Phefumula Emoyeni One (Pty) Ltd

PHEFUMULA EMOYENI ONE GRID CONNECTION

Geotechnical Scoping Report

41105236_02
JUNE 2024

CONFIDENTIAL

Phefumula Emoyeni One (Pty) Ltd

PHEFUMULA EMOYENI ONE GRID CONNECTION

Geotechnical Scoping Report

REPORT (REV1) CONFIDENTIAL

PROJECT NO. 41105236

OUR REF. NO. 41105236_02

DATE: JULY 2024

Phefumula Emoyeni One (Pty) Ltd

PHEFUMULA EMOYENI ONE GRID CONNECTION

Geotechnical Scoping Report

WSP

Building 1, Maxwell Office Park
Magwa Crescent West, Waterfall City
Midrand, 1685
South Africa

Phone: +27 11 254 4800

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1
Remarks	Scoping Report	Scoping Report
Date	07 June 2024	23 July 2024
Prepared by	David Gina	Khuthadzo Bulala
Signature		Date: 7/24/24 9:30:09 AM
Checked by	Heather Davis	Heather Davis
Signature		Davis, Heather (ZAHD05193) 7/24/24 09:24
Authorised by	Heather Davis	Heather Davis
Signature		Davis, Heather (ZAHD05193) 7/24/24 09:25
Project number	41105236	41105236
Report number	Rev 0	Rev 1
File reference	\\corp.pbwan.net\za\Central_Data\Projects\41100xxx\41105236 - Phefumela Emoyeni WEF\41 MO\01-Reports\Scoping\EGI\..\Rev0\41105236_RPT_WSP_Seriti Green_Phefumula Emoyeni EGI 400kV_Scoping_Rev0_20240607.docx	\\corp.pbwan.net\za\Central_Data\Projects\41100xxx\41105236 - Phefumela Emoyeni WEF\41 MO\01-Reports\Scoping\EGI\41105236_RPT_WSP_Seriti Green_Phefumula Emoyeni EGI 400kV_Scoping_Rev1_20240624.docx

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

WSP Group Africa (Pty) Ltd (WSP) was appointed by Phefumula Emoyeni One (Pty) Ltd (PEO) to conduct a geotechnical desktop study for the proposed PEO electrical grid infrastructure (EGI) near the town of Ermelo, in the Mpumalanga Province of South Africa.

The objective of the desktop study is to perform a high-level assessment of the impacts of the proposed EGI on the geotechnical conditions on and around the project site or vice versa. The geotechnical desktop assessment forms part of the environmental authorisation (EA) process.

The proposed grid connection comprises:

- 33kV cabling (trenched) and where necessary, overhead power lines (OHL's) to connect the wind turbines to the onsite collector substations.
- 3 x collector substations (IPP) substations adjacent to distribution substations, each being up to approx. 5ha in extent.
- 3 x 132kV OHL's.
- Main Transmission Substation (MTS): 400/132kV

This scoping report details the findings of the geotechnical desktop study undertaken for the Phefumula Emoyeni Grid Connection. The proposed activity is defined as establishing the development of the Grid Connection as detailed in Table 1-1.

Table 1-1 – Phefumula Emoyeni One Grid Connection Proposed Infrastructure

Component	Description
Applicant Name	Phefumula Emoyeni One (Pty) Ltd
Development	Phefumula Emoyeni One Up to 400kV Grid connection and MTS
Municipality	Msukaligwa Local Municipality, Gert Sibande District Municipality
Up to 400kV transmission line	▪ 400kV Loop-In-Loop-Out (LILO) OHL. ▪ Servitude width for 1 x up to 400kV transmission line is 60m for Loop-In-Loop-Out ▪ Height of 1 x 400kV power line structure is on average 48m but may reach up to 50m in exceptional circumstances depending on the complexity and slope of the terrain. ▪ Minimum corridor clearance is between 8.1 and 12.6m. ▪ Span length between pylon structures typically up to 100 – 250m apart, depending on complexity and slope of terrain. ▪ For up to 400kV structures footprint sizes may vary depending on design type up to 110m^2 (10.5m by 10.5m), with concrete foundations of up to 80m^2 and depths up to 3.5m typically depending on the number and design of the foundations (to be determined during the detailed design engineering phase). The actual number of structures required will vary according to the final route alignment determined.

Component	Description
	■ Pylon structures will either be monopole or lattice structures depending on what is identified as appropriate during final design. For safety reasons, transmission lines require certain minimum clearance distances. These distances are as follows: ■ The minimum vertical clearance distance between the ground and transmission line is 6.7m. ■ The minimum vertical clearance to any fixed structure that does not form part of the transmission line is 9.4m – 11m. ■ The minimum clearance distance between an up to 400kV transmission line and an existing road is 60m – 120m (depending on the type of road). ■ Any farming practice can be conducted under the conductors provided the safe working clearances and building restrictions are adhered to.
Up to 132kV transmission lines	■ The servitude width for 1 x up to 132kV transmission line is 31m. A 300m corridor must be assessed (150m on either side of the centre line) to allow for micro-siting. In the case of the Loop-In-Loop-Out alternative this servitude will apply to each of the two connecting power lines. ■ The maximum height for an up to 132kV powerline structure is 40m. ■ Pylon structures will be either monopole or lattice structures depending on what is identified as appropriate during final design. ■ Pylon structures may require anchors with guywires or be anchorless. ■ For up to 132kV structures, concrete foundation sizes may vary depending on design type up to 80m^2 (10m by 8m), with depths reaching up to 3.5m typically in a rectangular 'pad' shape. ■ A working area of approximately 100m x 100m is needed for each of the proposed structures to be constructed.
Main Transmission substation (MTS) (Approx. 17.4 Ha)	■ A high voltage substation yard to allow for multiple 132kV and 400kV feeder bays and transformers, with infrastructure to allow for step-up to 400kV as required. ■ Standard substation electrical equipment, including but not limited to transformers, busbars, office area, operation and control room, workshop and storage area, feeder bays, transformers, busbars, stringer strain beams, insulators, isolators, conductors, circuit breakers, lightning arrestors, relays, capacitor banks, batteries, wave trappers, switchyards, metering and indication instruments, equipment for carrier current, surge protection and outgoing feeders, as may be needed. ■ The control building, telecommunication infrastructure, oil dam(s) etc, ■ Workshop and office area within the collector substation footprint, ■ Fencing around the substation

Component	Description
	■ All access road infrastructure to and within the substation.
Three Distribution Substations	■ Dx1-approx. 6.62ha footprint ■ Dx2-approx. 5.23ha footprint ■ Dx3-approx. 6.13ha footprint
Temporary/ construction phase infrastructure	■ Construction compound at the MTS (3ha) (site offices including conservancy tank for ablutions, stores, material laydown area, generator, fuel storage, etc.) ■ 3 x construction compound/ laydown areas, including site office of 3ha each at each of the Dx locations (150m x 200m each) (including conservancy tank for ablutions) ■ Batch plant 4-7 ha (unless a commercial source is used and concrete trucked to site, preferable to keep options open) ■ Portable ablution facilities will be used along the powerline routes.

2 STUDY AREA INFORMATION

The proposed grid connection site is located approximately 25km north-west of Ermelo in the Msukaligwa Local Municipality of the Gert Sibande District Municipality in the Mpumalanga Province. The locality of the site within the region is shown in Figure 2-1.

The site can be accessed via the N11 and existing access roads from the east. The grid connection infrastructure will be developed within a project site which covers a total area of approximately 33 660 hectares (ha) which is currently used for crop and livestock farming.

The natural topography is characterised mainly by rolling plains and low hills in most areas which are locally interspersed by small ridges and flattish plateaus. There are many semi-perennial streams throughout the study area however the main perennial streams such as the Viskuile River and Bankspruit River, located north-west of the site drain in a north to north-westerly direction.

The servitude footprint of the grid connection infrastructure comprises 18.5km of internal OHL's in a 31m servitude, 17.4 ha for the MTS, 6.62 ha for the DX1 substation, 5.23 ha for the DX2 substation and 6.13 ha for the DX3 substation.

The layout of the of the proposed grid connection infrastructure is illustrated in Figure 2-2.

Figure 2-1 – Locality Map of the Phefumula Emoyeni One Grid Connection

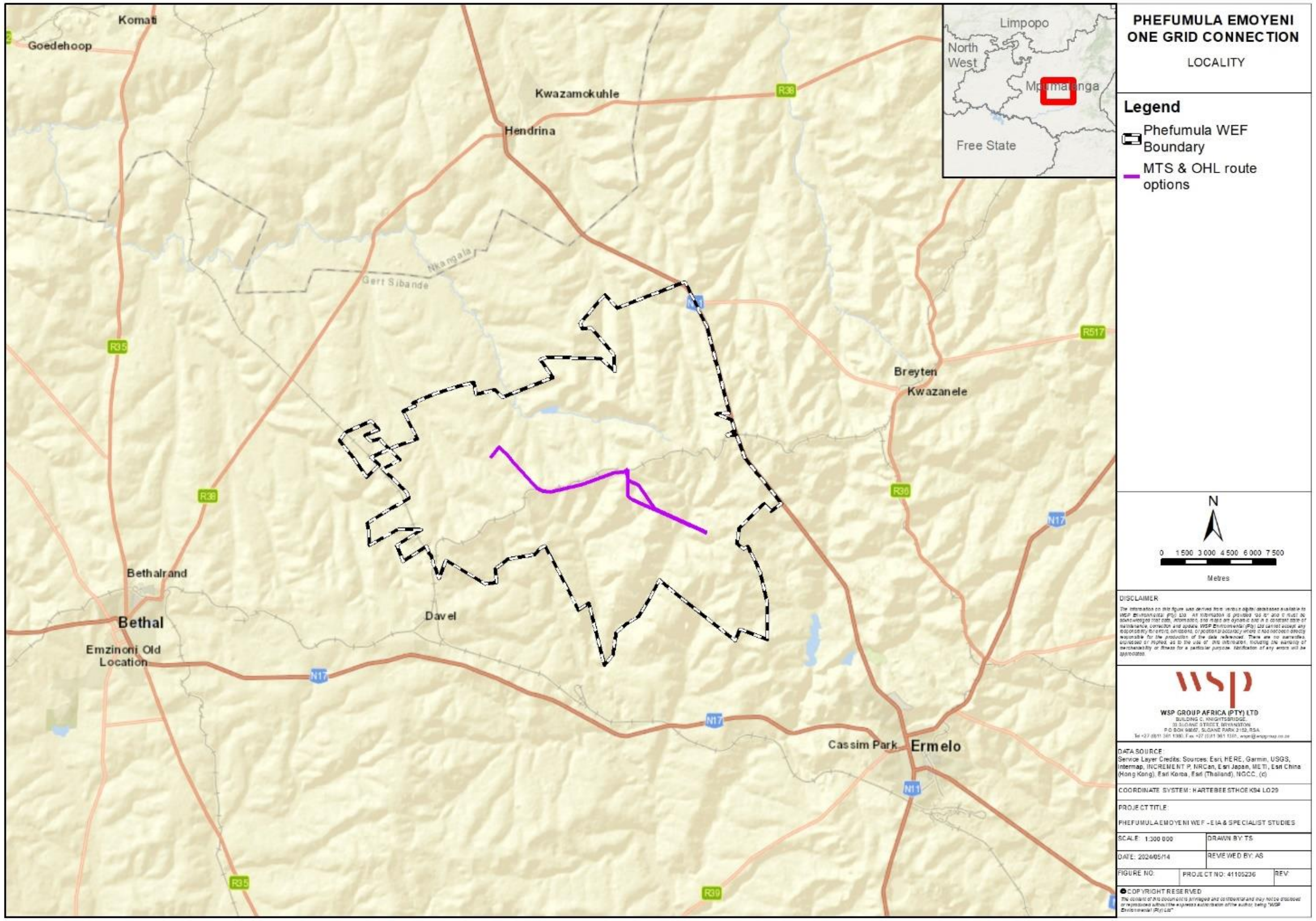

Figure 2-2 – Layout of the Phefumula Emoyeni One grid connection

3 GEOLOGY

According to the published 1: 250 000 scale geological map (Sheet 2628 East Rand), the study area is underlain by rocks of the Vryheid Formation (Pv), Ecca Group of the Karoo Supergroup. The Vryheid Formation comprises sandstone, shale and coal beds. The Vryheid Formation has been extensively intruded by Jurassic age dolerite (Jd). The dolerites occur both as sills and linear dyke structures that may extend over tens of kilometres. Minor areas of recent surficial deposits, alluvium, blanket areas along Klein Olifants River and Viskuile River at the north-eastern and western portions of the site respectively. An excerpt of the published geological map showing the project area is presented as Figure 3-1 and the lithostratigraphy is presented as.

Figure 3-1 – Geological Map of the Project Area

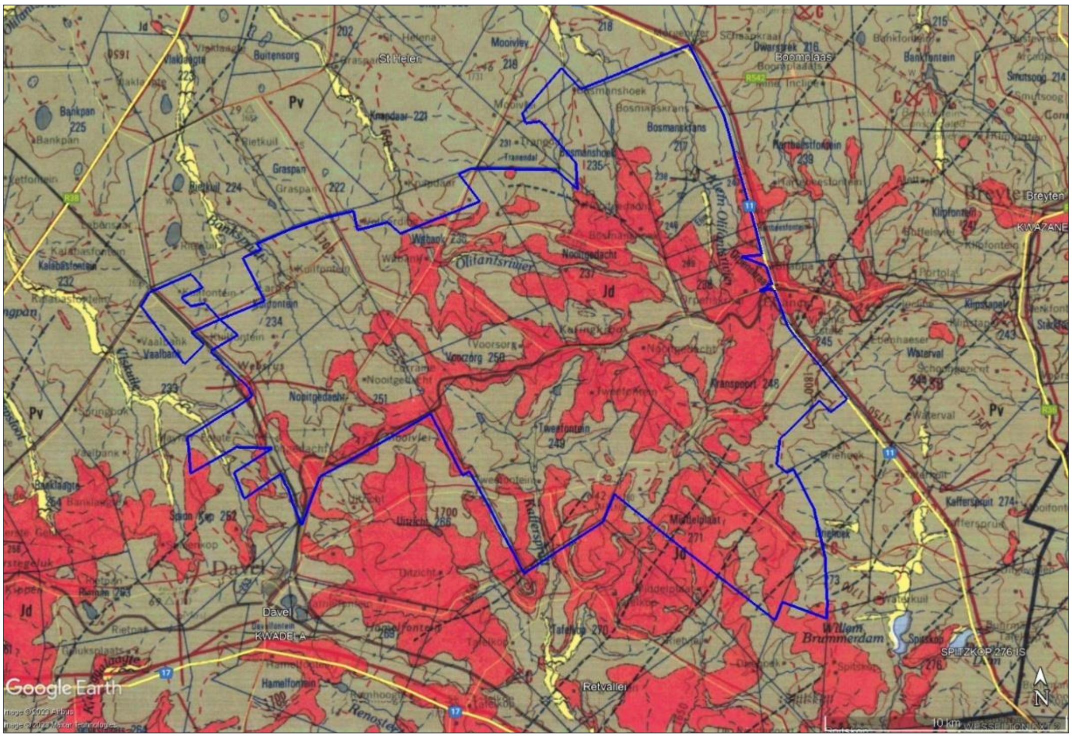

Table 3-1 – Lithostratigraphy of the Study Area

Supergroup	Group	Formation	Lithology	Map Symbol
Quaternary			Alluvium	
Intrusive			Dolerite	Jd
Karoo	Ecca	Vryheid	Sandstone, shale, coal beds	Pv

4 GEOTECHNICAL IMPACT ASSESSMENT

The geotechnical impact assessment of the proposed Phefumula Emoyeni One grid connection was performed according to the impact assessment methodology provided and included in Appendix A of this report.

The assessment considers development of the cable trenches, the MTS, onsite substations and OHL's. The geotechnical impacts for the grid connection are listed in Table 4-1 and the screening tool in the pre-mitigation situation is presented in Table 4-2

Table 4-1 – Geotechnical Impacts

Aspect	Impact	Mitigation Measures
Construction		
Soil erosion	Increase stormwater velocity. Increase in soil and wind erosion due to cleared vegetation. Creation of drainage paths along access tracks and side slopes. Sedimentation of non-perennial features and excessive dust.	Rehabilitation of affected areas (such as revegetation). Construction of temporary berms and drainage channels to divert surface water. Minimize earthworks and fills. Use existing road network and access tracks. Correct engineering design and construction of gravel access roads and culverts/drainage pipes at water crossings. Control stormwater flow. Quality control during construction of embankments including adequate drainage in design. Use proper linings on embankments.
Disturbance of fauna and flora	The displacement of natural earth material and overlying vegetation leading to erosion. Disturbance on natural fauna and flora ecosystems.	Limited excavations.
Oil spillages from heavy plant	Potential groundwater and drainage feature contamination.	Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection.
Slope stability	Slope instability around structures. Steeply dipping joints in rock or boulders in soil mass may prove treacherous in cuttings and deep foundation excavation leading to collapse of sidewalls. Collapse of "soft" ground in excavation especially in areas below the water table. Can lead to fatality.	Avoid steep slopes areas. Design cut slopes according to detailed geotechnical analysis and adopt appropriate support mechanisms. Adopt safe wok procedures in excavation.

Aspect	Impact	Mitigation Measures
Seismic activity	Damage of proposed development.	Design according to expected peak ground acceleration.
Groundwater	Potentially undermine soil below foundations and cause damage to structures.	Identify sources of groundwater and eliminate by detailed design/employ effective groundwater lowering techniques
Decommissioning		
Soil erosion	Increase in soil and wind erosion due to clearance of structures. Displacement of soil and damage to vegetation by vehicles.	Use existing road network and access tracks. Use of temporary berms and drainage channels to divert surface water. Minimize earthworks and demolish footprints. Rehabilitation of affected areas (such as revegetation). Reinstate channelized drainage features. Strip, stockpile and re-spread topsoil.
Disturbance of fauna and flora	The displacement of natural earth material and overlying vegetation leading to erosion.	Limited excavations
Oil spillages from heavy plant	Potential oil spillages in machinery due to clearance of structures.	Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection. Frequent checks and conditional monitoring
Slope stability	Slope instability around structures.	Avoid steep slopes areas. Design cut slopes according to detailed geotechnical analysis and adopt appropriate support mechanisms. Adopt safe wok procedures in excavation.
Cumulative		
Soil erosion	Increase stormwater velocity. Increase in soil and wind erosion due to clearing of vegetation. Creation of drainage paths along access tracks. Sedimentation of non-perennial features and excessive dust.	Rehabilitation of affected areas (such as revegetation). Construction of temporary berms and drainage channels to divert surface water. Minimize earthworks and fills. Use existing road network and access tracks. Correct engineering design and construction of gravel roads and water crossings. Control stormwater flow.

Aspect	Impact	Mitigation Measures
Disturbance of fauna and flora	The displacement of natural earth material and overlying vegetation leading to erosion.	Limited excavations
Oil spillages from heavy plant	Potential groundwater and drainage feature contamination.	Vehicle and construction machinery repairs to be undertaken in designated areas with proper soil protection.
Slope stability	Slope instability around structures. Steeply dipping joints in rock or boulders in soil mass may prove treacherous in cuttings and deep foundation excavation leading to collapse of sidewalls. Collapse of "soft" ground in excavation especially in areas below the water table. Can lead to fatality.	Avoid steep slopes areas. Design cut slopes according to detailed geotechnical analysis and adopt appropriate support mechanisms. Adopt safe wok procedures in excavation.
Seismic activity	Damage of proposed development.	Design according to expected peak ground acceleration.
Groundwater	Potentially undermine soil below foundations and cause damage to structures.	Identify sources of groundwater and eliminate by detailed design/employ effective groundwater lowering techniques

Table 4-2 – Geotechnical Impact Screening

Impact	Rating Criteria			Screening Tool
	Status	Consequence	Probability	
Construction				
Soil Erosion	Negative	Moderately severe	Probable	Low
Disturbance of Fauna and Flora	Negative	Moderately severe	Highly probable	Medium
Oil Spillages from Heavy Plant	Negative	Moderately severe	Probable	Low
Slope Stability	Negative	Moderately severe	Probable	Low
Seismic Activity	Negative	Severe	Improbable	Low
Groundwater	Negative	Negligible	Probable	Very Low
Decommissioning				
Soil erosion	Negative	Moderately severe	Probable	Low

Impact	Rating Criteria			Screening Tool
	Status	Consequence	Probability	
Disturbance of Fauna and Flora	Negative	Moderately severe	Highly probable	Medium
Oil Spillages from Heavy Plant	Negative	Moderately severe	Probable	Low
Slope Stability	Negative	Negligible	Improbable	Very Low
Cumulative				
Soil erosion	Negative	Moderately severe	Probable	Low
Disturbance of fauna and flora	Negative	Moderately severe	Highly probable	Medium
Potential oil spillages	Negative	Moderately severe	Probable	Low
Slope stability	Negative	Moderately server	Probable	Low
Seismic activity	Negative	Severe	Improbable	Low
Groundwater	Negative	Negligible	Probable	Very Low

5 GEOTECHNICAL DESKTOP STUDY EIA PHASE METHODOLOGY

The detailed geotechnical desktop assessment will include the following:

- Literature reviews of available published and unpublished information including, but not limited to, geological data, geological maps, topographical maps, aerial images and any existing geotechnical investigation reports of the study area
- Assessment of geotechnical evaluation criteria, including excavation conditions across the sites, seismicity, undermining, engineering properties of the underlying geology, slope stability etc.
- Assessment of the relevant geotechnical and geological fatal flaws within the study area
- Site reconnaissance to assess the ground conditions on site.

6 CONCLUSIONS

Based on WSP's scoping desktop study, the proposed PEO grid connection site is considered suitable for development. A "very low to medium" impact was assessed, from a geotechnical perspective, for the pre-mitigation situation. A detailed geotechnical desktop study will be undertaken and provide mitigation measures for the impacts.

6.1 ASSUMPTIONS AND LIMITATIONS

Your attention is drawn to Appendix B: Document Limitations.

The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimize the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by WSP, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

7 REFERENCES

- 1:250 000 Geological Map Series (2628 East Rand). Published by the Council of Geoscience

Appendix A

IMPACT ASSESSMENT METHODOLOGY

IMPACT ASSESSMENT METHODOLOGY

SCOPING PHASE

REPORTING REQUIREMENTS

- Project Description
- Legislative Context (as applicable)
- Assumptions and limitations
- Description of Baseline Environment
- Site Sensitivity Verification – including sensitivity mapping
- Identification and high-level screening of impacts and mitigation measures
- Plan of Study for EIA

Ensure that all reports fulfil the requirements of the relevant Protocols.

HIGH-LEVEL SCREENING OF IMPACTS AND MITIGATION

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase. The screening tool is based on two criteria, namely probability; and, consequence (**Table 0-3**), where the latter is based on general consideration to the intensity, extent, and duration.

The scales and descriptors used for scoring probability and consequence are detailed in **Table 0-3** and **Table 0-2** respectively.

Table 0-1: Probability Scores and Descriptors

SCORE	DESCRIPTOR
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable:** The possibility of the impact occurring is very low

Table 0-2: Consequence Score Descriptions

SCORE	NEGATIVE	POSITIVE

The Pavilion, 1st Floor
Cnr Portswood and Beach Road, Waterfront
Cape Town, 8001
South Africa

Tel.: +27 21 481 8700
Fax: +086 606 7121
www.wsp.com

4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

Table 0-3: Significance Screening Tool

CONSEQUENCE SCALE

PROBABILITY SCALE		**1**	**2**	**3**	**4**
	1	**Very Low**	**Very Low**	**Low**	**Medium**
	2	**Very Low**	**Low**	**Medium**	**Medium**
	3	**Low**	**Medium**	**Medium**	**High**
	4	**Medium**	**Medium**	**High**	**High**

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (**Table 0-4**) has been applied according to the nature and significance of the identified impacts.

Table 0-4: Impact Significance Colour Reference System to Indicate the Nature of the Impact

Negative Impacts (-ve)	**Positive Impacts (+ve)**
Negligible	**Negligible**
Very Low	**Very Low**
Low	**Low**
Medium	**Medium**
High	**High**

Appendix B

DOCUMENT LIMITATIONS

DOCUMENT LIMITATIONS

This document has been provided by WSP Group Africa Pty Ltd ("WSP") subject to the following limitations:

i) This Document has been prepared for the particular purpose outlined in WSP's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of WSP's Services are as described in WSP's proposal, and are subject to restrictions and limitations. WSP did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by WSP in regard to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry WSP was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

iv) In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. WSP's opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed WSP to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by WSP for incomplete or inaccurate data supplied by others.

vii) The Client acknowledges that WSP may have retained sub-consultants affiliated with WSP to provide Services for the benefit of WSP. WSP will be fully responsible to the Client for the Services and work done by all its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from WSP and not WSP's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against WSP's affiliated companies, and their employees, officers and directors.

viii) This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions based on this Document.

Building 1, Maxwell Office Park
Magwa Crescent West, Waterfall City
Midrand, 1685
South Africa

wsp.com