The RoD was renewed by LMTEC on **23 May 2019**.
- Terms of Reference for EIA: Terms of reference for an Environmental Impact Statement is prepared and submitted to the LMTEC for approval.
  - Terms of Reference for the ESIA of the proposed project has been prepared accordingly as part of a Scoping Report and will be submitted with the ESIA report in **August 2019**.
- Environmental Impact Statement: A full EIA process is then undertaken describing the potential impacts and their assessment as well as the mitigation measures for significant impacts. This process is undertaken if the LMTEC requests further information and is of the opinion that the Project Brief is not sufficient or, as in the current case, it is a requirement of international financing guidelines.
  - An ESIA report with detailed project description and environmental impacts as well as associated mitigation measures (draft report) was submitted in **August 2019** together with the Environmental and Social Management Plan (ESMP).
- EIA Licence: An EIA report is submitted to the environmental authorities for review and decision making. After satisfying all the requirements of the environmental authorities. A final ESIA report and ESMP will be submitted to LMTEC in **September 2019**. An EIA Licence is then issued to the developer. As a licence exists for the project it is anticipated that this may be updated to make reference to this ESIA.
  - An updated EIA Licence for the proposed project (ESIA) is expected in **October 2019**.
- Appeal: An appeal process commences where people aggrieved by the decision made by authority's lodge complaints to the environmental authorities.
- Monitoring and Auditing: The environmental authorities are responsible for the auditing and monitoring of the project implementation.

2.1.3.2 Triggering of the Environmental Impact Assessment Licence

The triggering of the EIA licence by the proposed project is outlined in **Table 4.**

Table 4: Environment Act EIA Listed Activities Triggered

ACTIVITY NO	DESCRIPTION	APPLICABILITY TO THE PROJECT
Activity 4	Dams, rivers and water resources including: (e) Project or activities affecting other water sources such as groundwater, spring and wells.	The proposed project is located adjacent to water sources (wetlands). The project infrastructure is expected to have an impact on these water sources.
Activity 10	Energy and electric infrastructure including (a) Electrical generation stations (b) Electrical transmission lines	The proposed project entails construction of PV panels that will generate electricity and a 33kV powerline within a footprint of 66ha.

2.1.4 Water Act (Act No 15 of 2008)

The Act relates to the issuance of a Water Use Permit and pollution prevention. The Act further makes provision for effluent management and the development of standards for effluent discharge. Section 5 of the Water Act lists water uses that requires a water use permit prior to being implemented.

2.1.4.1 Triggering of the Water Use Permit

The triggering of the water use permit by the proposed project is outlined in **Table 5.**

Table 5: Water Act Section 5 Water Uses Triggered

ACTIVITY NO	DESCRIPTION	APPLICABILITY TO THE PROJECT
Activity 3(a)	Taking water from a watercourse	Abstracting water from a borehole, should this be the preferred option of obtaining water.
Activity 3(c)	Impounding or diverting the flow of water in a watercourse	Disturbance of wetlands to make way for construction activities.
Activity 3(g)	Altering the bed, banks, course or characteristics of a watercourse	Disturbance of the wetland to make way for construction activities.

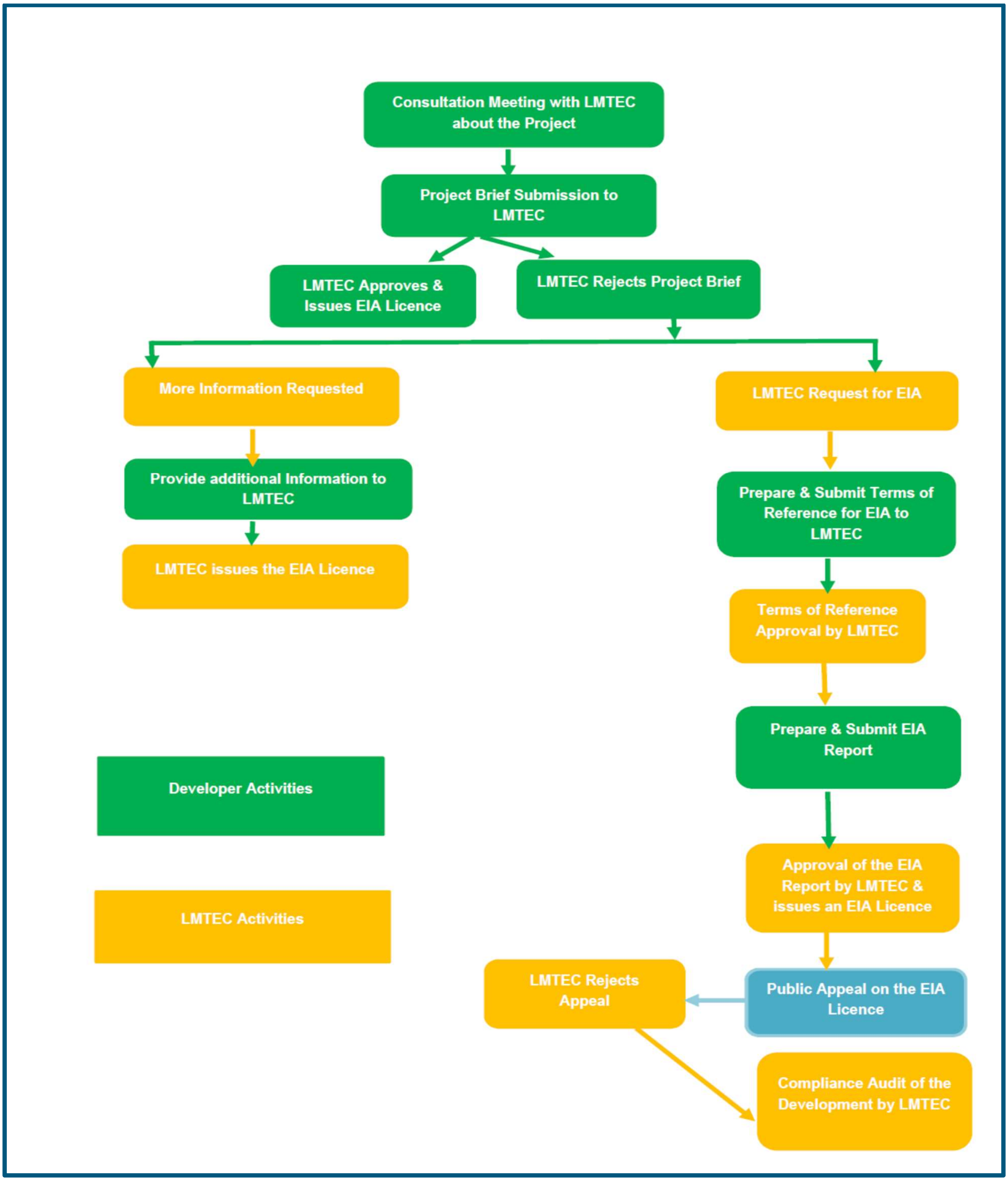

Figure 3: Summary of Lesotho EIA Process

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2.1.5 National Legislation

Table 6: Relevant National Legislation

LEGISLATION	PURPOSE	ENFORCING ORGANIZATION	RELEVANCE TO THE PROJECT
Water Act (Act No 15 of 2008)	The Act relates to the issuance of Water Use Permits and pollution prevention. The Act further makes provision for effluent management and the development of standards for effluent discharge.	Department of Water Affairs	The project will require water and as such, issues of water availability and water allocation will be very important, especially during the construction and operational phase of the project. Should the project undertake a water use listed in the Act (see Table 4 above) then it will be necessary to obtain a water use permit.
Environment Act (Act No 10 of 2008) (Air Quality)	The Act provides for the Department of Environment to establish criteria for measurement of air quality and standards for ambient air quality, occupational air quality and emissions.	Department of Environment	During the construction phase, air emissions in the form of dust will be generated. Thus, mitigation measures which comply with provisions of this Act and other local regulations, need to be adhered to by the Contractor. It should be noted that standards for air quality have not yet been promulgated.
Environment Act (Act No 10 of 2008) (Noise)	The Act makes provision for the Department of Environment to set minimum standards for noise emissions and vibrations. It also makes provisions for the noise levels and noise emission standards to be established and applied at construction sites and industrial plants.	Department of Environment	During the construction phase workers may be exposed to several safety and health risks. In the process of ensuring workers' safety, this Act needs to be adhered to. It should be noted that standards for noise emissions and vibrations have not yet been promulgated.
Environment Act (Act No 10 of 2008) (Waste)	The Act makes provisions for the Department of Environment to control all types of waste.	Department of Environment	The project will generate solid waste, especially during the construction phase, which should be managed in accordance with this legislation. A licence is required for

LEGISLATION	PURPOSE	ENFORCING ORGANIZATION	RELEVANCE TO THE PROJECT
			discharging pollution in excess of standards however no standards have been promulgated as yet. Broken solar panels are considered to be hazardous waste. A licence is required to transport hazardous waste and according to Section 76(2) this must be applied for in writing, to the Minister.
Environment Act (Act No 10 of 2008) (Energy)	The Act makes provisions for the conservation of energy and the promotion of renewable sources of energy.	Department of Environment Department of Energy Lesotho Electricity Company	Once completed the PV Plant will require operational licences under this Act which relates to energy.
Environment Act (Act No 10 of 2008) (Aquatic Resources)	The Act governs the protection of the water resources and management of riverbanks, rivers, wetlands, lakes and lakeshores.	Department of Environment	The project may affect aquatic species in the watercourses and some tributaries located closer to the study area. Should watercourses or tributaries be affected then it would be necessary to obtain a necessary permit.
Land Act (Act No 17 of 1979) (as amended)	It defines the process by which land allocation, lease, and title is managed in Lesotho. In rural areas, this process is overseen by Chiefs and/or Community Councils. This is the primary legal framework used for procurement of land for public purposes (e.g., infrastructure).	Ministry of Agriculture and Food Security Land Survey and Physical Planning Department	The project site is located on land owned by the Chief and local villages. Farming activities are also taking place. Due processes will have to be followed by the project developer in compliance with this legislation and other local Regulations.
The Land Act (Act No 9 of 2010)	The Act makes provision for compensation for the relocation of people for the purposes of development. It updated these processes, providing current regulations for land vesting, administration, lease, title, and allocation	Land Administration Authority	The project site is located on land owned by the Chief and local villages. Farming activities are also taking place. Due processes will have to be followed by the project developer in

LEGISLATION	PURPOSE	ENFORCING ORGANIZATION	RELEVANCE TO THE PROJECT
	(including definition of the authority for allocation). Part IX outlines the process and restrictions of acquisition of land for public purpose, whilst Part X covers fair compensation.		compliance with this legislation and other local Regulations.
Environment Act (Act No 10 of 2008) Environmental Impact Assessment Guidelines (2009).	The Act has provisions for the activities that will result in the detrimental environmental impacts. The EIA Guidelines lists the activities that will require an Environmental Impact Licence.	Lesotho Electricity Company	An Environmental Impact Assessment is required for transmission lines and the PV Plant to obtain approval.
Public Health Order (No 12 of 1970)	The order prevents anything injurious to public health.	Ministry of Health	Having site workers during the construction phase means that all precautions outlined in the Act for the protection of their health and safety needs to be adhered to.
Historical Monuments, Relics, Fauna and Flora Act (Act No 41 of 1967).	The Act prohibits the destruction or damage to any historical monuments, fauna and flora as well as removal from their habitat of Lesotho without permission. It further protects man-made cultural sites and artefacts, as well as 16 groups of fauna and 11 groups of flora. Amendments in 2003 and 2005 added more protected flora species. Examples of protected species include tortoises, terpins, cranes, storks, herons, egrets, and birds of prey.	Ministry of Tourism, Environment and Culture.	Should any heritage objects or features be discovered during the construction process, precautionary measures need to be implemented and the provisions of this Act need to be complied with. Should specialist studies identify any protected fauna or flora on the site during a biodiversity monitoring scheduled prior construction, written consent will be required if they need to be moved.
The 2006 National Heritage Bill (2006)	An Act to provide for the protection, preservation and conservation of cultural, natural and living heritage of Lesotho, and for connected matters.	Ministry of Tourism, Environment and Culture.	Should any heritage objects or features be discovered during the construction process, precautionary measures need to be implemented.
Roads Act (Act No 24 of 1969)	The Act covers "locating, constructing, opening, maintaining, protecting, deviating, working and closing of roads." This legislation provides regulations for land adjacent to roads as needed during road construction and	Ministry of Public Works: Department of Rural Roads	There are access roads already leading to the site. The existing roads need to be maintained

LEGISLATION	PURPOSE	ENFORCING ORGANIZATION	RELEVANCE TO THE PROJECT
	maintenance, as well as outlining fair compensation processes for individuals directly affected economically by road construction. An Environmental Impact Assessment is required for the development of new roads.		in good order and the provisions of all relevant legislation be adhered to.
Lesotho Electricity Supply Act (1969) Electricity Regulations (1970)	The Act provides for the legal framework outlining the responsibilities of the Lesotho Electricity Corporation (LEC). This includes responsibility for the generation, transmission, and distribution of electricity within Lesotho. The 1970 amendments provide specific rules regarding conditions of supply, service requirements, installation requirements, and measurements and payment procedures.	Lesotho Electricity Company	The project is regarding the generation of electricity which will influence the supply of electricity in the country. LEC will require the project to comply to their standards as is necessary in terms of this Act.
Lesotho Electricity Authority Act of 2002	The Act has provisions which are to: ▪ Ensure the security of the supply of electricity in Lesotho ▪ Ensure the promotion of sustainable and fair competition in the electricity sector where it is efficient to do so ▪ Protect the interests of all classes of consumers of electricity as to the terms and conditions and price of supply ▪ Ensure, so far as it is practical to do so, the continued availability of electricity for use in public hospitals, and centres for the disabled, aged and sick ▪ Ensure the availability of health and safety guidance in relation to electricity supply to the public ▪ Ensure the financial viability of efficient regulated electricity undertakings ▪ Ensure the collection, publication and dissemination of information relating to standards of performance by licensed operators and on the electricity sector in	Lesotho Electricity Company	LEC is meeting the requirements of this Act through the procurement of energy that will be generated by this project.

LEGISLATION	PURPOSE	ENFORCING ORGANIZATION	RELEVANCE TO THE PROJECT
	Lesotho for use by the industry, consumers and prospective investors. ▪ Develop annual supply targets for ensuring that such services are accessible to the widest number of electricity users		

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2.1.6 National Policies and Plans

The Policies below are relevant to the proposed project as the project needs to be executed in a manner that conserves the environment and complies with all necessary procedures that relate to energy (electricity).

Table 7: National Policies and Plans

POLICY/STRATEGY/PLAN	OBJECTIVES
National Environment Policy, 1998	The overall goal of the National Environment Policy is to achieve sustainable livelihood and development for Lesotho. The policy relates to the Lesotho's national development priorities. It focuses on the social and economic dimensions, the management and conservation of the natural resources and the promotion of community participation. The main goals of the NEP are (1) environmental conservation and improvement and (2) contributing to improved quality of life for Basotho through environmental preservation.
National Environment Secretariat (1990)	Formulation and implementation of environmental policies on a national level in Lesotho. As such, it is NES responsible for evaluation of the Project Brief / Environmental Impact Assessment process as described above. NES also conducts land use planning, regulation enforcement, data collection and analysis for environmental management, environmental awareness outreach, and annual report preparation.
National Environmental Action Plan (1989)	To address environmental degradation. This legislation provides a framework for integrating multiple metrics of concern, primarily taking environmental concerns into account is the creation of social/economic development policies and plans. The NEAP highlights areas of major environmental concern, suggests actions, and defines a structure for national policy.
Lesotho Energy Policy (2015)	In 2015 the Lesotho Energy Policy framework was enacted which envisions the path forward for the energy sector in Lesotho from 2015 to 2025 and included linking the energy sector with other development goals of Lesotho, including contributing towards the improvement of livelihoods, economic growth and investment, security of energy supply, environmental sustainability and gender equality. The policy statements addressed the Institutional and Regulatory Framework for the Energy Sector, including compliance to minimum safety, health, environmental, risks, and service standards in the energy sector. About renewable energy, the 2015 Lesotho Energy Policy sets as objectives to improve the energy security situation by reducing reliance on fossil fuels and imported electricity and to reduce Greenhouse Gas (GHG) emissions from the energy sector. In terms of power generation, the framework envisions that base load requirements should be met through local generation, which maximize the development of indigenous renewable energy resources and enhance the participation of the private sector and cooperative associations in electricity supply. It also calls for development of a power purchase agreement (PPA) framework that will allow the private sector and cooperative associations to participate as Independent Power Producers (IPPs) in mini or micro hydro, wind, solar and biomass power generation. It furthermore establishes institutional roles and pricing processes for energy.

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POLICY/STRATEGY/PLAN	OBJECTIVES
Lesotho National Electrification Master Plan (2007).	The Lesotho National Electrification Master Plan (NEMP) study was finalized in 2007, with an objective to provide clear guidelines and establish priorities for providing access to electricity in Lesotho. This report forecast energy demand and established target generation capacity to fulfil the objectives of various scenarios for household connection levels through 2020. The NEMP recommended an upgrade to the existing 132kV backbone connecting northern and southern Lesotho from Maputo to Mabote; this transmission line is the identified point of delivery of 20MW electricity for the proposed project. The respective roles of the Lesotho Electricity Company (LEC), the GoL Rural Electrification Unit (REU) and the private sector are indicated, including a preferred policy of selecting projects that promote transfer of skills in the case of international competitive bidding and advantage partnership with local firms. The NEMP furthermore considered environmental issues impact and mitigation, recommending: • Major constructions should be avoided in protected areas and tourism development areas. • Screening for archaeological finds, rock paintings etc. before construction. • Erosion control should be observed when clearing vegetation from construction sites and access roads. • The use of diesel generators should consider the recycling of spent oil.
Legal Notice No. 38 (2012)	In 2012, Legal Notice No. 38 in the Government Gazette promulgated the Lesotho Electricity Authority Application for Licenses Rules, pursuant to sections 34 and 35 of the Lesotho Electricity Authority Act of 2002. The Licence Rules outlines the process which need to be followed when lodging an application to the Lesotho Electricity Authority for the generation, transmission, distribution, supply, import and export electricity.
National Strategic Development Plan (2012)	The most recent NSDP was published in 2012 to cover the period from 2012/13 - 2016/17. The NSDP provides a pathway for implementation of the National Vision 2020: "By the year 2020 Lesotho shall be a stable democracy, a united and prosperous nation at peace with itself and its neighbors. It shall have a healthy and well-developed human resource base. Its economy will be strong, its environment well managed and its technology well established." The high-level strategies identified to achieve this vision are: (I) Pursue high, shared and employment creating economic growth; (II) Develop key infrastructure; (III) Enhance the skills base, technology adoption and foundation for innovation; (IV) Improve health, combat HIV and AIDS and reduce vulnerability; (V) Reverse environmental degradation and adapt to climate change; (VI) Promote peace, democratic governance and build effective institutions.

POLICY/STRATEGY/PLAN	OBJECTIVES
	As relates to Energy Infrastructure (under part II), the plan specifically identifies the following needs: • improve safety and reliability of grid connections to households and growth areas • mobilize investment to take advantage of potential for renewable energy generation in Lesotho, including hydropower, wind, and solar • promote energy conservation Furthermore, the design of the proposed project aligns with the following strategic objectives outlined in the NSDP (2012, pg. 102-103): • Increase clean energy production capacity to attain self-sufficiency, export and have a greener economy • Evaluate renewable power generation options and negotiate financing arrangements to expand national generation capacity

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2.2 International Requirements

2.2.1 IFC Performance Standards

The IFC PS are the benchmark for all international project financing. The IFC PS on Environmental and Social Sustainability form part of the IFC's Sustainability Framework. The IFC requires its clients[1] during all lending, borrowing or investments to apply these standards to manage environmental and social risks so that development opportunities are enhanced (IFC, 2012). In addition to the express Performance Standards of the IFC PS themselves, participants must meet the requirements of local and international laws in these areas. In this way, the IFC PS ensures project developers go beyond the minimum compliance with laws and regulations of the countries they operate in, where such laws and regulations fall below the IFC Standards. Together the eight IFC PSs establish standards that the client is to meet throughout the life of an investment, namely:

- PS 1: Assessment and Management of Environmental and Social Risks and Impacts;
- PS 2: Labour and Working Conditions;
- PS 3: Resource Efficiency and Pollution Prevention;
- PS 4: Community Health, Safety, and Security;
- PS 5: Land Acquisition and Involuntary Resettlement;
- PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PS 7: Indigenous Peoples[2]; and
- PS 8: Cultural Heritage.

2.2.2 World Bank EHS Guidelines

The WB Environmental, Health and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. The General EHS Guidelines are designed to be used together with the relevant Industry Sector Guidelines (April 30, 2007), which provide guidance to users on EHS issues in specific industry sectors. The EHS Guidelines for Electric Power Transmission and Distribution (April 30, 2007) are applicable in this Project as transmission lines are included. Hence it will be necessary for the project to be designed such that it meets the guidelines.

2.2.3 Additional Sources of Good Practice Guidance

Furthermore, the following IFC's Good Practice Documents will be consulted during the ESIA process:

- IFC/ WBG Utility-scale Solar Photovoltaic Power Plants: A Project Developer's Guide (2015);
- IFC/ WBG Good Practice Handbook for Companies Doing Business in Emerging Markets (March 2018);
- IFC Good Practice Note "Addressing the Social Dimension of Private Sector Projects" (December 2003); and
- IFC Good Practice Manual "Doing better business through effective public consultation and disclosure" (November 1999).

[1] The term "client" is used throughout the IFC Performance Standards broadly to refer to the party responsible for implementing and operating the project that is being financed, or the recipient of the financing, depending on the project structure and type of financing.
[2] PS 7 does not apply to the project as no indigenous people are affected.

2.3 Compatibility of the IFC Performance Standards and Lesotho Approval Route

The IFC PS represents the opportunity to ensure a bankable ESIA and subsequent third-party investment from lenders who are part of or signed up to these standards. The IFC PS do not conflict with Lesotho Law, and the scope places a special emphasis on engagement, disclosure and the consideration of key issues. Disclosure and consultation requirements 'for the Lesotho EIA' process allow for public consultation including an approach that will ensure that the affected communities can participate in exchanging their views on the draft ESIA produced.

Therefore, consultation in accordance with Lesotho Environmental legislation was conducted accordingly for the project. Disclosure and consultation in accordance with IFC Standards began early in the ESIA process and continued as risks and impacts arose. It was therefore necessary to plan and coordinate the two consultation processes to comply with both requirements.

The information in **Table 8** presents a condensed summary of the Project compliance requirements and commitments to the eight IFC Performance Standards. The complete IFC PS and WB EHS Guidelines can be viewed on the IFC website.

Table 8: Project Compliance Requirements and Commitments Against Eight IFC Performance Standards

PERFORMANCE STANDARD	COMPLIANCE	COMMITMENT OR FURTHER EVIDENCES BASED STUDIES REQUIRED	STATUS QUO
PS 1: Assessment and Management of Environmental and Social Risks and Impacts.	▪ Environmental and Social Management System (ESMS) required. ▪ Stakeholder engagement plan (SEP) required.	▪ Development of ESMS and SEP. ▪ Comprehensive Environmental, Social, Health and Safety (ESHS) Management plan for construction phase.	▪ ESMS pending. ▪ SEP developed. ▪ ESHS pending.
PS 2: Labour and Working Conditions.	▪ International Labour Organisation (ILO) standards and commitment required.	▪ Social impact assessment (SIA) of all phases of the project required. ▪ Contractor procurement and HR Policy for construction phase.	▪ SIA developed. ▪ HR Policy pending.
PS 3: Resource Efficiency and Pollution Prevention.	▪ EHS guideline adherence and commitment to ESMS.	▪ Pollution prevention and mitigation to be identified within ESIA.	▪ ESIA developed.
PS 4: Community Health, Safety, and Security (CHSS).	▪ Vectors of disease and community exposure to be assessed.	▪ Mitigation measures within the ESIA. ▪ CHSS Plan to be affected prior to construction phase (in pre-construction).	▪ ESIA developed. ▪ CHSS pending.
PS 5: Land Acquisition and Involuntary Resettlement.	▪ Evidence to be provided concerning land ownership, compensation and engagement process.	▪ Clear land tenure, Abbreviated Resettlement Action Plan compensation and mitigation measures.	▪ Underway.

PERFORMANCE STANDARD	COMPLIANCE	COMMITMENT OR FURTHER EVIDENCES BASED STUDIES REQUIRED	STATUS QUO
		▪ Relevant tenure arrangement and livelihood monitoring plans required prior to construction phase.	
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.	▪ Ecosystem impacts to be assessed and evaluated, with reference to ecosystem services.	▪ Evidence led studies to inform the design and ensure mitigation measures are appropriated.	▪ Biodiversity Study developed.
PS 7: Indigenous Peoples	▪ Engagement should ensure early identification.	▪ SEP to be developed. (Although PS 7 not applicable to this project).	▪ SEP developed.
PS 8: Cultural Heritage	▪ Assessment to be performed.	▪ Literature review and site inspection with development of chance find procedures prior to construction phase.	▪ Heritage study developed.

2.4 Operational Safeguard Policies of the African Development Bank

The AfDB has adopted a series of five Operational Safeguards with regards to ESIA process and these safeguards are outlined in **Table 9** below. The Operational Safeguards (OS) as with the IFC Standards set outs the Bank's overarching requirements for borrowers or Clients to identify, assess and manage the potential environmental and social risks and impacts of the project including climate change matters. Again, as with the IFC PS these OS do not conflict with the Lesotho Legislation. It must be noted that the when comparing the IFC PS with AfDB OS, there are three aspects which do not feature within the AfDB OS and these are Cultural Heritage, Community Health, Safety and Security (CHSS) and Indigenous People. In addition, there are certain aspects which have been grouped together within the AfDB OS such as labour conditions and health and safety. Overall there are more similarities than differences.

Table 9: Project Compliance Requirements and Commitments Against Eight IFC PS and Five AfDB OS

IFC PERFORMANCE STANDARD	IFC COMPLIANCE CRITERIA	AFDB SAFEGUARD	AFDB COMPLIANNCE CRITERIA
PS 1: Assessment and Management of Environmental and Social Risks and Impacts.	▪ Environmental and Social Management System (ESMS) required ▪ Stakeholder engagement plan (SEP) required.	▪ **OS 1:** Environmental and Social Assessment.	▪ Environmental, Climate Change and Social Management System required. ▪ Stakeholder engagement plan (SEP) required.
PS 2: Labour and Working Conditions.	▪ International Labour Organisation (ILO) standards and commitment required.	▪ **OS 5**: Labour Conditions, Health and Safety.	▪ International Labour Organisation (ILO) standards and commitment required.

IFC PERFORMANCE STANDARD	IFC COMPLIANCE CRITERIA	AFDB SAFEGUARD	AFDB COMPLIANNCE CRITERIA
PS 3: Resource Efficiency and Pollution Prevention.	▪ EHS guideline adherence and commitment to ESMS.	▪ **OS4:** Pollution Prevention and Control, Hazardous Materials and Resource Efficiency.	▪ EHS guideline adherence and commitment required.
PS 4: Community Health, Safety, and Security (CHSS).	▪ Vectors of disease and community exposure to be assessed.	-	-
PS 5: Land Acquisition and Involuntary Resettlement	▪ Evidence to be provided concerning land ownership, compensation and engagement process.	▪ **OS 2:** Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation	▪ Evidence to be provided concerning land ownership, compensation and engagement process.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.	▪ Ecosystem impacts to be assessed and evaluated, with reference to ecosystem services.	▪ **OS 3:** Biodiversity, Renewable Resources and Ecosystem Services	▪ Ecosystem impacts to be assessed and evaluated, with reference to ecosystem services.
PS 7: Indigenous Peoples	▪ Engagement should ensure early identification.	-	-
PS 8: Cultural Heritage.	▪ Assessment to be performed.	-	-

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3 PROJECT CONTEXT AND MOTIVATION

3.1 Site Description and Ownership

The proposed project is sited within the Ts'ana Talana council of Mafeteng District and owned by this council. In addition, it has the following coordinates as listed in **Table 10 and Table 11**.

Table 10: Co-ordinates of the Proposed PV Plant

	LATITUDE (S)	LONGITUDE (E)
Centre Point	29°47'50.88" S	27°20'18.27" E

Table 111: Coordinates of the Powerline

	LATITUDE (S)	LONGITUDE (E)
Starting Point	29°48'01.82" S	27°20'07.56" E
Middle Point	29°48'17.09" S	27°20'14.74" E
End Point	29°48'28.03" S	27°20'06.01" E

3.2 Surrounding Land Uses

The study area is surrounded by a natural area that is in proximity to the Tsana Talana and Litsahaneng rivers and their tributaries, Ha Raliemere, Ha Lempetje and Ha Ramarothole villages. There are subsistence agricultural activities undertaken closer to the site. Furthermore, there are regional roads with tar and secondary gravel roads, used to access the site.

Table 12: Surrounding Land uses within a 500m Radius of the Site

DESCRIPTION	Y/N	DESCRIPTION	Y/N
Natural area	Y	Light industrial	N
Low density residential	N	Medium industrial	N
Medium density residential	Y	Heavy industrial	N
High density residential	N	Power station	N
Informal residential	Y	Military or police base/station/compound	N
Retail commercial & warehousing	N	Spoil heap or slimes dam	N
Office/consulting room	N	Dam or reservoir	N
Quarry, sand or borrow pit	N	Hospital/medical centre	N
School	N	Tertiary education facility	N
Church	N	Old age home	N
Sewage treatment plant	N	Train station or shunting yard	N
Railway line	N	Major road (4 lanes or more)	N
Harbour	N	Plantation	N
Sport facilities	N	Agriculture	Y

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DESCRIPTION	Y/N	DESCRIPTION	Y/N
Golf course	N	River, stream or wetland	Y
Polo fields	N	Nature conservation area	N
Filling station	N	Mountain, koppie or ridge	N
Landfill or waste treatment site	N	Museum	N
Historical building	N	Protected Area	N
Graveyard	N	Archaeological site	N
Airport	N	Other:	N

Key: Y = Yes N = No

3.3 Project Description

The Project will entail the construction of a Photovoltaic Power Generation Plant that will include plant operations as well as plant maintenance for up to 25 years (**Figure 5**). The solar power generated will be sold to the Lesotho Electricity Corporation (LEC). The project will also include the following infrastructures:

- A power block consisting of approximately 70 000 solar panels will be used in the construction of the generation plant;
- Construction of a 33kV Powerline from the PV Plant to the Ramathole substation. The exact voltage and tower positions will be subjected to a final design and agreement with the Lesotho Electricity Corporation. The powerline will be approximately 1.1km in length with a servitude corridor of approximately 26m (13m in each side) (a corridor of 50 m (25 m either side) will however be assessed to allow micrositing) (**Figure 7**);
- Operation and Maintenance Building;
- Construction Laydown areas;
- Inverter Station (internal substation) to increase (“step-up”) the voltage of the electricity for transmission into the grid;
- The main site entrance road is gravel, 10m in length and 6m wide and will be connecting from the existing access road; and
- Total area to be fenced is approximately 66 hectares.

In addition to the above, the approximate vegetation clearance requirements are outlined below:

- Laydown area: 1.5Ha;
- Onsite substation: 1Ha;
- Internal roads: 1.8Ha;
- Civil Works required to implement the Freshwater Ecologists recommendations and Stormwater Management: 3.5-5Ha;
- Civil Works required for MV (trenching): 1-2Ha;
- Additional contingent area: 1.9Ha; and
- Total area to be cleared: 13.2 Ha.

As a Corporate Social Responsibility (CSR) initiative the Project will build a standalone solar PV-battery-backup generation (LPG or Diesel) mini grid in the Raliemere community. The CSR initiative will operate as a micro-utility in the village providing modern energy access to 184 Households, 1 School and 4 Small Enterprises. The electricity will be supplied via Pay As You Go (PAYG) prepaid, metered 220VAC electricity through a Lesotho Grid Code compliant distribution network at the uniform retail tariff rate set by the Lesotho Electricity and Water Authority (LEWA). The village has been informed and surveyed through a consultative process.

The solar farm will sell electricity to LEC. There are existing access roads leading to the project site from the main road.

3.3.1 Project Technology

The power plant will use crystalline silicon PV technology to convert sunlight into electricity. This project employs tier 1 solar PV panels mounted on single axis east to west trackers. It is anticipated that Direct Current combiners will be utilized to route power to six 4MW Inverter blocks including a step-up transformer for a medium voltage connection to the off-takers electric grid.

3.3.2 Project Construction

It is anticipated that construction will commence in the fourth quarter of 2019 however, this is dependent on the finalization of negotiations with the Government of Lesotho and a Lenders due diligence process. The site would be accessed from an existing, gravel access road. A 10m long and 6m wide, gravel access road would be constructed from the existing access road to the site. The existing access road would need to be graded for a length of approximately 1.3km to ensure an acceptable surface for construction traffic. Temporary access roads will only be constructed, where necessary, and rehabilitated upon completion of construction. Solar panels will be shipped to the nearest port and transported to site *via* road transport (flatbed trucks) as normal loads.

It is anticipated that construction traffic will consist of seven vehicles per hour, of which four will be heavy duty and three will be motor vehicles. Approximately 200 workers will be employed during the 9 to11-month construction phase and this will consist of unskilled labourers from local communities who will perform general work and imported skilled labourers. Minor levelling of the site may be needed. This would entail some cutting and filling, but most likely more filling is required than cutting. Any additional fill material required will be obtained from commercial sources. Topsoil will be removed from any cut or fill areas and replaced once levelling has taken place. The grass/low vegetation on site will not be scraped clear to keep dust to a minimum. Small shrubs or trees may be removed, if required.

A permanent on-site Operations and Maintenance (O&M) building will be constructed for the operation of the plant and will include rain water harvesting tanks for domestic water usage and will be powered by the plant. All buildings will be single story. Piles will be emplaced in predrilled pilot holes for anchoring the PV array structures to the subsurface, and concrete slabs will be poured for the inverters, step up transformers and switchgear, the power house (offices and control room), the parking lot, the back-up LPG generator and fuel tank and the security guard house.

Crews for the solar field will mount tracking frames onto the concrete poles and completed tracking frames will have PV panels installed with mounting brackets. Wiring between panels and the inverter will be underground. A security gate and associated guardhouse may be placed at the entrance to site. This is aimed at preventing unauthorised vehicular access to site during both construction and operation. The site will be fenced in with chain link fence or similarly visually permeable materials.

If possible, water will be sourced from an onsite borehole and stored on site in JoJo style tanks alternatively water will be trucked in from a municipal source. Approximately 150m3/MW (or 3000 m^3 in total) of water is required for construction. General and hazardous construction waste will be disposed of at an appropriate, licensed landfill facility. If there are no licenced facilities in Lesotho, then waste will be disposed of at a licenced facility in South Africa such as in Bloemfontein.

Temporary holding tanks will be utilized during construction to hold wastewater and Port-a-Potty style toilets will be used for ablutions. Wastewater will be disposed of in terms of relevant legislation / regulations.

3.3.3 Project Operation

The project will sell power to LEC for a period of 25 years and has the option to extend this period. Activities during operations will be limited to maintenance, occasional visits by LEC, LEWA, government personnel or visitors and minimal delivery of supplies and materials.

Project traffic during operations will consist of an average of six vehicles per day of which one will be a heavy duty and five will be motor vehicles. It is anticipated that approximately 11 people will be employed for the operational phase of the project and will maintain the facilities mechanical and electrical systems and conduct routine maintenance and repairs (technical oversight, safety compliance, maintenance, reporting, site work, cleaning and security). Periodically, as indicated by visual inspection and metered output, the solar field will be cleaned with water.

Approximately 20m^3/year of water is required during operations. Water will be sourced from an onsite borehole (if possible) or trucked in from a municipal source and stored on site in JoJo style tanks.

It is proposed to build septic tanks on site for wastewater and designs will comply with relevant legislation and regulations. General and hazardous waste will be disposed of at an appropriate, licensed landfill facility. Electricity during operations would be obtained from the site or from a back-up generator.

3.3.4 Project Decommissioning

Should operations not be extended past the initial 25 years then full decommissioning will occur, and the land will be returned as close as reasonably possible to its original state or better, such that the use of the land for future agriculture is not affected . Concrete foundations, should they be required for the panels, may be removed in totality or will be broken down such that they can be covered with topsoil and revegetated. In areas which may be cultivated (e.g. areas that were historically cultivated) it would be necessary to completely remove concrete foundations and any buried infrastructure that may negatively affect future agriculture . Decommissioning is likely to be of similar duration to construction, namely 9-11 months.

3.4 Project Motivation

3.4.1 Need and Desirability

The Project will contribute to a strategic phase-out of costly power imports from Mozambique, and to reducing Lesotho's reliance on imported coal-generated power from South Africa, thereby promoting power supply independence, achieving substantial savings in the national budget and abating regional carbon dioxide emissions. It is also hoped that the solar power project in the Mafeteng Province of Lesotho will contribute approximately 13% to Lesotho's maximum system demand of around 150 MW. By substituting 20 MW of costly imported power from Mozambique, it will decrease power retail prices in Lesotho. Furthermore, it will entail greenhouse gas emission substitution effects as a result of reducing imports of thermally generated power from neighbouring state, South Africa. Furthermore, the project will support rural development by stabilizing the grid in Mafeteng Province (https://www.iafrikan.com/2017/08/16/utility-scale-solar-pv-project-in-lesotho/).

3.5 Project Alternatives

A key component in the ESIA process is the identification and consideration of feasible and reasonable alternatives. The identified feasible alternatives should be evaluated in terms of social, biophysical, economic and technical aspects. Alternatives in relation to the proposed activity or development can be defined as different means of meeting the general purpose and requirements of the activity. These alternatives can include the following:

- The property on which or location where it is proposed to undertake the activity;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity;
- The operational aspects of the activity; and
- The option of not implementing the activity.

Site and location, layout as well as the no-go option alternatives have been identified and considered for the proposed project and these are described below. It is not possible to consider alternative types of activity (solar power) and technology (photovoltaic) as the project was a tender specified by government. Therefore, other alternatives listed above were not considered.

3.5.1 Site Alternative

Due to the mountainous terrain of Lesotho and the prevalence of high irradiance in the western lowlands, this area was considered for site identification. Furthermore, site selection focused on areas adjacent to the existing LEC 132kV line and substation in the Mafeteng district. Four sites near the existing LEC 132kV line and substation were initially identified in this area for the project namely sites 1, 2, 3 and 4 (**Figure 5**). A selection screening study was undertaken for the project through the following actions: review of satellite imagery; series of site visits to meet with the local chief about the acceptability of the prospective sites; assessment of the elevation gradient (flatter sites are better); soil stability and erosion (stable sites are better); ease of access points; proximity to village areas, schools, clinics and institutions (further away is better); and documenting the layout of the substation as well as the availability of a rectangular area which is approximately 60ha.

After further consideration of the length (approximately 1km) of high voltage wire to connect the PV plant with the substation and the topography of the area, a final site was selected which is Alternative Site 1(**Figure 6**).

Environmental investigations (visual inspection) were also conducted initially by Neo I during the Project Brief on the four sites to identify environmental sensitivities which would have excluded construction (dongas, surface water, forest, heritage sites, etc) and nominate/recommend the least sensitive site. The investigation indicated that none of the four alternative sites exhibit highly sensitive floristic attributes as all

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the variants are spatially situated on deteriorated habitat types, notably agricultural fields. The spatial proximity to other sensitive habitat types, does indicate a slight preference for Alternative Site 1 as other options do coincide marginally with sensitive habitat types including wetlands and ridge environs. Alternative Site 1 was therefore at the time preferred from a receiving environment point of view. As Alternative Site 1 is also preferred from a technical perspective, negotiations were initiated with landowners to secure the site to ensure that the project could be delivered on time. As such only Alternative Site 1 will be assessed.

3.5.2 Layout Alternative

Initially the preliminary layout, as provided in the Project Brief was a rectangular shape to maximise technical efficiencies (see **Figure 4**). This has however been shifted in location and amended in layout to avoid the large drainage line crossing the site (see **Figures 5 and 6**). Where relevant, the design/layout and operational aspects of the activity will be amended further during the detailed design process to avoid or reduce impacts, as per the mitigation measures contained in this report. Only the amended layout will be assessed.

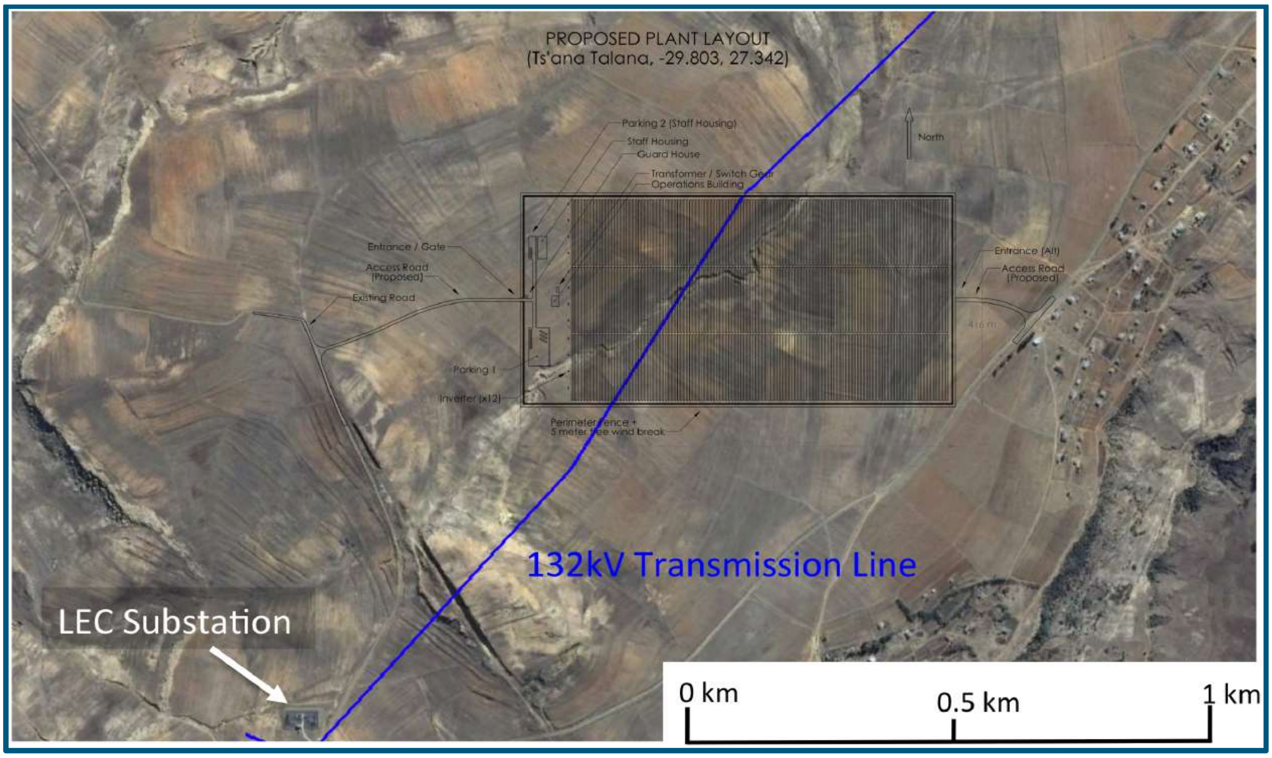

Figure 4: Preliminary PV Layout Originally Proposed

3.5.3 No-Go Project Alternative

The objectives of the proposed project are to contribute to a strategic phase-out of costly power imports from Mozambique and to reducing Lesotho's reliance on imported coal-generated power from South Africa. Should the proposed project not proceed as planned, the above-mentioned objectives will not be met, and Lesotho will continue to rely on the imported electricity from neighbouring countries. Thus, the no-go alternative is not preferred.

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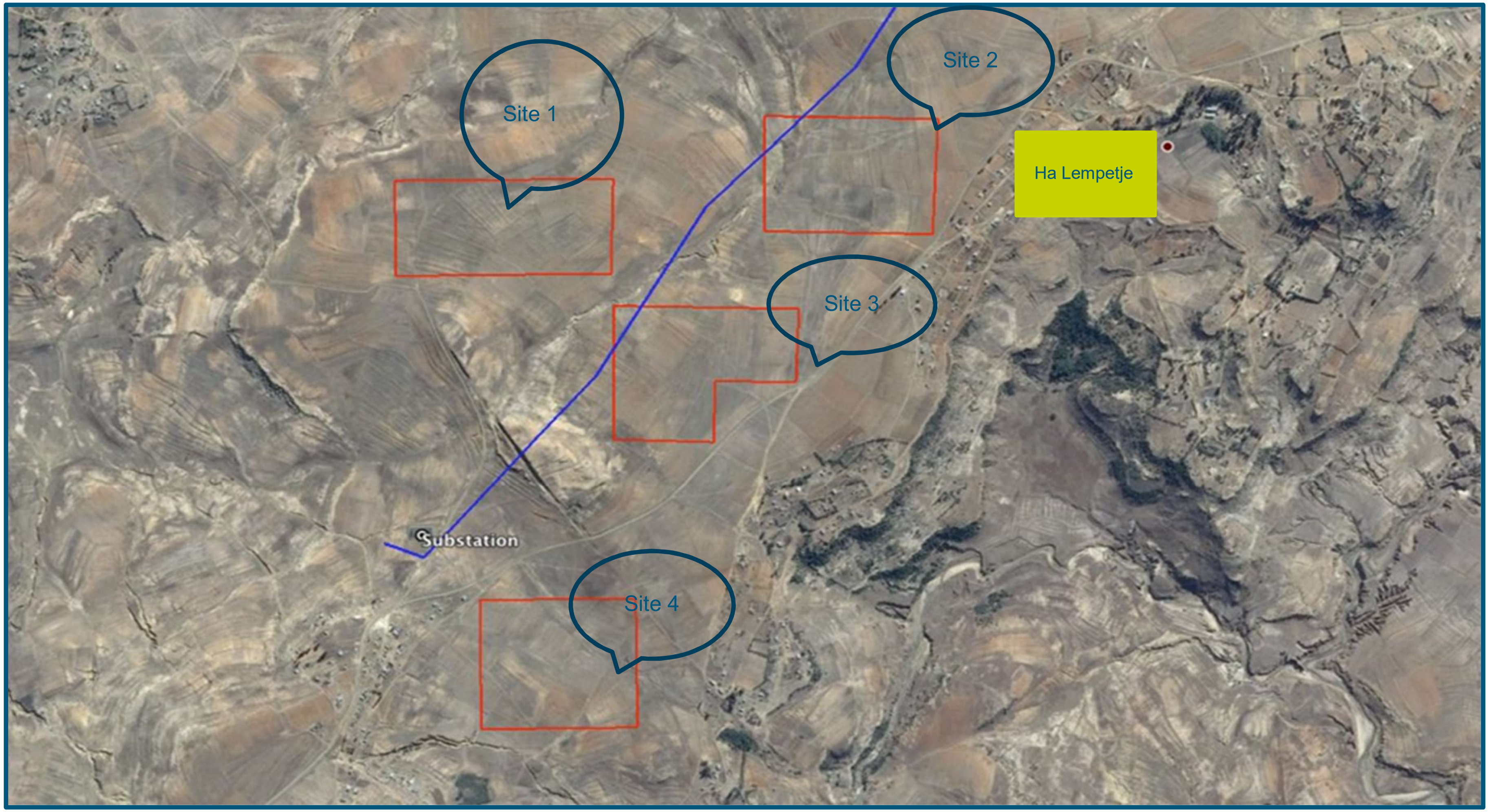

Figure 5: Four Sites Alternatives Identified for the PV Project

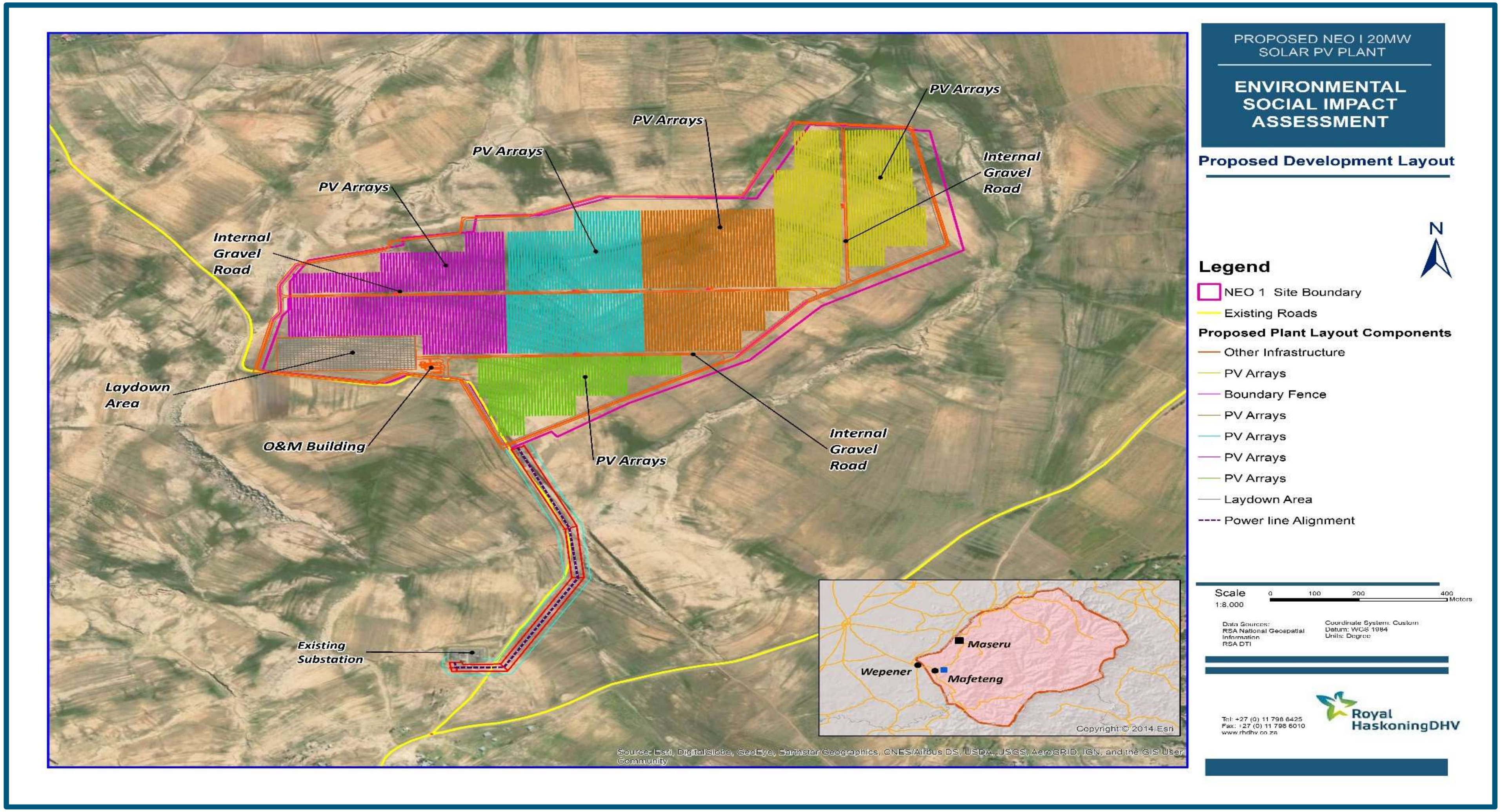

Figure 6: Layout of the PV Plant

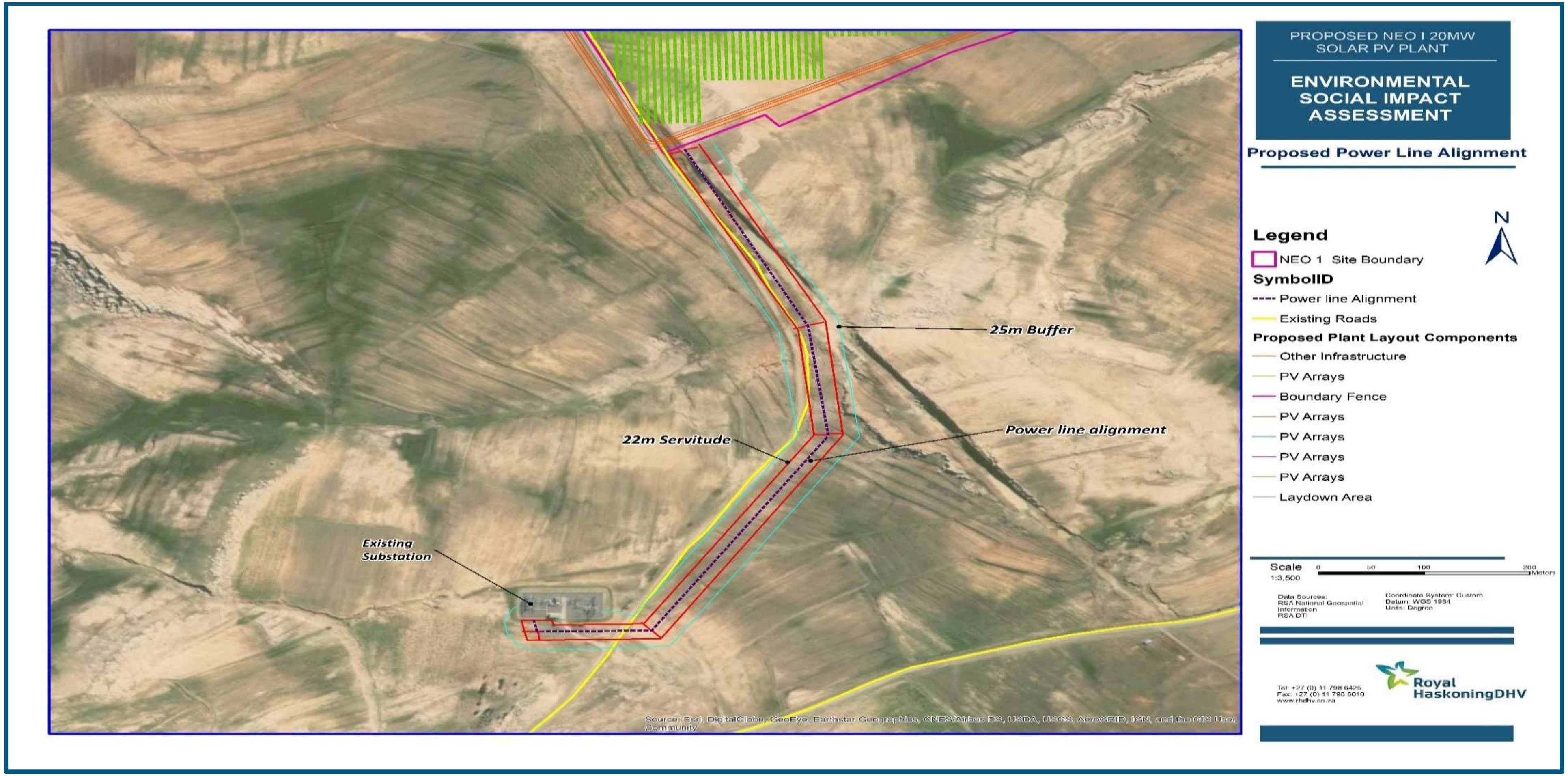

Figure 7: Proposed Powerline Alignment showing 50 m wide assessment corridor (light blue)[3]

[3] *Note that the powerline will be routed on the eastern side of the road shown in the corridor, up until where it crosses the road.*

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4 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL PARAMETERS

This section provides information on the environmental and social parameters and sensitive receptors that are at risk or being impacted upon by the construction and/or operational activities of the proposed Project, as identified based on literature review, field reconnaissance trips and the experience of our experts on similar projects. The scope of environmental components and the main indicator parameters used to characterise them are highlighted **Section 5**.

All environmental parameters within this ESIA report adheres to international standards and practices. Furthermore, the potential cumulative effects of the proposed Project with other proposed and consented projects in the area are also considered in this section. As far as possible, the data and reports were collected during the ESIA phase from data holders, such as previous ESIA studies, Lesotho Authorities' reports, Non-Governmental Organisations' (NGOs) studies and reports, and local University resources. In addition to the reports referred to, team members also conducted a site visit to understand the baseline environment. It must be noted that where Lesotho information was not available, South African data was used due to the proximity of these two countries.

The Government of Lesotho is also proposing a 70MW solar electricity generation facility adjacent to the NEO I project site within the Ha-Ramarothole Village in Mafeteng. RHDHV is only aware of the EIA report compiled for the project and the approval process of the EIA report by LMTEC is unknown.

4.1 Physical Environment

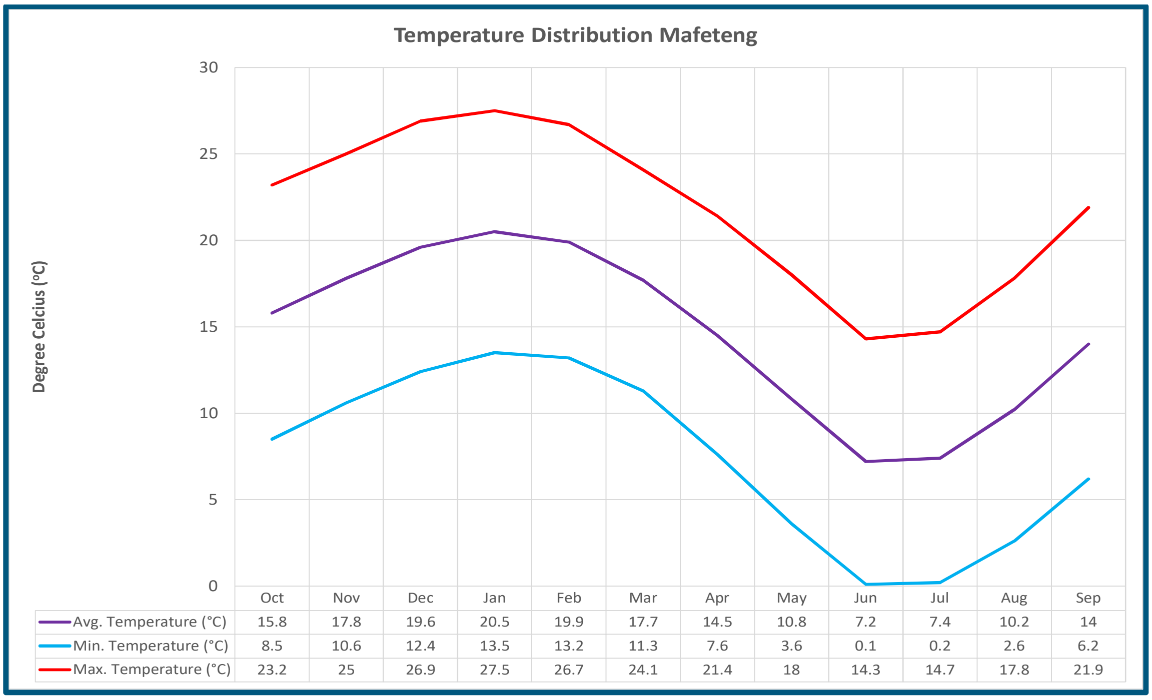
The sections below present what is known about the physical baseline environment, how the environment could potentially be changed and what receptors could be impacted. Changes to the physical environment can impact upon biological communities as well as the ecosystem services that they provide, and this is a subject that has been explored within the ESIA report.

4.1.1 Climatic Conditions

The general climate of the site is described as Subtropical Highland (Koppen Geiger classification Cwb) (Kottek, et al., 2006). This classification indicates warm summers, summer rainfall and a drier, cold winter. The main natural vegetation type is Moist Highveld Grassland as described by Kruger (2004). The site is situated on the watershed of the Caledon and Orange-Senqu River Basins, at an elevation of approximately 1 750 metres above mean sea level (mamsl).

4.1.1.1 Temperature

No local temperature data is available, but temperatures from the nearby town of Mafeteng is reported as shown in **Figure 8** (Climate data 2018). January is the warmest month, with an average temperature of 20.5 C. At 7.2 °C on average, June is the coldest month of the year. Frost and snow may occur at any time of the year but are rare occurrences during the warmer summer months.

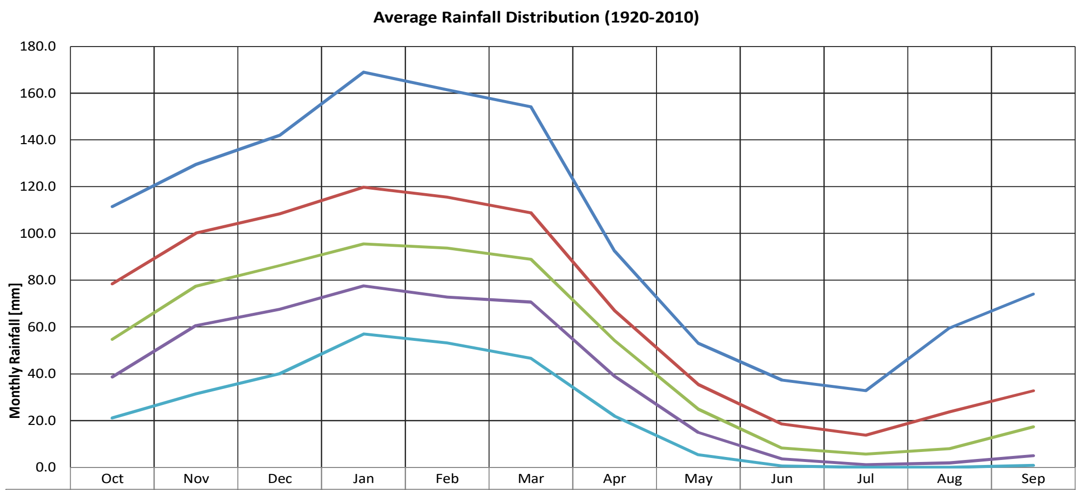


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Avg. Temperature (°C)	15.8	17.8	19.6	20.5	19.9	17.7	14.5	10.8	7.2	7.4	10.2	14
Min. Temperature (°C)	8.5	10.6	12.4	13.5	13.2	11.3	7.6	3.6	0.1	0.2	2.6	6.2
Max. Temperature (°C)	23.2	25	26.9	27.5	26.7	24.1	21.4	18	14.3	14.7	17.8	21.9

Figure 8: Maximum and Minimum Average Monthly Temperature

4.1.1.2 Rainfall

Rainfall for this study report was determined from data used in WR2012 (Bailey & Pitman, 2015) for Quaternary catchments D23F and D15. The site falls on the boundary of these two catchments, within D23F. In the region, rainfall tends to increase with altitude, toward the upper regions of the catchment. Average Mean Annual Precipitation (MAP) for catchment D23F is estimated at 638 mm, while the D15F catchment has an average MAP of 750 mm. The best estimate of MAP at the site would be in the order of 700 mm (or slightly higher). Rainfall distribution is likely to include elements of both Rain Zone D2G (catchment D23F) and Rain Zone D1L (catchment D15F). Taking these points into consideration, an interpolated 90-year rainfall record was generated for the site that had a MAP of 700mm and a distribution pattern as shown in **Figure 9.**



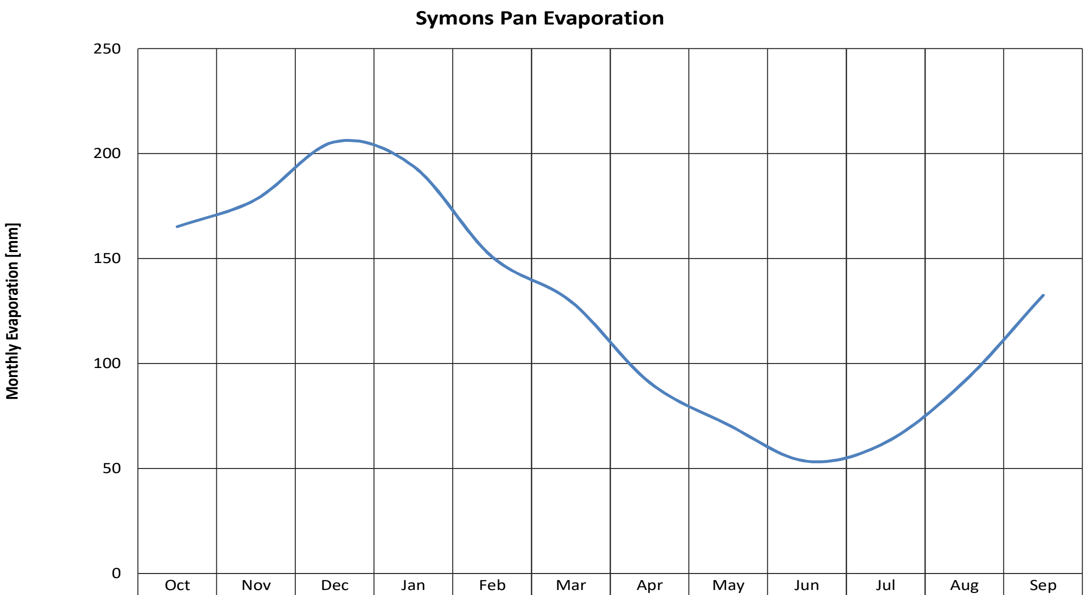
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
E10	111.5	129.5	142.0	169.0	161.4	154.2	92.4	53.1	37.3	32.8	59.6	74.1
E30	78.5	100.2	108.5	119.8	115.6	108.9	67.0	35.4	18.5	13.7	23.7	32.7
E50	54.7	77.5	86.3	95.5	93.8	89.0	54.2	24.8	8.2	5.6	8.0	17.3
E70	38.6	60.7	67.6	77.6	72.8	70.7	39.0	14.9	3.6	1.2	1.9	5.0
E90	21.1	31.5	40.1	57.0	53.2	46.6	21.9	5.3	0.6	0.0	0.0	0.8

E10 represents a value that is likely to be exceeded in 10% of years. An E50 value would be exceeded in 50 % of years, etc.

Figure 9: Monthly Rainfall Distribution Pattern

4.1.1.3 Evaporation

No local evaporation data was found. WR2012 suggests that Symons Pan evaporation for the site is 1 525mm per annum, distributed according to Evaporation Zone 20B (described in WR90). There is not sufficient data available to analyse trends of change in this data and evaporation is estimated as shown in **Figure 10.**



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Symons Pan	165.2	178.2	205.6	194	150.8	129.6	91	70.8	53.4	62.4	91.5	132.5

Figure 10: Estimated Symons Pan Evaporation

4.1.1.4 Current Climate, Existing Hazards and Extreme Events

The Kingdom of Lesotho is located in the sub-tropics but owing to its location on the edge of a broad inland plateau and high altitude has a highly variable climate due to the confluence of climatic influences. During summer, Lesotho is characterised by high temperatures and precipitation, with the opposite being true in winter due to the predominance of high pressure systems that bring about clear skies and dry air. Frost is common in winter, as are severe frontal storms with snow over the mountains. Spring and autumn are transitional and may exhibit characters of either winter or summer. Precipitation patterns in Lesotho are described in the National Adaptation Plan of Action (LMS, 2007):

- The lowest average annual precipitation occurs in the Senqu River Valley (450mm) and the highest in the north-eastern mountain zones (1300mm).
- The amount of precipitation received is highly variable in both time and space resulting in common occurrence of droughts and floods. High intensity rainfall often produces flash floods that accelerate soil erosion leading to high sediment loads in rivers.
- Snowfall occurs annually over the mountain tops and once every three years in the lowlands.

Between 1833 and 1900, very severe winters were observed in 18% of years, with some indication of a reduction in severity over time (Grab & Nash, 2009). Other significant heavy snowfalls were recorded in 1964, 1988, 1995 (LMS, 2007) and 2016 (NASA, 2018) (**Figure 11**). The heavy snow storms cause drastic human problems in the form of cold and restriction of movement and access to the mountain communities. The proposed PV installation is located outside the snow zone however, and therefore likely to only be indirectly affected by snow – in the form of cold temperatures and increased energy demand.

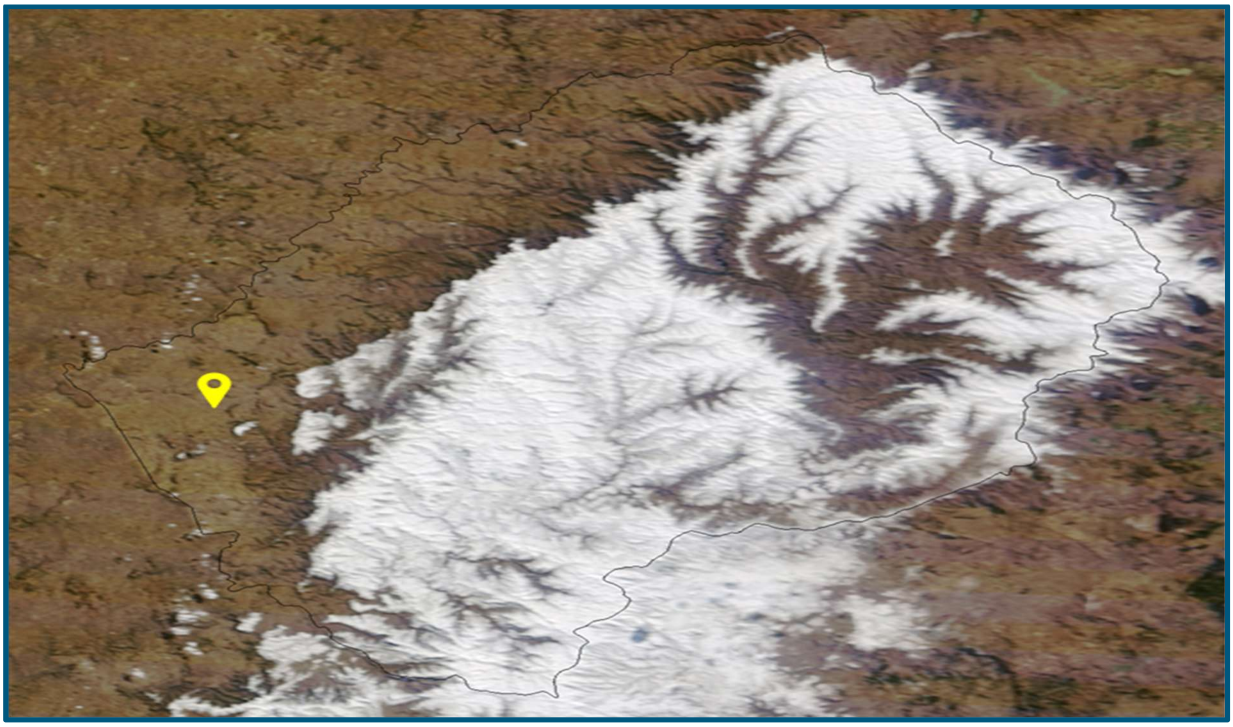


Figure 11: Heavy Snowfall over Lesotho - 27 July 2016 with Location of the Study Site Superimposed.

Source: (NASA, 2018)

According to descriptions provided by the Lesotho Meteorological Services (LMS) (LMS, 2018):

- Temperatures are highly variable, on diurnal, monthly and annual time scales, and are generally lower than those of other inland regions of similar latitude in larger landmasses of both north and southern hemispheres. This is partially due to the tapering of the African sub-continent and overall altitude of the country.
- Normal monthly winter minimum temperatures range from –6.3°C in the lowlands to 5.1°C in the highlands. However, extremes of monthly mean winter minimum temperatures of –10.7°C can be reached, and daily winter minimum temperatures can drop as low as -21°C. Sub-zero daily minimum temperatures can be reached even in summer both in the lowlands and in the highlands.
- Mean annual temperature range from 15.2°C in the lowlands to 7°C in the highlands.
- January records the highest mean maximum temperatures throughout the country, ranging from 20°C in high altitudes to 32°C in the lowlands
- Mean minimum temperatures of around 0°C are common in June, the coldest month, with the lowlands recording the monthly mean temperatures ranging from -3°C to -1°C in the lowlands and ranging from -8.5°C to –6°C in the highlands.

4.1.1.5 Climate Change Projections

Observational data obtained by the LMS for the period since 1980 and analysed for the Lesotho Water Security Assessment (World Bank, 2016), indicate that the variability in precipitation is high – for 67% of the time, rainfall will vary by 20% from the long-term average. This implies that climate change trends will be difficult to ascertain in respect of precipitation, given that data points are likely to remain within these bounds of current-day variability.

On the other hand, the same study found that both minimum and maximum temperatures have increased by 2°C between 1980 and 2003 (World Bank, 2016). This is corroborated by analysis of climate extremes such as number of frost days and growing season length. The higher temperatures will affect soil moisture availability, specifically during periods of below-average rainfall. This has implications for the highly erodible soils of the study area. Severe soil erosion would take place when heavy rainfall follows longer dry spells. Climate change projections obtained from a range of Global Circulation Models agree in general terms that although average annual precipitation is not likely to change over time, temperatures will progressively increase by between 0.9 and 2.9°C by 2050 relative to the historical average (World Bank, 2016). Unfortunately, the study did not detail the emissions scenarios used as model inputs.

4.1.1.6 Implications for the Ramarothole Project

The observed trends confirm the general regional pattern of universally increasing temperature indices, and a possibility of decreased overall availability of moisture due to increasingly erratic rainfall and increased evaporation. Projections of climate change continue the observed trend – confirmed temperature increases and uncertain changes in precipitation trends. Generally, any changes in precipitation values are overshadowed by present-day patterns of variability and swings between wetter and dryer periods. The climatic changes will alter the functioning of the natural ecological systems, due to the higher temperatures and lower water availability. The effects will include increased desiccation, species migration, higher wind speeds, increased erosive effects from wind and runoff, etc.

4.1.2 Land Use

The region surrounding the study area comprises of widespread and extensively transformed habitat resulting from anthropogenic land use categories such as subsistence farming and small scale agricultural practices and informal settlements, modernised human activities, such as cluster industrial developments, limited commercial agriculture and insignificant road and railway infrastructure, etc. remaining portions of natural shrublands and grassland in the region are extensively utilised for grazing purposes during both the austral summer and winter periods by cattle, goat and sheep and the ecology of the larger region has been progressively disturbed over the past decades because of this overgrazing. A mosaic appearance of the landscape on a local and regional scale reflect the intensive nature of the recent and historic anthropogenic disruptive activities. The severity of these land uses resulted in the transformation and decimation of the natural grassland of the region, ultimately rendering the remaining portions of natural grasslands highly sensitive and efforts to arrest the loss of biodiversity on a local region should be prioritised, despite the apparent misalignment with the rights that accompany landownership.

The only change in vegetation cover near the development site occurs around the local villages where trees have been planted, and in some of the areas immediately downslope of sandstone bedrock outcroppings to the south-east of the site where natural bushy / shrubby vegetation occurs. The patterns of human settlement are characterised by the presence of small scattered rural settlements, the closest of which are Ha Rallemere to the north-west, and Ha Sepechele to the east of the site (**Figure 12**). These villages consist of several separate homesteads with associated cultivated fields, kraals and other buildings. Both of these villages are linked to the formal road network *via* gravel roads, one of which skirts the south-western boundary of the development site. Water resources in the form of wetlands and tributaries of rivers are found on site and they are mainly used by grazing animals (cattle, goats and sheep) for drinking purposes (**Figure 12**).

The other landcover classes that have been identified in the vicinity of the site include eroded areas (dongas and gulleys) as well as water bodies (dams). An electricity substation is located to the south of the development site and a large electricity distribution power line (assumed to be of 132kV capacity, and consisting of lattice-form towers), along with a smaller local reticulation power line runs from this substation to the east of the site (**Figure 13** and **Figure 14**).

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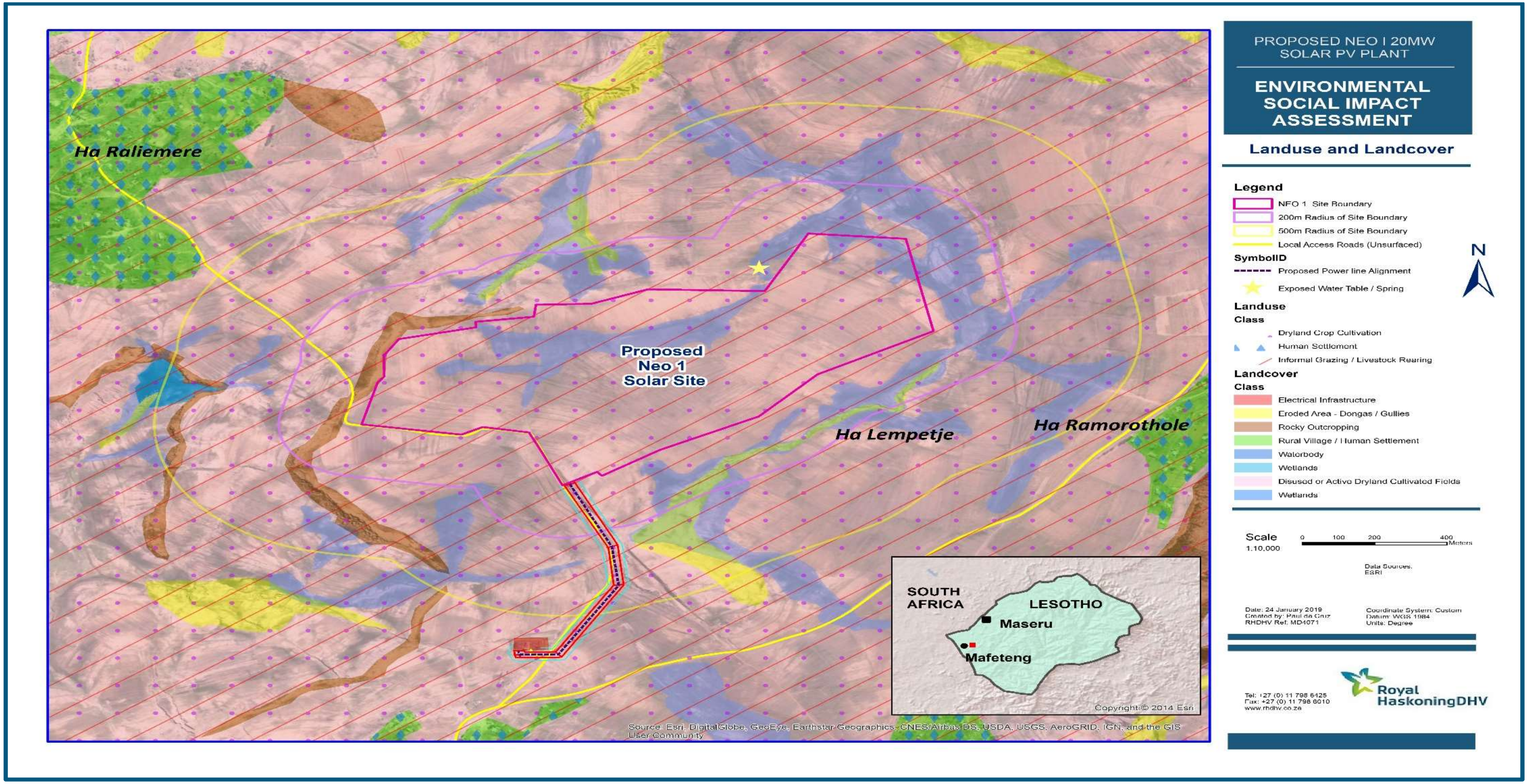

Figure 12: Simplified Land Use Map

Figure 13: Existing Powerline Aligned to the East of the Development Site

Figure 14: Existing Substation and Powerline Aligned to the South of the Development Site

4.1.3 Air

4.1.3.1 Wind

Dispersion comprises vertical and horizontal components of motion. The wind field largely determines the horizontal dispersion of pollution in the atmospheric boundary layer. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume stretching. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction and the variability in wind direction, determine the general path pollutants will follow, and the extend of cross-wind spreading. The mesoscale wind map and data for the Lesotho Wind Resource Analysis is provided. The spatial analysis of wind resources in the region of Lesotho presented in this report is based on a period of one year (from 1 January 2001 to 31 December 2001) simulated data using a non-hydrostatic model of regional primitive-equation of the atmosphere. A whole year of data was generated by an individual simulation of each calendar day in which the year was chosen at random from a record corresponding to the period 2000 to 2009.

The wind rose for Mafeteng shows how many hours per year the wind blows from the indicated direction. **Figure 15** shows the dominant wind direction is from the East-North-East (ENE) with a secondary wind direction from the North West. The numerical model uses a nested grid layout. The size of the coarser grid was defined to consider the effects of synoptic weather events on the wind resource in the region of interest, as well as allowing the development of the model circulations, caused by thermal factors. **Figure 16** below shows the map of annual average wind speed simulated with a resolution of 5km at a height of 80m from January to December.

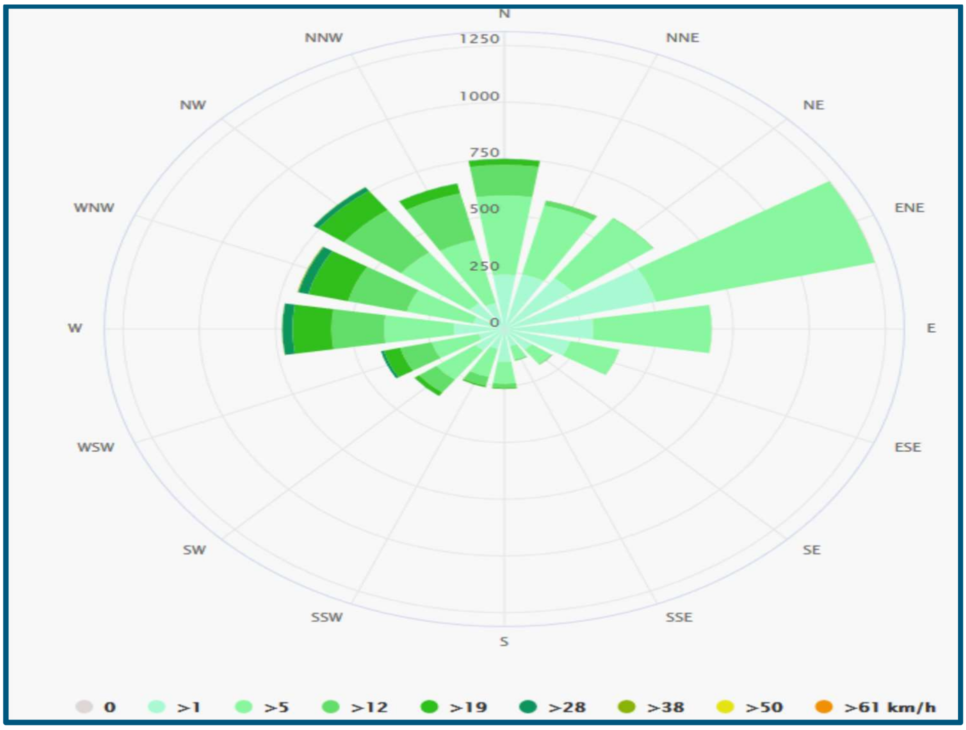

Figure 15: Wind Rose for Mafeteng

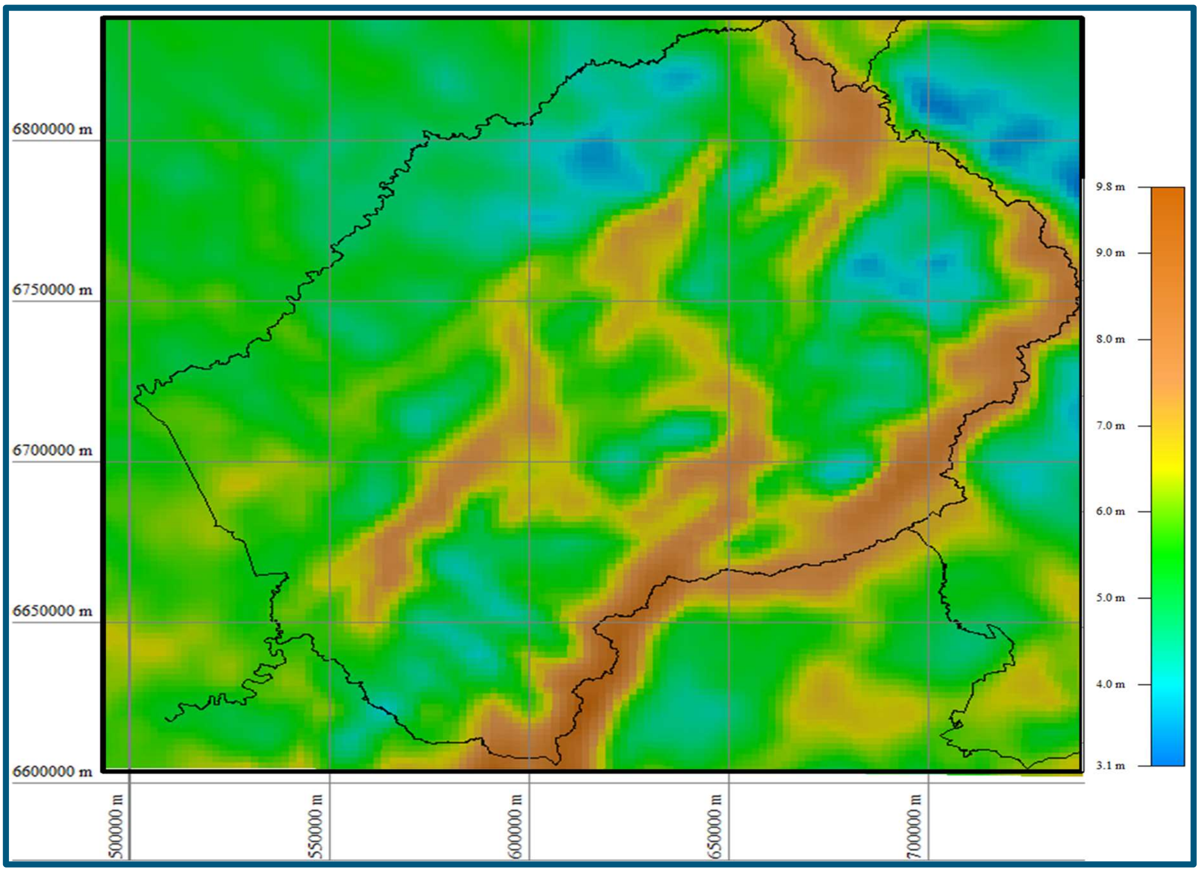

Figure 16: Average Annual Wind Speed Profile

The simulated monthly average wind speeds with a 5km resolution at a mast height of 10m is depicted by **Figures 17, 18 and 19**.

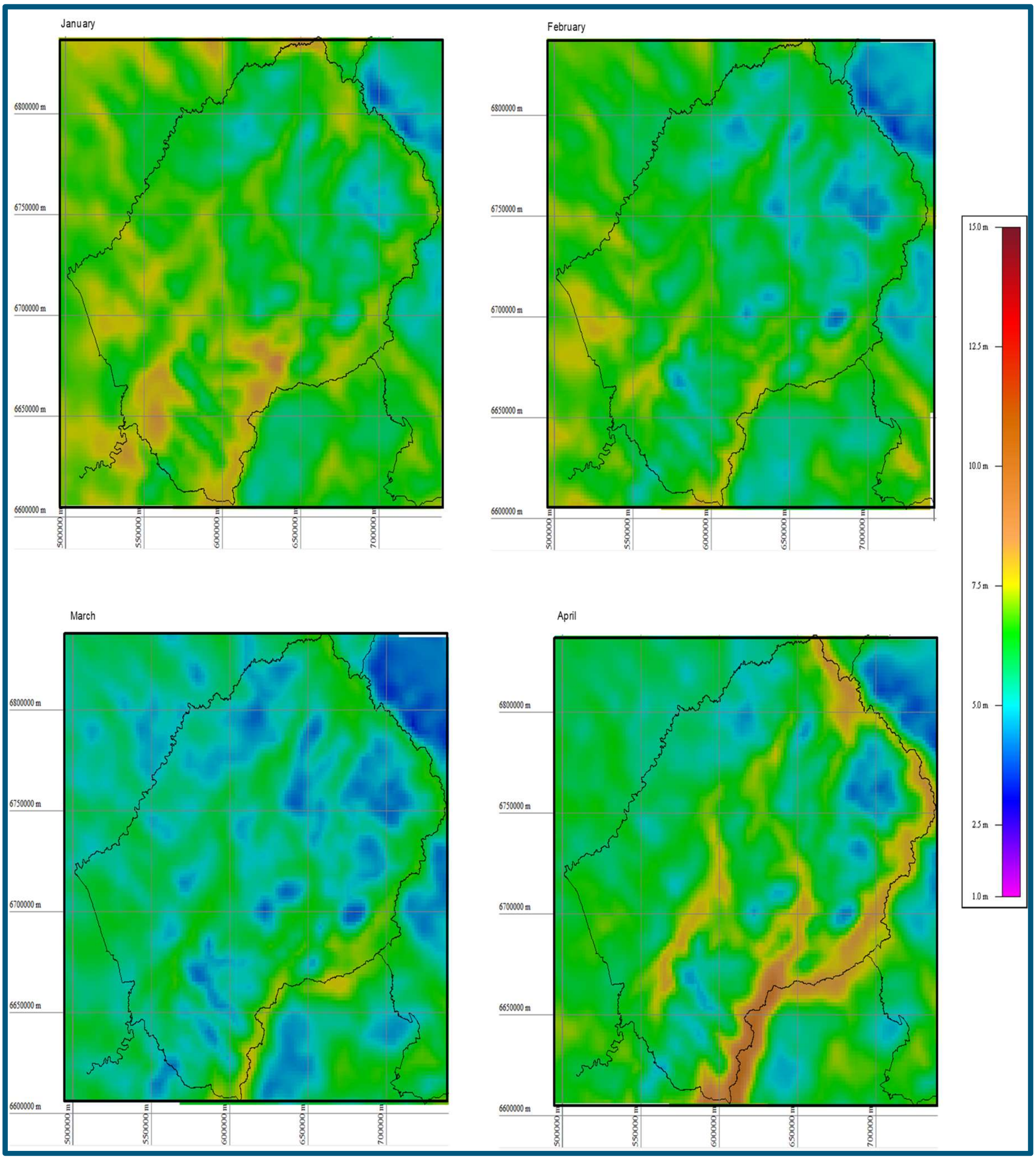

Figure 17: Monthly Average Wind Speed (m) from January to April

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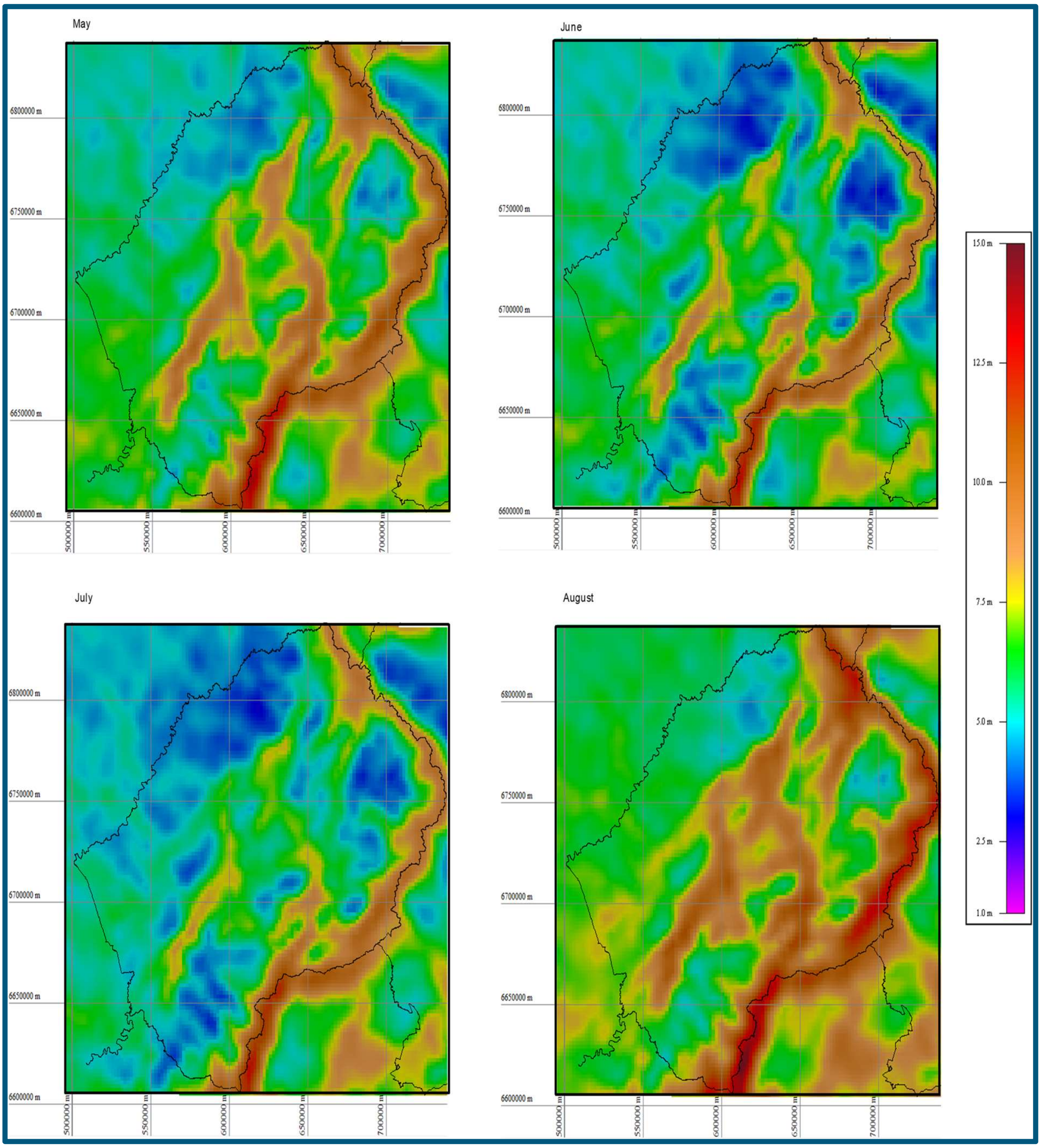

Figure 18: Monthly Average (m) from May to August

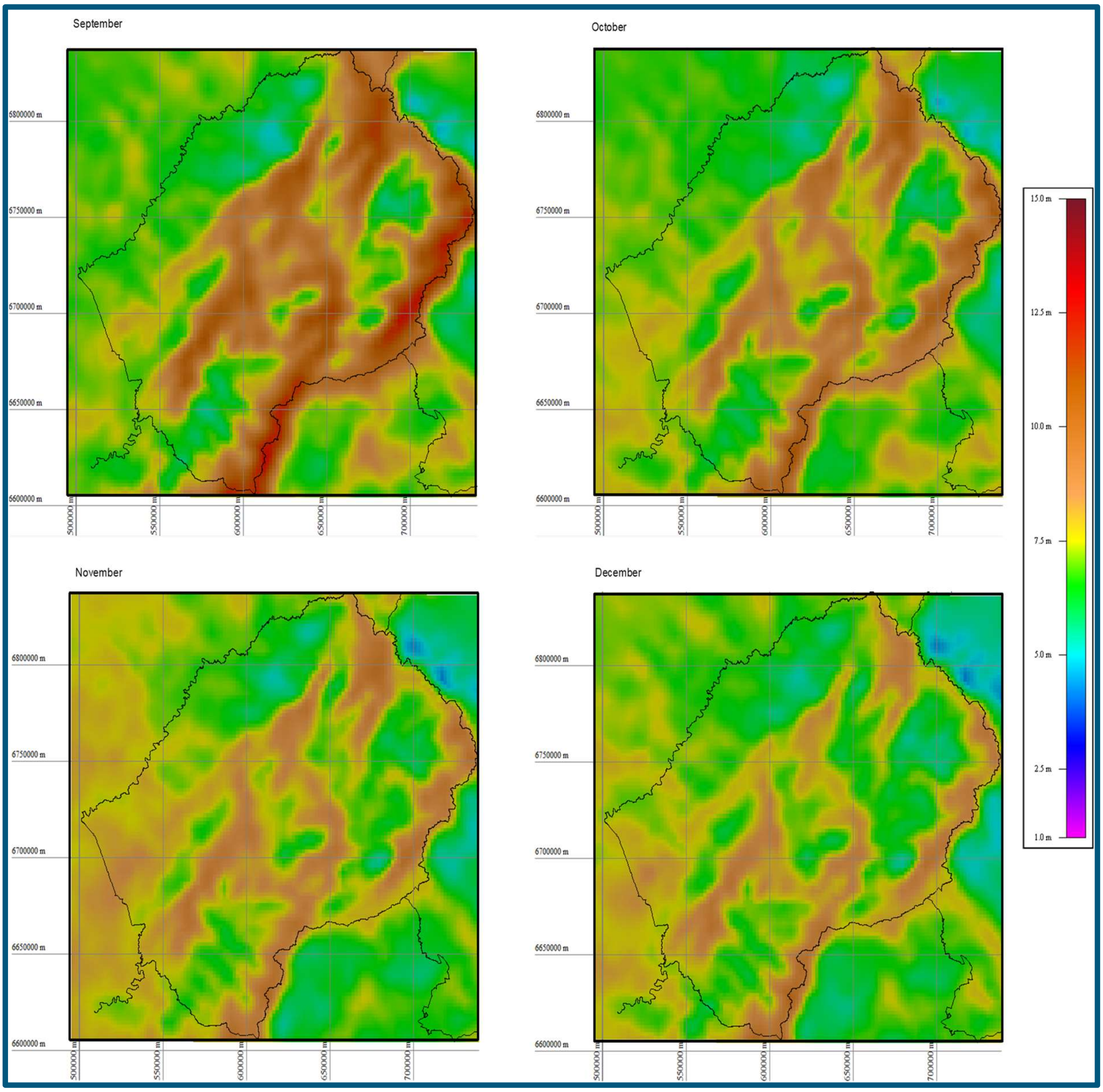

Figure 19: Monthly Average Wind (m) from September to December

4.1.3.2 Existing Sources of Air Pollution

A description of the emissions estimated from clearing and construction activities is discussed below. During the site visit, local, airborne pollutant sources were identified, however the air quality in the region can be viewed as natural (rural). These emissions are important to consider in terms of assessing the cumulative impact potential on air quality in the region. A qualitative discussion on each of these source types is provided below.

Agriculture

Large scale agriculture is not commonly found within Lesotho, with the Mafeteng area being predominantly subsistence agriculture. This form of agriculture commonly results in areas of overgrazing. The airborne pollutant associated with the farming is Particulate Matter (TSP, PM10, PM2.5, etc.) from wind erosion due to open tilled fields and planting.

Vehicles

The force of the wheels of vehicles travelling on unpaved roadways causes the pulverisation of surface material. Particles are lifted and dropped from the rotating wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic. Due to the nature of construction activities, road networks can often be of a temporary nature, and are thus unpaved. An unpaved road network exists in the area. Due to the volume of heavy vehicles using the roads near the site, the expected volumes of entrained dust are likely to be considerable and will need to be addressed.

Exhaust fumes contain nitrogen, oxygen, carbon monoxide, water vapour, sulphur dioxide, nitrogen oxide, volatile hydrocarbons and polyaromatic hydrocarbons (PAHs) and their derivatives, acetylaldehyde, benzene and formaldehyde, carbon particles, sulphates, aldehydes, alkanes, and alkenes.

Home Fires

Domestic fuel burning continues partly due to poor availability of power. In the region of the power plant, the housing is associated with low-income housing with minimal electricity usage for heating during the colder winter months and for cooking. The open-fires are made from any combustible material (usually wood) and is often used to cook and to heat up the house. The associated emissions from these cooking fires differentiate from the type of material used for energy and the most common airborne pollutants are. Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon monoxide (CO), Carbon dioxide (CO_2) and Particulate matter (TSP, PM_{10}, $PM_{2.5}$, etc.). During the winters cold day's inversions form over the surface of the land and cause the airborne pollutants from domestic fuel burning to be entrapped. The air movement cannot disperse the air pollutant from the region and causes the concentrations to build up. The inversion layer and domestic fuel burning takes place at the same time, which increases the severity of the situation at some locations. As the day heats up (midday) the inversion layer breaks up and the pollutants can disperse.

4.1.3.3 Sensitive Receptors

The proposed plant is located in a fairly sparsely populated area with rural dwellings making up the sensitive receptors near the plant. Other sensitive receptors within the area would be the local fauna and flora. It has been identified that dust settling on the leaves of plants can result in damage to plants and inhalation of dust may result in sickness and associated lung diseases for wildlife and humans which will be present in the vicinity of the proposed plant.

4.1.4 Noise and Vibration

4.1.4.1 Description of the Noise Receiving Environment

The measuring points for the study area were selected to be representative of the prevailing ambient noise levels for the study area and include all the noise sources such as distance traffic noise, agricultural activities but exclude traffic noise which was intermittent in the vicinity of the measuring points at the time of the noise survey. The measuring points are illustrated in **Figure 20**. The measuring points along the boundaries of the study area and the physical attributes of each measuring point are illustrated in **Table 13**.

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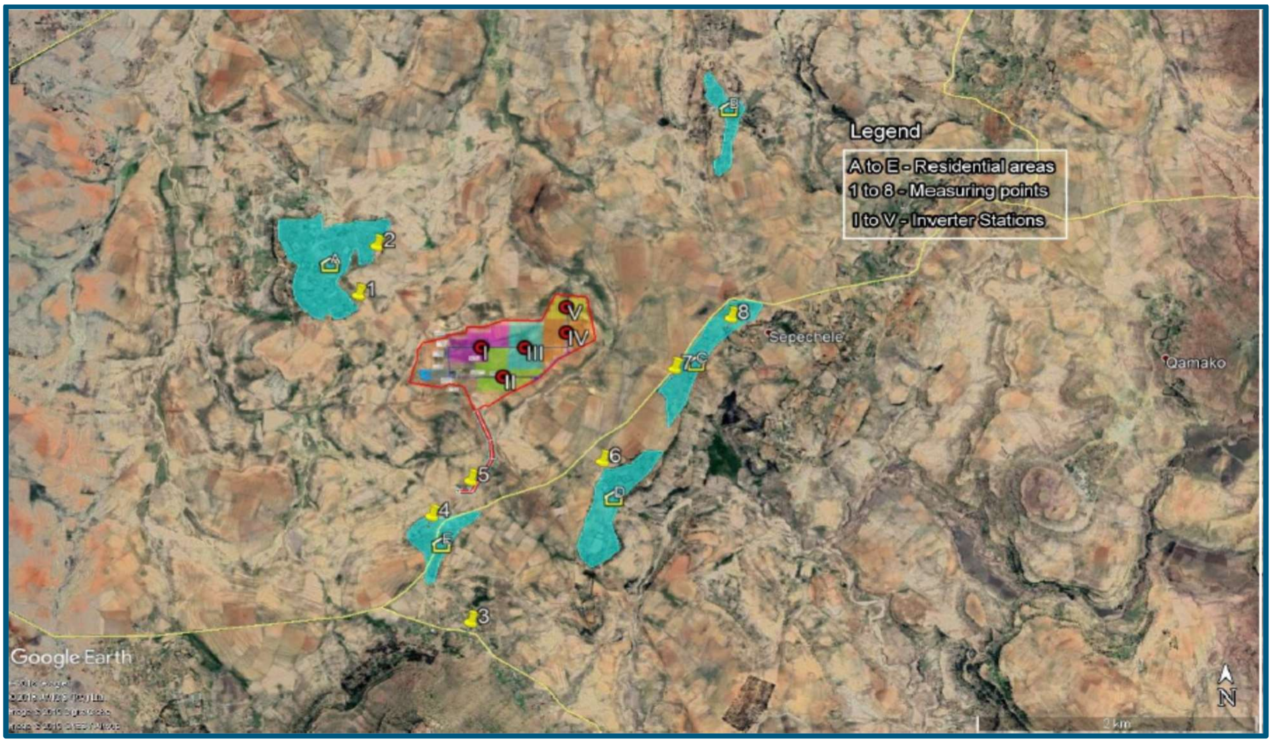

Figure 20: Measuring Points of the Study Area

Table 13: Measuring Points and Coordinates for the Study Area

NO	Coordinates (Zones 35J UTM 1960)		Remarks
	Easting	Northing	
1	531582.27 m	6703973.79 m	Ha Raliemere west of the PV Plant and at a raised level.
2	531710.94 m	6704383.71 m	Ha Raliemere west of the PV Plant and at a raised level.
3	532441.32 m	6701330.48 m	Ha Ramarothole and feeder road between Mafeteng and Hellspoort. Traffic increases the prevailing ambient noise level at times.
4	532148.41 m	6702172.69 m	Some distance from the Ramarothole substation. Distant traffic noise.
5	532429.97 m	6702455.74 m	North of the Ramarothole substation.
6	533402.52 m	6702606.60 m	Boundary of the Ha Lempetje residential area.
7	533939.68 m	6703360.12 m	Boundary of the Ha Lempetje residential area.
8	534362.88 m	6703776.30 m	Boundary of the Ha Lempetje residential area.

The prevailing ambient noise level were created by subsistence farming activities, intermittent traffic noise along the gravel roads and domestic type noises. The residential areas consist out of single housing units, cluster houses and villages with a formal and informal gravel road which runs through the study area. The formal gravel road will be upgraded to accommodate construction related traffic. The noise receptors are illustrated in **Figure 21**.

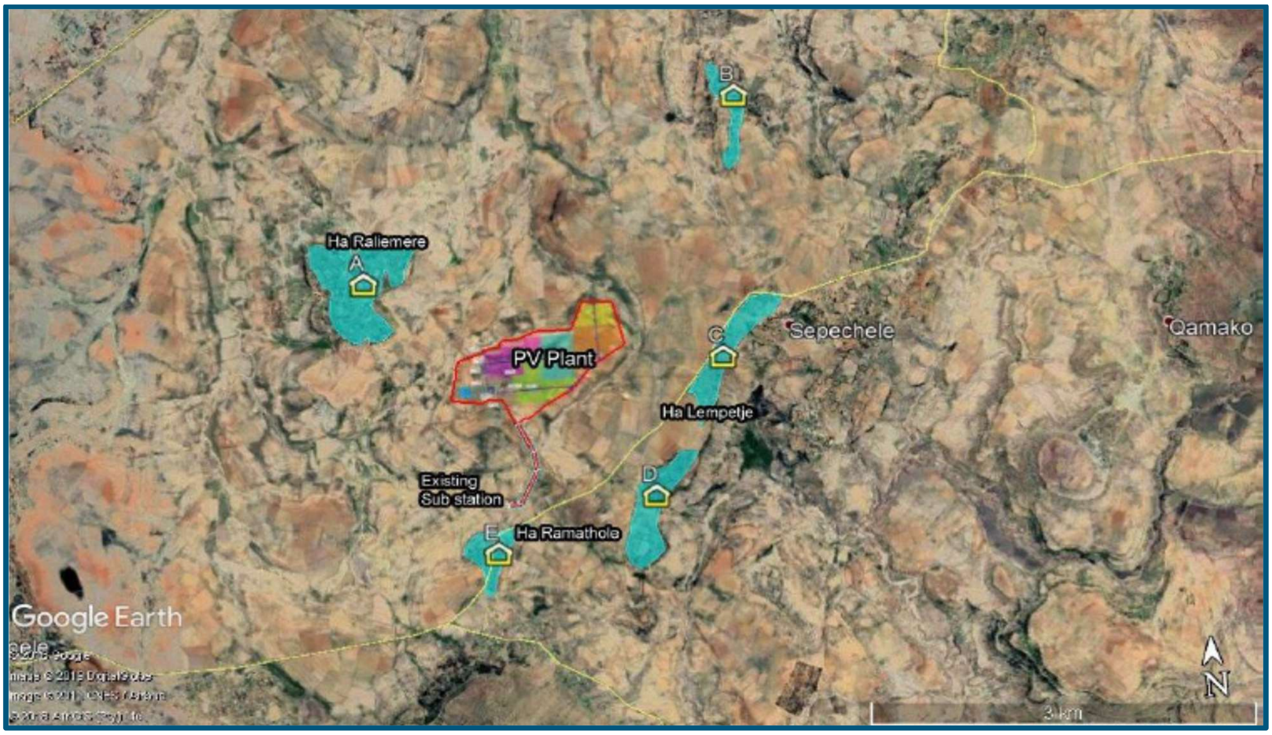

Figure 21: Noise Receptors in the Study Area

The distances between the nearest boundary of the abutting residential area to the potential noise source within the boundaries of the PV plant are illustrated in **Table 14**. The distances between the central inverter, stations (I-V), substation bay and 33kV line were calculated by means of the direct line of the site.

Table 14: Distances between the Noise Receptors and the Noise Sources

NOISE RECEPTOR	INVETER STATION (1)	INVETER STATION (2)	INVETER STATION (3)	INVETER STATION (4)	INVETER STATION (5)	SUB-STATION BAY	33KV
A	1010	1240	1326	1597	1522	1678	1278
B	2305	2344	2044	1750	1592	3186	2711
C	1621	1211	1115	926	985	1632	1397
D	1375	1107	1188	1180	1370	1121	827
E	1344	1160	1440	1627	1820	212	208

4.1.4.2 Noise Impact identification

Noise or sound is part of our daily exposure to different sources which is part of daily living and some of the sounds which are intrusive such as traffic noise forms part of the ambient noise to which people get accustomed to without noticing the higher sound levels. Any person in the workplace (during the agricultural farming activities) and at home is exposed to the following noise levels (Refer to **Table 15**). These are the average noise levels in the workplace and at home that will mask noise from a source introduced into an area.

Table 15: Different Noise Levels in and around the House and Workplace

	ACTIVITY	DBA
Communication	Whisper	30.0
Communication	Normal conversation	55.0-65.0
Communication	Shouted conversation	90.0
Communication	Baby crying	80.0
Home	Radio playing in background	45.0-50.0
Home	Background music	50.0
Home	Insects-crickets	53.0
Home	Animals	55.0
Home	Children playing	60.0
Shops/village	Amplified music	75.0
Shebeen/entertainment area	Amplified music	85.0
Village	People talking	80.0
Village	Train noise	80.0
Village	Motor vehicle noise	75.0

Two aspects are important when considering potential noise impacts of a project and they are:

- The increase in the noise level; and
- The overall noise level produced.

4.1.5 Surface Hydrology, Groundwater and Water Quality

4.1.5.1 Flood line Assessment

Catchment Characteristics

The proposed solar PV Plant falls within the two headwater drainage areas (named Catchment 1 and Catchment 2) which were delineated using ALOs DEM data. Catchment 1 has a well-defined water course whereas Catchment 2 has its defined river downstream towards the confluence of catchment 1's river (Refer to **Figure 22, 23, 24 and 25**). The two catchments drain their water from the undulating hills downslope through a relatively flat terrain and their characteristics are summarised in **Table 16**. The overall catchment area of the proposed solar PV plant is predominantly covered by grassland which were previously cultivated as shown in Google Earth historic imagery assessment. The headwater reaches of the two catchments are eroded, which signifies that the soils are poorly drained. However, downstream towards the confluence of the stream from the two catchments, the topography is relatively flat with small patches of dense grass. This implies that during the wet season these areas are ponded, and they contain soil moisture for a long period of time.

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Table 16: Hydraulic Characteristics of the Delineated Catchments

SITE	RIVER	AREA (KM2)	HYDRAULIC LENGTH (L)	DISTANCE TO CENTROID (L0)	SLOPE (M/M)
Catchment 1	Seekoei River Tributary	1.64	1.91	0.96	0.020
Catchment 2		0.45	1.10	0.55	0.025

Figure 22: River Cross Section in the Headwater of Catchment 1

Figure 23: Downstream view of Catchment 2 River

Figure 24: Eroded Upstream Section of the Main River

Figure 25: Current Land Cover at the Headwater Reaches of Catchment 2

Peak Flow Volumes

The peak flows used for flood line determination and the design for the stormwater management plan and drainage channels were calculated using three standard methods applied in South Africa. Based on the legislation adopted for this study, peak flows resulting from a 1:5-year storm were used for the design of the channel whereas the 1:50 and 1:100-year peak flows were used in flood line modelling. A summary of the calculated peak flow results for the two catchments is presented in **Table 17**. Peak flows calculated using the Rational Method 3 were selected for HEC-RAS hydraulic modelling as they proved to be more conservative compared to the other three. While the SCA-SA method also provided reasonable peak flows, the results from the other methods were not considered reliable especially for the small catchment.

Table 17: Summary of the Calculated Peak Flow Results for the Catchments

CATCHMENTS	RATIONAL METHOD ALTERNATIVE 3			RATIONAL METHOD ALTERNATIVE 2			SCS-SA		
	1.:5 YEAR	1:50 YEAR	1:100 YEAR	1.:5 YEAR	1:50 YEAR	1:100 YEAR	1.:5 YEAR	1:50 YEAR	1:100 YEAR
	M^3S^{-1}								
Catchment 1	9.65	19.04	22.74	4.45	8.26	10.91	6.99	14.63	17.35
Catchment 2	2.50	5.00	6.00	1.58	3.80	4.61	1.88	6.55	7.78

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Flood line Modelling

Flood lines were simulated for the two tributaries adjacent to the proposed Solar plant using the peak flows resulting from the 1.50 and 1:100-year return periods. After evaluating the simulation results, it was noted that a flood resulting from the 1:50-year event do not have any significant differences in the areal extent of the flood areas.

The modelling results show that there are relatively small quantities of flood water drained by Catchment 2 as the 1:100-year peak flows do not reach the site boundary near the PV Module 5. While the flood line in catchment 1 are also not inundating portions of the solar plant, downstream (near PV Module 5) the areal extent of the flood increases, spatially. Part of the reason is that the topographic data used (ALOS) are relatively coarse scale (30 x30 m cell size) and they do not adequately represent elevation differences within a small spatial area. Also given the river is characterised by small width and deep cutting, a 30m resolution ALOS pixel does not account for these differences. Under these conditions, the simulated 1:100-year floods do not pose any risk of flooding the proposed infrastructure (**Figure 26**).

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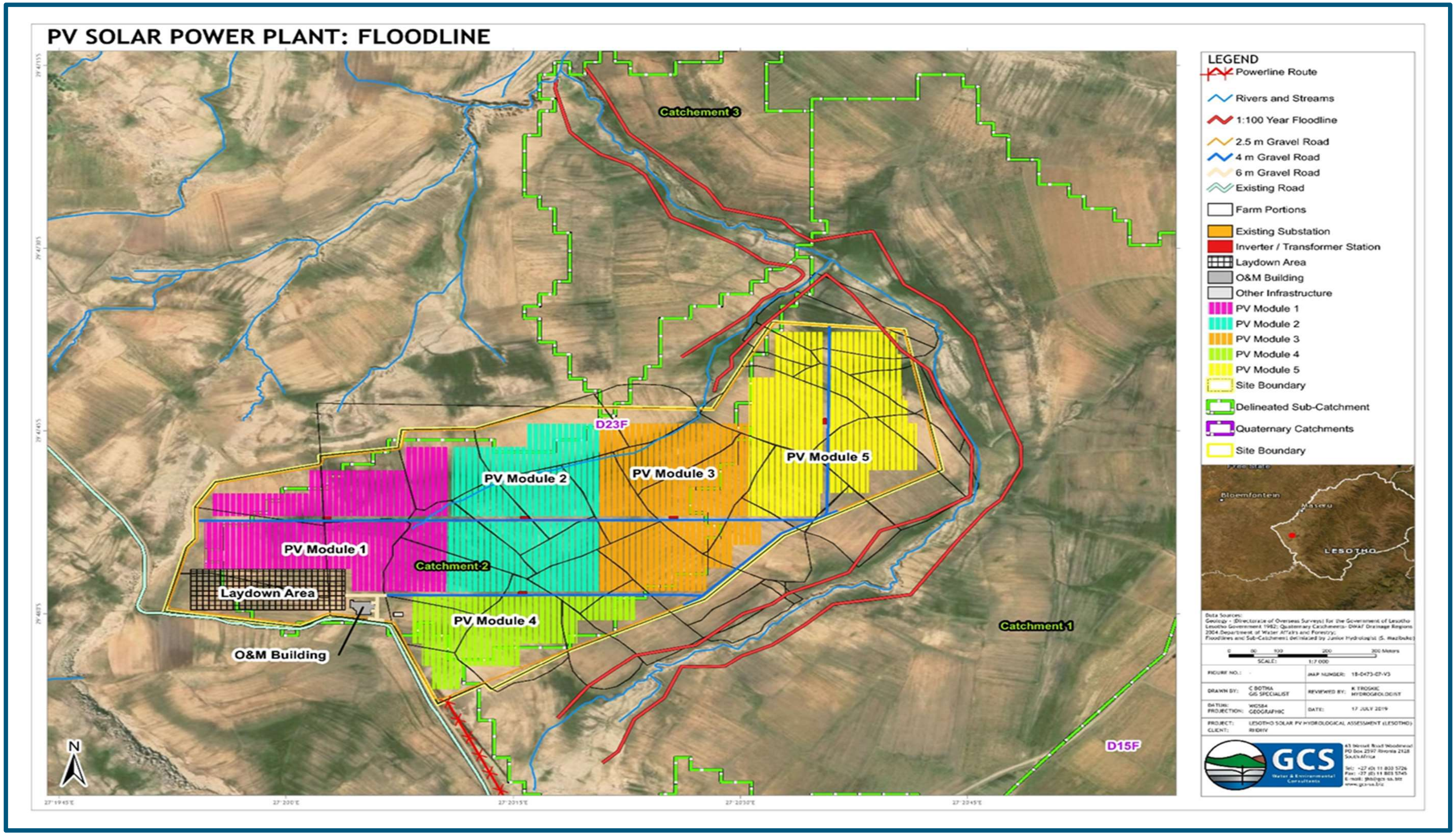

Figure 26: 100-Year Flood line (red) for the Proposed Solar PV Plant Site.

4.1.5.2 Groundwater Assessment

Hydrocensus

As part of the scoping study, desktop and satellite image review of the study areas were carried out. Based on the findings, no groundwater abstraction occurs on the position of the site layout. All surrounding villages (Ha Ramarothole, Tonki eat hope, Ha Ntjoko, Ha Lempetje and Ha Raliemere etc.) depend solely on groundwater in a form of both springs and boreholes. Some of these boreholes were visited during the Hydrocensus conducted on the 18th to the 20th October 2018. The locations of the identified boreholes and springs are presented in **Figure 27.** The Hydrocensus point details are presented in **Table 18**. The Total Dissolved Solids (TDS), Temperature, Electrical Conductivity (EC) and pH were recorded. The DS, EC and pH are all within the South African National Standards (SANS) 241-1:2015 drinking water quality guidelines (SABS, 2015). Water samples were collected from BH1, BH4 and Spring 3

Table 18: Hydrocensus Point Details

BH ID	COORDINATES		IN SITU CHEMICAL PROPERTIES			
	Latitude	Longitude	TDS (mg/l)	Temperature (^{0}C)	EC (µS)	pH
BH1*	-29.81133	27.33494	268	18.6	378	7.5
BH2	-29.78579	27.32037	203	20.6	292	7.91
BH3	-29.78996	27.319	288	19.8	410	7.46
BH4*	-29.79551	27.35823	305	21.5	439	8.28
BH5	-29.80883	27.29594	97	21.3	137.6	7.58
BH6	-29.80124	27.29512	283	24	406	7.35
Spring 1	-29.7862	27.31861	206	16.5	298	8
Spring 2	-29.7976	27.318647	37.9	11.4	59.1	8.2
Spring 3*	-29.7969	27.34634	158	22.2	228	7.87

*Water sample collected.

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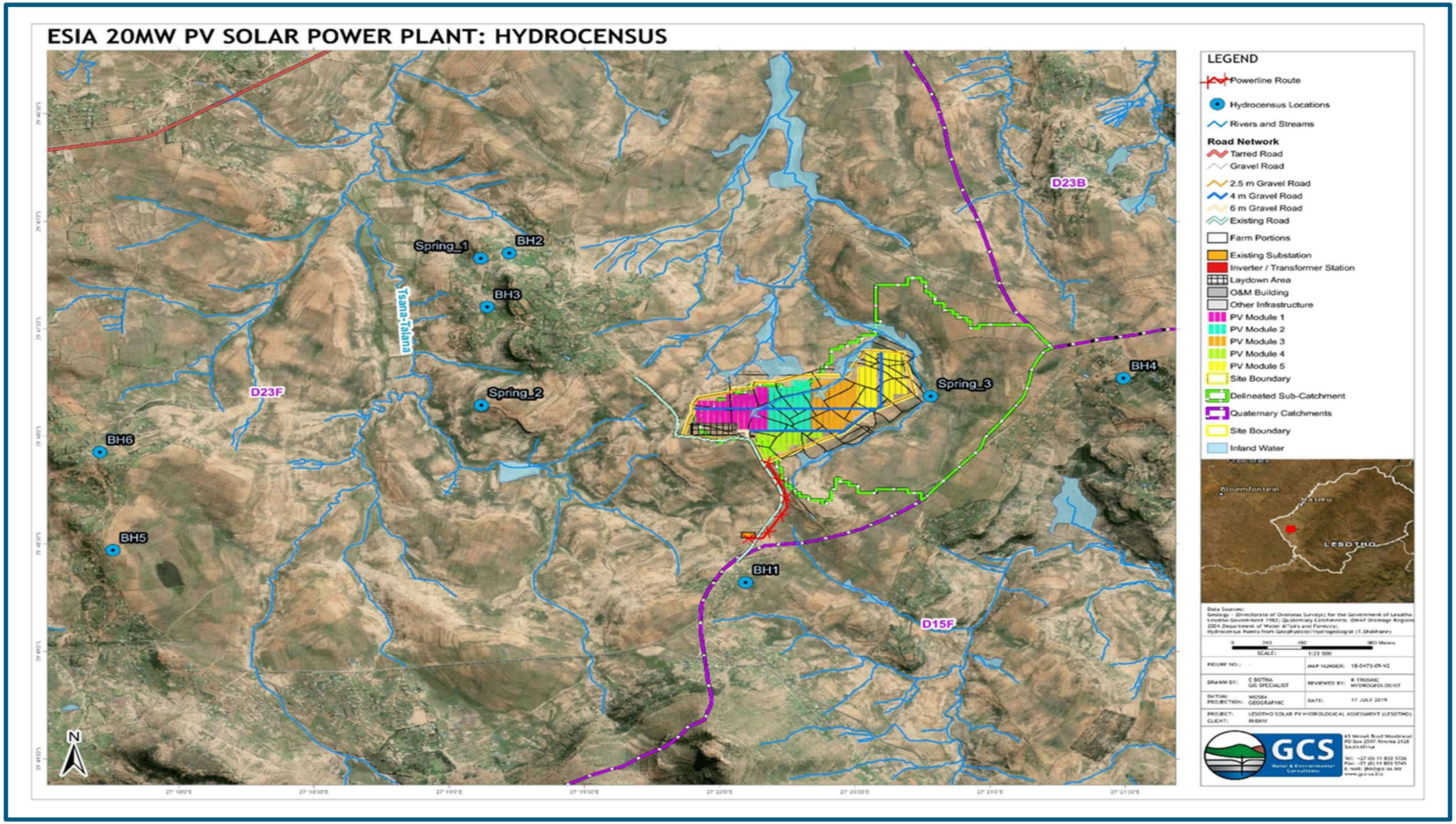

Figure 27: Google Satellite Map Depicting Operational Boreholes and Springs in Proximity of the Study Area

4.1.5.3 Results of the Water Quality Testing

Baseline Surface water Quality Analysis

Surface water (SW) samples were collected from SW1, SW 2 and SW 4 in streams (**Figure 29**). The water samples were compared to the South African National Standards (SANS) 241-1:2015 (drinking water standards). With the exception of Iron at sampling point BH1, which was higher than the SANS standards, all other water quality parameters in all samples are within acceptable standards.

Groundwater Quality

Water samples were collected from BH1 and BH4. The results were compared to the SANS 241-1:2015 drinking water quality guidelines. In-situ and laboratory analysis for a baseline hydrochemical facies indicate that at the time of analysis (October 2018), none of the chemical parameters exceed limits for drinking water standards as per the SANS 241-1:2015.

4.1.5.4 Water Balance

The following section presents the findings of the average annual, monthly and daily water balances of the proposed Solar PV plant.

Water Flow Diagram

A simple Process Flow Diagram (PFD) was drafted to present the insight into all linkages of the water flows from source to various components of the proposed solar plant. The information obtained from Neo I was used to draft a final PFD (**Figure 28**). Water flow philosophy for the proposed Solar PV plant is as follows:

- Raw water is abstracted from a borehole and will be pumped into the water storage tanks;
- From the storage tanks, water is distributed to the plant office area for domestic and consumption purposes (potable water) and to the PV modules for washing purposes;
- Sewage on site will be contained in a septic tank and soakaway system during operation. Port-a-potty style toilets will be used during construction and will be emptied by trucking on a planned regular basis;
- The available surface water from rainfall in the office area should be captured with a JoJo tank to supplement domestic water.

Depending on the scheduling of cleaning of PV module, during the wet season, the plant is expected to use relatively small quantities of water as the rain falling will contribute to the cleaning of the panels.

Average Water Balance

Water requirements and demands provided by the Client were estimated at 20m3/year. It should be noted that the solar PV plant generally have low maintenance and servicing requirements. However, to maximise both energy yield and the plant's lifespan, proper maintenance is vital. Local site conditions and the season of the years determines the frequency of the PV module cleaning. Cleaning of the PV modules can be done using three options namely (i) high-pressured water spraying (ii) the use of dust broom (iii) brush trolley. The latter two options are the cheapest options and do not require raw water for cleaning. Using the former options, (International Finance Corporation, 2015) estimates that 1.6L of water is required for cleaning a $1m^2$ PV module.

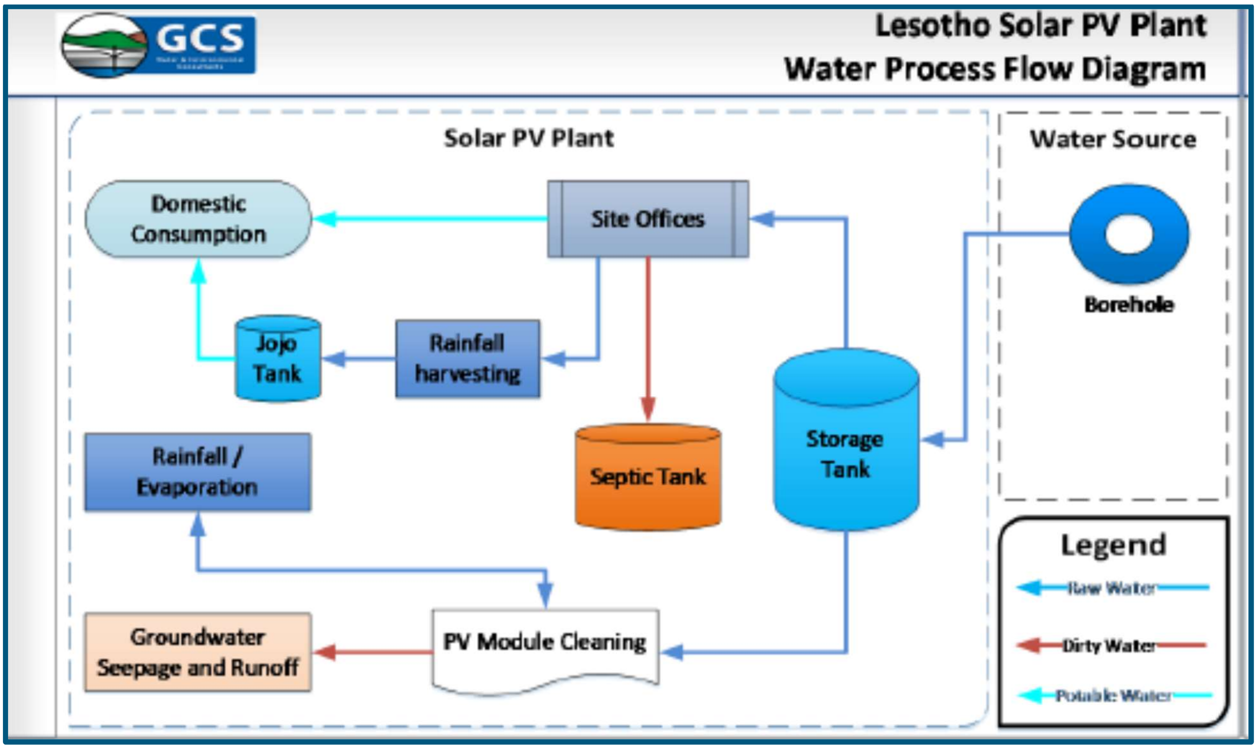

Figure 28: Water Process Flow Diagram for Solar PV Plant

Baseline Groundwater Reserve Determination

A preliminary Groundwater Reserve Determination (GDRM) was compiled for the sub-catchment containing the site. The Groundwater Reserve Determination considers the following parameters:

- Effective Recharge from rainfall and specific geological conditions;
- Basic Human needs for the site;
- Groundwater contribution to surface water (baseflow);
- Existing abstraction; and
- Surplus Reserve.

Quaternary Catchment

The site falls on the boundary of the two catchments, within D23F and C31F. Details are indicated in **Table 19**. Water balance studies indicate that 2.5% of annual rainfall recharges to the groundwater systems in the lowlands region. According to the GRDM the groundwater contribution to baseflow is 0.36mm/a.

Table 19: Summarised Quaternary Catchment Information

QUATERNARY CATCHMENT	RECHARGE (mm/a)	RAINFALL (mm/a)	BASEFLOW (mm/a)
D23F	15.95	638	0.36

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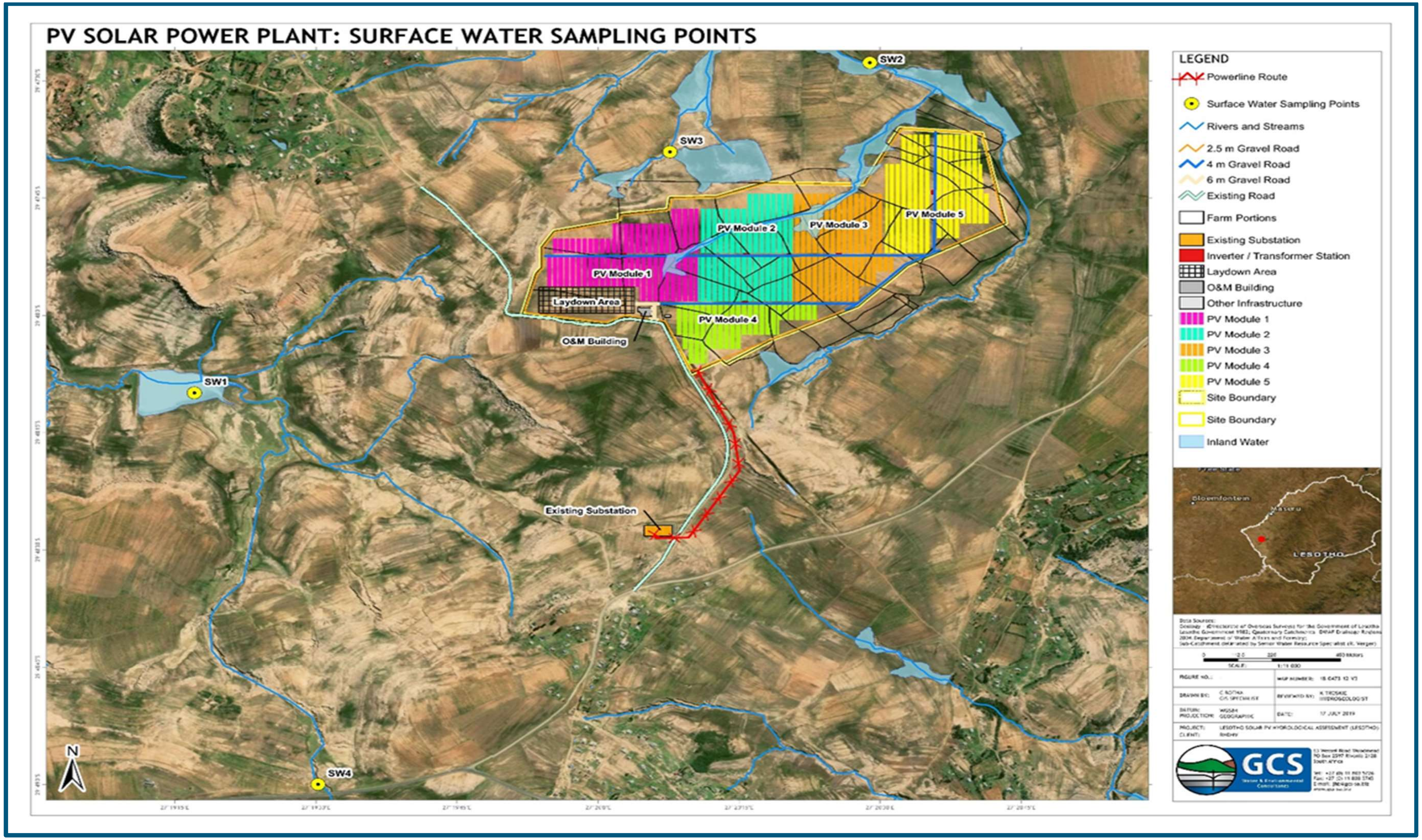

Figure 29: Surface Water Quality Sampling Point (SW1, SW2 and SW4)

4.1.6 Wetland Assessment

Wetlands have been characterised and assessed based on the findings of field assessment and utilising a number of tools as discussed below. In any assessment of wetlands, it is important to assess and characterise wetlands based on four factors:

- Wetland pressure /impacts;
- Wetland functionality;
- Wetland state; and
- Wetland Ecological Importance and Sensitivity.

These factors are separate but closely interlinked as shown in **Figure 30** below. It is very important to understand the links between wetland functionality, ecological importance, pressures and state. As indicated in **Figure 30** below, wetland state is directly influenced by pressure acting on the wetland. Pressures/impacts may adversely affect the ability of a wetland to perform certain functions, but certain aspects of wetland functionality may be enhanced in that the wetland may be acting to ameliorate the pressure acting upon it. The state and ecological functionality of a wetland can be used to assign a level of ecological value or sensitivity to the wetland but the impact acting on it can adversely affect its level of ecological sensitivity. These aspects are discussed in greater detail below.

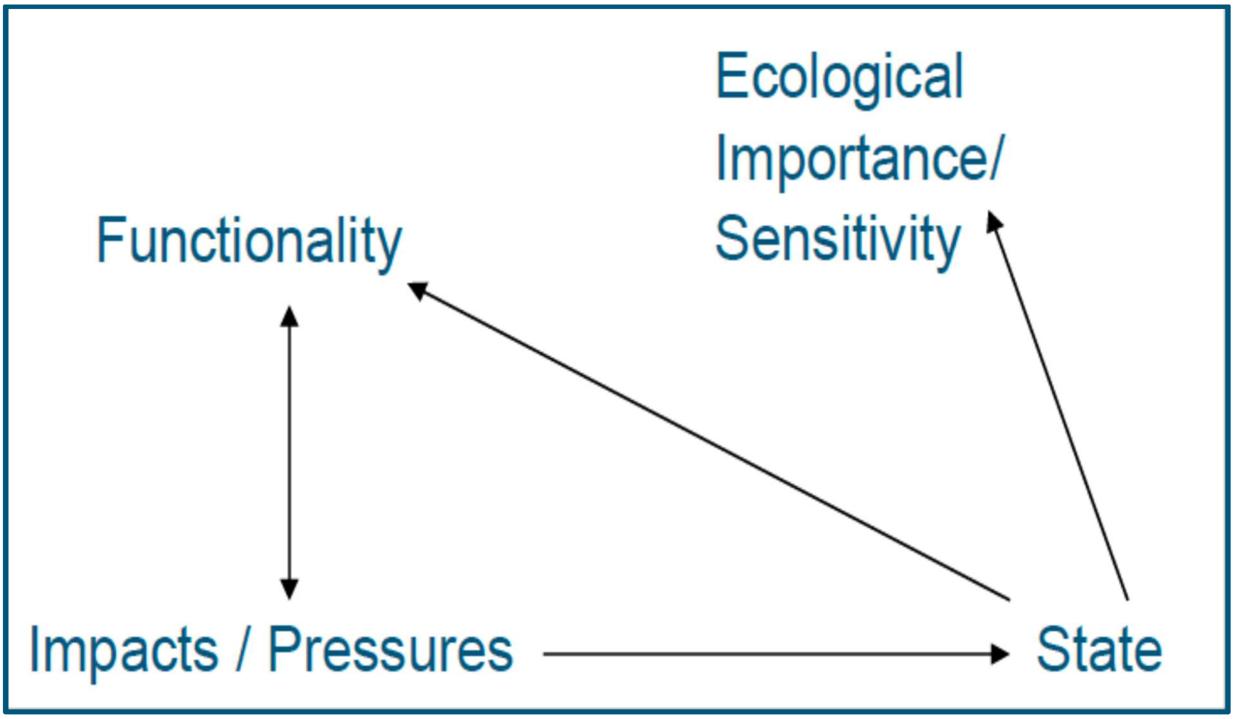

Figure 30: Relationship between Wetland State, Functionality, EIS and Impacts/Pressure Acting on a Wetland

Wetland Present Ecological State (PES) Assessment

The WET-Health (McFarlane et al, 2009) tool has been used to assess wetland Present Ecological State (PES). The WET-Health tool has been designed by the Water Research Commission to assess the health or integrity of a wetland. Health of the wetland equates to the wetland state as referred to in this study. The WET-Health techniques assess the hydrological, geomorphology and vegetative state of a wetland. Its assigns wetland units assessed into an Ecological Category (EC) that reflects its state of degradation. **Table 20** below indicates the PES (state) categories as assessed using the WET-Health methodology.

Table 20: PES Categories Assessed using WET-Health

ECOLOGICAL CATEGORY	PES SCORE	DESCRIPTION
A	0-0.9	**Unmodified, natural**
B	1-1.9	**Largely natural with few modifications.** A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	2-3.9	**Moderately modified.** Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	4-5.9	**Largely modified.** A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	6-7.9	**Seriously modified.** The loss of natural habitat, biota and ecosystem functions is extensive.
F	8 - 10	**Critically / Extremely modified.** Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible.

Assessment of Ecological Importance and Sensitivity (EIS)

Protection of freshwater ecosystems and biodiversity are a critical part of the purpose of the National Water Act. In this context and in the context of the need to protect water resources as espoused by the Act it is thus important to determine the ecological importance and sensitivity of a potentially affected water resource. The ecological importance of a water resource is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) of a surface water feature refers to its ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Rountree et al, 2013). Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity (Rountree et al, 2013).

A rapid scoring system to evaluate Ecological Importance and Sensitivity of wetlands has been developed as part of the development of a manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Rountree et al, 2013). The spreadsheet-based tool evaluates several factors to determine importance and sensitivity, including biodiversity value, landscape context and hydrological and water quality-related factors. A score from 0-4 is provided, with a score of 4 reflecting the highest degree of sensitivity as indicated by **Table 21** below. An EIS class from very high, high, moderate to low is assigned.

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Table 21: Ecological Importance and Sensitivity Scores as Calculated by the Wetland EIS Tool

RATING	EXPLANATION
None/ Very Low, Rating = 0	Rarely sensitive to changes in water quality/hydrological regime
Low, Rating =1	One or a few elements sensitive to changes in water quality/hydrological regime
Moderate, Rating =2	Some elements sensitive to changes in water quality/hydrological regime
High, Rating =3	Many elements sensitive to changes in water quality/ hydrological regime
Very high, Rating =4	Very many elements sensitive to changes in water quality/ hydrological regime

4.1.6.1 Wetland Sensitivity – Bioregional Planning Context

State of Rivers and Wetlands in the Study Area

The National Freshwater Ecosystem Priority Areas Project (NFEPA) database is a result of a process to develop cross-sector policy objectives for conserving South Africa's inland water biodiversity, which led to the definition of a national goal for freshwater conservation policy in South Africa: "to conserve a sample of the full diversity of species and the inland water ecosystems in which they occur, as well as the processes which generate and maintain diversity" (Driver *et al*, 2011)[4]. The project provided strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas (FEPAs). The NFEPA dataset includes Lesotho, as the spatial unit of assessment – the sub-quaternary catchment (see below) encompasses Lesotho as well as South Africa. The NFEPA assessment thus included the Kingdom of Lesotho and accordingly can be used to describe the state of freshwater resources in the context of the proposed development.

The NFEPA database has designated sub-quaternary catchments of importance, or priority catchments. This catchment approach is derived from a focus on sustainable development, given the current and future pressures on water resources. Protection and utilisation of natural resources need to work hand-in-hand to achieve sustainable development. In the context of water resources management, this means that catchments can be designed to support multiple levels of use, with natural rivers and wetlands that are minimally-used supporting the sustainability of hard-working rivers that often form the economic hub of the catchment. This concept is firmly embedded in South Africa's National Water Act and forms the foundation of the water resources classification system (Dollar *et al,* 2010). Keeping some rivers and wetlands in the catchment in a natural or good condition serves a dual purpose of conserving South Africa's freshwater biodiversity and promoting the sustainable use of water resources in the catchment.

A number of different FEPA types are relevant:

- River FEPAs - River FEPAs achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species and were identified in rivers that are currently in a good condition (A or B

[4] *It should be noted that it is not known whether the NFEPA project has been endorsed by the relevant authorities in Lesotho. However, in the absence of detailed water resource planning initiatives in Lesotho the NFEPA Project, which considered upstream catchments within Lesotho is a useful indicator of freshwater state at a regional scale.*

- ecological category). Their FEPA status indicates that they should remain in a good condition to contribute to national biodiversity goals and support sustainable use of water resources.
- Wetland FEPAs - Wetland FEPAs were identified using ranks that were based on a combination of special features and modelled wetland condition.

It is important to note that for River FEPAS, management of the catchment is also important; although FEPA status applies to the actual river reach within such a sub-quaternary catchment, surrounding land and smaller stream networks need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach. These are known as **Phase 1 FEPA catchments.**

Phase 2 River FEPAs and associated catchments have also been designated. Phase 2 FEPAs were identified in moderately modified rivers (C ecological category), only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition (A or B ecological category). River condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once FEPAs in good condition (A or B ecological category) are considered fully rehabilitated and well managed.

No FEPA Rivers have been designated in the study area; drainage on the site flows northwards into the Tsana-Talana stream, which has been assigned a River Condition category of a ***tributary that is not intact***, based on an assessment of land cover (refer to **Figure 31**). Accordingly, the river and the stream and wetlands feeding into it are likely to be subject to a high degree of modification, and thus the streams in the quaternary sub-catchment into which the proposed site falls (and the wider quaternary catchment) thus does not meet the requirements for designation as a Phase 1 or Phase 2 FEPA. The designation of the Tsana-Talana stream likely reflects the state of the downstream reach of the Caledon River, which has similarly been assigned a class D (largely modified from a natural state) rating (refer to **Figure 31**). It is also important to note that no FEPA wetlands have been designated in the vicinity of the study area (refer to **Figure 31**).

Analysis of Wetland Ecosystem Threat Level

In a similar manner to terrestrial ecosystems, freshwater ecosystems in South Africa have been assigned a threat status. The South African Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected – this threat rating system mirrors the internationally adopted system of the International Union for Conservation of Nature (IUCN). The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value.

The NFEPA Project derived wetland vegetation groups from Bioregions, splitting these into smaller groups through expert input to create 133 WetVeg groups. The WetVeg groups were assigned a threat status as part of the 2011 National Biodiversity Assessment to assign threat levels to wetland ecosystems in South Africa (which included Lesotho – see above).

The wetlands within the study area fall within the Mesic Highveld Grassland Group 1 which has been listed as being **endangered (EN)**, the second highest threat class (refer to **Figure 31**). The conservation and protection of the wetlands on the site is thus of critical importance, considering the threat to wetlands within most of the wider area. This designation is highly significant, as a high degree of importance should be placed in protecting wetlands that are not totally fragmented and which still display a degree of ecological functionality.

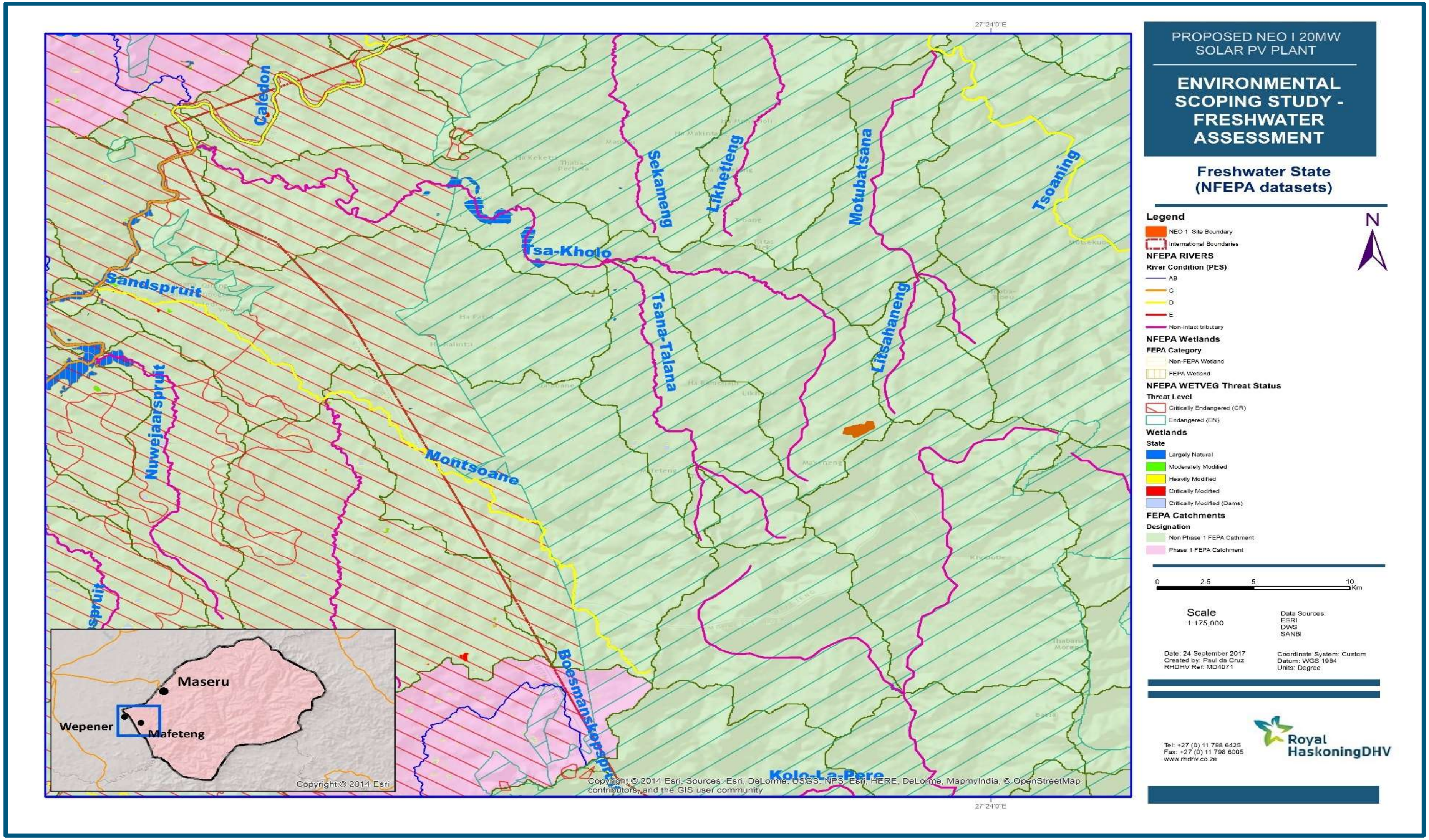

Figure 31: Wetland and River State in the Study area and Wider Area, as Designated by the NFEPA Project Datasets (Orange=PES C, Yellow=PES D, Pink=Non-Intact Tributary)

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4.1.6.2 Surface Water Typology and Occurrence

Overall Drainage Context

In an overall drainage context, the site is located within quaternary catchment D23F (refer to **Figure 32**). Quaternary catchments were delineated as the basic areal unit of planning of water resources development that was undertaken in the 1980's and 1990's in South Africa. South Africa (including Lesotho) was divided up into a series of fourth-order catchments based on runoff characteristics with catchment area being delineated inversely proportional to runoff (Midgely et al, 1994).

The D23F catchment is comprised of a short section of the Caledon River, and a tributary stream, the Tsa-Kholo stream. The Tsa-Kholo Stream is fed by the Tsana-Talana stream (**Figure 32).** Drainage within this quaternary catchment is generally northwards-flowing, towards the Caledon River. The proposed development site is located close to the upper quaternary catchment boundary, with the areas immediately to the south of the site falling within the D15F quaternary catchment, with southwards draining streams and wetlands into the Qhoqhoane River.

The Caledon River is a major tributary of the upper Orange River (also known as the Senqu or Gariep) River, and forms much of the north-western boundary of Lesotho. The Orange is the largest river in South Africa, draining the western side of the Drakensberg escarpment, and having a catchment that encompasses most of the interior plateau of South Africa, as well as large parts of Botswana and Namibia. The study area thus forms part of the primary catchment of the Orange / Gariep / Senqu area.

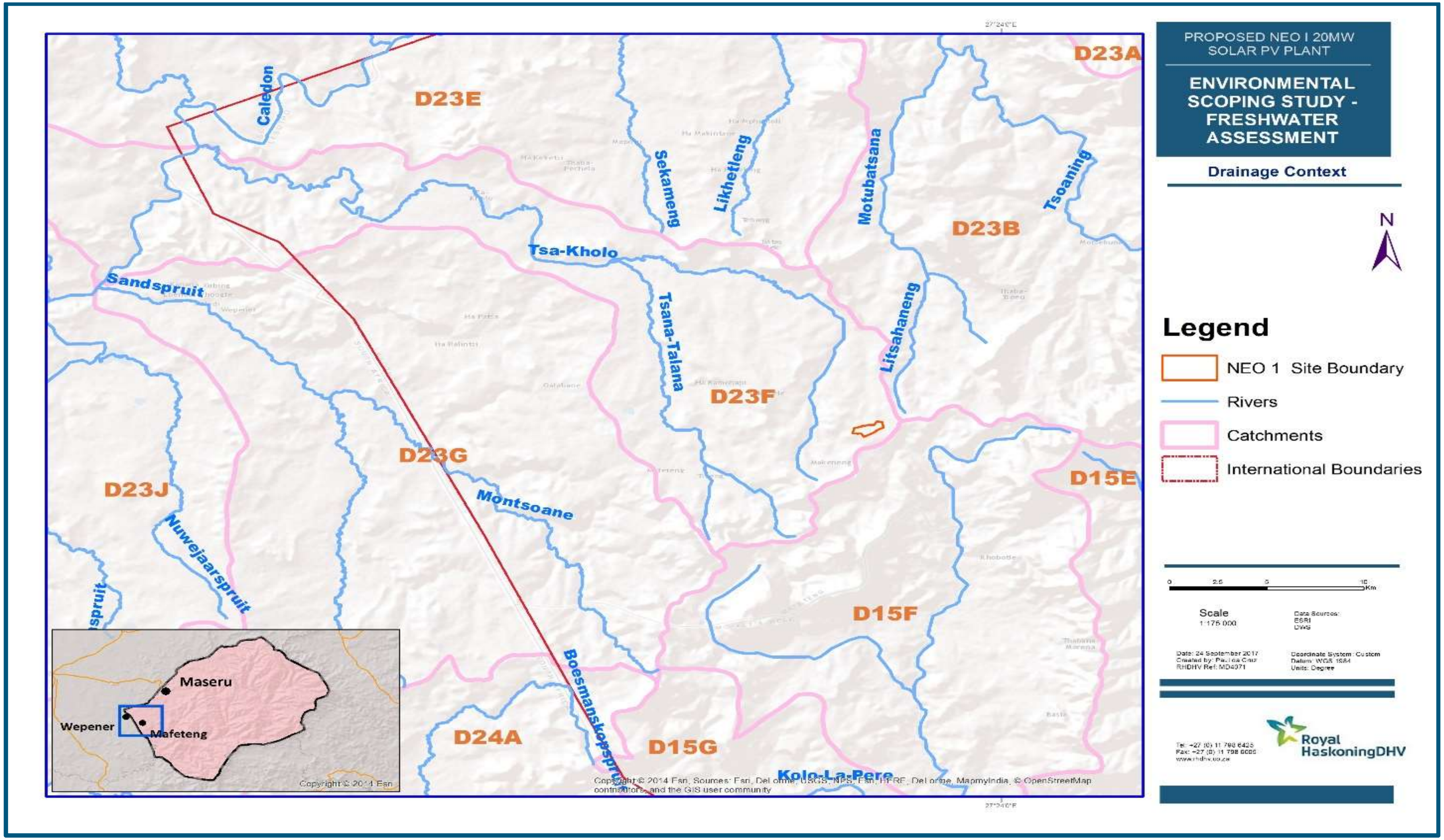

Figure 32: Drainage Context

4.1.6.3 Findings of Assessment: Delineation and Assessment of Wetlands on the Technically-Preferred Site

Soils and Soil Forms and their relation to Wetland Occurrence and Hydrology

Soils were investigated at various locations, primarily on the site, to determine the extent of wetland occurrence. These soil samples confirmed the presence of wetland habitat on the site, through both soil form types and soil wetness indicators. The most commonly occurring indicator of hydromorphism in parts of the site was the presence of a ***soft plinthic B (subsoil) horizon***. The soft plinthic B horizon is mostly associated with wetland habitat, as it is formed by the presence of a seasonally-occurring shallow water table that saturates the soils. The rise and fall (fluctuation) of this water table is responsible for the development of soils of plinthic character in the form of the localisation and accumulation of iron and manganese oxides to form distinct black and orange / red concretions / mottles, along with a gleyed soil matrix typified by grey colours. The soils in this horizon have vesicular character. The soft plinthic soil form was typically encountered in a terrain setting of midslopes or footslopes. This occurrence and the origin of soft plinthic material is strongly indicative of wetland habitat on the site being related to the presence of the occurrence of shallow, sometimes perched, water tables which facilitate the development of hydromorphism in the soils. Such shallow water tables occur in the seep wetlands in the valleyheads on, or adjacent to the site. The presence of areas of wetland habitat high up on the midslopes on the site is possibly indicative of distinct areas of shallow perched water tables, but these are hydrologically linked to the other (downslope) parts of the site through the mechanism of interflow.

The soft plinthic B horizon was encountered within a number of soil forms that occurred repeatedly across the soil samples at the site, most common of which was the Avalon Soil Form, along with less common occurrence of the Longlands Soil Form. The Avalon Soil Form is typified by a B (upper subsoil) horizon consisting of apedal, yellow-brown, soils that overlies a soft plinthic horizon. These yellow-brown apedal soils occur commonly on the site, and typically topsoil's and subsoils on the site are characterised as being apedal. In the Longlands Soil Form the soft plinthic B horizon underlies an E horizon (see below). The other most commonly occurring soil form on the site was the Pinedene Soil Form, where the yellow-brown apedal B horizon was underlain by unspecified material showing signs of wetness, typically in the form of a gleyed matrix and the presence of common to very common iron mottling.

As mentioned above in reference to the Longlands Soil Form, ***an E horizon*** was commonly encountered on the site. An E horizon forms through the marked net removal of colloidal matter (e.g. clay and organic matter) as compared to the overlying and / or underlying horizons. The 'bleached' E horizon is formed through the movement of water through the soil profile, mostly horizontal, termed interflow. The relatively common occurrence of the E horizon on the site is indicative that interflow is a prominent hydrological driver in a context of the generally sloping ground on the site. Other soil forms containing the E horizon encountered on the site were the Fernwood Soil Form and the Kroonstad Soil Form, both of which are wetland soil forms.

The last wetland diagnostic horizon that was encountered was the ***G horizon***. G horizons are subsoil horizons formed by the accumulation of colloidal matter, typically with a high clay content, and which display a gleyed matrix, with or without mottling, due to prolonged periods of saturation. G horizons are typically indicative of permanently saturated wetlands and were encountered in the areas of sampling in certain of the valleyhead seeps on the site, in certain of the other seep areas (e.g. in the seep off the site below a line of sandstone outcropping), and in association with the seep wetland just to the north of the site where it transitions to a valley bottom wetland. The soil forms associated with a G horizon that were encountered were a Katspruit Soil Form (where the G horizon underlies an Orthic A (topsoil) horizon) or associated with an E horizon to form a Kroonstad Soil Form.

To surmise, the soil forms and soil wetness indicators are definitive indicators of wetland habitat occurrence on parts of the site. Based on the type of diagnostic horizons commonly encountered, twinned with the terrain setting on the site (mostly sloping ground), the occurrence of wetland habitat is due to the presence of shallow, mostly seasonally-activated, rising and falling shallow groundwater that results in the development of hydromorphism in the soils. In these seep wetlands interflow hydrologically links the wetland areas to the wider drainage network. A seep wetland is present in the northern parts of the site. This seep and the other seeps described below are not characterised by overland flows, rather by interflow which hydrologically links the seep to the valley bottom wetland and the wider drainage system to the north. A separate seep wetland occurs just to the north of the site immediately downslope of a line of bedrock outcropping, while a third seep wetland originates in a shallow 'bowl-like' valleyhead on the southern boundary of the site, draining the area to the south-east and east of the site (refer to **Figure 33**). This seep transitions to a valley bottom wetland north-east of the site, and certain seep compartments on the footslopes to the south of this valley floor extend onto the north-eastern parts of the site. In certain of these seep wetland systems, gulleys have formed, capturing this interflow as surface water flows within the gulley.

<u>Wetland Vegetation</u>

The time of year of the survey (late October) meant that much of the vegetation on the site had not recovered fully from a dormant winter state, as exacerbated by an intensive daily livestock grazing presence in the wetlands. It was accordingly difficult to comprehensively identify plant species as growing parts such as inflorescences were not present. In addition, much of the site has been previously cultivated and ridging and furrowing was noted in large parts of the site. This physical disturbance has visibly altered the vegetation composition of many of the sample sites where the results of soil sampling indicated the presence of wetland habitat. Accordingly, vegetation could not be utilised with a very high degree of confidence as a wetland indicator, however changes in overall communities, and vegetation structure and composition were noted to mirror changes in soil wetness indicators in many of the sample sites. A subsequent site visit to the development site to identify parts of the wetlands on the development site requiring rehabilitation actions was however, conducted in April 2019 at the end of the summer growing season, and the site visit was utilised to identify hydrophyte species and to observe the nature of vegetation community change at a time when vegetation was in a better state.

Across much of the site where sampling was undertaken (i.e. in areas identified as wetland habitat in the scoping-phase desktop wetland delineation exercise) a very short, cropped grassland which was typified in some locations by a very sparse vegetation cover (especially in formerly cultivated areas) was noted. As described above, in many of the sample locations where the soils indicated wetland habitat, no distinctive hydrophytes were noted, although one of the likely dominant grass species *Eragrostis plana* (Tough love grass) is a facultative hydrophyte that is often associated with wetlands.
Much of the site is dominated by dwarf shrub vegetation, in particular the central and southern parts of the site. In these areas *Seriphium plumosum* (Slangbos) (common in overgrazed areas) is the dominant species, and no wetland habitat is associated with these areas. The soils in these parts of the site are

dominated by yellow apedal soils with no wetland soil forms present and no hydrophytic vegetation communities. Points at which this shrub community was noted to transition to the afore-mentioned grassland were in a number of sample locations located close to the delineated wetland boundary.

In depressional areas, in some of the upper parts of the seep wetland in the northern part of the site and in some of the footslope seep areas on the northern perimeter of the site, vegetation was noted to be slightly different in composition and growth form, with a greater degree of vegetation cover, likely due to the increased moisture levels in the soils in these areas. A greater diversity and compositional degree of hydrophyte occurrence was noted, with the most common hydrophytes noted being the sedges *Pycreus nitidus*, and *Isolepis* spp, and the herb *Ranunculus meyeri*. The geophyte [*Moraea (Homeria)collina*] was noted to commonly occur within some of the seep wetland areas and on the peripheries of the better-defined wetland areas.

Typical wetland communities were also observed close to the point at which the seep wetland that drains the northern part of the site transitions to a valley bottom wetland. Standing water was noted at these locations and a number of typical wetland hydrophytes, including Limo*sella major, Kyllinga alata*, *Juncus exertus* and *Pycreus macranthus* were noted just to the north of a part of the Northern Site Boundary.

Figure 33: Community of Hydrophytes within Moist Grassland in a Seep Wetland

Wetland Delineation, Typology and Occurrence

Wetlands and surface water features can be found across a landscape. The landscape can be divided up into a number of units, ***each of which can contain wetlands***. Wetlands occurring on these different terrain units typically differ in terms of their formative processes and hydrological inputs, and thus differ in terms of their functionality.

The classification of wetland form on, and in the vicinity of the site has been based upon the most updated wetland classification system for South Africa – the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al,* 2013). The South African classification system was used due to the lack of such system in Lesotho. The system uses a six-tiered approach for classifying inland aquatic systems, including wetlands. Levels 4 and 5 (hydrogeomorphic (HGM) unit and hydrological regime respectively) are the focal points of the classification system – i.e. these describe the functional unit (Ollis *et al*, 2013). **Table 22** below indicates the tiered classification for the different types of wetland that occur on, and in the immediate vicinity of the site.

Table 22: Tiered Classification for Wetlands in the Study Area

	SEEP WETLANDS	CHANNELLED VALLEY BOTTOM WETLANDS
Level 1 – System	Inland	
Level 2 – Regional Setting (NFEPA WetVeg Group)	Mesic Highveld Grassland Group 1	
Level 3 – Landscape Unit	Slope	Valley Floor
Level 4 – HGM Unit	***Seep***	***Un-Channelled valley bottom wetland***
Level 4B – Seep outflow characteristic	***Without*** channelled outflow	
Level 5A – Period of inundation / Hydrological Regime	Mostly never Inundated; (small areas close to valley bottom transition and some isolated depressions are seasonally inundated)	Most of wetland not inundated, small areas including flow depressions are seasonally inundated
Level 5B – Period of Saturation	Periodically / Seasonally / Permanently Saturated	
Level 6 – Other descriptors	**Natural vs. Artificial** – Natural	
	Salinity - Fresh (non-saline)	
	Vegetation Cover – Vegetated – Herbaceous (Grasses, herbs / forbs dominant) – Moist grassland	

Figure 34 below indicates the presence, and hydrogeomorphic form of wetlands on the site. All wetland units have been assigned a name, based on the presence of the wetland on the site, or within the 200m or 500m radial areas of the site. As can be seen in **Figure 34** the primary type of wetland on the site is the seep wetland. Seep wetlands are characterised by their location on sloping ground, with colluvial processes being the primary hydrological driver in this context. Seeps are hydrologically dominated by the presence of groundwater, either in the form of groundwater outflows / discharges (such as springs), or typified by the presence of perched water tables, as is the case for most of the seep wetlands on the site and its immediate vicinity. Seeps may or may not have channelled outflows, but irrespective are typically hydrologically connected to the wider drainage network in the form of interflow.

Seep wetlands often occur within valleyheads in gently undulating terrain, as typifies the development site and its surrounds. The primary wetland occurring on the site (*Neo1_Wetl_Site_1a*), as well as the seep wetland that rises just to the south of the southern site boundary (*Neo1_Wetl_200m_radius_4*) are good examples of such valleyhead seep wetlands. Seep wetlands on the site were also associated with certain terrain transition areas between the valley floor and the surrounding footslopes, termed 'seep compartments'; although directly linked to the valley floor wetland, they are not characterised by depositional processes, rather by groundwater inputs on gently sloping ground that occurs on the footslopes.

On the site and its environs, seepage and seep wetlands were also noted to occur in association with outcropping of bedrock. Along parts of the northern site boundary and close to the site's western boundary, lines of sandstone bedrock outcropping occur, and the shallow slopes downslope of these linear bedrock outcroppings are associated with seep wetlands, some parts of which demonstrate permanently saturated soils (as evidenced by the presence of a G Horizon). It appears likely that the horizontal rock beddings are directly associated with the downslope seepage downslope of them.

Only one wetland unit within the 500m radius of the site is not a seep wetland and takes the form of an unchanneled valley bottom wetland (*Neo1_Wetl_200m_radius_5*). The wetland unit transitions from the seep wetlands (*Neo1_Wetl_200m_radius_4* & *Neo1_Wetl_500m_radius_9*) that rise to the south and east of the development site to form an unchanneled valley bottom wetland. The transition is characterised by a change in terrain from sloping ground to a valley floor. This transition is evidenced by a very large area of sediment deposition from the highly eroded seep wetland upstream (eroded by a massive gulley) that takes the form of an alluvial fan. The wetland unit is not naturally channelled although it has experienced gulley erosion, and water inputs are primarily from its catchment and the seep wetlands to the south of it. The valley bottom is associated with large areas of lateral seepage compartments, as described above.

The wetland units that occur on the development site, or closest to the development site have been assessed in terms of their state and ecological importance and sensitivity. The presence of wetlands on the site has implications for the development, as the proposed development of the site would lead to impacts and transformation of these wetlands, as discussed below.

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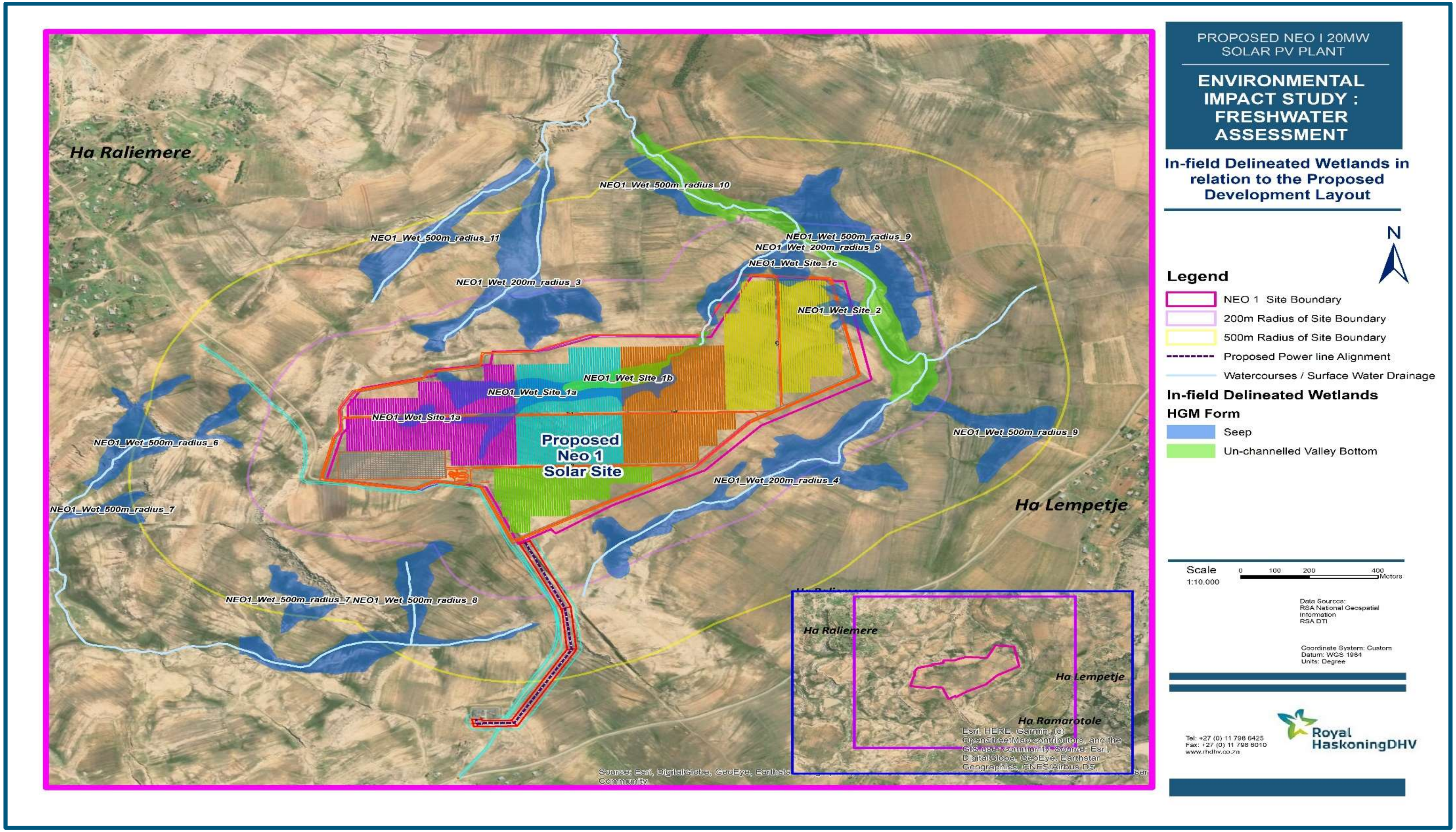

Figure 34: Wetland Occurrence on, and in the Vicinity of the Neo 1 Site

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4.1.6.4 Findings of EcoStatus Assessments

Assessment of Present Ecological State (PES)

For the assessment of PES, the wetlands on the site, and in the immediate vicinity of the site (i.e. within the 200m radius) were assessed. For the purposes of the PES assessment, separate assessments were undertaken for the following (combined) wetland units:

- NEO1_Wet_Site_1a, 1b & 2;
- NEO1_Wet_200m_radius_4 & 5; and
- NEO1_Wet_200m_radius_3.

These wetland units are either on the site or located very close to the site. The other wetland units in the 500m radius were not assessed as the likely impact on these units is low. **Table 23** below indicates the PES scores for the wetland units assessed.

Table 23: PES Scores and Ecological Category for Wetland Units in the in the Study Area

WETLAND UNITS	PES SCORE-HYDROLOGY	EC CLASS HYDROLOGY	PES SCORE GEOMORPH.	EC CLASS GEOMORPH	PES SCORE VEGETATION	EC CLASS VEGETATION	COMBINED PES SCORE	OVERALL EC CLASS
NEO1_Wet_Site_1a, 1b&2	1.0	B	0.9	A	4.9	D	2.25	C
NEO1_Wet_200m_radius_4&5	8.5	F	3.8	C	7.5	E	6.6	E
NEO1_Wet_200m_radius_3	3.0	C	2.4	C	4.7	D	3.4	C
All Wetland Units assessed	**4.8**	**D**	**2.5**	**C**	**6.0**	**E**	**4.5**	**D**

Analysis of PES Scores

The results of the PES assessment have indicated a very high level of transformation of the wetlands on the site and within the immediate vicinity of the site. The overall EC Class into which all wetlands combined, as calculated by the WET-Health software (considering their relative sizes), have been assigned is one that reflects ***a largely modified state*** – i.e. a large change in ecosystem processes and loss of natural habitat and biota has occurred.

The presence of extensive gulley erosion that is present to a greater or lesser extent in all the three (combined) wetland units is the single most important factor degrading the wetlands and being responsible for the varying degrees of modification of the wetland units in terms of hydrology, geomorphology and vegetative state. Gulley erosion is most pronounced in the wetland units 4 & 5 to the south and east of the site. The seep wetland unit 4 is characterised by an extremely deep and wide gulley that has eroded most of the spatial extent of the seep wetland (refer to **Figure 35** below), with very limited areas of intact wetland habitat remaining. This gulley is active at the head of the seep wetland and is currently threatening the last remaining area of intact seepage wetland at the head of the wetland. Gulleys are also present in the other (combined) wetland units, being present in the lower parts of wetland unit 1b close to where it transitions to a valley bottom wetland, and in the lower parts of wetland unit 3.

Figure 35: Active Headcut in the Upper Part of Wetland Unit 4

Actively migrating back into residual wetland habitat (left), and the deep and very wide gulley in a part of the reach downstream (right)

From a hydrological perspective gulleys significantly adversely affect wetlands by lowering the water table and by removing areas of wetland habitat which would be responsible for performing other wetland hydrological functions.

Gulleys also significantly disrupt the geomorphological integrity of the wetlands by removing significant volumes of substrate (soil) from the wetlands, but also by depositing large amounts of sediment into downstream parts of certain wetlands, especially where wetland terrain form transitions from a sloping setting to a valley floor setting. This is particularly pronounced in the wetland unit 5 where large volumes of sediment have been deposited into the valley bottom wetland as evident in **Figure 36**. Although the sediment has been retained within the wetland unit immediately downstream of the reach such large volumes of deposition can lead to resultant alterations in hydrological state (by desiccating the wetland through the introductions of higher-lying 'islands' of sediment) and vegetative state (the desiccation of the wetland allows the colonisation of the wetland by weeds and terrestrial pioneer plant species).

Vegetative state has been assessed to have experienced the highest levels of transformation for all three (combined) wetland units. This is primarily due to the significant extent of gulleys within the wetland units, both in terms of extending for much of the unit's length, but also occupying a significant portion of the lateral width of the respective wetland unit. The natural vegetation composition has been altered, especially in areas adjacent to the gulley in which the water table has been lowered. However, two other factors have also altered vegetation; historically most of the area, including the seep wetland areas and their immediate catchments, appears to have been cultivated, with associated ridging and furrowing present in much of the seep wetland areas that have not been eroded. This disturbance of the ground levels has altered the natural vegetative composition by altering the natural overland flows. The last factor that is degrading vegetation composition is grazing by livestock. Subsistence livestock rearing forms the primary economic activity in the rural areas of Lesotho in which the development site is located, and various herds of cattle and sheep move daily across the site and wider area. This almost constant grazing pressure is likely to have had an impact on vegetation composition with the likely removal of more palatable plant species, and certainly in terms of growth form.

Figure 36: Large Area of Sediment Deposition in the Valley Floor Wetland Unit 5 Downstream of the Major Gulley in Wetland Unit 4

Assessment of Ecological Importance and Sensitivity (EIS)

EIS was calculated collectively for all wetland units on the site and within a 200m radius of the site. This approach was adopted due to the relative uniformity of all wetland units on the site. **Table 24** below indicates the EIS scores for the wetlands on and in the immediate vicinity of the site.

Table 24: EIS Scores and Category for the Wetlands in the Study Area (all score out of 4)

EIS Score – Biodiversity & Ecological	EIS Score – Hydrological	EIS Score – Human Benefits	Overall EIS Score[5]	EIS Category (EC)
2.3	0.8	0.3	2.3	**Moderate**

Analysis of EIS Scores

The wetlands on and in the immediate vicinity of the site scored very low for the hydrological and human benefits sub-categories, but higher (moderate) for the biodiversity and ecological category.

The ecological value of the wetlands on the site and the immediate surrounds is related to the presence of, and foraging opportunities for Red Data Fauna species, in particular the Southern Bald Ibis (*Geronticus calvus*). Although not an obligate wetland species (i.e. only occurring within wetlands), the wetlands on the site are likely to provide important foraging opportunities for these birds, in particular the residual intact seepage areas at the head of wetlands. The degradation of the wetlands and their physical

[5] *The maximum score of the ecological, hydrological and human benefit sore is assigned as the overall the EIS score*

characteristics as moist grasslands mean that there are no unique of large populations of wetland species present.

The hydrological EIS score was very low, reflecting the high level of hydrological impact on the wetlands. The predominant wetland type on the site is a seep wetland and the resultant primary hydrological function would be streamflow regulation related to groundwater seepage. This functionality of all wetland units on the site has been drastically reduced by the extensive presence of gulley erosion.

Lastly, there is very little human benefit attached to the wetlands on site, with no harvesting of natural materials likely to occur and no cultural or tourism value associated with the wetlands. The grazing function and provision of water for livestock drinking is the only human benefit associated with the wetland unit.

4.1.7 Visual Environment

4.1.7.1 Visual Character

Visual character is influenced by the presence of built infrastructure such as buildings, roads and other objects such as electrical infrastructure. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a visual baseline in which there is little evidence of human transformation of the landscape. This is not to say that landscapes transformed by humans are necessarily visually degraded, as many landscapes and visual settings around the world are a product of hundreds or even thousands of years of human influence, and thus represent a perceived 'natural visual baseline'. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being very different to a largely natural undisturbed landscape. It should be noted that visual character is also related to aesthetic features of the environment, feeding into the related, but different concept of 'aesthetic quality' of the environment. Aesthetic quality is based on the existence of internal and built features in the landscape that are perceived to have aesthetically pleasing qualities, and the degree to which these are present or absent.

Due to the topographical and vegetative characteristics of the area, a viewer in the study area will have a general impression of a largely natural, rural landscape where there are wide-ranging vistas over the gently undulating to steeper and higher-lying hilly to mountainous terrain (with higher-lying ground in the distance in both the eastern and southern fields of view) that are constrained very little by the vegetation. The low density of human habitation that occurs in the form of scattered, small rural villages twinned with the dominance of open land used for informal livestock rearing thus engenders the area with a largely natural, rural feel. Anthropogenic structural features in the landscape are limited in spatial extent, and the only such features are the power line that runs to the east of the site. Due to these factors the wider area in which the development is located displays a largely natural visual character with strong rural influences, particularly where human settlement, in the form of small rural villages is located (**Figure 37**).

Figure 37: Highly Visual Character of the Study area, with very Limited Anthropogenic Structural Intrusion

The Potential and Importance of the Occurrence of a 'Cultural Landscape'

As explained above, the low density of human settlement and associated low level of change to the natural environment engenders the area with a largely natural visual character with rural influences. The visual context can be contextualised further by examining its location within a sub-regional context; the greater study area can thus be considered to be typical of a Lesotho Lowlands landscape that would typically be encountered across the western and south-western parts of the Kingdom of Lesotho. The study area is located within the Lesotho Lowlands, close to the transitional area between the flat to undulating plains of the interior of South Africa – the Highveld Plateau – and the mountainous terrain of the eastern escarpment that includes the highly mountainous Maloti Mountain Range that is located within Lesotho.

Lesotho has historically remained non-industrially developed and largely rural in nature. Apart from a handful of larger towns, the majority of the country is rural in nature with a low population density. The majority of the Lowlands in which the majority of its population in concentrated consists of a low density of small rural villages, within otherwise uninhabited spaces. The nature of development in the country that is tied to its economic profile and levels of poverty entails that the primary economic activity and landuse in the rural parts of the Lowlands is informal livestock rearing and subsistence cultivation of dryland crops. This has allowed the rural areas to maintain a largely rural, undeveloped character that has remained largely unchanged over many decades. The landscape of open grassland and dryland crop fields punctuated by isolated relief in the form of dolerite / basalt-capped hills occupied by Basotho pastoralists and their livestock typifies the rural Lowlands of Lesotho.

In this context the typical Lesotho Lowlands landscape could be considered to be a valuable 'cultural landscape' in a Southern African context. Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world; the concept of 'cultural landscape' is a way of looking at place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). The cultural landscape concept is a relatively new one in the heritage conservation movement across the world. In 1992 the World Heritage Committee adopted a definition for cultural landscapes:

Cultural landscapes represent the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal.

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

- "a landscape designed and created intentionally by man";
- an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
- an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The typical Lesotho landscape of open undulating open grassland punctuated by isolated relief, interspersed with scattered rural villages is a very important part of the cultural matrix of Lesotho’s socio-natural environment. The Lesotho Lowlands landscape arguably comprises of two of the above-mentioned categories – that of a continuing landscape that has survived modernity to retain characteristics that would have been present for centuries, and a landscape that is valued because of the importance of the natural environment. The large majority of economic activity in the rural Lowlands is solely dependent on natural resources present in the natural environment, and the livestock raising economy is intrinsically linked to the cultural perceptions of livestock (especially cattle) representing wealth. As such it could be argued that the landscape of the Lesotho Lowlands as it exists today has value as a cultural landscape. Importantly in a visual amenity value context (see below) the proposed development is being proposed in the context of a such a largely unchanged landscape that typifies the rural Lowlands of Lesotho. Change in this landscape in the form of industrial development could thus arguably degrade this landscape, although the extent of visual intrusion would be an important determining factor.

Amenity Values Related to Landscapes

It is important to note that the more recent concept of landscape has shifted from its physical meaning to an emphasis on landscape as an intrinsic part of the human landscape (Skřivanová and Kalivoda, 2010). In humankind’s recent past (especially since the industrial revolution) landscape change due to human action has been greatly accelerated; landscape has in many places been devastated in the name of development with the wastage and destruction of natural goods, including landscape (Skřivanová and Kalivoda, 2010). As explored below landscape is a very important part of the human psyche and cultural orientation and has significant value (e.g. beautiful landscape is the keystone of tourism all over the world – Ewald, 2001). In this context the need for the consideration of landscape is an important environmental issue, especially if insufficient regard is paid to it (Skřivanová and Kalivoda, 2010).

The presence of natural / perceived natural and rural elements or areas within the landscape as viewed from the surrounds of the site can engender perceptions of aesthetic quality or value to the landscape. Many studies of landscape conservation have highlighted the value placed by people in rural or natural landscapes. In this context it is worthwhile to briefly explore how landscape, and particularly largely natural or rural landscapes, are valued in order to contextualise and understand responses to proposed developments that are associated with significant landscape change.

A rural landscape can be defined as an area where an interaction between humans and nature over time has led to the development of a landscape that has its own characteristics, and which is a middle ground between an urban landscape and wilderness, consisting of human activities that are related to the natural environment, such as agriculture and pastoral activities (Mazehan et al, 2013).

Placing value in a landscape is a psychological and cultural practice; values and meanings are not intrinsic to the landscape, but rather they are phenomena created by humans through their cultural practices (Pun, 2004). It is thus important to note that perceptions of landscape may not be universally shared, and different individuals or groups of people may perceive or treat the same landscape differently, in turn ascribing different values and meanings to it (Pun, 2004). Values and meanings ascribed by local people may not be evident to an outsider. Indeed, differing values may be in competition among themselves (Pun, 2004).

There are different types of values that can be placed on a landscape; i.e. economic values (e.g. the relevancy of the landscape for business enterprises, or the market possibility of products from landscape), amenity values (values related to the non-material benefits associated with it) and security values (Pun, 2004). Amenity values can be subdivided into different sub-categories; "intrinsic" ecological value, scientific and educational value, aesthetical and recreational value, and orientational and identity value. Landscapes and the viewing of landscapes has also been shown to have positive psychological and health benefits; Velarde et al (2007), have shown through an examination of various environmental psychology studies that visual exposure to natural landscapes (e.g. by means of viewing natural landscapes during a walk, or viewing from a window) generally has a beneficial impact on human health (e.g. reduced stress, facilitating recovery from illness, and behavioural changes that improve mood and general well-being). Landscape as a source of beauty is prevalent within the arts, is strong draw card for recreational activities. In addition, landscape is an element in the ability of people to orient themselves and is strongly related to people's cultural identity and sense of place. It is in this context that value is placed in natural or rural landscapes.

The above values can be interlinked, but can also be conflicting, e.g. amenity values associated with a landscape held by a certain group of people as described above may conflict with economic values associated with the market or development possibility of the landscape that are held by others. It is in this context that visual impact associated with a potential development often arises as an issue in environmental impact assessments.
The latter three sub-categories of amenity value described above – aesthetic, identity and psychological health value are typically involved in the perception of visual impact, as development within a landscape can change the landscape to the degree to which the amenity value associated with a landscape is degraded or no present. It is likely that amenity value is present within the context of the wider area in which the development is proposed. Lesotho is a small country and its identity is as a 'mountain land kingdom'. Although not located in the highlands, the Lesotho Lowlands is intrinsically linked to the history of the Basotho people as Thaba Bosiu[6] and Maseru are located in this landscape context shared with the study area. In addition, the open landscape is key to the pastoral economy that dominates rural

[6] *Thaba Bosiu was King Moshoeshoe's (founder of the Basotho Nation) mountain base.*

Lesotho, and in this way, the natural features of the landscape have economic amenity value. Such amenity values may be degraded if large-scale landscape change were to occur.

4.1.7.2 Visual Sensitivity

The above cultural landscape context and the context of the potential amenity values placed in the landscape feed into the visual sensitivity of the area.

Value may be placed in the natural and rural elements of the landscape as currently visible, indicating a sensitivity to change within the landscape that may be caused by development of significant infrastructure (such as a solar power plant) in the area as proposed. This perception would form a central basis for the visual sensitivity of the area, if it existed. This degree of visual sensitivity may not be universally shared by all inhabitants, as those not exposed to such views of the landscape may not share these perceptions. Perception of visual impacts is a complex multi-faceted phenomenon that relates to value judgments; a new development may not be perceived to be a visual impact if the inhabitants do not associate it with degradation of the landscape or if the new development is perceived to be uplifting the area in terms of job creation or advancement of the area. In addition, if human receptors are not visually exposed to the new development such a development would be less likely to be perceived as a visual impact.

Location of Visual Receptors

Visual Impact is related to the presence of human receptors / viewers, thus visual impact is typically experienced from locations inhabited or occupied by humans. Accordingly, an understanding of the areas inhabited / occupied by humans (even transiently) is important in the classification of potential visual impacts. Sites of human habitation (e.g. residential areas, farmsteads and homesteads) typically make up the bulk of the receptor locations within an area. However, lodges and other accommodation facilities, as well as recreational sites are other static locations that are typically considered receptor locations. However not only 'static' locations can be termed as receptor areas; areas or routes of human movement such as roads can also be considered to be receptor locations, as well as wider areas in which certain activities that would be considered visually sensitive are practiced. This could include areas where tourism activities such as hiking trails or 4X4 routes, or hunting are practiced.

In order to identify receptor locations in the study area, a radius of 5km beyond the boundaries of the site has been used. This radius has been utilised, as beyond 5km, even a large structure would be difficult to differentiate from the surrounding landscape. It is important to note that no tourism or other recreational facilities occur within the 5km radius of the proposed development (**Figure 38**).

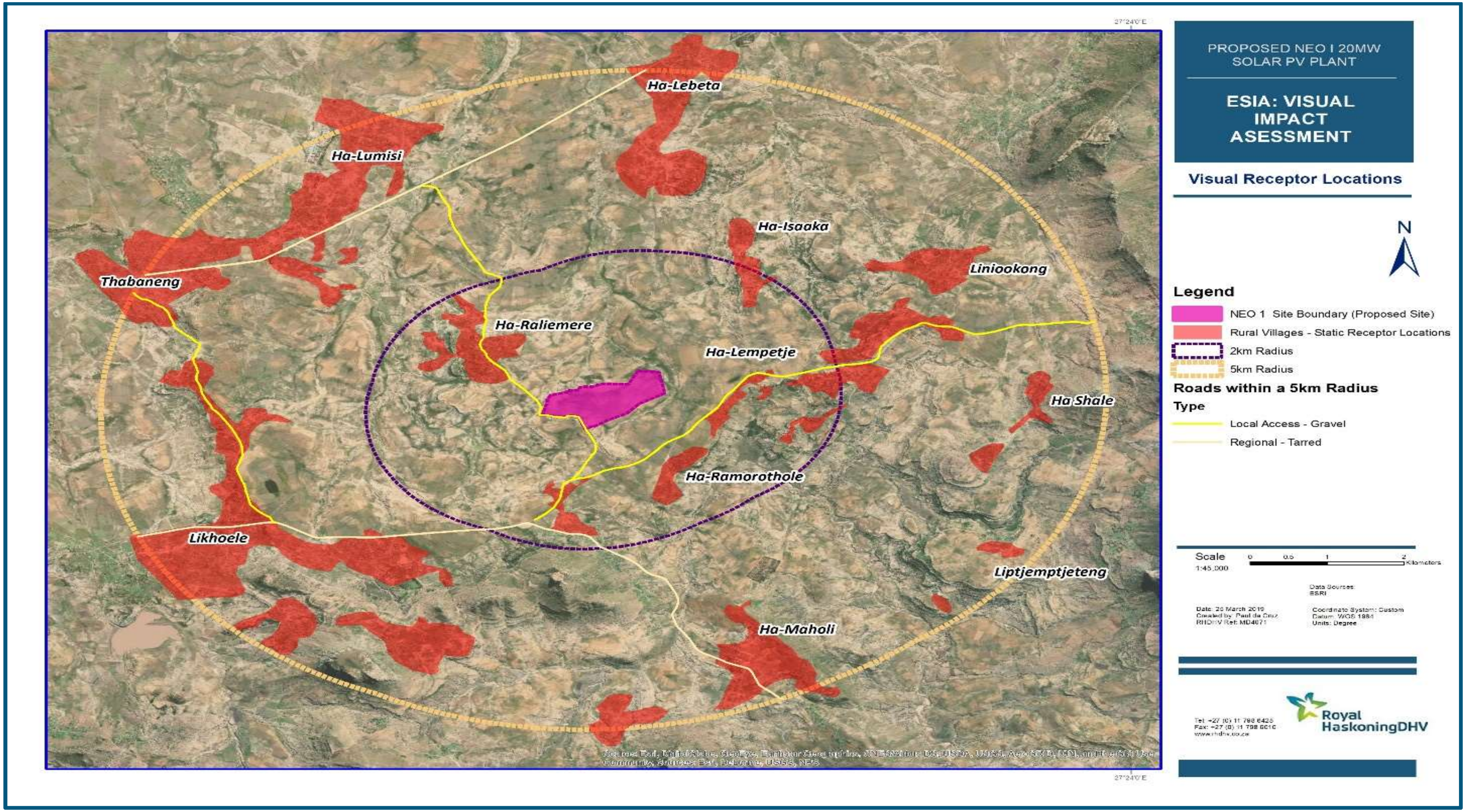

Figure 38: Visual Receptor Locations on the Site of the Proposed Development

As can be seen in **Figure 38** the static receptor locations in the 5km radius are comprised of several rural villages of differing size. The rural villages are spatially distributed across the 5km radial area, but the largest villages are located to the south-west and north-east of the site; the regional centre of Mafeteng is located to the south-west of the site (outside of a 5km radius) and the rural villages (located to the south-west of the site - Likhoele) tend to become larger with proximity to Mafeteng. A large cluster of villages – Ha Ramohapi and Likupa - is located to the north-west of the site along the A2 regional road (possibly having developed in ribbon fashion along this road). Both of these larger settlements are located in the outer periphery of the 5km radius. Another cluster of villages that appears to be associated with ribbon development along a rural district road is located to the north-east of the site.

The closest villages to the development site, i.e. located within a 2km radial area of the site are:

- Ha Raliemre located to the north-west (the closest part located approximately 630m from the site);
- Ha Sepechele / Ha Lempetje to the east (the western outskirts of which are located 650m away);
- Ha Ramorothole to the south-east (the closest parts of which are located 1000m from the site);
- A village located to the south of the site (the closest part of which is located 800m from the site); and
- A village located to the north-east (the closest part of which is located at a distance of 1.45km away).

A number of roads are located within the 5km radius. People moving along these roads would be non-static or mobile receptors. Their mobile nature entails that the view of the proposed development would be of short duration. These roads are indicated in **Figure 38** and include two tarred roads, located to the south of the site (an access road running east from Mafeteng) and a larger regional road that runs north-east from Mafeteng, linking the town to Maseru located to the north. A number of local access roads are located in the 5km radial area, providing access to the various villages described above. The closest roads to the site run immediately to the west of the site (providing access to Ha Raliemre from the tar road to the south and a link to the A2 road) and to the south and south-east of the site (providing access from the tar road to the south to the villages of Ha Sepechele Ha Lempetje, as well as link to the A2 road and higher lying areas to the east.

If one considers the distance factor alone, the above villages that are located within a 2km radius are likely to have the highest degree of potential visual exposure from the proposed development, although terrain and aspect are likely to perform a significant role in limiting visual exposure for certain of these villages.

4.1.8 Heritage Features and Objects Survey Results

During the physical survey in the Scoping Phase, the following sites, features and objects of cultural significance were identified in the study area in close proximity to the site boundary (**Figure 43**). The coordinates of the identified sites have also been included in **Figures 39-42**. It must be noted that there were no heritage objects and features of cultural significance identified within the powerline servitude.

4.1.8.1 Stone Age

Material dating to all phases of the Stone Age were identified to occur in a number of places. All of these are open surface scatters, which usually are viewed to have low significance. However, one identified site, is viewed to have high significance due to its complexity (inclusive of Early Stone Age (ESA), Middle Stone Age (MSA) and Late Stone Age (LSA) material) as well as the density of the material on the site.

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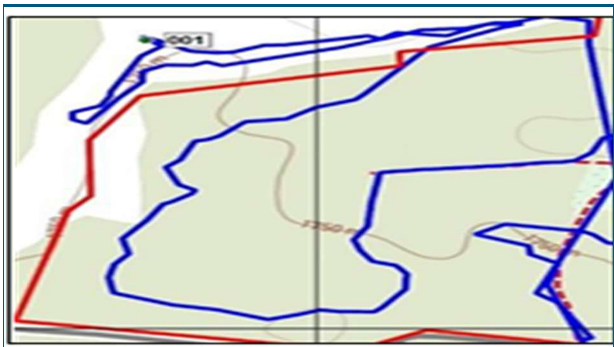
- ### Surface Scatter, C. 3 Artefacts/Cores/Flakes Per 2m^2.

Overhanging rock forming a small shelter. There is no archaeological deposit present. Stone artefacts (tools, cores and flakes) occur as medium density scatter surface material in the vicinity of the overhang. Most material date to MSA, but also LSA. Quartzite and hornfels dominate the MSA material, but possible LSA tools are of fine-grained silicates (CCS). Although most of the tools are poorly formed, it is possible to distinguish end-scrapers and side-scrapers. These are Grade 3 artefacts as they are surface finds and they are not in their original context and therefore viewed to have little significance. In addition, the artefacts are located outside the proposed PV development area and it is unlikely that it would be impacted on the by the development.

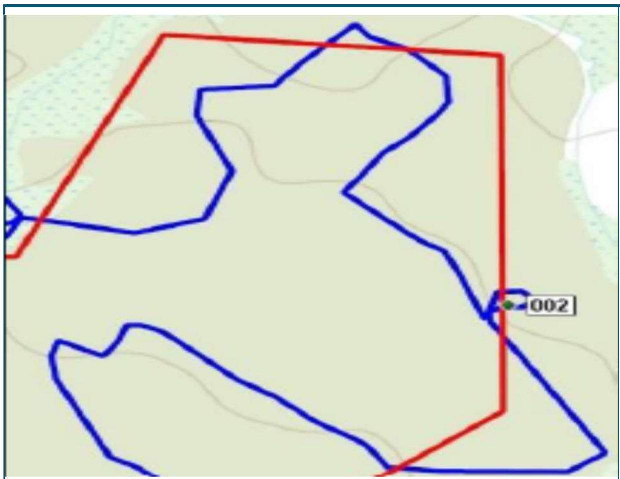


Coordinates: 29°47’ 46.6” S and 27°19’55.4” E

Figure 39: Location of Surface Scatter, C. 3 Artefacts/Cores/Flakes

- ### Surface Scatter, C. 1 Artefact/Core/Flake Per 5m^2

MSA material (tools and flakes) occur as a low-density surface scatter in an area of sheet erosion. The material used is quartzite and hornfels. Although most of the tools are poorly formed, it is possible to distinguish points, scrapers and side-scrapers. These are Grade 3 artefacts as they are not in their original context and therefore viewed to have little significance. In addition, the artefacts are located on the border of the proposed PV development area and it is unlikely that it would be impacted by the development.

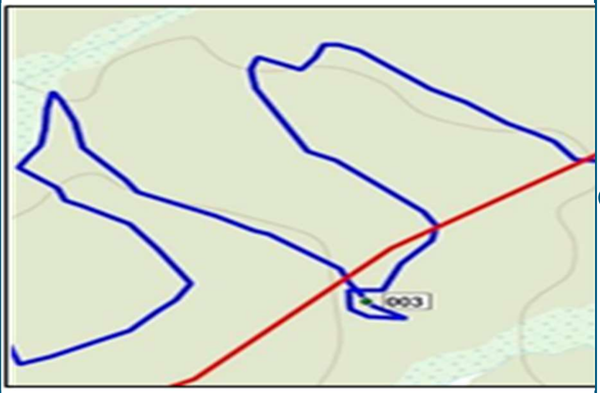


Coordinates: 29°47’ 44.7” S and 27°20’41.1” E

Figure 40: Location of Surface Scatter, C. 1 Artefact/Core/Flake

Surface Scatter, C. 3 Artefacts/Cores/Flakes Per 2m^2

MSA material (tools and flakes) occur as surface scatter in an area of sheet erosion. The material used is quartzite and hornfels. Although most of the tools are poorly formed, it is possible to distinguish points, blades, scrapers and side-scrapers. These are Grade 3 artefacts as they are not in their original context and therefore viewed to have little significance. In addition, the artefacts are located on the border of the proposed PV development area and it is unlikely that it would be impacted by the development.



Coordinates: 29°47’ 55.7” S and 27°20’32.2” E

Figure 41: Location of the Surface Scatter, C. 3 Artefacts/Cores/Flakes Per 2m²

- ### Surface Scatter, C. 5 Artefacts/Cores/Flakes Per 2m²

Stone artefacts (tools, cores and flakes) occur over a large area on a low hill. ESA-MSA transition (Faure smith), MSA and LSA material was identified. The material used for the MSA is mostly hornfels and quartzite, whereas fine-grained silicates were used for the LSA material. Although most of the tools are poorly formed, it is possible to distinguish points, blades, scrapers and side-scrapers. Significant of this area is the occurrence of possible Faure smith bifaces and Levallois type cores. These are Grade 3 artefacts as they are surface finds and they are not in their original context and therefore viewed to have little significance. In addition, the artefacts are located across the boundary of the proposed PV development area and it is unlikely that it would impact on the by the development.

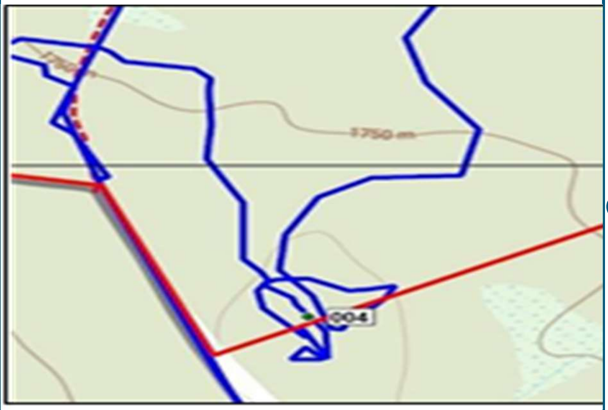
	Coordinates: 29°48’ 05.8” S and 27°20’12.5” E
	
	
Levallois type core	Possible Fauresmith biface

Figure 42: Location of the Surface Scatter, C. 5 Artefacts/Cores/Flakes Per 2m²

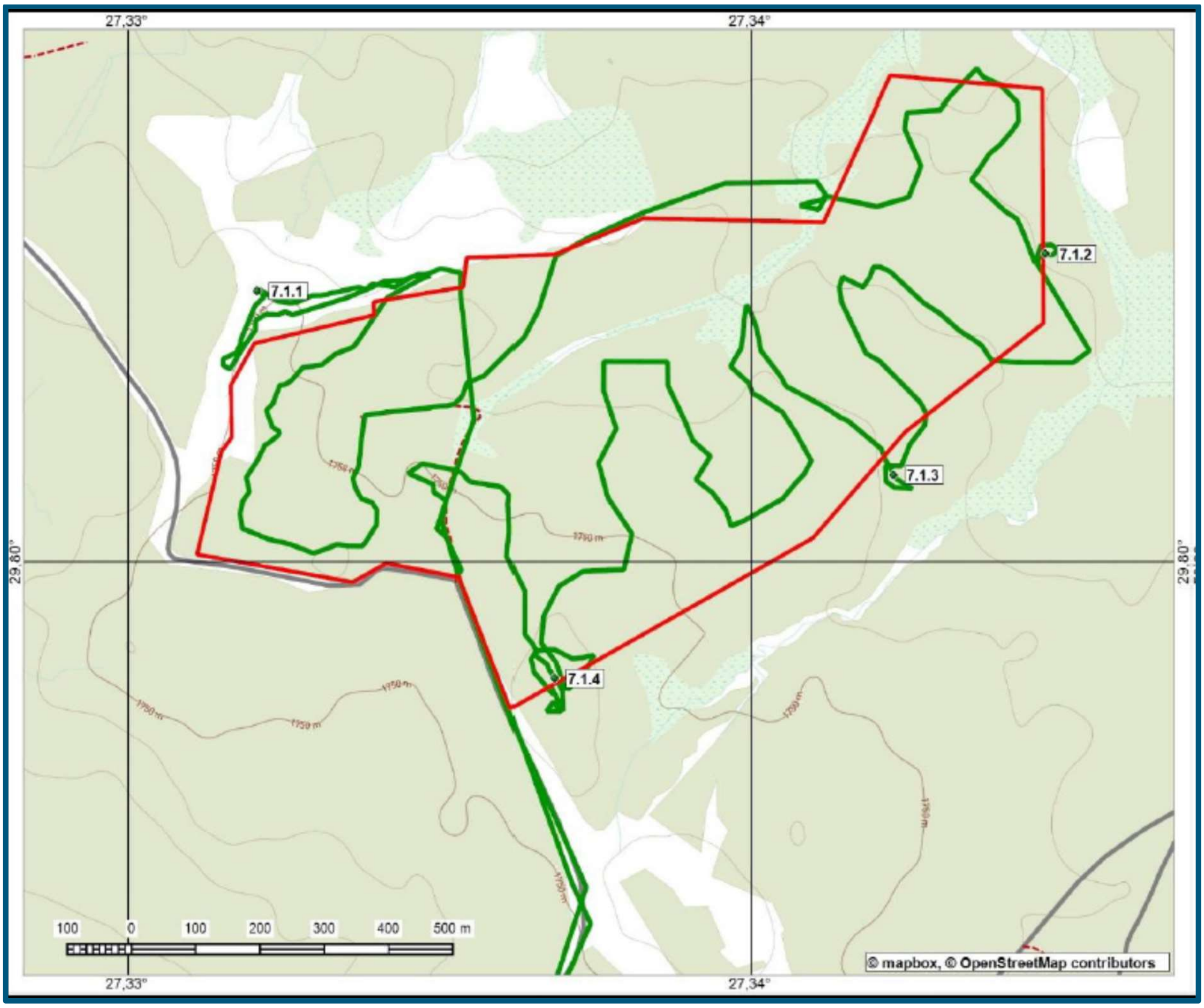


Figure 43: A Locality Map Depicting all Identified Heritage Artefacts

4.1.8.2 Iron Age

No site features or objects of cultural significance dating to the Iron Age were identified in the study area.

4.1.8.3 Historic Age

A number of features dating to recent times were identified in the study area and these are (**Figure 44**):

- Piles of stones that are interpreted to be field clearing cairns. These features are viewed not to have any significance.
- Engraved game boards, called morabaraba (Afrikaans = meul), a number of which were found to be engraved on level outcrops. This is a practice that is found all over southern Africa and therefore these are not viewed to be significant.

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Field clearing cairns	Engraved game boards

Figure 44: Identified Features Dating to Historic Period

4.2 Biological Environment

The sections below present what is known about the biological and ecological baseline environment, how these communities and species could potentially be impacted upon and what further work is required to gather the necessary baseline information to undertake an appropriate impact assessment. Communities that are impacted upon can have the capacity to recover if only a temporary occurrence, however if it is long term it is often not possible to reinstate the community in the same location, and thus it will have an impact upon the ecosystem services that the habitats and communities provide. The assessment of potential impacts on ecosystem services is explored in detail within this ESIA Report.

4.2.1 Regional Floristic Attributes

4.2.1.1 Regional Floristic Traits-Eastern Free State Sandy Grassland (GM4)

The study area corresponds to the Grassland Biome, notably the Mesic Highveld Grassland, comprising a macro-ecological type known as the Eastern Free State Sandy Grasslands, as defined by Mucina & Rutherford (2006) (**Figure 45**). Mesic Highveld Grassland is found mainly in the eastern, precipitation-rich regions of the Highveld, extending as far as the Northern Escarpment. The division between dry and moist grassland is made on the basis of annual rainfall, with 500-700 mm rainfall marking the boundary. Above 600 mm of rainfall, sour andropogonoid grasses predominate. Above 600 mm of rainfall, sour andropogonoid grasses predominate. The 600 mm rainfall limit also corresponds to soil nutrient factors: plan growth in most grasslands with dystrophic soils is most macronutrient-limited and in dry grasslands with eutrophic soils it is mostly water-limited. Altitude also has a strong influence on most climatic variables. Generally, an increase in altitude corresponds with a decrease in temperature and an increase in rainfall. Different grassland units within the Mesic Highveld Grasslands are distinguished on the basis of geology and other substrate properties, including elevation, topography and rainfall.

The Eastern Free State Sandy Grassland is geographically situated in the Free State Province, Lesotho and marginally into KwaZulu-Natal Province, including Ladybrand (west) to the base of foothills of the Drakensberg (Maloti) and the Escarpment in the vicinity of Harrismith (east) and Mafeteng (south). Altitude ranges between 1 520 m and 1 800 m but reaches 2 020 m in places.

The landscape is flat to slightly undulating and undulating terrain with streams and rivers that drain the foothills of the Drakensberg. Closed grassland dominated by *Eragrostis curvula, Tristachya leucothrix* and *Themeda triandra* is typical of these areas. Other dominant grasses include *E. capensis, E.*

racemosa, Cymbopogon pospischilii, Elionurus muticus, Eragrostis plana and Aristida junciformis. Numerous herb species, notably of the Asteraceae family, is encountered; species of *Helichrysum, Hilliardiella*, and *Berkheya* increase the alpha diversity considerably. The abundance of numerous *Helichrysum* species is conspicuous. This unit is also found embedded within many hills and small mountains carrying Gm 5 Basotho Montane Shrubland. Due to wide range of grazing and fire regimes, the grassland has a patchy appearance.

The conservation status of this unit is Endangered; only 2 % is statutorily conserved in the Qwaqwa and Golden Gate Highlands National Parks as well as in the Sterkfontein Dam Nature Reserve. Almost half on this unit is already transformed for cultivation (maize), building of dams (e.g. Sterkfontein, Loch Athlone, Saulspoort). *Cirsium vulgare, Cosmos bipinnatus* (forming spectacular displays along road verges and on old fields), *Hypochaeris radicata, Plantago virginica, Tagetes minuta, Verbena bonariensis, V. brasiliensis, Richardia brasiliensis, Guilleminea densa* and others are frequent alien invaders and diminish the agricultural and biodiversity value of these grasslands.

Important taxa within this unit include the following:

Graminoids: *Aristida junciformis* subsp. *galpinii*, *Cymbopogon pospischilii*, *Digitaria monodactyla*, *D. tricholaenoides*, *Elionurus muticus*, *Eragrostis chloromelas*, *E. curvula*, *E. plana*, *E. racemosa*, *Harpochloa falx*, *Heteropogon contortus*, *Hyparrhenia hirta*, *Microchloa caffra*, *Monocymbium ceresiiforme*, *Setaria sphacelata*, *Themeda triandra*, *Tristachya leucothrix*, *Andropogon appendiculatus*, *A. schirensis*, *Aristida congesta*, *A. diffusa*, *Brachiaria serrata*, *Cymbopogon caesius*, *Cynodon dactylon*, *Cyperus obtusiflorus* var. *flavissimus*, *C. obtusiflorus* var. *obtusiflorus*, *Diheteropogon amplectens*, *Ehrharta capensis*, *Eragrostis capensis*, *Helictotrichon natalense*, *H. turgidulum*, *Koeleria capensis*, *Panicum gilvum*, *Setaria nigrirostris*, *Trachypogon spicatus*, and *Trichoneura grandiglumis*.

Herbs: *Barleria monticola, Berkheya onopordifolia* var. *onopordifolia*, *B. speciosa*, *Dicoma anomala*, *Helichrysum psilolepis*, *Acalypha angustata*, *A. peduncularis*, *Ajuga ophrydis*, *Anthospermum herbaceum*, *Berkheya pinnatifida*, *B. setifera*, *Crabbea acaulis*, *Cycnium racemosum*, *Dianthus basuticus*, *Haplocarpha scaposa*, *Hebenstretia dentata*, *H. dura*, *Helichrysum ammitophilum*, *H. aureonitens*, *H. caespititium*, *H. cephaloideum*, *H. herbaceum*, *H. nudifolium* var. *nudifolium*, *H. nudifolium* var. *pilosellum*, *H. oreophilum*, *H. rugulosum*, *H. spiralepis*, *Hermannia depressa*, *Hirpicium armerioides*, *Ipomoea crassipes*, *I. pellita*, *Kohautia amatymbica*, *Lactuca inermis*, *Nolletia ciliaris*, *Pelargonium luridum*, *Pentanisia prunelloides* subsp. *prunelloides*, *Selago densiflora*, *S. galpinii*, *Senecio coronatus*, *S. erubescens* var. *crepidifolius*, *S. inornatus*, *Sonchus nanus*, *Tolpis capensis*, *Trifolium burchellianum*, *Hilliardiella natalensis*, and *H. oligocephala*.

Geophytic Herbs: *Boophone disticha*, *Crinum bulbispermum*, *Cyrtanthus stenanthus*, *Drimiopsis maculata*, *Eucomis autumnalis* subsp. *autumnalis*, *Gladiolus dalenii*, *G. papilio*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*, *Watsonia lepida*, *Xysmalobium involucratum*, and *X. undulatum*.

Herbaceous Climber: *Rhynchosia totta*.

Low Shrubs: *Helichrysum melanacme*, *Anthospermum rigidum* subsp. *pumilum*, *Euphorbia striata* var. *cuspidata*, *Gnidia kraussiana*, *Helichrysum dasycephalum*, *Polygala hottentotta*, and *Tephrosia capensis* var. *acutifolia*.

Biogeographically important (endemic) taxon that often occur on the Low Escarpment is the low shrub *Heteromma krookii*.

4.2.1.2 Regional Phytodiversity

The SANBI database was consulted to provide a brief account of the known regional phytodiversity; the presence of only 187 plant species within the ¼-degree grid (2927CD) has been recorded, reflecting a poor knowledge of the floristic diversity of the area in general. Typical to a grassland landscape, the growth form of the vegetation is dominated by a high percentage of graminoids (33 species, 17.6 %) and herbs (50 species, 26.7 %). Moderate occurrences of geophytes, succulents and shrubs are noted reflecting the paucity of comprehensive floristic data for the region (refer **Table 25**). The diversity of plants within the study area is represented by 50 plant families, dominated by Poaceae (graminoids, 33 species, 17.6% %) and Asteraceae (25 species, 13.4 %). This fairly low diversity of plant families reflects a high paucity of accurate floristic data for the region, and on closer inspection the absence or poor representation of plant families typically associated with the grassland region, indicates the severity of anthropogenic impacts on a local and regional scale that rendered the vegetation heavily modified.

Table 25: Growth Forms Recorded in the Study Area

GROWTH FORM	NUMBER	PERCENTAGE OF TOTAL PLANTS RECORDED ON SITE
Climbers	4	2.1 %
Cyperoids	5	2.7 %
Dwarf shrubs	13	7.0 %
Geophytes	26	13.9 %
Graminoids	33	17.6 %
Herbs	50	26.7 %
Hydrophytes	3	1.6 %
Lithophytes	6	3.2%
Parasites	2	1.1 %
Sedges	1	0.5 %
Shrubs	19	10.2 %
Succulents	19	10.2 %
Suffrutex	4	2.1 %
Trees	2	1.1 %
TOTAL	**187**	

4.2.1.3 Plants of Conservation Importance Regional Records

The assessment of plants of conservation concern and importance is based on the following legislative sets:

- Union for Conservation of Nature;
- National Forests Act of 1998; and
- Lesotho Legislation/ Schedules.

IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001) was employed as the basis of conservation categories for plants. This list was amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

The SANBI information source does not indicate the presence of any plant of conservation importance within the Q grid in which the study area is spatially situated. Considering the paucity of accurate and comprehensive floristic data for the region, this apparent absence of Red Data sampling records confirms the paucity of comprehensive floristic data, rather than the true absence of plants of conservation importance from the region and possibility of plant species of conservation importance persisting in the region cannot be discounted at this stage of the process.

Although not within the scope of this particular investigation, several seasonal surveys are generally required to confirm (or refute) the absence of conservation important plants from an area, particularly if the diversity and ecological status of the habitat conforms to the general habitat requirements for certain/ specific species.

4.2.1.4 Floristic Diversity of the Site and Immediate Surrounds

Alpha Diversity

It should be noted that the site investigation was conducted during October 2018, before the advent of significant summer rains. Unequivocal identification of some species was therefore not possible, and some species (with specific reference to annuals), that will only be present in vegetative and reproductive growth during later periods, may have been overlooked. This is also of particular significance regarding the presence of conservation important plant species in relation to the proposed development.

The site investigation revealed a presence of approximately 81 plant species. The recorded floristic diversity is regarded poor; not only reflecting sub-optimal survey conditions, but also the severity and long-term history of anthropogenic impacts on and the severity of impacts resulting from persistently high grazing pressure and anthropogenic transformative agricultural activities. Notably, the absence of most species that are typically associated with natural grassland ecotype indicates the absence of habitat types that could potentially be construed as natural or pristine representations of the regional ecological type. Furthermore, the absence of a diverse composition of growth forms such as geophytes and succulents reflect the severity of habitat transformation.

The paucity of accurate and comprehensive regional floristic data, with particular reference to conservation important plants, is reflected in poor sampling records for the region. A comprehensive appraisal of the diversity of the site, and comparative assessment of survey results with the regional floristic diversity will therefore not yield confident and sensible results, apart from confirming the obvious atypical and dissimilar nature of floristic attributes of the site. Suffice to state that, although the total of 81 plant species equates to approximately 43 % of the regional diversity, there is only an approximate 8.0 % overlap in the species composition (sensu lato).

Apart from areas in vicinity to settlements, where exotic trees predominate against the steeper, rocky slopes, the grassland physiognomy is strongly reflected in the absence of a diverse and dominant tree layer; scattered small trees and low shrubs generally persist in sheltered habitat types, mostly associated with the topographical variable units such as outcrops, ridges, ledges and cliffs.

Plants of Conservation Importance- 2018 Survey Results

The ESIA phase, although conducted during a seasonal period (early austral summer, October) which was not conducive to the location and identification of conservation important plants, afforded an opportunity to assess the ecological status and diversity of habitat types within the receiving environment and to establish the suitability in terms of general habitat requirements.

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No plants of conservation importance was identified during the site survey period. Based on the appraisal of habitat types and status, the persistence of conservation important plants within the study site is regarded as highly unlikely as all habitat was found to be either entirely transformed by long-term historic and persistent agricultural efforts and severe grazing practices, or severely degraded. Within the immediate surrounds, limited habitat was identified that are regarded as moderately suitable as habitat for conservation important plant species.

Alien and Invasive Plant Species-2018 Survey Results

The presence of common weeds, exotic and declared alien and invasive plant species recorded on the site and immediate surrounds are indicated in **Table 26** .Because some of these species exhibit significant and aggressive invasive properties, their abundance and propagation within the site and immediate surrounds should periodically be scrutinised and the development and implementation of a dedicated Alien and Invasive Management Plan, as part of the ESMP for the development is strongly advised. In particular, species indicated in **bold (Table 26)** are regarded a significant threat to the environmental status of the receiving environment.

Table 26: Exotic and Invasive species Recorded

SPECIES NAME	FAMILY	STATUS/ USES	
Acacia dealbata	Fabaceae	Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014), CARA 2002 – Category 1(Western Cape), Category 2 (rest of SA)	Silver Wattle (e), Silwerwattel (a)
Agave sisalana	**Agavaceae**	**Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014)**	**Sisal**
Argemone ochroleuca	Papaveraceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Mexican poppy (e), Bloudissel (a)
Berkheya discolor	Asteraceae	Common weed	Mohata-o-mosoeu (ss)
Berkheya setifera DC.	Asteraceae	Weed, widespread	Rasperdisseldoring (a)
Cirsium vulgare (Savi) Ten.	Asteraceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Scottish thistle (e), Skotse dissel (a)
Crepis hypochoeridea (DC.) Thell.	Asteraceae	Weed, indicator of disturbed areas, Naturalised exotic	--
Cupresses macrocarpa	Cupressaceae	Ornamental, non-indigenous (USA), probably sterile variety	Monterey Cypress (e), Golden Crest (e)
Echinopsis schickendantzii	**Cactaceae**	**Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)**	**Torch Cactus (e), Orrelkaktus (a)**
Eucalyptus species	Myrsinaceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014) (see act for detail)	Eucaluptus gum tree (e), Bloekomboom (a)
Moraea pallida (Baker) Goldblatt	Iridaceae	Indicates overgrazing, often in colonies. Poisonous to cattle	Yellow Tulip (e), Berkatjietee (a), Khahla-e-nye-nyane (ss)
***Opuntia ficus-indica* (L.) Mill.**	**Cactaceae**	**Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)**	**Prickley pear (e), Turksvy (a)**
Pennisetum clandestinum Chiov.	Poaceae	Declared Invader - Category 1B in protected areas and wetlands in which it does not already occur (NEM:BA, 2004. AIP, 2016)	Kikuyu Grass (e), Kikoejoegras (a)
Populus deltoidea	Salicaceae	None	Poplar (e), Populier (a)
Prunus persica (L.) Batsch var. *persica*	Rosaceae	Naturalised exotic, edible fruit	Peach (e), Perske (a)
Rosa species	Rosaceae	None	--
Rubus rigidus Sm.	Rosaceae	Invader Species	Bramble (e), Braambos (a)

SPECIES NAME	FAMILY	STATUS/ USES	
Rumex species	Polygonaceae	Native to Europe, common weed	--
Salix babylonica L.	Salicaceae	Non-endemic	Weeping willow (e), Treurwilger (a)
Salix mucronata Thunb. ssp. *mucronata*	Salicaceae	Non-endemic	African Willow (e), Wildewortel (a)
Seriphium plumosum	Asteraceae	Invasive properties	Bankrupt bush (e), Bankrotbos (a)
Solanum sisymbrifolium Lam.	Solanaceae	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Wild tomato (e), Doringbitterappel (a)

Vegetation Development Drivers of the Site and Surrounds

Historically, development of grassland vegetation is generally the result of complex interacting driving forces that include climatic-, geological (soil), topographical- and moisture gradients typical of the grassland regions of the Lesotho landscapes. Importantly, and on a smaller scale, anthropogenic activities have recently contributed to severe deterioration and decimation of natural grasslands by means of subsistence cultivation, extensive agricultural activities and intensive, persistent and inappropriate grazing strategies, notably within the lowland plains and wetland habitat types. The study area and the general surrounds strongly reflect these driving forces and are characterized by extremely high levels of habitat transformation that caused the sterilisation of extensive areas of natural grassland habitat, ultimately rendering the remaining grasslands as heavily modified.

In general, the proposed development footprint is situated on varying slopes and aspects, and soils are generally shallow, siliceous and grainy. These soils are also rather poor, with resulting vegetation that is often regarded as 'sourish'. On lower topographical units (floodplains and seepages) soils conform to deeper horizons that comprise of clayey soils with higher moisture retention capabilities. Conversely, vegetation in these parts tend to be 'sweeter', hence the high occupation and utilisation factors noted within these parts. A review of aerial imagery and results obtained from this basic botanical survey of the site and immediate surrounds, indicated the following habitat types to be present (refer **Figure 45**):

- *Cynodon dactylon – Gazania krebsiana* Erosion Gulleys;
- *Halleria lucida – Mossia interviralis* Rocky Ledges and Cliffs;
- *Moraea pallida– Wahlenbergia cf. dieterlenii* Agricultural Fields; and
- *Pentameris ariodes* – Trifolium burchellianum Drainage Lines and Seeps.

Cynodon dactylon – Gazania krebsiana Erosion Gulleys

The extent of erosion gulleys in the surrounds of the development footprint provides evidence of the severity of impacts resulting from inappropriate grazing practices that caused trampling of stabilising vegetation and exposing soils to eroding effects of downpours and runoff and the persistent subsistence agricultural strategies. The duplex nature of these soils resulted in the formation of severe and deep erosion gulleys through the removal of the sandy topsoil's and exposure of the lower, structured clay horizons to rapidly flowing water after raining events. These erosion gulleys are particularly prevalent, and originating in, the upper parts of the smaller catchments in areas where the slopes exceed 7 % (pers. obs.). No obvious activities were noted to combat the exacerbation of these features and further expansion is reasonably expected in future. Erosion gulleys noted in proximity to the site, although not located within the development footprint, include areas to the immediate south and north, running in an eastern direction.

As these soils are periodically subject to further erosion during raining advents, extremely little vegetation is noted within these features. Isolated and singular plants generally occur in sheltered areas and crevices. No plants of particular prominence/ abundance were recorded in these parts and soils are generally bare and exposed.

***Halleria lucida – Mossia interviralis* Rocky Ledges and Cliffs**

As with the previous unit, the *Halleria lucida - Mossia interviralis* ecological type is not represented within the development footprint, but since it constitutes an important and sensitive habitat type within the immediate surrounds of the development, mention is made thereof. These features are characterised by the exposed underlying geology, forming open plates of flat, exposed rocks, or crests, that terminate in steep cliffs of huge boulders, eventually connecting with the lower slopes of grassland plains. As these features are generally poor in flora and also inaccessible for most parts, the characterising vegetation has retained some measure of the original regional ecological type. Biophysical attributes of this unit that has had a direct and significant bearing on the characterising vegetation include crags, shallow and sandy soils, sheltered hollows, moisture retention in isolated pockets, etc. These biophysical features also vary significantly between representative portions of this habitat type in the region, depending on slopes, aspect, extent, etc. The nature of these features vary between relatively small and low ledges and cliffs, to areas characterised by high cliffs and huge boulders with extensive crests of exposed surface rocks.

The proximity to populated areas/ settlements is a particularly important factor determining the prevalence and ecological status of the vegetation of this habitat type. Areas in proximity to settlements are generally characterised by the presence of the invasive tree species *Acacia dealbata* and the absence/ disappearance of natural vegetation (refer **Figure 46).** Representative portions situated further away from populated areas, but still with access for grazing purposes, are characterised by an admixture of 'natural' species and plants that indicate a severe and persistent utilisation/ grazing factor. Only when situated significant distances from populated areas, and also when becoming inaccessible for cattle, are 'normal' vegetative factors retained.
Because of the highly variable biophysical attributes of these features, a high diversity of plants are noted on a local and regional scale, but the vegetation that characterises these areas are generally hardy and habitat specific, being able to survive in challenging conditions such as shallow and poor soils, heavily shaded and cool micro-climates, etc. Conversely, the absence of a dense and dominant vegetal cover and the dominating physical attributes do provide some protection against effects such as fire, severe and repetitive grazing, etc, explaining the presence of some woody shrubs and trees.

Representative portions in proximity to the development footprint are generally characterised by the presence of shrubs and low trees that are restricted to inaccessible features. The presence of a woody component is a distinguishing floristic feature that indicates the prominence and presence of surface rocks. These species include *Halleria lucida* (d), *Celtis africana, Diospyros lycioides*, and *Kiggelaria Africana*. Shrubs that are often encountered include *Cliffortia linearifolia* (d), *Myrsine africana* (d), *Rubus rigidus* and *R. ludwigii* and *Searsia erosa*. A poor compliment of grasses are noted, but a diverse herbaceous layer include species such as *Argyrolobium species*, *Asclepias aurea*, *Cheilanthes species*, *Delosperma species, Gazania krebsiana, Helichrysum caespititium* (d), *H. cf. splendidum* (d), *Massonia species, Mossia interviralis* (d), and *Pellaea calemelanos*. A total of 34 plant species were recorded in this unit; because of seasonal constraints, this recorded alpha diversity is regarded low and it is highly likely that a more suitable seasonal survey (December to February) will reveal the presence of several other plant species. The presence of conservation important plants in this unit can also not be discounted at this stage. It is therefore strongly recommended that annual monitoring surveys (at least for a period of 5 years) be conducted within these areas to ascertain a more accurate floristic knowledge of these areas.

These offsite features, not only because they represent isolated and extremely limited remnants of the original natural vegetation, but also because they are often associated with plants of conservation importance, are regarded as highly sensitive.

***Moraea pallida– Wahlenbergia cf. dieterlenii* Agricultural Fields**

This unit comprises the largest extent of the proposed development footprint, constituting old and fallow agricultural fields. Soils in these parts vary between sandy and loamy, slopes are generally less than 7% and no surface rocks are present. The historic nature of these agricultural attempts is demonstrated as far back as aerial imagery allows, notably 2004 (GoogleEarth, refer **Figure 47**). The persistent and severe nature of agricultural activities dictates that no natural vegetation remains within these areas and the vegetatal cover is regarded as entirely transformed; it is however unclear when agricultural activities ceased. Since the cessation of agricultural activities, the vegetation has been dominated by an admixture of grasses and forbs, the composition, dominance and presence varying depending on the changing status of the land.

From aerial imagery, it is notable that the area comprises of numerous, separate fields that were cultivated during different periods. These agricultural activities also ceased during different periods and the nature of the existing vegetation is determined by the period that these fields have been fallow, allowing the recovery/ development of vegetation into different seral (intermediate) stages. The 'eldest' of these fields are characterised by a prominent layer of the shrub *Felicia filifolia*, while 'younger' fields are characterised by the absence of this shrub and instead a prominent and moderately diverse herbaceous layer. The forb *Wahlenbergia cf. dieterlenii* is prominently encountered throughout the area, while the presence of the geophyte *Moraea pallida* generally indicates the deteriorated nature of the area, the prominence of this species also indicates the extent of time since the cessation of agricultural activities.

The cessation of cultivation resulted in the successional occupation by a composition of pioneer and opportunistic species, of which the abundance and presence continually changed (seral stages) to the present stage(s). This present stage of the eldest areas is often described as a (late) climax status as future changes in species composition is generally minimal, remaining stable without significant anthropogenic intervention. However, 'younger' areas are characterised by sequential changes in the presence, abundance and dominance of species until a climax status is achieved where little/ few changes are resulting. This could potentially take 50 years or more to culminate into a stable, albeit, atypical, vegetation.

Pristine grassland (primary vegetation), of which no representative portions were recorded within the site or immediate surrounds, typically exhibits a relative high number of co-dominant species (grasses and forbs), which individually do not attain an exclusive dominance. Lesotho grasslands are known for a high diversity of, particularly, the herbaceous layer, comprising numerous annuals, geophytes, succulents and other types of specialised floristic growth forms. The species composition of the proposed development site is notably poor; a diversity of only 36 species were recorded. Noteworthy species recorded in this unit include the grasses *Aristida congesta* ssp. *barbicollis, Chloris virgata, Cynodon dactylon* (d), *Pentameris airoides* ssp. *jugorum*, the forbs and low shrubs, *Crepis hypochoeridea, Felicia muricata* (d)*, Helichrysum caespititium* (d)*, Moraea pallida* (d) and *Wahlenbergia dieterlenii* (d) and the shrub *Felicia filifolia* (d).

Structural and compositional attributes of the vegetation on the site do not conform to the regional ecological type (Eastern Free State Sandy Grassland); extremely few species that are typically associated with the regional vegetation were recorded on the site. Furthermore, no plant taxa of conservation importance was recorded during the survey period. Considering biophysical habitat conditions and the existing status of the dominant vegetation, as well as the severity of transformative anthropogenic activities, the likelihood of any conservation important species persisting on the site is regarded as low. The estimated ecological status and floristic sensitivity of this habitat type are therefore estimated as low.

Pentameris ariodes – Trifolium burchellianum Drainage Lines and Seeps

Several grasslands seepages are situated in the eastern extent of the site. Additionally, natural drainage lines, including a natural spring and grasslands seepages are situated immediately on the eastern boundary of the site. These areas, although exhibiting significant deterioration, are regarded highly sensitive. Severe, persistent and inappropriate grazing and trampling has resulted in the development of an altered vegetatal cover, the development of erosion and altered flowing patterns of the drainage lines. Soils in these areas are characterised by a comparatively high clay content, slopes are generally flat, sloping towards the east and north. As a result of the clayey conditions and relative flat slopes, moisture is retained in the soils for long periods, rendering the vegetation palatable and moist for extended periods of the year, resulting in high and persistent grazing. The formation of deep pools within the floodplain is notable and would under normal circumstances have contributed significantly to the biodiversity infrastructure of the region. However, because of the severity of anthropogenic impacts, this contribution has been minimalised.

A natural spring is situated on the north-eastern border of the site and the flow of water is evident. This is a highly significant and sensitive biophysical feature, although no significant or conservation important plant species has been recorded at this locality. The vegetation of these units comprises of the grasses *Eragrostis chloromelas, Pennisetum clandestinum, Pentameris airoides* subsp. *jugorum, Paspalum dilatatum* and the forbs *Centella asiatica, Marsilea* cf. *macrocarpha* and *Trifolium burchellianum.* The recorded floristic diversity in these units are generally low, reflecting on the severity of the existing impacts.

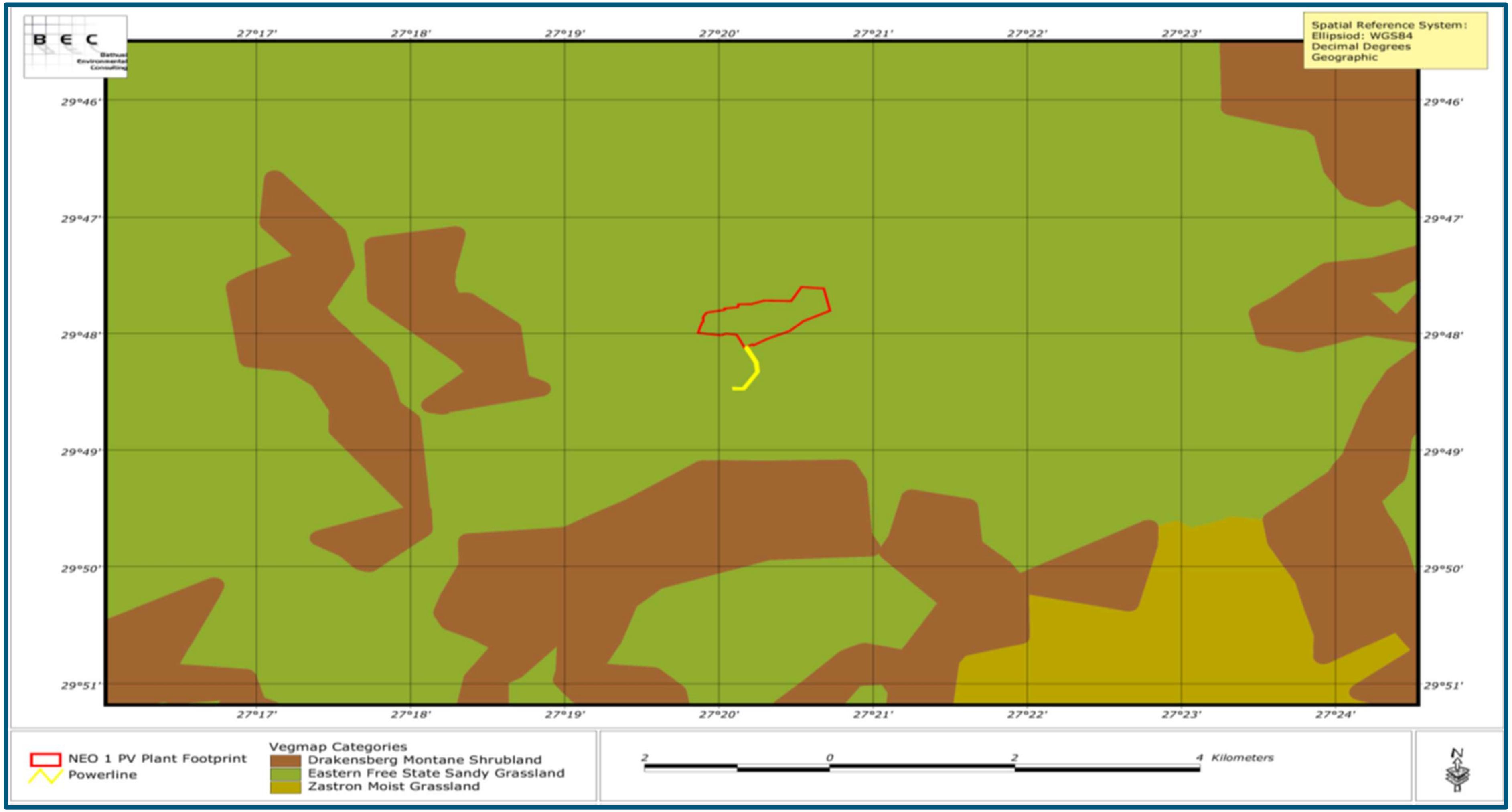

Figure 45: Vegmap Categories of the Surrounding Region

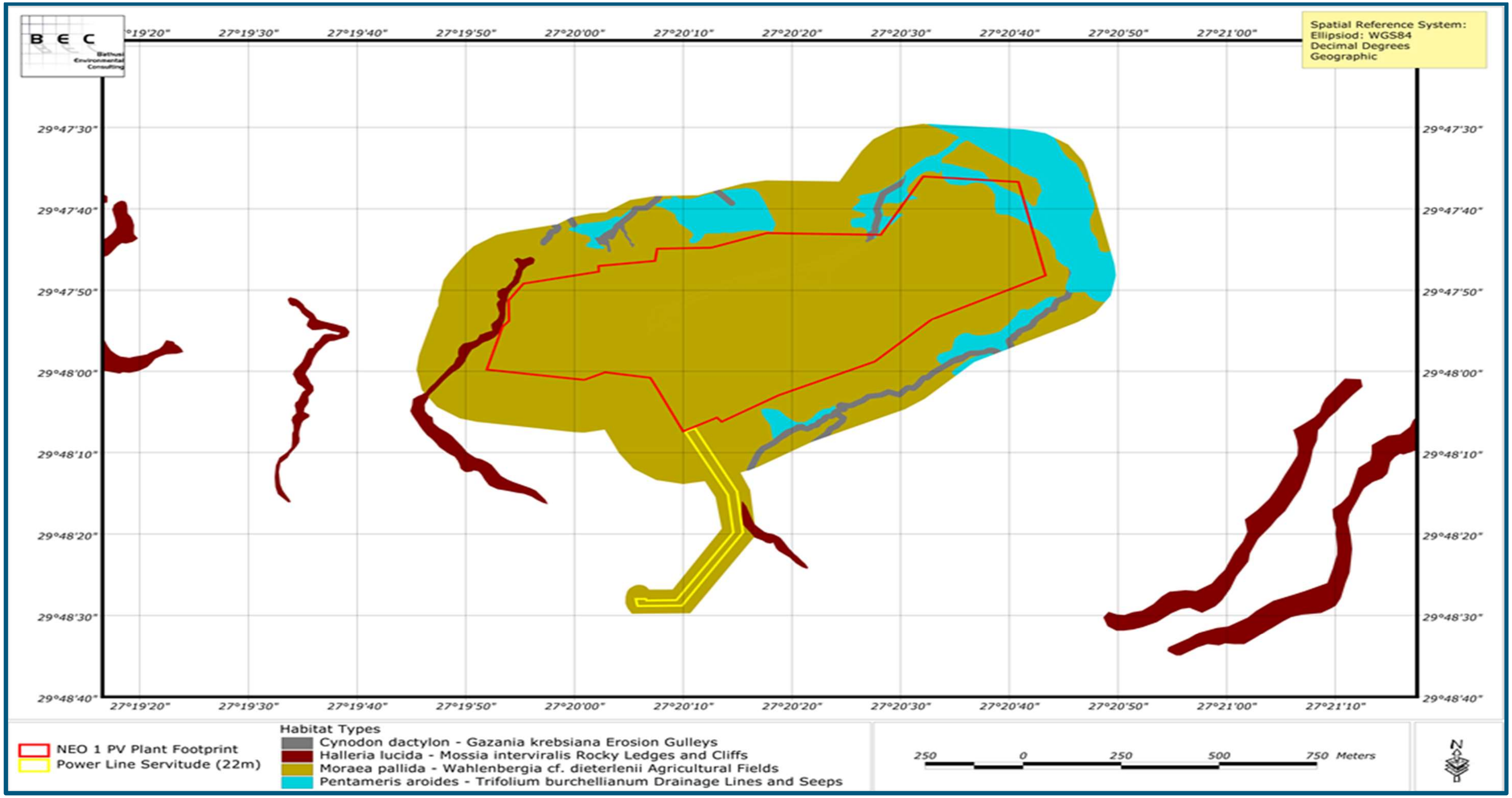

Figure 46: Botanical Units of the Development Footprint and Immediate Surrounds

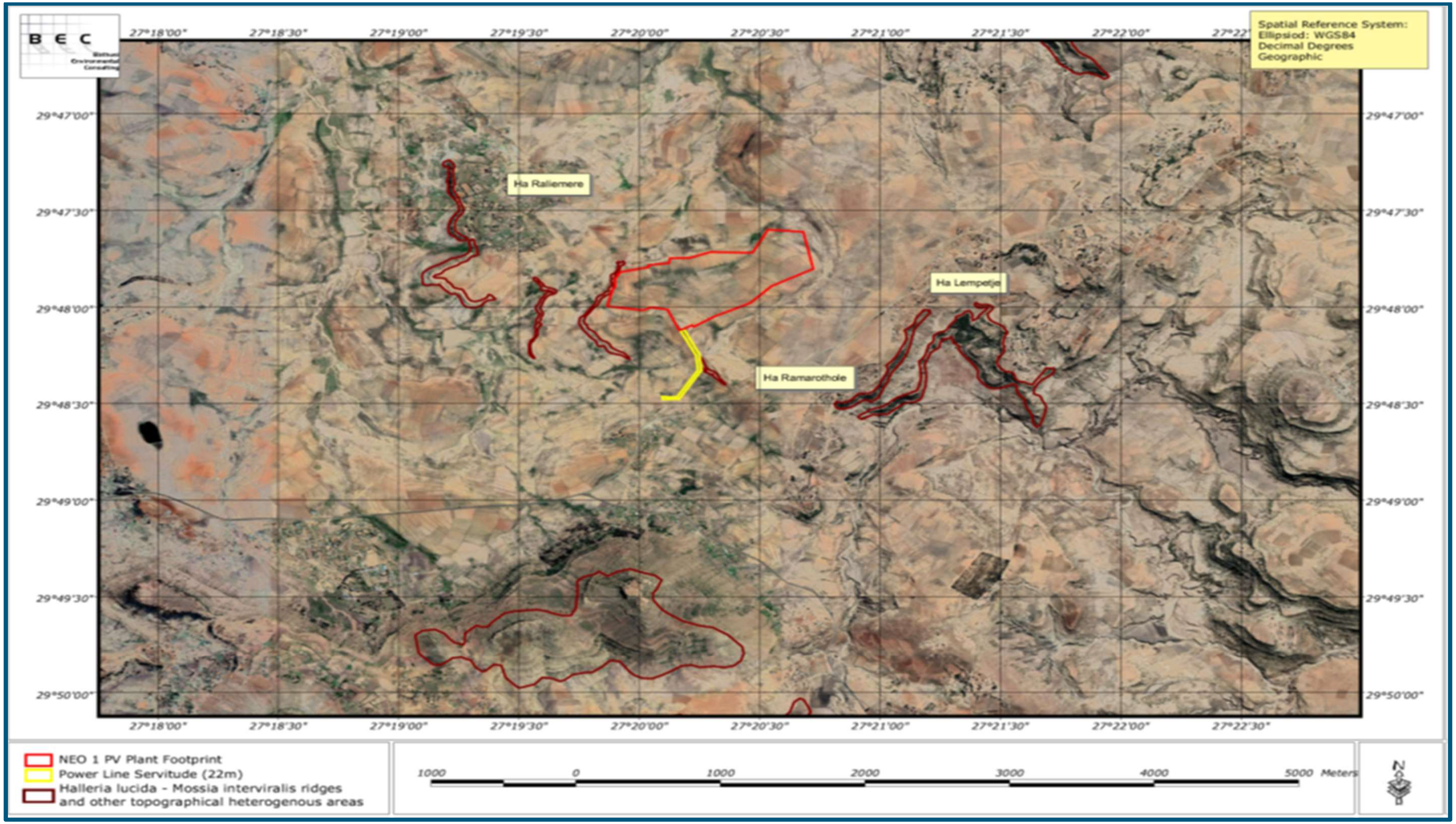

Figure 47: Geographical Distribution of the Halleria lucida

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Estimated Floristic Sensitivity

For existing protected areas and species, the floristic importance ascribed to certain areas is obvious and simplistic. Most countries will have differentiated the biodiversity importance of their protected areas (national or local) as part of their designation. Conversely, outside of protected areas, but within areas that are clearly of value for biodiversity, the evaluation of importance is complex and often vague. It is therefore important to note that the absence of protected status should never be interpreted as low biodiversity importance; many areas of international importance for biodiversity lie outside of protected areas. The challenge is to include a suitable range of criteria to determine whether the site is of local, regional, national or international importance. Additionally, areas that are characterised by severe and intensive disruption of the natural ecological processes and decimation of the principal floristic attributes, are generally regarded to exhibit low sensitivity attributes. It is important to note that no universal standard exist to assess or evaluate the floristic sensitivity of the receiving environment. However, some of the common criteria include the following:

- Keystone species, conservation important species and suitability of habitat for these species;
- Rarity and fragility of the habitat;
- Species/habitat richness;
- Species endemism and perceived species richness;
- Fragility value of ecosystem services also considering contribution to ecological infrastructure.

A basic and subjective evaluation of the receiving environment of the perceived floristic sensitivity of the receiving environment is presented in **Table 27** and illustrated in **Figure 48**.

Table 27: Flora Habitat Sensitivities for the Study Area

COMMUNITY	RD SPECIES	LANDSCAPE SENSITIVITY	STATUS	SPECIES DIVERSITY	FUNCTIONALITY	TOTAL	SENSITIVITY INDEX	SENSITIVITY CLASS
Cynodon dactylon – Gazania krebsiana Erosion Gulleys	1	2	2	2	1	51	16%	low
Halleria lucida – Mossia interviralis Rocky Ledges and Cliffs	7	9	6	7	10	243	76%	medium-high
Moraea pallida– Wahlenbergia cf. *dieterlenii* Agricultural Fields	1	2	2	3	3	62	19%	low
Pentameris ariodes – Trifolium burchellianum Drainage Lines and Seeps	4	10	7	8	9	229	72%	medium-high

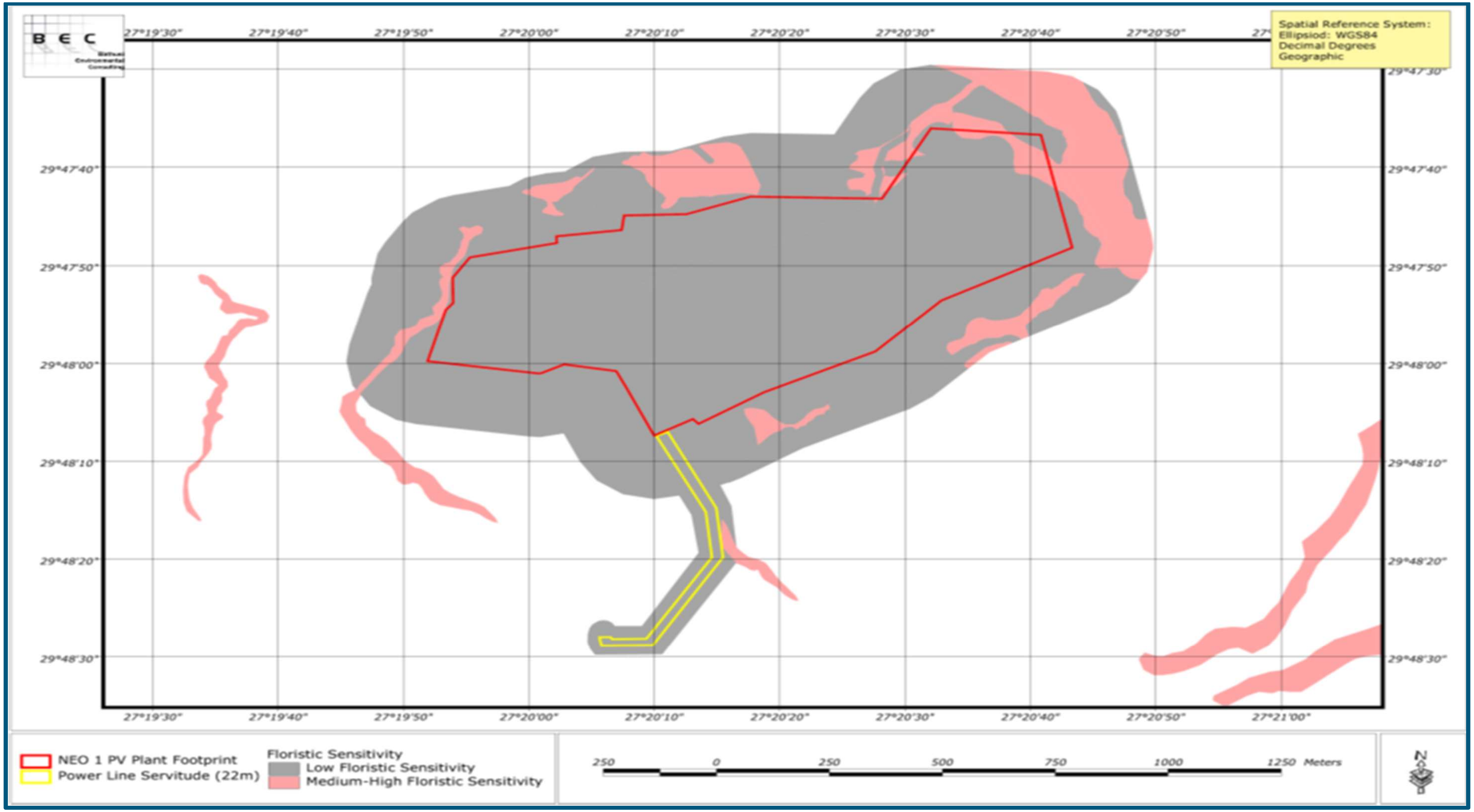

Figure 48: Estimated Floristic Sensitivity of the Development Footprint and Immediate Surrounds

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4.2.1.5 Faunal Sensitivity

The faunal sensitivities of the macro habitat types of the study area and surrounds were estimated using five comparable and relevant ecological characteristics:

- Habitat Status (ST): the level of habitat transformation and degradation vs. pristine faunal habitat;
- Habitat diversity (DV): the number and frequency of different faunal micro habitats found within each of the macro habitat types;
- Habitat linkage (LN): the degree to which a macro habitat type is linked to other natural areas enabling movement of animals to and from the habitat found in the study area;
- Habitat sensitivity (SN): the relative presence of elements of inherently sensitive faunal habitats such as surface rock associated with outcrops and surface and underground water found in wetlands; and
- Red data species (RD): the degree to which suitable habitat for the red data species likely to be found in the study area is located within each macro habitat type.

The following faunal sensitivity categories were used:

- Low: 0-19 %;
- Medium low: 20-39 %;
- Medium: 40-59 %;
- Medium-high: 60-79 %; and
- High: 80-99 %.

Faunal Macro Habitat Types

Animals do not exist in isolation within ecosystems; animals of terrestrial as well as aquatic ecosystems are influenced by plant community structure and species diversity. Many aquatic species find refuge in extensive reedbeds that are frequently found within lowland wetland ecosystems (Sychra, Adamek and Petrivalská, 2010). Furthermore, the structure and age of vegetal formation of ponds and impounds play a significant role in selecting species traits related to the population dynamics and feeding habits of species (Cereghino et al., 2008). Similarly, terrestrial animals' ecological reactions depend on plant community structure; studies on species richness have indicated that for spiders, local processes are important, with assemblages in a particular patch being constrained by habitat structure (Borges and Brown, 2004). Likewise, plant community structure is often influenced by primary consumers; herbivores are known key drivers of ecosystem function and nutrient dynamics within grazed plant communities (Duncan, 2005; Kamffer and Verreynne, 2018). Plant communities that were described for the study area are regarded adequately representative of the macro faunal habitat types, including:

- *Cynodon dactylon – Gazania krebsiana* Erosion Gullies;
- *Halleria lucida – Mossia interviralis* Rocky Ledges & Cliffs;
- *Moraea pallida – Wahlenbergia cf. dieterlenii* Agricultural Fields; and
- *Pentameris ariodes – Trifolium burchellianum* Drainage Lines & Seeps.

The study area is located within the Q-grid 2927CD; an assessment of faunal disciplines revealed the listing of only 6 amphibian species for 2927CD and there are no red data species listed.

Species Identification

A total of only nineteen animal species (excluding avifauna) were recorded in the study area. This diversity represents the following (refer to **Table 28**): Photographic evidence of some of these species are presented in **Figure 49**. None of the species observed in the study area during the field investigation are listed as threatened or near threatened species, they also do not have any regional (ADU-UCT, 2017) or global listing as Red Data listed species.

- Eight Orders; and
- Sixteen Families.

Table 288: Aninmals Recorded in the Study Area

BINOMIAL NAME	ENGLISH NAME	RS	GS
Odonata: Coenagrionidae			
Africallagma glaucum Burmeister, 1839	Swamp Bluet	NL	LC
Odonata: Aeshnidae			
Anax imperator Leach, 1815	Blue Emperor	NL	LC
Odonata: Libellulidae			
Crocothemis erythraea Brullé, 1832	Broad Scarlet	NL	LC
Sympetrum fonscolombii Selys, 1840	Nomad	NL	LC
Orthoptera: Pyrgomorphidae			
Phymateus viridipes Stål, 1873	Green Milkweed Locust	NL	NL
Lepidoptera: Pieridae			
Pontia helice (Linnaeus, 1764)	Common Meadow White	LC	LC
Lepidoptera: Nymphalidae			
Vanessa cardui (Linnaeus, 1758)	Painted Lady	LC	LC
Lepidoptera: Lycaenidae			
Aloeides maluti Pringle, 1983	Maluti Copper	LC	NL
Hymenoptera: Apidae			
Xylocopa caffra (Linnaeus, 1767)	Carpenter Bee	NL	NL
Anura: Pyxicephalidae			
Amietia delalandii (Duméril and Bibron, 1841)	Delalande's River Frog	LC	LC
Anura: Pipidae			
Xenopus laevis Daudin, 1802	Common Platanna	LC	LC
Squamata: Scincidae			
Trachylepis punctatissima Smith, 1849	Speckled Rock Skink	LC	LC
Trachylepis varia (Peters, 1867)	Variable Skink	LC	NL
Squamata: Cordylidae			
Cordylus cordylus Linnaeus, 1758	Cape Girdled Lizard	LC	LC
Squamata: Agamidae			
Agama aculeata distanti (Boulenger, 1902)	Distant's Ground Agama	LC	NL
Agama atra Daudin, 1802	Southern Rock Agama	LC	LC
Macroscelidea: Macroscelidae			
Elephantulus myurus Thomas & Schwann, 1906	Eastern Rock Sengi	LC	LC
Rodentia: Bathyergidae			
Cryptomys hottentotus (Lesson, 1826)	Southern African Mole-rat	LC	LC
Rodentia: Muridae			
Gerbilliscus brantsii (A. Smith, 1836)	Highveld Gerbil	LC	LC

**RS: Regional Status and *GS: Global Status*

***LC: Least Concern and*

	
Aloeides maluti Pringle, 1983	*Elephantulus myurus* Thomas & Schwann, 1906
	
Cryptomys hottentotus (Lesson, 1826) - burrows	*Gerbilliscus brantsii* (A. Smith, 1836) - burrows

	
Agama aculeata distanti (Boulenger, 1902)	*Phymateus viridipes* Stål, 1873

Figure 49: Selected Animal Species Recorded in the Study Area

The species inventory collated during the field investigation for the study area and immediate surrounds added significantly to existing faunal distribution data for 2927CD. The recorded species include the following groups:

- Four dragonflies;
- Three butterflies
- Two frogs;
- Five reptiles; and
- Three mammals.

Evidence of selected species were submitted to the Virtual Museum to augment the database (refer **Figure 50**).

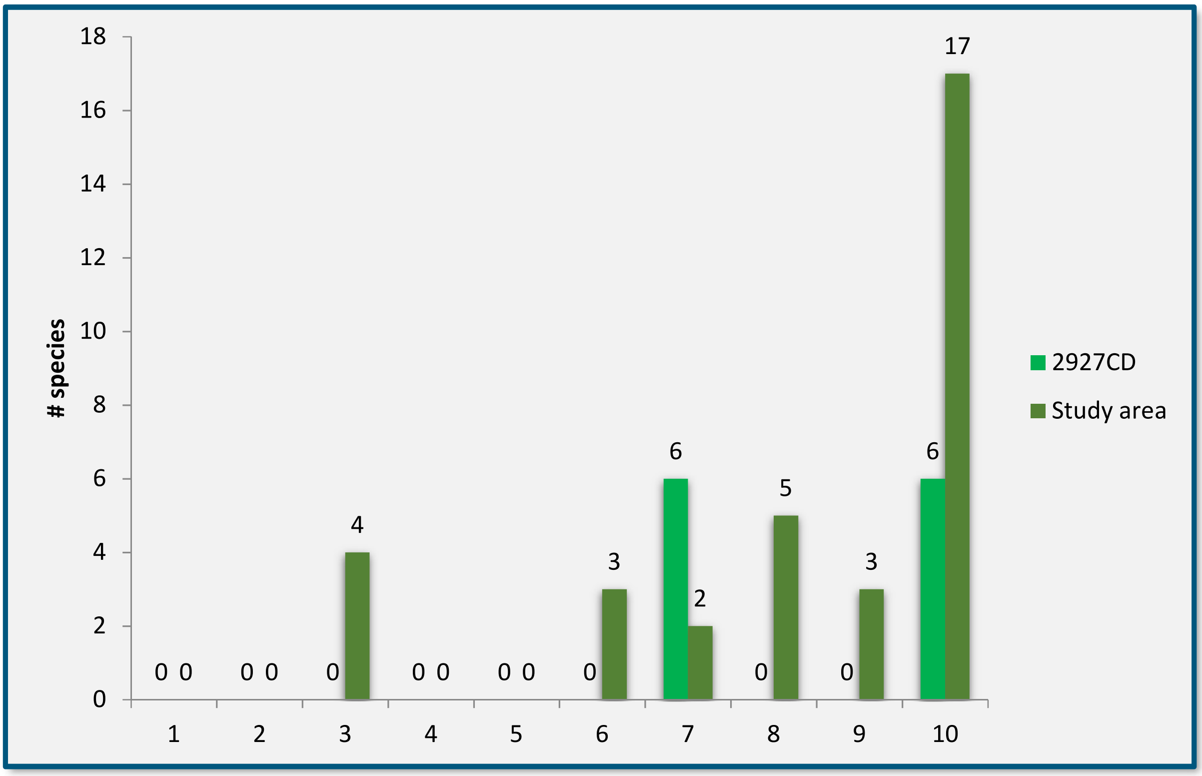

Figure 50: Comparison between 2927CD and Study Area Listed Species Richness

4.2.1.6 Faunal Habitat Sensitivity

The faunal sensitivities of the macro habitat types were estimated using five comparable and relevant ecological characteristics:

- Habitat Status (HT): the level of habitat transformation and degradation vs. pristine faunal habitat;
- Habitat Diversity (DV): the number and frequency of different faunal micro habitats found within each of the macro habitat types;
- Habitat Linkage (LN): the degree to which a macro habitat type is linked to other natural areas enabling movement of animals to and from the habitat found in the study area;
- Habitat Sensitivity (SN): the relative presence of elements of inherently sensitive faunal habitats such as surface rock associated with outcrops and surface and underground water found in wetlands; and
- Red Data species (RD): the degree to which suitable habitat for the red data species likely to be found in the study area is located within each macro habitat type.

The following faunal sensitivity categories were used:

- Low 0-19 %;
- Medium-low20-39 %;
- Medium40-59 %;
- Medium-high 60-79 %; and
- High 80-99 %.

The faunal habitat sensitivities were estimated for the four faunal macro habitats described for the study area and surrounds (refer **Table 29**) , illustrated in **Figure 51** and are considered to be the same as the floristic sensitivity shown in **Figure 48** .

Table 29: Faunal Sensitivities of the Habitat Types of the Study Area

STATUS	HABITAT TYPE	HT	DV	LN	SN	RD	AVE	SENS CLASS
Natural	Rocky Ledges & Cliffs	6	7	7	7	7	68 %	medium-high
	Drainage Lines & Seeps	6	7	8	6	6	66 %	medium-high
Transformed	Erosion Gullies	2	2	3	1	1	18 %	low
	Agricultural Fields	2	2	3	1	1	18 %	low

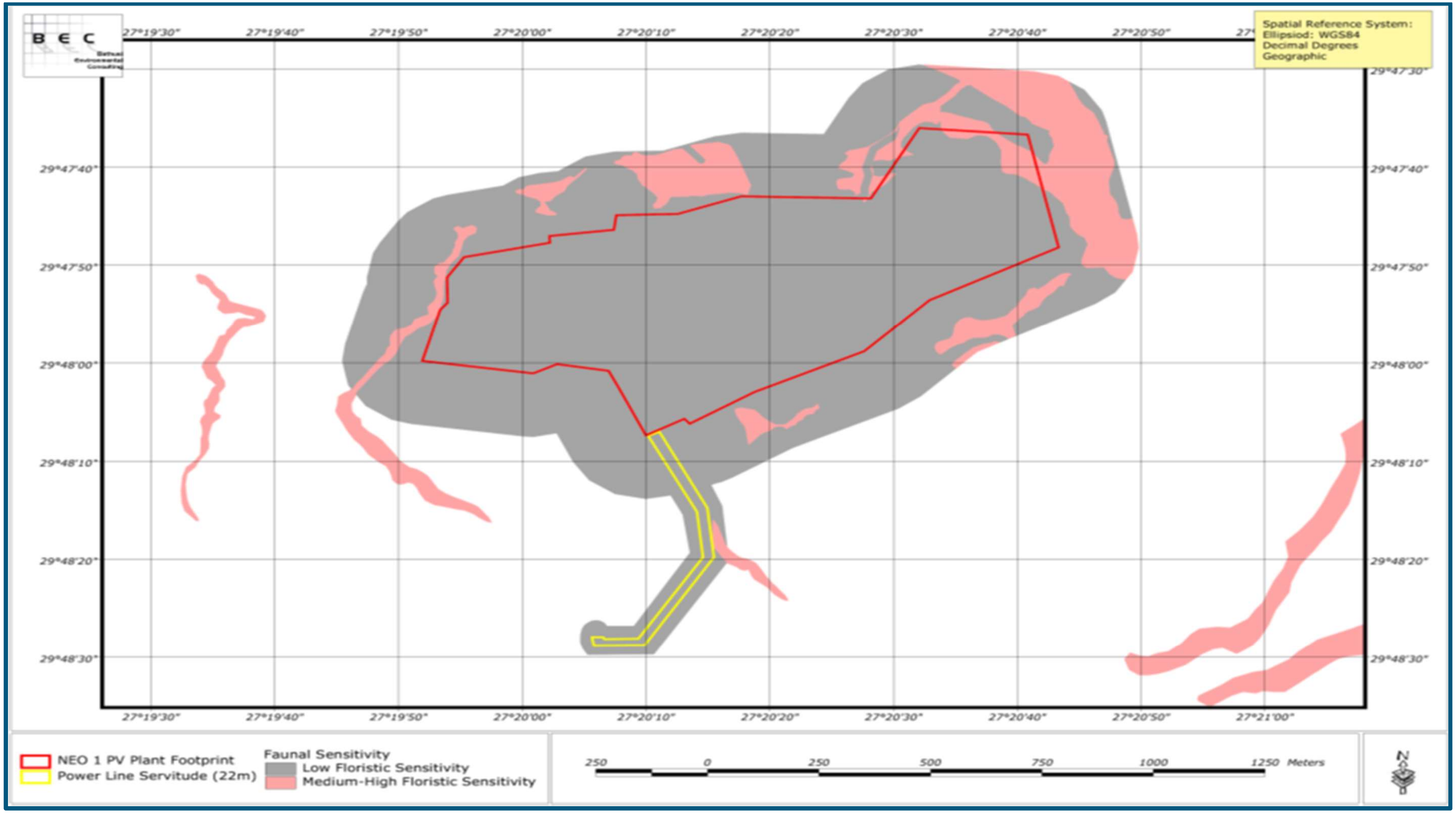

Figure 51: Estimated Faunal Sensitivity of the Development Footprint and Immediate Surrounds

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4.2.1.7 Bird Species Composition and Diversity Patterns

Avifaunal Broad -Scale Habitat Types

- **Moraea Pallida– Wahlenbergia CF. Dieterlenii Agricultural Fields**

Nearly the entire study site consists of tilled agricultural and fallow land. The transformation of natural grassland into agricultural fields explains the low bird richness in the area (c. <110 species) along with the possible historical displacement of endemic and obligatory grassland specialist taxa. However, the early successional seral stage of this habitat, along with the high propensity for annual plants (and inherent seed bank thereof) attracts congregations of granivore bird species, especially when the seed bank is germinating.

This unit consists mainly of a gradient of successional seral stages, representing recently tilled land which is currently used for the production of crops (mainly *Zea mays* (maize)) and early secondary seral (intermediate) stage which is fallow land that was probably used for agricultural purposes during the previous season. It is characterised by shortly grazed secondary graminoids (mainly *Cynodon dactylon* and *Chloris virgata*) and early aspect forb species such as *Crepis hypochaeridea, Felicia muricata, Helichrysum caespititium* and *Wahlenbergia dieterlenii*. Some sections of this habitat showed successional progress and are characterised by the dominance of the shrub *Felicia filifolia* and an abundance of termitaria (termite mounds). These *Felicia filifolia*-dominated shrubland were prominent on areas where recent cultivation and agricultural practice has ceased. The presence of the geophyte *Moraea pallida* generally indicates the deteriorated nature of this habitat, and the extent of time since the cessation of agricultural activities.

Typical bird species that forage in large numbers include Red-capped Lark (*Calandrella cinerea*), Cape Sparrow (*Passer melanurus*) and the insectivorous African Pipit (*Anthus cinnamomeus*). Other species that are also present include Speckled Pigeon (*Columba guinea*), Pied Crow (*Corvus albus*), Egyptian Goose (*Alopochen aegyptiaca*) and Western Cattle Egret (*Bubulcus ibis*). Bird species prone towards collision with the proposed electrical infrastructure associated with the PV facility that may also utilise this habitat include Western Cattle Egret (*Bubulcus ibis*), Black-headed Heron (*Ardea melanocephala*), Southern Bald Ibis (*Geronticus calvus*), large-bodied anseriform species such as Egyptian Goose (*Alopochen aegyptiaca*), White Stork (*Ciconia ciconia*) and Blue Korhaan (*Eupodotis caerulescens*). The Southern Bald Ibis (*Geronticus calvus*) is the only threatened foraging bird species with a high frequency of occurrence.

- ***Pentameris Ariodes – Trifolium Burchellianum* Drainage Lines and Seeps**

This habitat is located along the edges of drainage lines and is prominent on north-eastern and south-eastern parts of the study site (refer **Figures 52**). It is often colonised by dense, shortly-grazed secondary grassland dominated by *Eragrostis chloromelas, Pennisetum clandestinum, Pentameris airoides* subsp. *jugorum, Paspalum dilatatum* and consists of a number of pools which hold surface water for extended periods. The shortly grazed moist grassland provides foraging and roosting habitat for Cape Longclaw (*Macronyx capensis*) and Cape Wagtail (*Motacilla capensis*). However, if grazing regimes are appropriately managed and the graminoid structure is restored, this habitat type will also provide habitat for Long-tailed Widowbird (*Euplectes progne*), Yellow-crowned Bishop (*E. afer*), Southern Red Bishop (*E. orix*), Zitting Cisticola (*Cisticola juncidis*) and Levaillant's Cisticola (*C. tinniens*). It is also often visited by terrestrial species such as Blacksmith Lapwing (*Vanellus armatus*), Southern Bald Ibis (*Geronticus calvus*) and Black-headed Heron (*Ardea melanocephala*). When inundated during the wet season, the numerous pools are likely to be colonised by a number of waterbirds, most notably Yellow-billed Duck (*Anas undulata*) and White-faced Duck (*Dendrocygna viduata*). A natural spring is situated on the north-eastern border of the site. This spring is considered to be perennial as evidenced by the occurrence of obligate wetland plant taxa such as *Marsilea cf. macrocarpha*.

- ***Cynodon Dactylon – Gazania Krebsiana* Erosion Gulleys**

This habitat consists of deeply incised seasonal drainage lines with evidence of bank erosion occurring on the northern and southern boundaries of the study site. This habitat type is often important daily flyways for waterbird species in the region while also providing ephemeral foraging habitat for waterbird and wading bird taxa when inundated during the wet season. Important bird taxa confined to this habitat when inundated with a high probability of colliding with the infrastructure include Reed Cormorant (*Microcarbo africanus*), African Black Duck (*Anas sparsa*), Yellow-billed Duck (*A. undulata*), White-faced Duck (*Dendrocygna viduata*), Red-billed Teal (*A. erythrorhyncha*), Grey Heron (*Ardea cinerea*), Little Egret (*Egretta garzetta*) and African Sacred Ibis (*Threskiornis aethiopica*).

- ***Halleria Lucida – Mossia Interviralis* Rocky Ledges and Cliffs (offsite)**

This habitat includes south- and west-facing ridges consisting of exposed sandstone outcrops and cliffs. It is prominent along the proposed distribution line and also occurs to west of the study site (refer **Figures 52** and **53**). This habitat is characterised by the exposed localised sandstone escarpments, with flat sheetrock and exfoliating rock at the crests that gives way to steep cliffs of large boulders towards the footslope, thereby eventually connecting with the lower slopes of grassland plains. These ridges provide perching and hunting vantage points for birds of prey (e.g. Jackal Buzzard *Buteo rufofuscus*, Lanner Falcon *Falco biarmicus* and Rock Kestrel *F. rupicolus*), as well as foraging and breeding habitat for facultative rupiculous (rock-loving) bird taxa such as Cape Bunting (*Emberiza capensis*), Familiar Chat (*Oenanthe familiaris*), Mountain Wheatear (*Myrmecocichla monticola*), Eastern Long-billed Lark (*Certhilauda semitorquata*) and Long-billed Pipit (*Anthus similis*).The larger, and more prominent ridges in the region also provide habitat for the near threatened African Rock Pipit (*Anthus crenatus*), although this species was not observed from the ridges immediately adjacent to the study site.

- **Azonal Habitat: Artificial Impoundments**

An artificial impoundment characterised by open surface water and exposed mudflats is situated approximately 900 m south-west of the study site (refer **Figure 53**). During the site visit bird richness was low, with only two collision-prone bird species observed, namely Egyptian Goose (*Alopochen aegyptiaca*) and Grey Heron (*Ardea cinerea*). However, the impoundment may also attract a number of Palearctic Scolopacid wader taxa (e.g. sandpipers and stints) during the summer, as well as Charadriid plovers such Three-banded Plover (*Charadrius tricollaris*).

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A


B


C


D


E


F


G


H

Figure 52: Habitat Types on the Study Site and Nearby the Study Site

(a-d) *Moraea pallida – Wahlenbergia cf. dieterlenii* agricultural fields, (e-h) *Pentameris ariodes – Trifolium burchellianum* drainage lines and seeps, (i-j) *Cynodon dactylon – Gazania krebsiana* erosion gulleys, (k-n) *Halleria lucida – Mossia interviralis* rocky ledges and cliffs and (o-p) an artificial impoundment.

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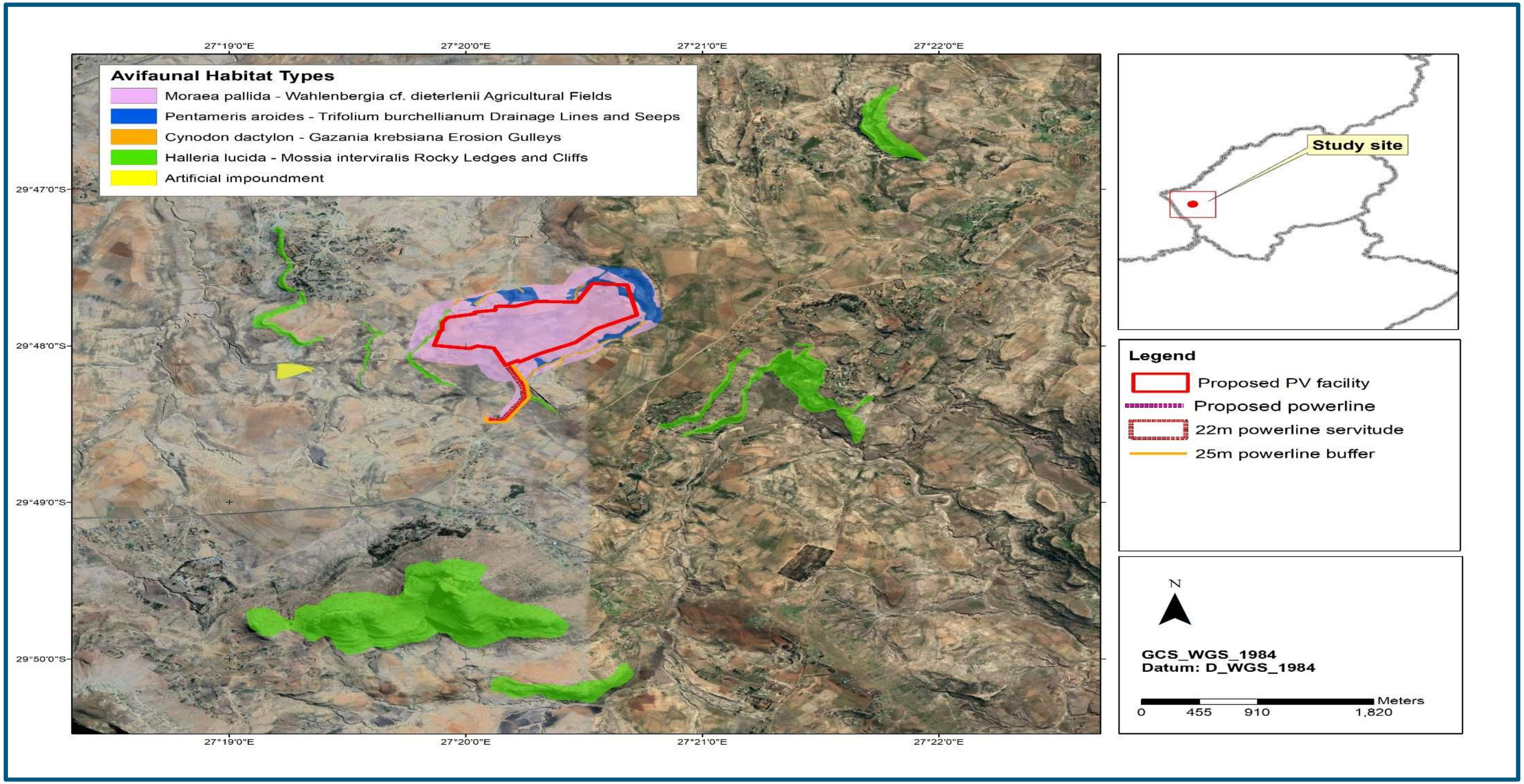

Figure 53: Avifauna Habitat Types

4.2.1.8 Species Richness and Predicted Summary Statistics

Approximately 109 bird species are expected to occur on the study site (refer **Table 30**), of which 51 species (c. 48 % of the expected number of species) was confirmed during the survey in October 2018. The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2)[7] (Harrison et al., 1997; www.sabap2.org). The expected and observed richness is strongly correlated with extant and historical transformation of grassland habitat, grazing pressure and the absence of any major mountain range within the immediate surroundings of the study site.

The expected bird richness equates to 30 % of the approximate 361 species listed for Lesotho[8]. In addition, the expected bird richness also equates to approximately 13 % of the 855 species recorded within South Africa[9] (and 11 % of the approximate 976[10] species listed for the southern African subregion[11]). In addition, the species richness obtained from the SABAP2 pentad grids corresponding to study site (excluding SABAP1) was significantly lower with 59 bird species recorded prior to the current survey, which emphasises the poor atlas coverage of the area (refer to **Figure 54**) and disrupted ecological condition of the habitat types on the study site. On a national scale, the predicted species richness per pentad on the study area is considered to be low (refer to **Figure 54**). According to the SABAP2 database, the study area hosts between 51-75 species, which is similar to the observed richness derived during the site visit.

According to **Table 30**, the study site and immediate surroundings is poorly represented by biome-restricted species, with only one species, namely Southern Bald Ibis (*Geronticus calvus*), expected to be present. The study site is also poorly represented by endemic and near-endemic bird species, with six endemics species (to South Africa and Lesotho) recorded: Southern Bald Ibis (*G. calvus*), Blue Korhaan (*Eupodotis caerulescens*), Eastern Long-billed Lark (*Certhilauda semitorquata*), Pied Starling (*Lamprotornis bicolor*), African Rock Pipit (*Anthus crenatus*) and Ground Woodpecker (*Geocolaptes olivaceus*). Near-endemic species (shared with South Africa) observed on the site included Jackal Buzzard (*Buteo rufofuscus*), Cloud Cisticola (*Cisticola textrix*) and Large-billed Lark (*Galerida magnirostris*).

Table 30: Total Number of Red Listed Species of the Study Area

	EXPECTED	OBSERVED
Total number of species (*sensu* Lepage, 2018) *	109 (30 %)	51 (48 %)
Number of Red Listed species (Taylor et al., 2015 & IUCN 2017) *#	15 (50 %)	4 (27 %)
Number of biome-restricted species (Barnes., 2001 – Afrotropical Highlands) *	1 (14 %)	1 (100 %)
Number of Lesotho Highland endemics (marginally shared with South Africa)	0	0
Number of endemics (BirdLife SA, 2018) **	6 (14 %)	6 (100 %)

[7] *The expected richness statistic was derived from QDS 2927CD (51 Thabana-Morena) and pentad grid 2945_2720 (including eight adjacent grids). Sixty (60) bird species were recorded from the QDS and 73 bird species (based on 14* ad hoc *cards, two full protocol cards). The SABAP2 statistic was corrected by excluding erroneous submissions of species "splits", including the Clapper and Long-billed Lark complex (splits emanating from* Mirafra opiate *and* Certhilauda curiosities*), Orange River White-eye (*Zosterops pallidus*), Olive Thrush (*Turnus olivaceus*) and Northern Grey-headed Sparrow (*Passer griseus*).*

[8] sensu *Lepage (2018).*

[9] *With reference to South Africa including Lesotho and Swaziland (BirdLife South Africa, 2018).*

[10] *sensu www.zestforbirds.co.za (Hardaker, 2018).*

[11] *A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, Swaziland and Lesotho).*

	EXPECTED	OBSERVED
Number of near-endemics (BirdLife SA, 2018) **	6 (20 %)	3 (50 %)

* only species within the geographic boundaries of Lesotho were considered.
** only species within the geographic boundaries of South Africa (including Lesotho and Swaziland) were considered.
# three species were observed during SABAP1 (Southern Bald Ibis & African Rock Pipit) and SABAP2 (ad hoc observations of Lanner Falcon), although 15 species have been recorded in the wider region spanning five QDGCs.

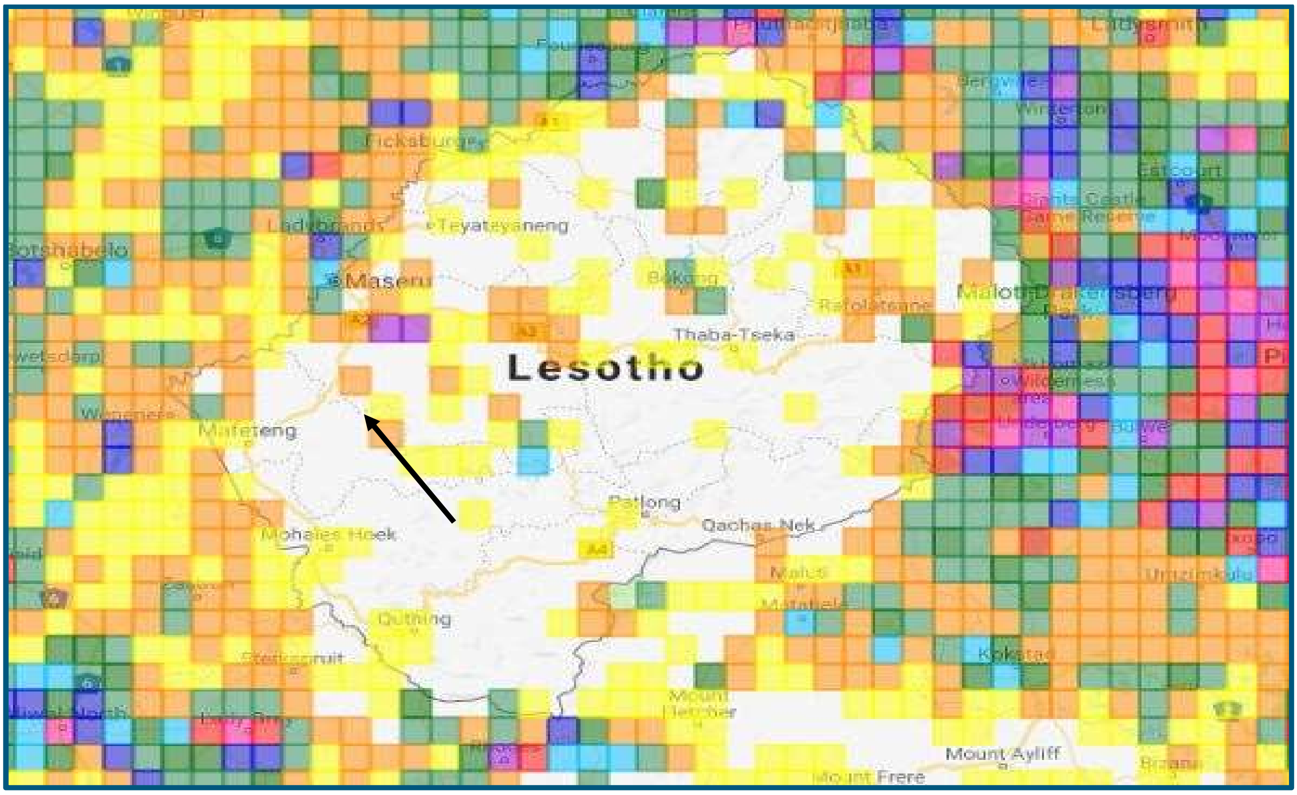

Figure 54: The Atlas Coverage of Pentad Grids in Lesotho (map courtesy of SABAP2 and the Animal Demography Unit). The arrow indicates the approximate position of the study site.

4.2.1.9 Important Bird and Biodiversity Areas

The avifaunal importance of a particular area is often analysed based on BirdLife International's criteria to evaluate and identify Important Bird Areas (IBAs). Criteria used are outlined by the BirdLife International Secretariat (Fishpool, 1997):

- Category A1: the regular presence of significant numbers of globally threatened species. In general, only IUCN species listed as Critically Endangered, Endangered or Vulnerable are considered. The regular presence of a Critical or Endangered species, irrespective of population size, at a site may be sufficient for a site to qualify as an IBA. For Vulnerable species, the presence of more than threshold numbers at a site is necessary to trigger selection;
- Category A2: the area holds a significant component of a group of species whose breeding distributions is restricted to an Endemic Bird Area (EBA) or Secondary Area. In other words, an EBA provides habitat for two or more species with restricted ranges co-occur and have global distributions of less than 50 000 km². It is noteworthy that 70 % of these species are also globally threatened. A Secondary Area (SA) holds one or more restricted-range species but does not qualify as an EBA because less than two species are entirely confined to it. A typical SA includes a single restricted-range species which does

not overlap in distribution with any other restricted-range species. For SAs, species occur where there are disjunct records of one or more restricted-range species, which are clearly geographically separate from any of the EBAs;

- Category A3: the area holds significant numbers of species whose distributions are largely confined to one biome. These species have shared distributions greater than 50 000 km².
- Category A4: the area may qualify on any one or more of the four criteria listed below:
  - The area is known to hold on a regular basis more or less 1 % of a biogeographic population of a congregatory waterbird species.
  - The area is known to hold on a regular basis more or less 1 % of the global population of a congregatory seabird or terrestrial species.
  - The area is known or thought to hold on a regular basis more or less 20 000 waterbirds or more or less 10 000 pairs of seabirds of one or more species.
  - The area is known or thought to exceed thresholds set for migratory species at bottleneck sites.

The study site is not located in close proximity to any Important Bird Area (Barnes, 2001) (refer **Figure 55**). Also, the prevalent habitat types on the study site have a low probability to sustain bird species that are restricted or endemic to the Lesotho Highlands (e.g. Mountain Pipit *Anthus hoeschi*, Drakensberg Rockjumper *Chaetops aurantius* and Drakensberg Siskin *Crithagra symonsi*). In addition, bird species restricted to the Namib-Karroo Biome (e.g. Layard's Warbler *Sylvia layardi* and Sickle-winged Chat *Emarginata sinuata*) are predicted to be absent or have low probabilities of occurrence on the study site. These two species have localised distribution ranges within Lesotho.

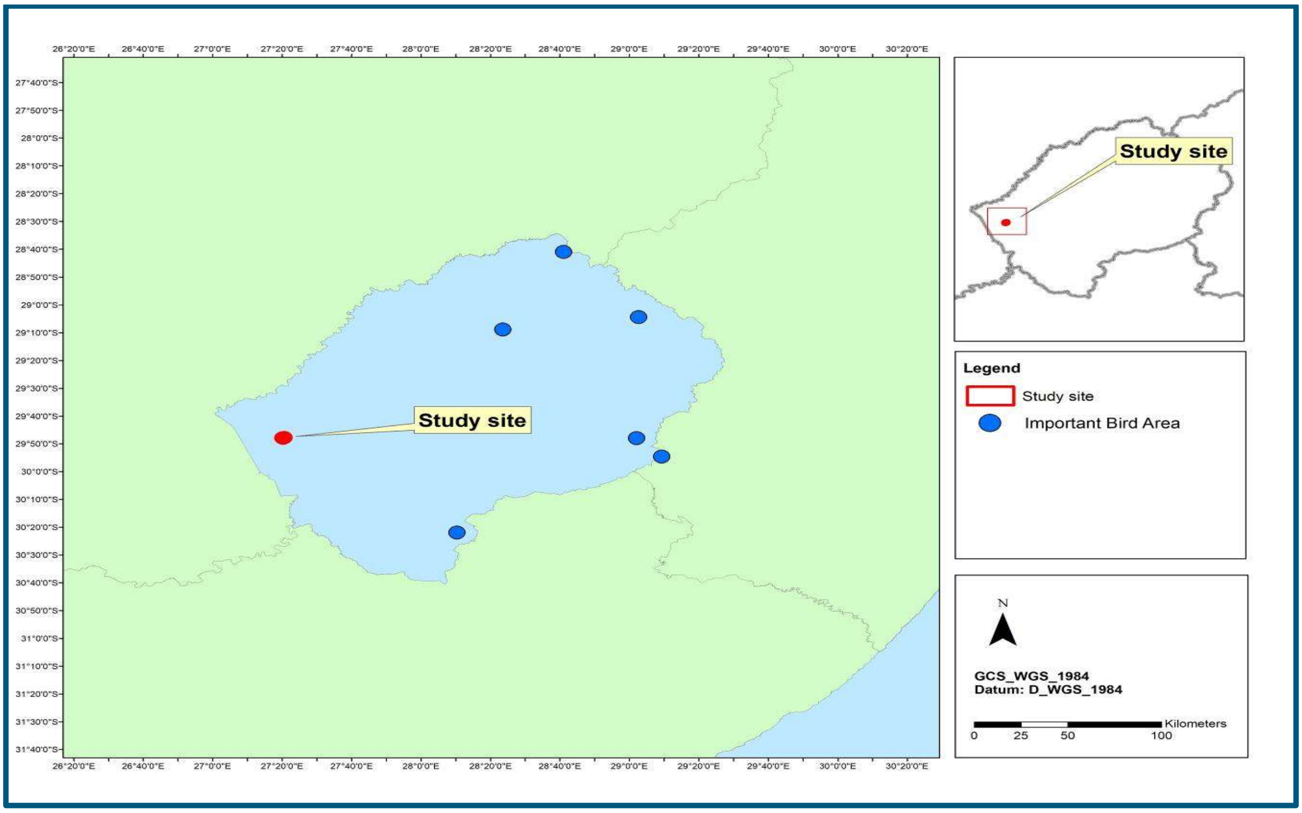

Figure 55: Map Illustrating the Important Bird Areas in Lesotho with Spatial Reference to the Study Site.

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4.2.1.10 Bird Species of Conservation Concern

Table 31 provides an overview of bird species of conservation concern that could occur on the study site based on their historical distribution ranges (including observation from nearby or adjacent QDG cells) and the presence of suitable habitat. According to **Table 31**, a total of 15 species have been recorded in the *wider study region* which includes seven globally threatened species, four globally near threatened species, three regionally threatened species and one regionally near-threatened species.

It is evident from **Table 31** that the highest reporting rates (SABAP2 = 50.00%) were observed for the globally vulnerable Southern Bald Ibis (*Geronticus calvus*), the globally near threatened African Rock Pipit (*Anthus crenatus*), the globally near threatened Blue Korhaan (*Eupodotis caerulescens*), the globally near threatened Ground Woodpecker (*Geocolaptes olivaceus*) and the regionally vulnerable Lanner Falcon (*Falco biarmicus*). These species have a high likelihood of occurrence and were indeed confirmed from the study area and immediate surroundings during the October 2018 survey.

The remaining species (as per **Table 31**) are regarded as irregular foraging visitors with low probabilities of occurrence. However, extensive areas of potential foraging habitat persist for some of these species (e.g. Secretarybird *Sagittarius serpentarius* and Abdim's Stork *Ciconia abdimii*) despite being absent or undetected during the survey. It is possible that the low reporting rates reflect the poor coverage of the study area by citizen scientists (e.g. birdwatchers) and the possibility exists that some of these species could occur in higher numbers during other times of the year.

Table 31: Threatened and Near Threatened Bird Species that Could Utilise the Proposed Study Area

SPECIES	GLOBAL CONSERVATION STATUS*	REGIONAL CONSERVATION STATUS**	SABAP1 REPORTING RATE (DERIVED)	SABAP2 REPORTING RATE	PREFERRED HABITAT	OCCURRENCE STATUS
Anthropoides paradiseus (Blue Crane)	Vulnerable	Near-threatened	3.65 (observed from two QDG cells adjacent to study site)	Not recently observed within the study area post 2007	Prefers open grasslands. Also forages in wetlands, pastures and agricultural land.	A highly irregular to rare foraging visitor to the study site.
Anthus crenatus (African Rock Pipit)	Near-threatened	Near-threatened	15.50	50.00 (recorded for the first time during the site visit)	Prefers boulder-strewn slopes and rocky scree - mainly associated with mountain ranges, koppies and outcrops.	Not present on site, although recorded from nearby ridges and outcrops.
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	2.90 (observed from two QDG cells adjacent to study site)	Not recently observed within the study area post 2007	Mountainous areas or areas with prominent outcrops with a high prey base (e.g. hyrax)	Vagrant to the study site.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	3.00 (only observed from 2927CA)	Not recently observed within the study area post 2007	Arid open lowland karroid shrubland and grassy plains.	Vagrant considered to be absent from study site.

SPECIES	GLOBAL CONSERVATION STATUS*	REGIONAL CONSERVATION STATUS**	SABAP1 REPORTING RATE (DERIVED)	SABAP2 REPORTING RATE	PREFERRED HABITAT	OCCURRENCE STATUS
Calidris ferruginea (Curlew Sandpiper)	Near threatened	-	1.72 (only observed from adjacent QDG cells)	Not recently observed within the study area post 2007	Open large water bodies with exposed muddy shoreline habitat.	Unlikely to occur on study site although the nearby dam provides ephemeral foraging habitat.
Ciconia abdimii (Abdim's Stork)	-	Near-threatened	3.45	Not recently observed within the study area post 2007	Open stunted grassland, fallow land and agricultural fields.	An uncommon to fairly common summer foraging visitor to areas consisting of secondary grassland, agricultural land and pastures.
Ciconia nigra (Black Stork)	-	Vulnerable	1.72	Not recently observed within the study area post 2007	Breed in mountain terrain and prefers to forage on large ephemeral pans or wetland systems.	A rare to irregular foraging visitor to the study site.
Circus maurus (Black Harrier)	Endangered	Endangered	4.00	Not recently observed within the study area post 2007	Breeds in karroid vegetation at high altitudes or in fynbos. Migrates to lower elevations in winter where it visits grassland habitat.	An irregular winter visitor to the study site.
Eupodotis caerulescens (Blue Korhaan)	Near-threatened	(delisted)	6.94	50.00 (recorded for the first time in the area)	Prefers extensive open short grassland and cultivated land.	Confirmed, regarded as a regular foraging visitor to the site.
Falco biarmicus (Lanner Falcon)	-	Vulnerable	12.50	50.00 (*sensu* seven *ad hoc* observations)	Varied, but prefers to breed in mountainous areas.	An occasional foraging visitor to the study site.
Geocolaptes olivaceus (Ground Woodpecker)	Near-threatened	-	-	50.00 (recorded for the first time during the site visit)	Boulder-strewn slopes, hills and mountain areas.	A resident to the nearby ridges.
Geronticus calvus (Southern Bald Ibis)	Vulnerable	Vulnerable	11.54	50.00	A species restricted to montane grassland (especially when burned) and breed/nest on steep cliffs.	Considered to be a regular foraging visitor to the study site.

SPECIES	GLOBAL CONSERVATION STATUS*	REGIONAL CONSERVATION STATUS**	SABAP1 REPORTING RATE (DERIVED)	SABAP2 REPORTING RATE	PREFERRED HABITAT	OCCURRENCE STATUS
Gyps coprotheres (Cape Vulture)	Endangered	Endangered	2.90 (from adjacent QDG cells)	It was not recently recorded from the area since 2007.	Mainly confined to mountain ranges, especially near breeding colonies. Ventures far afield in search of food.	An occasional overhead foraging visitor.
Oxyura maccoa (Maccoa Duck)	Vulnerable	Near-threatened	-	It was not recently recorded from the area since 2007, although it was recorded from pentad grids in the wider region.	Large saline pans and shallow impoundments.	Probably absent from the study site due to the absence of suitable habitat. Regarded as a rare visitor to the nearby dam.
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	6.56	It was not recently recorded from the area since 2007.	Prefers open grassland or lightly wooded habitat.	Regarded as uncommon or irregular foraging visitor - it is perhaps more regular owing to poor atlas coverage of the area.

(species highlighted in green were confirmed from the study area)

4.2.1.11 Annotations on Conservation Important Species

Southern Bald Ibis (Geronticus calvus) - Globally and Regionally Vulnerable

The Southern Bald Ibis is endemic to the north-eastern parts of South Africa, Lesotho and western Swaziland, with the core of its distribution located in the north-eastern Free State, the Mpumalanga escarpment and the KwaZulu-Natal Drakensberg (BirdLife International, 2016). It is currently listed as Vulnerable due to its small global population size, which is believed to be declining as a result of habitat transformation and degradation. The regional population is estimated at 3 300 – 4 000 mature individuals (Henderson, 2015), with several breeding colonies located within Lesotho suggesting a population size in the low thousands (BirdLife International, 2016).

It is threatened by human interference at breeding localities, and also habitat loss due to afforestation, opencast mining activities and agricultural intensification (BirdLife International, 2016). However, a recent eminent threat to this species is climate change, with a predicted reduction of its extent of occurrence of 20 % by 2050 (Colyn et al. in prep). It prefers to breed on vertical cliffs, while high-altitude grassland, especially when recently burned, is its preferred foraging habitat. It also utilises cultivated land, pastures and tilled land during foraging bouts (pers. obs.). It will also attempt to breed on the vertical sides of old opencast void systems (pers. obs.).

G. calvus is regarded as a regular foraging visitor to study area and is readily attracted to recently burned and shortly grazed grassland in the area. It is predicted that the Southern Bald Ibis (*G. calvus*) is a regular foraging visitor to the study site, with approximately nine individuals observed feeding approximately 4 km east of the study site *en route* to Manganeng village (**Figure 56** and **Figure 59**). It could potentially become displaced from the site by the infrastructure, and it could collide with the panels and electrical infrastructure (e.g. pylons) when attempting to perch. It is assumed that these birds roost (and potentially breed) in the sandstone cliffs pertaining to the large mountain massifs to the east of the study area (c. 6km east of the study site).

Figure 56: Southern Bald Ibis (Geronticus calvus) Approximately 4 km East of the Study Site.

Blue Korhaan (Eupodotis caerulescens) - Globally Near Threatened

This species was recently delisted to least concern during a recent regional conservation assessment by Taylor et al. (2015) in the absence of data indicating a significant reduction in the population size and that most of the population is stable (Hofmeyer, 2012). However, it remains globally near threatened owing to its small global distribution range (Birdlife International, 2017a) and owing to projected recent declines observed from SABAP2 in the north-west of its distribution range (Lee et al., 2017). This species is endemic to South Africa, with its distribution extending into the lowlands of western Lesotho (Taylor et al, 2015).

This species frequents short grassland, usually in the vicinity of surface water and termitaria, and is more abundant in the Grassy Karroo (Harrison et al., 1997) than the grassland along the Great Escarpment. It appears to have benefited from livestock grazing (Taylor et al, 2015), and a foraging male was observed from the centre of the study site as well as a pair from similar habitat approximately 700 m north of the study area (**Figure 57 and Figure 59)**. It is predicted to become displaced from the site by the infrastructure, and at risk of collision with the electrical infrastructure.

Figure 57: Blue Korhaan (Eupodotis caerulescens) at the Centre of the Study Site.

Lanner Falcon (Falco biarmicus) - Regionally Vulnerable

The Lanner Falcon (*Falco biarmicus*) breeds mainly in mountainous areas and prefers deep ravines and sheer cliffs for nesting purposes. Although fairly common within its distribution range with approximately <10 000 mature individuals in South Africa and with >5 % of the global population occurring in the region (Taylor, 2015). It is at risk due to persisting loss of open habitat to make way for agricultural land, with a 40 % decline reported between 1997 and 2013. It is also susceptible to collision with powerlines.

It is regarded as an occasional foraging visitor to the area, which is assumed to represent post-breeding seasonal migratory individuals from the eastern grassland parts of Lesotho and South African. It was not observed during the October survey, although ad hoc observations during SABAP2 reveal that it was recorded in 2014 from a neighbouring pentad grid (c reporting rate of 33.33 %). It could utilise the numerous ridges and cliffs in the immediate surrounding area as vantage and hunting posts.

Ground Woodpecker (Geocolaptes olivaceus) - Globally Near Threatened

Data obtained from the South African Bird Atlas Project (SABAP20 suggest a moderate population decline in the Ground Woodpecker (*Geocolaptes olivaceus*), although the rate of decline is unknown (BirdLife International, 2017b). The Ground Woodpecker was recently upgraded to the near threatened category (BirdLife International, 2017b). It is endemic to South Africa, but also occurs in mountainous areas of Lesotho and Swaziland. Lee et al. (2017) suggest that reporting rate of this species has declined by 51.7 % and its range has declined 43.3 % between data from SABAP1 and SABAP2. However, the projected decline by Lee et al. (2017) might be incomplete due to incomplete sampling during SABAP2 (as was evidenced by results obtained from this project). The species is sedentary, where it occurs on rocky slopes and mountainous areas. It is currently under threat from afforestation and the eminent threat from climate change (van Wilgen et al, 2016).

A pair was confirmed from rocky cliffs and ledges located approximately 300 m south-west of the study area (**Figure 58 and Figure 59**). The observation of this pair is the first confirmed record of this species in the study area. The species is unlikely to be adversely affected by the project if the infrastructure footprint avoids encroaching into the *Halleria lucida – Mossia interviralis* rocky ledges and cliffs which are located offsite.

Figure 58: Ground Woodpecker (Geocolaptes olivaceus) in a Rocky Ridge Adjacent to the Study Site

African rock Pipit (Anthus crenatus) - Globally and Regionally Near Threatened

The African Rock Pipit is considered to have a small population density, and according to reporting rates between SABAP1 and SABAP2 it may have experienced a moderate decline which placed this species in the Near threatened category (BirdLife International, 2017c; Peacock, 2015). It is endemic to South Africa and Lesotho with a global population size estimated by Taylor et al. (2015) as 3,300-8,900 mature individuals where it is restricted to rock and boulder-strewn slopes and scree. It is currently threatened by afforestation which could isolate populations from each other and genetic mixing. However, it is not affected by grazing or agricultural activities due to its specific habitat requirements, although climate change and habitat shifts could pose a future threat to this species (van Wilgen et al, 2016).

Preliminary analyses predict that this species may lose 85 % of its range by 2017-2100 due to climate change, making it an ideal indicator of climate change (Coetzee et al., 2009). It was not seen but was heard calling[12] from the rocky ledges south of the study site near the proposed power line (**Figure 59**). The species is unlikely to be adversely affected by the project provided the infrastructure footprint avoids encroaching into the *Halleria lucida – Mossia interviralis* rocky ledges and cliffs which are located offsite.

[12] *The call of the African Rock Pipit (*Anthus crenatus*) is highly diagnostic and carried far. It is unlikely that the call of this species could to be mistaken for any other bird species.*

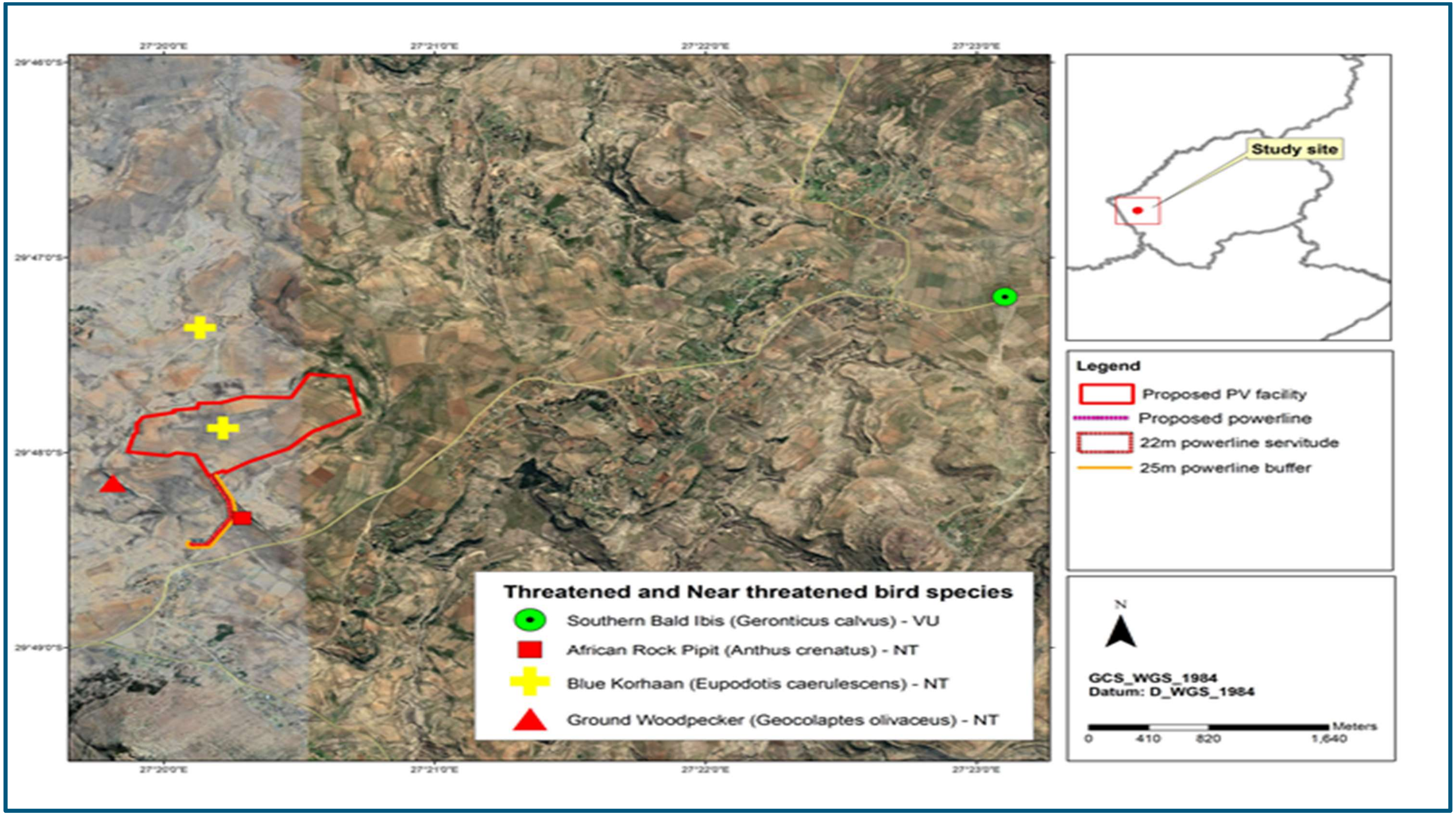


Figure 59: Localities of Threatened and Near Threatened Bird Species on the Study Site and Immediate Surroundings

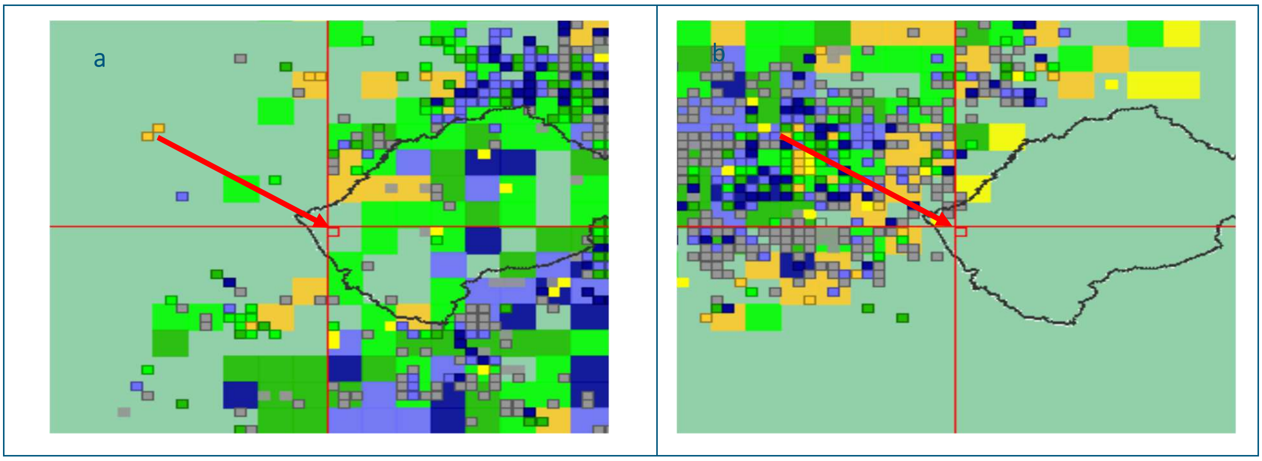
Novelties and "Out of Range" Species

Five of the observed bird species represent new records for the study area or at least part of the study area. They are either fully or marginally out of range according to their respective known distribution ranges. Most of these species have simply not been observed in the region owing to the paucity of dedicated citizen scientists (e.g. the birding fraternity) visiting the area. However, these observations include overlooked species that were not previously recorded in the area during SABAP1 ("full out of range" species), which include the following (refer **Figure 60**):

- Wing-snapping Cisticola (*Cisticola ayresii*) - Two independent observations from displaying males over Moraea pallida– Wahlenbergia cf. dieterlenii agricultural fields. The species could be confused with the similar-looking Cloud Cisticola (*C. textrix*) which also occurs on the study site, but the structure of the calls is different from each other, thereby facilitating an accurate identification of the species.
- Red-breasted Swallow (*Crecopsis semirufa*) - A single observation of an adult bird flying along a powerline servitude at the north-western part of the study site.
- Crested Barbet (*Trachyphonus vaillantii*) - A pair was calling from Manganeng village located to the east of the study site.
- Common Myna (*Acridotheres tristis*) - Observed from villages in close proximity to the villages and human activities. Often in association with grazing cattle near villages.

The following species represent marginal out of range species that were not recorded since the inception of SABAP2 (refer **Figure 60**):

- Ground Woodpecker (*Geocolaptes olivaceus*) - A pair was observed and photographed from a nearby ridge sytem.



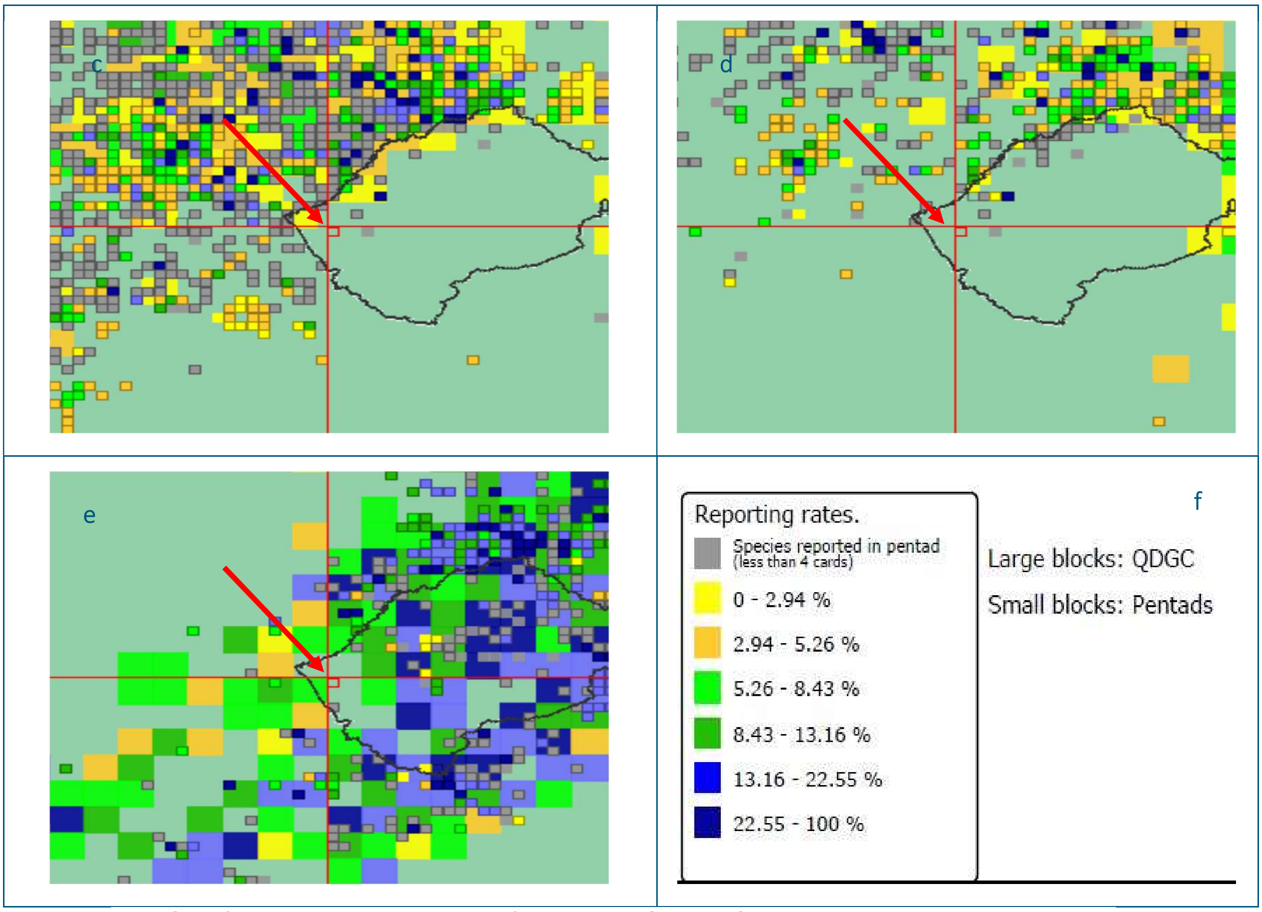


Figure 60: "Full Out of range" and "Marginal out of range" Bird Species Observed (arrow points to study area)

Large squares represent quarter degree grids (SABAP1) and small squares are pentad grids (SABAP2): (a) Wing-snapping Cisticola (*Cisticola ayresii*), (b) Red-breasted Swallow (*Crecopsis semirufa*), (c) Crested Barbet (*Trachyphonus levaillantii*), (d) Common Myna (*Acridotheres tristis*) and (e) Ground Woodpecker (*Geocolaptes olivaceus*). (f) represents the legend to the maps and the arrow indicates the location of the study site.

4.2.1.12 Bird Assemblage Structure and Composition

Summary of Point Counts

A total of 26 bird species and 157 individuals were recorded from 12 bird vantage points. The data provides an estimate of the bird richness and their numbers on the study area obtained during an austral dry season. A mean of 5.8 species and 13.1 individuals were recorded per point count. The highest number of species recorded from a point count was 11 species from *Halleria lucida – Mossia interviralis* rocky ledges and cliffs and the lowest was one species from old agricultural lands. The highest number of individuals recorded per point count was 36 individuals, and the lowest was four individuals. The mean frequency of occurrence of a bird species was 22.76 % and the median was 16.76 %, while the most common value (mode) was 8.33 %. The latter represents those species that were encountered in only a single point count. One species (c. Red-capped Lark *Calandrella cinerea*) occurred in all the point counts, while three species occurred in more than 40 % of all the point counts (refer **Table 32**).

Table 32: Bird Species (from 12 species) with a Frequency of Occurrence Greater than 20%, Observed in the Study Area.

SPECIES	FREQUENCY (%)	SPECIES	FREQUENCY (%)
Red-capped Lark (*Calandrella cinerea*)	100.00%	Mountain Wheatear (*Myrmecocichla monticola*)	41.67%
African Pipit (*Anthus cinnamomeus*)	83.33%	Spike-heeled Lark (*Chersomanes albofasciata*)	33.3%
Cape Sparrow (*Passer melanurus*)	41.67%	Cape Longclaw (*Macronyx capensis*)	25.00
Large-billed Lark (*Galerida magnirostris*)	41.67%	Cloud Cisticola (*Cisticola textrix*)	25.00

Dominance and Typical Bird Species

The dominant (typical) species on the study area are presented in **Table 33**. Only those species that cumulatively contributed to more than 90 % to the overall similarity between the point counts are presented.

The three typical bird species on the study area include the Red-capped Lark (*Calandrella cinerea*), African Pipit (*Anthus cinnamomeus*) and Spike-heeled Lark (*Chersomanes albofasciata*). The typical species forms part of nearly every bird assemblage and habitat unit on the study area and are considered widespread species. Approximately 50 % of the typical species are insectivorous (mainly ground gleaners), while the other 50 % are small bodied granivores (consuming graminoid seeds).

Table 33: Typical Bird Species in the Study Area

SPECIES	AVERAGE ABUNDANCE	CONSISTENCY	% CONTRIBUTION	PRIMARY TROPHIC GUILD
Red-capped Lark (*Calandrella cinerea*)	2.83	2.04	49.81	Granivore: ground gleaner
African Pipit (*Anthus cinnamomeus*)	1.75	1.30	25.78	Insectivore: ground gleaner
Spike-heeled Lark (*Chersomanes albofasciata*)	0.75	0.30	6.32	Granivore: ground gleaner
Cape Sparrow (*Passer melanurus*)	2.42	0.41	5.04	Granivore: ground gleaner
Mountain Wheatear (*Myrmecocichla monticola*)	0.83	0.41	4.67	Insectivore: ground gleaner

Bird composition and Diversity

Multidimensional scaling and hierarchical agglomerative clustering ordination of relative bird abundance values obtained from 12-point counts could only find a significant difference ($R=0.6$, $p<0.05$) between the compositions on the agricultural fields and the rocky cliffs and ledges (refer **Figure 61**). It appears that the compositions on the drainage lines and erosion gulleys form a continuum with those assemblages pertaining to the agricultural fields and the rocky cliffs and ledges.

An attempt was made to provide a description of the composition on each habitat based on a subjective delineation which also includes those species that were observed on the drainage lines and erosion gulleys.

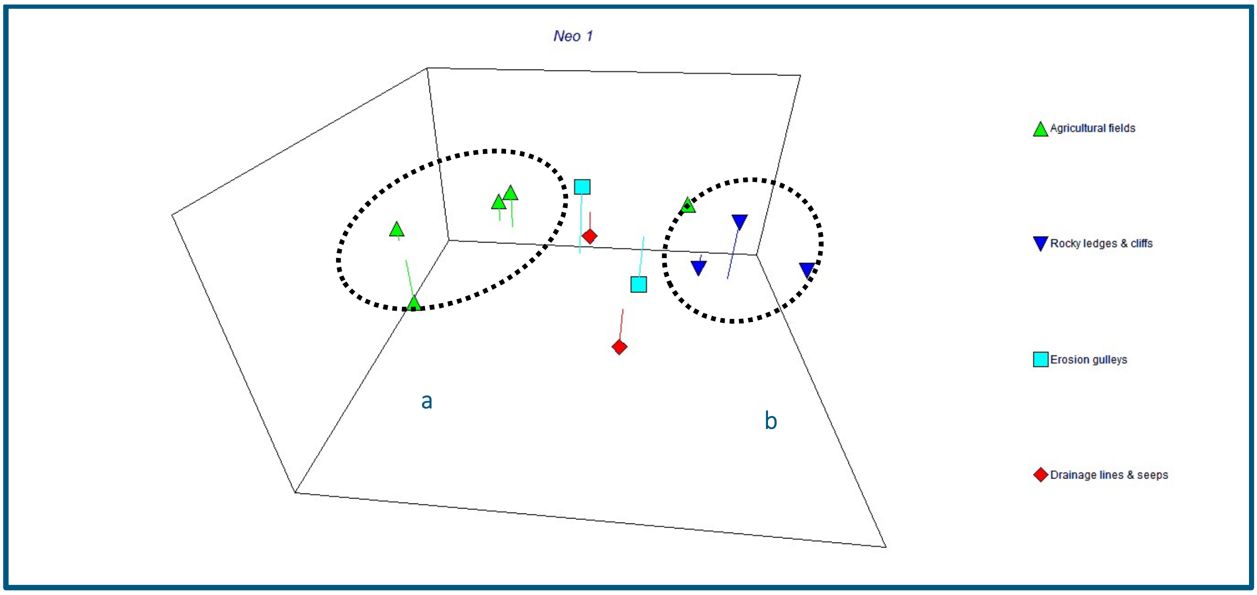


Figure 61: Three-dimensional Non-Metric Multidimensional Scaling Ordination of the Relative Abundances of Bird Species

This is based on Bray-Curtis similarities obtained from 12-point counts. It differentiates between two discrete (major) bird associations on (a) agricultural fields and (b) rocky ledges and cliffs.

Moraea pallida – Wahlenbergia cf. dieterlenii **Agricultural Fields**

Dominant species: The bird composition consists primarily of widespread grassland insectivorous and granivore taxa, including nomadic species such as Red-capped Lark (*Calandrella cinerea*), African Pipit (*Anthus cinnamomeus*) and Spike-heeled Lark (*Chersomanes albofasciata*). Indicator species with high abundance values in this habitat (species largely restricted to this habitat on the study area) include Blue Korhaan (*Eupodotis caerulescens*), Pied Starling (*Lamprotornis bicolor*), Spike-heeled Lark (*Chersomanes albofasciata*) and Red-headed Finch (*Amadina erythrocephala*).

Pentameris aroides – Trifolium burchellianum **Drainage Lines and Seeps**

Dominant species: The bird composition consists primarily of widespread grassland taxa such as Red-capped Lark (*Calandrella cinerea*) and African Pipit (*Anthus cinnamomeus*). It forms a continuum with the agricultural fields. Indicator species with high abundance values in this habitat (species largely restricted to this habitat on the study area) include Black-headed Heron (*Ardea melanocephala*), Western Cattle Egret (*Bubulcus ibis*) and Cape Wagtail (*Motacilla capensis*).

Cynodon dactylon – Gazania krebsiana **Erosion Gulleys**

Dominant species: The bird composition consists primarily of widespread grassland taxa such as Red-capped Lark (*Calandrella cinerea*) and African Pipit (*Anthus cinnamomeus*). It forms a continuum with the agricultural fields and the drainage lines. Indicator species – None noted that exhibited a high abundance values in this habitat (species largely restricted to this habitat on the study area), although Cape Canary (Serinus canicollis) and Bokmakierie (Telophorus zeylonus) show higher abundance values at this habitat but also occurs on the rocky ledges and cliffs.

Halleria lucida – Mossia interviralis Rocky Ledges and Cliffs

Dominant species: The bird composition consists of rupicolous (rock-loving) insectivorous and granivore taxa, although it also includes widespread grassland taxa that are abundant on the agricultural fields. Typical species include Mountain Wheatear (*Myrmecocichla monticola*), Red-capped Lark (*Calandrella cinerea*), African Pipit (*Anthus cinnamomeus*), Large-billed Lark (*Galerida magnirostris*) and Cape Bunting (*Emberiza capensis*). Indicator species with high abundance values in this habitat (species largely restricted to this habitat on the study area) include Mountain Wheatear (*Myrmecocichla monticola*), Cape Bunting (*Emberiza capensis*), Eastern Long-billed Lark (*Certhilauda semitorquata*) and Ground Woodpecker (*Geocolaptes olivaceus*).

It is also evident from **Table 34 and Figure 62** that the highest diversity of bird species and evenness (as described by rarefaction curves with high expected numbers of species) occurs on the rocky cliffs and ledges (offsite). The lowest number of bird species was recorded from the drainage lines and seeps. The low number of species from the drainage lines is probably a function of inundation since it is predicted that this habitat will host more species during the rainy season.

Table 34: Species Richness and Number of Bird Individuals Confined to the Habitat Units

HABITAT UNIT	NUMBER OF SPECIES (S)	NUMBER OF INDIVIDUALS (N)	SHANNON-WIENER INDEX H'(LOG$_E$)
Agricultural fields	10.00	11.20	1.91
Rocky ledges & cliffs	17.00	17.67	2.56
Erosion gulley's	12.00	15.00	2.02
Drainage lines & seeps	8.00	9.00	1.83

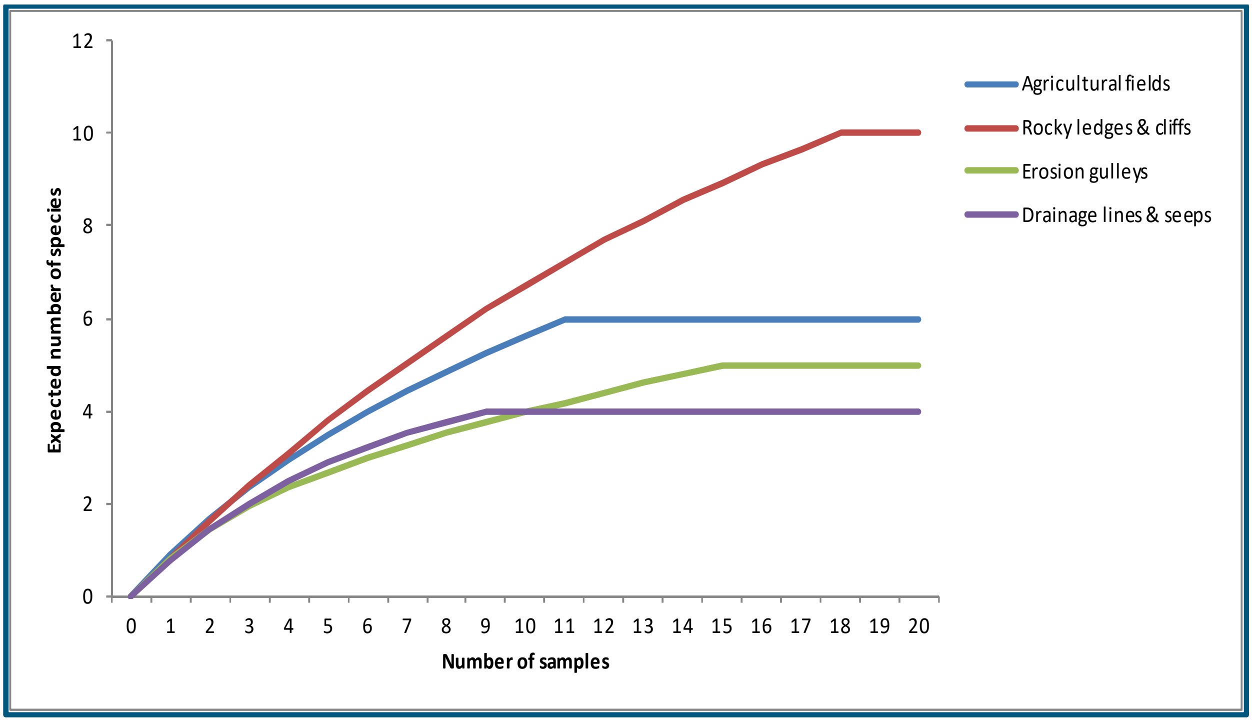


Figure 62: Rarefaction Curves for the Bird Associations on the Respective Habitat Units on the Study Site.

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Passerine and Non-passerine Densities

According to count data obtained from 12-point counts, the total number of species recorded on the study area is 26 species, which is approximately 1.45 species. ha-1 (**Table 35**). The average density per hectare is considerably low with 1.77 birds. ha-1 and ranges between 1.40 birds. ha-1 on the agricultural fields to 2.39 birds. ha-1 on the erosion gulley's.

Table 35: Average Abundance Values and Density Estimates for 26 Bird Species Recorded from 12 Point Counts

SPECIES	AGRICULTURAL FIELDS	ROCKY LEDGES & CLIFFS	EROSION GULLEY'S	DRAINAGE LINES & SEEPS
Red-capped Lark	2.40	2.33	5.50	2.00
African Pipit	0.80	1.67	3.00	3.00
Cape Sparrow	3.60	2.67	1.00	0.50
Large-billed Lark	0.20	1.33	0.50	0.00
Mountain Wheatear	0.00	2.33	0.50	1.00
Spike-heeled Lark	1.40	0.00	1.00	0.00
Cape Longclaw	0.00	1.33	0.00	0.00
Cloud Cisticola	0.20	0.33	1.00	0.00
Cape Crow	0.20	0.00	0.50	0.00
Speckled Pigeon	0.40	0.33	0.00	0.00
Cape Canary	0.00	1.00	0.50	0.00
Bokmakierie	0.00	0.67	0.50	0.00
Ant-eating Chat	0.00	0.33	0.00	1.00
Cape Bunting	0.00	1.33	0.00	0.00
Red-headed Finch	1.00	0.00	0.00	0.00
Pied Starling	1.00	0.00	0.00	0.00
Wing-snapping Cisticola	0.00	0.33	0.00	0.00
Rock Kestrel	0.00	0.00	0.50	0.00
Black-headed Heron	0.00	0.00	0.50	0.00
Western Cattle Egret	0.00	0.00	0.00	0.50
Cape Wagtail	0.00	0.00	0.00	0.50
Pied Crow	0.00	0.00	0.00	0.50
Ground Woodpecker	0.00	0.67	0.00	0.00
Rufous-naped Lark	0.00	0.33	0.00	0.00
Eastern Long-billed Lark	0.00	0.33	0.00	0.00
Southern Fiscal	0.00	0.33	0.00	0.00
Sum	**11.20**	**17.67**	**15.00**	**9.00**
Density/ha	**1.40**	**1.88**	**2.39**	**1.43**

Areas with High Avifauna Sensitivity

Areas with High sensitivities include the **rocky ledges and cliffs**, as well as the **drainage lines and seeps (Figure 63)**:

- The rocky ledges and cliffs (offsite) provide potential habitat for bird species with facultative rupicolous habits and provide also potential foraging habitat for the globally near threatened African Rock Pipit (*Anthus crenatus*) and Ground Woodpecker (*Geocolaptes olivaceus*). This habitat contributes towards the regional avifaunal diversity in the area, and it represents one of a few habitat types that are natural and untransformed.

- The rocky ledges and cliffs are often used as vantage points for foraging and/ or roosting birds of prey (it is potentially utilised by the regionally vulnerable Lanner Falcon *Falco biarmicus* and the regional endemic Jackal Buzzard *Buteo rufofuscus*).
- The drainage lines and seeps (mostly offsite) support bird species which are often prone towards powerline collisions (waterbirds, wading birds etc.), while they also facilitate avian dispersal across the landscape.

Areas with Medium Avifauna Sensitivity

Areas with Medium sensitivities include the **moist secondary grasslands** (onsite) bordering the drainage lines and seeps and the **erosion gulleys** (mostly offsite):

- These habitat units are considered to be of secondary and semi-transformed ecological condition, although it provides habitat for many bird species that are associated with wet or moist grassland habitat.
- It occurs invariably along erosion gulleys, thereby is linear in spatial configuration and contributes towards ecological connectivity and avian dispersal.

Areas with Low Avifauna Sensitivity

Areas with Low sensitivities include the transformed grassland and **agricultural fields** (onsite):

- These habitat units are widespread in the region and sustain avifaunal species with widespread distribution ranges. The majority of the species on these habitat types are widespread or nomadic species.

Areas with Very Low Avifauna Sensitivity

Areas with Very Low sensitivities include mainly transformed areas consisting of **infrastructure and villages**: These habitat types are of small surface area and often not viable to sustain large terrestrial bird species. They are often dominated by unspecialised and generalist passerine species.

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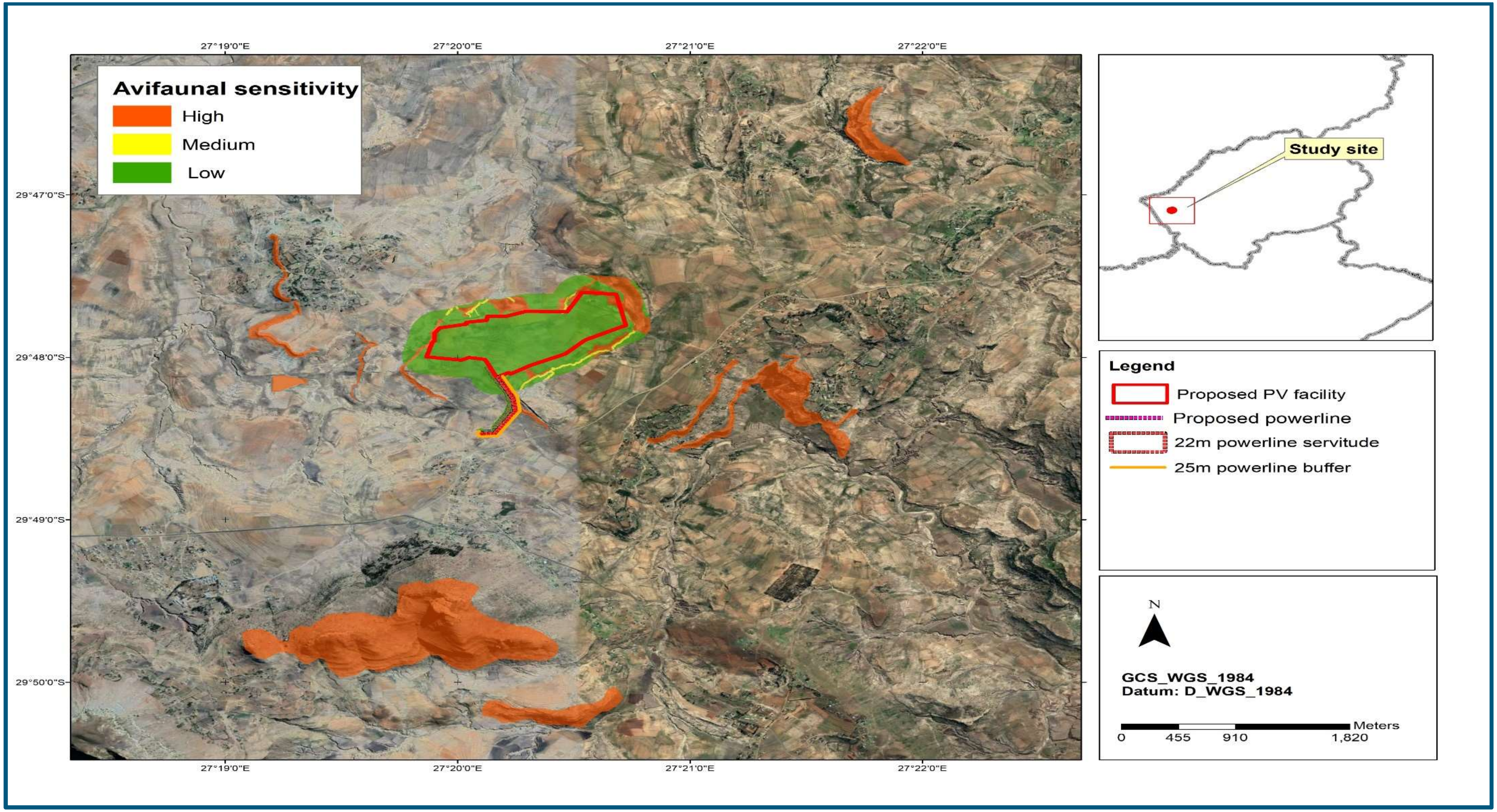

Figure 63: Avifaunal Sensitivity According to the Dominant Habitat Types on the Study Site and Immediate Surrounds

Table 36: SANBI Botanical Sampling Records in the Surrounds of the Study Area

SPECIES	FAMILY	GROWTH FORM
Acalypha punctata var. *punctata*	*Euphorbiaceae*	*Dwarf shrub*
Ajuga ophrydis	*Lamiaceae*	*Herb*
Albuca baurii	*Hyacinthaceae*	*Geophyte*
Albuca setosa	*Hyacinthaceae*	*Geophyte*
Albuca tortuosa	*Hyacinthaceae*	*Geophyte*
Albuca virens subsp. *virens*	*Hyacinthaceae*	*Geophyte*
Alepidea serrata var. *serrata*	*Apiaceae*	*Herb*
Aloe broomii var. *broomii*	*Asphodelaceae*	*Succulent*
Aloe ecklonis	*Asphodelaceae*	*Succulent*
Aloe ferox	*Asphodelaceae*	*Succulent*
Aloe maculata subsp. *ficksburgensis*	*Asphodelaceae*	*Succulent*
Aloe subspicata	*Asphodelaceae*	*Succulent*
Aponogeton junceus	*Aponogetonaceae*	*Geophyte*
Arctotis arctotoides	*Asteraceae*	*Herb*
Aristaloe aristata	*Asphodelaceae*	*Succulent*
Aristea abyssinica	*Iridaceae*	*Herb*
Aristida congesta subsp. *congesta*	*Poaceae*	*Graminoid*
Asclepias eminens	*Apocynaceae*	*Herb*
Asparagus asparagoides	*Asparagaceae*	*Succulent*
Asparagus denudatus	*Asparagaceae*	*Shrub*
Asparagus microraphis	*Asparagaceae*	*Shrub*
Asparagus stellatus	*Asparagaceae*	*Dwarf Shrub*
Aspidoglossum araneiferum	*Apocynaceae*	*Succulent*
Aspidoglossum lamellatum	*Apocynaceae*	*Succulent*
Asplenium adiantum-nigrum var. *adiantum-nigrum*	*Aspleniaceae*	*Lithophyte*
Asplenium aethiopicum	*Aspleniaceae*	*Lithophyte*
Berkheya buphthalmoides	*Asteraceae*	*Herb*

SPECIES	FAMILY	GROWTH FORM
Berkheya discolor	*Asteraceae*	*Herb*
Bromus commutatus	*Poaceae*	*Graminoid*
Brunsvigia radulosa	*Amaryllidaceae*	*Geophyte*
Buglossoides arvensis	*Boraginaceae*	*Herb*
Carex acutiformis	*Cyperaceae*	*Hydrophyte*
Carex spartea	*Cyperaceae*	*Sedge*
Chamarea sp.	*Apiaceae*	*Herb*
Cheilanthes eckloniana	*Pteridaceae*	*Lithophyte*
Cheilanthes hirta var. brevipilosa forma brevipilosa	*Pteridaceae*	*Herb*
Cheilanthes quadripinnata	*Pteridaceae*	*Lithophyte*
Cheilanthes viridis var. viridis	*Pteridaceae*	*Lithophyte*
Cineraria geifolia	*Asteraceae*	*Suffrutex*
Cliffortia paucistaminea var. paucistaminea	*Rosaceae*	*Shrub*
Commelina africana var. lancispatha	*Commelinaceae*	*Herb*
Convolvulus arvensis	*Convolvulaceae*	*Climber*
Convolvulus sagittatus	*Convolvulaceae*	*Herb*
Conyza podocephala	*Asteraceae*	*Herb*
Conyza scabrida	*Asteraceae*	*Shrub*
Cotyledon orbiculata var. oblonga	*Crassulaceae*	*Succulent*
Crassula natans var. natans	*Crassulaceae*	*Succulent*
Crassula sediflora var. sediflora	*Crassulaceae*	*Succulent*
Crassula vaillantii	*Crassulaceae*	*Succulent*
Ctenium concinnum	*Poaceae*	*Graminoid*
Cucumis myriocarpus subsp. myriocarpus	*Cucurbitaceae*	*Herb*
Cymbopogon caesius	*Poaceae*	*Graminoid*
Cymbopogon dieterlenii	*Poaceae*	*Graminoid*
Cymbopogon pospischilii	*Poaceae*	*Graminoid*
Cynoglossum spelaeum	*Boraginaceae*	*Herb*

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SPECIES	FAMILY	GROWTH FORM
Cyperus obtusiflorus var. obtusiflorus	*Cyperaceae*	*Cyperoid*
Cyperus parvinux	*Cyperaceae*	*Cyperoid*
Cyperus usitatus	*Cyperaceae*	*Cyperoid*
Cyphia triphylla	*Lobeliaceae*	*Climber*
Cyrtanthus contractus	*Amaryllidaceae*	*Geophyte*
Dimorphotheca jucunda	*Asteraceae*	*Herb*
Diospyros lycioides subsp. lycioides	*Ebenaceae*	*Shrub*
Dipcadi viride	*Hyacinthaceae*	*Geophyte*
Dolichos pratensis	*Fabaceae*	*Climber*
Dryopteris inaequalis	*Dryopteridaceae*	*Geophyte*
Dysphania multifida	*Amaranthaceae*	*Herb*
Echinochloa stagnina	*Poaceae*	*Graminoid*
Eleocharis dregeana	*Cyperaceae*	*Cyperoid*
Elionurus muticus	*Poaceae*	*Graminoid*
Equisetum ramosissimum subsp. ramosissimum	*Equisetaceae*	*Hydrophyte*
Erica schlechteri	*Ericaceae*	*Shrub*
Eriocephalus eximius	*Asteraceae*	*Shrub*
Eriospermum cooperi var. cooperi	*Ruscaceae*	*Geophyte*
Eriospermum schinzii	*Ruscaceae*	*Geophyte*
Eucomis autumnalis subsp. autumnalis	*Hyacinthaceae*	*Geophyte*
Eucomis autumnalis subsp. clavata	*Hyacinthaceae*	*Geophyte*
Eulophia hians var. hians	*Orchidaceae*	*Geophyte*
Eulophia hians var. nutans	*Orchidaceae*	*Geophyte*
Eulophia ovalis var. ovalis	*Orchidaceae*	*Geophyte*
Fallopia convolvulus	*Polygonaceae*	*Climber*
Felicia filifolia subsp. filifolia	*Asteraceae*	*Shrub*
Festuca scabra	*Poaceae*	*Graminoid*
Ficinia cinnamomea	*Cyperaceae*	*Cyperoid*

Royal HaskoningDHV

SPECIES	FAMILY	GROWTH FORM
Fingerhuthia africana	*Poaceae*	*Graminoid*
Fingerhuthia sesleriiformis	*Poaceae*	*Graminoid*
Garuleum woodii	*Asteraceae*	*Suffrutex*
Gladiolus dalenii subsp. dalenii	*Iridaceae*	*Geophyte*
Gnaphalium confine	*Asteraceae*	*Herb*
Habenaria epipactidea	*Orchidaceae*	*Geophyte*
Hebenstretia dentata	*Scrophulariaceae*	*Herb*
Hebenstretia dura	*Scrophulariaceae*	*Shrub*
Helichrysum chionosphaerum	*Asteraceae*	*Herb*
Helichrysum cooperi	*Asteraceae*	*Herb*
Helichrysum dregeanum	*Asteraceae*	*Dwarf Shrub*
Helichrysum pedunculatum	*Asteraceae*	*Herb*
Helichrysum rugulosum	*Asteraceae*	*Herb*
Helichrysum splendidum	*Asteraceae*	*Herb*
Helichrysum sutherlandii	*Asteraceae*	*Dwarf shrub*
Helictotrichon longifolium	*Poaceae*	*Graminoid*
Helictotrichon turgidulum	*Poaceae*	*Graminoid*
Heliophila suavissima	*Brassicaceae*	*Dwarf Shrub*
Hibiscus aethiopicus var. ovatus	*Malvaceae*	*Herb*
Hibiscus trionum	*Malvaceae*	*Herb*
Hyparrhenia dregeana	*Poaceae*	*Graminoid*
Hyparrhenia hirta	*Poaceae*	*Graminoid*
Hyparrhenia tamba	*Poaceae*	*Graminoid*
Hypericum aethiopicum subsp. sonderi	*Hypericaceae*	*Herb*
Hypoxis acuminata	*Hypoxidaceae*	*Geophyte*
Hypoxis argentea var. sericea	*Hypoxidaceae*	*Geophyte*
Hypoxis longifolia	*Hypoxidaceae*	*Geophyte*
Hypoxis rigidula var. pilosissima	*Hypoxidaceae*	*Geophyte*

SPECIES	FAMILY	GROWTH FORM
Hypoxis species	*Hypoxidaceae*	*Geophyte*
Indigastrum fastigiatum	*Fabaceae*	*Herb*
Jamesbrittenia aurantiaca	*Scrophulariaceae*	*Herb*
Juncus dregeanus subsp. dregeanus	*Juncaceae*	*Herb*
Ledebouria cooperi	*Hyacinthaceae*	*Geophyte*
Lepidium trifurcum	*Brassicaceae*	*Herb*
Lessertia species	*Fabaceae*	*Dwarf shrub*
Limeum aethiopicum var. fluviale	*Limeaceae*	*Herb*
Limosella grandiflora	*Scrophulariaceae*	*Hydrophyte*
Lindernia parviflora	*Linderniaceae*	*Herb*
Listia heterophylla	*Fabaceae*	*Dwarf Shrub*
Lobelia laxa	*Lobeliaceae*	*Herb*
Lotononis lotononoides	*Fabaceae*	*Shrub*
Lotononis macrosepala	*Fabaceae*	*Herb*
Lotononis pulchella	*Fabaceae*	*Shrub*
Lotononis sericophylla	*Fabaceae*	*Shrub*
Lycium ferocissimum	*Solanaceae*	*Shrub*
Malva pusilla	*Malvaceae*	*Herb*
Manulea crassifolia subsp. crassifolia	*Scrophulariaceae*	*Herb*
Massonia jasminiflora	*Hyacinthaceae*	*Succulent*
Melolobium microphyllum	*Fabaceae*	*Shrub*
Merxmuellera drakensbergensis	*Poaceae*	*Graminoid*
Merxmuellera macowanii	*Poaceae*	*Graminoid*
Nenax microphylla	*Rubiaceae*	*Dwarf Shrub*
Nolletia ciliaris	*Asteraceae*	*Suffrutex*
Olea europaea subsp. cuspidata	*Oleaceae*	*Tree*
Ornithogalum flexuosum	*Hyacinthaceae*	*Geophyte*
Osteospermum scariosum var. scariosum	*Asteraceae*	*Herb*

SPECIES	FAMILY	GROWTH FORM
Panicum schinzii	*Poaceae*	*Graminoid*
Panicum stapfianum	*Poaceae*	*Graminoid*
Passerina montana	*Thymelaeaceae*	*Shrub*
Pelargonium alchemilloides	*Geraniaceae*	*Dwarf Shrub*
Pennisetum macrourum	*Poaceae*	*Graminoid*
Pennisetum sphacelatum	*Poaceae*	*Graminoid*
Pennisetum thunbergii	*Poaceae*	*Graminoid*
Pentameris basutorum	*Poaceae*	*Graminoid*
Pentanisia angustifolia	*Rubiaceae*	*Herb*
Phalaris arundinacea	*Poaceae*	*Graminoid*
Physalis peruviana	*Solanaceae*	*Herb*
Polygala gracilenta	*Polygalaceae*	*Herb*
Polygala gymnoclada	*Polygalaceae*	*Herb*
Relhania acerosa	*Asteraceae*	*Shrub*
Salvia repens var. repens	*Lamiaceae*	*Herb*
Schizocarphus nervosus	*Hyacinthaceae*	*Geophyte*
Schizoglossum atropurpureum subsp. atropurpureum	*Apocynaceae*	*Succulent*
Schizoglossum linifolium var. linifolium	*Apocynaceae*	*Succulent*
Schkuhria pinnata	*Asteraceae*	*Herb*
Searsia divaricata	*Anacardiaceae*	*Tree*
Searsia dregeana	*Anacardiaceae*	*Shrub*
Searsia erosa	*Anacardiaceae*	*Shrub*
Selaginella caffrorum var. caffrorum	*Selaginellaceae*	*Lithophyte*
Selago albida	*Scrophulariaceae*	*Dwarf Shrub*
Selago saxatilis	*Scrophulariaceae*	*Dwarf Shrub*
Senecio arabidifolius	*Asteraceae*	*Herb*
Setaria italica	*Poaceae*	*Graminoid*
Setaria sphacelata var. sphacelata	*Poaceae*	*Graminoid*

SPECIES	FAMILY	GROWTH FORM
Setaria sphacelata var. torta	*Poaceae*	*Graminoid*
Silene undulata subsp. undulata	*Caryophyllaceae*	*Herb*
Solanum retroflexum	*Solanaceae*	*Herb*
Sonchus dregeanus	*Asteraceae*	*Herb*
Sporobolus africanus	*Poaceae*	*Graminoid*
Sporobolus species	*Poaceae*	*Graminoid*
Stachys rugosa	*Lamiaceae*	*Shrub*
Stenostelma corniculatum	*Apocynaceae*	*Herb*
Teedia lucida	*Scrophulariaceae*	*Dwarf shrub*
Tenaxia disticha	*Poaceae*	*Graminoid*
Thesium costatum var. costatum	*Santalaceae*	*Parasite*
Thesium resedoides	*Santalaceae*	*Parasite*
Trachyandra asperata var. asperata	*Asphodelaceae*	*Succulent*
Trachyandra asperata var. basutoensis	*Asphodelaceae*	*Succulent*
Trachypogon spicatus	*Poaceae*	*Graminoid*
Tragus racemosus	*Poaceae*	*Graminoid*
Ursinia montana subsp. montana	*Asteraceae*	*Herb*
Wahlenbergia dieterlenii	*Campanulaceae*	*Dwarf Shrub*
Xysmalobium species	*Apocynaceae*	*Suffrutex*
Xysmalobium undulatum var. undulatum	*Apocynaceae*	*Succulent*

Table 37: Floristic Diversity Recorded on the Site During October 2018

SPECIES NAME	FAMILY	GROWTH FORM	STATUS/ USES	COMMON NAME
Acacia dealbata	*Fabaceae*	*Tree*	*Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014), CARA 2002 – Category 1(Western Cape), Category 2 (rest of SA)*	*Silver Wattle (e), Silwerwattel (a)*
Agave sisalana	*Agavaceae*	*Succulent*	*Declared Invader - Category 2 (NEM:BA, 2004. AIP, 2014)*	*Sisal*
Argemone ochroleuca	*Papaveraceae*	*Perennial herb*	*Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)*	*Mexican poppy (e), Bloudissel (a)*

SPECIES NAME	FAMILY	GROWTH FORM	STATUS/ USES	COMMON NAME
Aristida bipartita (Nees) Trin. & Rupr.	*Poaceae*	*Grass*	*Unpalatable, indicator of degraded veld, Increaser IIC*	*Rolling grass (e), Grootrolgras (a)*
Aristida congesta subsp. barbicollis	*Poaceae*	*Grass*	*Poor grazing potential, Increaser IIC*	*Spreading Three-awn (e), Lossteekgras (a)*
Asclepias aurea (Schltr.) Schltr.	*Apocynaceae*	*Forb*	*None*	*Golden Star Drops (e)*
Berkheya discolor	*Asteraceae*	*Perennial herb*	*Least Concern*	*Mohata-o-mosoeu (ss)*
Berkheya setifera DC.	*Asteraceae*	*Forb*	*Weed, widespread*	*Rasperdisseldoring (a)*
Buddleja salviifolia (L.) Lam.	*Buddlejaceae*	*Shrub*	*Traditional uses*	*Quilted Sagewood (e), Saliehout (a)*
Bulbine narcissifolia	*Liliaceae*	*Succulent*	*Medicinal uses*	*Wild Kopieva (e), Wildekopieva (a)*
Castalis spectabilis	*Asteraceae*	*Forb*	*None*	*Bloubietou (e)*
Celtis africana Burm.f.	*Celtidaceae*	*Tree*	*Timber*	*White Stinkwood (e), Witstinkhout (a)*
Centella asiatica (L.) Urb.	*Apiaceae*	*Hydrophilic*	*Edible parts, medicinal properties*	*Marsh pennywort (e), Varkoortjies (a)*
Centella species	*Apiaceae*	*Hydrophilic*		
Cheilanthes species	*Sinopteridaceae*	*Fern*	*None*	--
Chloris virgata Sw.	*Poaceae*	*Grass*	*None*	*Feather-top Chloris (e), Witpluim-chloris (a)*
Cirsium vulgare (Savi) Ten.	*Asteraceae*	*Forb*	*Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)*	*Scottish thistle (e), Skotse dissel (a)*
Cliffortia linearifolia Eckl. & Zeyh.	*Rosaceae*	*Shrub*	*None*	--
Crepis hypochoeridea (DC.) Thell.	*Asteraceae*	*Forb*	*Weed, indicator of disturbed areas, Naturalised exotic*	--
Cupresses macrocarpa	*Cupressaceae*	*Tree*	*Ornamental, non-indigenous (USA), probably sterile variety*	*Monterey Cypress (e), Golden Crest (e)*
Cynodon dactylon (L.) Pers.	*Poaceae*	*Grass*	*Indicator of disturbed areas, grazing potential*	*Common Couch Grass (e), Gewone kweekgras (a)*
Delosperma species	*Mesembryanthemaceae*	*Succulent*	*None*	--
Dimorphotheca jucunda	*Asteraceae*	*Forb*	*None*	
Diospyros lycioides	*Ebenaceae*	*Small tree*	*Medicinal uses, edible parts, dyes*	*Star Apple (e), Bloubessie (a)*
Echinopsis schickendantzii	*Cactaceae*	*Succulent*	*Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)*	*Torch Cactus (e), Orrelkaktus (a)*
Eragrostis chloromelas Steud.	*Poaceae*	*Grass*	*Edible parts, Increaser IIB*	*Curly leaf (e), Krulblaar (a)*
Eragrostis plana Nees	*Poaceae*	*Grass*	*Weaving, unpalatable, indicator of degraded areas, Increaser IIC*	*Tough love grass (e), Taai-pol eragrostis*
Eriospermum species	*Liliaceae*	*Geophyte*	*None*	--

SPECIES NAME	FAMILY	GROWTH FORM	STATUS/ USES	COMMON NAME
Eucalyptus species	*Myrsinaceae*	*Tree*	*Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014) (see act for detail)*	*Eucalyptus gum tree (e), Bloekomboom (a)*
Euphorbia striata	*Euphorbiaceae*	*Succulent*	*None*	*Milkweed (e), Melkgras (a)*
Felicia filifolia	*Asteraceae*	*Forb*	*None*	*--*
Felicia muricata	*Asteraceae*	*Forb*	*None*	*Wild Aster (e), Blouheuning (a)*
Gazania krebsiana	*Asteraceae*	*Forb*	*Medicinal uses, food source*	*Butter flower (e), Botterblom (a)*
Halleria lucida L.	*Scrophulariaceae*	*Tree*	*Edible fruit, traditional medicinal uses*	*Tree-fuschia (e), Geelhoutkop (a)*
Haplocarpha scaposa Harv.	*Asteraceae*	*Forb*	*None*	*Tonteldoosbossie (a)*
Helichrysum caespititium (DC.) Harv.	*Asteraceae*	*Prostrate herb*	*Medicinal uses*	*Speelwonderboom (a)*
Helichrysum cf. splendidum	*Asteraceae*	*Forb*	*None*	*--*
Hermannia coccocarpha	*Malvaceae*	*Forb*	*None*	*Moederkappie (a)*
Hermannia depressa N.E.Br.	*Malvaceae*	*Prostrate herb*	*Medicinal uses*	*Rooiopslag (a)*
Hyparrhenia hirta (L.) Stapf	*Poaceae*	*Grass*	*Thatching & weaving*	*Thatch Grass (e), Dekgras (a)*
Hypoxis argentea	*Hypoxidaceae*	*Geophyte*	*None*	*Small Yellowstar (e)*
Kiggelaria africana L.	*Flacourtiaceae*	*Shrub*	*Traditional uses, larval host for Acrea horta & Cymothoe alcimeda*	*Wild Peach (e), Wildeperske (a)*
Kohautia amatymbica Eckl. & Zeyh.	*Rubiaceae*	*Perennial herb*	*Edible parts*	*Tremble tops (e)*
Ledebouria ovatifolia (Baker) Jessop	*Liliaceae*	*Geophyte*	*None*	*--*
Leonotis species	*Lamiaceae*	*Dwarf shrub*	*Medicinal uses, colours & dyes*	*Minaret Flower (e), Wildedagga (a)*
Listia heterophylla E.Mey	*Fabaceae*	*Prostrate herb*	*Least Concern*	*Geelklawer (a)*
Lobelia cf laxa	*Lobeliaceae*	*Forb*	*None*	*--*
Marsilea species	*Marsileaceae*	*Hydrophilic*	*None*	*Waterklawer (a)*
Massonia species	*Hyacinthaceae*	*Geophyte*	*None*	*--*
Melianthus comosus Vahl	*Melianthaceae*	*Shrub*	*None*	*Touch-me-not (e), Kruidjie-roer-my-nie (a)*
Melinis repens	*Poaceae*	*Grass*	*Poor grazing potential, Increaser IIC*	*Natal Red Top (e), Natal-rooipluim (a)*
Moraea pallida (Baker) Goldblatt	*Iridaceae*	*Geophyte*	*Indicates overgrazing, often in colonies. Poisonous to cattle*	*Yellow Tulip (e), Berkatjietee (a), Khahla-e-nye-nyane (ss)*
Mossia intervallaris (L.Bolus) N.E.Br.	*Aizoaceae*	*Succulent*	*None*	*--*
Myrsine africana L.	*Myrsinaceae*	*Shrub*	*None*	*African Boxwood (e), Vlieëbos (a)*

SPECIES NAME	FAMILY	GROWTH FORM	STATUS/ USES	COMMON NAME
Nemesia fruticans	*Scrophulariaceae*	*Forb*	*None*	*Wildeleeubekkie (a)*
Opuntia ficus-indica (L.) Mill.	*Cactaceae*	*Succulent*	*Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016), edible parts*	*Prickley pear (e), Turksvy (a)*
Osteospermum scariosum	*Asteraceae*	*Dwarf shrub*	*None*	*Bietou (a), = Tripteris aghillana*
Oxalis species	*Oxalidaceae*	*Geophyte*	*Edible parts*	*Bobbejaanuintjie (a)*
Paspalum dilatatum Poir.	*Poaceae*	*Grass*	*Moist places, palatable, Increaser IIB*	*Common Paspalum (e), Gewone Paspalum (a)*
Pellaea calomelanos	*Adianthaceae*	*Fern*	*Medicinal properties*	*Hard Fern (e), Hardevaring (a)*
Pennisetum clandestinum Chiov.	*Poaceae*	*Grass*	*Declared Invader - Category 1B in protected areas and wetlands in which it does not already occur (NEM:BA, 2004. AIP, 2016), not listed elsewhere*	*Kikuyu Grass (e), Kikoejoegras (a)*
Pentameris airoides Nees subsp. jugorum (Stapf) Galley & H.P.Linder	*Poaceae*	*Grass*	*Important in stabilising trampled and disturbed veld*	*Common annual Pentaschistis (e), Gewone eenjarige Pentaschistis (a)*
Populus deltoidea	*Salicaceae*	*Tree*	*None*	*Poplar (e), Populier (a)*
Prunus persica (L.) Batsch var. persica	*Rosaceae*	*Tree*	*Naturalised exotic, edible fruit*	*Peach (e), Perske (a)*
Rosa species	*Rosaceae*	*Climber*	*None*	--
Rubus ludwigii Eckl. & Zeyh. subsp. ludwigii	*Rosaceae*	*Shrub*	*Edible parts, medicinal uses*	*Silver Bramble (e), Wildebraam (a)*
Rubus rigidus Sm.	*Rosaceae*	*Climber*	*Invader Species*	*Bramble (e), Braambos (a)*
Rumex species	*Polygonaceae*	*Forb*	*Native to Europe, common weed*	--
Salix babylonica L.	*Salicaceae*	*Tree*	*Non-endemic*	*Weeping willow (e), Treurwilger (a)*
Salix mucronata Thunb. ssp. mucronata	*Salicaceae*	*Tree*	*Non-endemic*	*African Willow (e), Wildewortel (a)*
Searsia erosa (Thunb.) Moffett	*Anacardiaceae*	*Shrub*	*Traditional and medicinal uses*	*Broomkarree (e), Besembos (a)*
Searsia lancea L.f.	*Anacardiaceae*	*Tree*	*Edible parts, tanning*	*Common Karree (e), Gewone Karree (a)*
Senecio achilleifolius DC.	*Asteraceae*	*Forb*	*Indicator of moist conditions*	*Slootopdammer (a)*
Seriphium plumosum	*Asteraceae*	*Shrub*	*Invasive properties*	*Bankrupt bush (e), Bankrotbos (a)*
Solanum sisymbrifolium Lam.	*Solanaceae*	*Dwarf shrub*	*Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)*	*Wild tomato (e), Doringbitterappel (a) (= Solanum sisymbriifolium)*
Sporobolus species	*Poaceae*	*Grass*	*None*	--

SPECIES NAME	FAMILY	GROWTH FORM	STATUS/ USES	COMMON NAME
Trifolium burchellianum	*Fabaceae*	*Prostrate herb*	*Least Concern*	*Wild Clover (e), Wildeklawer (a)*
Ursinia alpina N.E.Br.	*Asteraceae*	*Perennial herb*	*Least Concern*	--
Wahlenbergia dieterlenii (E.Phillips) Lammers	*Campanulaceae*	*Perennial herb*	*None*	--
Wahlenbergia species	*Campanulaceae*	*Perennial herb*	*None*	--
Zornia capensis Pers.	*Fabaceae*	*Forb*	*None*	--

4.3 Human Environment

The section will present what is known about the human baseline environment in the project area. This is presented as a status quo of the current conditions. The baseline conditions will be better understood through an expansion of the data gathering method, thus aiding the evaluation of social and economic impacts the project is likely to have on the affected communities.

4.3.1 Compensation for Leased Site Land and Powerline Route

The Neo I Special Purpose Vehicle (SPV) will be leasing the land from the Property Company (yet to be formed – henceforth PropCo). The PropCo will include all owners of the plots that are within the proposed development site.[13]

Two Valuers from private companies were commissioned (by Neo I) to undertake valuations of the affected plots. One Valuer represents the owners, while the other represents Neo I. Both Valuers made their submissions to the Government Valuer (at the Lesotho Land Commission) and agreed upon a land lease rate . The legal entities commissioned by Neo I and assigned to this project (one for the affected owners and one for Neo I) will put in place the legal mechanisms required for the land lease arrangements to take effect. As at February 2019, Neo I is registered and PropCo incorporation is still in progress.

A servitude will be registered for the powerline route and the compensation process is underway for this registration.

4.3.2 Socio-Economic Baseline

4.3.2.1 The Kingdom of Lesotho

Lesotho is a small, mountainous, and land-locked country situated in the Eastern part of Southern Africa and surrounded by South Africa. The estimated 2018 population of Lesotho is 2.26 million. The population growth rate is around 2.6% per annum. The average population density in Lesotho is 69 persons per km^2 and classified as a lower-middle-income country. It covers 30,350 km^2 of 60% represents rangelands, 9% arable land and the remaining part mainly mountains and steep hills with its lowest point 1,400m above sea level. The country is divided into four regions; the lowlands along the western plateau, the Senqu valley, the foothills and the mountains. The country was previously a British protectorate and gained its independence in October 1966. Lesotho is a constitutional monarchy, ruled by a King as Head of State, and governed by a 33-member Senate and a 120-member National Assembly. About 99.7% of Lesotho's population identifies as Basotho, a Bantu-speaking people. There are several subgroups of the Basotho, including the Batloung (Tlou), Bakuena (Kuena), Baphuthi (Phuti), Bataung (Tau), Batsoeneng (Tsoene), Matebele and Bafokeng. The main language is Sesotho, although English is the other official language.

Lesotho is ranked amongst the least developed countries in Southern Africa. Its Human Development Index (HDI) has gradually deteriorated in the last few years. In 1978 the country was ranked 127 out of 174 countries on the Human Development Index (HDI) scale. In 2011 it was ranked 160 out of 187 countries, indicating major erosion in human development achievements over time. This level of human development is one of the lowest in the SADC region. The main contributor to the decline in human development is the

[13] The transmission route is in the process of being confirmed. Preliminary indications show a maximum of 12 affected landowners. This is in addition to the 36 PAPs in the direct proposed plant area

decreasing life expectancy. In 1990 the life expectancy for Lesotho was about 60 years and this has been reduced by about 12 years, which is below what is attained by its neighbours (Botswana, Namibia, Swaziland and South Africa). The main factor influencing the decline in life expectancy is the impact of HIV and AIDS. This impact is amongst others manifesting itself in high maternal and child mortality. Poverty and food insecurity are also major contributing factors. Over 62 percent of Lesotho's population live on less than US$2 a day (FAO Country Programming Framework 2013-2017).

Lesotho has a Gender Inequality Index of 0.532, ranking 108 out 146 countries. Customary practices have always discriminated against women, denying them access to productive assets such as land and compromising their economic freedom. Recently, substantial work has been done on the policy and legal fronts to protect women against gender discrimination. For instance, through the Legal Capacity of Married Persons Act (2006), women can now own land, receive inheritance and make their own decisions. However, cultural practices still treat women as minors and often deny them the same rights that the legal frameworks are seeking to protect (FAO Country Programming Framework 2013-2017).

According to the Central Bank of Lesotho's Annual Report, Lesotho's gross domestic product (GDP) is estimated to have grown by 2.3 percent in 2017. This was due to stronger growth from mining and quarrying output growth and information and communication sector output growth, respectively. The secondary sector performance deteriorated at the back of the decline in the construction sector output as well as a slowdown in the manufacturing sector. The real Gross National Index (GNI) is estimated to have grown by 1.9 percent in 2017 compared with a negative growth of 1.6 percent recorded in 2016. The positive growth in GNI is mainly attributed to the increase in income receivables from the rest of the world, in particular, the increase in remittances of migrant mineworkers, the increase in interest earned by commercial banks which was moderated by the decline in interest earned by the Central Bank of Lesotho as well as other incomes. The general minimum wage therefore increased by an annual average of 5.1 percent across all sectors for the fiscal year 2017/2018 as determined by the Government of Lesotho through the Lesotho Wages Advisory Board. This was lower than the 10.0 percent that was instituted in the previous fiscal year. The average annual inflation rate for Lesotho recorded 5.2 percent in 2017 relative to 6.6 percent in 2016.

4.3.2.2 The T'sana Talana Community Council

The Project area is located in the T'sana Talana Council area to which the T'sana Talana Community Council has administrative jurisdiction.

<u>Administrative Division and Governance</u>

In 1997, the Lesotho Parliament passed a Local Government Act No. 6, and in 1998, a Local Government Election Act, amended in 2004. In 2004, amendments were passed to the Act to reduce the number of local councils, and to ensure that one third of all seats are reserved for women. According to the local government legislation, the directly elected community councils are the lower tier and the indirectly elected district councils representing community councils are a second tier in rural areas. There are 128 community councils of which T'sana Talana is one of those.

The official working paper of the government of Lesotho on the establishment of Local Government adopted by Cabinet on 10 February 2004, envisaged the Local Government system as based on political devolution and decentralisation of functions, staff, and finances within the framework of a unitary state. The principle, therefore, was to bring democracy and its opportunities closer to the communities.

The term of office is a maximum of five years and the minimum age for candidates is eighteen. Mayors and chairpersons are elected from amongst council members. Only one committee is required by the Local Government Act to be established, the standing committee on finance and planning and the councils are free to set up other committees as they feel appropriate. The Constitution provides for an Ombudsman to inquire into grievances of local citizens which might be raised about local government authorities. Key local powers and functions of the community councils as stipulated in the local Government Act (No 6 of 1997), are as follows:

- Area Economic Planning;
- Burial and Cemeteries;
- Grounds;
- Grazing Control;
- HIV and AIDS Coordination;
- Land Allocation;
- Natural Resource Control;
- Pollution and Environmental Conservation;
- Pre-Primary Education;
- Public Markets Control;
- Rural Access Roads;
- Sports and Recreation; and
- Water Supply.

The Council must have between nine and 15 members and no more than two appointed Chiefs. The council is headed by an indirectly elected chairperson. There are legal provisions for community councils to have two Chiefs which are considered on a par with other councillors but are not elected and are nominated by other Chiefs. Chiefs however are also allowed to stand in elections in other wards (Montfort University and National University of Lesotho, 2008).

Within each Council, Councillors have an obligation to consult with communities to produce development plans, and members of the public are also involved in prioritising the plans in preparation for implementation. A District Development Coordinating Committee (DDCC) is established in each district. The DDCC considers draft development plans for the district prepared by each council and coordinates such plans into a composite district development plan. The membership of the DDCC includes:

- Councillors,
- Non-governmental organisations,
- Youth representative,
- Representative of people with disabilities, and
- Selected public officers from central government as ex-officio members.

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4.3.2.3 Potentially Impacted Areas

Questionnaire Survey

A socio-economic household baseline survey was undertaken, aimed at providing baseline data on the household structure, livelihoods activities and socio-economic status of the people residing in the areas affected by the project. In addition, the survey aimed to obtain perceptions of communities on potential social, economic and environmental impacts of the Project as well as expectations in general. The following specific information was collected via the administration of the survey:

- Household Composition and Characteristics;
- Education;
- Employment;
- Livelihoods Resources and Activities;
- Household Assets (fixed and movable);
- Food Security;
- Energy Sources;
- Access to Water and Sanitation; and
- Perceptions and Expectations.

The comprehensive household survey was administered in the three villages of Ha Ramarothole, Ha Lempetje and Ha Raliemere, from the September 26th – October 3rd, 2017 by a team of enumerators and supervisors. A total of 120 households were targeted in the three villages (i.e. 40 households were targeted from each of the three villages, equally distributed due to limited data on the population size to provide a reliable sampling frame). The households surveyed were selected using systematic random sampling. In terms of coverage, the survey achieved 100% completion rate (i.e. 120 surveys successfully completed).

- **Study Area Population and Demographics**

According to the three Chiefs of each of the three villages, the number of people currently living at Ha Ramarothole is 596, Ha Lempetje 700 and Ha Raliemere 676 respectively. Most young people are migrating from these villages to settle in town and in other places. For those young parents that pass on, they leave their children under the care of the elderly. The rate of death is higher among men than women. At present, there are many families headed by widows and children.

The household survey undertaken reveals that the majority of the households are complex, with a varying number of members per household, ranging from one person per household to 10 people per household. The large families of 10 or more were made up of extended family members permanently residing in the household including parents' in-laws, daughters/sons' in-laws, nieces/nephews, cousins, grand-children, other relatives and people not related. The survey indicates that the average size of households is five (5) persons per household which is slightly higher than the national household size estimated at about 4.4 persons. Out of the families surveyed, none were child-headed. 60% of the heads of households were older people aged above 50 years to 90 years.

- **Natural Resource Access and Use**

The area is not rich in natural resources, however there is water that the community use for domestic and livestock purposes. Soil, grass and rocks/stones are used to build houses. The land is also available for livestock grazing and agricultural purposes as discussed in the previous sections of this report. The community also have access to the forest and shrubs that they use as firewood for cooking and heating.

- **The Local Economy and Workforce**

Mafeteng is one of ten districts in Lesotho. It is located about 76 kilometres south of Maseru. Mafeteng has several services and shops that supply other districts in the Southern part (Mohales'hoek, Quthing) such as dry cleaning services, Shoprite supermarket and other small superettes. The National Drug Service Organisation (NDSO), a leading statutory body established as a trading account of the Ministry of Health and Social Welfare in Lesotho, is also found in the district. The NDSO is mandated to procure, store and distribute medicines and medical consumables on behalf of the government and other health institutions in Lesotho. There are two hotels in the district, that being the Golden Hotel located on the road to Maseru and the Mafeteng Hotel located on Hospital Road. The hotels are the centre of the town's limited nightlife, with each having a public and private bar. There is little tourism although travellers occasionally stop in town en route to the Van Rooyen's Gate border crossing at Wepener or Malealea Lodge, a tourist destination in Mafeteng District.

According to the Lesotho Integrated Labour Force Survey 2008, Mafeteng recorded the third highest number of employment where there are more males employees (37 679), than female employees (27 055). The district presents the second highest (58.6%) proportion of women employed for wage-related work. Over fifty six percent (56.8%) of the workforce is involved in servicing households (as domestic workers, gardeners, etc), 30% are in the private sector, 9% are government employees and 5% are employed in parastatal companies. Mafeteng seems to have a high rate of out-migration (18.8%) while the in-migration is 9.3% and the movement from one place to another is usually influenced by socio-economic factors such as job opportunities, change in marital status and availability of social amenities. The total youth unemployment rate in Mafeteng is reported to be 14.6%.

- **Profile of the Economy and Employment**

According to the Household survey **(Table 38**), many heads of households in the three villages are not earning any income from formal employment and the total unemployment rate is 36.9%. There is 8.3% of the surveyed population that is unemployed; 15.8% are self-employed and 13.3% are engaged in domestic responsibilities including subsistence farming. In addition, only a small percentage of the population (6.7%) receive a Government social grant[14].

Table 38: Occupation of the Heads of Households

EMPLOYMENT STATUS	NUMBER OF RESPONDENTS (N)	PERCENT
Working remuneration, formally/informally	24	20.0
Any form of self-employment	19	15.8

[14] According to the UNICEF- Lesotho 2017 Social Assistance Budget Brief, the Lesotho Social Assistance budget is not fully child sensitive. It is dominated by Old Age Pension followed by Tertiary Bursary programmes. In 2017/18, about 37 per cent of the Social Assistance budget was allocated to the Old Age Pension programme for a total beneficiary of about 85,087 people, 70 years and over. In 2017/18, the second highest proportion of budget was allocated to the Tertiary Bursary programme for about 16,200 students. The universal school feeding programme with a total beneficiary of 389, 000, was allocated about 12 per cent of the Social Assistance budget. The Child Grant programme was allocated the second lowest proportion, 3.4 per cent in 2017/18, to cover about 27,000 vulnerable families with about 80,000 children. The number of families that benefited was far below the number of eligible families.

EMPLOYMENT STATUS	NUMBER OF RESPONDENTS (N)	PERCENT
Unemployed (18 years or older) but actively looking for work	10	8.3
Retired from formal employment (private or government sector)	2	1.7
Home maker/housewife (married person)	19	15.8
Domestic responsibilities (unmarried or married outside homestead)	16	13.3
Herd boy	8	6.7
Pensioner (government old-age pension/social grant)	14	11.7
Old and no longer economically active (without pension)	8	6.7
TOTAL	**120**	**100.0**

- **Agriculture, Livestock and Livelihoods**

According to the Household survey conducted by Puisano Communications in September 2017, only 30% of the people were involved in crop production and amongst these 24.2% of farmers were cultivating one field, 5.8% were cultivating two fields, and 0.8% were cultivating three fields as per **Table 39** below. The majority of people, that being 69.2% of the households, did not grow any crops due to various reasons. Additionally, the survey revealed that 41.3% did not have money to buy agricultural inputs, 30.4% were affected by drought and 15.2% did not have draught animals to use for ploughing. The other reasons not commonly mentioned were, 'a lack of labour to work in the fields' and 'a lack of farming implements'. Subsistence farming is practised, however if there is surplus it is sold within the communities or exchanged for some of the services such as payment for initiation, school fees etc.

Table 39: Number of Fields Cultivated in the Current Season

NUMBER OF FIELDS	NUMBER OF RESPONDENTS	PERCENT
0	83	69.2
1	29	24.2
2	7	5.8
3	1	0.8
TOTAL	**120**	**100.0**

- **Other Income Sources and the Structure of Expenditure**

According to the household survey, other sources of income in the three villages includes the sale of different types of goods (31.4%), sale of liquor and local (home-brewed) beer (22.9%), the operations of small shops that sell everyday goods (14.3%), sewing and tailoring (5.7%) and traditional healing (5.7%). Furthermore, other services found (with each amounting to 2.9% of the household income), include catering and hospitality services, marketing services, saddlery, plastering, transport/taxi, hiring out of draught animals and the sale of natural raw resource. According to the Chiefs and Councillors, young men in these villages who could not get decent employment in Mafeteng, relocated to South Africa, with many involved in illegal mining. Some people also go to towns such as Maseru and Maputsoe to work in the textile factories while most young women relocate to South Africa to work as domestic workers.

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Literacy and Education

The collective educational level of the heads of households in the three communities shows that most have low literacy levels (**Table 40**).

Table 40: Education Level in the Affected Villages

CURRENT EDUCATION STATUS	NUMBER OF RESPONDANTS	PERCENT
No education	32	26.7
Primary	65	54.2
Junior Secondary	13	10.8
Senior Secondary	6	5.0
Technical/Vocational	3	2.5
Tertiary (University etc.)	1	0.8
TOTAL	**120**	**100.0**

According to the focus group meeting held with Chiefs and Councillors on the 27th of September 2018, there are no tertiary institutions or secondary schools in the area. There is one primary school at Ha Raliemere and one at Ha Lempetje. Students from these villages go to school in any of the neighbouring villages, be it Makeneng or Ha Makhathe where there are two high schools and one vocational school within T'sana Talana Council (Mafeteng District Council handbook, 2008).

Infrastructural Services

The proposed Project area and surrounds is in a rural setting where there is a lack of general infrastructure. The available infrastructure services are very limited and amounts to a gravel road traversing through Ha Ramarothole and a mobile phone communication network. Data gathered *via* the FGM showed that infrastructure needs include maintenance of local roads, provision of transport services between Ha Raliemere and Ha Lempetje villages, water supply reticulation, landline telephone network, electricity, sanitation and waste services.

Access Roads

The proposed site is accessed through a gravel road which is approximately 1km long and connects to the main district road from Mafeteng town to Thabana-Morena in the South. The site can also be accessed from the North West on the main road from Maseru to Mafeteng, through a gravel road that connects from Ha Mohapi. This gravel road is approximately 5km to the proposed site and although not in good condition, is still in use.

Health

According to the Chiefs and Councillors, residents of the three villages are faced with a huge medical challenge. Not only do they lack proper sanitation, but also do not have access to good quality healthcare and qualified medical staff. There are no clinics in the villages except for Ha Lempetje where there is Health Post where nurses come once a month to offer basic health services such as attend to common colds, boils, burns and render first aid. They also provide child growth monitoring and conduct health education and the promotion of healthy lifestyles in the village.

There are also village health workers who have been provided with basic training by the Ministry of Health and are available via the local clinics. They head home-based caregivings in the village. They keep a kit for home-based care and first aid services. As is the case in most other rural areas, HIV is the predominant health challenge in these villages. HIV/AIDS patients have created their own support group for those that are fighting the illness. Due to a lack of services nearby many villagers are forced to travel to Mafeteng town for health care services as there is a clinic and hospital in town.

The main health hazard has been identified as a lack of safe drinking water and basic sanitation. Sanitation provision is generally very poor with the majority of villagers use the bush as toilets since there are no formal toilets and most pit latrines are in poor condition. For example, in Ha Ramarothole, only 6 of 117 households have a proper pit latrine (M. I Pelea, July 2014).

- **Housing**

According to the household survey, most people in the three villages (77.5%) use different types of traditional house designs. Those include the polata, roundavel, optaka and heisi. However, a few (22.5%) wealthier villagers are able to afford modern housing. **Figure 64** below shows the different types of houses in the affected area. Most of these houses are of good quality, characterised by walls made of bricks with plaster (43.4%), flooring made of concrete/cement (47.5%), and roofs made from corrugated iron (95%) See **Table 41** below.

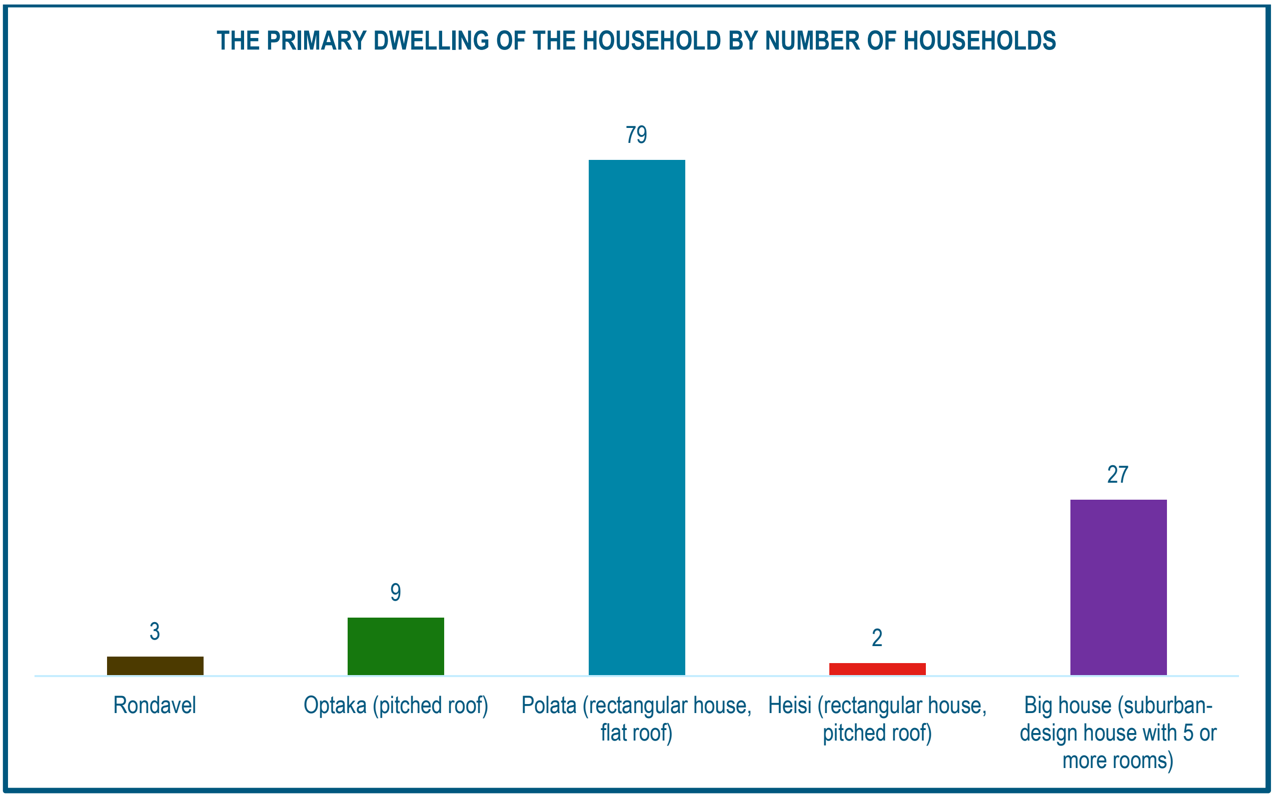

Figure 64: The Primary Dwelling of the Household by Number of Households

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Table 41: Quality of Building Materials (% of households)

TYPE OF MATERIALS	NUMBER OF HOUSEHOLDS	PERCENT
Walls		
Sticks and Mud/Stones	15	12.5
Natural Stone	28	23.3
Bricks with no Plaster	16	13.3
Bricks with Plaster	52	43.4
Mud Block	8	6.7
Corrugated iron sheets	1	0.8
TOTAL	**120**	**100.0**
Flooring		
Mud, Earth, Dung	51	42.5
Concrete, Cement	57	47.5
Tile/Carpet/Vinyl Finish	12	10.0
TOTAL	**120**	**100.0**
Roof		
Thatch/Grass	3	2.5
Corrugated Iron	114	95
Tiles	3	2.5
TOTAL	**120**	**100.0**

- **Electricity**

The main source of energy within the proposed area is electricity, gas, paraffin, candle, wood, generator and cow dung. The majority of the households (55.8%) within the communities use electricity for lighting, followed by those who use paraffin for lighting purposes. During the FGMs it was discovered that it's only those households that are able to afford electricity, that access it. Electricity is only available to villages in Ha Ramarothole and Ha Lempetje villages. Other households that do not have access to power supply, use other sources such as gas, candle, and generators. Most households use bio-gas sources that include brushwood, dried cow dung, and crop residue for cooking, as indicated in **Table 42** below.

Table 42: Primary Sources of Energy (% of households)

TYPE OF ENERGY SOURCE	NUMBER OF HOUSEHOLDS	PERCENT
Lighting		
Electricity	67	55.8
Gas	1	0.08
Paraffin	50	41.7
Candle	18	0.15
Generator	1	0.01
Cooking		
Electricity	13	0.11
Gas	23	0.19

Paraffin	31	0.26
Wood	34	0.28
Brushwood, cow dung, crop residue	92	0.77

- **Water**

Access to drinking water is a challenge in the three villages affected by the proposed project. According to the survey, most households (60%) in the project area are accessing water from a tube well, with 22.5% still sourcing drinking water from unsafe water sources such as unprotected springs while few households obtain water from the protected spring, public and homestead taps. The Chiefs and Councillors during the focus group meeting held on the 27th September, indicated that most of the affected area have very strong water sources that provide water during dry seasons, however these are far from the villages and are not well developed. They confirmed that people such as the elderly, sick, and people living with disability sometimes drink dirty water from puddles and little dams formed by rainwater, as they are not able to walk long distances to fetch water. A natural spring which lies just outside the proposed development area, is accessed by people and animals.

Figure 65: Single Tap at Ha Ramarothole Village

Figure 66: Tap used by Ha Raliemere Community

Figure 67: Spring used by Ha Lempetje Community	*Figure 68: Natural Spring outside development area*

Historical and Cultural Aspects

The Basotho people combine modern and traditional ways of living, however traditional authority is still exercised through a system of Chieftaincy, extending from the King through the Chiefs to the village level. Despite increasing urbanization and the growth of modern institutions and bureaucracy, many Basotho are still interested in building a rural homestead and perpetuating traditional institutions. They also remain loyal to the Chieftaincy system. Institutions such as the initiation schools, which perpetuate traditional values, are still significant but are changing in structure. Observations indicate that the traditional initiation practice for both boys and girls is fast losing a lot of meaning for which it was introduced. Especially now that it has become voluntary and having been substituted in many areas by modern-western practices (Matobo et al. 2009). Due to ill practices during initiations, the institution has now become a channel for diseases and deaths, which include HIV and AIDS in those cases where the operation is not handled with extra care to the extent that there could be infection through contact with already infected blood. Also, staying together in the small huts (mephato) has a potential for spreading communicable diseases like tuberculosis. Village life centres largely on the farm fields, the Chief's court, the kraals, the school and the church. Circumcision forms an integral part of the ritualized initiation ceremonies that train boys to take their place as full members of the family, clan, and nation. Many young boys spend a large part of their lives as herdsmen, while women and young girls do much of the hard work in the fields.

Village life is dominated by basic agricultural tasks, with heavy responsibilities falling on women. Craftwork is still practiced in the villages and includes pottery, grass weaving (notably of traditional Basotho hats), and the painting of elaborate decorations on the walls of houses. Herders play a traditional musical instrument called the *lesiba*, a stringed and wind instrument consisting of a string and feather on which the musician blows. Dances such as the "gum boot dance" demonstrate the influence of migrant labour on traditional forms of cultural expression. The more traditional *mohobelo* is a men's stomping dance that consists of synchronized movements and high kicks. Women perform their own dance by kneeling in a line and beating the ground with their knees "*mokhibo*". Most villagers cherish the traditional beliefs in supernatural powers and customs. Offering animals as sacrifice to the ancestors is commonly practiced in the village, either to attract sympathy from the gods or to thank them for one's blessing. Some villagers follow the Christian religion. Due to the sharp variations in climate, both men and women wear blankets, often multi-coloured with different names and designs. Men and women also wear the typical Basotho hats woven from reeds with different designs for men and women. Basotho culture enjoys a rich tradition of oral literature that is given expression in folk songs, proverbs, jokes, myths, and legends.

- **Social Organisation**

The typical Basotho community in Lesotho believes in customary marriages. However, through proclamation 74 of 1871, Christian marriage was recognized as marriage at par with the Basotho customary marriage. Today Lesotho has a dual legal system: the British or received Roman Dutch Law from the Cape Colony and the Basotho customary law. Theoretically the two legal systems have produced two different sets of cultural groups. Those who adhere to customary laws are traditional, mainly rural in outlook, and enjoy more marriage stability. Marriage problems are mainly settled amicably out of court, and property is inherited with ease through primogeniture.

The adherents of the civil law on the other hand are mainly urban and educated men and women who ideally are divorced from the traditions and customs of Basotho. Marriages are fragile, and one out of every three marriages ends in divorce. This cultural group lives a permissive life, cohabit and their women champion 'Beijing' male-female equality more than other Southern African women (MODO, I.V.O. 2002).

Basotho have many children, with about five or more children per household in rural areas. It is common in both rural and urban area to live with extended family. Many Basotho people have crops and livestock. A family's wealth is shown by how many cattle they have. The Basotho grow crops around their village and some have plots allocated by Chief. The women do domestic work and also most of the outside work such as farm work, road construction in rural areas and plastering of the houses with mud.

- **Cemeteries and Sacred Places**

In Lesotho when there is a death in the family, the Council allocates a space at the community cemetery and no one in the village can dig a grave without this permission. There are some families who, in the past, had burial grounds in their own yards but the new Local Government Act does not allow this. Families have to bury the deceased at the cemetery site allocated by the Council. At the burial grounds, the corpse is put in the grave facing the east. And each male member of the family according to their seniority throws a spade-full of soil into the grave. After that friends and sympathizers could join to cover it neatly. Women visit the grave the following morning and also place stones on the grave in order of seniority within the family. Once this is done, family members can visit the grave whenever they want for different reasons, but it should be early in the morning or in the afternoon. Every person who has visited a cemetery has to wash their hands with water and aloe before entering the house. The deceased are regarded as ancestors and the cemeteries are respected as sacred places where even animal grazing is not allowed (A. K Opong; November 1997).

It must be noted that the Ha Raliemere community has burial sites very close to the main road through the community (**Figures 69 and 70**). They are potentially impacted by the construction vehicles that will pass by as the main road leads from the proposed development site, via the Ha Raliemere community. The grave sites are adjacent to the main road and as such, may be directly impacted. Grave site co-ordinates: 29°47'34.03"S; 27°19'34.64"E.

Figure 69: View of the Proposed Development Site from the Ha Raliemere Community

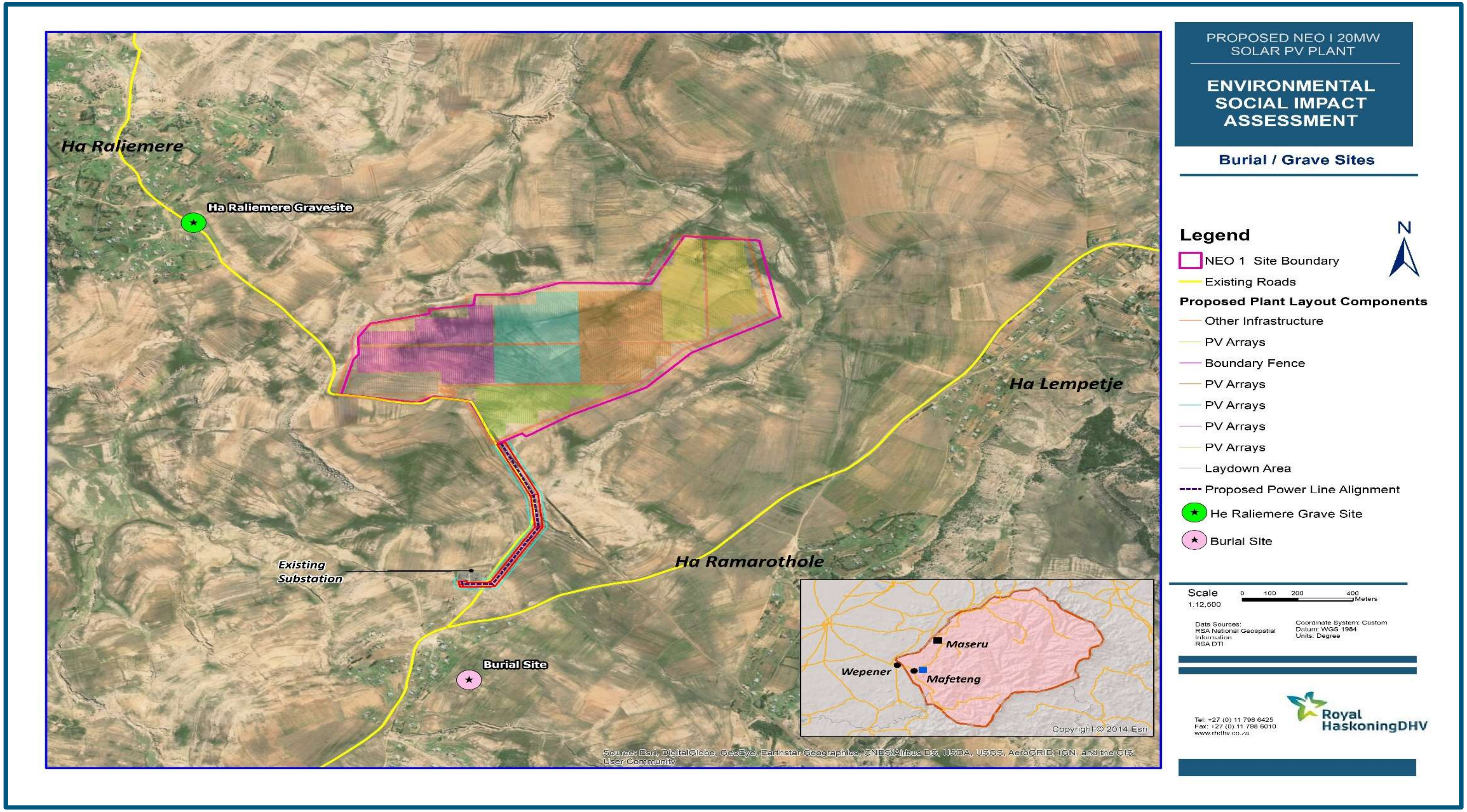

Figure 70: Burial Sites from the Ha Raliemere Community and Proximity to the Site

Focus Group Meetings

The questionnaire survey mentioned above had focussed on developing a profile for the three communities found within the immediate area of the proposed development. The Focus group meetings (FGMs) targeted data gathering from the more vulnerable people in the three villages, Ha Ramarothole, Ha Lempetje and Ha Raliemere, the relevant Chiefs of each village, and the relevant Councillors[15] and Non-Government Organisations (NGO's). The meetings were conducted from the 25th to 27th of September 2018 as per the schedule in **Table 43** below.

Table 43: Focus Group Meeting Schedule

TIME	TUESDAY 25 SEPTEMBER 2018	WEDNESDAY 25 SEPTEMBER 2018	THURSDAY 25 SEPTEMBER 2018
10h00	Ha Ramarothole vulnerable people	Ha Lempetje vulnerable people	Chiefs & Councillors s
14h00	Ha Raliemere vulnerable people	NGO's	

Focus Group Meetings with Vulnerable Groups in Ramarothole Village

The FGM was held on the 25th of September at 10h00am at Chief Ramarothole's residence. Participants comprised vulnerable people made up of the elderly people, orphans, widows, sick people and people living with a disability. The table below indicates the age, gender and vulnerability categories that were represented (**Table 44 and Figure 71**).

Table 44: Age and Gender of Vulnerable Group from Ha Ramarothole

AGE	GENDER	VULNERABILITY CATEGORY
29	Male	Orphan[16]
69	Female	Widow, single parent head of household
64	Female	Widow
33	Female	Disabled (Physically challenged)
56	Female	Disabled (Physically challenged)
29	Male	Orphan
50	Female	Widow, single parent head of household
65	Female	Widow, single parent head of household
54	Male	Widower
38	Male	Disabled (Physically challenged)
66	Male	Disabled (Physically challenged)
76	Male	Elderly
32	Female	Widow, single parent head of household

[15] *Councillors comprise members elected by the electoral division, Chiefs representing traditional leadership, and women occupying reserved seats determined by proportional representation lists submitted by political parties.*
[16] *The fact that a 29 year old person identifies themselves as an orphan is related to the fact that the individual grew up without biological parents since childhood, is unmarried, and is still a dependent.*

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[redacted]

Figure 71: Ha Ramarothole Vulnerable People FGM

The discussions with this group are captured in the **Table 45** below.

Table 45: Discussion with Vulnerable Group from Ha Ramarothole

QUESTIONS	RAMAROTHOLE PARTICIPANTS
1. Are you aware of the PV project? Yes ( ) No ( )	Yes
2. If yes, when was the first time you knew about it, and what were the sources of information?	Through public gathering by the Chiefs of the three affected villages in 2017
3. If no, interviewer should tell the respondent about the project and about the grievance channel that exists. *(Leave BID and Community Feedback form with them)*	Channel of grievance was explained, and BID was provided to all.
4. What are the principal occupational economic activities in the village (farming, commerce, industry, homemaking etc.)?	Agricultural /Farming (but not thriving due to recent droughts) and livestock farming.
5) Of the ………… households in the village, how many are considered 'vulnerable'? *(Include single parents' families, female headed homes, child headed homes, physically / mentally challenged, the very old and very sick, and those receiving only a State pension/ welfare support)*	No information rendered.
6. How do these vulnerable households make ends meet from day-to-day? Source of income?	• Agricultural / Farming (those who do not have land assist those who have land – during the harvesting period). Also practices livestock farming. • People over 70yrs receive a government grant

QUESTIONS	RAMAROTHOLE PARTICIPANTS
	• Piece jobs i.e. domestic work, collecting wood, herding, traditional smearing of the house with mud, • Ask for help from the community
7. What is the main source of water for households in this village? Is there a public water supply? If so, where is it located?	• There is a tank in the village supplying water to the pumps in the village by gravity, but pressure is low due to tree roots affecting the water pressure. • The available tap only supplies approximately 3 people with water per day
8. What is the back-up plan to source water during dry periods? *(Mainly which time of year?)*	• They go to other villages with sources that can stand drought or buy from individuals who have installed boreholes at M5 for each 20L. • Lack of water is mostly around April to November each year.
9. Who in the household is responsible for fetching water *(adult M/F, or children (girls/ boys)?*	• Water is collected using donkeys, by children, by paying people who can assist them or voluntarily assistance by community members
10. What are your concerns for the project? Related to • Air (pollution) /Smell • Noise • Soil/ groundwater Pollution • Traffic • Water availability • Waste water	• Air/smell (Not sure if there will be any issues, but dust will be an issue due to construction activities) • Noise (from construction vehicles and machines) • Soil/GW pollution (hydrocarbon spills from construction vehicles and converter machines) • Traffic (increased traffic due to construction vehicles) • Water availability (community and animals will no longer be able to use the spring close to the project and the community will share the scarce water with the project. The project should assist the affected community with bringing water from other alternative sources) • Waste-water (will pollute the water and there will be odours).
11. Is Health and Safety a concern? Explain.	Yes. New people in the area may result in increased crime. The fact that the area does not have electricity may make criminal activity easier.
12. Do women in the village have specific development issues they wish to make known?	No.

- **Focus Group Meetings with Vulnerable Groups in Ha Raliemere Village**

The FGM was held on the 25th of September at 14h00pm at Chief Ha Raliemere's residence. Participants comprised vulnerable people made up of the elderly people, orphans, widows, sick people and people living with A disability. The table below indicates the age, gender and vulnerability categories that were represented (**Table 46 and Figure 72**).

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Table 46: Age and gender of Vulnerable Group from Ha Raliemere

AGE	GENDER	VULNERABILITY CATEGORY
33	Female	Widow, single parent head of household
71	Female	Physically disabled & elderly
33	Female	Widow, single parent head of household
22	Female	Physically disabled
30	Female	Physically disabled
33	Female	Widow, single parent head of household
66	Male	Elderly
24	Male	Orphan
18	Female	Orphan
30	Male	Orphan

[redacted]

Figure 72: Ha Raliemere Vulnerable People FGM

The discussions with this group are captured in the **Table 46** below.

Table 47: Discussion with Vulnerable Group from Ha Raliemere

QUESTIONS	HA RALIEMERE
1. Are you aware of the PV project? Yes ( ) No ( )	Yes
2. If yes, when was the first time you knew about it, and what were the sources of information?	Through public gathering by the Chiefs of the three affected villages in 2017.
3. If no, interviewer should tell the respondent about the project and about the grievance channel that exists. *(Leave BID and Community Feedback form with them)*	Channel of grievance was explained, and the BID was provided to all.
4. What are the principal occupational economic activities in the village (farming, commerce, industry, homemaking etc.)?	Agriculture/ Farming and livestock rearing.
5) Of the ……… households in the village, how many are considered 'vulnerable'? *(Include single parents' families, female headed homes, child headed homes, physically / mentally challenged, the very old and very sick, and those receiving only a State pension/ welfare support)*	No information rendered.
6. How do these vulnerable households make ends meet from day-to-day? Source of income?	• Agriculture- Farming and animals • Over 70yrs people receive government grant • Piece jobs i.e. domestic work, collecting wood, herding, traditional house plastering using soil
7. What is the main source of water for households in this village? Is there a public water supply? If so, where is it located?	One borehole located within the village
8. What is the back-up plan to source water during dry periods? *(Mainly which time of year?)*	They go to other villages with sources that can stand drought, but shortage of water is throughout the year
9. Who in the household is responsible for fetching water *(adult M/F, or children (girls/ boys)?*	Children fetch water or those who have donkeys use them
10. What are your concerns for the project? Related to • Air (pollution) /Smell • Noise • Soil/ groundwater Pollution • Traffic • Water availability • Waste water	• Air/smell (don't think there will be any issues) • Noise (noise from construction vehicles, people from other areas) • Soil/GW pollution (hydrocarbon spills from construction vehicles and converter machines) • Traffic (increased traffic due to construction vehicles) • Water availability (there is scarce water and the project will use it and make it worse and also destroy the wetlands around the proposed site) • Waste water (will pollute the water and there will be smell)
11. Is Health and Safety a concern? Explain.	New people in the area resulting in increased crime rate as the area does not have electricity
12. Do women in the village have specific development issues they wish to make known?	No

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- **Focus Group Meetings with Vulnerable Groups in Ha Lempetje Village**

The FGM was held on the 26th of September at 10h00am at Chief Ha Lempetjie's residence. Participants comprised vulnerable people made up of the elderly people, orphans, widows, sick people and people living with A disability. The table below indicates the age, gender and vulnerability categories that were represented (**Table 48 and Figure 73**).

Table 48: Age and gender of Vulnerable Group from Ha Lempetje

AGE	GENDER	VULNERABILITY CATEGORY
58	Female	Widow, single parent head of household
76	Female	Elderly
66	Female	Widow, single parent head of household
36	Female	Sickly
72	Female	Elderly
66	Female	Widow, single parent head of household
62	Female	Widow, single parent head of household
32	Female	Orphan
34	Female	Orphan
67	Female	Widow, single parent head of household
61	Female	Widow/ elderly, single parent head of household
50	Female	Sickly
69	Female	Elderly
82	Female	Elderly
80	Female	Elderly
65	Male	Elderly

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[redacted]

Figure 73: Ha Lempetje Vulnerable People FGM

The discussions with this group are captured in the **Table 49** below.

Table 49: Discussion with Vulnerable Group from Ha Lempetje

QUESTIONS	HA LEMPETJE RESPONSE
1. Are you aware of the PV project? Yes ( ) No ( )	Yes
2. If yes, when was the first time you knew about it, and what were the sources of information?	Through public gathering presented by Chief Ramakopoi Seeiso in 2017. However, some people (i.e. old people) did not go and they heard about the meeting proceedings from others.
3. If no, interviewer should tell the respondent about the project and about the grievance channel that exists. *(Leave BID and Community Feedback form with them).*	Channel of grievance was explained, and the BID was provided to all.
4. What are the principal occupational economic activities in the village (farming, commerce, industry, homemaking etc.)?	Agriculture- Farming and animals
5) Of the ………… households in the village, how many are considered 'vulnerable'? *(Include single parents' families, female headed homes, child headed homes, physically / mentally challenged, the very old and very sick, and those receiving only a State pension/ welfare support).*	No information rendered.

QUESTIONS	HA LEMPETJE RESPONSE
6. How do these vulnerable households make ends meet from day-to-day? Source of income?	They invest energy in agricultural farming and animal rearing. Alternatively, they look for piece jobs i.e. domestic work being undertaken by widows
7. What is the main source of water for households in this village? Is there a public water supply? If so, where is it located?	13 boreholes pumps in the village and only two working. There is also a spring
8. What is the back-up plan to source water during dry periods? *(Mainly which time of year?)*	They go to other villages with sources that can stand drought, but lack of water is throughout the year
9. Who in the household is responsible for fetching water *(adult M/F, or children (girls/ boys)?*	Donkeys, children and grandchildren
10. What are your concerns for the project? Related to • Air (pollution) /Smell • Noise • Soil/ groundwater Pollution • Traffic • Water availability • Waste water	• Air/smell (If it is going to be the same as solar for domestic use, we don't think there will be any issues) • Noise (noise from construction vehicles, people from other areas) • Soil/GW pollution (hydrocarbon spills from construction vehicles and converter machines) • Traffic (increased traffic due to construction vehicles and traffic signs must be made available, pedestrians and children walking from and to school will be affected by traffic, some drivers are careless especially those driving construction vehicles) • Water availability (quality of water from the spring next to the project site will be affected) • Waste water (water pollution of the spring)
11. Is Health and Safety a concern? Explain.	• Fumes from the diesel (used for machines and vehicles) and coal (from stoves) may affect the health of the community and workers. • Increase in lightning incidents due to electricity poles. • Affairs with construction workers and this may result in destroying marriages or fights amongst community and project workers.
12. Do women in the village have specific development issues they wish to make known?	No.

- **Focus Group Meeting with Chiefs and Councillors**

An FGM was held on the 27th of September at 10h00 at the Mafeteng Hotel with the Chiefs and Councillors of Ha Ramarothole, Ha Raliemere and Ha Lempetje communities. The Chiefs and Councillors present at the meeting have jurisdiction over the villages that will be directly affected by the proposed project. **Table 50** below renders further information on the relevant Chiefs of each village and the number of years presiding as Chief, as well as Councillors relevant to the T'sana Talana Council Area.

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Table 50: Details of Chiefs and Councillors

NAME OF THE CHIEF/COUNCILLORS	VILLAGE	OCCUPIED POSITION SINCE YEAR	NUMBER OF PEOPLE IN THE VILLAGE
Chiefs			
[redacted]	Responsible for 20 villages including the three affected by the project.	2001	No information
	Ha Lempetje	2007/2009	Estimated 700
	Ha Ramarothole	2015	Estimated 596
	Ha Raliemere	2003	Estimated 676
Councillors			
[redacted]	T'sana Talana Council Area.	2005	
		2017	
		2017	
		2017	
		2011	

The discussions with this group are captured in the **Table 51** below.

Table 51: Discussions with Chiefs and Councillors

QUESTIONS	CHIEFS & COUNCILLORS RESPONSE
1. Are you aware of the PV project? Yes ( ) No ( )	Yes
2. If yes, when was the first time you knew about it, and what were the sources of information?	Others knew about the project through Puisano Consultants in 2017 while Chief Fako Seeiso and Chief Ramarothole had knowledge through the former DA and other consultants who were bidding for the tender in 2010.
3. If no, interviewer should tell the respondent about the project and about the grievance channel that exists. *(Leave BID and Community Feedback form with them).*	Channel of grievance was explained, and the BID provided to all.
4. What are the principal occupational economic activities in the village (farming, commerce, industry, homemaking etc.)?	Agriculture/ Farming and animal livestock production.
5) Of the ………… households in the village, how many are considered 'vulnerable'? *(Include single parents' families, female headed homes, child headed homes, physically / mentally challenged, the very old and very sick, and those receiving only a State pension/ welfare support)*	NIISA (National Information System for Social Assistance) recently (in the last 3 years) undertook a survey in the three villages and the following statistics on the number of households[17], were made available: Lempetje (approx. 300)

[17] *These 'vulnerable household' figures cannot be verified. NISSA does not have a publicly accessible database. The figures are seemingly similar to the total number of households per village.*

QUESTIONS	CHIEFS & COUNCILLORS RESPONSE
	Ramarothole (approx. 150) Raliemere (approx. 256)
6. How do these vulnerable households make ends meet from day-to-day? Source of income?	Agriculture/ Farming and animal rearing.
7. What is the main source of water for households in this village? Is there a public water supply? If so, where is it located?	Springs located outside of villages.
8. What is the back-up plan to source water during dry periods? *(Mainly which time of year?)*	They go to other villages with sources that can stand drought, but lack of water is throughout the year.
9. Who in the household is responsible for fetching water *(adult M/F, or children (girls/ boys)?*	• Everyone fetches water and use donkeys if going far from the village. • Old people sometimes use the dirty dam water for domestic use as they cannot go to the springs.
10. What are your concerns for the project? Related to • Air (pollution) /Smell • Noise • Soil/ groundwater Pollution • Traffic • Water availability • Waste water	• Air/smell (odours from waste- dumping site should be identified, fumes and dust from machines and construction vehicles, • Noise (noise from construction vehicles, blasting will cause noise and cracking of houses – assuming blasting is part of the process) • Soil/ groundwater pollution (hydrocarbon spills from construction vehicles and converter machines) • Traffic (increased traffic due to construction vehicles and traffic signs must be made available, pedestrians and children walking from and to school will be affected by traffic, some drivers are careless especially those driving construction vehicles) • Water availability (wetlands and springs currently being used will be far away from some villages (request Neo Ito supply affected communities with boreholes as there is a lot of ground water) • Wastewater (groundwater contamination, water quality will be affected)
11. Is Health and Safety a concern? Explain.	• Dust will affect workers- clinics should be provided nearby • Crime increase-there should be visible policing and street lighting. • Extra marital affairs with construction workers - may result in destroying marriages or fights amongst community and project workers. • Training on HIV and AIDS, STDs etc. must be carried out.

QUESTIONS	CHIEFS & COUNCILLORS RESPONSE
12. Do women in the village have specific development issues they wish to make known?	Women have identified the need to create a source of income. In the various villages, women have initiated various income generating sources. • Ha Ramarothole village has the Traditional women's dance group. • Ha Raliemere has the Traditional women's dance group, Liloting Raliemere Farming Association, Hatooa Mose Mosali- tents & chairs hire, and a health oriented support group that helps the sick, and people living with HIV/AIDS. • Ha Lempetje has the Traditional women's dance group, stokvel (system of contributing money, to be shared at the end of the year), and the farming of pigs and chickens.
13. Main sources/ reasons of in and out migration in your village?	• Illegal mining in RSA, herding, to work at firms, domestic work mostly in RSA, contract work such as construction. • Some people come to herd and some to stay while doing construction work. Some run away from their villages due to conflict, therefore settle in these villages.
14. Current traffic (vehicular movements) and pedestrian usage of roads	• Ha Ramarothole has good public transport • Ha Raliemere and Ha Lempetje, people walk long distances to access public transport
15.Current level of services and location of facilities (health, education)	• There are no schools at Ha Ramarothole and there is one primary school at Ha Raliemere and one at Ha Lempetje. • There are no clinics in the three villages but there is a health post where nurses come once a month. • There are health village workers at Ha Lempetje.
16. Power supply needs and future power supply arrangements	• There is electricity at Ha Ramarothole and Ha Lempetje but the vulnerable do not have access due to affordability (Request to Neo Ito assist) • There is no electricity at Ha Raliemere. Community members will have to contribute money in a scheme for LEC to meters in the village (One Power is requested to assist)

- **Focus Group Meeting with Non-Governmental Organisations (NGOs)**

Focus Group Meeting (FGM) was held on the 26th of September at 14h00 at the District Administrator's (DA) offices. Attendees were from different international and local NGOs with offices in Mafeteng. The names of each NGO represented in the meeting and their interests are indicated in **Table 52** below.

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Table 52: NGOs Represented and their Interest

NAME OF NGO	INTEREST
World Vision	World Vision is a global Christian relief, development and advocacy organisation dedicated to working with children, families and communities to overcome poverty and injustice.
PSI	PSI provides HIV testing and counselling (HTC) services that remain a model of efficiency and government partnership. In addition to PSI's core programming areas, PSI has expanded its portfolio to include HIV prevention interventions in the workplace; diagnosis and treatment of sexually transmitted infections; provision of high quality HTC Services to children less than 14 years through index tracking and testing and community based testing of children at high risk and comprehensive HIV prevention activities with the Lesotho Defence Force.
Participatory Initiative for Social Accountability (PISA)	PISA aims to contribute to a vibrant and open democracy in Lesotho, where citizens know, demand and exercise their rights and responsibilities, and in which government representatives supply accountability and transparency. As one of its entry points to enhancing social responsibility in Lesotho, PISA provides civic education to strengthen citizen's knowledge, awareness, skills and motivation to participate in democratic processes and development initiatives. PISA provides Information, Education and Communication (IEC) in the form of trainings, workshops, public gatherings and information dissemination through various mass media. PISA works on core civic education topics (like democracy and governance), as well as on developmental issues (like gender, HIV and climate change).
Mafeteng Community Radio	Mafeteng Community Radio is the first community owned radio station in the country. It is a direct result of a partnership between the Lesotho National Commission for UNESCO and the Mafeteng community represented by the Mafeteng Multi Media Association. Some of the community issues of interest are; health, agriculture and service delivery.
Community Development and Peace Promotion Movement (CDPPM)	CDPPM focuses on community development and peace promotion initiatives.
Lesotho Red Cross	Red Cross purpose is to protect life and health and to ensure respect for the human being. It promotes mutual understanding, friendship, co-operation and lasting peace amongst all people. Red Cross activities in Lesotho comprised mainly of health clinic operations, to support government's health programmes.
Skill share Lesotho	Skill Share provides services on poverty reduction, injustice and inequalities across all the districts in Lesotho, both by sharing skills and empowering people to meet their social and economic needs. Since 1999, Skill share Lesotho has focused on the following: • Education and training for employment creation • Support for disadvantaged groups including people with disabilities, women, youth and people living with HIV/AIDS • Rural development, in particular, construction of rural roads and bridges

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NAME OF NGO	INTEREST
	• Environment science and technology

The discussions with this group are captured in the **Table 53** below.

Table 53: Discussions by NGOs

QUESTIONS	NGOS RESPONSE
1. Are you aware of the PV project? Yes ( ) No ( )	Out of 9 attendees, only two knew about the project
2. If yes, when was the first time you knew about it, and what were the sources of information?	In the course of 2017, an NGO task team had informed the greater NGO network.
3. If no, interviewer should tell the respondent about the project and about the grievance channel that exists. *(Leave BID and Community Feedback form with them)*	Attendees were told about the project. Channel of grievance was explained, and the BID was provided to all.
4. What are the principal occupational economic activities in the village (farming, commerce, industry, homemaking etc.)?	Agriculture/ Farming and animal livestock farming.
5) Of the ………… households in the village, how many are considered 'vulnerable'? *(Include single parents' families, female headed homes, child headed homes, physically / mentally challenged, the very old and very sick, and those receiving only a State pension/ welfare support)*	No information rendered. N/A
6. How do these vulnerable households make ends meet from day-to-day? Source of income?	Not sure but believes that many depend on crop and livestock farming and government grant.
7. What is the main source of water for households in this village? Is there a public water supply? If so, where is it located?	Springs.
8. What is the back-up plan to source water during dry periods? *(Mainly which time of year?)*	Use of donkeys to collect water and some use cars during functions/events
9. Who in the household is responsible for fetching water *(adult M/F, or children (girls/ boys)?*	Everyone collects water and use donkeys if fetching from water sources far away from the village.
10. What are your concerns for the project? Related to • Air (pollution) /Smell • Noise • Soil/ groundwater Pollution • Traffic • Water availability • Waste water	The information rendered was not any different to that presented by Chiefs/ Councillors. • Air/smell (oil fumes will affect workers, dust during construction) • Noise (noise from construction vehicles, blasting will cause noise if will happen) • Soil/GW pollution (hydrocarbon spills from construction vehicles and converter machines) • Traffic (increased traffic due to construction vehicles and traffic signs must be made available, pedestrians and children walking from and to school will be affected by traffic, some drivers are careless especially those driving construction vehicles)

QUESTIONS	NGOS RESPONSE
	• Water availability (damage to the existing wetlands and animals and community will be affected as users) • Waste water (pollution of the wetlands and springs nearby)
11. Is Health and Safety a concern? Explain.	• Need for in-depth sensitization by the Compensation Committee to avoid conflicts • Increase in crime -there should be visible policing. • Affairs with construction workers may result in destruction of marriages or fights/ conflicts amongst community and project workers.
12. Do women in the village have specific development issues they wish to make known?	None that they know of.

4.3.2.4 Identified Vulnerable Groups

There are several vulnerable groups in the three villages affected by the proposed project:

- ***Single parents****:* Among this group, single mothers and widow women require particular support. In both cases, the women often find themselves caring for a household whilst also seeking to provide a living for them. Young widows work as domestic workers in Lesotho and South Africa and leave the children on their own without parental care and guidance.
- ***Orphans****: Diseases such as tuberculosis and* HIV/AIDS has claimed the lives of thousands of parents in Lesotho, leaving a number of children orphaned and alone, and many more vulnerable. Single orphans (children who have lost one parent) and double orphans (children who have lost both parents) are left without the support structures needed to grow up as educated, socially responsible adults. Without parental guidance or strong role models, they are left to find their own way. According to the Chiefs and Councillors of the three villages, most of the boys are herding animals in the villages and surroundings in order to be paid while orphan girls work as domestic workers within Lesotho and South Africa.
- ***People living with disability and the chronically ill****:* In the affected areas, there are physical disabled people. Physical disabilities result in a variety of limitations based on the specific area or areas of the body affected and the degree to which the disability limits movement, strength, control, etc. Getting around is a problem for some of these group of people. They are also at an increased risk of poverty as they are not able to do some of the work or participate in money generating projects such as those available in the villages.
- ***Elderly****:* Especially grandmothers who are the key support structure for children and are essential to their survival. Many of them have lost their own children and family members, leaving them confused, lonely and grief-stricken. Despite their own poverty, illnesses and hopelessness, grandmothers have opened their homes and hearts to Lesotho's orphaned children, filling the role of parents and guardians. They have the burden and the unique opportunity to support their grandchildren to become educated young leaders. Ten elders of Ha Raliemere village were killed recently due to lack of security. Elders who are over 70 years receive grant of M750 per month from government.

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4.3.2.5 The Project Affected People (PAPs)

There are no buildings or structures in the proposed development area. According to the Social and Environmental baseline survey produced in May 2018 (due to changes in PAPs this only surveyed 24 of the current PAPs), the site at the time of the survey (September 26th – October 3rd, 2017) was mainly used for subsistence agricultural and cattle herding. The affected fields were planted and ploughed annually for staple crops including maize, sorghum, wheat and beans and these are sold to the community if there is surplus. Few households planted fodder for the animals. After harvest time, when the fields are not used, the land is used for grazing by cattle, sheep and donkeys.

During the survey it was noticed that many of the fields were not cultivated. The reasons stated by most households for not cultivating the land were related to lack of money to buy agricultural inputs, and recent drought conditions. Some owners reported that they were waiting for Government support (block farming) which never materialized. A meeting with members of the Compensation Committee (29 August 2018) revealed that owners were not cultivating land (for the last year) as they were expecting compensation for the land (**Figures 74 and 75**). They were aware that they could continue farming until such time the tenure arrangement was confirmed and that they will be compensated for the crop at the time of land being required for the start of the development. However, all owners chose not to farm.

As at July 2019, Neo I had identified 39 plots owned by 36 landowners whilst the powerline servitude consists of five plots and five landowners, making it a total of 41 landowners. The 5 PAPs within the transmission route do not fall within the public road space, and therefore, since private land is affected, they become eligible for compensation along with the 36 PAPs in the direct development area. In total, there are 44 affected plots of land and 41 PAPs.

A map provided by Neo I, first produced by Ntshihlele Land Surveyors in February 2019, and later updated, identifies the plots of land that will be directly affected by the development site and transmission line routing, as per the **Figure 76** below.

[redacted]

Figure 74: Meeting with the Compensation Committee (August,2018)	*Figure 75: Some PAPs awaiting a meeting (August 2018)*

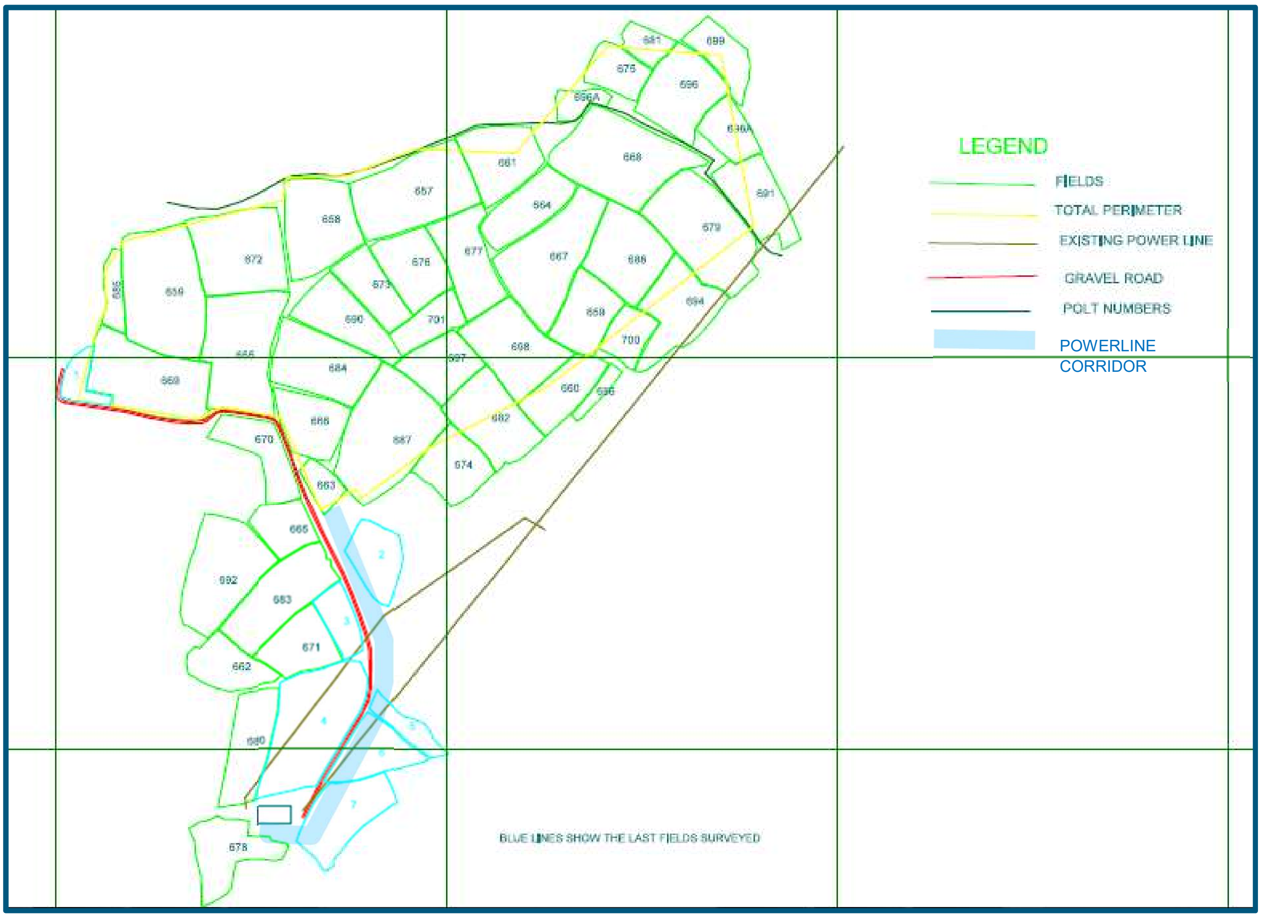

Figure 76: PAP Identification in Relation to Land Owned

The corresponding landowners were also identified to each field, tagged with corresponding numbers in the **Table 54** extract that follows.

Table 54: Corresponding Map Reference and PAP (Landowner)

DEVELOPMENT AREA				
Id Nr	First Name	Last Name	Area (M²)	Affected Area
673	[redacted]	[redacted]	13055	13055
698	[redacted]	[redacted]	24761	24761
691	[redacted]	[redacted]	17803	17803
1	[redacted]	[redacted]	5 949	5 949
657	[redacted]	[redacted]	33613	33613
672	[redacted]	[redacted]	29975	29975
659	[redacted]	[redacted]	39494	39494
679	[redacted]	[redacted]	35081	35081
699	[redacted]	[redacted]	11128	11128
675	[redacted]	[redacted]	10097	10097
694	[redacted]	[redacted]	21703	21703
663	[redacted]	[redacted]	5607	5607

681	[redacted]		6047	6047
658	[redacted]		25863	25863
674	[redacted]		15676	15676
696	[redacted]		22423	22423
696	[redacted]		4901	4901
688	[redacted]		23521	23521
664	[redacted]		16330	16330
685	[redacted]		5934	5934
695	[redacted]		15698	15698
700	[redacted]		8540	8540
690	[redacted]		18190	18190
701	[redacted]		9904	9904
687	[redacted]		39 188	39 188
684	[redacted]		24759	24759
661	[redacted]		19402	19402
669	[redacted]		31766	31766
655	[redacted]		33954	33954
656	[redacted]		3305	3305
698	[redacted]		10049	10049
660	[redacted]		14509	14509
668	[redacted]		36547	36547
667	[redacted]		32298	32298
697	[redacted]		14904	14904
677	[redacted]		17504	17504
676	[redacted]		19573	19573
682	[redacted]		22761	22761
666	[redacted]		15630	15630
POWERLINE ROUTE				
ID Nr	**First Name**	**Last Name**	**Area (M^2)[18]**	
678	[redacted]		17848	To be confirmed
2	[redacted]		13326	To be confirmed
5	[redacted]		6681	To be confirmed
6	[redacted]		15102	To be confirmed
7	[redacted]		20554	To be confirmed

Census of Project Affected People (PAPs)

As mentioned earlier, the census was conducted in 2017. An updated assessment of the number of PAPs (due to the clearer understanding of the affected area and the transmission line routing), shows that 44 plots of land (or 41 PAPs), are affected. Therefore, the 2017 census is only indicative of the socio-economic profile of a portion of the PAPs, but certainly does not represent the total number. The Census specifically collected the following information:

[18] *The powerline route will only be finalised at detailed design and will aim to avoid as many PAPs as possible. As such it is not possible at this point to say what area, if any, will be affected by the powerline servitude.*

- The demographic profile of individuals and/or households directly affected by the project, including: the demographic profile of the heads of the households and their spouses (*where applicable*); types and proof of marital status; and, type and proof of identification of heads of households and their spouses (*where applicable*).
- An inventory of landholding focusing on the land affected by the project (e.g. size of the field, tenure status of agricultural land, current use of land, estimated economic loss which may result from land acquisition).

At the time, out of a total of 48 PAPs identified, a total of 36 (79%) households were interviewed for the census. The Report states, "*A total of 12 PAPs and/or households could not be located during the data collection and assets verification exercise*." PAPs within the powerline transmission route (9 PAPs identified at the time), were not initially included in the census, as the routing of the powerline was not confirmed in 2017[19]. Furthermore, the PAP list has been updated hence only 24 of the 40 current PAPs (60%) were surveyed. **Table 55** below indicates the number of PAPS from each village that were available for the census.

Table 55: Number of Project Affected Persons Interviewed

NAME OF VILLAGE	NUMBER OF RESPONDENTS	PERCENT
Ha Lempetje	14	38.9
Ha Ramarothole	20	55.6
Ha Raliemere	2	5.6
TOTAL	**36**	**100.0**

Of the PAPs, the higher proportion (of repondents) are found in the 45 to 64 year age group. The census results show that 72% of respondents were the actual Heads of households, while the remaining 28% were the spouses. There is no determination made between the number of Heads of households that were represented in the 45-64 year age group. It was ascertained however, that 64% of PAP households were male-headed.

Of almost eighty nine percent (88.9%) of PAP heads of households, 47.2% were married or are widowed (41.7%). Over 60% of PAPs (of the 89%) were married through customary law. Over 60% of PAPs (63%) have between 4-7 household members in each home, with the average household size being 5 members. Out of the families surveyed, none were child-headed. Among those engaged in small non-agricultural businesses, the most common small business involved the sale of goods (31.4%), followed by local beer brewing or sale of liquor (22.9%). Other activities include running a small shop (14.3%), sewing and tailoring (5.7%), traditional healer (5.7%). Catering and hospitality services, marketing services, saddlery, plastering, transport/taxi, hiring out draught animals and sale of natural raw resources accounted for 2.9% (each) of livelihood involvement.

- **PAP Agricultural Practices**

Assets affected by the project are identified as fields and almost all PAP households (94.4%), had one field located within the proposed project site with two households possessing two fields within the project site.

[19] *It is thus practical to update the census survey.*

According to the surveyor's report, the size of the fields affected by the project varied by size, ranged from 967m^2 to 41,487m^2.

At the time of the census, a few PAPs (36.1% or 13 households) were cultivating the land, and the remaining 63.9% were not using the fields (refer to **Table 56** below). For the two families that own two fields located in the project site, one family cultivated both fields while the other family did not. Of the PAPs that were farming, they reported cultivating the fields to plant staple crops such as maize and beans. Others planted wheat, sorghum, and beans, while one household planted fodder.

Table 56: PAP Cultivated Land as at September 2017

CURRENT CULTIVATION STATUS	NUMBER OF RESPONDENTS (N)	PERCENT
Yes	13	36.1
No	23	63.9
TOTAL	**36**	**100.0**

In the case of households that were not cultivating the fields, the period they stopped cultivating their fields differed, ranging from as far back as 2005, while others had stopped cultivating in the past year (2016). The reasons stated by most households for not cultivating the land were related to the lack of money to buy agricultural inputs, and unfavourable weather conditions. The other observations made during data collection for the Census were as follows:

- A dispute on the land holding was recorded. This was specifically related to one of the claims of land holding through inheritance between two parties who reside at Ha Lempetje. The dispute was being adjudicated by the Principal Chief of Likhoele at the time of data collection. *(Subsequent consultation activities showed the dispute was resolved by the Principal Chief in favour of the rightful owner).*
- There were also four (4) fields whose owners were expected to be identified by the Chiefs but all four (4) fields were declared bare (*thite*) and not belonging to anybody.

Further Recommended Actions

The RHDHV team had, at Neo I's request compiled a Redress Action Plan, and specifically refers to corrective actions that would align with the IFC's Performance standard 5. This is found in **Table 57** below.

** Note: This Redress Action was recommended during the early phase (scoping) of the Project. The need for an ARAP was communicated by the AfDB during the ESIA phase. The contents of the recommended reports in the Redress Action Plan and the content of the ARAP, are aligned.*

Table 57: Redress Action Plan (IFC PS 5)

PS 5: LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT – Not required in its entirety as a corrective action as the Project will require a tenure leasing arrangement. However key IFC PS 5 requirements will be adopted to reach best practice.		
Objective	**Compliance requirements that need to be met (as part of ESIA)**	**Corrective Action Required**
The specific objectives of this PS are: ▪ To avoid, and when avoidance is not possible, minimize	As with PS 1 ▪ Consultation and disclosure, including the establishment of appropriate grievance mechanisms. These would however	The corrective action proposed herein acknowledges that this project does not constitute land acquisition and/or involuntary displacement and will

Objective	Compliance requirements that need to be met (as part of ESIA)	Corrective Action Required
PS 5: LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT – Not required in its entirety as a corrective action as the Project will require a tenure leasing arrangement. However key IFC PS 5 requirements will be adopted to reach best practice.		
displacement by exploring alternative project designs; ▪ To avoid forced eviction; ▪ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; ▪ To improve, or restore, the livelihoods and standards of living of displaced persons; and ▪ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites	target the Project Affected Population (PAPs)	instead be a leasing arrangement of the unused land. A RAP and LRP are not prescribed, however the proposed action herein is based on the fact that **all actions are required to be documented and verifiable** for the Lenders purpose. **Apply disclosure process that includes (as in PS1):** ▪ Feedback of compensation process/ tenure arrangement (*on-going until PAP sign off and compensation pay-out*). ▪ Announces the cut-off date for claims (*Typically in parallel to the census and inventory undertaking*). ▪ Implement a general grievance mechanism that would be applicable to the compensation process as well as the labour component going into the construction phase (ongoing). A **reporting and monitoring mechanism** will be required. A **Land tenure arrangement report** which is accompanied by a (standalone/ or annexure) **Livelihood monitoring report** is proposed (This is in progress) <u>Purpose of the **Tenure arrangement report**</u>: It is a 'once off' report ▪ The entire process will be documented with verifiable data ▪ It will reflect all relevant parties' involvement (including the Compensation Committee, Valuers and Lawyers) ▪ It will show the valuation approval by the Government valuer (as an independent party)

PS 5: LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT – Not required in its entirety as a corrective action as the Project will require a tenure leasing arrangement. However key IFC PS 5 requirements will be adopted to reach best practice.		
Objective	**Compliance requirements that need to be met (as part of ESIA)**	**Corrective Action Required**
		▪ It will detail the full list of landowners and the corresponding leasing compensation rates (with sign off). Purpose of the **Livelihood monitoring report** (either standalone or Annex to Tenure arrangement report) ▪ It will substantiate the present livelihood status of the PAPs (pre and post lease re-imbursement) ▪ It should ideally be updated on a yearly basis for the 25 year lease period. ▪ This will act as the livelihood monitoring of PAPs that is typically required by Lenders.

4.3.2.6 Expectations of the Project

Different groups interviewed through the various focus group meetings seemed to have similar expectations that landowners will be compensated with a reasonable amount of money that can change their present economic status. There is also an expectation that the PAPs will be given priority over other community members for job opportunities. In general, the community is expecting Neo Ito assist with the following:

- Install electricity to vulnerable homes who could not join the scheme due to affordability;
- Supply electricity to Ha Raliemere;
- Supply water infrastructure so that all three villages can have reliable water supply;
- Build schools for the affected community; and
- Build a clinic within the villages.

It should be noted that Neo I have not agreed to any of these expectations except for providing power to Ha Raliemere. The suggestions will however be considered as Corporate Social Responsibility projects.

5 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The ESIA aim to achieve the following:

- To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;
- To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- To promote improved social and environment performance of companies through the effective use of management systems.

Impact assessment must take account of the nature, scale and duration of effects on the environment, whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimisation of an impact is noted. A discussion of the impact and the rationale behind the assessment of its significance is provided in this Section.

The ESIA of the project activities is determined by identifying the environmental aspects and then undertaking an environmental risk assessment to determine the significant environmental aspects. The environmental impact assessment is focussed on the following phases of the project namely:

- Planning Phase;
- Construction Phase; and
- Operational Phase.

5.1 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- **Nature:** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- **Extent**: The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration**: Indicates what the lifetime of the impact will be;
- **Intensity**: Describes whether an impact is destructive or benign;
- **Probability**: Describes the likelihood of an impact actually occurring; and
- **Cumulative**: In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

The criteria to be used for the rating of impacts is provided in **Table 58**.

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Table 58: Criteria to be used for the Rating of Impacts

DESCRIPTIVE CRITERIA		
Nature	**Category**	
Extent (E)	Categories 1 – 4	
	1	Footprint / site
	2	Local (within a radius of 2 kms of site)
	3	Regional
	4	National
Duration (D)	Categories 1 – 4	
	1	Short (less than five years)
	2	Medium term (5-15 years)
	3	Long term (15-30 years)
	4	Permanent
Intensity (I)	Categories 1 – 4	
	1	Low
	2	Moderate
	3	High
	4	Very High
Probability (P)	Categories 1 – 4	
	1	Improbable
	2	Probable
	3	Highly Probable
	4	Definite
IMPACT: Cumulative		
Extent (E)		
Duration (D)		
Intensity (I)		
Probability (P)		
Significance	**Significance = E + D + I + P**	
	Minimum value of 1, maximum of 16	
	Status determines if positive / negative	
	Neg (13 - 16 points) NEGATIVE VERY HIGH	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
	Neg (10 - 12 points) NEGATIVE HIGH	These are impacts which individually or combined pose a significantly high negative risk to the environment. These impacts pose a high risk to the quality of the receiving environment. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.

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DESCRIPTIVE CRITERIA	
Neg (7 - 9 points) NEGATIVE MODERATE	These are impacts which individually or combined pose a moderate negative risk to the quality of health of the receiving environment. These systems would not generally require immediate action, but the deficiencies should be rectified to avoid future problems and associated cost to rectify once in HIGH risk. Aesthetically and/or physically non-compliance can be expected over a medium term. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable. Mitigation is possible with additional design and construction inputs.
Neg (4 - 6 points) NEGATIVE LOW	These are impacts which individually or combined pose a deleterious or adverse impact and low negative risk to the quality of the receiving environment, and may lead to potential health, safety and environmental concerns. Aesthetically and/or physical non-compliance can be expected for short periods. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Pos (4 - 6 points) POSITIVE LOW	These are impacts which individually or combined pose a low positive impact to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance.
Pos (7 - 9 points) POSITIVE MODERATE	These are impacts which individually or combined pose a moderate positive effect to the quality of health of the receiving environment. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable.
Pos (10 - 12 points) POSITIVE HIGH	These are impacts which individually or combined pose a significantly high positive impact on the environment. These impacts pose a high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is longer term, greater in extent, intense in its effect and highly likely to occur. The effects of the impact may affect the broader environment.
Pos (13 - 16 points) POSITIVE VERY HIGH	These are permanent and important beneficial impacts which may arise. Individually or combined, these pose a significantly high positive impact on the environment. These impacts pose a very high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is long term, greater in extent, intense in its effect and highly likely or definite to occur. The effects of the impact may affect the broader environment.

5.2 Physical Environment Impact Assessment

The sections below present identified physical environmental impacts, their assessment and significance thereof as well as migation measures for significant impacts.

5.2.1 Climate Change

5.2.1.1 Impacts of Climate Change on the Proposed Facility

The facility's performance may be affected by increased temperatures and increased dust mobilisation that reduce the efficiency of the panels, and intense rainfall that threatens its physical integrity. Neither of these categories of effects are likely fatal flaws and can be managed as part of the routine planning and management of the project. Appropriate site management such as erosion management through vegetation management and soil stabilisation will manage the risk sufficiently, as long as regular monitoring can ensure early detection of issues.

Biophysical and Social Impacts

An assessment of the potential links between the construction and operation of the power plant, and its biophysical and social impacts, as contextualised by climate change, is provided below. Important inputs into the assessment are the two main climatic stressors that are expected to play the biggest role in future – water availability and increased temperatures.

Table 59: Assessment of links between Climate Change and Environmental Effects on the Project

CLIMATE CHANGE CONCERNS	RELATION TO PROPOSED DEVELOPMENT	ASSESSMENT OF IMPACTS	MITIGATION OPTIONS
Surface and Groundwater			
▪ Local water availability for humans, livestock and ecological requirements will come under pressure.	▪ Use of water (construction & operation) ▪ Obstructing human movement corridors giving access to water.	▪ Water is to be sourced from boreholes, where feasible, similar to where the surrounding communities get their water from. ▪ There is a natural spring in the area, outside the project boundary, Land Use Map in the ESIA) which is accessed very occasionally when conditions require supplementing of community boreholes. The project will slightly inconvenience one community in terms of	▪ Limit borehole abstraction to sustainable levels.

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CLIMATE CHANGE CONCERNS	RELATION TO PROPOSED DEVELOPMENT	ASSESSMENT OF IMPACTS	MITIGATION OPTIONS
		access to the spring, but not cut off access completely.	
▪ Wetlands will degrade under drier, hotter climate regime	▪ Destruction or sedimentation of wetlands and water sources (refer to Soils and Agriculture)	▪ N/A (see related impact category)	▪ N/A
Biodiversity			
▪ Increased pressure to find microclimatic refuge and surface water as grasslands and wetlands deteriorate due to desertification and degradation.	▪ Exclusion of wildlife and interruption of movement through extensive fencing ▪ Use of water (refer to Surface and Groundwater)	▪ No sensitive habitat or ecological features were identified in the biodiversity assessment process. The facility is therefore not an impediment to sensitive faunal movement.	▪ Wildlife-friendly fencing, with ground-level openings of at least 150mm and no electrification of the lower section.
▪ Desertification will reduce carbon stored in biomass	▪ Desertification and soil erosion (refer to Soils and Agriculture)	▪ N/A (see related impact category)	▪ N/A
Soil and Agriculture			
▪ Progressive reduction in water availability and desertification that increases erodibility and threat of serious erosion when intense rainfall follows a period of drought.	▪ Localised disruption of run-off pattern (panel array, access road, cabling) ▪ Reduction in vegetation cover will have a negligible effect on the sequestration effect of natural biomass, and hence a negligible impact on the Lesotho GHG accounts.	▪ The project site will be subject to increased intensity runoff due to the concentrating effect of the installed PV panels. This will increase the risk of soil erosion and the resultant sedimentation of local seep wetlands or non-perennial streams. Both these impacts are subject to the adequacy of mitigation measures in the form of soil cover and storm water	▪ Revegetation and monitoring of erosion must be included in the construction and operational management plans.

CLIMATE CHANGE CONCERNS	RELATION TO PROPOSED DEVELOPMENT	ASSESSMENT OF IMPACTS	MITIGATION OPTIONS
		management during construction and operation. It is important that the species selection for revegetation work remains sensitive to anticipated climatic conditions – i.e. groundcover and tree introduction must be drought and heat resistant.	
▪ Human vulnerability will increase due to threats to subsistence agriculture	▪ Compensation to previous users of the agricultural lands	▪ No active agriculture is present on the site due to the need for labour intensive irrigation. By implication, the site represents a community asset which could be brought into commission should the water availability improve (e.g. through water pumped from boreholes). Such livelihood alternatives are important contributors to making people less vulnerable to climate change. The sterilisation of the land through erection of PV panels therefore impacts on community resilience. By implication, the site lease / compensation plan needs to adequately compensate the community for the	▪ Since a contingency community asset is being sterilised for the ensuing 20 years or so, on-going livelihoods monitoring must check for decreased community resilience.

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CLIMATE CHANGE CONCERNS	RELATION TO PROPOSED DEVELOPMENT	ASSESSMENT OF IMPACTS	MITIGATION OPTIONS
		loss of potential livelihood alternatives. Such calculations need to form part of the social assessment.	
Heritage			
▪ Human vulnerability will increase in respect of traditional / historic agricultural practices and access to water	▪ Historic / cultural connections to water resources (refer to Surface and Groundwater) ▪ Food security (refer to Soils and Agriculture)	▪ N/A (see related impact category)	▪ N/A
Air Quality and Emissions			
▪ Use of fossil fuels will increase GHG emissions	▪ Increased GHG emissions	▪ The use of fossil fuels on site is inevitable, as construction equipment and vehicles typically run on liquid fuels. These emit various greenhouse gases, depending on the nature of the fuels, the equipment or machinery in use and the efficiency of use. The total GHG emissions footprint is therefore highly sensitive to operational and design parameters.	▪ Use of fossil fuels will increase GHG emissions
▪ Vehicle movement and construction activities will mobilise dust, which may be exacerbated by increased air temperature and drought conditions	▪ Construction activities will affect human activities where dust is mobilised	▪ Although the predominant wind direction for the site is East-North East, the strongest wind speeds are associated with wind from the West to North. Excessive dust generated on site will	▪ Appropriate road maintenance, activity staging and revegetation activities must be imposed to reduce the extent of bare surfaces or travel speeds on roads. The use of water for dust

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CLIMATE CHANGE CONCERNS	RELATION TO PROPOSED DEVELOPMENT	ASSESSMENT OF IMPACTS	MITIGATION OPTIONS
		therefore be blown towards Ha Lempetje, possibly leading to air quality concerns. Although wind speeds will increase as anticipated climatic changes take effect, the impact is likely to be limited to the construction period, meaning that longer-term climate changes are not a concern.	suppression must be considered in context of reduced water availability. (Note that detailed mitigation options are evaluated under the Air Quality Specialist Assessment)
Human vulnerability			
▪ Human vulnerability will increase in respect of agricultural practices and access to water, with secondary impacts on health and social support systems. This may be exacerbated by climate change-induced migration to less exposed areas such as what surrounds the project site.	▪ Vulnerability will also be related to the availability of water resources (refer to Surface and Groundwater), and food security (refer to Soils and Agriculture)	▪ As discussed under the Surface and Groundwater, and Soils and Agriculture sections, the resilience of the affected communities will be impacted on by the sterilisation of agricultural fields and potentially the reduction in water availability if borehole extraction exceeds natural recharge rates. The scale of this impact is, however, relative to the ability of the community to obtain water for irrigated agriculture in time of need.	▪ Vulnerable groups, such as those that will lose access to agricultural resources, should be left more resilient by the project , but at least no worse off. In this regard on-going livelihoods monitoring must check for decreased community resilience.
▪ Energy security will be affected by increased uncertainty in the hydropower sector	▪ National energy security will be improved by increasing the solar	▪ The 72MW installed capacity in the hydropower sector will be supplemented by the	▪ No mitigation required.

CLIMATE CHANGE CONCERNS	RELATION TO PROPOSED DEVELOPMENT	ASSESSMENT OF IMPACTS	MITIGATION OPTIONS
	power inputs into the national power grid	envisaged 20MW solar PV project. This will reduce the Kingdom's reliance on electricity imports from South Africa and hence improve the country's energy security and carbon footprint. It may therefore not directly affect the reliance on hydropower.	

Cumulative Impacts

The impacts identified are rated according to four descriptive criteria, namely Extent (E), Duration (D), Intensity (I) and Probability (P), with the significance determined by the cumulative rating of all four categories. A cumulative score is then used as an indicator of significance. The climate change cumulative impacts are negative moderate to negative low.

Climate Change Impact Rating

The impacts identified in the assessment above are consequently rated in terms of Extent, Duration, Intensity and Probability. All impacts are rated from the perspective of the surrounding communities, a construction period of one year and for an assumed project lifespan of 25 years. Eight impacts are rated for significance and residual impact determined in anticipation of mitigation measures (**Table 60**).

5.2.1.2 Greenhouse Gas Emissions Mitigation

Provisional calculations indicate that the project will contribute a significant portion of the unconditional national GHG emissions mitigation target, along with the added benefit of having lower embodied emissions as compared to fossil fuel-based electricity generation options. Given a current national GHG emissions total of 4.17Mt CO^2eq, a 10% reduction in emissions (without adjusting for any future increases under a BAU scenario) will require 417kt CO^2eq to be offset through an improved emissions profile or emissions sequestration.

The project under scrutiny, being a solar PV installation, will itself have a negligible operational territorial emissions profile – i.e. within the project boundaries - and excluding emissions embodied in materials and transport to the site, the directly attributable GHG emissions will be close to zero. Emissions will be limited to construction and maintenance activities that require energy other than what is available on site, such as liquid fuels for vehicles. When considering non-territorial emissions, it has been shown that the embodied emissions of a solar PV installation are relatively low, as compared to conventional coal, gas, bioenergy or hydropower facilities (Pehl, et al., 2017).

By implication, the use of solar radiation for electricity production, as comparted to the local SAPP grid, will result in an emissions reduction of roughly 47kt CO^2eq per year. This assumes a SAPP grid emissions factor of 0.98t CO^2eq/MWh (IGES, 2018) and a project output of 48 000 MWh per year. The project therefore contributes substantially to the national emissions reduction target as calculated above (11.2%).

In addition, the project satisfies half of the national mitigation objective related to sourcing energy from solar power installations – the INDC specifies a target of 40MW to be sourced from solar by 2020 (MEM, 2015). This also fits in with the policy objective of promoting renewable energy systems across the country, as stated in the National Climate Change Policy (LMS, 2017).

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Table 60: Climate Change Construction Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Water availability	Without Mitigation	-2	-3	-2	-1	**-8**	Negative Moderate
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
2	Movement of animals	Without Mitigation	-2	-3	-1	-1	**-7**	Negative Moderate
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
3	Soil erosion and sedimentation of water resources.	Without Mitigation	-2	-3	-1	-1	**-8**	Negative Moderate
		With Mitigation	-1	-1	-1	-2	**-5**	Negative Low
4	Loss of agricultural land	Without Mitigation	-1	-3	-1	-4	**-9**	Negative Moderate
		With Mitigation	-1	-3	-1	-4	**-9**	Negative Moderate
5	GHG emissions	Without Mitigation	-1	-1	-1	-4	**-7**	Negative Moderate
		With Mitigation	-1	-1	-1	-4	**-7**	Negative Moderate
6	Dust mobilisation	Without Mitigation	-2	-1	-1	-4	**-8**	Negative Moderate
		With Mitigation	-2	-1	-1	-2	**-6**	Negative Low
7	Energy security	Without Mitigation	+4	+3	+3	+4	**+14**	Positive Very High
		With Mitigation	+4	+3	+3	+4	**+14**	Positive Very High
8	GHG mitigation	Without Mitigation	+4	+3	+4	+4	**+15**	Positive Very High
		With Mitigation	+4	+3	+4	+4	**+15**	Positive Very High

SUMMARY OF MITIGATION MEASURES	▪ The loss of agricultural land, and the community resilience that it represents, must be mitigated through adequate compensation to the affected community members. ▪ GHG emissions can only be reduced to an extent, given the reliance on fossil fuels, but the impact is of limited severity, and hence not a serious concern.		
Average for without mitigation		**-2.2**	**Negative Low**
Average for with mitigation		**-0.7**	**Negative Low**

5.2.2 Air Quality Impact Assessment

5.2.2.1 Emission Inventory

This section outlines the potential ambient air quality impacts associated with the proposed activities at the power plant. A detailed emissions inventory is compiled to determine the emissions released from the proposed activities. Dispersion modelling simulations was undertaken using the AERMOD dispersion model and the impacts will be presented graphically as isopleths plots. Emissions are calculated based on the impacts upon area within the overall study area. in the case of the proposed solar project this is defined as follows (**Table 61**):

Table 61: Surface Area Directly Impacted

Activity	Disturbed footprint (Ha)
Laydown Area	1.5 ha
Onsite Substation	1 ha
Internal Roads	1.8 ha
Civil Works required to implement Freshwater Ecologist recommendations and Stormwater Management	3.5 – 5 ha
Civil Works required for MV (trenching)	1 - 2 ha
Additional contingent area (worst case)	1.9 ha
TOTAL CLEARED (Worst Case)	**Up to 13.2 ha**

* Approximately 20.1% of total project area.

5.2.2.2 Dispersion Results and Discussion

The Solar Power Plant project that is proposed is likely to only emit particulate matter. For the purpose of this impact assessment dispersion modelling was only done for PM10. The model calculated are the long-term (annual) concentrations for the region and also the daily averages were calculated for worst case and normal operations. Worst case operations are included to indicate where no dust suppression or mitigation of any type is implemented. The results from the dispersion model runs are presented below.

Construction Phase

Construction is commonly of a temporary nature with a definite beginning and end. Construction usually consists of a series of different operations, each with its own duration and potential for dust generation. Dust emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions. Construction sites are good candidates for dust control measures because land disturbance from clearing and excavation generates a large amount of soil disturbance and open space. The identified sources of dust during the construction phase is windblown dust and vehicle transportation and activity on the open and exposed ground surface. The use of long-term stockpiles on site should be avoided wherever possible. If necessary, the following measures should be in place. This can take the form of:

- Wind breaks;
- Water sprays;
- Revegetation of stockpiles;
- Material drop heights should be reduced and
- All stockpiles should be damped down, especially during dry weather.

It should be noted that emissions generated by wind are also dependent on the frequency of disturbance of the erodible surface. Each time material is added to or removed from a storage pile or surface, the potential for erosion by wind is restored. Any crusting of the surface binds the erodible material (USEPA, 1996). The worst case scenario is presented together with the mitigated (Normal) scenario, the dispersion model was run on an hourly emissions rate file where the emission rate was only applied to when construction would occur at the construction site. The control efficiency of the mitigation measures were applied to each of the sources and a mitigated emission rate was calculated. It is presumed that under normal conditions, vegetation cover will be protected as much as possible.

Operational Phase

The dispersion model ran for both a worst-case scenario (unmitigated) and a mitigated (normal) scenario. The mitigation measures include the wetting of surfaces, general housekeeping (ensuring there isn't large amounts of dust), wetting the road surfaces or applying chemical suppressants. **Figures 77** and **Figure 78** indicate the daily maximum predicted emissions for the entire site (cumulative) with no mitigation and with mitigation respectively. The current South African Standard for daily particulate matter is 75µg/m³ indicating that with no mitigation, it is likely that the standards will be exceeded for the cumulative impacts. The South African standards were used due to the lack of Lesotho standards. These impacts are mostly from dust emissions from the road between the site and the substation, and therefore special focus needs to be made to manage these emissions. **Figure 79** and **Figure 80** show the impacts for the construction phase of the proposed solar project, and **Figure 81** and **Figure 82** indicate the potential impacts that the unpaved roads will have on the surrounding environment, due to the operation of the site. The powerline route has been highlighted in yellow on the maps for reference purposes.

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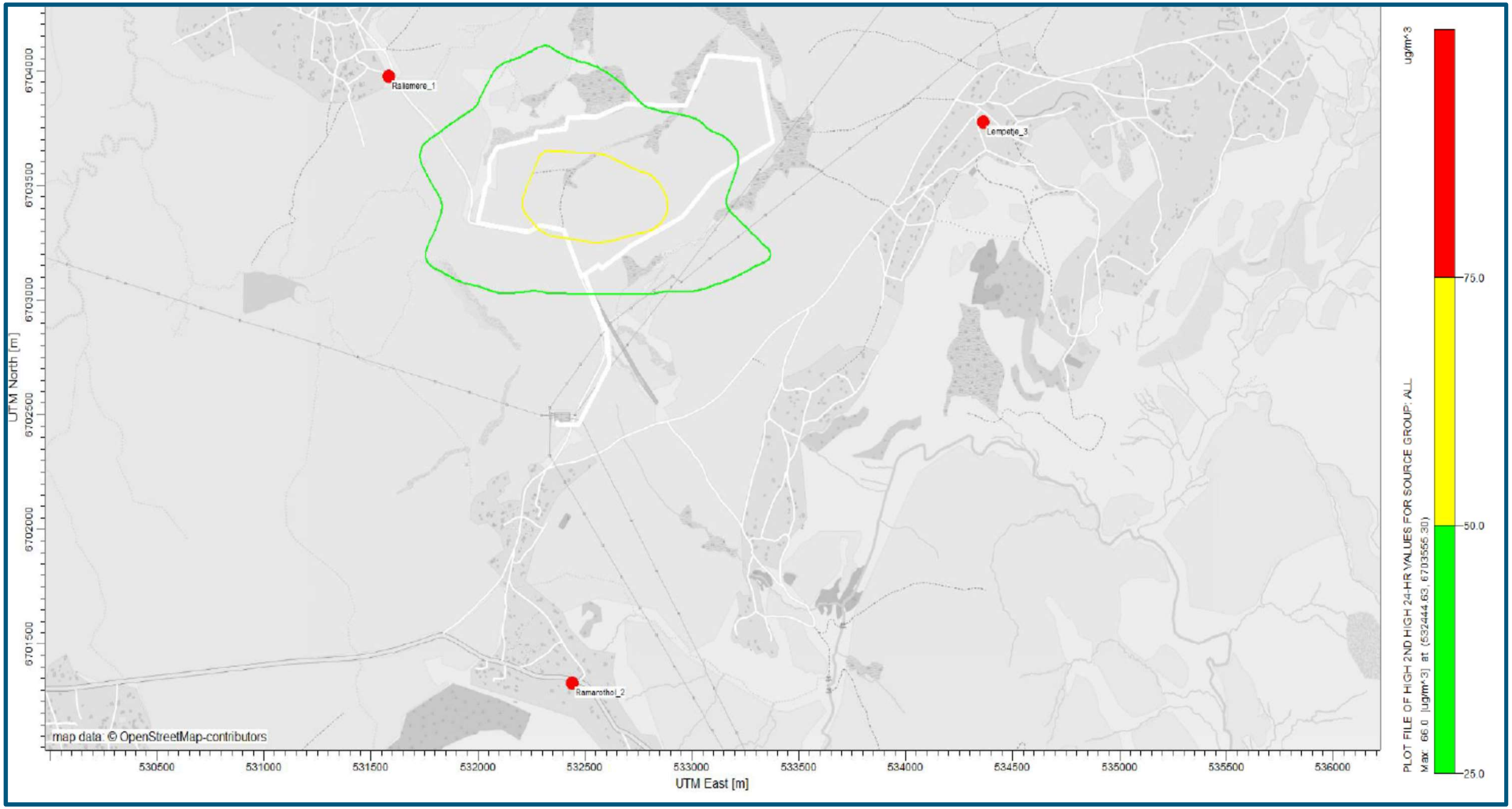

Figure 77: Cumulative Daily PM10 Impact During Construction with no Mitigation (South African Standard: 75µg/m³)

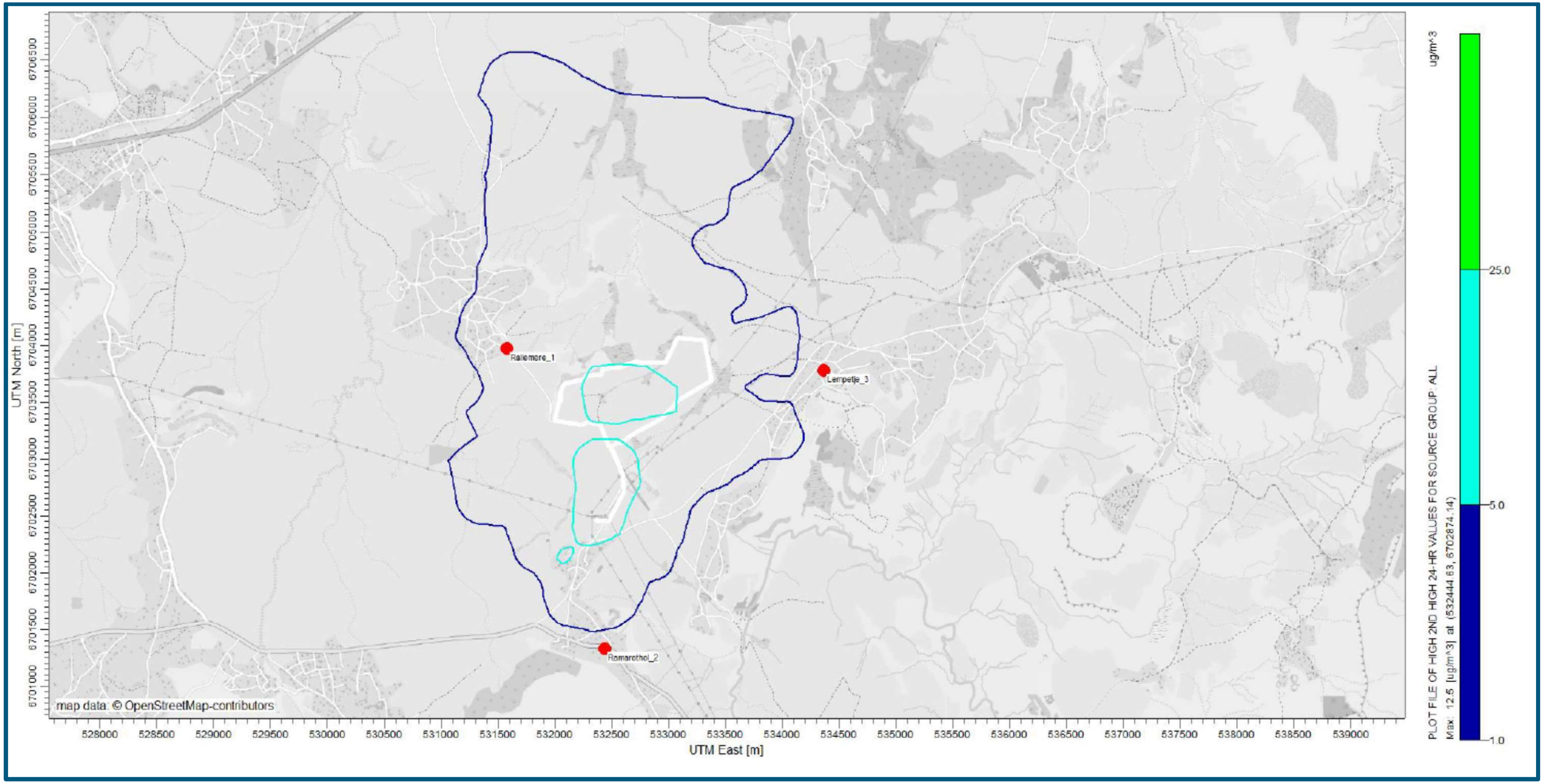

Figure 78: Cumulative Daily PM10 Impact During Construction with Mitigation

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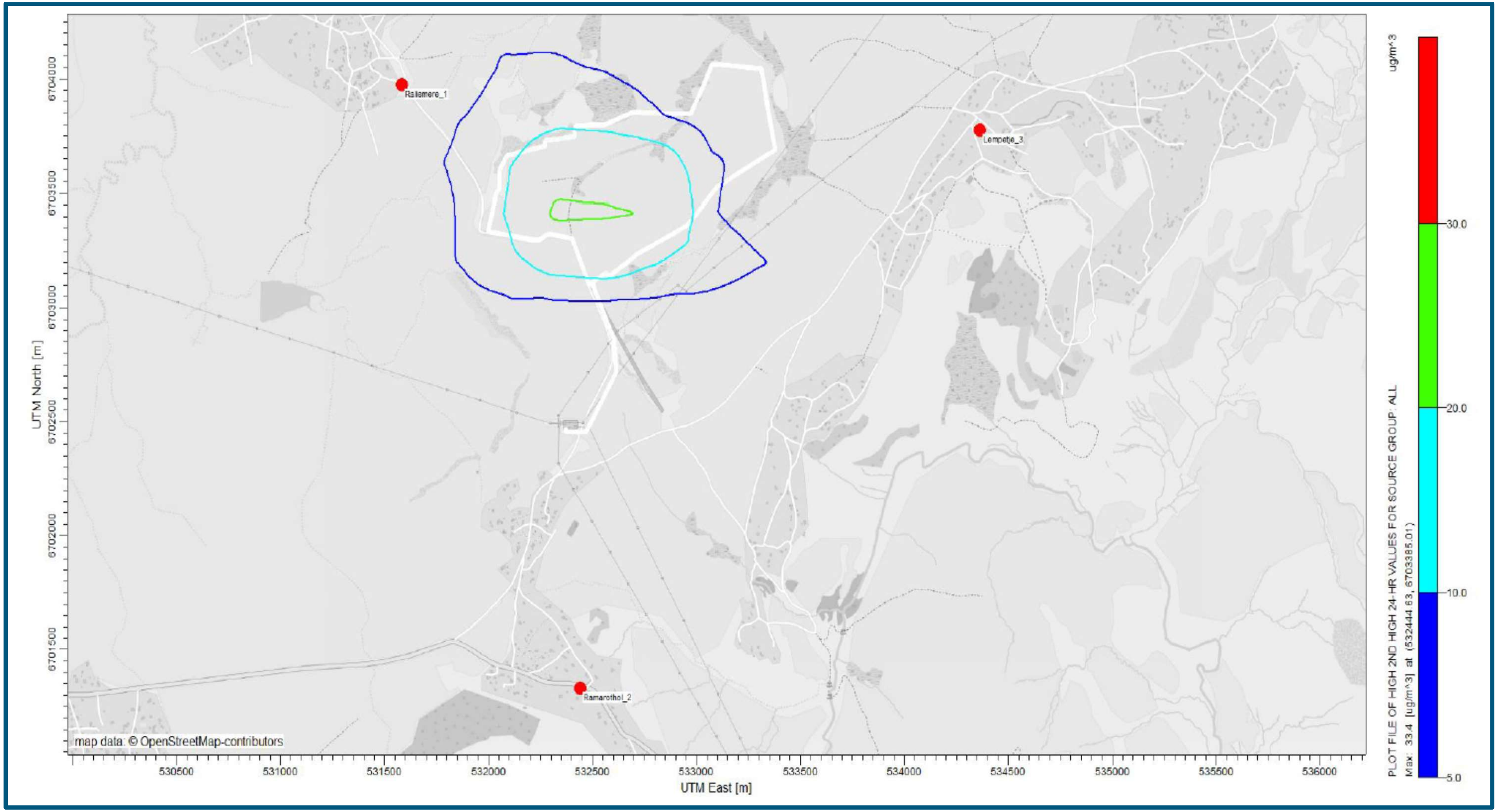

Figure 79: PM10 Impact of the Solar Project Site Activity during Operation with no Mitigation (South African Standard : 75µg/m³)

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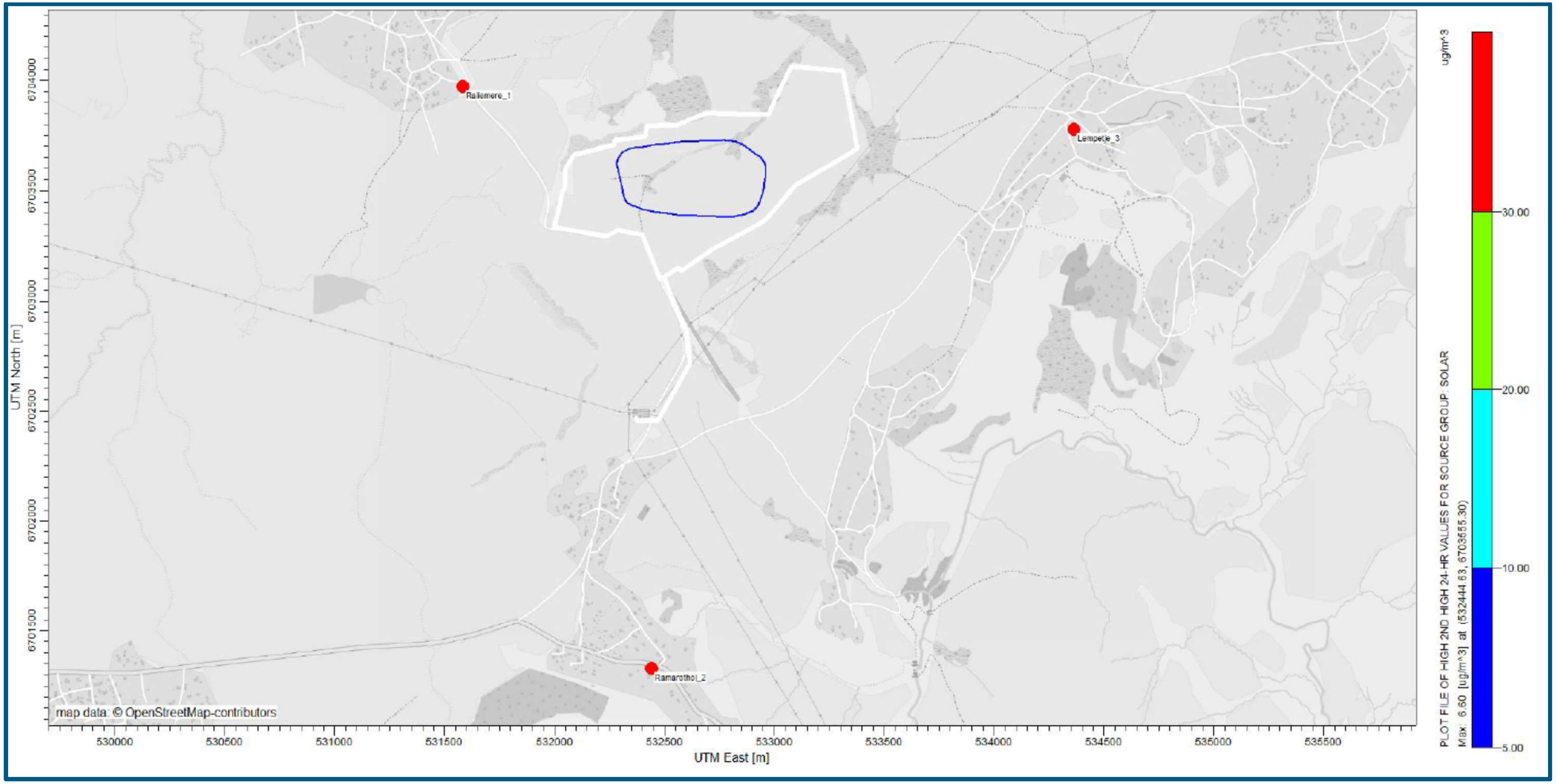

Figure 80: PM10 Impact of the Solar Project Site Activity during Operation with Mitigation (South African Standard : 75µg/m³)

5.2.2.3 Construction Impacts

Creation and Grading of Access Roads

Access roads are constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Current roads will be used for access with some additional upgrades, for approximately 1.3km. Onsite roads would require the addition of 2km of road (approximately 4m wide).

Large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads (USEPA, 1996). Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads (USEPA, 1996). Passing traffic can thus re-suspend the deposited material. To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover if there is insufficient rainfall. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts.

A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated. The periodic watering or application of chemical suppressant to these road sections will aid in the reduction of dust generated from these sources. Cognisance should be taken to increase the watering rate during high wind days and during the summer months when the rate of evaporation increases, and during periods of low rainfall.

Preparation of Areas Identified for the Construction of the PV Plant and Supporting Infrastructure

Removal of material usually takes place with a bulldozer, extracted material is then stored in piles for later use during rehabilitation procedures. Fugitive dust is generated during the extraction and removal of overlying material, as well as from windblown dust generated from cleared land and exposed material stockpiles. Dust problems can also be generated during the transportation of the extracted material, usually by truck, to the stock piles. This dust can take the form of entrainment from the vehicle itself or due to dust blown from the back of the trucks during transportation.

To avoid the generation of unnecessary dust, material drop height should be reduced and material storage piles should be protected from wind erosion. This can take the form of wind breaks, water sprays or revegetation of stockpiles. All stockpiles should be damped down, especially during dry weather.

It should be noted that emissions generated by wind are also dependent on the frequency of disturbance of the erodible surface. Each time material is added to or removed from a storage pile or surface, the potential for erosion by wind is restored. Any crusting of the surface binds the erodible material. Dust created during the transportation can be limited by watering the road sections that are being used and by either wetting the material being transported or covering the back of the trucks, to limit the windblown dust from the load.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles. Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health. It is important to note that impacts will be of a temporary nature, only occurring during the construction period. Particulate emission estimates from the construction activity of the solar project are presented below (**Table 62**).

$$E_{TSP} = 1.2\ (ton/ha/month\ of\ activity)$$

Table 62: Heavy Construction Emission Rates

LOCATION	AREA (M^2)	EMISSION RATE FOR TSP ($G/M^2/S$)	EMISSION RATE FOR PM10 ($G/M^2/S$)	EMISSION RATE FOR PM2.5 ($G/M^2/S$)
Stockpile Area	15 000	2.28×10^{-5}	1.14×10^{-5}	2.85×10^{-6}
Solar Surface Area*	114000	5.06×10^{-6}	2.53×10^{-6}	6.33×10^{-7}
Site Access Road	7 800	2.68×10^{-5}	1.24×10^{-5}	2.85×10^{-6}
Unpaved Roads	18 000	2.29×10^{-5}	2.14×10^{-5}	1.85×10^{-6}

*Refer to Table 61

To quantify the particulate emissions created as a result of wind erosion on exposed surfaces, the following equation was utilised:

$$E_{TSP} = 0.4\ (kg/ha/hr)$$

$$E_{PM10} = 0.2\ (kg/ha/hr)$$

The equation relates the amount of particulate matter (in kg) emitted per hectare of exposed ground per hour (**Table 63**).

Table 63: Exposed Open Ground Affected by Wind Erosion

LOCATION	AREA (M^2)	EMISSION RATE FOR TSP ($G/M^2/S$)	EMISSION RATE FOR PM10 ($G/M^2/S$)	EMISSION RATE FOR PM2.5 ($G/M^2/S$)
Stockpile Area	15 000	1.11×10^{-5}	5.56×10^{-6}	1.39×10^{-6}
Solar Surface Area*	114000	2.46×10^{-6}	1.23×10^{-6}	3.09×10^{-7}
Site Access Road	7 800	1.14×10^{-5}	5.56×10^{-6}	1.39×10^{-6}
Unpaved Roads	18 000	1.31×10^{-5}	6.56×10^{-6}	1.18×10^{-6}

5.2.2.4 Operational Impacts

During the operational phase, access roads will need to be maintained to ensure entrained dust is kept to a minimum. A large amount of dust emissions are generated by vehicle traffic over temporary unpaved roads. Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads. Passing traffic can thus re-suspend the deposited material. To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts. A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated. Particulate emission estimates from trucks travelling on unpaved roads within the project area are presented below. The equation used to determine particulate emissions from trucks travelling on unpaved roads is presented below.

$$E_{(kg/VKT)} = \left(\frac{0.4536}{1.6093}\right) \times k \times \left({}^{s}/_{12}\right)^{a} \times \left({}^{W}/_{3}\right)^{b}$$

Where s is the surface material silt content (%), W is the mean vehicle weight, and a, b and k are empirical constants.

These emission factors relate the amount of particulate emissions (in kilograms) to the number of kilometres travelled by all vehicles on site (VKT). **Table 64** presents the empirical constants used in the equation for different particle sizes; and **Table 65** presents the vehicular statistics for the project, used in the calculations.

Table 64: Empirical Constants for Different Particle Sizes (unpaved roads)

CONSTANT	TSP	PM10	PM2.5
k	4.9	1.5	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

Table 65: Vehicular Statistics for the Solar Project

NAME OF LOCATION	NO. OF TRUCKS	MEAN WEIGHT OF FLEET (TONS)	AVERAGE SPEED (KM/H)	VKT PER DAY	EMISSION RATE FOR TSP (G/M²/S)	EMISSION RATE FOR PM10 (G/M²/S)	EMISSION RATE FOR PM2.5 (G/M²/S)
Existing Road	1	48	40	6.6	3.44×10^{-6}	4.04×10^{-7}	4.04×10^{-8}
Existing Road	5	3	40	33	1.72×10^{-5}	2.02×10^{-6}	2.02×10^{-7}

Particulate matter emissions from the wind erosion of exposed ground were calculated using the following equation (NPI):

$$E_{TSP} = 0.4\ (kg/ha/hr)$$

$$E_{PM10} = 0.2\ (kg/ha/hr)$$

The equation relates the amount of particulate matter (in kg) emitted per hectare of exposed ground per hour (**Table 66**). These emissions are expected to decrease overtime during construction and operational phases due to the concurrent re-vegetation of the exposed and disturbed area. The figures provided above are for the worst case and where vegetation takes longer than expected to recover.

Table 66: Exposed Open Ground Affected by Wind Erosion during Operation (Totalling approximately 132.2ha)

LOCATION	EMISSION RATE FOR TSP ($G/M^2/S$)	EMISSION RATE FOR PM10 ($G/M^2/S$)	EMISSION RATE FOR PM2.5 ($G/M^2/S$)
Stockpile Area	1.00×10^{-5}	5.00×10^{-6}	1.25×10^{-6}
Solar Area	8.64×10^{-7}	4.31×10^{-7}	1.08×10^{-7}
Roads	1.08×10^{-5}	5.4×10^{-6}	1.35×10^{-6}

5.2.2.5 Decommissioning Impacts

The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The total rehabilitation will ensure that the total area will be a free draining covered with topsoil and re-vegetated. Possible sources of fugitive dust emission during the closure and post-closure phase include:

- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc.

Table 67: Air Quality Construction Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Dust emissions from Road construction.	Without Mitigation	-2	-2	-2	-3	**-9**	Negative Moderate
		With Mitigation	-1	-1	-1	-2	**-5**	Negative Low
2	Dust Emissions from Exposed stockpiles	Without Mitigation	-2	-1	-2	-1	**-6**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
3	Dust emissions from Site Clearing.	Without Mitigation	-2	-1	-2	-1	**-6**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Lowe
SUMMARY OF MITIGATION MEASURES		▪ Wet / Dust suppression of unpaved roads as soon as possible, along with a maximum speed limit of 40km/h. ▪ Wet /Dust suppression, covering with bio textile and installation of wind breaks. ▪ Wet suppression or stabilization of storage piles. Minimum disturbance of land during construction.						
Average for without mitigation							-7	Negative Moderate
Average for with mitigation							-4.3	Negative Low

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Table 68: Air Quality Operational Impacts

PHASE: OPERATIONAL								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Dust emissions from roads during normal operation.	Without Mitigation	-2	-2	-2	-2	**-8**	Negative Moderate
		With Mitigation	-2	-1	-1	-1	**-5**	Negative Low
2	Dust emissions from exposed stockpiles.	Without Mitigation	-2	-1	-1	-1	**-5**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
3	Dust emissions from Site during normal operation.	Without Mitigation	-2	-1	-1	-1	**-5**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Wet / Dust suppression of unpaved roads as soon as possible, along with a maximum speed limit of 40km/h. ▪ Wet /Dust suppression, covering with bio textile and installation of wind breaks. ▪ Minimum disturbance and revegetation of disturbed areas on site.						
Average for without mitigation							-6	Negative Low
Average for with mitigation							-4.3	Negative Low

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Table 69: Air Quality Decommissioning Impacts

PHASE: DECOMMISIONING								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Dust emissions from roads during normal operation.	Without Mitigation	-2	-1	-1	-1	-5	Negative Low
		With Mitigation	-1	-1	-1	-1	-4	Negative Low
2	Dust emissions from exposed stockpiles.	Without Mitigation	-2	-1	-1	-1	-5	Negative Low
		With Mitigation	-1	-1	-1	-1	-4	Negative Low
3	Dust emissions from Site during normal operation.	Without Mitigation	-2	-1	-1	-1	-5	Negative Low
		With Mitigation	-1	-1	-1	-1	-4	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Wet / Dust suppression of unpaved roads as soon as possible, along with a maximum speed limit of 40km/h. ▪ Wet /Dust suppression, covering with bio textile and installation of wind breaks. ▪ Minimum Disturbance and revegetation of disturbed areas on site. ▪ Plants used for revegetation should be indigenous to the area.						
Average for without mitigation							-5	Negative Low
Average for with mitigation							-4	Negative Low

5.2.3 Results of the Noise Survey

The results of the environmental noise survey include the noise sources in the area such as domestic and natural noise sources provided in **Table 70**. Leq is average noise level for the specific measuring point over a period of time, the Lmax is the maximum noise level and the Lmin is the minimum noise level registered during the noise survey for a specific area in dBA.

Table 70: Daytime and Nighttime Noise Levels

MEASURING POINTS	DAYTIME - DBA				NIGHTTIME - DBA			
	Leq	Lmax	Lmin	Remarks	Leq	Lmax	Lmin	Remarks
1	35.2	56.9	22.6	Distant Bell noise at animals & wind noise	35.6	59.0	29.4	Insect & domestic noise
2	28.8	48.9	20.5	Domestic & animal noises	36.7	59.5	27.1	Insects
3	51.3	70.2	23.6	Traffic from road between Thabana & Morena	37.5	49.6	31.9	Distant barking & insect noises
4	31.4	55.5	18.8	Distant birds & animals	29.4	50.4	21.9	Distant insects
5	30.4	46.4	22.3	Distant insects	34.1	49.7	24.7	Insects
6	32.3	62.7	19.8	Domestic, distant traffic & animals	24.7	49.5	15.9	Natural sounds
7	35.5	58.0	20.8	Domestic & animal noises.	31.0	55.5	24.3	
8	34.0	61.8	22.1	Distant animal bell noises & doemstic	34.6	53.5	23.8	

The different noise levels of machinery and equipment which may be used during the construction of the PV plant are illustrated in **Table 71**. It must be noted that all these machineries will not work at one time.

Table 71: Noise Levels of Standard Construction Machinery

EQUIPMENT	REDUCTION IN THE NOISE LEVEL SOME DISTANCE FROM THE SOURCE-DBA								
Cumulative distance from source in meters	2m from the machinery and or equipment	15m	30m	60m	120m	240m	480m	960m	1920m
Dump truck	91.0	62.5	56.5	50.4	44.4	38.4	32.4	26.4	20.3
backhoe	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3

EQUIPMENT	REDUCTION IN THE NOISE LEVEL SOME DISTANCE FROM THE SOURCE-DBA								
Drilling Equipment	100.0	71.5	65.5	59.4	53.4	47.4	41.4	35.4	29.3
Flatbed truck	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pickup truck	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Tractor trailer	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Crane	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pumps	70.0	41.5	35.5	29.4	23.4	17.4	11.4	5.4	-0.7
Welding machine	72.0	43.5	37.5	31.4	25.4	14.4	13.4	7.4	1.3
Generator	90.0	61.5	55.5	49.4	43.4	37.4	31.4	25.4	19.3
Compressor	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Pneumatic tools	85.0	56.5	50.5	44.4	38.4	32.4	26.4	20.4	14.3
Cumulative noise levels from construction activities when all of such work within a radius of 30m	**101.5**	**72.9**	**66.9**	**60.9**	**54.9**	**48.9**	**42.8**	**36.8**	**30.8**

Construction Phase

The noise reduction calculated in **Table 72** is for direct line of sight and medium ground conditions. Engineering control measures and topography can have an influence on how the noise level is perceived by occupants of nearby noise sensitive areas. The cumulative noise level of the machinery and equipment will be 60.9dBA at 60m and 36.8dBA at 960m from the construction area if all the machinery operates in a radius of 30m at one time. However, this will seldom happen, and the cumulative noise level will therefore be lower. The arithmetic calculated noise levels (dBA) during the construction phase for the different activities near the residential areas are illustrated in **Table 72**.

Table 72: Noise Intrusion Levels During the Construction Phase

RESIDENTIAL	SITE CLEARING & GRUBBING OF FOOTPRINT	CIVIL CONSTRUCTION	CONSTRUCTION OF INTERNAL ROADS	TRANSPORTAION OF BUIDLING MATERIAL TO DIFFERENT OF THE SITE	ASSEMBLY OF PV PANELS	BUIDLING ACTIVITIES	CUMULATIVE AMBIENT DAYTIME NOISE LEVEL	CALCULATED DAYTIME AMBIENT NOISE LEVEL – DBA*	DAY TIME NOISE INTRUSION DBA
A	21.5	21.5	20.5	16.5	17.0	12.0	26.9	33.3	1.1
B	24.3	24.3	23.3	19.3	19.8	14.8	29.7	36.0	1.2
C	16.8	16.8	15.8	11.8	12.3	7.3	22.2	32.7	0.4
D	24.9	24.9	23.9	19.9	20.4	15.4	30.3	33.9	2.5
E	21.0	21.0	20.0	16.0	16.5	11.5	26.4	33.1	1.1

**Calculated ambient noise level is the prevailing ambient noise level measured plus the cumulative noise level from the different activities at the residential areas A to E; and*
**The noise intrusion level is the difference between the existing prevailing ambient noise level and the calculated noise level when the PV plant will be operational*

Operational Phase

The arithmetic calculated noise levels (dBA) during the operational phase for the different activities in the vicinity of the residential areas are illustrated in **Table 73.**

Table 73: Noise Intrusion Levels during the Operational Phase - No Insects

NOISE RECEPTOR	INVETER STATION 1	INVETER STATION 2	INVETER STATION 3	INVETER STATION 4	INVETER STATION 5	SUBSTATION BAY	33KV	CUMULATIVE LEVELS	CUMULATIVE NOISE LEVEL DAYTIME	NOISE INTRUSION LEVEL DAYTIME
A	19.5	23.7	10.5	7.5	19.1	26.3	33.2	24.1	32.8	0.6
B	12.7	17.7	4.9	0.6	11.4	20.0	34.9	19.3	34.9	0.1
C	17.0	23.3	10.7	6.1	17.2	25.3	33.1	24.0	32.9	0.6
D	18.3	23.8	14.0	11.3	15.6	25.9	32.5	24.2	32.2	0.8
E	18.4	23.4	28.5	20.4	14.6	30.5	34.3	29.9	34.1	2.1

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**Calculated ambient noise level is the prevailing ambient noise level measured plus the cumulative noise level from the different activities at the residential areas A to E; and*
**The noise intrusion level is the difference between the existing prevailing ambient noise level and the calculated noise level when the PV plant will be operational*

Calculation of the Road Traffic Noise

The calculation of the noise levels during the construction phase are based on a total of 7 vehicles per hour of which 4 will be heavy-duty vehicles and 3 will be motor-vehicles. The calculations of the noise levels during the operational phase are based on a total of 5 vehicles per hour of which 1 will be heavy-duty vehicles and 4 will be motor-vehicles. The calculated traffic noise level at 50m from the road will be **39.8dBA** during the construction phase and **37.7dBA** during the operational phase.

Table 74: Noise Construction Impacts

PHASE: CONSTRUCTION								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Increase of noise at the boundary of the PV footprint and the abutting houses due to grubbing of the footprint area and site clearing.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
2	Increase of noise at the boundary of the PV footprint and the abutting houses due to civil construction activities such as slabs for PV panels.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
3	Increase of noise at the boundary of the PV footprint and the abutting houses due to construction of internal roads.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
4	Increase of noise at the boundary of the PV footprint and the abutting houses due to the assembly of PV panels.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
5		Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
	Increase of noise at the boundary of the PV footprint and the abutting houses due to the transportation of building materials to and from the specific areas.	With Mitigation	-1	-1	-1	-1	**-4**	**Negative Low**
SUMMARY OF MITIGATION MEASURES		▪ Equipment and machinery that will be used on site must comply with the manufacture's specifications on acceptable noise levels and during daytime only. ▪ All construction activities must be limited to daytime only.						
Average for without mitigation							**-4**	**Negative Low**
Average for with mitigation							**-4**	**Negative Low**

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Table 75: Noise Operational Impacts

PHASE: OPERATIONAL								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Increase of noise at the boundary of the PV footprint and the abutting houses due to central inverter.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
2	Increase of noise at the boundary of the PV footprint and the abutting houses due to operation the emergency generator.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
3	Increase of noise at the boundary of the PV footprint and the abutting houses due to operation of the substation.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
4	Increase of noise at the boundary of the PV footprint and the abutting houses due to the operation of the 33kV powerlines.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
SUMMARY OF MITIGATION MEASURES	▪ Equipment with noise levels exceeding 85.0dBA to be acoustically screened off by means of engineering control measures or construct an acoustic screen between the inverter and abutting residential area. ▪ The emergency generator to be enclosed and screened off by means of engineering control measures. ▪ All sources at the substation exceeding 85.0dBA to be acoustically screened off by means of engineering control measures.							

Average for without mitigation	**-4**	**Negative Low**
Average for with mitigation	**-4**	**Negative Low**

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Table 76: Noise Decommissioning Impacts

PHASE: DECOMMISSIONING								
NO.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Increase of noise at the boundary of the PV footprint and the abutting houses due to removal of infrastructure.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
2	Increase of noise at the boundary of the PV footprint and the abutting houses due to planting of grass and vegetation at rehabilitated areas.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Equipment and machinery that will be used on site must comply with the manufacture's specifications on acceptable noise levels and during daytime only. ▪ Removal of infrastructure and revegetation of disturbed area must be limited to daytime only.						
Average for without mitigation							**-4**	Negative Low
Average for with mitigation							**-4**	Negative Low

5.2.4 Surface Hydrology, Groundwater and Water Quality

5.2.4.1 Cumulative Impacts

The cumulative impact assessment considers this project within the context of other similar land uses in the local and greater regional context. The cumulative impact is expected to be low negative and should not reduce both the scenic value and water quality downstream areas even after closure and rehabilitation. Based on the assumption that no contributing activities are located nearby, the cumulative impacts will thus be of low significance. The overall environmental significance of the proposed project after lifetime indicate that there will be relatively low negative impacts. This is based on the assumption that the mitigation measures are adhered to during the construction and operation on the proposed Solar PV plant.

5.2.4.2 Impact Assessment

The impact assessment was undertaken for the construction, operation and decommissioning phases of the proposed project. The impacts and associated mitigation measures identified are listed in the below tables.

Once the PV Solar Plant has ceased and all rehabilitation is completed, the land scape will be rehabilitated to its pre-development conditions. Very low residual drainage lines are expected due to the limited alteration of the terrain of the proposed development.

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Table 77: Surface Hydrology, Groundwater and Water Quality Construction Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Increased sedimentation due to footprint clearance and vegetation removal.	Without Mitigation	-1	-1	-2	-3	**-7**	Negative Moderate
		With Mitigation	-1	-1	-1	-3	**-6**	Negative Low
2	Increased risk of flooding.	Without Mitigation	-1	-3	-2	-2	**-8**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
3	Water pollution from vehicles.	Without Mitigation	-1	-1	-3	-2	**-7**	Negative Moderate
		With Mitigation	-1	-1	-2	-2	**-6**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Minimise the footprint clearance and vegetation removal as much as possible to be within construction area. ▪ Implement stormwater management plan to reduce soil erosion from pervious areas. ▪ Implement stormwater management plan to reduce soil erosion from pervious area. ▪ Use secondary containment, conduct quick clean-ups for any chemical spills, used oil disposal should be conducted by accredited vendors. ▪ Implement a water quality monitoring programme.						
Average for without mitigation							**-7**	Negative Moderate
Average for with mitigation							**-5.6**	Negative Low

Table 78: Surface Hydrology, Groundwater and Water Quality Operation Impacts

PHASE: OPERATION								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Increased sedimentation.	Without Mitigation	-1	-2	-2	-3	**-8**	Negative Moderate
		With Mitigation	-1	-1	-1	-2	**-5**	Negative Low
2	Increased risk of flooding.	Without Mitigation	-1	-3	-2	-1	**-7**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
3	Water pollution from vehicles and increased sedimentation.	Without Mitigation	-1	-1	-3	-2	**-7**	Negative Moderate
		With Mitigation	-1	-1	-2	-2	**-6**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Clear the designated footprint only, encourage vegetation growth. ▪ Implement stormwater management plan to reduce soil erosion from pervious area. ▪ Use secondary containment, conduct quick clean-ups for any chemical spills, used oil disposal should be conducted by accredited vendors. ▪ Implement a water quality monitoring programme.						
Average for without mitigation							**-7**	Negative Moderate
Average for with mitigation							**-5.3**	Negative Low

Table 79: Surface Hydrology, Groundwater and Water Quality Decommissioning Impacts

PHASE: DECOMMISSIONING								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Increased sedimentation	Without Mitigation	-1	-1	-2	-3	**-7**	Negative Moderate
		With Mitigation	-1	-1	-1	-2	**-5**	Negative Low
2	Water pollution from spills of vehicles and machinery and increased sedimentation.	Without Mitigation	-1	-1	-3	-3	**-8**	Negative Moderate
		With Mitigation	-1	-1	-1	-2	**-5**	Negative Low
SUMMARY OF MITIGATION MEASURES	▪ Revegetate the area where infrastructure is removed and any other disturbed areas onsite. ▪ Conduct the clean-up of chemical spillages and used oil disposal should be conducted by accredited vendors.							
Average for without mitigation							**-7.5**	Negative Moderate
Average for with mitigation							**-5**	Negative Low

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5.2.5 Wetland Impacts

5.2.5.1 Potential Impacts Associated with the Proposed Development

Several potential impacts of the proposed development could be exerted on freshwater features (wetlands). These impacts can be broadly divided into direct impacts and indirect impacts. The likelihood of whether both direct and indirect impacts would occur, whether only indirect impacts could potentially occur is dependent on two potential development scenarios:

a) the entire site is developed, as indicated in the proposed development layout, or
b) wetlands are maintained as non-development areas on the site with an associated buffer.

The No-go (no development) Option must also be considered and is discussed further below.

Under the first scenario (a) direct transformative impacts on wetland would materialise, with indirect impacts possible for downstream wetland units (off the site). Under the second scenario (b) only indirect impacts would be likely.

Direct impacts are associated with the physical damage to and transformation of wetlands, typically when the wetland falls within the footprint of the development. Such physical transformation of wetlands results in loss of wetland habitat, as well as loss of wetland biota. The habitat quality / state of the wetland is typically degraded as a result of such physical transformation and the functionality (ecosystem goods and services) associated with the wetland is also typically adversely impacted.

Indirect impacts occur when a freshwater feature is not directly affected but occur as a result of activities occurring in the wetland’s catchment. Such indirect impacts are often associated with stormwater runoff. Stormwater runoff can pollute freshwater resources as pollutants such as oils or silt and can alter the hydrology and morphology of the resource. It is important to note that both indirect and direct impacts can occur in both the construction and operational phases of the development.

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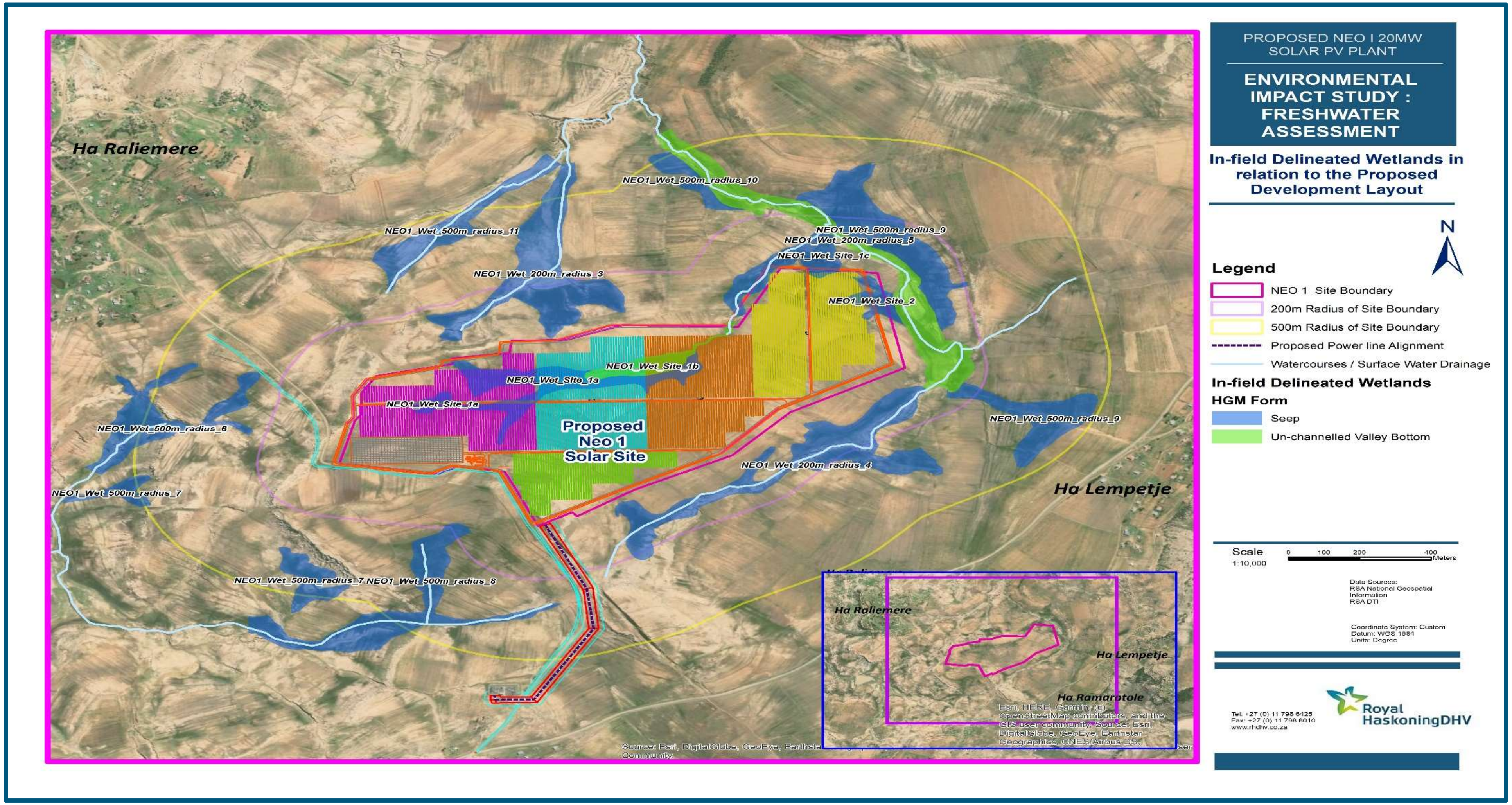

Figure 81: Wetland Occurrence in the Context of the Proposed Development Layout

Scenario 1 – Direct Impacts (Development over Wetlands on the Site)

Under this scenario the entire area of the development site would be maximised for development, as indicated in **Figure 81** which indicates wetland occurrence on the site in the context of the proposed layout. This would result in the direct impact on the seep wetland located in the northern part of the site, as well as on seepage compartments in the north-eastern part of the site. In addition, wetlands on the development site, comprised mainly of the wetland unit 1a, as well as parts of the wetland units 1b and 2 will be affected. This area of wetland habitat would be transformed / impacted further from its current state, as detailed below.

The nature of the transformative impact, and degree of loss of wetland functionality and habitat would depend on the nature of the development, in particular the nature of earthworks. Unlike a housing or other commercial development, solar power plants do not necessarily have a total transformative impact, with the footprint of the panels on the ground being restricted to the panel footings. Natural vegetation can be allowed to remain under the panels, provided it does not grow above a certain height, as is proposed for the current development. However, transformation could be greater if the bulk earthworks on the site entailed the terracing of the site to allow flat areas on which the panels could be constructed. If such terracing occurred, the wetland habitat (vegetation) would be removed and the hydrology of the wetlands (in terms of interflow) would be adversely affected. Underground services (such as cabling between the panels) and access roads (see below) would also result in disturbance of / transformation of soils and vegetation.

It should be noted that the updated project description has confirmed that no large-scale earthworks related to terracing of the site is proposed and that the panels would be constructed whilst retaining the current ground levels, although some degree of cut and fill is required. Accordingly, the transformative impact of the PV arrays within wetlands would be comprised of the panel footings, as well as cabling and access roads between the panel arrays. It is not known if cut and fill will occur in any wetlands. This impact must be viewed in the context of the degraded state of the wetlands on the site, particularly with respect to the residual effects of historical cultivation, however the physical disturbance of wetland vegetation and soils would exert a further impact on the wetland areas falling into the solar power plant footprint under this scenario.

It is important to note that roads (internal roads within the development site) could also exert a direct impact on wetlands – an impact of greater intensity and greater physical footprint than the impact associated with the panels themselves. The road footprint is responsible for the direct transformation / loss of wetland habitat, and also constitutes a hard barrier to the movement of both water and biota. Road surfaces and road substrate can present a hydrological barrier to the movement of water (both surface water – especially if the road is raised above ground level – and sub-surface flows). The design of the road (e.g. the degree to which sufficient culverts, or free-draining road substrate were included in the design) would influence the impounding nature of the road. Should insufficient measures to allow free drainage across the road be included in the design, the road could cause an alteration in the hydrology of the wetland by causing ponding and greater saturation upstream of the road and a drying out of the wetland downstream. Insufficient numbers of culverts and improper designs such as level drops can lead to chanellisation of flow and scour that can also lead to hydrological and geomorphological (erosive) degradation of the wetland.

Under the scenario of total site development, indirect impacts could also potentially materialise in the wetland units downstream of the site, i.e. affecting wetland units 1b and 5. The nature of such downstream impacts is detailed in the section below.

Scenario 2 – Indirect Impacts (Exclusion of Wetlands from Development)

Under this scenario wetlands on the site would be excluded from being developed, with the inclusion of a wetland buffer. Accordingly, the wetland units on the site would not be directly impacted unless a linear feature such as an access road or buried underground service were to cross the wetland. Apart from such linear features, only indirect impacts could materialise on the wetlands on the site. Large parts of the catchments of the respective wetland units on, and in the immediate vicinity of the site would be developed. As the sloping catchment areas would naturally drain towards the wetlands the possibility of indirect impacts in the form of stormwater ingress or (shallow) groundwater pollution of the freshwater sites thus exists, as detailed further below.

5.2.5.2 Potential Stormwater-Related Impacts

Stormwater ingress during rain events into wetlands could be an impacting factor in both the construction phase and the operational phase, especially due to the development of hard surfaces (e.g. roads, buildings, parking areas, etc.). During construction stormwater is a particularly significant factor due to the clearing of vegetation that tends to occur on development sites – in this case earthworks could occur where cut and fill occurred. It should be noted that the development plans to retain the natural vegetation with the exception of any trees or larger shrubs (although such vegetation is not present on the development site). Soils within the cleared areas are thus left exposed for a certain period and are accordingly at risk of being eroded and transported as overland flow during heavy rainfall events.

Stormwater will naturally flow downslope, and in the context of the proposed solar power plant, would largely flow north-wards or north-eastwards into the shallow valleyhead in the northern part of the site. There is a pollution and hydrological risk posed by stormwater; stormwater could carry pollutants such as heavy metals or hydrocarbons in solution, or suspended silt that could enter a wetland via overland flow. Should the construction site not be properly managed, such stormwater generated could assist in transporting pollutants into the surrounding environment. During the operation of the facility If measures were not taken to prevent spillages of hazardous materials on the solar power site (e.g. oil contained within the step-up transformers or fuel for an emergency generator stored on the site) such hazardous materials, if spilled / leaked, could be transported by stormwater into the closest freshwater feature in the manner detailed above.

If there is a sufficient volume of stormwater, especially if there are large areas of impermeable surfaces present with minimal infiltration capacity, stormwater discharged into a wetland or other freshwater feature can result in hydromorphological impacts such as erosion that is caused by scour. This is particularly pertinent on the site of the proposed development as the occurrence of duplex soils in parts of the site renders these soils highly erodible. Stormwater discharges thus carry a higher risk of erosion due to these soil characteristics. It is important to note that stormwater could also cause further erosion outside of wetlands (i.e. in their catchments) and could thus result in a higher silt load into the wetlands, which could further degrade the wetland feature.

The intensity of the potential stormwater-related impact during the operational phase of the project would depend on a number of factors, most important of which is whether a buffer area is maintained around the wetlands on the site, and whether stormwater control / attenuation features are installed on the site. In the former case, if a buffer zone was implemented, stormwater that would flow off the site into the buffer area (that would be comprised of grassy vegetation) would be able to be absorbed into the ground, especially due to the presence of relatively easily drained apedal soils that dominate the midslopes surrounding the wetlands on the site. This capacity of the surrounds to impede surface flows is likely to be enhanced by the presence of ridging and furrowing associated with the historical cultivation on the proposed development site which would presumably be retained within the buffer. The low ridging that is aligned parallel to the slope would generally impede surface flows. Stormwater could however be transported more easily down the slopes if it were to run down a path. Such paths that are already 'channelised' could channel overland flow from the site into outer peripheries of the wetland, and accordingly could transport silt into the wetland, that if deposited in large quantities could result in further vegetative alteration of the wetland. The inclusion of a buffer around the wetlands on the site is detailed below.

5.2.5.3 Subsurface Water (Groundwater) Impacts

Potential pollution of shallow groundwater, that includes the sub-surface movement of water just below the surface known as interflow is a potentially greater threat, in the event of pollutants such as hydrocarbons or heavy metals in suspension entering the soil in large volumes. The nature of the soils on the site enhances the potential for the lateral and vertical movement of pollutants within the soil. Freely draining apedal soils are likely to be dominant across most of the site. The presence of an E horizon in a percentage of the soil forms in the area is similarly indicative of such lateral sub-surface soil movement. The presence of interflow is demonstrated in **Figure 82**, in which the arrow indicates a soil pipe exposed by a headcut in the seep unit 1a through which groundwater (interflow) is flowing. If pollutants are discharged / spilled in large quantities, these could be transported through the soils down the slope if they remain in suspension. Although the dynamics of deeper groundwater on the site are unknown, pollutants entering the soil profile on the site and moving vertically into the soil profile could arguably then interact with groundwater within the sandstone bedrock which is intergranular in nature. As groundwater flows on the site are expected to mimic the topography, such pollutants could eventually be discharged as groundwater seepage into the seep wetlands and wider drainage systems, especially into the seep wetlands located below the line of sandstone bedrock outcropping located along part of the northern site boundary from which active groundwater seepage is likely. Mitigation measures should thus be specified and implemented in both the construction and operational phases to prevent the ingress of such pollutants into the soils on the site.

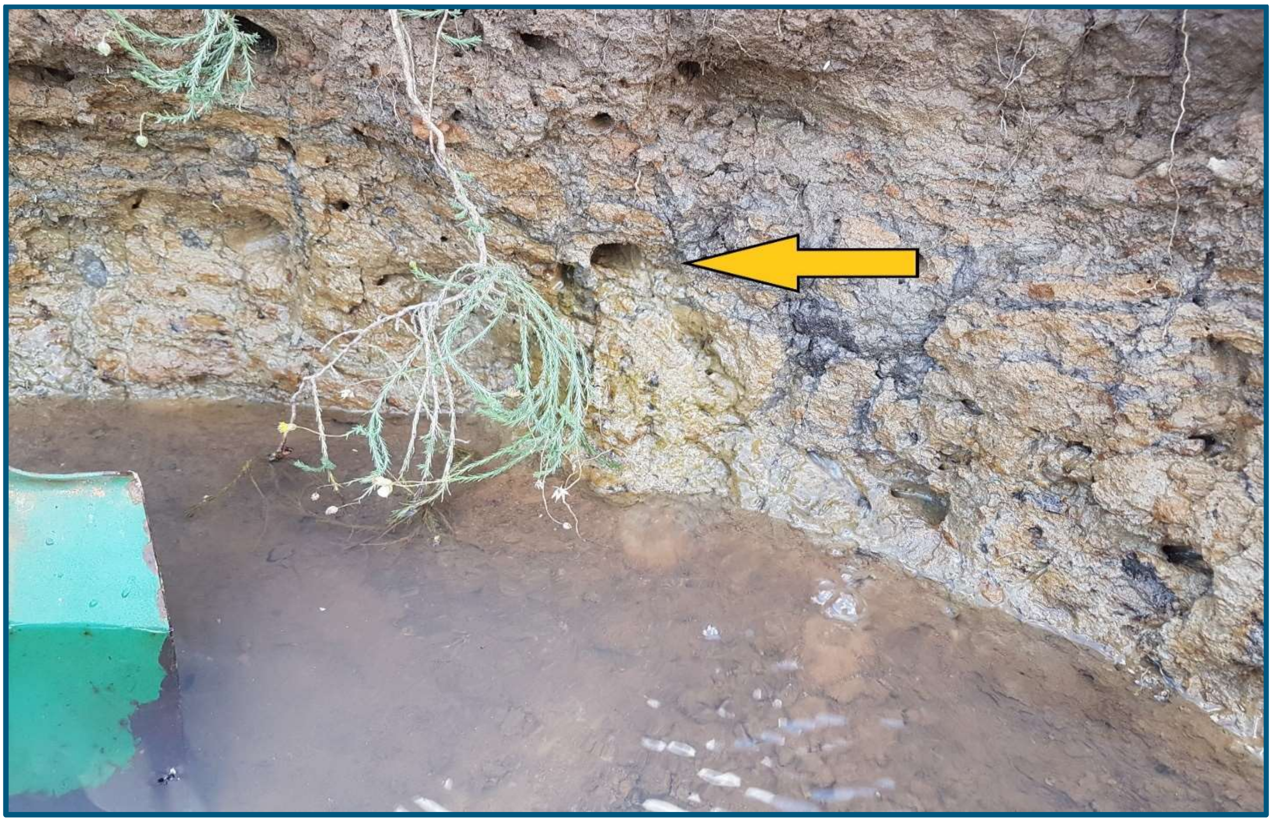

Figure 82: Soil Pipe Exposed by an Active Headcut from Groundwater (interflow)

5.2.5.4 Other General Construction Impacts

General construction-related impacts could occur (e.g. washing of equipment in streams, conducting of 'informal ablutions' within wetlands). Construction vehicle and other equipment access routes can also be a source of physical, transformative impacts, especially if no access roads to a site occur. The road network to the site is formalised (on existing gravel-surface roads) but internal roads will need to be constructed within the development site. Access roads can result in a transformative impact on wetlands but can also adversely affect the hydrology of the wetland by obstructing / effectively impounding both surface and sub-surface flows. Such accesses on the site should preferably avoid crossing wetlands, as detailed in the mitigation measures section.

Abstraction of water for construction purposes can also constitute an impact, especially if it is uncontrolled and un-authorised as part of a water abstraction authorisation process. However, water is proposed to be sourced from a borehole on the site (with the abstraction licenced), or if this is not possible water would be trucked in from municipal source.

Positive Impacts

It is proposed that the entire development site will be fenced with no access to unauthorised people / livestock. Should the wetlands on the site be excluded from the development footprint, it is possible that the development could constitute a positive impact in the respect of wetlands, as livestock will be unable to access the wetlands. One of the most significant impacts currently affecting the wetlands, and accordingly significantly degrading the vegetative state of the wetland is the very high level of livestock grazing in the wetlands. Livestock are at the same time responsible for the trampling of saturated soils in wetlands thus further degrading the vegetative composition, and in a related manner such trampling is a very significant factor contributing to the initiation and further development of headcut and gulley erosion on the site.

Should livestock be removed from the wetlands for the duration of the operational life of the project the grazing and trampling pressure on the wetlands will be removed and the wetland vegetation will naturally recover, in growth structure, and possibly in terms of species composition. This factor alone would be likely to improve the vegetative state of the wetlands on the site, thus improving the overall state (PES) for the wetland units. This would constitute a positive impact on the wetlands on the site that would offset impacts on wetlands that are related to the development of the proposed power plant.

Cumulative Impacts

Cumulative impacts should be considered as part of any development. The development would result in a cumulative impact if this level of impact is increased, or if further parts of wetland units were to be transformed or degraded. The impact assessment section has identified that two types of wetland impacts could result (direct and indirect impacts) and both types would result in the materialising of a cumulative impact. The mitigation measures are thus critical to be implemented to prevent such cumulative impacts.

A separate solar power plant has been proposed in the vicinity of the Neo1 Solar Development site (the 70 MW Ha-Ramarothole Solar Project), with the development proposed in two phases – Phase 1 located immediately to the south-west of the Neo1 development site and Phase 2 being located to the south and south-east of the proposed development site. The ESIA for the proposed project did not include an identification and delineation of the affected wetland areas / wetland habitat on the site, but only included an assessment of water quality of surface water features in the vicinity of the site.

The ESIA report states that the footprint of both phases does not directly impact wetlands, but the introduction of access roads and the construction of the solar farm will increase runoff from paved areas, gravel roads and solar panels lead to increased flooding in the wetland receptor areas. It is important to note that the ESIA does not provide a proposed layout in order to confirm this statement, however the delineation of wetlands in the (500m) radial area on the site indicates that there are significant areas of seep wetland habitat on both the phase 1 and phase 2 sites. Without access to the proposed plant layouts, it cannot be confirmed whether wetlands will be physically affected, however significant seep wetland areas occur on both of the phase sites of the Ha-Ramarothole Solar Project. Should wetlands be physically affected (transformed / degraded) and indirectly impacted, as described in the Ha-Ramarothole Solar Project ESIA report, a cumulative impact will be created should both projects proceed and be developed, as both projects occupy area in which wetlands are located.

5.2.5.5 Wetland Mitigation Measures

In considering the mitigation of impacts on wetlands associated with the development, the first option would be to avoid or prevent impacts, in line with the mitigation hierarchy. As such, with reference to the two development scenarios as detailed in above sections, the second scenario i.e. exclusion of the wetlands from development and inclusion of a buffer zone was recommended as the preferred option for the development on the site. Under this option the environmental status quo would be maintained and no further impacts on wetlands resulting from the proposed development would materialise. This recommendation was made in the context of any wetland and freshwater feature being a sensitive component of the biophysical environment, irrespective of the degree of transformation (state) of that feature, considering wetlands on the site and in the wider area retain a degree of functionality. Under this consideration of freshwater sensitivity, no freshwater feature should be allowed to be further impacted by the proposed development (unless rehabilitation efforts are implemented that allow a no-net loss of biodiversity to materialise. This is important in the context of the mitigation hierarchy as the impacts would be avoided (in the case of direct impacts) and minimised (in the case of undirect stormwater-related impacts).

Under this scenario a buffer around wetlands would be strongly recommended in order to ameliorate the potential indirect impacts of the proposed development on wetlands (as detailed in Section 10.2 above). A buffer zone is a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another (MacFarlane et al, 2015). Buffer zones associated with water resources have been shown to perform a wide range of functions, and on this basis, have been proposed as a standard measure to protect water resources and associated biodiversity. These functions include:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

The extent of the buffer is important to ensure that the buffer functions adequately, and can perform an adequate mitigatory function, however must not be too wide to preclude development on a site. A guideline for the determination of buffer zones for rivers, wetlands and estuaries has been developed by the South African Water Research Commission and provides a useful tool for contextualising and specifying a buffer width that is specific for a certain development type. The buffer tool has been applied to the current development; the initial buffer recommendation was for a buffer of 65m, with the determining factor being the risk of an increase in sediment inputs and turbidity in the construction phase of the development, which for the development type is rated as high. However, considering the implementation of stormwater mitigation measures (with the recommended implementation of stormwater controls for the construction site) that are recommended, this risk can be modified with confidence to a moderate degree of risk with the implementation of adequate mitigation. Should the risk be able to be modified to a moderate degree of risk, the tool recommends a buffer zone of 30m in width. A buffer (non-development area) of 30m was considered adequate and suitable for the proposed development under Development Scenario A, in addition to the wetland areas.

The client's engineering team considered the recommendation of the non-development of wetlands on the development site and the maintenance of an associated non-development buffer and stated that such a measure would threaten the commercial viability of the development by making cost-efficient layouts unfeasible. No option for the increasing of the size / area of the site is possible as this would entail dealing with different landowners (Louise Corbett, pers comm).

Accordingly, the first scenario of developing over the wetlands on the site, would need to be considered. In the context of the mitigation hierarchy, if impacts cannot be avoided or minimised, which would not be possible if wetlands on the site were included in the development footprint without the implementation of mitigation measures, then rehabilitation or offsetting would need to be considered. Under this scenario further impacts would materialise on the wetlands but could be offset by rehabilitation efforts to ensure a principle of no net negative impact. In order to enable the development over wetlands on the site to be part of the recommendation of the report, a suite of rehabilitation measures that would be implemented as part of the construction activities on the site would need to be adhered to. A suite of rehabilitation measures for the wetlands on the site has been recommended, as detailed below.

Proposed Rehabilitation Measures for Headcuts and Gulleys

Two primary options for the rehabilitation of headcuts and gulleys exist:

- The use of rock gabion baskets and reno mattresses; and
- The reprofiling of gulleys and headcuts with large earth moving equipment and associated stabilisation and revegetation.

The majority of headcuts and gulleys on the development site are located in the upper part of the most southern wetland 'tongue' in wetland unit 1a (**Figure 83 and Figure 84**). A series of headcuts and shallow associated gulleys are located from the head (upper or southern-most) part of the tongue to the point at which the seep transitions to a valley bottom. The headcuts are relatively shallow (no more than 1.5m deep) and the associated gulleys are also shallow (approximately 0.5m-1m in depth). Headcuts are also located in part of the valley bottom wetland unit on the site (wetland unit 1b), having developed from drains dug into the wetland, as well as in certain parts of the other seep wetland units on the site located close to the wetland boundaries, or even outside of the wetland boundaries in some cases (including wetland units 1c &2).

The use of rock gabions to stabilise headcuts is the most commonly utilised form of rehabilitation utilised in Southern African wetland rehabilitation projects. Gabions are effective (if properly implemented) as they stabilise the actively eroding head / face of the gulley while at the same time allowing the flow of water through the feature. The rocks within the gabion baskets help to trap sediment and promote the growth of vegetation while preventing the further migration of the feature. Gabion baskets need to be properly keyed into the ground and slopes to ensure that water does not bypass the baskets, thereby moving the area of erosion to behind / upslope of the gabions.

Figure 83: Shallow Gulley Extending Downslope of an Active Headcut.

Note the areas of sheet erosion and loss of vegetation adjacent to the gulley

Figure 84: Example of a Headcut in the Upper (southern) Part of the 'tongue' in Wetland Unit 1a

The second method proposed to rehabilitate the headcuts and gulleys on the site is the use of earth moving equipment to infill the feature and to re-profile the erosion feature to re-establish the natural slope. This method is the technically-favoured method to deal with gulley and headcut erosion on the site. This rehabilitation method is feasible due to a number of reasons:

- Most of the headcuts and associated gulleys on the site are shallow thus able to be infilled; and
- The southern wetland tongue in which most of the headcuts are located is not hydrologically characterised as a fluvial environment i.e. no permanent / seasonal surface flows are present in the wetland.

The reprofiling / re-landscaping of the headcut features is also recommended to address the root problem of many of the headcuts and erosion on the site, which is the erosion of the areas upslope of and adjacent to the vicinity due to the excess movement (trampling) of soils and vegetation around the wetland and gulleys by livestock, which has led to the development of areas of sheet erosion and smaller lateral headcuts and rills. The infilling and stabilisation of these areas with topsoil (twinned with the removal of livestock from the site) will assist in addressing the source of the erosion within the wetland.

The second proposed method i.e. infilling and slope re-profiling is the recommended rehabilitation measure for the majority of the headcuts and gulleys on the site. For certain headcuts (i.e. the headcut in the upper part of wetland unit 2, a combination of gabions and slope reprofiling and importation of topsoil and associated revegetation is recommended (refer to **Figure 85**). It is very important that the methods utilised to stabilise the re-profiled soils on sites are designed in the context of the presence of both overland and sub-surface flows in the wetland. The former is likely to occur occasionally (after significant rainfall events), whilst the latter (i.e. interflow) is likely to be much more permanently-occurring within the wetlands. The use of reno mattresses in certain of the gulleys on the site may thus be required to stabilise soils in a context of seasonally or permanently saturated soils on the site.

Figure 85: Headcut in the Upper Part of Wetland Unit 2

Proposed Rehabilitation Measures for Ridges and Furrows

Ridging and furrowing is present across most of the site, both inside the wetlands and outside of the wetlands. The origin of the ridging and furrowing is unclear; however, it is likely to relate to historical cultivation of crops on the site. Ridging of soil may also have been historically created on the site to impound runoff water and to improve vegetation for grazing purposes. In this way the ridging and furrows / drains alter the natural hydrology of water by disrupting the natural overland flow of water in most of the wetland areas on the site. The deeper furrows / drains are a particularly significant impacting factor as they channel water from within the wetland, thereby drying out the wetland, and in a number of sites within the wetland are directly related to active headcut erosion in the wetland.

The infilling of drains is the primary measure proposed in most parts of the wetlands on site to remediate the effects of drains / furrows. Drains / furrows can either be entirely filled to restore the natural ground level (preferred in the context of the shallow depth of most of the drains / furrows on the site), or soil plugs (comprised of a soil type that is largely impermeable preferably clay) can be placed at 5m intervals within the drains to impound flows that are concentrated within the drain (**Figure 86**).

Figure 86: Example of a Drain Associated with a Ridge Behind it

In certain cases, ridging and furrowing has occurred to the extent that a terraced effect has been created. In such cases the reprofiling of the 'terraced' area to restore the natural slope is recommended. This must be accompanied by the requisite revegetation of topsoil (e.g. through hydroseeding) and the protection of soils, e.g. with the use of measures such as geotextile pegged into soils to protect exposed soils from erosional forces such as wind and water.

It should be noted that in rehabilitation measures for ridges and furrows are focussed on the longer / deeper / higher furrows and ridges and in particular for those located in sloping settings. In certain parts of the wetlands that are flatter, the recommendation has been made to leave shallow riding / furrowing in its current state, as such ridging furrowing in effect enhances the functioning of the wetland by increasing the surface roughness of the wetland, thereby increasing the retention of water in the wetland. Flattening the wetland surface in these cases would be counterproductive. Forty-five (45) Sites for rehabilitation action have been identified in the wetlands on the site, and in a few cases just off the site. The off-site rehabilitation sites have been included in the rehabilitation plan as the impacts, if left unattended, will affect the wetlands on the site.

Should the rehabilitation efforts be successfully undertaken according to the methodologies stipulated above, the improvement in wetland functioning and wetland habitat quality will offset the loss of wetland habitat associated with the development of solar power infrastructure in the wetland. In this way the development will adhere to the principles of no-net loss of biodiversity (in the context of wetland habitat) as espoused in the IFC guidelines and the mitigation hierarchy. It is important to note however, that rehabilitation of wetland habitat is not a once-off effort, and the monitoring of rehabilitation sites post-rehabilitation (construction) will be necessary. Follow up rehabilitation efforts, especially in the context of revegetation, protection of exposed soils and remediation of developing erosion is likely to be required on the site and part of the operational budget for the development must be set aside for such purposes.

Works in Parts of Wetlands with Higher-Sensitivity, Intact Habitat

The rehabilitation measures field trip was utilised to identify the parts of the wetlands on the site that are most sensitive in respective of being containing the most intact and least disturbed wetland habitat on the site refer to **Figure 87**. The field visit was conducted immediately after a period of heavy rainfall at the end of the summer rainy season. This offered an excellent opportunity to assess the effect of the impacting features, especially drains, gulleys and headcuts, on the wetland areas on the site and to identify any parts of the wetland which are not significantly affected by such impacting factors, and which thus contain relatively intact wetland habitat in spite of the overall state of degradation of wetlands on the site.

Ideally these parts of the wetlands on the site should be maintained as free of development or infrastructural impacts as possible. A recommendation has been made that these parts of the wetlands be kept free of the higher impact infrastructure, in particular roads and inverter stations. The feedback from the engineering team has been received regarding development in these more sensitive parts of the site; the most intact and sensitive parts of the wetlands on the site cannot be avoided. Options for layout optimisation to completely avoid these areas were investigated but placing PV substructure in these parts of the wetland would not allow the desired DC capacity to be met. However, in this context works in the most sensitive parts of the wetlands on site would be limited to:

- Ramming of piles for substructure;
- Cable trenching;
- Civil work required for stormwater management and proposed Rehab Measures stemming from Freshwater Assessment.

Accordingly, no roads or inverter stations would be placed in these wetland areas, thereby reducing the impact of the proposed development in these parts of the wetlands on the site.

Other Measures to Reduce the Impact of Infrastructure on Wetlands

The engineering design team for the project examined the layout with the purpose of identifying any measures to reduce or ameliorate the impact of the development components on the wetland. Certain infrastructure cannot be relocated, i.e. the boundary fence and patrol road along the boundary, both of which would cross wetlands. As per the feedback of the engineers, design measures have been specified (below) to mitigate the impact of this infrastructure on wetlands:

- Due to the technical layout needs of the development, the internal road running east-west over the site cannot totally avoid crossing wetland habitat. However, the road is able to be shifted slightly to the south to reduce the impact area of wetland habitat crossed;
- Inverter Stations – No inverter stations (which have a footprint on the ground, and which would have foundations) would be placed in any wetland area;
- The location of the MV Switching station can be moved to the west to avoid the wetland areas completely.

In addition, it is very important that the proposed laydown area that is located in the south-western part of the site is not located within a wetland area. **The laydown area that is shown to straddle the part of the seep wetland unit 1a must be relocated to lie outside of the wetland,** with the use of areas in the south western part of the development area that do not occupy wetland habitat.

Design Measures for Cabling (trenching)

Cabling is required as part of the development and cables are required to be buried. Cabling in wetland areas will thus require the excavation of soils, which will entail the physical disturbance of wetland habitat. However subject to the implementation of the mitigation measures below, underground cabling in wetlands will not have a permanent adverse impact on wetlands. The following mitigation measures are stipulated:

- Trenching must be undertaken with a light tracked vehicle (e.g. a Bobcat) that will not cause undue compaction of wetland soils in the vicinity of the cable trench.
- Duplex soils are present over much of the wetland areas on the site, and in this context, it is very important that excavated topsoils be stored separately to subsoils. Subsoils must be returned first to the trench with topsoil's placed above.
- No imported free-draining material must be placed around the cabling in the trench, as this free-draining material could become a path for preferential subsurface drainage within the trench, especially in sloping settings (i.e. where the trench runs down the slope). This free- draining effect would adversely affect the subsurface hydrology of the wetland, as the trench would act as a form of drain.
- Soils must be reinstated in the trench in a manner in which the trench does not become a surface furrow or ridge. Accordingly, on reinstatement, the topsoil must be reinstated to be slightly above the natural ground level to accommodate soil settling within the trench over time.

Design Measures for the Internal Access Road located in Wetlands

- Where the boundary road crosses the valley bottom wetland unit 1b, on the northern perimeter of the site, it is recommended that culverts or drainage features must be included in the design of the road. As detailed below, roads in wetlands must contain free-draining aggregate in the road sub-surface, but the presence of outcropping of / shallow sandstone bedrock may make this stipulation not possible. In this case culverts placed above the bedrock must be implemented as part of the road design; and
- The latest conceptual layout indicates that a single access road can be aligned in an east-west orientation and will bisect the seep wetlands on the site (wetland unit 1a). The engineering design team

have indicated that such a road will be a compacted dirt road. The road must not act to impound surface or sub-surface flows. As such the road surface should be placed at ground level to allow surface flows to bypass it. Any road substrate must not be impermeable, thereby preventing the lateral movement of subsurface flows (interflow). If the road design includes a sub-surface road base, this base must allow the movement of water.

Other Design-Related Mitigation Measures

Other potential mitigation measures that needs to be implemented during the design finalisation are listed below also refer to **Figure 88**.

- Shifting the road as far as south as possible to avoid wetlands;
- Locating inverter stations and the MV switching station outside of wetland areas;
- Shifting the laydown area out of the wetland; and
- Utilising the vacant non-wetland part of the site for development.

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Table 80: Wetland Impacts at Construction Phase

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Construction of the solar power plant utilising the current layout i.e. developing the entire area of the development site. Direct transformative impact on wetlands related to bulk earthworks (potential terracing of the site) and other clearing activities, as well as other construction-related activities including uncontrolled movement of vehicles and other construction machinery in wetlands.	Without Mitigation	-2	-2	-3	-4	**-11**	Negative High
		With Mitigation	-1	-2	-3	-4	**-10**	Negative High
SUMMARY OF MITIGATION MEASURES		▪ Clearing of areas to be completed in a phased manner. ▪ Implementation of Stormwater Control Measures on the construction site. ▪ Construction staff must not interact with the wetlands and surface water features outside of the site footprint that causes pollution to these features. ▪ Implementation of rehabilitation efforts as identified in the wetland rehabilitation plan for the site.						

Table 81: Wetland Impacts at Operational Phase

PHASE: OPERATIONAL								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	▪ Operation of solar power plant utilising the current layout i.e. developing the entire area of the development site. ▪ Direct transformative / degradative impact on wetlands related to terracing of site, development of roads or placing of panels on the natural slope, along with roads and buried services. ▪ Potential pollution of wetlands in the event of spillage of hazardous materials.	Without Mitigation	-2	-3	-3	-4	**-12**	**Negative High**
		With Mitigation	+2	+3	+2	+3	**+10**	**Positive High**
SUMMARY OF MITIGATION MEASURES	▪ Non-terracing of the site, rather development of panels on the natural slope with limited cut and fill and retention of natural vegetation. ▪ Implementation of stormwater-related design mitigation and pollution control measures. ▪ Implementation of rehabilitation efforts as identified in the wetland rehabilitation plan for the site. ▪ Exclusion of livestock from the site.							

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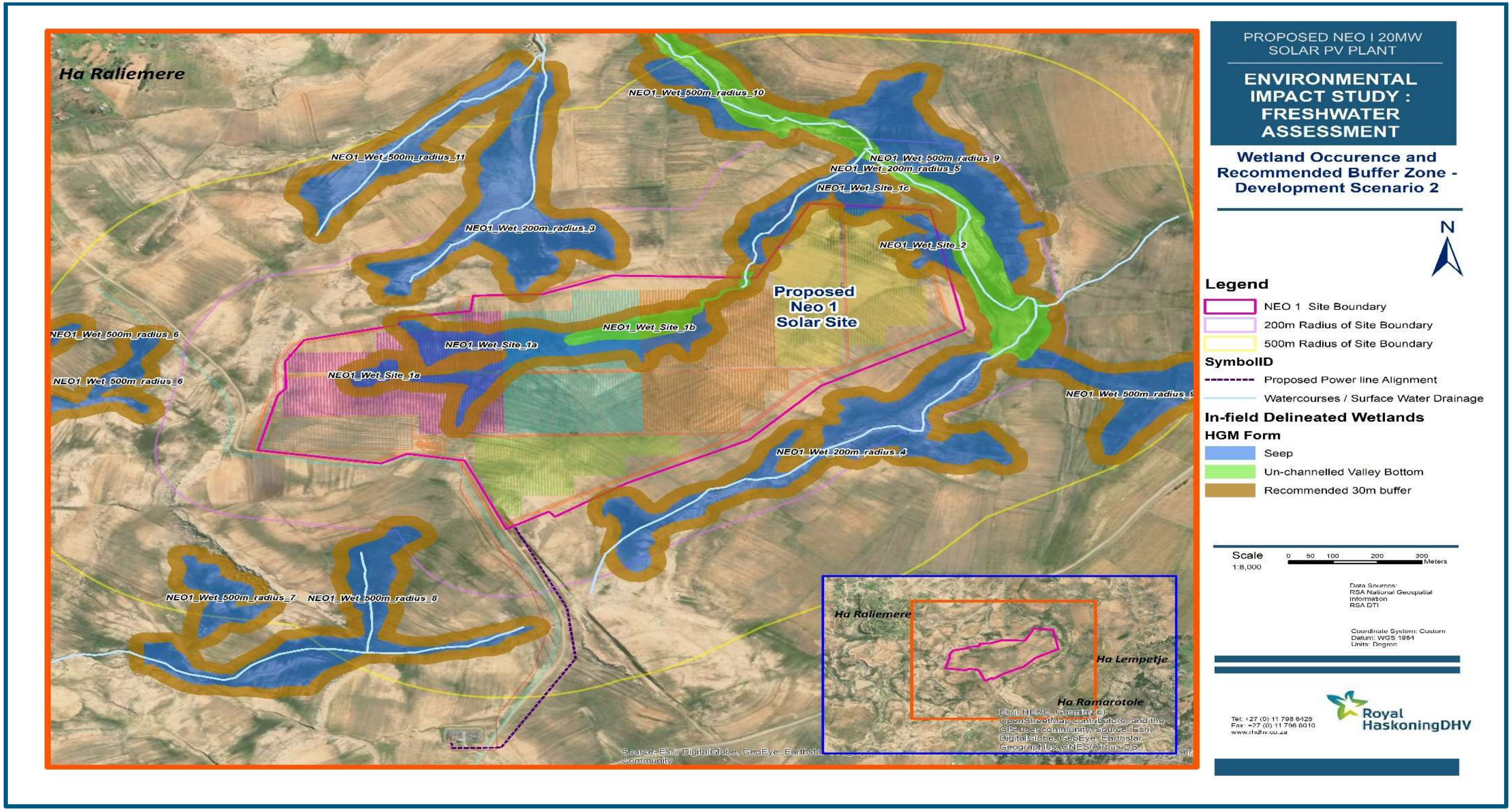

Figure 87: Implication of the 30m-wide Buffer Area around Wetlands and in the Vicinity of the Development Site

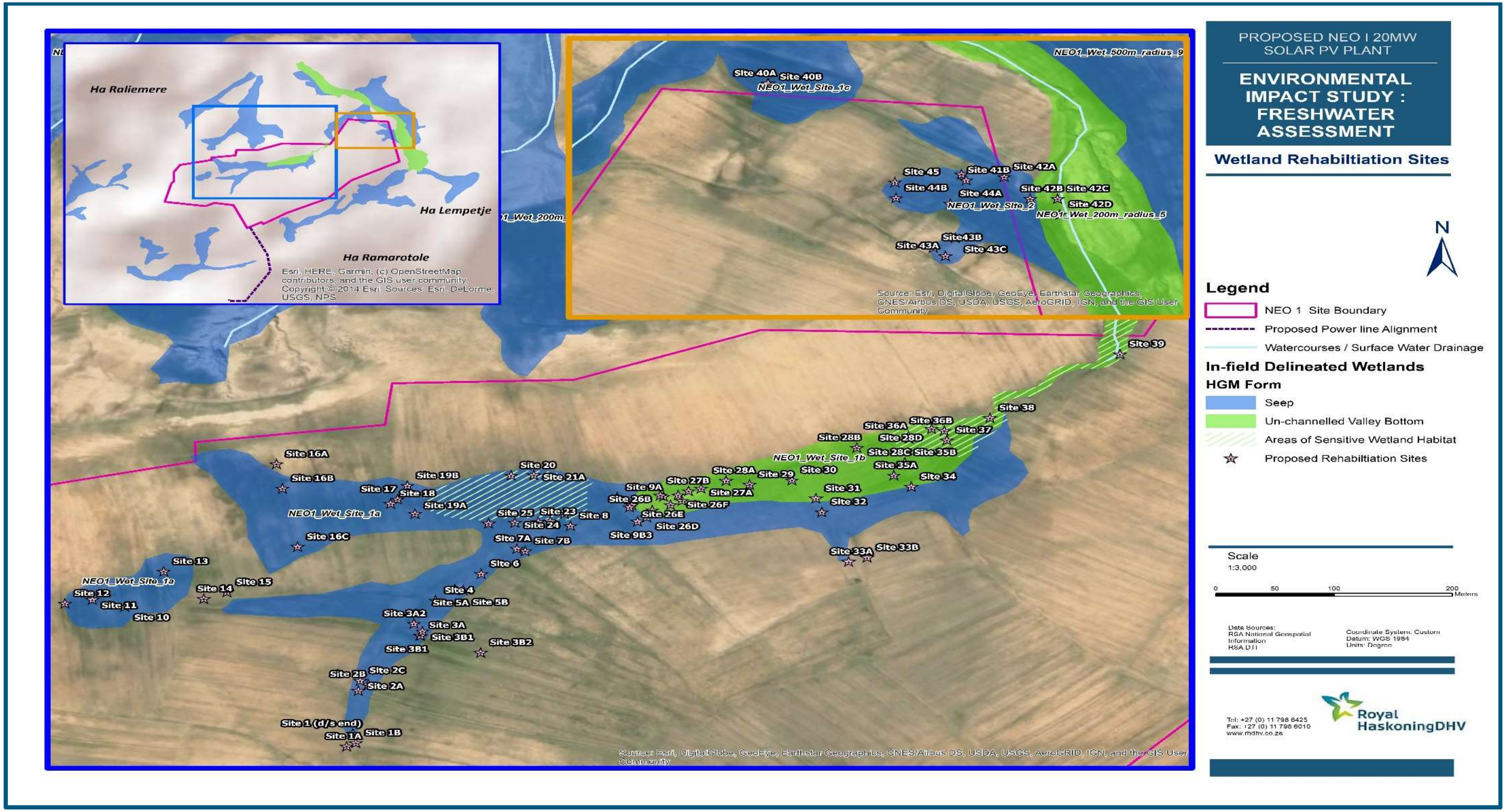

Figure 88: Sites of Proposed Rehabilitation Actions in the Wetlands on the Development Site

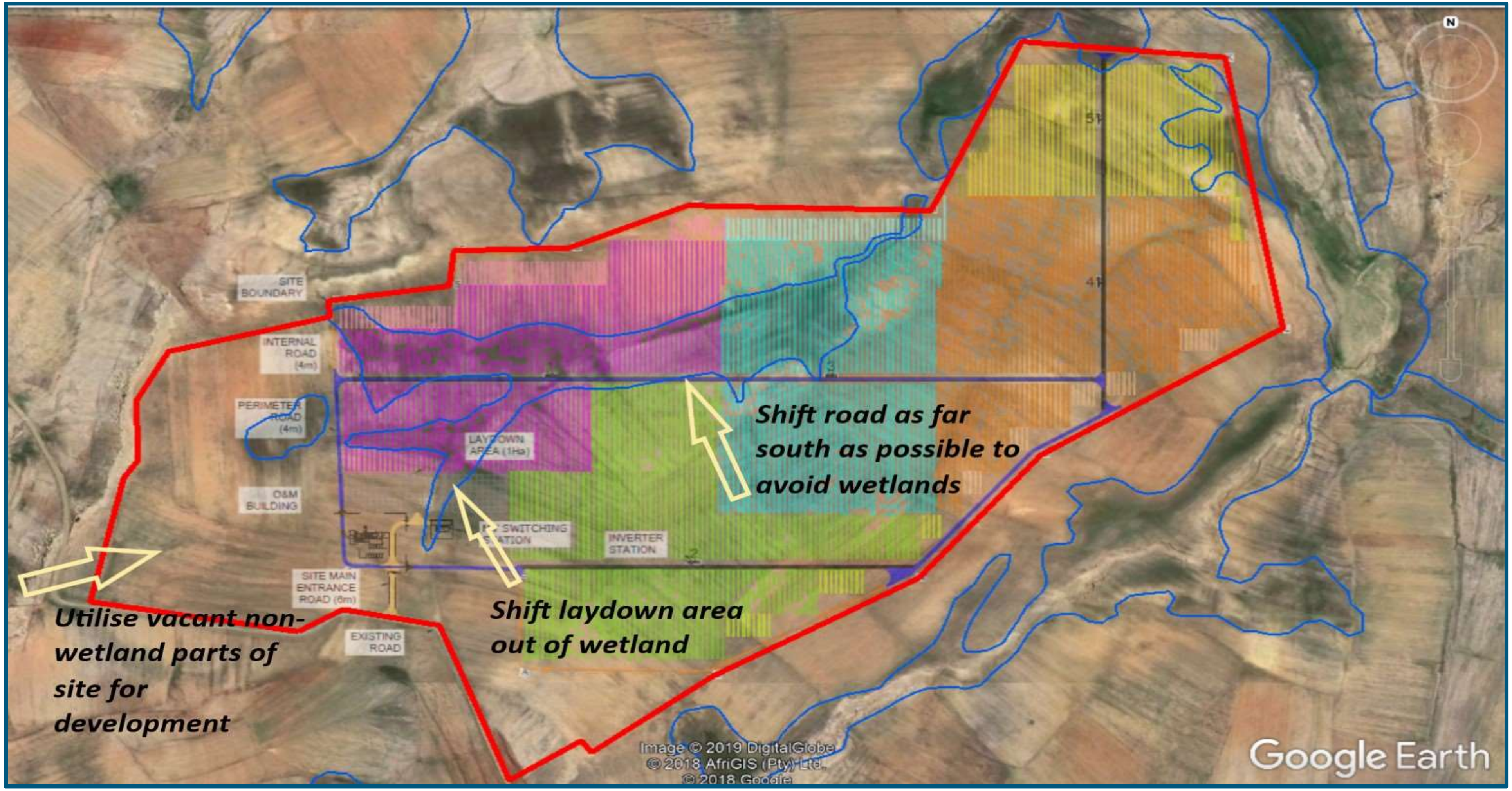

Figure 89: Updated conceptual Layout and Proposed Design / Layout Measures to Minimise Wetland Impacts

5.2.6 Assessment of Visual Impacts

5.2.6.1 Generic Aspects of Visual Impacts Associated with Developments and Structures

Before exploring the site-specific impacts associated with the proposed development, it is necessary to explore some generic aspects of visual impact as associated with new developments such as the proposed solar power development.

Size and Footprint of an Object/ Development

Size of a new object / series of objects placed into a landscape is an important determinant in terms of visibility. The larger a structural feature, the more it is likely to be visible. Spatial footprint is also an important factor, as the larger the spatial footprint of a development, the more it will be likely to occupy a large portion of a landscape, thus having a greater potential to alter the visual character of the landscape.

Viewing Distance

The distance of the viewer / receptor location away from an object is the most important factor in the context of the experiencing of visual impacts. Beyond a certain distance, even large structural features tend to be much less visible and are difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially with increasing distance away from the object, with maximum impact being exerted on receptors at a distance of 500m or less. The impact decreases exponentially as one moves away from the source of impact, with the impact at 1000m being a quarter of the impact at 500m away (Refer to **Figure 90**). At 5000m away or more, the impact would be negligible.

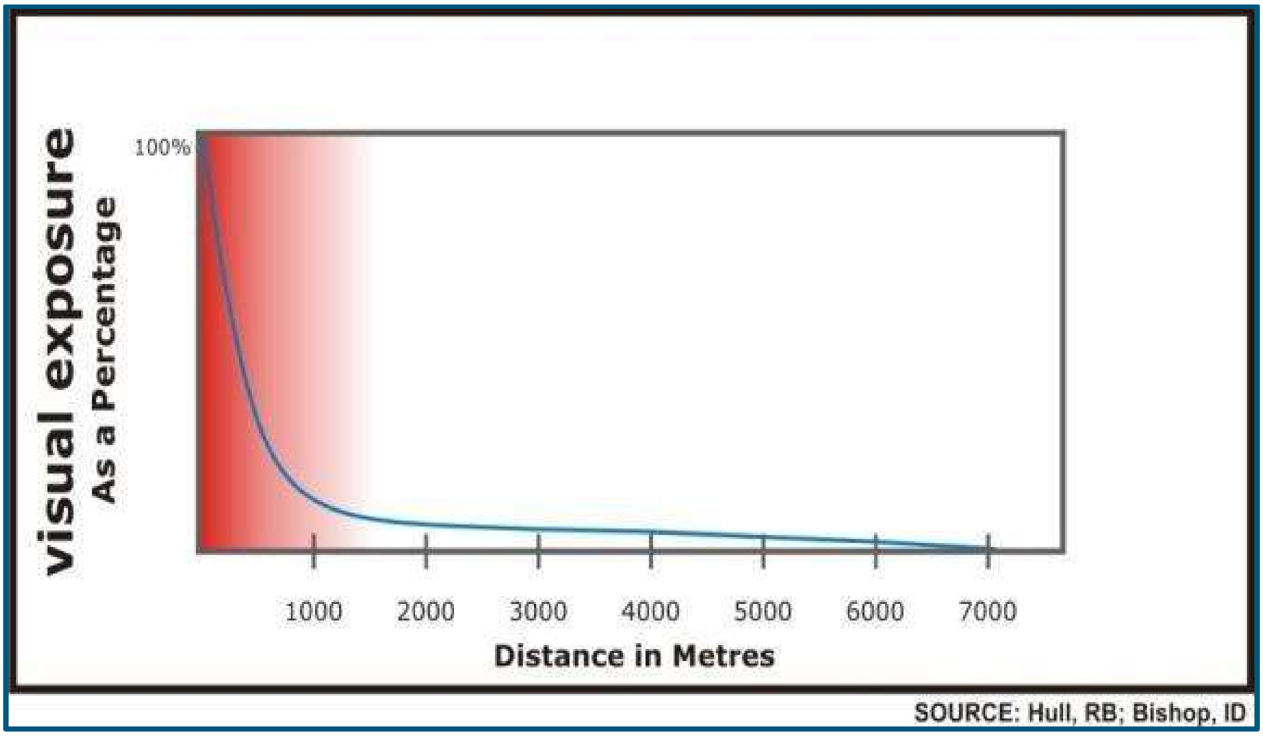

Figure 90: Diagram Illustrating Diminishing Visual Exposure over Distance

Presence of Receptors

It is important to note that visual impacts are only experienced when there are receptors present to experience the impact; thus, in a context where there are no human receptors or viewers present there are not likely to be any visual impacts experienced.

Viewer Perception

As described above, value can be placed in a landscape in terms of its aesthetic quality, or in terms of its sense of identity or sense of place with which it is associated. If no such values are held with respect to a landscape, there is less likely to a perception of visual impact if the landscape is visually altered. Development within a landscape may not be perceived negatively at all if the development is associated with progress or upliftment of the human condition. The perception of visual impacts is thus highly subjective and thus involves 'value judgements' on behalf of the receptor. The context of the landscape character, the scenic / aesthetic value of an area, and the types of land use practiced tend to affect the perception of whether new developments are considered to be an unwelcome intrusion. Sensitivity to visual impacts is typically most pronounced in areas set aside for the conservation of the natural environment (such as protected natural areas or conservancies), or in areas in which the natural character or scenic beauty of the area acts as a draw card for visitors (tourists) to visit an area, and accordingly where amenity and utilitarian ecological values are associated with the landscape.

When landscapes have a highly natural or scenic character, amenity values are typically associated with such a landscape. Structural features such as industrial / power generation developments and related infrastructure are not a feature of the natural environment but are rather representative of human (anthropogenic) change to a landscape. Thus, when placed in a largely natural landscape, such structural features can be perceived to be highly incongruous in the context of the setting, especially if they affect or change the visual quality of a landscape. It is in this context of incongruity with a natural setting that new developments are often perceived to be a source of visual impact.

Landform (topographical) and Micro-topographical Context

The landform context of the environment in which the object is placed is an important factor. The location of the feature within the landform setting – i.e. in a valley bottom or on a ridge top is important in determining the relative visibility of the feature. In the latter case, the feature would be much more visible and would 'break' the horizon, if a viewer was located 'inferior' (lower than) to the object in the topographical context. Similarly, the landform context in which the viewer is located is important in that topography can inherently block views towards an object if the viewer is located in a setting such as a steep-sided valley or on an aspect facing away from the object.

The micro-topography within the landscape setting in which the viewer and object are located is also important; the presence of micro-topographical features and objects such as buildings or vegetation that would screen views from a receptor position to an object can remove any visual impact factor associated with it.

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Landscape Development Context

The presence / existence of other anthropogenic objects associated with the built environment may influence the perception of whether a new development is associated with a visual impact. Where buildings and other infrastructure exists, the visual environment could be considered to be already altered from a natural context and thus the introduction of a new structural feature into this setting may be considered to be less of a visual impact than if there was no existing built infrastructure visible.

Receptor Type and Nature of the View

Visual impacts can be experienced by different types of receptors, such as people driving along roads, or people living / working in the area in which the structural feature is visible. The receptor type in turn affects the nature of the typical 'view' of a potential source of visual impact, with views being permanent in the case of a residence or other place of human habitation, or transient in the case of vehicles moving along a road. The nature of the view experienced affects the intensity of the visual impact experienced.

Weather and Visibility

Meteorological factors, such as weather conditions (presence of haze, or heavy mist) which would affect visibility can impact the nature and intensity of a potential visual impact associated with a structural feature.

5.2.6.2 Visual Impacts Related to Solar Power Plants

Generic Features Common to All Types of Solar Power

It is important to note that the development and associated environmental assessment of solar power plants in Southern Africa is relatively new, and thus it is valuable to draw on international experience. Thus, this section of the report draws on international literature and web material to describe the generic impacts associated with solar power.

In general, solar power generating facilities need to occupy a very large area in comparison to other types of power generation facilities relative to the level of power output generated (Sullivan *et al*, 2012). This is an important component of the visual aspect of solar power plants as they can occupy large parts of a landscape, especially when viewed from an elevated position.

The large size, strong regular geometry of solar facilities, and the use of mirrors or glass panels with metal supporting structures, may result in high visual contrast being created that is visible for long distances in many instances (Sullivan *et al*, 2012). In favourable viewing conditions, large facilities can be visible from a distance of 16km or greater; it should be noted however that viewed from such long distances, the facilities may not be recognisable as solar facilities (Sullivan, *et al*, 2012). Built structures associated with solar power facilities would introduce complex, rectilinear geometric forms and lines and artificial looking textures and colours into the landscape; these would typically contrast markedly with natural appearing landscapes (US Department of Interior, 2013).

Previous studies have indicated that the ancillary infrastructure (in addition to the arrays of panels or mirrors) such as substations or cooling towers are also important in contributing towards observed visual contrasts and visual intrusion, particularly in the case of concentrating solar facilities (Sullivan *et al*, 2012). The visual impacts associated with this ancillary infrastructure is most pronounced in the case of views towards facilities from a low angle or low elevation, where the viewer is on the same, or lower horizontal plane as the facility. From low viewing angles, taller structures such as cooling towers extend far above the much lower collector

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arrays, creating a vertical contrast, and being particularly prominent if they extend above the horizon. If metallic (or containing metallic components), these can also be associated with glinting or glare.

A commonly expressed concern is whether glint or glare would negatively affect aircraft flying above the facility. It should be noted that in recent times several large-scale solar projects have been completed and constructed at or near certain major airports in the USA (such as Denver International Airport or the Oakland FedEx International Airport Hub) without any reports of such problems (Power Engineers, 2010). It should be noted however that the solar power facilities at these airports are solar panel facilities that are typically low in reflectivity. Such low reflectivity is likely to be present in the context of the proposed development.

As most solar power plants tend to be located in vacant or uninhabited areas due to space availability, the landscape context is often natural; in this context the solar field could be considered to be a visual intrusion that possibly acts to alter the visual environment, especially if the pre-development visual context is natural. The level of visual exposure to the power plant (and potential visual intrusion of the facility) is dependent on the location of the solar fields in relation to receptor locations.

- **Photovoltaic Panels**

The nature of the visual impact is dependent on the type of technology used – PV or CSP (Concentrated Solar Power). The proposed development comprises of Photovoltaic (PV) technology; this is comprised of PV panels, which grouped together form a 'solar field'. Each PV panel is typically a large structure, being between 5m and 10m in height (equivalent to one and a half storeys to two and a half storeys in height). The height of these objects would make them visible, especially in the context of a flat landscape. More importantly, the concentration of these panels will enhance their visibility, and depending on the number of panels in each solar field, and thus its spatial extent (or footprint) could become an important focal point in a landscape, especially if the landscape is natural in character.

Because PV solar facilities do not require infrastructure associated with heating, transporting, boiling, and cooling water and other heat transfer fluids, in general they contain fewer large / complex structures (the are 'visually simpler') than parabolic trough and power tower facilities (Sullivan et al, 2012). It is important to note that PV panels are usually smaller in height than parabolic troughs, thus being slightly less visible. The low profiles of solar collector arrays of PV and parabolic trough facilities entail that these are typically able to be fully or partially screened by bushy vegetation in flat landscapes where viewpoints are not elevated (U.S Department of the Interior, 2013).

Although PV facilities are not associated with glare, PV plants can create increased visibility and contrast through the creation of geometric patterns of reflected light caused by simultaneous reflection of sunlight from regularly-spaced metal surfaces in the collector array. In the case of PV facilities this could be due to the presence of metal surfaces in the gaps between the PV modules. It should be noted that these may not necessarily cause discomfort to the viewer and may change dramatically as the observer moves (Sullivan et al, 2012).

It is important to note the array will almost always appear mostly black when viewed from the south, because the panels would face north to maximise the solar radiation exposure, thus entailing that the undersides would generally be in shadow Sullivan et al, 2012).

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Buildings and other structures such as tanks could be of sufficient height to protrude above collector arrays as viewed from outside the facility and would likely contrast with the collector arrays in terms of form, line, and colour (US Department of the Interior, 2013).

- **Vegetation Clearing**

One of the important potential indirect impacts of a solar power development relates to the clearing of natural vegetation. Clearing of vegetation could result in the potential loss of vegetative screening, which would result in the opening of views. Importantly in a visual contrast context the clearing of vegetation could result in the exposure of soils which could contrast with the colour of surrounding natural vegetation as well as potentially creating significant changes in form, line, colour, and texture for viewers close to the solar field. Lastly (especially in arid settings in which solar power plants are often developed) vegetation removal could result in windblown dust which could constitute an indirect visual impact (US Department of the Interior, 2013).

All of the above components of the proposed development will require the clearing of vegetation, to differing degrees. This clearing will be most intensive in instances where the land will need to be graded and terraced where necessary, in order to provide a level surface for foundations. However, no terracing on the development site is proposed; limited cut and fill will be required but for the most part the natural gradient of the land will be retained, and the natural grassy vegetation will be largely retained. This practice of clearing vegetation will intensify the visibility of the solar energy facility, particularly in locations where natural woody vegetation would exist, but to a lesser degree when the proposed facility is located on land where woody vegetation does not occur, as in the case of the development site.

- **Lighting**

Due to the nature of solar power plants which would primarily be operational during sunlit (daylight) hours, lighting (at night) is not a major operational component of such facilities. However solar power generation facilities would include exterior lighting around buildings, parking areas, and other work areas, as well as security and other lighting around and on support structures (e.g., the control building) (US department of the Interior, 2013). In the context of a natural setting in which there would be little to no lighting, visible lighting at solar power generation facilities could constitute light pollution, especially in settings where landuses and activities (e.g. ecotourism establishments) which value the absence of lighting in a natural setting. Maintenance activities conducted at night, such as mirror or panel washing might require vehicle-mounted lights, which could also contribute to light pollution (US department of the Interior, 2013). Light pollution impacts associated with utility-scale solar facilities include sky glow, light trespass, and glare (US department of the Interior, 2013).

- **Access Roads**

Roads can be associated with visual impacts, especially in the context of a road being constructed into a natural / rural visual context where there is no existing infrastructure. Viewed from a distance, roads can be responsible for creating an artificial “band” (a contrasting linear form with two roughly parallel edges dividing an area in two) in the landscape which draws the viewer’s attention, and which may create a new visual contrast in the landscape. The traffic along the road could heighten the perceived visual impact, especially if traffic volumes along the road are high, if heavy vehicles travelling on a road create large amounts of dust

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which rise into the air and which can be highly visible, and if vehicles travel along the road at night when lighting may create visual intrusion and light pollution in an otherwise dark rural night-time context.

Road access to the development site is existing, and as such no new access roads will be developed. Access roads will be developed on the site itself, but these will not be visible on their own and will form part of the visual configuration of the plant.

5.2.6.3 Site Context and Potential Visual Exposure Associated with the Proposed Development

As distance is a significant factor in the experiencing of visual impacts, the site context is important in how impacts associated with the proposed development on the development site are likely to be experienced. **Figure 90** above indicates the proposed location of the power generation facilities on the site in relation to the sensitive receptors on the site. Distance banding from the proposed facility footprint has been used to determine the zone of likely visual exposure to the facilities into which the respective receptor locations would fall. Increasing distance from the proposed facility footprint has been used to give an indication of the likely visibility or potential degree of visual exposure to the solar plant developments from different parts of the study area. The following zones (distance bandings) have been utilised:

- <2km – zone of high potential visual exposure;
- 2km-5km – zone of moderate potential visual exposure; and
- >5km – zone of low potential visual exposure.

As visible in **Figure 91** five (5) villages fall into the area of high visual exposure, while a further three (3) are partly located in this zone. These villages are located in different directions from the site, and thus topography will perform an important role in affecting the realistic degree of visual exposure. **Table 82** below indicates the degree to which the development site will be able to be viewed from these receptor locations.

Table 82: Visual Exposure Factors at Static Receptor Locations within a 2km Radius of the Development Site

RECEPTOR LOCATION	DISTANCE OF CLOSEST POINT OF VILLAGE TO THE SITE	VISUAL EXPOSURE OF DEVELOPMENT SITE TO THE RECEPTOR LOCATION DUE TO LOCAL TOPOGRAPHY	OVERALL DEGREE OF VISUAL EXPOSURE
Ha Raliemere Village (refer to Figure 91 & 94)	560m	High+ – Village located on local high point (crest) with south / south-east-facing aspect towards the development site +Note part of the village is located on the northern side of a local high point and these parts of the village will have no visual exposure to the site.	**High+ / None**
(Ha Lempetje) Village (refer to Figure 92)	640m	High+ – Village located on ground higher (especially parts of the village located on the slopes of a local koppie/outcropping) than much of the site, on the opposite side of the valley to the site +Note part of the village is located on the north-eastern / eastern side of a local high point and these parts of the village will have no or limited visual exposure to the site.	**High+ / None**
Village to the South	800m	None or Low – Village located in lower-lying ground than the site with intervening higher-lying ground, and site slopes down to the north (in the opposite direction), hence most of the village will have no visual exposure to	**None**

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RECEPTOR LOCATION	DISTANCE OF CLOSEST POINT OF VILLAGE TO THE SITE	VISUAL EXPOSURE OF DEVELOPMENT SITE TO THE RECEPTOR LOCATION DUE TO LOCAL TOPOGRAPHY	OVERALL DEGREE OF VISUAL EXPOSURE
(refer to Figure 93)		the development site. Only the southern-most parts of the village on higher-lying ground on the slopes of a koppie would be exposed to views of a limited part of the site	
Ha Ramorothole	1000m	None – Village located on ground that slopes down to the southeast with intervening higher-lying ground between the village and the site. The site slopes down to the north (in the opposite direction), hence the village will have no visual exposure to the development site.	**None**
Village to the North-east (partly in 2km radial area)	1450m	Moderate – Village located on high-lying ground, with line of sight to the to the development site which is located on a northern / north-eastern aspect which faces this village. The southern edge of the village would be the only part of the village with a line of site to the site, with a distance factor reducing visual exposure. The lower-lying parts of the site close to the valley bottom would not be visible from the village.	**Low**
Ha Lempetje (2 villages partly in 2km radial area)	1360 / 1600m	None – Villages are located in a valley head that is lower -lying than Sepechele that lies between the site and these villages. There is accordingly no line of sight to the development site, hence the villages will have no visual exposure to the development site.	**None**

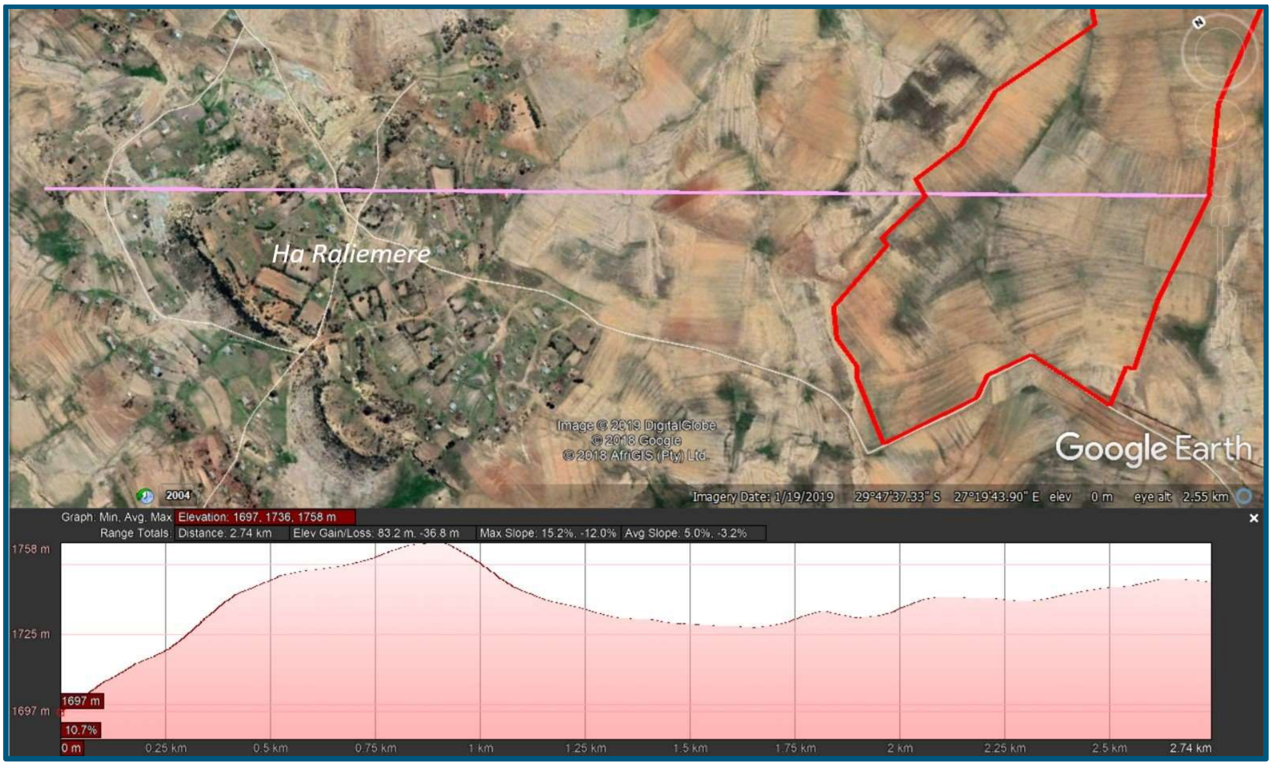

Figure 91: Elevation Profile from the Development Site North-Westwards to Ha Raliemere Village

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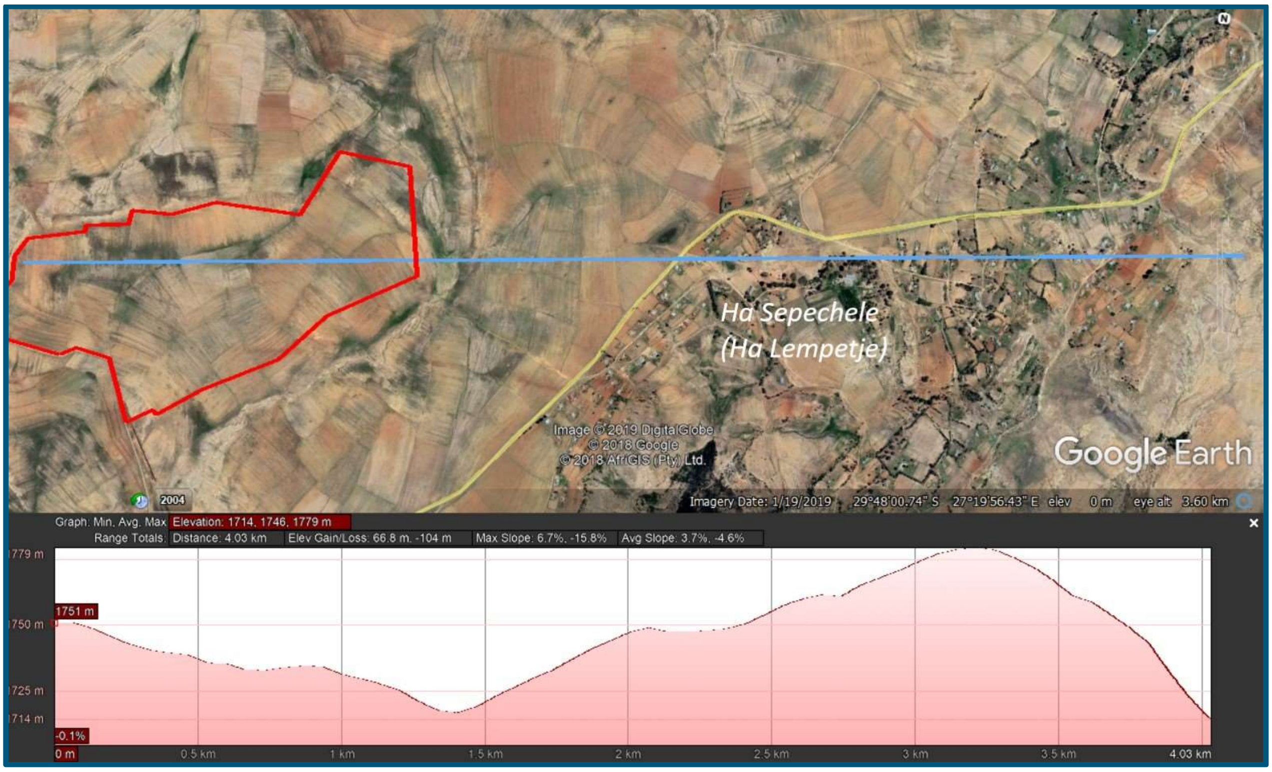

Figure 92: Elevation Profile from the Development Site East to Ha Sepechele (Ha Lempetje) Village

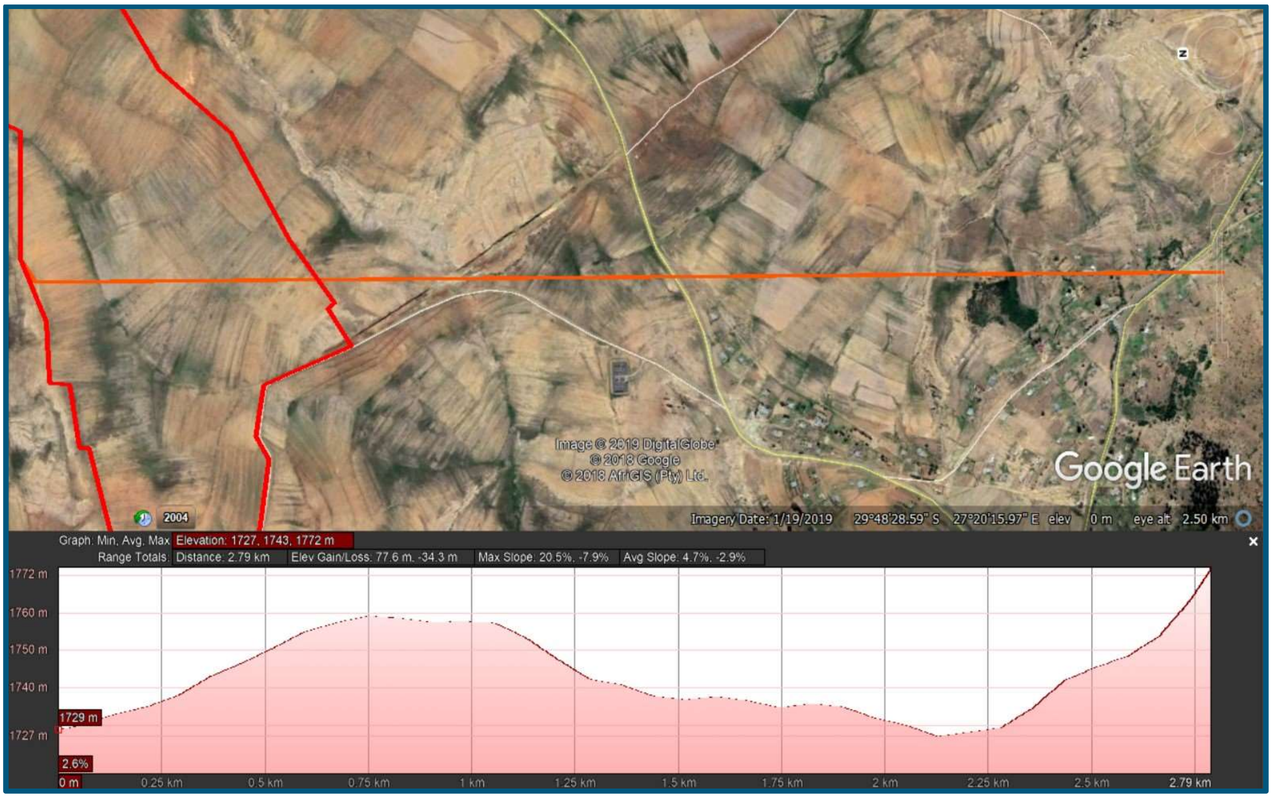

Figure 93: Elevation Profile from the Development Site South to the Area to the Unnamed Village to the South

Figure 94: View Towards the Proposed Development Site from the Outskirts of Ha-Raliemere Village

As can be seen from the analysis above, the villages of Ha-Raliemere and Ha-Sepechele and the portions of the gravel local access roads leading to them would be associated with the highest degree of visual exposure to the site of the proposed development. This is not only due to their proximity to the site of the proposed development, but due to their location in the context of the local terrain setting which entails that they are located in terrain settings – i.e. local crests – and aspects which face the development site. Conversely other receptor locations situated close to the site (within 1km) would have little to no visual exposure towards the site due to their location in lower-lying areas, with intervening topography that would block any line of sight to the development site.

5.2.6.4 Discussion of Overall Potential Visual Impact associated with the Proposed Development

The potential visual intrusion factor associated with the proposed development at the closest receptor locations has been discussed above. The two closest villages could be exposed to a high degree of visual intrusion (especially the peripheries of these villages located closest to the proposed development). The context of the change in land cover associated with the development of the proposed solar power plant is important in the assessment of visual impacts; the coverage over the area of the site would be nearly universal and PV arrays, as well as ancillary infrastructure will be developed over most of the site. The development will thus result in landscape change to the parts of the landscape in the areas from which it is able to be viewed.

As demonstrated in **Figure 94** above, the development would not occupy the entirety of the landscape as visible from the closest static receptor locations, thus the entire landscape would not be visibly altered. This would reduce the potential visual impact factor associated with the proposed development. The area of visual exposure is also limited by topographical factors, with the positioning of the development on a northern-facing slope excluding much of the area in a southern arc from the development from any potential visual exposure. The position of the two closest static receptor locations – on relatively high-lying areas within the context of the surrounding area – entails that these receptor locations are visually exposed to a broad view of the surrounding areas, and thus in spite of the relative proximity of the proposed development to these locations, the site will only occupy a portion of the landscape.

The perception of whether this land cover and resultant landscape change would constitute a negative visual alteration is also uncertain, as discussed above, especially if the development is associated with job creation, modernisation and improvement of service provision to this rural part of south-western Lesotho. Landscapes should not necessarily be perceived as being static, or needing to remain static, but rather being dynamic, reflecting modernisation and progress in technology. In the way that urban areas expand over time or new urban areas are created, the introduction of solar power technology to the rural areas of Lesotho may be perceived to be an accepted new component of the rural landscape.

Due to the limited extent of the landscape change as viewed from the areas in the visual envelope of the site, twinned with the restricted extend of the site's visual envelope, the visual impacts associated with the proposed development are unlikely to be perceived as being significant. This statement needs to be qualified by any further feedback that may emerge from the public participation process for the proposed development's ESIA.

A number of mitigation measures as detailed below would act to ameliorate the visual intrusion factor associated with the proposed development to a certain degree.

Lastly the perceptions of visual impact can be considered. No formal public participation process had yet commenced at the time of writing of the current draft of the report, but a preliminary meeting between the proponent's representatives and the local chief can be considered[20]. In this meeting Chief Mabuse stated that one of the benefits of the project would be that the project would look good (visual impact). This statement implies a positive perception of the visual change to the landscape that would be resultant from the development.

It must be cautioned that any visual-related public participation feedback from the wider affected community should be considered in attempting to ascertain a more comprehensive understanding of perceptions of visual change and impact.

[20] *Reference from the site visit and Pap Meetings undertaken by the client's representatives 17-18 January 2018 - 2) - Meeting with Chief Mabuse 18 January 2019 (Raliemere). The client's representative's (Louise Corbett) site noted are referenced.*

Table 83: Visual Construction Impacts

No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
PHASE: CONSTRUCTION								
1	Clearing activities on parts of the site, in addition to the movement of heavy machinery could be conducive to the creation of dust clouds that could be visible from a wide area in the visual envelope of the construction site.	Without Mitigation	-2	-2	-2	-3	**-9**	**Negative Moderate**
		With Mitigation	-2	-2	-1	-2	**-7**	**Negative Moderate**
2	Heavy vehicles traveling to the site along the unsurfaced roads will create dust clouds that will be able to be viewed from a relatively great distance.	Without Mitigation	-2	-2	-2	-3	**-9**	**Negative Moderate**
		With Mitigation	-2	-2	-1	-2	**-7**	**Negative Moderate**
SUMMARY OF MITIGATION MEASURES		▪ Avoid complete clearing of the construction site, and only clear vegetation in a phased manner. ▪ Regular dust suppression must be applied on the construction site where earth is exposed, and along unsurfaced access roads to the construction site. ▪ Construction vehicle speed limits must be strictly adhered to avoid the creation of excessive dust.						
Average for without mitigation							**-9**	**Negative Moderate**
Average for with mitigation							**-7**	**Negative Moderate**

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Table 84: Visual Operational Impacts

PHASE: OPERATIONAL								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	The solar panel arrays would alter the landscape context as viewed from the parts of the landscape (esp. visual receptor locations) within the viewshed of the proposed development due to the change from grassland / old fields to dense rows of PV arrays.	Without Mitigation	-2	-3	-2	-2	**-9**	**Negative Moderate**
		With Mitigation	-2	-3	-1	-1	**-7**	**Negative Moderate**
2	Night lighting at the plant could introduce new sources of lighting into an otherwise poorly lit night-time context.	Without Mitigation	-2	-3	-2	-2	**-9**	**Negative Moderate**
		With Mitigation	-2	-3	-1	-1	**-7**	**Negative Moderate**
SUMMARY OF MITIGATION MEASURES		▪ Plant indigenous trees around the periphery of the site, as over time (i.e. as these trees grow), the trees will help to shield the PV arrays from the surrounding landscape and will assist in lowering the visual intrusion potential of the plant. ▪ Night lighting at the plant should be limited to essential security lighting, where necessary. All lighting should be inward and downward focussed to reduce light spill.						
Average for without mitigation							**-9**	**Negative Moderate**
Average for with mitigation							**-7**	**Negative Moderate**

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Table 85: Visual Decommissioning Impacts

PHASE: DECOMMISSIONING								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Any physical infrastructure not removed could constitute a visual impact if it became derelict and decrepit, especially on the scale of the entire plant.	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-2	-2	-1	-1	**-6**	Negative Low
SUMMARY OF MITIGATION MEASURES	▪ All physical infrastructure on the site should be fully removed, where it will not be used by landowners, and the site should be revegetated.							

5.2.7 Potential Heritage Impacts

There were no significant potential heritage impacts identified as most the heritage features identified are located outside the boundary of the study site. However, stone artefacts that occurs over a large area on a low hill (C5) were identified to have medium impacts. It is therefore recommended that an area with a diameter of 100m, calculated from the highest point on the hill, is set out as a buffer zone and that this area is fenced off with danger tape during construction activities. If that is not possible and development takes place in this area, a systematic collection should be done by an archaeologist to recover as many of the stone tools as possible. For the removal of Stone Age artefacts, a valid permit would be required from the Heritage Commission.

Table 86: Heritage Construction Impacts

PHASE: OPERATIONAL								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Disturbance of tools and flakes of heritage importance located in the boundary of the project site.	Without Mitigation	-1	-1	-1	-1	-4	Negative Low
		With Mitigation	-1	-1	-1	-1	-4	Negative Low
2	Disturbance of the Stone Artefacts located across the site boundary.	Without Mitigation	1	2	3	2	8	Negative Moderate
		With Mitigation	1	1	1	1	4	Low
SUMMARY OF MITIGATION MEASURES		▪ Plant indigenous trees around the periphery of the site, as over time (i.e. as these trees grow), the trees will help to shield the PV arrays from the surrounding landscape and will assist in lowering the visual intrusion potential of the plant. ▪ Night lighting at the plant should be limited to essential security lighting, where necessary. All lighting should be inward and downward focussed to reduce light spill.						
Average for without mitigation							-6	Negative Low
Average for with mitigation							-4	Negative Low

5.3 Biological Environment Impact Assessment

5.3.1 Quantitative Evaluation of Expected Impacts on the Floristic Receiving Environment

Direct Impacts

The largest extent of impacts within the biological environment is likely to result because of direct (physical) effects of land clearing activities and habitat loss. Direct impacts include any effect on the various habitat types, including locally endemic species, populations or individual species of conservation importance, as well as on overall species richness, diversity and abundance. These impacts also include effects on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. Loss of sensitive, restricted or protected habitat types are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty. Impacts of a direct nature include the following:

- Loss of plant taxa of conservation importance/ concern;
- Loss of habitat associated with plant taxa of conservation importance;
- Local depletion of plant taxa and reduction of phytodiversity;
- Loss of atypical, sensitive, conservation important habitat or ecosystems of restricted abundance; and
- Loss and alteration of ecological processes and ecosystem services within the proposed site.

Indirect Impacts

In contrast, indirect impacts are not always immediately evident and can consequently not be measured at a specific moment in time; ‘spill-over effects’ are spatially and temporally removed from the actual activity and manifestations are typically subtle. The extent of the effect is frequently at a scale that is larger than the actual site of impact, but usually restricted to a local scale (and not regional). A measure of estimation, extrapolation, or interpretation is therefore required to evaluate the importance of these impacts and is usually a factor of the sensitivity of the receiving surrounding environment. This type of impact typically results in adverse effects or deterioration of surrounding areas due to uncontrolled, development related activities.

In addition, the ecological functionality of the immediate and surrounding area could be adversely affected by the proposed development, with reference to the ecological interaction between plants and animals. The aesthetic appeal of the region, although a personal and highly debatable attribute, is regarded a potential receiver of landscape changes resulting from land transformation. Lastly, one of the most important effects of indirect impacts is the alteration of biophysical characteristics of the surrounding areas through the introduction and proliferation of plants with an exotic nature or encroachment characteristics. Impacts of an indirect nature generally include the following:

- Impacts on surrounding habitat types that are associated with plants of conservation importance (decreased habitat quality of surrounding areas due to peripheral impacts such as spillages, litter, increased erosion, contaminants, etc.);
- Altered quality and ecological functionality (including fire, erosion) of surrounding areas and natural habitat;

- Decreased aesthetic appeal of the landscape; and
- Exacerbated encroachment of invasive, exotic and encroacher plant species.

Cumulative Impacts

Cumulative impacts are generally defined as those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. Impacts of a cumulative nature place direct and indirect impacts of this projects into a regional and national perspective. Cumulative impacts typically adversely affect the local and regional conservation status of plant and animal taxa and protected habitat types as well as local and regional fragmentation levels, but also issues such as increased exploitation due to the exacerbation of anthropogenic activities on a local scale. These impacts are notoriously problematic to control or prevent, often requiring huge financial commitments to mitigate. Impacts of a cumulative nature typically include the following:

- Increased plundering of natural resources due to increased human encroachment;
- Exacerbation of existing levels of habitat fragmentation and isolation; and
- Cumulative impacts on local/ regional and national conservation targets and obligations (loss of natural grassland habitat).

Table 87: Direct Floral Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Loss of plant taxa of conservation importance.	Without Mitigation	-1	-3	-1	-1	**-6**	Negative Low
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
2	Loss of habitat associated with plant taxa of conservation importance.	Without Mitigation	-2	-3	-2	-1	**-8**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
3	Local depletion of plant taxa and reduction of phytodiversity.	Without Mitigation	-1	-2	-2	-1	**-6**	Negative Low
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
4	Loss of a typical, sensitive, conservation important habitat or ecosystems of restricted abundance.	Without Mitigation	-2	-2	2-	-2	**-8**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
5	Loss and alteration of ecological processes and ecosystem services within the proposed site.	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-2	-2	-1	-1	**-6**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ The immediate compilation and implementation of an Alien and Invasive Management Programme. ▪ The immediate development and implementation of an Annual Biodiversity Monitoring Protocol. Monitoring efforts should, at least, include a pre-construction, construction and post construction assessment of the biological environment.						

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No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
PHASE: CONSTRUCTION								
		▪ Prevent contamination of natural grasslands, drainage lines, grasslands seepages from the development footprint or any other source of pollution. ▪ Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines. ▪ The use of fire as a vegetation management tool should be guided and instructed by a qualified ecologist. ▪ Removal of vegetation shall be avoided until such time as soil stripping is required. ▪ Exposed surfaces must be re-vegetated or stabilised as soon as is practically possible.						
Average for without mitigation							-7.4	Negative Moderate
Average for with mitigation							-5.2	Negative Low

Table 88: Indirect Floral Impacts

PHASE: CONSTRUCTION								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Impacts on surrounding habitat types that are associated with plants of conservation importance	Without Mitigation	-2	-2	-2	-2	**-8**	Negative Moderate
		With Mitigation	-2	-2	-1	-1	**-6**	Negative Low
2	Altered quality and ecological functionality (including fire, erosion) of surrounding areas and natural habitat	Without Mitigation	-2	-2	-1	-2	**-7**	Negative Moderate
		With Mitigation	-2	-2	-1	-1	**-6**	Negative Low
3	Exacerbated encroachment of invasive, exotic and encroacher plant species	Without Mitigation	-2	-4	-2	-3	**-11**	Negative High
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
SUMMARY OF MITIGATION MEASURES	▪ The immediate compilation and implementation of an Alien and Invasive Management Programme. ▪ The immediate development and implementation of an Annual Biodiversity Monitoring Protocol. ▪ Prevent contamination of natural grasslands, drainage lines, grasslands seepages from the development footprint or any other source of pollution. ▪ Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited; The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines. ▪ The use of fire as a vegetation management tool should be guided and instructed by a qualified ecologist. ▪ Removal of vegetation shall be avoided until such time as soil stripping is required. ▪ Exposed surfaces must be re-vegetated or stabilised as soon as is practically possible.							

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
Average for without mitigation							-8.6	Negative Moderate
Average for with mitigation							-5.6	Negative Low

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Table 89: Cumulative Floral Impacts

PHASE: CONSTRUCTION								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Increased plundering of natural resources due to increased human encroachment	Without Mitigation	-2	-2	-1	-1	**-6**	Negative Low
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
2	Cumulative - Exacerbation of existing levels of habitat fragmentation and isolation.	Without Mitigation	-2	-4	-1	-1	**-8**	Negative Moderate
		With Mitigation	-2	-3	-1	-1	**-7**	Negative Moderate
3	Cumulative impacts on local/ regional and national conservation targets and obligations	Without Mitigation	-3	-4	-1	-2	**-10**	Negative High
		With Mitigation	-2	-2	-1	-1	**-6**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Implement measures listed for direct and indirect impacts.						
Average for without mitigation							**-8**	Negative Moderate
Average for with mitigation							**-6**	Negative Low

5.3.2 Faunal Impacts

Direct Impacts

Faunal habitat types within the study area (and surrounds) are been significantly degraded and heavily modified through constant and long-term over-grazing and trampling of the terrestrial and wetland-associated habitats of the study area and surrounds. The original indigenous medium and large herbivores have been replaced by cattle, sheep, goats, pigs and horses, but with no natural migration patterns and the persistent and high grazing pressures, the status of the grasslands have been severely altered – structurally as well as compositionally. Direct impacts of habitat and species loss in the study area are not considered significant, even prior to the implementation of a mitigation strategy.

Indirect Impacts

Indirect impacts of the proposed activity within the study area have an estimated significance of moderately high prior to the implementation of a mitigation strategy. Some small, albeit important, natural faunal habitat refugia have been identified in parts bordering the study area; rocky ledges, cliffs and wetland seeps that have significant potential as habitat for species of conservation importance. Rehabilitation of these areas could improve the habitat status of both rocky and wetland habitats, increasing their habitat potential and the potential for the reintroduction of original conservation important species to the local area. The proper mitigation and management of likely impacts of the proposed project will reduce the significance of all indirect impacts to low.

Cumulative Impacts

It is estimated that anticipated cumulative impacts for the proposed project are of moderate significance (prior to mitigation). The region, in which the study area is situated, does exhibit numerous natural faunal habitats and is likely to host many and diverse natural animal assemblages. Many of these animal taxa are heavily reliant on free movement corridors and migratory channels through the landscape and require access to suitable habitat patches for feeding, refuge and propagation purposes. The loss of certain levels of individual animals and suitable habitat patches on a regional scale, as a result of habitat destruction and an increased influx of people, has the potential to lead to regional extinctions of certain species as well as the detrimental transformation of animal communities in the region. It is however possible to manage these impacts within the proposed development to some extent.

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Table 90: Direct Faunal Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Loss of conservation important species and - habitat	Without Mitigation	-1	-3	-1	-1	**-6**	Negative Low
		With Mitigation	-1	-3	-1	-1	**-6**	Negative Low
2	Loss of natural habitat, including essential habitat refugia.	Without Mitigation	-2	-3	-2	-1	**-8**	Negative Moderate
		With Mitigation	-1	-3	-1	-1	**-6**	Negative Low
3	Local depletion of faunal diversity resulting from human/animal conflict	Without Mitigation	-2	-3	-2	-1	**-8**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Implement the wetland mitigation measures and rehabilitation plan in sensitive faunal habitat and developmental areas; ▪ No animals may be hunted, trapped, snared or killed for any purpose whatsoever; boundary fences should be patrolled regularly to check for and remove any snares or other animal traps; ▪ No domestic pets, with specific reference to feral cats, of any kind should be allowed on site, near the study area or at the construction camps and permanent, new accommodation of personnel in the vicinity of the site.						
Average for without mitigation							**-7.3**	Negative Moderate
Average for with mitigation							**-5.6**	Negative Low

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Table 91: Indirect Faunal Impacts

PHASE: CONSTRUCTION								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Degradation of untransformed habitat in surrounding areas	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
2	Loss of movement corridors and migration patterns & introduction of alien/invasive species	Without Mitigation	-2	-4	-2	-3	**-11**	Negative High
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
3	Increase in edge effects in the ecological region of the study area	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Implement the wetland mitigation measures and rehabilitation plan in sensitive faunal habitat and developmental areas; ▪ No animals may be hunted, trapped, snared or killed for any purpose whatsoever; boundary fences should be patrolled regularly to check for and remove any snares or other animal traps; ▪ No domestic pets, with specific reference to feral cats, of any kind should be allowed on site, near the study area or at the construction camps and permanent, new accommodation of personnel in the vicinity of the site.						
Average for without mitigation							**-9.6**	Negative Moderate
Average for with mitigation							**-5**	Negative Low

Table 92: Cumulative Faunal Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Depletion, losses and degradation of faunal habitat	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Moderate
2	Depletion of animal species and communities on a regional scale.	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
SUMMARY OF MITIGATION MEASURES		▪ Implement the wetland mitigation measures and rehabilitation plan in sensitive faunal habitat and developmental areas; ▪ No animals may be hunted, trapped, snared or killed for any purpose whatsoever; boundary fences should be patrolled regularly to check for and remove any snares or other animal traps; ▪ No domestic pets, with specific reference to feral cats, of any kind should be allowed on site, near the study area or at the construction camps and permanent, new accommodation of personnel in the vicinity of the site.						
Average for without mitigation							**-9**	Negative Moderate
Average for with mitigation							**-5**	Negative Low

5.3.3 Avifauna Impacts

5.3.3.1 Impacts of PV Solar Facilities on Birds

The magnitude and significance of impacts to birds caused by solar facilities will depend on the following factors:

- The geographic locality of the planned solar facility;
- The size or surface extent of the solar facility;
- The type of solar facility (according to the technologies applied, e.g. PV or Solar Concentrator Plant); and
- The occurrence of collision-prone bird species (which are often closely related to the locality of the solar facility).

Any planned solar facility corresponding to an area with threatened, range-restricted or collision-prone species will have a higher impact on these birds. In addition, any planned solar facility located in close proximity to important flyways, wetland systems or roosting/nesting sites used by the aforementioned species will have a higher impact.

The main impacts associated with PV solar facilities include (Jenkins et al., 2017):

- The loss of habitat and subsequent displacement of bird species due to the ecological footprint required during construction;
- Disturbances caused to birds during construction and operation;
- Direct interaction (collision trauma) by birds with the surface infrastructure (photovoltaic panels) caused by polarised light pollution and/or waterbirds colliding with the panels (as they are mistaken for waterbodies);
- Collision with associated infrastructure (mainly overhead powerlines and reticulation); and
- Attracting novel species to the area (owing to the artificial provision of new habitat such as perches and shade) which could compete with the residing bird population.

5.3.3.2 Avian Impacts at the Neo 1 PV Solar Energy Facility

Loss of Habitat and Displacement of Birds

Clearing of vegetation to accommodate the panel arrays and associated infrastructure will result in the potential loss of transformed grassland, secondary moist grassland and displacement of bird species. From the results it is evident that species with widespread distribution ranges are more likely to become displaced, in particular small to medium sized non-passerines (e.g. Columbidae - doves and pigeons) and passerines (e.g. Alaudidae -larks). In addition, approximately 1.77 birds. ha-1 will become displaced by the activity (as per Jenkins et al., 2017), which is considered to be low. From the results (on site observations and SABAP information), the following bird species are most likely to be impacted by the loss of habitat due to their habitat requirements, fecundity and conservation status (although not limited to):

- Southern Bald Ibis (*Geronticus calvus*);
- White Stork (*Ciconia ciconia*);
- Blue Korhaan (*Eupodotis caerulescens*) and potentially also
- Secretarybird (*Sagittarius serpentarius*); and
- Abdim's Stork (*Ciconia abdimii*).

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Considering the existing transformed nature of the dominant habitat types on the study site and their widespread occurrence in the region, including the general occupancy of widespread and unspecialised bird species, it is evident that the predicted impact due to the overall displacement and habitat loss is moderate without mitigation measures. Threatened and near-threatened birds such as Blue Korhaan (*Eupodotis caerulescens*) and Southern Bald Ibis (*Geronticus calvus*) will also become displaced. However, these species occur at low densities on the study site and when considering the widespread occurrence of similar foraging habitat adjacent to the study site, the impact is regarded as moderate without mitigation.

Creation of "new" avian Habitat and Bird Pollution

It is also possible that the infrastructure (during operation) could attract a number of species which may occupy the site or interact with the local bird assemblages in the wider region. These include mainly alien and cosmopolitan species and aggressive omnivorous passerines which could displace other bird species from the area:

- House Sparrow (*Passer domesticus*);
- Common Myna (*Acridotheres tristis*);
- Cape Crow (*Corvus capensis*)
- Pied Crow (*Corvus albus*); and
- White-necked Raven (*Corvus albicollis*).

The infrastructure could attract large numbers of roosting columbid taxa, especially Speckled Pigeons (*Columba guinea*), which could result in avian "pollution" through excreta, thereby fouling the panel surfaces. The impact could be managed and will result in a low significance.

Collision Trauma caused by Photovoltaic Panels (the "lake-effect")

The study site is located in close proximity to a number of drainage lines. These habitat types are often utilised by waterbirds which could accidentally mistake the reflective panels for waterbodies, thereby resulting in bird collisions with the panel surfaces. It is unknown at this stage what the significance of the impact will be, and it will depend on a subsequent site visit during the peak wet season when most of these features are inundated. During the October 2018 site visit these habitat features were mainly dry and this makes predictions regarding the occurrence of waterbird species and their numbers (e.g. density) in the area inconceivable. However, desktop results and site observations show that the following species could interact with the panel infrastructure:

- Red-knobbed Coot (*Fulica cristata*);
- Reed Cormorant (*Microcarbo africanus*);
- African Black Duck (*Anas sparsa*);
- Yellow-billed Duck (*Anas undulata*);
- White-faced Duck (*Dendrocygna viduata*);
- Red-billed Teal (*Anas erythrorhyncha*);
- Little Egret (*Egretta garzetta*);
- Purple Heron (*Ardea purpurea*);
- Black-headed Heron (*Ardea melanocephala*) and
- Grey Heron (*Ardea cinerea*).

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The precautionary principle was applied in absence of sufficient information on the occurrence of waterbird taxa in the area as well as the lack of data on bird mortalities caused by collisions, which results in an impact of high significance in the absence of any mitigation measures.

Interaction with Overhead Powerlines and Reticulation

An overhead powerline (33 kV) is proposed of approximately 1 km in length. Birds are impacted in three ways by means of overhead powerlines. It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with transmission lines. These include the following:

- **Electrocution**

Electrocution happens when a bird bridges the gap between the live components or a combination of a live and earth component of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a tower or attempts to fly-off a tower. Many of these species include vultures (of the genera Gyps and Torgos) as well as other large birds of prey such as the Martial Eagle (Polemaetus bellicosus) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on the tower structures if available nesting platforms are a scarce commodity in the area. Other types of electrocutions happen by means of so-called "bird-streamers". This happens when a bird, especially when taking off, excretes and thereby causing a short-circuit through the fluidity excreta (Van Rooyen & Taylor, 1999).

Large transmission lines (from 220 kV to 765 kV) are seldom a risk of electrocution, although smaller distribution lines (88 – 132 kV) pose a higher risk. However, for this project, the design of the pylon is an important consideration in preventing bird electrocutions.

- **Collision**

Collisions with earth wires have probably accounted for most bird-powerline interactions in South Africa. In general, the earth wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as bustards, korhaans, storks and a variety of waterbirds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. most species of storks) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the earth wires. Areas where bird collisions are likely to be high could be ameliorated by marking the lines with appropriate bird deterrent devices such as "bird diverters" and "flappers" to increase the visibility of the lines.

- **Physical Disturbances and Habitat Destruction Caused During Construction and Maintenance**

Construction activities go hand in hand with high ambient noise levels. Although construction is considered temporary, many species will vacate the area during the construction phase and will become temporarily displaced. A rocky ledge system occurs in close proximity to the powerline servitude which deserves special consideration since this habitat feature often attracts birds of prey (the latter often include falconiform taxa which hunt small passerines). Construction activities in close proximity to these features could possibly displace these individuals from the area or increase the risk of collision with the powerlines.

Powerline Collision-Prone Bird Species

A total of 33 collision-prone bird species have been recorded from the study site, of which 13 species were observed during the site visit (c. 40 % of the predicted species). In addition, eight species are birds of prey (**Table 93**). Species with a high risk of colliding with overhead powerlines include the Blue Korhaan (*Eupodotis caerulescens*), White Stork (*Ciconia ciconia*), Jackal Buzzard (*Buteo rufofuscus*) and Southern Bald Ibis (*Geronticus calvus*).

Table 93: Collision-Prone Bird Species and Red Listed Species

COMMON NAME	SCIENTIFIC NAME	OBSERVED ON SITE (OCTOBER 2018)	SABAP2 REP. RATE (FULL PROTOCOL)	SABAP2 REP. RATE (AD HOC)	SABAP1 REP RATE.
Buzzard, Jackal	*Buteo rufofuscus*	1	50.00	7.14	0.00
Buzzard, Steppe	*Buteo buteo vulpinus*				22.22
Coot, Red-knobbed	*Fulica cristata*				19.23
Cormorant, Reed	*Microcarbo africanus*				5.56
Cormorant, White-breasted	*Phalacrocorax lucidus*				11.11
Crow, Cape	*Corvus capensis*	1	100.00	42.86	15.38
Crow, Pied	*Corvus albus*	1	100.00	28.57	61.54
Duck, African Black	*Anas sparsa*				11.11
Duck, White-faced	*Dendrocygna viduata*			7.14	0.00
Duck, Yellow-billed	*Anas undulata*			7.14	11.11
Egret, Western Cattle	*Bubulcus ibis*	1	100.00	21.43	46.15
Egret, Little	*Egretta garzetta*				5.56
Falcon, Amur	*Falco amurensis*			50.00	12.50
Falcon, Lanner	*Falco biarmicus*			7.14	5.56
Fish-eagle, African	*Haliaeetus vocifer*				11.11
Goose, Egyptian	*Alopochen aegyptiacus*	1	100.00	7.14	16.67
Goose, Spur-winged	*Plectropterus gambensis*	1	50.00		0.00
Grebe, Little	*Tachybaptus ruficollis*				12.50
Hamerkop	*Scopus umbretta*				23.08
Heron, Black-headed	*Ardea melanocephala*	1	50.00	7.14	15.38
Heron, Grey	*Ardea cinerea*	1	50.00		19.23
Heron, Purple	*Ardea purpurea*				5.56
Ibis, African Sacred	*Threskiornis aethiopicus*				12.50
Ibis, Hadeda	*Bostrychia hagedash*	1	50.00	7.14	11.54
Ibis, Southern Bald	*Geronticus calvus*	1	50.00	7.14	11.54
Kestrel, Lesser	*Falco naumanni*			7.14	0.00
Kestrel, Rock	*Falco rupicolus*	1	50.00		57.69
Kite, Black-winged	*Elanus caeruleus*				11.54
Korhaan, Blue	*Eupodotis caerulescens*	1	50.00		0.00
Night-Heron, Black-crowned	*Nycticorax nycticorax*				11.11
Pigeon, Speckled	*Columba guinea*	1	100.00	57.14	22.22
Stork, White	*Ciconia ciconia*				19.23
Teal, Red-billed	*Anas erythrorhyncha*				12.50

Cumulative Impacts

Cumulative impacts are defined as impacts that result from additional or incremental activities caused by past or present actions together with the current project. Therefore, cumulative impacts are those that will affect the general avifaunal community on the study area due to other solar farms and electrical infrastructure. The Neo 1 PV facility will form part of several solar facilities to be constructed in the study area, and the cumulative exacerbation of adverse effects on bird communities in the area are anticipated to be minimal, when viewed in collective interpretation of the effects of anticipated developments on a local and regional scale.

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Table 94: Avifauna Impacts

PHASE: CONSTRUCTION								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Loss of habitat and displacement of birds.	Without Mitigation	-1	-3	-1	-2	**-7**	Negative Moderate
		With Mitigation	-1	-2	-1	-2	**-6**	Negative Low
2	Loss and displacement of threatened and near threatened bird species.	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-1	-2	-1	-2	**-6**	Negative Low
3	Creation of "new" avian habitat and bird pollution.	Without Mitigation	-1	-2	-1	-2	**-6**	Negative Low
		With Mitigation	-1	-2	-1	-1	**-5**	Negative Low
4	Collision trauma caused by photovoltaic panels (the "lake-effect").	Without Mitigation	-2	-3	-3	-2	**-10**	Negative High
		With Mitigation	-2	-2	-2	-2	**-8**	Negative Moderate
5	Power line interaction: Collision with powerlines.	Without Mitigation	-2	-3	-3	-3	**-11**	Negative High
		With Mitigation	-2	-2	-2	-2	**-8**	Negative Moderate
SUMMARY OF MITIGATION MEASURES	▪ Guide surface infrastructure towards habitat of low avifaunal sensitivity. Technical requirements of the project require the use of a portion of wetland habitat (c. 0.8 ha) habitat within the north-eastern part of the study area. While this minor loss of wetland is not anticipated to have a significant effect on the functionality of the habitat type on a large scale, caution is advised as it implies development within a sensitive environment that exhibit important avian habitat characteristics. ▪ Prevent an overspill of construction activities into areas of high avifaunal sensitivity. ▪ Implement the mitigation measures contained within the wetland report and rehabilitation plan.							

	▪ Use indigenous plant species native to the study area during landscaping and rehabilitation. ▪ The proposed powerline should avoid crossing of drainage lines, seeps and erosion gulleys.		
Average for without mitigation		**-8.6**	**Negative Moderate**
Average for with mitigation		**-6.6**	**Negative Low**

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5.4 Human Environment

5.4.1 Analysis of the Social and Economic Impacts

5.4.1.1 A Best Practice Approach

Tables 95, 96 and 97 fully explores the potential negative and positive impacts that will most likely be experienced during the preconstruction/construction and operational phases of the project. Congruent to the impacts, mitigation and management measures have been proposed for each impact that responds to international best practice, particularly the IFC's Performance Standards 2012. The Integrated Safeguards System of the African Development Bank is acknowledged, as is the need for an **Abbreviated Resettlement Action Plan** (ARAP) for projects that impact fewer than 200 people. The ARAP will also be sent to the Lesotho Authorities as part of their prescribed review of a 'compensation plan. The ARAP will pay special attention to disadvantaged PAPs, PAPs living below the poverty line; the landless or those without legal title; the elderly; women and children (especially female-headed households and infants); and ethnic, religious and linguistic PAP minorities. While the IFC's PS's within its guideline document provides a way for how best to comply with key human rights principles, this study has to additionally take account of the Lesotho local environment and recommend actions that are best suited.

As per the African Development Bank's Environment and Social Basic Guide, the ARAP will include the following actions[21]:

- Carry out a census of the expected number of displaced persons and their socioeconomic status. Value displaced persons' assets and other sources of livelihood.
- Consult the displaced and the host populations about project alternatives and inform them of how the project might affect them.
- Describe compensation options that will be (or have been) offered and other resettlement assistance that will be (or have been) provided. It is preferable to involve local NGOs.
- Assign institutional responsibilities for implementing the resettlement plan and state NGOs' role in monitoring the plan.
- Agree upon schedules, budget and sources of funds with the executing agency.

5.4.1.2 Vehicles for Implementing Mitigation Measures

This SIA proposes a number of 'vehicles' that would assist in the implementation of the mitigation and development initiatives which are outlined in the Social Management Plan (SMP) **Table 91**. The 'vehicles' that are recommended below are done so in a way that accounts for a best practice process that will also respond to international standards (particularly the International Finance Corporations (IFCs) Performance Standards:

- ***The establishment of a formal grievance management system***. A system of lodging concerns, queries and recommendations by labourers, residents or businesses in the proximate area, should apply. There must be a formal response issued on each grievance record. This grievance system must be freely available to any individual that requires a response to a grievance that may be associated with the development. This should be gazetted and in place particularly from the pre-construction phase and throughout the Plant's existence;

[21] To be fulfilled under a separate Terms of Reference

- ***Corporate Communication.*** The Plant's management will seek to manage concerns and expectations through appropriate communication with stakeholders. A corporate channel of communication must be found (leaflets/ brochures/ regular adverts in local newspapers) which render notices that are in the public interest. This model will also assist in public disclosure of information;
- ***The Compensation Committee.*** This Forum was initially established with the intention of facilitating the sale-purchase consultations. However, the property will now be leased. The Compensation Committee will however stay in place as it serves the process of facilitating consultation with Neo I and the Lessors. The Committee serves as a direct community-based vehicle at the centre of information sharing and dissemination between the Plant management and stakeholders. This is indicative of an open, transparent and accountable feedback system between the public and business;
- ***Local Non-Government Organisations (NGOs) and Community Based Organisations (CBOs):*** Seek the assistance of CBOs in the proximate development area, and applicable community-based committees to deal with local development and welfare issues. These structures are potentially valuable implementing agents for development initiatives, especially at community and household levels;
- ***Abbreviated Resettlement Action Plan (see above section)***
- Development and implementation of a ***Community Health, Safety and Security Plan***. The plan should incorporate:
  - Objectives,
    - Identification of the Plant's related risks to communities,
    - Consultation and communication structures,
    - Health and safety measures undertaken by the Plant management,
    - Requirements and expectations during emergency (hazardous) situations (whether flooding/ other) incidents, and
    - Management of the plan and its objectives;
- Preparation and implementation of a ***Construction Phase Code of Practice for Contractors***. The Code should incorporate:
  - Roles and responsibilities,
  - Health and safety,
  - Community relations,
  - HIV/AIDS prevention,
  - Contractor training and counselling,
  - Monitoring, and
  - Disciplinary measures;
- Either in conjunction with the above, or as a separate plan, put in place an Occupational Health, Safety and Security Management Plan for the duration of the construction phase and amend the Plan for implementation during the operations phase. It must be applied and monitored;
- ***Local labour office* (on site).** A local site office which is fully involved in the screening and recruitment of employees (specifically during Construction), is recommended. The independency of such an office is important;
- Design and implement a ***Human Resources Development Policy*** (during Construction), and a ***Human Resources Development Plan*** (during Operations). All elements regarding career planning, progression, recruitment policy and screening, non-discrimination practices, work skill capacitation (on the job), on-going training, development and monitoring must be clearly and explicitly detailed in the Plan. Formulation and implementation of recruitment and employment must include fair access and an

objective and transparent process. Implementation should include: documentation of policy, the inclusion of policy principles in all communication dealing with recruitment; and communication of policy to key stakeholders, including proximate communities and unions (if any);

- The formulation and implementation of a ***Goods and Service Procurement Policy*** to include fair access and an objective and transparent procurement process. Implementation should include:
  - Documentation of policy,
  - Inclusion of policy principles in all communication to do with procurement, and
  - Communication of policy to key stakeholders, including proximate communities, chambers of commerce, and unions (if any).

5.4.1.3 A Summary of the Impacts Identified

Impacts identified during the Preconstruction and Construction phases of the Project include:

- Potential loss of cultivated areas on proposed development site (negative);
- Potential loss of land due to the transmission line (negative);
- Tenure arrangement for the proposed development site (negative that evolves into a positive);
- Restricted access (to people) over the development site (negative);
- Possible cultural heritage finds in the powerline routing impact area (negative);
- No access to cattle shepherding and natural resources through the site (negative);
- Sourcing of equipment and machinery locally (in Lesotho) (positive);
- Inconvenience and danger to proximate residents through increased road traffic, dust and noise (negative);
- Local job creation opportunities (positive);
- Perceived preferential access to a finite number of jobs (negative);
- Increased social ills in villages in close proximity (negative);
- Potential increase in criminal activity in nearby communities (negative);
- Additional pressure on basic services provision (education, housing and healthcare) (negative); and
- Increase in HIV/AIDS cases and associated vulnerabilities (negative).

Impacts identified during the Operation phase of the Project include:

- Restricted access (to people) over the development site (negative);
- No access to cattle shepherding and natural resources through the site (negative);
- Potential noise pollution from the plant operating on a 24 hour basis (negative);
- Potential visual impact of the plant on nearby communities (negative);
- Implementation of specific power supply CSI activity (positive); and
- Local job creation opportunities (positive).

Impacts identified during the Decommissioning phase of the Project include:

- Inconvenience and danger to proximate residents through increased road traffic, dust and noise (negative); and
- Decreased agricultural value of land (negative).

5.4.2 Social Impact Significance Rating Scale

5.4.2.1 Social Impacts Preconstruction Phase

Potential loss of Cultivated Areas on Proposed Development Site.

Negative High impact significance which will alter to a Negative Low impact significance after mitigation. The census undertaken in 2017 identified PAPs (36% of the original 48) that had been farming the land at the time of the census. While it has been established that the number of PAPs is likely to be 37, and there are no current farming practices on the land, *compensation (in the form of rental) to eligible PAPs for loss of livelihood activity* must take place. This is aligned to IFC's PS5. The establishment and application of a *formal grievance management system* would assist in identifying challenges that require a resolution.

Cumulative Impacts: The Government PV plant (70MW Ha-Ramarothole Solar Power Project) will economically displace a total of 102 people, covering an area of approximately 162 (ha) of agricultural and communal fields. The project has not identified compensation amounts or processes that will be applied. There is unlikely to be a cumulative impact as the Neo Project will probably conclude on the compensation arrangements with PAPs and commence construction first.

Potential Loss of Land due to the Transmission Line

Negative High impact significance which will alter to a Negative Moderate impact significance after mitigation. This measurement has been applied with the assumption that the transmission line will follow the existing road servitude and not deviate into private property. Should the routing affect private property, a deviation is recommended or the payment of compensation for the land-take becomes valid. At present, it is estimated there are portions of 5 plots that will be impacted and a once-off payment for the servitude rights will be made to the landowner. The landowners can continue land use practices following construction, within certain restrictions (including the avoidance of building structures, and trees over a certain height within the Right of Way (RoW).

Cumulative Impacts: The ESIA for the Government PV plant (70MW Ha-Ramarothole Solar Power Project) (November 2018), does not mention transmission lines.

Tenure Arrangement for the Proposed Development Site

Negative High impact significance which will alter to a Positive High impact significance after mitigation. The land will be leased as opposed to purchased. This affords the owners a quarterly lease fee to *assist them in maintaining food security and the general household needs*. The baseline study established that climate change and a lack of funding for farming resources have made farmers despondent, to the point that the majority have stopped crop farming. The introduction of the intention to lease the land has helped turn a negative impact, into a positive one. The sub-lease tenure arrangement must include *compensation rates aligned to present day market rates and any inflation accommodation*. For the purpose of reporting, an ARAP is recommended. The establishment and application of a formal grievance management system throughout the project would assist in identifying challenges that require a resolution.

Cumulative Impacts: The Government PV plant (70MW Ha-Ramarothole Solar Power Project) will economically displace a total of 102 people, covering an area of approximately 162 (ha) of agricultural and communal fields. The project has not identified any tenure and/or compensation arrangements for the site.

There is unlikely to be a cumulative impact as the Neo Project will probably conclude on the tenure and compensation arrangements with PAPs and commence construction first.

Restricted Access (to people) over the Development Site

Negative Low impact significance which will remain the same. This impact cannot be mitigated. It is unavoidable that land access to people will be hindered as the lessor will become the responsible party. However, the impact on people is likely to be low as no movement of people over the site occurs for the sake of maintaining familial relationships, and it is not an area of high pedestrian traffic. The proposed site will be fenced off for security and safety reasons. The site area is relatively small and given that the surrounding area is open and accessible for use, the impact will remain Negative low. Formal grievance system to be maintained throughout project.

Cumulative Impacts: The Government PV plant (70MW Ha-Ramarothole Solar Power Project) in close proximity closer to the existing Ga Ramarothole community and substation, and not close to the proposed Neo Plant. There is no cumulative impact expected regarding restricted access as the main roads will be fully functional.

Cultural Heritage Finds in the Development Area

Medium to Low negative impact significance during preconstruction and construction will change to a Low negative impact, post mitigation. A Grade 3 Stone Age site was found within the routing of the powerline. As per the Heritage study results, it is recommended that an area with a diameter of 100m, calculated from the highest point on the hill, is set out as a buffer zone and that this area is fenced off with danger tape during construction activities. If fencing-off is not possible and development takes place in this area, a systematic collection should be done by an archaeologist to recover as many of the stone tools as possible.

For the removal of Stone Age artefacts, a valid permit would be required from the Heritage Commission. If heritage features are identified during construction activities, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits. The mitigation measures as indicated in the Heritage Specialist's Study (as identified above), should be implemented.

At Ha Raliemere community, grave sites adjacent to the (main) roadside were observed, over 1 kilometre from the development site. While, not directly impacted, there would be an element of inconvenience related to use of these sites during the construction phase. These too must be fenced off to ensure that these sites remain secure and accessible to those that use them. Should the family relatives of the deceased wish, the fence can be removed post construction.

Cumulative Impacts: Heritage sites will be site specific. We are aware that none are in current use by the communities. Should any be found to be impacted by the Government PV plant, the proper mitigation must be applied by that project.

No Access to Cattle Shepherding and Natural Resources Through the Site

Medium/moderate negative impact significance pre mitigation and low negative post mitigation. The land is not currently specifically used for cattle grazing or crop farming. Shepherds have let their cattle roam over the land, as there is no current development activity. There is a natural spring close to the site, although not on the portion to be developed. Access to the natural spring for cattle will still be available, although not directly through site. This presents only a slight deviation for shepherds and local communities. The deviation itself does not present any further safety or security concerns for cattle or people. It has been established from the social baseline that communities use the spring in times of severe need as all have boreholes within their villages. Formal grievance system to be maintained throughout project.

Cumulative Impacts: Both PV solar sites (Neo and the Government's) are likely to be fenced off. Although it will not be adjacent fencing. Human and animal movement will be impacted where access will not be granted. The allowance for a broad (wide) cattle and wagon path must be assured as the deviation route for both Projects. While indications are that the path between the two sites is at approximately 60 meters, the use of this width of land must be disclosed to communities and agreed to.

Sourcing of Equipment and Machinery Locally (in Lesotho)

Medium positive impact significance pre and post mitigation. The sourcing of equipment from regional and national sources is probable. This specifically relates to the area of Mafeteng and Maseru as opposed to the Tsana Talana Council area. There should be a concerted effort made by engineers to draw up a procurement plan that will give first preference to local suppliers (particularly for the non-specialised material/products/services). This may be called a *Goods and Service Procurement Policy*. There would be no anticipated change in the impact significance after mitigation as it is expected that Procurement strategies would initially be aimed at local (Lesotho) procurement. Formal grievance system to be maintained throughout project.

Cumulative Impacts: There is insufficient information available to adequately measure the possible cumulative impacts of both the Neo IPV plant and the anticipated Government PV plant on local procurement trends however the impacts would be positive. The Government ESIA does not mention procurement needs and expectations.

Inconvenience and Danger to Proximate Residents through Increased Road Traffic, Dust and Noise.

Negative High impact significance will adjust to a Negative Medium impact significance after mitigation. The nearby surrounding communities of Ha Ramarothole, Ha Raliemere, and Ha Lempetje will be directly impacted during the construction phase of the project as they are closest to the proposed site location and utilise the same (and only) main road past the site. Of the three villages, Ha Ramarothole and Ha Raliemere have households located close by the main road and will face the severity of the impact.

It is expected that during construction, there will be an increased number of construction vehicles on the road. It is recommended that routes be utilised at scheduled times of the day - that would help keep the roads free when school children are returning home, allowing children mobility without being hampered by large trucks utilising the same road. Road signage, maintaining speed limits, watering down of the road during dry periods and the acknowledgement of free roaming cattle must be addressed.
A policy on Contractor Health and Safety for the duration of their work on site, must apply, and be monitored. In addition, a Contractor's Code of Conduct (especially in terms of respecting local by-laws and specific practical community concerns on which agreement may be reached), should be applied for the duration of the construction. Regular information sharing discussions with the Contractors must be pursued, giving residents an opportunity to voice concerns and grievances throughout the duration of project construction. In addition, it is vitally important that a formal grievance management system be put in place (and should remain throughout the life of the plant).

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Cumulative Impacts: Depending on whether the construction phase activities for both the Neo I and the Government plant takes place at the same time, the traffic, dust and noise impacts will be extremely high. The recommendation is that construction be phased (for both plants), so as not to cause impacts that are beyond mitigation due to their intensity. The Ha-Ramarothole and Ha- Raliemere communities will likely be most affected by air pollution, with all communities likely to be affected by noise impacts from construction vehicles and the movement of construction staff. The Neo I site will not be supporting a construction (labour) camp – therefore no cumulative impact from this source is expected.

Local Job Creation Opportunities

A Medium Positive impact significance pre and post mitigation will be experienced. Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly informs the local community (on site and at local community centres) of the progress and job / skills needs at the development site. A formal job application process must be communicated (should this be a requirement). It is expected that the Contractor will have a *Human Resource Procedure/ Policy* in place in order to respond to IFC PS 2. The potential is that a large number of jobs (*estimated 200*) will be created for the short duration of construction. The social baseline has identified that job creation is one of the foremost mentioned needs in the local communities, so concerted effort will have to be made to fulfil such a goal. The data collection amongst the Vulnerable groups in the villages specifically showed the realisation and need amongst women to increase their income-earning capability. Women must be afforded fair and equal access to work opportunities. Formal grievance system to be maintained throughout project.

Cumulative Impacts: While the local economic benefit from job creation is noted, there is potential for social conflict due to competition for a finite number of jobs. Each company will have to develop and adhere to a very strong and ethical code of conduct (and HR Procedure/ Policy) when determining recruitment practices.

Perceived Preferential Access to a Finite Number of Jobs

Very High Negative impact significance will evolve into a High Negative impact after mitigation. There will be a predominant perception that others (external to Tsana Talana Council area) may be afforded preferential access to work, particularly during the construction phase. This is a perception that can only be thwarted by a transparent and fair recruitment process throughout the phase. Establish and maintain management systems to ensure that thorough and regular communication occurs, particularly with hopeful locals in Mafeteng and the Council area. Approximately 200 jobs will be created during the construction phase, anticipated to commence in late 2019, with the majority being of benefit to local communities. Formal grievance system to be maintained throughout project.

Cumulative Impacts: Each company will have to develop and adhere to a very strong and ethical code of conduct (and HR Procedure/ Policy) when determining recruitment practices.

Increased Social Ills in Villages in Close Proximity

Negative High impact significance becomes a Negative Medium impact significance after mitigation. The increase in household cash flow (from employment opportunities) will probably be accompanied by its own challenges. The most critical is related to alcohol consumption, abuse, prostitution, unintentional pregnancies within the local population and potentially, the spread of sexually transmitted diseases and HIV/AIDs. The management measure to be taken must ensure on-going work shopping of appropriate behaviour from the plant labour population. This can be structured through a *Construction Phase Code of*

Practice for Contractors. IFC PS 4 also requires that a Community, Health, Safety and Security Plan be developed. This should be maintained through the construction and operation phases. On-site health and safety workshops are critical. An on -site clinic must be at the forefront of such issues. Communication with local Chiefs is also an important tool that will assist in monitoring such a situation. Formal grievance system to be maintained throughout project.

Cumulative Impacts: Social ills can be properly managed if both Neo and the Government Solar Plant effectively and systematically roll out the necessary ESAP as per the ESMP.

Potential Increase in Criminal Activity in Nearby Communities

Medium Negative impact remains the same pre and post mitigation, although the scale does show an improvement within that category. With the increased movement of people to and from and also within the development site, there is potential for increased criminal activity on site and in the nearby villages. This information was gleaned from the FGMs held during the course of the social baseline data collection. Increased police presence (patrols) and crime knowledge sharing in communities is recommended. While it is envisaged that the development site will be under (unarmed) 24 hour protection from a private security firm, petty crimes may still persist. Management measures dealing with transferring and sharing information about criminal activities with the local community is recommended. The establishment of a Resident's Forum may be a vehicle that could help achieve collaboration.

Cumulative Impacts: It is likely that the incidents of crime may increase with the movement of foreign people (that is, not local). Visible policing (by well-trained community friendly) private security companies should be investigated if both Projects are under construction at the same time.

Additional Pressure on Basic Services Provision (Education, Housing And Healthcare)

Medium Negative impact remains the same pre and post mitigation, although the scale does show an improvement within that category. If construction workers move into the area with families, services such as housing availability, education and healthcare services will experience increased pressure. In order to provide mitigation, it is strongly advisable that Neo I and the applicable government departments (perhaps even National government) liaise effectively on how to combat avoidable service delivery constraints - particularly since the highest number of workers will be on site during the construction period. It is expected that Neo I will carefully screen the service delivery situation prior to recruiting construction staff. Neo I will also have to consider what service delivery options it will put in place for its own staff - the availability of an on-site 24 hour clinic is one option.

Cumulative Impacts: It is likely that the cumulative impact of both Plants being constructed at the same time, would show a denser population in the Mafeteng area, thus increasing the burden on social services.

Increase in HIV/AIDS Cases and Associated Vulnerabilities

Negative Very High impact significance evolves into a Negative Medium impact significance after mitigation. A large construction workforce (particularly if the majority are single men), could potentially contribute to the spread of HIV/AIDs in the Council area, albeit unintentionally. There are various mitigation and management measures that should be pursued. Some of these are: The establishment of a formal grievance management system- The establishment of a 24 hour clinic for construction staff (where monitoring and voluntary testing could occur) - Invitation to Government health representatives and local awareness building experts to render knowledge workshops to construction staff (and local communities) - The development and implementation of a policy on Community, *Health, Safety and Security*- The development and implementation of a *Contractor's Code of Conduct.*

Cumulative Impacts: The likelihood of health issues (including STDs and HIV/AIDs) is more possible with the increased movement of people (particularly during the construction stage). Regular health checks and the application of worker health protocol must be implemented and maintained for maximum effect.

5.4.2.2 Social Impacts Operational Phase

Restricted Access (to People) Over the Development Site

Negative Low impact significance which will remain the same. This impact cannot be mitigated. It is unavoidable that land access to people will be hindered as the lessor will become the responsible party. The proposed site will be fenced off for security and safety reasons. However, the impact on people is likely to be low as no movement of people over the site occurs specifically for the sake of maintaining familial relationships. The site area is relatively small and given that the surrounding area is open and accessible for use, the impact will remain Negative low. Formal grievance system to be maintained throughout project.

Cumulative Impacts: The fenced area around the sites will be maintained for the life of the Plant, and so will the alternative paths create.

No Access to Cattle Shepherding and Natural Resources Through the Site

A low negative impact significance pre and post mitigation. The probability of this being an impact is low, as people and cattle would not have access from the construction period, thus would be accustomed to the fact that the site itself is off-limits. There is a natural spring close to the site, although not in the area of operation. Access to the natural spring for cattle will still be available, although not directly through site. This presents only a slight deviation for shepherds and local communities. The deviation itself does not present any further safety or security concerns for cattle or people. It has been established from the social baseline that communities use the spring in times of severe need as all have boreholes within their villages. A plea from Chiefs for the sinking of further boreholes, was made, as many village boreholes are dysfunctional. For example, in Ha Lempetje, there are 13 boreholes in the village, but only 2 work. In Ha Raliemere there is one borehole in the village. The PV plant proposes to utilise water gained from a new borehole, if feasible, and will have no known impact on the nearby spring. (Note: The Project's hydrological study concludes that "a detailed hydrogeological investigation would be required in order to determine sustainable yield from proposed water supply borehole as well as an update of the groundwater impact assessment. Should a new borehole not be a feasible option, water will be trucked onto site. Formal grievance system to be maintained throughout project.

Cumulative Impacts: The fenced area around the sites will be maintained for the life of the Plant, and so will the alternative paths created for access to areas of resource significance.

Potential Noise Pollution from the Plant Operating on a 24 Hour Basis

A low negative impact significance improves but remains a medium/ moderate negative impact post mitigation. A low negative impact will be experienced in the vicinity of the plant's mechanical processes. This project must ensure the use of noise avoidance mechanisms such as housing engines with brick walls

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and using machinery/ engines with low noise emissions. Note: The Noise study concludes that: "The noise impact will be negative low during the construction and decommission phases and negative low to negative low during the operational phase. The threshold value of 3.0dBA granted by the IFC will not be exceeded." Noise surveys will be executed should any noise-related grievances be lodged from impacted communities.

Cumulative Impacts: This will require further investigation as the location of the Plants will influence the noise levels experienced by each community.

Potential Visual Impact of the Plant on Nearby Communities

Moderate negative impact significance pre and post mitigation for construction and operational phases and low negative post mitigation in decommissioning. The plant will be more visible to 2 out of the three communities, that is, Ha Raliemere, and Ha Lempetje. Visual screens such as high growth indigenous trees can be planted in advance of the construction of the plant assuming it does not severely affect the feasibility of the PV plant's operation.

Cumulative Impacts: Judging from the maps provided (and compared), the communities that will experience a partial visual impact would be Ha Raliemere and Ramarothole, while Sepechele and Ha Lempetje will quite possibly have to bear the consequence of a full visual impact from both Plant facilities.

Implementation of Specific Power Supply CSI Activity

A medium positive impact significance pre and post mitigation. With the completion of the plant and its operation at maximum, the plant will contribute to its national electricity grid supply. Neo I will install a Pay-As-You-Go (prepaid) electricity grid in Ha Raliemere.

Cumulative Impacts: There is insufficient information available to adequately measure the possible cumulative impacts of both the Neo 1 PV plant and the anticipated Government PV plant as with regards to CSI activities.

Local Job Creation Opportunities

High positive impact significance pre and post mitigation. Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly informs the local community (on site and at local community centres) of the progress and job / skills needs at the development site. A formal job application process must be communicated (should this be a requirement). The permanent jobs on site would be 10-11 positions spanning the work areas of maintenance, cleaning and grass cutting. The data collection amongst the Vulnerable groups in the villages specifically showed the realisation and need amongst women to increase their income-earning capability. Women must be afforded fair and equal access to work opportunities.

Cumulative Impacts: The only cumulative impact likely, is positive, although with a limited intensity -as there are only a minimum number of jobs available in the Operations phase

5.4.2.3 Social Impacts Decommissioning Phase

Inconvenience and Danger to Proximate Residents Through Increased Road Traffic, Dust and Noise.

Negative High impact significance will adjust to a Negative Medium impact significance after mitigation. The nearby surrounding communities of Ha Ramarothole, Ha Raliemere, and Ha Lempetje will be directly impacted during the decommissioning phase of the project as they are closest to the proposed site location and utilise the same (and only) main road past the site. Of the three villages, Ha Ramarothole and Ha Raliemere have households located close by the main road and will face the severity of the impact. It is expected that during decommission, there will be an increased number of construction vehicles on the road.

It is recommended that routes be utilised at scheduled times of the day - that would help keep the roads free when school children are returning home, allowing children mobility without being hampered by large trucks utilising the same road. Road signage, maintaining speed limits, watering down of the road during dry periods and the acknowledgement of free roaming cattle must be addressed. A *policy on Contractor Health and Safety* for the duration of their work on site, including decommissioning, must apply, and be monitored. In addition, a *Contractor's Code of Conduct* (especially in terms of respecting local by-laws and specific practical community concerns on which agreement may be reached), should be applied for the duration of the construction. Regular information sharing discussions with the Contractors must be pursued, giving residents an opportunity to voice concerns and grievances throughout the duration of project construction. In addition, it is vitally important that a *formal grievance management system* be put in place (and should remain throughout the life of the plant).

Cumulative Impacts: If decommissioning were to take place at the same time for both Plants, the noise, air and traffic impacts (as during construction), will be experienced.

Decreased Agricultural Value of Land

Negative medium/ moderate impact pre and post mitigation, although the scale shows an improvement post mitigation. For the duration of the Plants existence, no farming or soil enrichment processes would have taken place however the exclusion of grazing is likely to improve the vegetation on site dramatically, as well as result in an improvement of wetlands and erosion gulleys. On decommissioning, land will have to be rehabilitated to increase agricultural farming value. Rehabilitation will have to take place, irrelevant to whether or not the PAPs will utilise the land for farming.

Cumulative Impacts: There is insufficient information available to adequately measure the possible cumulative impacts of both the Neo IPV plant and the anticipated Government PV plant, on land value.

Table 95: Social Construction Impacts

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Potential loss of cultivated areas on proposed development site.	Without Mitigation	-1	-3	-3	-4	**-11**	Negative High
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
2	Potential loss of land due to the transmission line.	Without Mitigation	-2	-3	-2	-4	**-11**	Negative High
		With Mitigation	-1	-4	-1	-1	**-7**	Negative Moderate
3	Tenure arrangement for the proposed development site.	Without Mitigation	-1	-3	-3	-4	**-11**	Negative High
		With Mitigation	+1	+3	+3	+4	**+11**	Positive High
4	Restricted access to people over the development site.	Without Mitigation	-1	-3	-1	-1	**-6**	Negative Low
		With Mitigation	-1	-3	-1	-1	**-6**	Negative Low
5	Cultural heritage finds in the development area.	Without Mitigation	-1	-2	-3	-2	**-8**	Negative Moderate
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
6	No access to cattle shepherding and natural resources through the site.	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		Without Mitigation	+4	+1	+2	+2	**+9**	Positive Moderate

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PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
7	Sourcing of equipment and machinery locally (in Lesotho)	With Mitigation	+4	+1	+2	+2	**+9**	Positive Moderate
8	Inconvenience and danger to proximate residents through increased road traffic, dust and noise.	Without Mitigation	-2	-1	-3	-4	**-10**	Negative High
		With Mitigation	-2	-1	-2	-2	**-7**	Negative Moderate
9	Local job creation opportunities.	Without Mitigation	+3	+1	+2	+3	**+9**	Positive Moderate
		With Mitigation	+3	+1	+2	+3	**+9**	Positive Moderate
10	Perceived preferential access to a finite number of jobs.	Without Mitigation	-3	-3	-3	-4	**-13**	Negative Very High
		With Mitigation	-3	-3	-2	-2	**-10**	Negative High
11	Increased social ills in villages in close proximity.	Without Mitigation	-2	-1	-4	-4	**-11**	Negative High
		With Mitigation	-2	-1	-2	-2	**-7**	Negative Moderate
12	Potential increase in criminal activity in nearby communities	Without Mitigation	-2	-1	-3	-3	**-9**	Negative Moderate
		With Mitigation	-2	-1	-2	-2	**-7**	Negative Moderate
		Without Mitigation	-2	-1	-3	-3	**-9**	Negative Moderate

PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
13	Additional pressure on basic services provision (education, housing and healthcare).	With Mitigation	-2	-1	-2	-2	**-7**	**Negative Moderate**
14	Increase in HIV/AIDS cases and associated vulnerabilities.	Without Mitigation	-2	-4	-4	-4	**-14**	**Negative Very High**
		With Mitigation	-2	-3	-2	-2	**-9**	**Negative Moderate**
SUMMARY OF MITIGATION MEASURES		▪ Compensation (rental) to eligible PAPs for loss of livelihood activity must take place. This is aligned to IFC's PS5. The establishment and application of a formal grievance management system would assist in identifying challenges that require a resolution. ▪ Should the routing of the transmission line deviate from the existing road and affect private property, the payment of compensation for the servitude is recommended. ▪ The sub-lease tenure arrangement must include compensation rates aligned to present day market rates and any inflation accommodation. ▪ For the purpose of reporting, a Tenure arrangement report is recommended. ▪ For the purposes of monitoring the livelihood impact of the tenure arrangement, a Livelihood monitoring report is recommended. ▪ Formal grievance system to be maintained throughout project. ▪ At Ha Raliemere community, grave sites nearby the roadside were observed approximately 600 meters from the development site. While, not directly impacted, there would be an element of inconvenience related to use of these sites during the construction phase. These too must be fenced off to ensure that these sites remain secure and accessible to those that use them. Fencing can be removed after construction should the relatives so wish.						

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PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
		▪ Road signage, maintaining speed limits, implementation of dust suppression measures during dry periods and the acknowledgement of free roaming cattle must be addressed. ▪ A policy on Contractor Health and Safety for the duration of their work on site, must apply, and be monitored. ▪ The development and implementation of a Contractor's Code of Conduct. ▪ Contractor's Code of Conduct (especially in terms of respecting local by-laws and specific practical community concerns on which agreement may be reached), should be applied for the duration of the construction. ▪ Regular information sharing discussions with the Contractors must be pursued, giving residents an opportunity to voice concerns and grievances throughout the duration of project construction. ▪ A formal job application process must be communicated (should this be a requirement). It is expected that the Contractor will have a Human Resource Procedure/ Policy in place in order to respond to IFC PS 2. ▪ The social baseline has identified that job creation is one of the foremost mentioned needs in the local communities, so concerted effort will have to be made to source local labour as far as possible. ▪ Fair and transparent recruitment process must be implemented in consultation with the Mafeteng local authorities. ▪ The management measure to be taken must ensure on-going work shopping of appropriate behaviour from the plant labour population. This can be structured through a Construction Phase Code of Practice for Contractors. ▪ IFC PS 4 also requires that a Community, Health, Safety and Security Plan be developed. This should be maintained through the construction and operation phases. ▪ On-site health and safety workshops and an on-site clinic must be provided is critical. ▪ Communication with local Chiefs is also an important tool that will assist in monitoring such a situation the implementation of health and safety. ▪ Increased police presence (patrols) and crime knowledge sharing in communities is recommended. While it is envisaged that the development site will be under 24 hour protection from a private security firm, petty crimes may still persist.						

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PHASE: CONSTRUCTION								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
		▪ Management measures dealing with transferring and sharing information about criminal activities with the local community is recommended. The establishment of a Resident's Forum may be a vehicle that could help achieve collaboration. ▪ It is strongly advisable that Neo I and the applicable government departments (perhaps even National government) liaise effectively on how to combat avoidable service delivery constraints - particularly since the highest number of workers will be on site during the construction period. ▪ It is expected that the Neo I will carefully screen the service delivery situation prior to recruiting construction staff. Neo I will also have to consider what service delivery options it will put in place for its own staff - the availability of an on-site 24 hour clinic is one option. ▪ Management of HIV/AIDS ▪ The establishment of a formal grievance management system; ▪ The establishment of a 24 hour clinic for construction staff (where HIV monitoring, and voluntary testing could occur); ▪ Invitation to Government health representatives and local awareness building experts to render HIV and other health issue knowledge workshops to construction staff (and local communities); and ▪ The development and implementation of a policy on Community, Health.						
Average for without mitigation							-7.4	Negative Moderate
Average for with mitigation							-3.4	Negative Low

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Table 96: Social Operational Impacts

PHASE: OPERATIONAL								
No.	**POTENTIAL IMPACT**	**MITIGATION**	**EXTENT**	**DURATION**	**INTENSITY**	**PROBABILITY**	**SIGNIFICANCE = E+D+I+P**	**STATUS CLASSIFICATION**
1	Restricted access (to people) over the development site.	Without Mitigation	-1	-3	-1	-1	**-6**	Negative Low
		With Mitigation	-1	-3	-1	-1	**-6**	Negative Low
2	No access to cattle shepherding and natural resources through the site.	Without Mitigation	-1	-3	-1	-1	**-6**	Negative Low
		With Mitigation	-1	-3	-1	-1	**-6**	Negative Low
3	Potential noise pollution from the plant operating on a 24 hour basis.	Without Mitigation	-1	-1	-1	-1	**-4**	Negative Low
		With Mitigation	-1	-1	-1	-1	**-4**	Negative Low
4	Potential visual impact of the plant on nearby communities.	Without Mitigation	-2	-3	-2	-2	**-9**	Negative Moderate
		With Mitigation	-2	-3	-1	-1	**-7**	Negative Moderate
5	Implementation of specific power supply CSI activity.	Without Mitigation	+2	+3	+4	+4	**+9**	Positive Moderate
		With Mitigation	+2	+3	+4	+4	**+9**	Positive Moderate
6	Local job creation opportunities.	With Mitigation	-2	-3	-2	-4	**+11**	Positive High
		Without Mitigation	-2	-3	-2	-4	**+11**	Positive High
SUMMARY OF MITIGATION MEASURES	▪ Formal grievance system to be maintained throughout project.							

PHASE: OPERATIONAL								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
		▪ Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly informs the local community (on site and at local community centres) of the progress and job / skills needs at the development site. A formal job application process must be communicated (should this be a requirement).						
Average for without mitigation							**-0.8**	**Negative Low**
Average for with mitigation							**-0.5**	**Negative Low**

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Table 97: Social Decommissioning Impacts

PHASE: DECOMMISSIONING								
No.	POTENTIAL IMPACT	MITIGATION	EXTENT	DURATION	INTENSITY	PROBABILITY	SIGNIFICANCE = E+D+I+P	STATUS CLASSIFICATION
1	Inconvenience and danger to proximate residents through increased road traffic, dust and noise.	Without Mitigation	-2	-1	-3	-4	**-10**	Negative High
		With Mitigation	-2	-1	-2	-2	**-7**	Negative Moderate
2	Decreased agricultural value of land.	Without Mitigation	-1	-3	-2	-3	**-9**	Negative Moderate
		With Mitigation	-1	-3	-1	-2	**-7**	Negative Moderate
SUMMARY OF MITIGATION MEASURES		▪ Road signage, maintaining speed limits, implementation of dust control measures during dry periods and the acknowledgement of free roaming cattle must be addressed. ▪ A policy on Contractor Health and Safety for the duration of their work on site, including decommissioning, must apply, and be monitored. ▪ A Contractor's Code of Conduct (especially in terms of respecting local by-laws and specific practical community concerns on which agreement may be reached), should be applied for the duration of the decommissioning. Regular information sharing discussions with the Contractors must be pursued, giving residents an opportunity to voice concerns and grievances throughout the duration of the project decommissioning. ▪ On decommissioning, all disturbed areas will have to be rehabilitated to allow for farming. Rehabilitation will have to take place, irrelevant to whether or not the PAPs will utilise the land for farming.						
Average for without mitigation							**-9.5**	Negative Moderate
Average for with mitigation							**-7**	Negative Moderate

6 CONSULTATION AND PUBLIC ENGAGEMENT

6.1 Stakeholder Engagement

A **Stakeholder Engagement Plan (SEP)** is prepared in accordance with IFC requirements to allow for a two-way consultation process. The SEP ensured that consultation with stakeholders and the public is proactive, as opposed to reactive, and will be implemented through the course of the project (i.e. design, construction, operation and decommissioning).

Community engagement is an important part of project development and should be an on-going process involving the disclosure of information to project-affected communities. The purpose of community engagement is to build and maintain over time a constructive relationship with communities located in close proximity to the project and to identify and mitigate the key impacts on project-affected communities. The nature and frequency of community engagement should reflect the project's risks to, and adverse impacts on, the affected communities.

For the consultation and disclosure process associated with the Neo PV Solar Power Plant the team followed the requirements stated in the national legislation and further improved engagement expectations with the inclusion of the IFC's stakeholder engagement requirements. Such is outlined in **Table 98** below.

Table 98: Stakeholder Engagement Requirements of the Project – aligned to the IFC Performance Standard 1

ASPECT	KEY REQUIREMENTS	ADHERENCE TO IFC REQUIREMENTS	PROCESS TO DATE
Stakeholder analysis and planning	▪ Identify Project affected stakeholders, including vulnerable groups[22] ▪ Develop and implement a Stakeholder Engagement Plan	▪ Project SEP	▪ Stakeholder and PAPs identification is an ongoing process. ▪ SEP has been developed.
Disclosure of information	▪ Provide stakeholders with access to information on: ○ Purpose, nature and scale of the Project ○ Duration of proposed Project activities ○ Any risks, potential impacts and mitigation measures ○ Proposed stakeholder engagement process	▪ Project SEP and leaflet/Briefing paper BID	▪ Process on going.
Consultation	▪ Consultation will be in line with the degree of potential project impacts and will: ○ Begin early and continue throughout the Project lifecycle ○ Be based on prior disclosure and dissemination of information	▪ Consultation during the Scoping and ESIA stages ▪ Public Hearing	▪ Process on going

[22] *Vulnerable stakeholders are defined as those who may be differently or disproportionately affected by the Project due to pre-existing disadvantaged status, or whose situation may mean that they are hard to reach, and/or require differentiated measures in consultation and disclosure activities to allow their effective participation.*

ASPECT	KEY REQUIREMENTS	ADHERENCE TO IFC REQUIREMENTS	PROCESS TO DATE
	○ Focus on those directly affected ○ Be free of outside interference and external manipulation ○ Enable meaningful participation ○ Be documented		
External communications	▪ Implement and maintain a procedure for external communications that: ○ Registers communication ○ Screens and assesses issues raised ○ Tracks and documents responses	▪ Project CLO activities	▪ During construction
Complaint Form for Project Affected Communities	▪ Establish a Complaint / comment (grievance) form to receive and facilitate resolution of Affected Communities' concerns and grievances about the Project.	▪ Community Feed-back mechanism	▪ During construction
Ongoing reporting to affected communities	▪ Report to the community with frequency that is proportionate to the concerns of affected communities but not less than annually.	▪ Project CLO activities	▪ During construction

6.2 Consultation Prior to the ESIA

There have been several meetings held within the 2017-2018 period in the affected villages. The villages of Ha Ramarothole, Ha Lempetje and Ha Raliemere have been engaged in meetings when the Project was in its pre-feasibility stage. This had occurred prior to RHDHV onboarding in August of 2018. The table below indicates these items in detail. Key issues raised in community meetings were related to finalising compensation rates, establishing the compensation vehicle (i.e. the Compensation Committee) and its terms of reference, appointment of the surveyor, establishing a Co-operation, undertaking a census survey, and appointment of the lawyer representing land owners.

Further to this, Neo I had continued to engage with PAPs, even after RHDHV was appointed, as the tenure arrangement and compensation process required finalisation. Meetings from November 2018 to the present day are also captured in (**Table 99**).

Table 99: Details of the Stakeholder Consultation Undertaken by Neo I

STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
National Level			
▪ Mafeteng District Council and Tšana-Talana Community Representatives: ▪ Member of Parliament ▪ Representatives from Relevant Government Ministries ▪ Representatives of Community-Based/Non-Governmental Organizations	8 Sept 2017	▪ Overview of Neo PV power generation development project. ▪ Proposed resettlement/compensation approach.	Puisano team will make necessary follow-ups on the action items agreed upon as follows: ▪ Puisano to team with the chiefs to agree on logistical arrangements for the community gatherings planned for September 11th, 2017, including time and location for the meetings. ▪ Neo I Consortium should provide the stakeholders with a map of the project location outlining boundaries and size. ▪ Puisano will commence with the Census among affected persons and Environmental and Socio-Economic Baseline Study among all community members in the Khubetsoana area starting from September 25th, 2017. The Chiefs were requested to sensitize the communities so that the field teams working on the two data collection exercises will be expected and welcomed. ▪ Puisano to meet with Chiefs to obtain the list of the persons directly affected by the project, including an additional 17 households. ▪ Puisano to discuss with Neo I Consortium to organize a follow up meeting with the District Administrator (DA), District Council Secretary (DCS) and Community Council (CC) to further discuss the current concerns related to the proposed agreement and collection of Form Cs and Leases of land owners. ▪ Puisano to make follow-ups on the names of the Compensation Committee members.

STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
			▪ Puisano to organize an orientation meeting with the Compensation Committee after membership has been confirmed, and possibly provide orientation for new Community Council members after it has been on-boarded.
Regional Level			
Mafeteng District	6 April 2017	▪ In attendance was Neo I, Potlako Sefako from Power Consult, and the District Administrator, Ntsane Mathibeli. ▪ Offered introduction to Neo I and their intentions as the preferred bidder in the DOE/LEC tender for the 20MW project. ▪ Expressed our intention to engage with the community and develop the site at Ha Ramarothole. Credentials in the form of a letter from LEC were presented to District officials. ▪ Discussed engaging in a process to formalize the tenure of land owners to align with the 2010 Land Act. The District indicated that they would be available to assist as needed and appropriate.	▪ Date of next feedback session is on the 8th of September 2017.

STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
Tšana-Talana Council	6 March 2018	▪ Update on the Progress of Neo PV Power Generation Development Project. ▪ Feedback with regards to finding the Land Evaluators. ▪ Proposal or suggestion with regards to finding the Land Surveyor/Evaluator.	▪ So far, the Co-Operative seems to be the one that can work in this regard however communication will continue, to ensure that the best solutions is found. ▪ One Power alerted the meeting that at the beginning the land owners will get a lump sum as mentioned before, while the process/package of compensation will not change. ▪ The Land owners will be trained and advised on running a Co-operative or Organization. The legal representatives will register the Co-operative and the field owners will be advised on the three names which their Co-op will be named. ▪ One Power mentioned that it will incur all the administration costs for the Co-operative office however it was still to be discussed. ▪ Form C's shall be ready by Friday the 13 April 2018 and given to their owners.
Community Level			
Ha Lempetje, Ha Ramarothole & Ha Raliemere (Project Affected Persons (PAPs) and Representatives)	6 Nov 2017	▪ Project overview, anticipated impacts, proposed mitigation measures, proposed compensation processes to individuals and communities affected, and next steps. ▪ Census survey study results. ▪ Compensation process/consultation plan. ▪ Conflict resolution process. ▪ Date for work to begin. ▪ Valuator responsibility and appointment.	▪ Employment opportunities during construction. ▪ Recruitment committee to be established by the contractor and the community during construction phase. ▪ Community should think of long term income generating projects that can be supported by the project. ▪ Affected owners should continue ploughing until compensated. ▪ The spring close to the proposed area will be protected. ▪ Land ownership and inheritance should be confirmed by a letter from the family.

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STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
			▪ Affected fields to be surveyed to determine size. ▪ Puisano to find out how LEC will carry out compensation for fields where poles will be installed. ▪ Conflict resolution committee to be established. ▪ Land owners must submit applications to the chief's office. ▪ Land allocation committee will then work on the applications. ▪ Three chiefs to appoint an appropriate valuator. ▪ The Contractor will pay the community valuator.
Ha Ramarothole (Project Affected Persons (PAPs) and Representatives)	7 April 2018	▪ A kick-start to all Project activities (Project outline) and compensation.	▪ Census survey was undertaken to collect basic information of the affected people, register the affected entities by residence/locality and establish a list of legitimate beneficiaries before the onset of the Project works. ▪ Survey completed, compensation still outstanding.
Ha Raliemere	7 April 2018	▪ Progress report of the Project. ▪ Compensation. ▪ Chose name of the Cooperation.	▪ Registration of the Cooperation. ▪ Finalise compensation. ▪ Compensation rates.
All Project Affected Persons	19 April 2018 (extraordinary meeting)	▪ Introduction of the Land valuer to PAPs. ▪ Land valuer presentation on the description and need for land valuation. ▪ Land valuer reported that he will be making an estimation of the value of the land, based on 10.00 Maloti per square metre. Valuer	▪ Land valuer met with Neo I and Government valuers. ▪ Puisano and Neo Ito assist in ensuring that meeting takes place and feedback is provided to PAPs.

STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
		will meet with Neo I and Government valuers to discuss the proposed rate. ▪ A decision on the rate to be used will be taken amongst the 3 parties. ▪ Report-back on the agreed compensation rate, will take place.	
The Compensation Vehicle			
Compensation Committee	27 April 2018	▪ Committee Terms of Reference (ToR). ▪ Responsibilities of the Committee.	▪ Written project brief and Framework to be provided by Neo I and Puisano. ▪ Invitations to the meetings should be done through the Chairperson. ▪ Members should be provided with incentives to carry out committee tasks i.e. airtime. ▪ Lawyer representing land owners to be appointed to assist affected owners with the process of leasing out their fields to Neo I. ▪ Agreed to call a special meeting on the 30th April to discuss the appointment of the lawyer as a matter of urgency.
Compensation Committee	30 April 2018	▪ Appointment of the lawyer to represent land owners and why it is necessary. ▪ Committee responsibilities. ▪ Committee ToRs.	▪ Discussion on the elected three people to represent the land owners instead of appointing the lawyer. ▪ Committee to meet the three elected community representatives to rectify the elections that took place. ▪ Meeting to be held with the community to also rectify the elections that took place.

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STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
			▪ Clarify the responsibilities of the lawyer to be appointed ▪ Say who the lawyer will report to. ▪ To stop the committee meetings until the project brief, framework/work plan and lawyer ToRs are clear. ▪ Committee quorum to be agreed on.
Meetings held between October 2018 to Present			
Community Meeting (PAP/ Landowners only)	05 October 2018	▪ Mr Khotso Majake requested money because he has stopped ploughing his field.	▪ Neo I has stated from the beginning that landowners should continue to use their fields as they have before. Should any crops be in the ground when construction commences these will be compensated. ▪ The Compensation Committee presented an updated compensation offer to the affected people on Friday, 8 February 2019. Note that compensation for the powerline route is still being determined. ▪ This is taking longer than compensation for the project site as it is not certain if government or Neo I will own the powerline nor the exact route the powerline will follow. Neo I is working to resolve this matter. Initial compensation will be paid when the company is established and again when a lease agreement is signed.
Community Meeting (PAP/ Landowners only)	10 October 2018	▪ Mr Lira Mabele complained that Neo I has told us since 2017 that they are going to use our fields for generation of electricity; it	▪ A number of permits and agreements are required for the project before construction can start. Neo I is working to obtain all these permits and agreements as quickly as possible.

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STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
		is now 2018 and nothing has taken place. I hope we are not getting blind-folded with our fields.	
Compensation Committee	07 November 2018	▪ Mr. Tankiso Mokhethi (the land surveyor) report. ▪ Leases be issued to PAPs (Lawyer is Awaiting contract signing & further instructions). ▪ Legal documents to be written in Sesotho. ▪ The following documents to be finalised: ○ Deed of sale ○ Articles of incorporation ○ Agreement of sub lease	▪ Presentation by Land Surveyor (by Ntšihlele Land Surveyors). ▪ Presentation by Community Lawyer (By Advocate Maqakachane). ▪ Agenda for Community Meeting (afternoon of 07 Nov 2018). ▪ Compensation Committee allowances. ▪ Public meeting dates yet to be announced.
Community Meeting (PAP/ Landowners only)	07 November 2018	▪ PAPs to submit documents for lease application. ▪ Land surveyor to complete S10 Form and submit it on behalf of the land owners to LAA for preparation of Land Lease. (Awaiting further instructions on land valuation/agreement on land rates). ▪ The issue of Mr Bookholoane, Mohapi and Mr Lenko will be resolved by the Council. ▪ The Issue of Mr Letsoalos field will be resolve through the Courts.	▪ Introduction of Lawyer and activity Update. ▪ Land Survey- Confirmation of Form C. ▪ Public meeting dates yet to be announced.

STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
Compensation Committee	30 November 2018	Main agenda items included: ▪ The Land valuer's report back of his proposed compensation rates to Neo I ▪ Compensation rates proposed by Neo I ▪ The Land valuer's opinion on the Neo I offer i.e., interpretation of offer. The Committee indicated that they have to understand the compensation offer and be convinced of its fairness before it can be presented to the PAPs.	▪ Neo I provide written information regarding how it reached the proposed compensation rate. ▪ Ntate Steven, the community valuer, to address the Committee on his initial rates (as he had not done), and additionally report back on his negotiations with the Neo I and Government valuers. ▪ Ntate Steven to also be present in the next meeting to help and guide the Committee on negotiations and/or the appropriateness of the offer.
Community Meeting (PAP/ Landowners only)	30 November 2018	▪ The Chairperson tabled the agenda of the day, indicating that the meeting was for the purposes of report back on the compensation offer from Neo I. Unfortunately, the Committee did not have full information to proceed with the agenda. He reported that although the Committee had received a letter from Neo I with the proposed compensation rates, it was simply not explanatory enough. The Committee has referred back to Neo I for more information that would clarify their offer. ▪ When this information is available, the Committee promised the PAPs that they will be called again.	▪ Once the above action points take place, the meeting with PAPs will be held.

STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
Compensation Committee	10 December 2018	▪ Valuation determined the market rate for sale of the land. The Lease rate was determined by taking the sale amount and dividing by the Lease/PPA period. I.e. over the course of 25 years the owners receive rents equivalent to the sale price of the land, plus initial lump sum "signing bonus" equal to 15% of total compensation (lump sum + rents) ▪ In Lesotho, the initiatives to help the people to survive and have a fair standard of living is run by the Ministry of Social Welfare and the Vulnerability Assessment Team. It was recommended that a research should be done to see if the proposed rates meet the government standards.	▪ Report back of the Lawyer's discussion with Neo 1. (It was concluded that the lawyer should negotiate with Neo I and indicate that while the Committee may consider 50c rate per square metre, they however wish to propose an increment to people with smaller fields). ▪ Potential feedback meeting (to PAPs) on the 21st December.
Community Meeting (PAP/ Landowners only)	13 March 2019	▪ Ms Mampho Shai of Likhoele and Mr Thabo Ralenono mentioned that they have noticed white stones in their fields and wanted clarity for their purpose. .	▪ The stones in question were all yellow. ▪ The yellow stones mark the route of the existing powerline.
Community Meeting (PAP/ Landowners only)	13 March 2019	Mr Abele Mohlabi mentioned that he saw someone tempering with community soil; agreement was that there would be no	▪ The contractor is drilling boreholes and digging test pits to determine what soil/rock and water is present across the site. This information is needed for the engineers to design foundations for

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STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
		construction on the land before people can receive their compensation money; but someone is already touching our soil. ○ Wishes to speak to lawyer to launch complaint ○ Community Reps not giving him a fair chance to ask questions and get a fair response	the solar panels and to see if they will be able to obtain water on site for construction. These investigations are not part of the construction of the project. Construction of the project will only take place after compensation has been paid. Notice of the current investigations were communicated to three representatives (one from each village). Unfortunately, this information was not shared as per procedure, leading to Chiefs not being aware of the presence of the Contractor on site. The conclusion to this matter was that the communication procedure must be followed, and representatives must be careful in relaying messages on time to avoid a similar situation in future. ▪ Please indicate if you are satisfied with the responses provided or if you would like further to follow up. ▪ It will be noted to the Compensation Committee at their next meeting that it is important to allow all PAPs to voice their concerns and for these to be passed on to the project team so that they can be addressed. Please note that concerns can also be reported to M'me Mamello Moleli directly. It is also important that concerns are raised in a responsible manner as committee members also deserve to be treated fairly. ▪ A meeting with representatives from the three communities (including the chiefs of each village) and the "Contractor on site" Mr Victor took place on Sunday, 5 May 2019. All were in agreement that the way the selection and hiring of the labourers and security was done lacked transparency and needed to be rectified. To

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STAKEHOLDER	DATE OF ENGAGEMENT	MAIN POINTS OF DISCUSSION	FOLLOW UP ACTIONS
			resolve the employment issues, the Contractor was asked how much work was still to be done and whether his job needed any special skills and abilities and whether getting new people on the job would impact on the progress of his job. He indicated that no special skills were required but the job needed younger people, and preferably male to accomplish due to the strength needed to operate machinery used in the survey work. He expected to finish his job by end of the week- 10 May. Based on the estimated time left to finish the job, it was agreed that in order not to jeopardise the contractor's schedule he should continue with the current labourers and security. ▪ In the absence of any guidelines currently Puisano will work closely with the Chiefs and community reps, and using the existing PAPs list, will select eligible 'employees' based on the Contractors criteria. If no one matches the profile, then indirectly affected community members will be selected who match the Contractors criteria followed by people in the area. ▪ If any further contractors need to come to site before construction and require labourers Neo I will compile labour guidelines to ensure a fair employment process. The construction contractor will compile guidelines for construction employment. ▪ It was agreed that each of the Chiefs will call a Pitso to explain what happened and how any pre-construction employment will happen going forward.

6.3 Consultation During Scoping

The first stage of formal communication with the public was during the Scoping stage of the ESIA and was largely conducted by the social expert from Puisano[23] Mme Mamello and our social experts Mme Ntseketsi Lerotholi and Mme Kim Moonsamy (from Royal HaskoningDHV). The consultation meeting, held on the 29th of August, produced a wide range of information from the Local Chiefs (from the local affected villages of Ha Ramarothole, Ha Lempetje and Ha Raliemere), and the Compensation committee (which was set up in 2017) as Neo I had at the time commissioned a census of the affected individual plots.

A few points that became imminent at the meeting included:

- The Committee has a mandate which will be made available. It was established on the 7th of September 2017. The role of the Committee is to, amongst other things, express the views from the communities, to be their 'voice';
- The Chiefs confirmed that there are no structures having cultural or historical values situated on the project site;
- Some of the land is communal land – owned by the community. The project will compensate indirectly affected people – through Corporate Social Investment (CSI). Some land is owned by LEC for the power line transmission. Affected fields here are not part of this compensation process. All affected would face economic displacement (if the land is purchased);
- The Lesotho Meteorology and Energy Department may know about the PV plant that is being planned nearby;
- All 48[24] affected owners have Form C1 from the Council in accordance with the Lesotho Land Tenure Act. (Compensation will differ);
- The list of affected people originated from Neo I with estimates of land measurements. Owners have signed a document stating that people will sell their land to Neo I(Nov/Dec 2017). A signage form was designed by the Compensation Committee - both husband and wife signed, and the measurement (of land) from the Form C1 was attached. An example was verified at the meeting;
- Neo I will now rent the land;
- A census was undertaken between September and October 2017. Project Affected People (PAP) knew about the census, but no cut-off date announced. Compensation Committee was briefed about the project (when it was established on the 7th of September). Combined community meeting (x3) where information regarding the SIA and census and dates were communicated and their (PAP) availability requested;
- No formal grievance register exists. There were concerns from the affected communities. Presented in public meetings, not at the Compensation Committee meetings. Recorded in minutes. Some village Chiefs stated that they had meetings with the three villages, but no record/s or registers are in existence. With regards to the land dispute – letter from Principal chief– stating that the field belongs to a particular person. Issue was resolved via the Chief;
- Most have had stopped farming. Crop was not doing well in the last few years due to dry conditions (attributed to climate change). They were however told to continue farming and they will be

[23] Puisano Communications is a Maseru-based consultancy the had aided Neo I in their past communications with the local affected communities.

[24] Note that the number of affected owners (excluding the powerline) is at 36, where it was originally 47. While there were originally 47 PAPS, there are now 36 PAPs (9 fell off from change in intention with transmission line area, and 2 no longer included as the project boundary has been adjusted)

compensated for crop at the time the land is needed. But many chose differently. Due to recent drought, most people are no longer keen on farming. Very few have land elsewhere; and

- Mafeteng is mostly dry. There is a wetland and dam close to the site. Possible that the dam water may be for farming. Participant stated that it is being used for domestic and animal uses.

Other meetings that took place during the Scoping Phase are captured in the **Table 100** below.

Table 100: Details of other Scoping Phase Meetings

DATE AND TIME	ACTIVITY AND LOCATION	DESCRIPTION OF FINDINGS
29 August 2018	Meeting with the Project Compensation Committee at Tšana Talana Council at 11H00.	The purpose of the meeting was to introduce the Royal HaskoningDHV Team and the Environmental and Social Impact Assessment Study. In addition, the meeting was also used as platform to understand the setup of the local communities located with the study site, the social engagement which commenced in 2017 and the formation of the Compensation Committee.
	Meeting with landowners at the Ramathole Substation.	A brief informal meeting was held with the affected landowners to introduce the project team and inform them about the Environmental and Social Impact Assessment Study commencement and the appointment of Royal HaskoningDHV.
	Field reconnaissance	The Royal HaskoningDHV project team accompanied by the representatives of Neo I and the Local Chief (Ha Ramarothole) walked through the project site to understand the receiving environment.
30 August 2018	Meeting with Lesotho Department of Environment at their offices.	Royal HaskoningDHV convened a meeting with the officials from the Lesotho Department of Environment. The purpose of the meeting was to inform them about the appointment of Royal HaskoningDHV to conduct the Environmental and Social Impact Assessment of the PV project; provision of the project background; to understand their requirements and the review timeline as the local authority who will issue the EIA Licence.
	Meeting with Puisano at their Offices in Maseru West.	This meeting was aimed at explaining the roles of each team members. To also understand the work that has been done by Puisano since their Appointment in 2017.

During the site visit it was also confirmed that local communities are quite favourable to the Project itself, and moreover to the improved access to power. Important items for them is the prospect of the creation of new jobs and working opportunities and the potential to receive electricity to their villages[25]. The discussion about compensation has been in progress for the last year (since September 2017) and affected PAPs wish to see it conclude.

[25] *Note: direct access to electricity from the proposed PV plant is not confirmed. The initiative to include electricity supply as part of Neo ICSI programme will service the village of Ha Raliemere only.*

6.4 Grievance Redress Mechanism

During the ESIA it was imperative to implement and maintain a procedure for external communications, as well as to establish a grievance mechanism for Affected Communities, which is planned for in the SEP. The public concerned were given sufficient time to prepare and participate effectively in the process in accordance with IFC PS 1. Details of the Grievance and Redress Mechanism are contained in **Appendix B of the SEP**.

6.5 Consultation During the ESIA

The aims of the stakeholder consultation during the ESIA study are:

- To inform I&APs and key stakeholders of the proposed project and the ESIA study being undertaken;
- To define a consistent, comprehensive, coordinated and culturally appropriate approach to stakeholder engagement throughout the life of the Project;
- To generate a good understanding of the Project by ensuring that adequate, appropriate and timely information is provided to stakeholders;
- To ensure stakeholders understand the potentially significant environmental and social impacts of the Project;
- To understand local opinion, expectations and concerns about the Project;
- To manage expectations and possible misconceptions about the Project;
- To assist in developing effective mitigation measures and management plans for these impacts;
- To optimise any local benefits that can be delivered throughout the Project;
- Where possible, to enable affected communities to have an influence on and be involved in Project design, construction and operation; and
- To lay a good foundation for future stakeholder engagement.

The below sections describe measures which were taken to ensure comprehensive stakeholder consultation and engagement.

6.5.1 Identification of Key Stakeholders

The first step of ESIA process was to identify key stakeholders which includes:

- Central and District Government Representative;
- Local authorities (Mafeteng District Council),
- Affected and surrounding communities (Ha Ramarothole, Ha Lempetje, Ha Raliemere)
- Non-Governmental Organisations.

All stakeholders and I&AP information including contact details is included within a database. This database has been updated on an ongoing basis throughout the project and will act as a record of the communication/public involvement process.

6.5.2 Advertising

The ESIA process for the proposed project was advertised in three local newspapers of Lesotho namely Informative News, Public Eye and Lesotho News (**refer to Appendix D of SEP**). The advertisement requested I&APs to register and to become involved in the project. The primary aim of the advertisement is to ensure that the widest group of I&APs are informed of the project and to elicit comments regarding the project. The advertisement simultaneously informed I&APs of Draft ESIA Report availability, dates and venues of the planned public meetings. In addition, site notices written in English and Sesotho with project information were erected in public areas within the Mafeteng District (copies to be included in **Appendix D of the SEP**).

Although the English advert in the Informative News newspaper was legible, the Sotho advert was unclear. RHDHV confirmed in writing with Ms Tlalane M.Ramaema of the LMTEC on 26 August 2019 that this is however not of concern as other means and efforts (Sotho BID, Sotho executive summary distribution, Sotho grievance / community feedback sheet, etc) were made to ensure that all stakeholders and I&APs were adequately notified of the proposed project and report availability.

6.5.3 Background Information Document

A Background Information Document (BID) was compiled in English and Sesotho and distributed to stakeholders and I&APs. The aim of the document is to provide a brief outline of the application and the nature of the development. It is also aimed at providing preliminary details regarding the ESIA process and explains how stakeholders and I&APs can become involved in the project. The BID was distributed to all identified I&APs and stakeholders together with a registration and comment sheet between **25 September 2018 and 28 September 2018** inviting them to submit details of any issues, concerns or input they might have with regards to the project. This distribution will continue until the ESIA process is finalised.

6.5.4 Public Meetings

Public Meetings were held as per the dates shown in **Table 101** and minutes of the meetings and associated attendance registers (refer to **Appendix F** of the **SEP)** .

Table 101: Details of the Public Meetings

DTE	TIME	STAKEHOLDER	VENUE
06 August 2019	10H00 – 12H00	Government Departments	Mafeteng Hotel
06 August 2019	14H00 – 16H00	Compensation Committee	Tsana Talana Council Offices
07 August 2019	09H00 - 11H00	Ha Raliemere	Ha Raliemere: Chief's Place
07 August 2019	12H00 – 14H00	Ha Lempetje	Ha Lempetje: Chief's Place
07 August 2019	15H00 - 17H00	Ha Ramorothole	Ha Ramorothole: Chief's Place

6.5.5 Review of the Draft ESIA Report

The draft ESIA Report was made available for review at the following public locations within the study area, which are identified as readily accessible to I&APs:

- Mafeteng community centre;
- Tsana Talana Council offices;
- DA offices in Mafeteng;
- Maseru public library; and
- RHDHV website: www.dhv.com/newsite/pages/environmental/current-projects.php.

As is in line with the local EIA regulatory environment in Lesotho, a 30 day review process was allowed which was from **05 August 2019 to 05 September 2019**. I&APs registered on the project database were notified about the availability of this report through advertisement.

6.5.6 Comments and Response Report

Comments raised in the stakeholder engagement process during the ESIA process and response thereto has been compiled into the comments and response report. The comments and response report will categorise inputs received from Interested and Affected Parties / and other stakeholders into main headings such as technical, environmental, social, economic, general, etc (**refer to Appendix D of SEP**) .

6.5.7 ESIA Licence

On receipt of the amended ESIA Licence from LMTEC, stakeholders registered on the project database will be notified of the Licence and its associated conditions via emails and letters.

7 CONCLUSION AND RECOMMENDATIONS

The ESIA process for the proposed project has been undertaken in accordance with the IFC standards and Lesotho Regulatory Requirements.

The findings made in the ESIA are as a result of comprehensive specialists' assessments undertaken. These studies were based on issues identified through the ESIA process and the parallel process of stakeholder engagement. The stakeholder engagement process has been rigorous and extensive and every effort has been made to include representatives of all stakeholders within the process.

7.1 Evaluation of the Proposed Project

The proceeding chapters of this report provide a detailed assessment of predicted environmental and social impacts on specific components of the social and biophysical environment as a result of the proposed project. This chapter concludes the ESIA report by providing a holistic evaluation of the most important environmental and social impacts identified through the process. It draws on the information gathered as part of the ESIA process as well as knowledge gained by the team and presents an informed opinion about the proposed project.

7.1.1 Alternatives

Four site alternatives were identified and investigated for the proposed project and site alternative 1 emerged as the preferred alternative in the Scoping Report. Only alternative 1 was assessed in this ESIA Report.

7.1.2 Major Significant Impacts

The major environmental impacts associated with the proposed project as discussed within the ESIA include:

- **Physical Environment**
  - Climate change;
  - Air quality;
  - Noise;
  - Surface hydrology, ground water and water quality;
  - Wetland;
  - Visual; and
  - Heritage.
- **Biological Environment**
  - Flora;
  - Fauna; and
  - Avifauna.
- **Human Environment**
  - Social; and
  - Socio-economic.

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7.2 Conclusion of Specialist Studies

From the findings of the specialist's studies undertaken, the following conclusions were made regarding the impacts:

7.2.1 Physical Environment

7.2.1.1 Climate Change

The impact assessment indicates the following salient points:

- The project's contribution to the national GHG emissions mitigation will be significant i.e. reduce national emissions and will compensate for the small amount of emissions associated with the construction phase.
- The climatic trends and projections indicate that water availability and temperature stress are likely to affect the region in future, and these effects must be taken into account in the social impact assessment.

Of particular relevance are the following suggestions with regards to potential mitigation of the identified impacts:

- The vulnerability of people will increase in future. Therefore, the proposed compensation paid to people who lose access to agricultural land must account for the loss of livelihood potential.
- Soil erosion risk will increase due to the variability of rainfall combined with higher temperatures. Construction plans and operational runoff management must take this into consideration.

7.2.1.2 Air Quality

Based on the predicted model results and from the general condition of the area, it is recommended that mitigation measures be put in place to manage the dust emissions expected on site. With the management measures traditionally used in the construction industry, all emissions will fall well below the ambient standards that have been used, and it is expected that the site will accordingly comply with environmental legislation in this regard.

7.2.1.3 Noise

The proposed PV Plant project will be situated in an area where there are feeder roads (gravel and tar) and residential areas. The noise impacts assessment revealed that the noise impact will be negative low during the construction, operation and decommissioning phases. The threshold value of 3.0dBA granted by the IFC will not be exceeded. The recommended noise mitigatory measures will ensure that the proposed PV Plant will be environmentally sustainable and will reduce noise levels to negative low for all phases. Domestic animals depend on acoustic signals for essential functions. The noise impact will be below 2.5dBA which is very low and therefore classified as not significant which will not interfere with the acoustic signals for essential functions.

7.2.1.4 Surface Hydrology, Groundwater and Water Quality

Conclusions derived from this study can be summarised as follows:

- Increased sedimentation, a risk of flooding, and spillage from vehicles are the main identified potential environmental impacts during construction, operational and decommissioning phases of the project.
- Mitigation plans of the identified impacts during the three phases include:
  - Minimisation of areas to be cleared for designated infrastructure footprint;

- Construction of the infrastructure out the delineated flood lines;
- Implementation of the recommendations of the storm water management plan;
- Cleaning of any chemical spills;
- Implementation of a surface and ground water quality monitoring programme;
- Restoration of natural vegetation to enhance soil stability;
- The proposed stormwater drainage network be grass-lined to reduce the effect of erosion;
- Information on the sources of raw water should be provided together with the number of employees during the three phases of the project as well as the surface area for each PV module. All this information will be used in the calculation of the plant water balances;
- The Client need to confirm the drafted PFD diagram to feed into the calculation of the water balances;
- The inflow and outflow of water from different components of the PV plant should be measured. This will help improving future water balances should there be changes in the system; and
- Limit any water abstraction to sustainable levels in alignment with a detailed hydrogeological investigation would be required to determine sustainable yield from proposed water supply boreholes.

- If all the recommended identified mitigation measures be adhered to ensure that the identified potential impacts to the environment is negative low.

7.2.1.5 Wetland

The freshwater assessment has assessed the potential impacts associated with the proposed Solar PV Power Plant in south-western Lesotho near the town of Mafeteng. There are a number of freshwater features (wetlands) on the proposed development site and in the immediate vicinity of the site within a valley head seep wetland occurring in the northern part of the development site and seep wetlands occurring immediately to the north and south-east to the east of the site.

The construction and operation of the solar power plant could lead to the further degradation of wetlands on the site if the entire site is developed as proposed. The development of infrastructure in the wetlands on site, in particular the higher impact transformative infrastructure such as roads and other infrastructure with a direct footprint on the ground will lead to a net loss of biodiversity in the context of the wetlands (freshwater features) on the site. In line with the mitigation hierarchy, these impacts could be avoided if wetlands and an associated 30m buffer zone be retained as non-developed parts of the site to protect these features. However, this is not technically feasible and would render the development on the site financially non-feasible. Thus, in order to accommodate the development of infrastructure in the wetlands on the site and in order to ensure no net loss of freshwater-related biodiversity occurs, a series of sites for rehabilitation of physical impacting features has been proposed. Should the rehabilitation efforts be successfully undertaken according to the methodologies stipulated in this, should the other mitigation measures be implemented, and should livestock be kept out of the site, the improvement in wetland functioning and wetland habitat quality will offset the loss of wetland habitat associated with the development of solar power infrastructure in the wetland. In this way the development will adhere to the principles of no-net loss of biodiversity (in the context of wetland habitat) as espoused in the IFC guidelines and the mitigation hierarchy. Provided the recommended mitigation measures are implemented, it is recommended that the development can proceed.

7.2.1.6 Visual

The visual environment of the study area in which the proposed development is located has been investigated, and the visual character and sensitivity has been characterised. The study area is highly rural in nature with natural features dominating the landscape. There is thus expected to be an element of visual sensitivity associated with the study area, although this may not translate into perceptions of visual impact. The proposed development may not be perceived to be a source of visual impact if there are positive factors associated with it, e.g. improved service provision, source of employment, etc. A preliminary meeting between the proponent's representatives and the local chief can be considered in this context. In this meeting Chief Mabuse stated that one of the benefits of the project would be that the project would look good (visual impact). This statement implies a positive perception of the visual change to the landscape that would be resultant from the development.

An assessment of the degree of likely visual exposure of receptor locations within a 2km radius of the proposed development has been undertaken. This assessment has revealed that the two villages / settlements located closest to the proposed development (Ha Raliemere and Ha Sepechele (Ha Ramorothole)) and the local access roads leading to these villages will be exposed to the greatest degree of visual exposure – a high level of visual exposure, based not only on their proximity but topographical factors (i.e. located on terrain with an aspect that faces the proposed development). The receptor locations within the outer edges of these villages that are located closest to the proposed development could thus potentially experience the highest degree of visual impact. The degree of likely visual impact created by the proposed development is directly dependent on the perceptions of the inhabitants of the local area, however the relative portion of the landscape occupied by the proposed development and the degree of overall landscape change created by the proposed development is likely to reduce the degree of potential visual impact as the development would only occupy a portion of the landscape as viewed from the closest receptor locations. Should visual impacts be raised as a significant social environmental impact in the public participation process feedback for the ESIA's scoping phase, it is recommended that a further detail impact phase visual assessment be undertaken to filly quantify the degree of visual impact that would be created and to recommend adequate mitigation measures to avoid or adequately ameliorate these issues.

7.2.2 Biological Environment

7.2.2.1 Flora

The botanical receiving environment of the site and immediate surrounds demonstrates classic attributes of severely deteriorated and modified habitat as defined by the IFC Performance Standard 6. Historic, long-term and persistent subsistence agricultural practices and persistent, inappropriate and high grazing pressure have decimated and transformed natural vegetation within the development footprint (and surrounds), leading to the establishment of secondary climax vegetation and several other successional vegetatal stages that does not exhibit any characteristics of the original natural grasslands of the Sandy Eastern Free State Sandy Grasslands ecological type. Limited habitat were recognised as being moderately important in terms of the provision of ecological services, notably the wetlands towards the east of the footprint.

Existing scientific floristic knowledge of the area is sparse; the regional ecological type is described as the Eastern Free State Sandy Grassland and is currently afforded a Least Concern conservation status.

Scientific knowledge of the floristic diversity of the immediate region similarly indicates a high paucity of accurate and comprehensive data with only 187 species indicated in the relevant ¼ degree grid. The recorded diversity of only 81 species (October 2018) within the development footprint and immediate surrounds substantiates the categorisation of the vegetation of the site and surrounds as transformed and deteriorated. Considering the known high floristic diversity of the Grassland Biome in general, and the similarly diverse nature of natural grasslands in Lesotho, the poor floristic diversity of the site confirms the modified nature of the receiving environment.

Additionally, no plant species of conservation concern or -importance were recorded during this assessment, although there were some seasonal constraints. Furthermore, no habitat was identified as being of particular importance for Red Data refugia or suitable for the persistence of these species within the development footprint. However, several small niches were identified within the proximity to the site that is typically affiliated with plants of conservation concern. The monitoring of these areas as part of an annual monitoring programme will inform more accurately on the status of this aspect as well as contribute to scientific knowledge of the local and regional flora. As could be expected, an evaluation of potential and likely impacts on the floristic receiving environment revealed that impact significance are generally low to moderate. The comprehensive and timeous implementation of the botanical mitigation strategy is expected to ameliorate the significance of impacts to an acceptable level.

It is therefore the considered opinion of the specialist that the proposed development and operation of the NEO 1 PV Project is not expected to result in significant or severe impacts on the floristic environment on a local or regional scale; with the understanding that a complete and comprehensive mitigation approach is followed for the duration of the project, i.e. through completion of the decommissioning phase and revegetation of all development areas.

7.2.2.2 Fauna

Based on the results and analyses of the literature study and field investigation of October 2018, the following conclusions were reached regarding the faunal communities of the study area and surrounds and anticipated impacts of the proposed project on these faunal communities:

- Biodiversity conservation is critical for the continued supply of ecosystem services to secure the sustainability of livelihoods, especially for poor rural people in developing countries;
- Animals do not exist in isolation within ecosystems; animals or terrestrial as well as aquatic ecosystems are influenced by plant community structure and species diversity;
- The plant communities described for the study area are representative of the macro faunal habitat types;
- No red data listed animals or any other animals of conservation concern were encountered during the field investigation; none are known to occur in the Q-grid 2927CD in which the study area is found;
- The animals found to inhabit the study area and immediate surrounds are common and widespread species and not currently considered to be of any direct (species level) conservation importance;
- The sampling effort of the field investigation has significantly added to the species inventory list of the Q-grid 2927CD (Virtual Museum);
- Erosion gullies and agricultural fields of the study area exhibit low faunal sensitivities and the rocky ledges & cliffs (offsite) and drainage lines and seeps indicate medium-high faunal sensitivities;
- Three direct, three indirect and two cumulative impacts associated with the proposed project are anticipated to have relevance to the faunal communities of the study area and surrounds;

- All of the impacts anticipated can be effectively mitigated, reducing those with moderate, moderate-high and high significances to impacts with low significances;
- A comprehensive, annual faunal monitoring program will ensure that any changes to the faunal communities will be identified and managed with additional mitigation and management measures; and
- The objectives of Performance Standards 1 and 6 of the IFC that has relevance to the conservation and protection of the fauna of the region were considered and has been satisfied by the faunal assessment.

7.2.2.3 Avifauna

The avifaunal community on the site and immediate surrounds consists mainly of widespread species and was found with a low richness of species with low occupied densities. This illustrates the overall modified habitat condition of the habitat types on the study site. Only the rocky ledges and some of the drainage lines located to the east of the site are recognised as being important in terms of bird richness and dispersal.

A total of 109 bird species are expected to occur, with 51 observed during the survey (October 2018) within the development footprint and immediate surrounds. It highlights the perturbed condition and early seral stages of the dominant habitat types on the study site. However, the poor bird richness in the area also exemplified the fact that the avifauna on the western part of Lesotho is poorly known and insufficiently sampled. Nevertheless, four bird species of conservation concern were recorded during this assessment, with two (African Rock Pipit *Anthus crenatus* and Ground Woodpecker *Geocolaptes olivaceus*) being restricted to the rocky ledges and cliffs and another two species (Blue Korhaan *Eupodotis caerulescens* and Southern Bald Ibis *Geronticus calvus*) occurred on the agricultural fields and secondary grasslands. The latter species occurred in low densities in the area although being widespread in the area. As could be expected, an evaluation of potential and likely impacts on the avifauna revealed that the impact significance are generally low to moderate, with the exception of the potential for birds to collide with the panels and associated powerlines. In the absence of sufficient information on the occurrence and densities of waterbirds, the impact related to collision trauma is regarded as high (without mitigation) unless supporting evidence is acquired by means of a follow-up survey during the peak wet season.

Apart from the above, the opinion of the specialist is that the proposed development and operation of the NEO 1 PV Project is not expected to result in any highly significant or severe impacts at a local scale; with the understanding that a complete and comprehensive mitigation approach is followed along with pre- and post-construction monitoring.

7.2.3 Human Environment

Negative impacts (of a medium rating) are more predominant during the Project's construction phase. They will be very limited during the operations phase, as only maintenance issues will apply, and impacts are not likely to occur to human activities and/or livelihood generation. There are a few negative impacts that seem acute during the construction phase, but after mitigation almost all impacts initially regarded as 'high,' downgrade into a 'medium' or 'low' negative impact.

One of the negative impacts which remains at a 'high" negative includes, "Perceived preferential access to a finite number of jobs". This can only be properly mitigated with regular and transparent information exchange with the local communities. However, even with this, there is the potential that recruitment practices may seem unfair and misunderstood. For this reason, the activation of the Stakeholder engagement plan for the benefit of the Project, its beneficiaries, its impacted communities, the labour force, and the public at large, be carefully, consistently and systematically implemented.

Some positive impacts that remain high (during the operation phase) include, the potential increase in local gross geographic figures, the increase in (permanent) local job creation activities, and an increase in Lesotho's power producing independence. Of particular importance is that the compensation (rental) arrangements be expedited and PAPs are able to (with guidance) restore and/ or improve food security and living conditions. The SIA has, in its investigation, not met resistance to this project. PAPs (and the community in general) see the Project as a positive, and beneficial development, and the value of energy-creation and its local use, as long-awaited and a welcome relief.

While many negative impacts can be mitigated, it will require commitment from the Project Proponent and Site Management to properly and consistently meet with the ESMP compliance requirements. Much of the mitigation found within this report will be amalgamated with the ESMP for implementation during the Project's existence. This SIA in the sections above recommends the necessary mitigation and monitoring measures for this Project. It is strongly recommended that they be adhered to as they will be monitored by the Lenders.

7.2.4 Impact Rating Summary

A summary of the impact ratings for physical, biological and human environments are provided in **Tables 102, 103 and 104**.

The rating criteria as described in **Section 5** above specified that Points 4-6 depicts a low rating, 7-9 a moderate rating, 10-12 a high rating and 13 -16 a very high significance rating. At the bottom of each table in Section 5 above, the overall ratings before and after mitigation were averaged and the tables below are a summary of all the averaged values. It must however, be noted that for certain environmental aspects (for example post construction social impacts) positive and negative impact ratings considered together depicted an average value of less than 4, which in this specific instance would indicate a "very low" negative or positive impact.

Table 102: Summary of Physical Environment Impacts

PHYSICAL ENVIRONMENT	CONSTRUCTION	OPERATION	DECOMMISSIONING	TOTAL AVERAGE
CLIMATE CHANGE				
Average scoring without mitigation	-2.2 (Negative Low)	0	0	**-2.2**
Average scoring with mitigation	-0.7 (Neutral)	0	0	**-0.7**
AIR QUALITY				
Average scoring without mitigation	-7 (Negative Moderate)	-6 (Negative Low)	-5 (Negative Low)	**-6**
Average scoring with mitigation	-4.3 (Negative Low)	-4.3(Negative Low)	-4 (Negative Low)	**-4.2**
NOISE				
Average scoring without mitigation	-4 (Negative Low)	-4 (Negative Low)	-4 (Negative Low)	**-4**
Average scoring with mitigation	-4 (Negative Low)	-4 (Negative Low)	-4 (Negative Low)	**-4**
SURFACE HYDROLOGY, GROUNDWATER AND WATER QUALITY				
Average scoring without mitigation	-7(Negative Moderate)	-7(Negative Moderate)	-7.5 (Negative Moderate)	**-7.1**
Average scoring with mitigation	-5.6 (Negative Low)	-5.3 (Negative Low)	-5 (Negative Low)	**-5.3**
WETLANDS				
Average scoring without mitigation	-11 (Negative High)	-12 (Negative High)	0	**-7.6**
Average scoring with mitigation	-10 (Negative High)	+10 (Positive High)	0	**0**
VISUAL				
Average scoring without mitigation	-9 (Negative Moderate)	-9 (Negative Moderate)	-9 (Negative Moderate)	**-9**
Average scoring with mitigation	-7 (Negative Moderate)	-7(Negative Moderate)	-6 (Negative Low)	**-6.6**
HERITAGE				
Average scoring without mitigation	-6 (Negative Low)	0	0	**-2**
Average scoring with mitigation	-4 (Negative Low)	0	0	**1.3**

Table 103: Summary of Biological Environment Impacts

BIOLOGICAL ENVIRONMENT	CONSTRUCTION	OPERATION	DECOMMISSIONING	TOTAL AVERAGE
FLORA				
DIRECT				
Average scoring without mitigation	-7.4 (Negative Moderate)	0	0	**-7.4**
Average scoring with mitigation	-5.2 (Negative Low)	0	0	**-5.2**
INDIRECT				

BIOLOGICAL ENVIRONMENT	CONSTRUCTION	OPERATION	DECOMMISSIONING	TOTAL AVERAGE
Average scoring without mitigation	-8.6 (Negative Moderate)	0	0	**-8.6**
Average scoring with mitigation	-5.6 (Negative Low)	0	0	**-5.6**
CUMULATIVE				
Average scoring without mitigation	-8 (Negative Moderate)	0	0	**-8**
Average scoring with mitigation	-6 (Negative Low)	0	0	**-6**
FAUNA				
DIRECT				
Average scoring without mitigation	-7.3 (Negative Moderate)	0	0	**-7.3**
Average scoring with mitigation	-5.6 (Negative Low)	0	0	**-5.6**
INDIRECT				
Average scoring without mitigation	-9.6 (Negative Moderate)	0	0	**-9.6**
Average scoring with mitigation	-5 (Negative Low)	0	0	**-5**
CUMULATIVE				
Average scoring without mitigation	-9 (Negative Moderate)	0	0	**-9**
Average scoring with mitigation	-5 (Negative Low)	0	0	**-5**
AVIFAUNA				
Average scoring without mitigation	-8.6 (Negative Moderate)	0	0	**-8.6**
Average scoring with mitigation	-6.6 (Negative Low)	0	0	**-6.6**

Table 104: Summary of Human Environment Impacts

HUMAN ENVIRONMENT	CONSTRUCTION	OPERATION	DECOMMSIONING	TOTAL AVERAGE
SOCIAL AND SOCIO-ECONOMIC				
Average scoring without mitigation	-7.4 (Negative Moderate)	-0.8 (Negative Low)	-9.5 (Negative Moderate)	**-5.9**
Average scoring with mitigation	-3.4 (Negative Low)	-0.5 (Negative Low)	-7(Negative Moderate)	**-3.6**

The physical environment aspects generally depict moderate to low total average scoring prior to mitigation and after mitigation measures. The physical environmental aspect which had the highest average scoring prior to mitigation measures being implemented and after mitigation was impacts on wetlands. Other physical environmental aspects depict moderate average scoring prior mitigation measure however, after mitigation measures the scoring was moderate to low (**Table 102**). In terms of the biological environments, the average scoring is moderate prior to mitigation and low after mitigation measures (**Table 103**). The social environment depicts moderate-low scoring prior and after mitigation (**Table 104**).

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7.3 Recommendations

No fatal flaws were identified for the proposed project. The identified significant impacts can be mitigated by the developer through the implementation of the mitigation measures provided in this report and the Environmental and Social Management Plan (ESMP). To achieve appropriate environmental management standards and to ensure that the findings of the environmental studies are implemented through practical measures, the recommendations contained within various specialists' sections of this ESIA report are included within the ESMP. The ESMP must form part of the Contract for the appointed Contractor. The ESMP must be used to ensure compliance with the environmental specifications and management measures. The implementation of this ESMP for all life cycle phases (construction, operation as well as decommissioning) of the proposed project is considered to be instrumental in achieving the appropriate environmental management standards as detailed for this project. It is also recommended that the process of communications and consultation with the community representatives be maintained after the completion of the ESIA process.

Should an Environmental License be issued for the Project (or the existing license be updated), it is Royal HaskoningDHV's recommendation after the undertaking of this ESIA process that an ESMP must be implemented.

An ESMP has been developed for the construction, operational and decommissioning phases. This Plan is based on the format provided in the World Bank EHS Guidelines and were made Project specific using the recommendations arising from the ESIA process. The ESMP sets out the approach and responsibilities for managing the environment during project lifecycle (especially construction and operation). In addition, it includes the following:

- Summary of all anticipated significant adverse environmental and social impacts;
- Description of the mitigation measures (including whether these are continuous or in the event of contingencies);
- Description of the need for monitoring activities;
- Protocols for environmental sampling and reporting;
- Capacity development and environmental training of staff (description of the supervision, monitoring of implementation, remedial action, financing, reporting and staff training).

The ESMP has been included as **Appendix E** of this document.

8 LIST OF REFERENCES

1. Bailey, A. & Pitman, W., (2015). Water Resources of South Africa (2012) Study (WR2012): Executive Summary Version 1. WRC Report No. K5/2143/1, Gezina, South Africa: Water Research Commission Report.
2. Davies J. (2003). Hydrogeological Atlas of Lowland Lesotho. British Geological Survey, Wallingford, United Kingdom.
3. Grab, S. W., & Nash, D. J. (2009). Documentary Evidence of Climate Variability during Cold Seasons in Lesotho, Southern Africa, 1833–1900. Climate Dynamics, 34(4), 473-499.
4. International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability Framework (2012).
5. International Finance Corporation (IFC) Environmental Health and Safety Guidelines (2007)
6. IGES. (2018, September 26). IGES List of Grid Emission Factors. Retrieved from Institute for Global Environmental Strategies: https://pub.iges.or.jp/pub/iges-list-grid-emission-factors.
7. LMS. (2017). Lesotho's National Climate Change Policy. Maseru: Lesotho Meteorology Services, Ministry of Energy and Meteorology.
8. Longi Solar. (2018, July). LR6-72PD-355-375M Hi-MO1 High Efficiency Low LID Mono Perc Technology specification sheet. Retrieved from http://en.longi-solar.com/uploads/attach/20180730/5b5ec2b64460a.pdf
9. MEM. (2015). Lesotho's Intended Nationally Determined Contributions. Maseru: Ministry of Energy and Meteorology.
10. Mitchell RB (2002-2018) International Environmental Agreements Database Project (Version 2018.1).
11. Mucina L & Rutherford M.C. (edd) (2006). The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria
12. National Environment Secretariat (2009): Guidelines for Environmental Impact Assessment.
13. Ollis, D.J., Snaddon, C.D., Job, N.M. and Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.
14. Pehl, M., Arvesen, A., Humpenöder, F., Popp, A., Hertwich, E. G., & Luderer, G. (2017). Understanding future emissions from low-carbon power systems by integration of life-cycle assessment and integrated energy modelling. Nature Energy, 2, pages939–945. doi: doi: 10.1038/s41560-017-0032-9
15. Southern Africa Development Countries Environmental Legislation Handbook (2012). Third Edition.
16. World Bank Environmental and Social Framework. World Bank, Washington DC, 2016.
17. http://www.emapsworld.com/lesotho-districts-map.html (2010-2017) accessed in 11 September 2018
18. https://www.iafrikan.com/2017/08/16/utility-scale-solar-pv-project-in-lesotho/ (accessed 11 September 2018).

Appendix A - Project Brief

Appendix B - Environmental Clearance

Appendix C - Reddress Action Plan

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Appendix D - Specialist Reports

Appendix E – Environmental & Social Management Plan

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Appendix F – Stakeholder Engagement Plan