DRAFT BASIC ASSESSMENT REPORT

Proposed 132 kV Overhead Transmission Line for the Hotazel Solar Farm near Hotazel, Northern Cape

Hotazel Solar Farm 1 (Pty), subsidiary of Juwi Renewable Energies (Pty) Ltd

7 April 2017

Revision: 0

Reference: 112667

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PROJECT DETAILS

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Document control aurecon						
Report title		Proposed 132 kV Overhead Transmission Line for the Hotazel Solar Farm near Hotazel, Northern Cape				
Document ID			**Project number**		112667	
File path		C:\Users\Cornelia.Steyn\Desktop\HotzHell\BAR Hotazel .docx				
Client		Hotazel Solar Farm 1 (Pty), subsidiary of Juwi Renewable Energies (Pty) Ltd	**Client contact**		Nazley Towfie	
Rev	**Date**	**Revision details/status**	**Prepared by**	**Author**	**Verifier**	**Approver**
0	30 March 2017	1st Draft	Corlie Steyn	Corlie Steyn	Patrick Killick	Diane Erasmus
Current revision		0				

Approval			
Reviewer signature		Approver signature	
Name	Patrick Killick	Name	Diane Erasmus
Title	Senior Environmental Practitioner	Title	Associate

NEMA requirements for Basic Assessment Reports

#	Content as required by NEMA	Page
3(a)	(i) details of the EAP who prepared the report; and	Appendix H
	(ii) details of the expertise of the EAP to carry out scoping procedures.	
3(b)	the location of the activity, including-	Section A
	(i) the 21 digit Surveyor General code of each cadastral land parcel;	
	(ii) where available, the physical address and farm name;	
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	N/A
3(c)	a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is-	Appendix A
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	N/A
3(d)	a description of the scope of the proposed activity, including-	Section A (1.1.1.)
	(i) all listed and specified activities triggered and being applied for; and	
	(ii) a description of the activities to be undertaken, including associated structures and infrastructure;	Section A (1.1.1 and 1.1.2)
3(e)	a description of the policy and legislative context within which the development is proposed including -	Section A (1.10)
	(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	
	(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	
3(f)	a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section A (1.10)
3(g)	a motivation for the preferred site, activity and technology alternative;	Section E
3(h)	a full description of the process followed to reach the proposed preferred alternative within the site, including:	Section A (1) and (2)
	(i) details of all the alternatives considered;	
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section C and Appendix E
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 3 and Appendix E
	(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section B
	(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section D and Appendix F
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Appendix F
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section D, E and Appendix F
	(viii) the possible mitigation measures that could be applied and level of residual risk;	
	(ix) the outcome of the site selection matrix;	Section D
	(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and	N/A
	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Section A, Section D, Section E and Appendix A
3(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including -	Section B and Appendix F
	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	
3(j)	an assessment of each identified potentially significant impact of risk, including -	Section D and Appendix F
	(i) cumulative impacts;	
	(ii) the nature, significance and consequences of the impact and risk;	
	(iii) the extent and duration of the impact and risk;	
	(iv) the probability of the impact and risk occurring;	
	(v) the degree to which the impact and risk can be reversed;	
	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	
	(vii) the degree to which the impact and risk can be avoided, managed or mitigated;	
3(k)	where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	Section D and F
3(l)	an environmental impact statement which contains -	Section E
	(i) a summary of the key findings of the environmental impact assessment;	
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	Appendix A
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section D
3(m)	based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;	Section E and Appendix G
3(n)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as	Section E

	conditions of authorisation;	
3(o)	a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Assumptions are contained where relevant in specialists reports, refer to Appendix D:
3(p)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section E
3(r)	an undertaking under oath or affirmation by the EAP in relation to-	Section E and Appendix H
	(i) the correctness of the information provided in the report;	
	(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and	
	(iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
3(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	
3(t)	any specific information that may be required by the competent authority; and	N/A
3(u)	any other matter required in terms of section 24(4)(a) and (b) of the Act.	N/A

Contents

Figures

Tables

Abbreviations

BAR	Basic Assessment Report
CO_2	Carbon Dioxide
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEANC	Department of Environmental Affairs and Nature Conservation
DoE	Department of Energy
EAP	Environmental Assessment Practitioner
EMPr	Environmental Management Programme
EIA	Environmental Impact Assessment
ERA	Electricity Regulation Act (No. 4 of 2006)
GN	Government Notice
G:S:B-	General: Small: negative water balance
GWh	Gigawatt hours
ha	Hectares
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt
LILO	Loop in loop out
MW	Megawatts
MWh	Megawatt hours
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NHRA	National Heritage Resources Act (No. 25 of 1999)
NWA	National Water Act (No 36 of 1998)
PV	Photovoltaic
SAHRA	South African Heritage Resources Agency
SACNASP	South African Council for Natural Scientific Professions
SDF	Spatial Development Framework
SO^2	Sulphur Dioxide
UNCBD	United Nations Convention on Biological Diversity
UNFCC	United Nations Framework Convention on Climate Change

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

(For official use only)

File Reference Number:	
Application Number:	
Date Received:	

Basic assessment report in terms of the Environmental Impact Assessment Regulations, 2014, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

Kindly note that:

1. This **basic assessment report** is a standard report that may be required by a competent authority in terms of the EIA Regulations, 2014 and is meant to streamline applications. Please make sure that it is the report used by the particular competent authority for the activity that is being applied for.
2. This report format is current as of **08 December 2014**. It is the responsibility of the applicant to ascertain whether subsequent versions of the form have been published or produced by the competent authority
3. The report must be typed within the spaces provided in the form. The size of the spaces provided is not necessarily indicative of the amount of information to be provided. The report is in the form of a table that can extend itself as each space is filled with typing.
4. Where applicable **tick** the boxes that are applicable in the report.
5. An incomplete report may be returned to the applicant for revision.
6. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the regulations.
7. This report must be handed in at offices of the relevant competent authority as determined by each authority.
8. No faxed or e-mailed reports will be accepted.
9. The signature of the EAP on the report must be an original signature.
10. The report must be compiled by an independent environmental assessment practitioner.
11. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.
12. A competent authority may require that for specified types of activities in defined situations only parts of this report need to be completed.
13. Should a specialist report or report on a specialised process be submitted at any stage for any part of this application, the terms of reference for such report must also be submitted.
14. Two (2) colour hard copies and one (1) electronic copy of the report must be submitted to the competent authority.
15. Shape files (.shp) for maps must be included in the electronic copy of the report submitted to the competent authority.

1. SECTION A: ACTIVITY INFORMATION

Has a specialist been consulted to assist with the completion of this section?

► YES	NO

If YES, please complete the form entitled "Details of specialist and declaration of interest" for the specialist appointed and attach in Appendix I.

All specialist reports contain the signed form entitled "Details of specialist and declaration of interest" (Please refer to Appendix I).

1.1. Project description

1.1.1. Describe the project associated with the listed activities applied for:

Context:

Three transmission corridor alternatives to evacuate power from the Hotazel solar facility to the national grid are being considered. In accordance with standard practice, the three alternatives will be comparatively assessed against the "no-go" alternative, i.e. the impacts of the project should it not proceed. Two of the transmission line alternatives connect directly to existing Eskom substations, namely the Hotazel and Umtu substations and the third Alternative is a shorter Loop-in Loop-Out (LILO) connection option connecting with Eskom's Ferrum/Umtu 132kV distribution line near the site. Whichever one is constructed, it would form part of the national grid and therefore fall under the ownership and operation of Eskom. Ownership of this infrastructure is to be ceded to Eskom once the transmission line has been constructed and must therefore have a separate environmental authorisation to allow for the transference of the Environmental Authorisation (EA) into Eskom's name with the change in ownership. For this reason, the transmission lines are the subject of this separate application and not part of the Hotazel Solar Park EIA application that is being run in parallel.

NOTE: The Loop In Loop Out (LILO) connection depends on technical capacity upgrades to the Eskom line, which are eluded to but not guaranteed. The LILO alternative does not currently constitute a "feasible alternative" in terms of NEMA however, it has been comparatively assessed as the status might change in the near future and become feasible and the option can then be pursued through an EA amendment process. For the purposes of the current application the LILO alternative cannot be put forward as the preferred option due to the current technical infeasibility and uncertainty regarding upgrades.

The components of the three alternatives are:

Transmission line 1: Hotazel Substation (Alternative 1: Preferred Alternative)

- A ≤200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed
- Servitude width 35m
- ≤110monopole pylons
- ≤12km long and 4m wide service track

Transmission line 2: Umtu substation (Alternative 2) ▪ A ≤200m wide corridor ≤14km double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤140 monopole pylons ▪ ≤15km long and 4m service track
Transmission Line 3: LILO connection (Alternative 3)[1] ▪ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ▪ Servitude width 35m per line (70m total). ▪ ≤60 monopole pylons (i.e. ≤120 pylons in total) ▪ ≤6km long and 4m wide service track
Transmission Line 4: No-Go (Alternative 4) The transmission line will not be constructed and the status quo remains. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

1.1.2. Provide a detailed description of the listed activities associated with the project as applied for:

Listed activity as described in GN R. 983, GN R. 984 and GN R.985	Description of the activities to be undertaken, including associated structures and infrastructure
GN R983: Listing Notice 1	
Activity. 11 (i): The development of facilities or infrastructure for the transmission and distribution of Electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	The construction of a 132 kV transmission line from the proposed Hotazel Solar Park development to the existing Eskom Umtu or Hotazel Substations (or LILO) are located outside of the urban edge and therefore triggers this activity.
GN R984: Listing Notice 2	
Listed activities in terms of NEMA GN No. 984	None
GN R985: Listing Notice 3	
Listed activities in terms of NEMA GN No. 985	None

1.2. Feasible and reasonable alternatives

"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—
(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

Describe alternatives that are considered in this application as required by Appendix 1 (3)(h), Regulation 2014. Alternatives should include a consideration of all possible means by which the purpose and need of the proposed activity (NOT PROJECT) could be accomplished in the specific instance taking account of the interest of the applicant in the activity. The no-go alternative must in all cases be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed.

The determination of whether site or activity (including different processes, etc.) or both is appropriate needs to be informed by the specific circumstances of the activity and its environment. After receipt of this report the, competent authority may also request the applicant to assess additional alternatives that could possibly accomplish the purpose and need of the proposed activity if it is clear that realistic alternatives have not been considered to a reasonable extent.

The identification of alternatives should be in line with the Integrated Environmental Assessment Guideline Series 11, published by the DEA in 2004. Should the alternatives include different locations and lay-outs, the co-ordinates of the different alternatives must be provided. The co-ordinates should be in degrees, minutes and seconds. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection.

1.2.1. Site alternatives

Alternative 1 (preferred alternative) : Hotazel substation
Transmission line 1: Hotazel Substation (Alternative 1: Preferred Alternative) ▪ A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤110monopole pylons ▪ ≤12km long and 4m wide service track
Alternative 2 : Umtu substation (Alternative 2)
Transmission line 2: Umtu substation (Alternative 2) ▪ A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed ▪ Servitude width 35m

1 *"The Loop In Loop Out connection depends on technical capacity of the Eskom line before being deemed a feasible alternative. This is considered the least, technically, viable alternative at this stage, though this might change in future"*

■ ≤140 monopole pylons ■ ≤15km long and 4m service track		
Alternative 3 : LILO connection (Alternative 3: Not currently feasible)		
Transmission Line 3: LILO connection (Alternative 3: Not currently feasible)[2] ■ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ■ Servitude width 35m per line. ■ ≤60 monopole pylons (i.e. ≤120 pylons in total) ■ ≤6km long and 4m wide service track		
Alternative 4 : No-Go alternative		
No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.		

In the case of linear activities:

Alternative:	**Latitude (S):**	**Longitude (E):**
Alternative S1 (preferred) (Hotazel)		
Starting point of the activity	27°14'17.54"S	23° 0'35.19"E
Middle/Additional point of the activity	27°14'44.35"S	22°58'8.52"E
End point of the activity	27°12'22.14"S	22°57'29.58"E
Alternative S2 (2nd preference) (Umtu)		
Starting point of the activity	27°14'17.54"S	23° 0'35.19"E
Middle/Additional point of the activity	27°14'25.51"S	22°57'23.45"E
End point of the activity	27°13'12.84"S	22°54'18.33"E
Alternative S3 (3rd preference) (LILO)		
Starting point of the activity	27°14'17.54"S	23° 0'35.19"E
Middle/Additional point of the activity	27°15'8.05"S	22°59'18.11"E
End point of the activity	27°15'59.75"S	22°57'57.34"E

For **<u>route alternatives that are longer than 500m</u>**, please provide an addendum with co-ordinates taken every 250 meters along the route for each alternative alignment. Please Refer Annexure J3

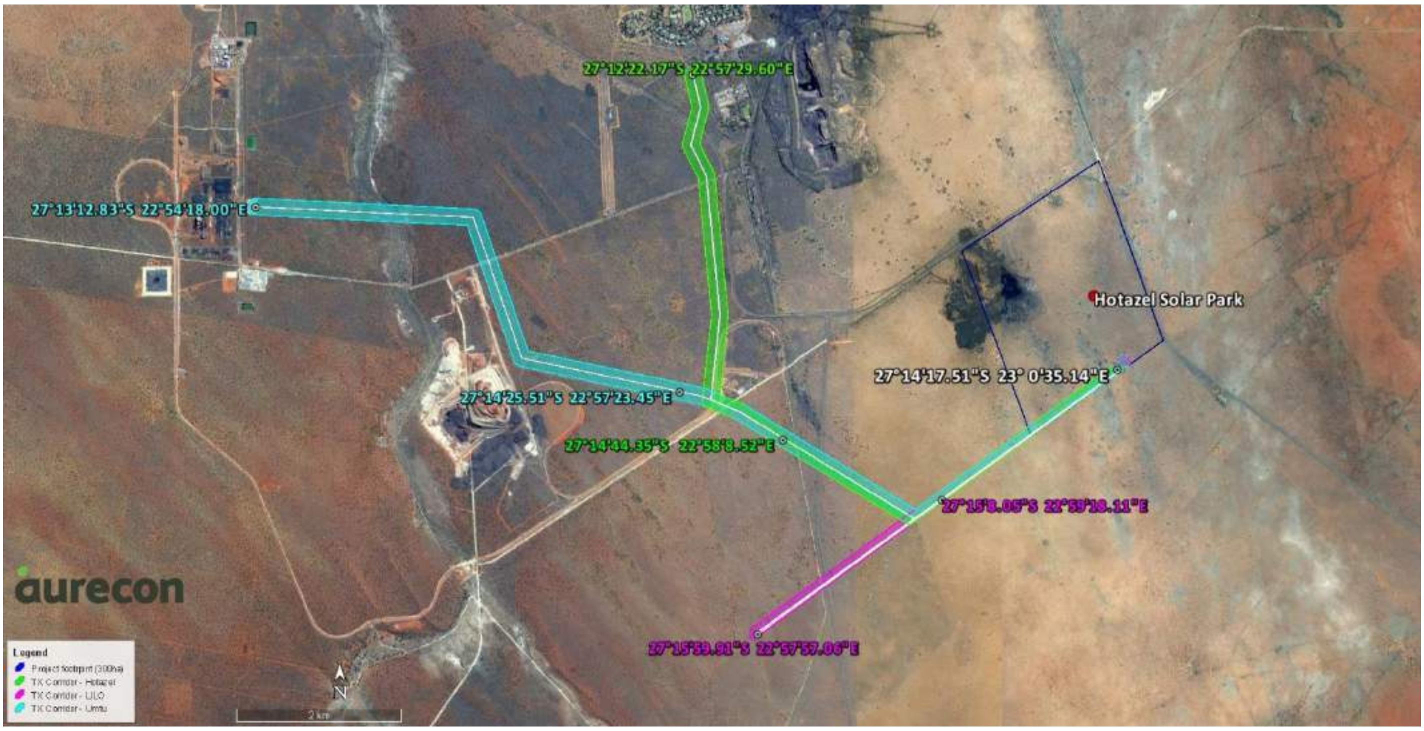


Figure 1 | Overview of Transmission line alternatives and locations

In the case of an area being under application, please provide the co-ordinates of the corners of the site as indicated on the lay-out map provided in Appendix A.

1.2.2. **Lay-out alternatives**

4 Alternative routes are being assessed in this Basic Assessment		
Alternative 1 (preferred alternative)		
Description	Lat (DDMMSS)	Long (DDMMSS)

[2] *"The Loop In Loop Out connection depends on technical capacity of the Eskom line before being deemed a feasible alternative. This is considered the least, technically, viable alternative at this stage, though this might change in future"*

Alternative 2		
Description	Lat (DDMMSS)	Long (DDMMSS)
Alternative 3		
Description	Lat (DDMMSS)	Long (DDMMSS)

1.2.3. Technology alternatives

There are possible alternatives regarding transmission pole types that could be used. The proposed infrastructure will be constructed in accordance with the relevant standards for such infrastructure, and in accordance with Eskom's technical requirements. Pylon structures (stayed and self-supporting monopoles, with possible lattice structures at bend/ strain points) will be selected and installed in accordance with the latest industry standards and Eskom's technical requirements at the time of construction, and within the parameters of this assessment. The final pylon structures to be utilised will also be informed by the local geotechnical and topographical conditions on site, which will be confirmed during the detailed design phase. Pylons types have not been assessed as alternatives in this assessment. Refer to Appendix C:

1.2.4. Other alternatives (e.g. scheduling, demand, input, scale and design alternatives)

Transmission lines will undergo micro-siting during the pre-construction phase to optimise the routing and avoid highly localised features, constraints and other developments / infrastructure. These micro-siting alternatives are not known at this time and cannot be assessed, and if they were, may be subject to change later and thus assessing them as part of this application would not be of any use. For this reason, the assessment has focused on a 200m wide corridor in which the transmission line will be located.

1.2.5. No-go alternative

The No-Go alternative implies that the construction of this transmission line would not go ahead and the *status quo* would be maintained. This would potentially prevent ≤200MW of renewable energy being added to the national grid.

Paragraphs below should be completed for each alternative.

1.3. Physical size of the activity

Indicate the physical size of the preferred activity/technology as well as alternative activities/technologies (footprints):

Preferred Alternative		Size of the activity:
Alternative A1 (preferred activity alternative)	Pylon footings (110 x 1.5 m^2): Access track (12km x 4m)	≤165 m^2 ≤ 48,000 m^2
	Total	**≤ 48,165 m^2**
Alternative A2 (if any)	Pylon footings (140 x 1.5 m^2): Access track (15km x 4m)	≤210 m^2 ≤ 60,000 m^2
	Total	**≤ 60,210 m^2**
Alternative A3 (if any)	Pylon footings (120 x 1.5 m^2): Access track (6km x 4m)	≤180 m^2 ≤ 24,000 m^2
	Total	**≤ 24,180 m^2**

Alternative:		**Length of the activity:**
Alternative A1 (preferred activity alternative)		≤11 km
Alternative A2 (if any)		≤14 km
Alternative A3 (if any)	(≤5.5 km x 2)	≤11 km

Indicate the size of the alternative sites or servitudes (within which the above footprints will occur):

Alternative:		**Size of the site/servitude:**
Alternative A1 (preferred activity alternative)	35m Servitude	≤ 38.50 ha
Alternative A2 (if any)	35m Servitude	≤ 49.00 ha
Alternative A3 (if any)	35m Servitude x 2 lines	≤ 38.50 ha

1.4. Site access

Does ready access to the site exist?	► YES	NO
If NO, what is the distance over which a new access road will be built	m	

Describe the type of access road planned:

Access roads would run the length of the proposed servitudes and would be directly below the transmission line. Access to the transmission line route(s) would be gained from the substations or where the transmission line intersects with existing roads or other transmission service roads in the area). The transmission line service road will take the form of a cross-country track, approximately 4m wide and will be used only by off-road vehicles and equipment during construction and maintenance. Obstacles and larger vegetation will be removed and depressions filled where they cannot be avoided and only the minimum needed to allow cross country travel by 4 wheeled drive truck and smaller vehicles needed to erect pylons in the construction phase and conduct inspections or maintenance in the operational phase.

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

Refer to Appendix A for the site access layout plan. The service road will follow the same route and the transmission line as indicated in Section 1.2.1 above.

1.5. Locality map

An A3 locality map must be attached to the back of this document, as Appendix A. The scale of the locality map must be relevant to the size of the development (at least 1:50 000. For linear activities of more than 25 kilometres, a smaller scale e.g. 1:250 000 can be used. The scale must be indicated on the map.). The map must indicate the following:

- an accurate indication of the project site position as well as the positions of the alternative sites, if any;
- indication of all the alternatives identified;
- closest town(s;)
- road access from all major roads in the area;
- road names or numbers of all major roads as well as the roads that provide access to the site(s);
- all roads within a 1km radius of the site or alternative sites; and
- a north arrow;
- a legend; and
- locality GPS co-ordinates (Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection).

A small scale locality map (as described above) is provided hereunder and is repeated at A3 scale in Appendix A.1:

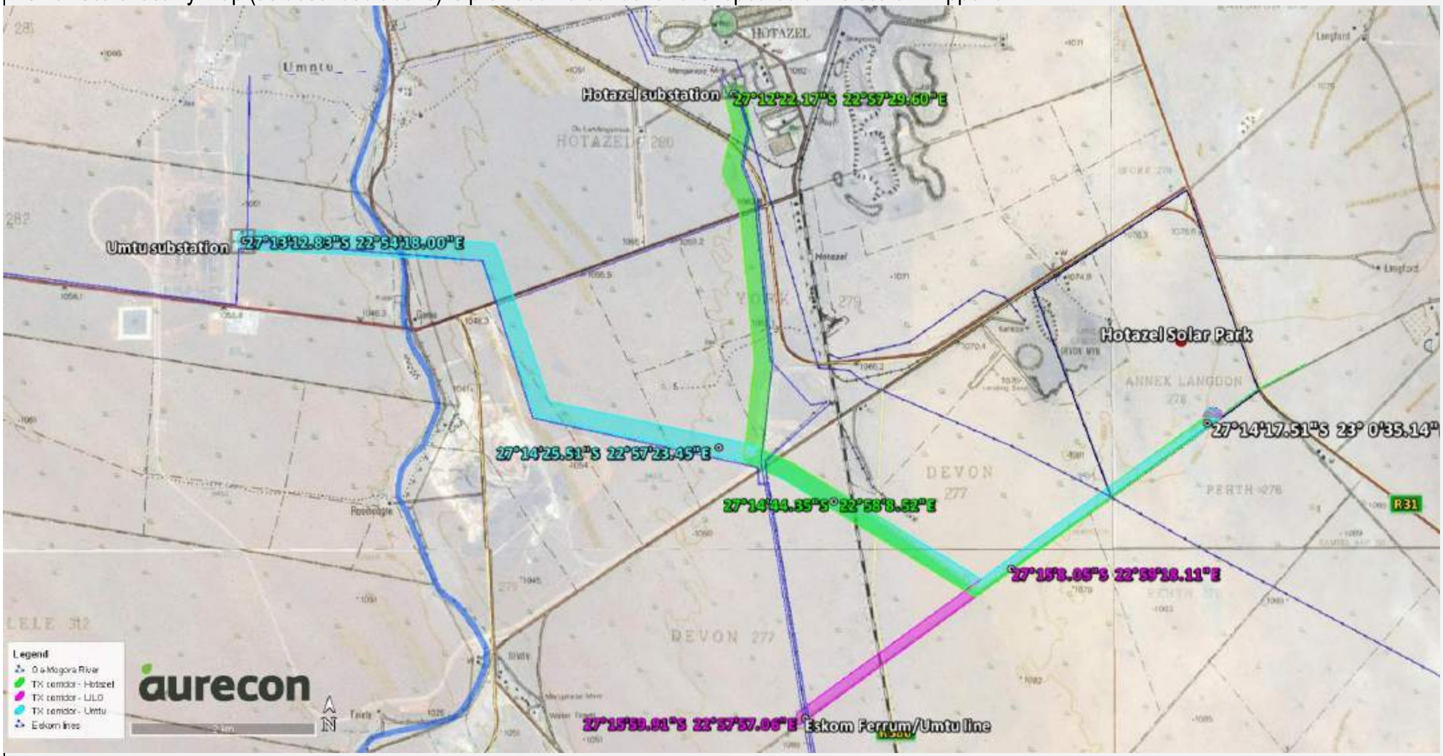


Figure 2 | Locality map

1.6. Layout/route plan

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as Appendix A to this document.

The site or route plans must indicate the following:

- the property boundaries and numbers of all the properties within 50 metres of the site;
- the current land use as well as the land use zoning of the site;
- the current land use as well as the land use zoning each of the properties adjoining the site or sites;
- the exact position of each listed activity applied for (including alternatives);
- servitude(s) indicating the purpose of the servitude;
- a legend; and
- a north arrow.

A small scale Layout/Route Plan) is provided hereunder and is repeated at A3 scale in Appendix A.2:

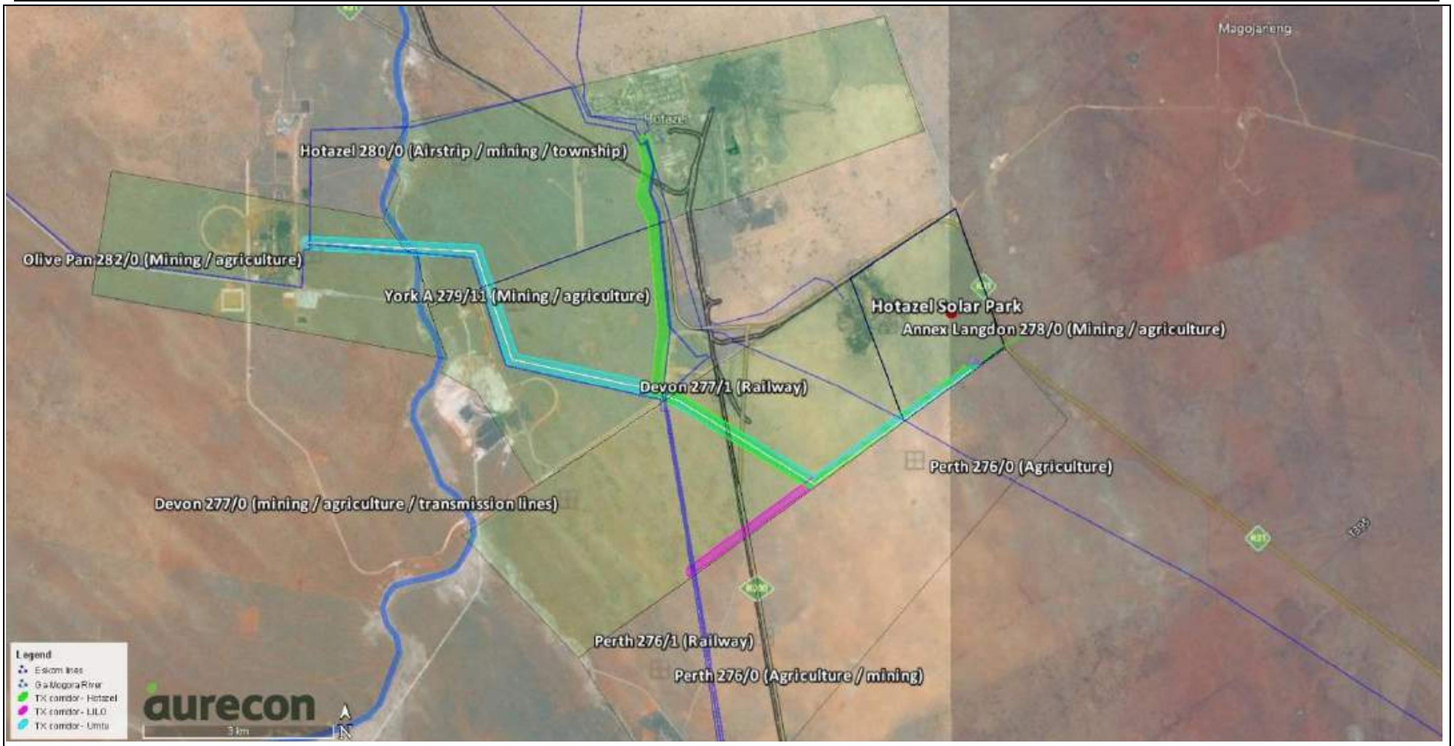


Figure 3 | Route Plan

1.7. Sensitivity map

The layout/route plan as indicated above must be overlain with a sensitivity map that indicates all the sensitive areas associated with the site, including, but not limited to:

- Watercourses – **see Ga Moraga River**
- the 1:100 year flood line (where available or where it is required by DWA) – **see Ga Moraga River no go and buffer zones**
- ridges **- NONE**
- cultural and historical features **- NONE**
- areas with indigenous vegetation (even if it is degraded or infested with alien species); - **the entire site / routes are covered by indigenous vegetation**
- critical biodiversity areas. **- NONE**

The sensitivity map must also cover areas within 100m of the site and must be attached in Appendix A.

A small scale sensitivity map (as described above) is provided hereunder and is repeated at A3 scale in Appendix A.3:

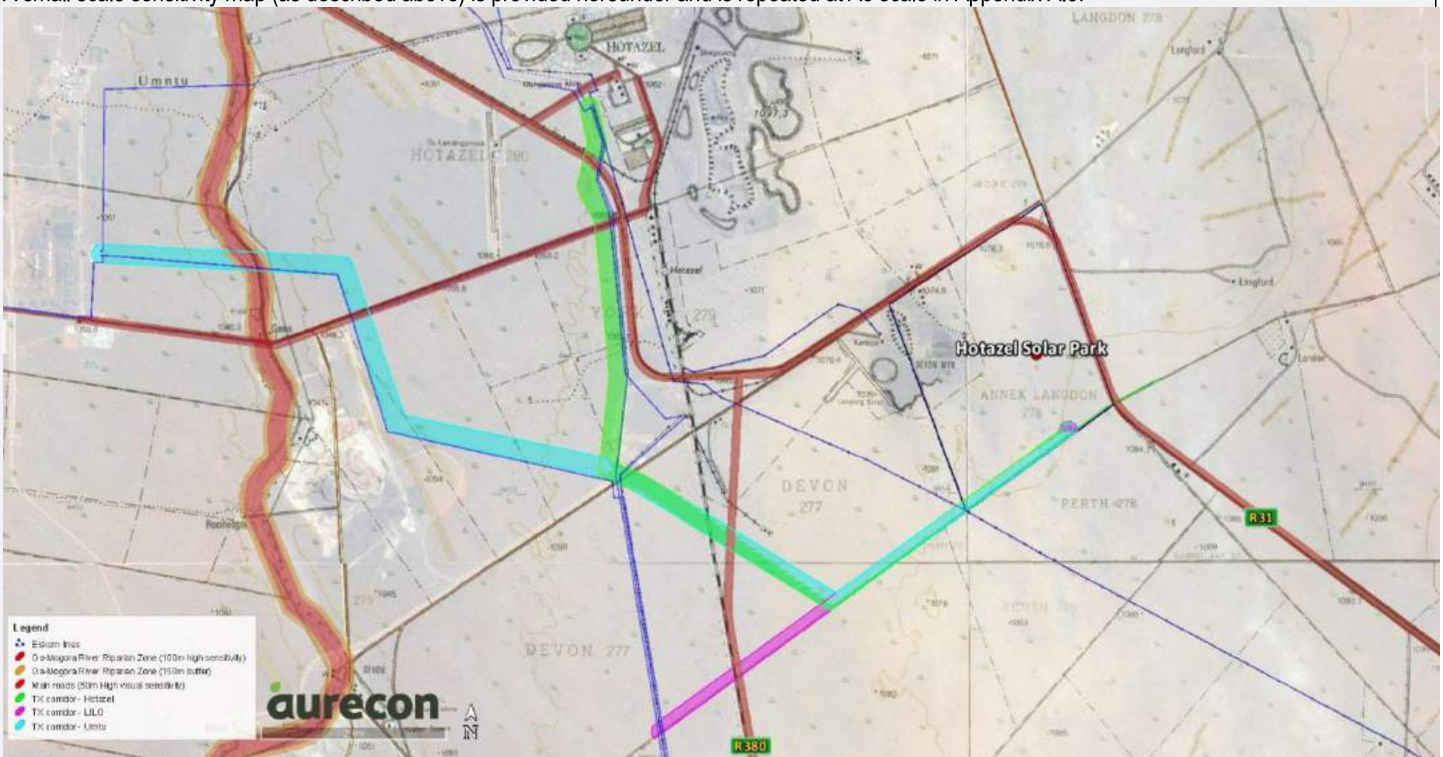


Figure 4 | Environmental Sensitivity map

1.8. Site photographs

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached under Appendix B to this report. It must be supplemented with additional photographs of relevant features on the site, if applicable.

Site Photographs are included in Appendix B.

1.9. Facility illustration

A detailed illustration of the activity must be provided at a scale of at least 1:200 as Appendix C for activities that include structures. The illustrations must be to scale and must represent a realistic image of the planned activity. The illustration must give a representative view of the activity.

Refer to Appendix C: for an illustration of the transmission pylon types that may be required by Eskom.

1.10. Activity motivation

Motivate and explain the need and desirability of the activity (including demand for the activity):

Is the activity permitted in terms of the property's existing land use rights?	**▶ YES**	**NO**	**Please explain**
The proposed servitudes would be situated on private property which is currently zoned as Agricultural land. The current agricultural practices will continue once the transmission lines have been constructed. The activity does not require a change in land use.			
Will the activity be in line with the following?			
(a) Provincial Spatial Development Framework (PSDF)	**▶ YES**	**NO**	**Please explain**
The Northern Cape Provincial Spatial Development Framework (PSDF) 2011 promotes the provision of electricity to all and supports economic development through sustainable green energy initiatives on a national scale. The proposed construction of the 132 kV transmission line will allow electricity, generated through renewable technology, to be evacuated from the PV facility to the national grid. Electrification of households is speeding up in the Northern Cape. A good deal of progress has been made in bringing services to the citizens of the province in South Africa with the most remote communities.			
(b) Urban edge / Edge of Built environment for the area	**YES**	**▶ NO**	**Please explain**
The proposed transmission lines fall outside of the urban edge. The size and nature of solar farm would not permit a solar facility to exist within the urban edge in a traditional configuration.			
(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).	**YES**	**▶ NO**	**Please explain**
The proposed project comprises the provision of infrastructure for the transmission of electricity into the national grid, which is compatible with the IDP for the Northern Cape and SDF of the Joe Morolong Municipality. Within the Strategies and Priorities of the Joe Morolong SDF the following aspects of land use needs for the residents were identified: 1) Creation of a sustainable environment[3] within the Joe Morolong Municipality; 2) Economic Development; and 3) Infrastructure development.			
(d) Approved Structure Plan of the Municipality	**▶ YES**	**NO**	**Please explain**
The proposed project entails power transmission infrastructure, which is compatible and even underpins Local Economic Development (LED) objectives of the Joe Morolong Municipality.			
(e) An Environmental Management Framework (EMF): adopted by the Department (e.g. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)	**YES**	**▶ NO**	**Please explain**
There is currently no approved EMF for the study area.			
(f) Any other Plans (e.g. Guide Plan)	**YES**	**▶ NO**	**Please explain**
No other plans are applicable to this application.			
Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)?	**YES**	**▶ NO**	**Please explain**
The SDF does not provide a timeframe associated with the activity being applied for. However the National Development Plan identifies access to electricity to all South Africans as the tenth Strategic Integrated Project, specifically to expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. The IDP makes provision for infrastructure reticulation and bulk infrastructure for electricity, (Presidential Infrastructure Coordinating Commission, Strategic Integrated Planning Projects, 2012).			
Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.)	**▶ YES**	**NO**	**Please explain**
Strategic level: The construction of the transmission lines would facilitate the connection of the PV to the national grid. The need for renewable energy is well documented and reasons for the desirability of renewable energy include: *Utilisation of resources available to South Africa* - South Africa currently generates and estimated 90% of its required electricity from coal of which there is a ready supply at the local level. However, national government is on the verge of augmenting the existing generation capacity of thermal and nuclear power plants with renewable energy power generation, thus creating the framework that will lead to an increase in the supply of clean energy for the nation.			

[3] *"Land-use Planning and Management that promotes sustainable development by recognizing the relationship between, and giving practical effect to, environmental integrity, human well-being and economic efficiency within a defined geographical space, the boundaries of which were determined in accordance with environmental and social criteria" (Northern Cape PSDF: Volume 1 p41).*

Meeting nationally appropriate emission targets in line with global climate change commitments - As can be seen by the numerous policies and legislation described in Section 10 the need for renewable energy is well documented. Due to concerns such as climate change, and the on-going exploitation of non-renewable, resources, there is increasing international pressure on countries to increase their share of renewable energy generation. The Hotazel PV projects together with the associated transmission lines are expected to contribute positively towards climate change mitigation. *Job opportunities and contribution to social upliftment* - Local investment would take the form of social upliftment opportunities. The site is relatively close tor Hotazel, where high levels of unemployment are experienced; hence the proposed PV and associated transmission line projects would uplift the local community through job creation and training. Should the development of the proposed 132 kV transmission line be acceptable, it is considered viable that long term benefits for the community in Hotazel and society at large would be realised as highlighted above. The proposed projects would also have international significance as it contributes to South Africa being able to meet some of its international obligations by aligning domestic policy with internationally agreed strategies and standards as set by the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and United Nations Convention on Biological Diversity (UNCBD), all of which South Africa is a signatory to.			
Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? (Confirmation by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as Appendix I.)	▶ **YES**	**NO**	**Please explain**
No provision for additional services is required. Minimal municipal services maybe required during the construction and maintenance activities and these will be sourced through the municipality or commercial service. Both solid waste and sewage would be delivered into the respective licenced municipal streams. Potable water will be obtained from the Municipality or commercial source. The demands are expended to be negligible. Juwi is currently discussing these requirements with the relevant authorities and their response will be provided in due course.			
Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? (Comment by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as Appendix I.)	**YES**	▶ **NO**	**Please explain**
No additional services are required once the transmission line is operational – there will thus be no impact on infrastructure planning.			
Is this project part of a national programme to address an issue of national concern or importance?	▶ **YES**	**NO**	**Please explain**
This project would form part of the National Grid under Eskom's administration. This project will form part of the REIPPPP and is key part of the IRP and IEP			
Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.)	▶ **YES**	**NO**	**Please explain**
The proposed transmission line provides the critical link from the PV facility to the national grid. The location factors apply to the PV facility and as such dictate the location of the transmission lines. The Hotazel region has a favourable solar resource, large areas of unutilised (little intensive agricultural, industrial or urban development) land is available and good access to the national electricity grid due to its central location and established transmission network.			
Is the development the best practicable environmental option for this land/site?	▶ **YES**	**NO**	**Please explain**
The proposed transmission line transverses mostly farmland which is predominantly for grazing. Once the transmission line is constructed, the land can continue to be used for grazing and, due to the relatively small footprint of the towers, the grazing capacity of the land will not be reduced significantly.			
Will the benefits of the proposed land use/development outweigh the negative impacts of it?	▶ **YES**	**NO**	**Please explain**
The negative impacts for the proposed development are of very low to medium magnitude, local extent and long term and moderate negative to very low negative (-) significance with mitigation. Therefore, the proposed development's impacts with mitigation measures are reduced and are considered to be acceptable. Furthermore it should be noted that three potential positive impacts associated with the facilitation on energy production and local economy (employment), climate change and social conditions would result and these would be of high positive (+) significance, with and without mitigation measures.			
Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?	▶ **YES**	**NO**	**Please explain**
The Hotazel area has been identified as a renewable hub for both wind and solar energy projects. The project would not set a precedent as others have done before, but would continue the precedent.			
Will any person's rights be negatively affected by the proposed activity/ies?	**YES**	▶ **NO**	**Please explain**
No juristic or natural person's right will be adversely affected as land use agreements will be negotiated with the affected landowners. Furthermore, the location of the poles, access roads, and security measures will all be negotiated with the landowners and agreed upon before construction commences.			
Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?	**YES**	▶ **NO**	**Please explain**
The proposed transmission line will be located within the rural farmlands and won't compromise the urban edge.			
Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)?	**YES**	▶ **NO**	**Please explain**
The proposed transmission line will not contribute to any of the 17 SIPS.			
What will the benefits be to society in general and to the local communities?			
The municipal area is approximately 5 813 km² in size. Joe Morolong Local Municipality is part of the John Taolo Gaetsewe District Municipality. The municipality strives to deliver basic services to its community by ensuring that there is water, sanitation and electricity. The Hotazel area is an arid area where farmers do their best to earn a living from the land. The towns are generally small and many residents operate on a survival socio-economic level. The need to improve the quality of life for all, and especially for the poor, is critical in these towns. It is expected that the proposed project together with the PV site will contribute directly to the upliftment of individuals through direct and indirect employment opportunities and the societies in which they live. The Joe Morlong Local municipality has a total population of 89,530 with a high unemployment rate of 38,6%.Through interviews with landowners, where the			

proposed transmission line will cross, various issues were mentioned which occur in the area. They are as follows:

- Poor roads;
- Poor communication; and
- Crime.

Economically, the construction of the 132 kV transmission line will create employment opportunities during the construction period, as well as generating new business sales which in turn will result in an increase in the gross value added in the country (Refer to the Social Assessment Appendix D). The impact of the transmission lines on GDP would be two-fold namely impacts during construction and impacts during operation. The impacts on GDP during construction would only be temporary whereas the impacts during operation would be long-term. Once the construction of the proposed transmission lines is complete, it requires periodic maintenance of the servitude. This maintenance can be done by the contractors employed by Eskom or could be performed by the owners of the farm themselves, if they desire to do so. In both cases, people engaged in maintenance will be appropriately reimbursed for the work performed. It is unfortunately not known how much will be spent on maintenance of the transmission line per annum. It is not expected to be a considerable amount as it will involve the use of small teams of unskilled labour engaged in clearing of the servitude of inappropriate vegetation and contaminants that carry a fire hazard (if required). However, this activity is sustainable as maintenance needs to be performed annually throughout the lifespan of the transmission lines; although it will not provide employment for the whole year but rather be short-term employment every year. The socio-economic impact analysis in the Social Assessment (refer to Appendix D) indicates that the construction of the proposed transmission lines would have an overall positive impact.

Any other need and desirability considerations related to the proposed activity?	Please explain ◄

The proposed transmission line and PV site is close to the town Hotazel where high levels of unemployment are experienced; hence the proposed PV and associated transmission line projects would provide an opportunity to uplift the local community through job creation and skills development.

How does the project fit into the National Development Plan for 2030?	Please explain ◄

The National Development Plan for 2030 aims to create jobs, develop and expand infrastructure, transition to a low-carbon economy and unify South Africa. This project, along with the construction of the PV facility, will fit into the National Development Plan as follows:

- Create jobs:
  - The transmission lines are unlikely to result in any new employment by itself but will enable the Hotazel Solar Park to. Construction activities will result in direct jobs being created on site and other directly related sectors such as the transport and manufacturing sectors. Indirect jobs are also created due to the multiplier effect in the economy.
  - Indirect opportunities for small businesses would be generated such as accommodation, food and service industries through the increased number of people travelling to and residing Hotazel.
- Transition to a low-carbon economy:
  - This project, together with the PV facility, is a renewable energy project and will result in the expansion of South Africa's renewable generation capacity.
  - The construction of the PV facility together with the associated transmission line will assist in diversifying South Africa's energy portfolio.
  - Solar power is a proven source of renewable energy and does not rely on carbon fuels.
  - Transformation and unity:
- Employment equity.
  - Employment equity will be met through the Operation and Maintenance Project Company and the contractors responsible for the construction of the transmission lines, as set out in the requirements of the DOE REIPPPP Tender Process.
  - Helping facilitate access to electricity for all through creating additional generation capacity as well as further diversifying generation and helping stabilise the grid.

Please describe how the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account.

The purpose of section 23 of NEMA is to promote the application of appropriate management tools in order to ensure the integrated environmental management of activities. The table below lists the general objectives of integrated management and provides a motivation as to how the proposed development has taken the objectives into account.

Section 23(2) of NEMA: The general objective of integrated environmental management is to:	Description as to how the proposed development has taken these general objectives into account.
(a) promote the integration of the principles of environmental management set out in section 2 of NEMA into the making of all decisions which may have a significant effect on the environment;	The underlying principle of this Basic Assessment process is to ensure that the development is socially, environmentally, and economically sustainable. This has guided the assessment of impacts of the project by Specialists to ensure that the project will be undertaken in an environmentally responsible manner in which 10 Specialists have been appointed for the assessment of the impacts of the proposed transmission line and PV facilities. In recognition that social responsibility is something which needs to be actively developed, a public participation programme will be undertaken. This process will be undertaken in such a manner to promote active participation and foster a clear understanding of the project and transparent sharing of information.
(b) identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2;	Section D of this Basic Assessment Report (BAR) includes the list of potential impacts associated with this project. Each impact was evaluated to determine the significance of the impact and mitigation measures have been proposed to reduce negative impacts and to enhance positive impacts.
(c) ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them;	Specialist studies were commissioned to ensure that specific impacts are adequately assessed and appropriate mitigation measures are proposed.
(d) ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment;	The public participation process is described in section C. In accordance with regulation 54(2)(e) and 54(7) of GN R.543., the following activities have been undertaken: ► Advertisement ► Site notice ► Letters to neighbouring property owners ► Letters to commenting authorities
(e) ensure the consideration of environmental attributes in management and decision making which may have a significant effect on the environment; and	An Environmental Management Program (EMPr) has been drafted to include the recommendations from the respective specialists to guide the construction phase in an environmentally and socially sound manner.
(f) identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in section 2.	Recommendations and mitigations presented in the EMPr will minimise the disturbance to both the biophysical and socio-economic environments. Where negative impacts are unavoidable, strict management and rehabilitation is recommended to minimise the potential negative impacts.

Please describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.

The philosophy of Sustainable Development underpins the requirements of NEMA and the consideration of environmental impact. To achieve Sustainable Development it is important to find the balance between the competing demands for resources from the Economic system, the Social system, and the Ecological system.

Chapter 1 of NEMA outlines principles of Sustainable Development which it states are applicable to the "*actions of all organs of states that may significantly affect the environment*". These principles are seen as governing the intent and underlying philosophy of the Act and therefore must be considered in the decision regarding whether or not to authorisation an activity which has triggered an EIA process.

Table 1 below considers each principle listed in Section 1 of NEMA and its consideration within this process.

Table 1: The applicability of NEMA Sustainability Principles to the proposed project

NEMA Sustainability Principle	Consideration for this proposed activity and BA Process
(1) The principles set out in this section apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and – Shall apply alongside all other appropriate and relevant considerations, including the State's responsibility to respect, protect, promote and fulfil the social and economic rights in Chapter 2 of the Constitution and in particular the basic needs of categories of persons disadvantaged by unfair discriminations; Serve as the general framework within which environmental management and implementation plans must be formulated; Serve as guidelines by reference to which any organ of state must exercise any function when taking any decision in terms of this Act; or any statute provision concerning the protection of the environment; Serve as principles by reference to which a conciliator appointed under this Act must make recommendations; and Guide the interpretation, administration and implementation of this Act, and any other law concerned with the protection of management of the environment.	All principles must be considered in the application and consideration for authorisation. The underlying principle of this Basic Assessment process is to ensure that the development is socially, environmentally, and economically sustainable. This has guided the assessment of impacts of the project to ensure that the project will be undertaken in an environmentally responsible manner. In recognition that social responsibility is something that needs to be actively developed, a public participation programme has been undertaken. This process has been undertaken in such a manner to promote active participation and foster a clear understanding of the project and transparent sharing of information.
(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.	This BA process has considered both the natural and socio-economic environment and mitigation measures provided respond to this principle.
(3) Development must be socially, environmental and economically sustainable.	The need to improve the quality of life for all, and especially for the poor, through job creation is critical in South Africa. It is expected that the proposed project would contribute directly to the upliftment of the individuals and the societies in which they live. The proposed project would also include the following benefits that would contribute to environmentally and social sustainability: Reducing pollution as the generation of energy from PV facilities produces far less pollution per MW/h than coal-fired facilities; Local economic development; Local skills development; Construction industry businesses will benefit from an increase in the demand for their goods, materials and services; Increased business productivity will directly result to improved spending power; and Increase in the competitiveness of the region in terms of energy generation.
(4) (a) Sustainable development requires the consideration of all relevant factors including the following:	
That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;	Disturbance of the ecosystem and loss of biological diversity would be minimised through design measures and appropriate mitigation measures. Sensitive areas have informed the site selection and design phase to ensure that sensitive areas are avoided to limit the disturbance of ecosystems. Furthermore, an EMPr will be compiled to ensure that mitigation measures are implemented during the planning, construction, operational and decommissioning phases.
That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;	Pollution associated with the construction phase will be limited by strict adherence to the EMPr. The operational phase will include limited maintenance to the transmission lines and will be managed by the Eskom Standard Practices and their Health and Safety policy.
That the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where is cannot be altogether avoided, is minimised and remedied;	Heritage and palaeontological impact assessments were undertaken. Refer to Annexure D3. The impacts on the heritage and palaeontology resources were investigated and it was concluded by the specialist study that there do not appear to be any significant heritage issues. A key factor also influencing the local and landscape character is infrastructure that has been developed for the extraction of Manganese. Also influencing the regional landscape is the associated electrical power and railway infrastructure required by the mines. These include two Eskom Substations (Hotazel and Umtu), multiple railway lines and multiple power lines. The Intertek Mine is an open pit type mine that is located directly west of the proposed PV study area. Located to the west of the power line study area is the Kalagadi Manganese Mine.
That waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;	A minimal amount of construction waste would be generated during the construction phase. Waste would be disposed of by the contractor into a licensed municipal waste stream. No waste is foreseen during the operational life.

That the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;	The project would facilitate the utilisation of a renewable natural resource (solar) and in so doing reduce the demand on non-renewable resources.
That the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised and equitable, and takes into account the consequences of the depletion of the resource;	The project would facilitate the exploitation of a renewable natural resource, solar power, which does not have an exceedance level.
That a risk-averse and cautious approach is applied which takes into account the limits of current knowledge about the consequences of decisions and actions; and	Limitations and gaps in knowledge have been highlighted and taken into account in the Basic Assessment process. The information provided in this BAR is considered to be sufficient for decision-making purposes, and where there is uncertainty with predictions, recommendations have been made.
That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.	The Basic Assessment process has assessed impacts associated with this proposed project. Appropriate mitigation measures have been proposed for impacts which are deemed to have negative impacts.
(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.	The Basic Assessment process has been undertaken in accordance with the legal requirements as a fundamental guiding principle. The selection of the preferred transmission line route will be determined by the impact assessment process to ensure that the preferred alternative is indeed the best environmental and technically feasible option.
(c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.	The Basic Assessment process, including the public participation process, has been undertaken in a manner to ensure that impacts are assessed fairly using scientifically acceptable methodology and mitigation measures are proposed to reduce negative impacts, including the vulnerable and disadvantaged.
(d) Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination	Environmental resources such as air, water, soil and vegetation have been considered and avoidance or mitigation measures provided to ensure that none of these resources are compromised and thereby limiting access thereto.
(e) Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.	The Basic Assessment process has considered the environmental, health and safety consequences of the development through the construction and operational life of the project. Aspects of the decommissioning of the proposed transmission line have been touched on in the EMPr and would need to be subject to further investigation via an environmental authorisation process after the operational lifespan.
(f) The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation by vulnerable and disadvantaged persons must be ensured.	Public participation by all I&APs has been promoted and opportunities for engagement provided during the Basic Assessment process in terms with the 2014 EIA Regulations.
(g) Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.	The Basic Assessment process has taken cognisance of all interests, needs and values espoused by all I&APs. Specialist studies have included field work where the specialists would have the opportunity to engage with landowners and locals to gain a better insight of the land and concerns which people may have.
(h) Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.	Public participation by all I&APs has been promoted during the Basic Assessment process in terms of the 2014 EIA Regulations.
(i) The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.	This Basic Assessment process has considered both the natural and socio-economic environment and mitigation measures provided respond to impacts, fulfil this principle.
(j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.	The project area is subject to both the health and safety requirements of the Occupational Health and Safety Act (OHS) Act.
(k) Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with	The Basic Assessment process has been thoroughly documented and all relevant information known to the Environmental Assessment Practitioner (EAP), as well as

the law.	written comments received, are included in the reporting for consideration by the authorities.
(l) There must be intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The relevant authorities have been notified of the project and provided opportunity to comment. This authority process has been documented in the BAR.
(m) Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.	The relevant authorities have been notified of the project and provided opportunity to comment.
(n) Global and international responsibilities relating to the environment must be discharged in the national interest.	The establishment of the proposed PV facilities and the associated transmission lines will contribute positively towards meeting the national energy target as set by the DoE, of a 30 % share of all new power generation being derived from IPPs. Renewable energy is recognized internationally as a major contributor in protecting the climate, nature and the environment, as well as providing a wide range of environmental, economic and social benefits that can contribute towards long-term global sustainability. Should the development of the proposed 132 kV transmission line be acceptable, long term benefits for the community and society in Hotazel would be realised as highlighted above. The proposed project would also have international significance as it contributes to South Africa being able to meet some of its international obligations by aligning domestic policy with internationally agreed strategies and standards as set by the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and United Nations Convention on Biological Diversity (UNCBD), all of which South Africa is a signatory to.
(o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.	The impacts are documented in the Basic Assessment process to inform decision-makers regarding the potential ramifications of the proposed project, so that an informed decision can be taken in this regard.
(p) The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage, or adverse health effects must be paid for those responsible for harming the environment.	The mitigation measures recommended to minimise negative impacts and enhance positive ones are for implementation and therefore for the cost of the proponent.
(q) The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.	Public participation by all I&APs has been promoted and provided opportunities for engagement during the Basic Assessment process.
(r) Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems required specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.	The proposed activity does not occur within a sensitive, vulnerable, highly dynamic or stressed ecosystems. NO CBA's, NPAES, FEPA, IBAs, or formally protected areas are present.

1.11. Applicable legislation, policies and/or guidelines

List all legislation, policies and/or guidelines of any sphere of government that are applicable to the application as contemplated in the EIA regulations, if applicable:

Title of legislation, policy or guideline	**Applicability to the project**	**Administering authority**	**Date**
National Environmental Management Act (No. 107 of 1998) (NEMA), as amended	The proposed servitudes will trigger listed activities GN R.544 item 10, 11, 18 & GN R546 item 14, thus requiring a Basic Assessment Process.	DEA	1998
National Environmental: Biodiversity Act (No. 10 of 2004) (NEMBA)	The objective of the NEMBA is to manage and conserve biological diversity and resources in a sustainable manner. The vegetation type found within the proposed servitudes has been determined through an ecological impact assessment.	DEA	2004
National Water Act (No. 36 of 1998)	The proposed transmission line may trigger a section 21(C and/or i) water use, as the pylons may be within 32m of a water resource. In order to minimise the impact of towers and to avoid sensitive environments, tower positions would be planned where possible to avoid water resources.	Department of Water Affairs (DWA)	1998
National Heritage Resources Act (No. 25 of 1999)	As the transmission line exceeds 300 m in length a full Heritage Impact Assessment (HIA) has been undertaken and submitted to the South African Heritage Resources Agency (SAHRA).	South African Heritage Resources Agency (SAHRA)	1999
Conservation of Agricultural	The EMP describes mitigation measures to ensure the control of any undesired aliens,	Department of	1983

Title of legislation, policy or guideline	Applicability to the project	Administering authority	Date
Resources Act (No. 43 of 1983) (CARA)	declared weeds, and plant invaders listed in the regulation that may pose as a problem as a result of the proposed transmission line and access road. An agricultural potential impact assessment has been undertaken to determine the impact of the proposed transmission lines on the agricultural potential of the affected farms.	Agriculture	
Kyoto Protocol	In Africa, the CO_2 emissions are primarily the result of fossil fuel burning and industrial processes, such as coal fired power stations. The International Energy Agency (2008) "*Renewables in global energy supply: An IEA facts sheet"* estimates that nearly 50% of global electricity supplies will need to come from renewable energy sources in order to halve carbon dioxide emissions by 2050 and minimise significant, irreversible climate change impacts. The servitudes would facilitate the evacuation of renewable energy generated at wind energy facilities to the national grid thus helping to reach these targets.	UNFCCC	1997
White Paper on Energy Policy of the Republic of South Africa	This project together with the PV would integrate environmental costs into economic analysis which will help promote a sustainable option as part of South Africa's energy policy towards energy diversification.	Department of Energy (DoE)	1998
White Paper on Renewable Energy	Addressing environmental impacts and the overarching threats and commitments to climate change, the White Paper provides the platform for further policy and strategy development in terms of renewable energy in the South African energy environment.	Department of Minerals and Energy (DME)	2003
National Energy Act (No. 34 of 2008)	This project together with the PV facilities will facilitate new generation capacity through renewable technologies, namely wind, as listed in the IRP and all IPP procurement programmes which will be undertaken in accordance with the specified capacities and technologies as listed in the IRP[4].	Department of Energy (DoE)	2008
Electricity Regulation Act (No. 4 of 2006) (ERA)		Department of Energy (DoE)	2006
IPP Procurement Process	The projects will assist in facilitating South Africa's aim to procure 3,725 MW capacity of renewable energy by 2016. This 3,725 MW is broadly in accordance with the capacity allocated to renewable energy generation in IRP2010.	Department of Energy (DoE) 2006	2011
Integrated Energy Plan (IEP) for the Republic of South Africa	This project together with the PV facilities would assist in facilitating in the provision of low cost electricity for social and economic developments, ensuring security of supply, and minimising the associated environmental impacts.	DME	2003
Integrated Resource Plan (IRP)	The IRP is a National Electricity Plan which determines the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. As such the proposed projects would form part of South Africa's energy mix set out in the balanced revised scenario within the target for total system capacity.	DME	2003
NEMA Environmental Impact Assessment Regulations Guidelines and Information Document Series	The NEMA Environmental Impact Assessment Regulations Guidelines and Information Document Series were consulted to ensure that the BA process complies with the legislated process.	DEA&DP	2010 & 2011
National Environmental Guidelines: Integrated Environmental Management (IEIM), Information Series (DEAT, 2002, 2005 & 2007).	The National Environmental Guidelines were consulted to ensure that the BA process complies with the legislated process.	DEAT	2002 – 2007

1.12. Waste, effluent, emission and noise management

1.12.1. Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase?	▶ **YES**	NO
If YES, what estimated quantity will be produced per month?	$30m^3$	

Low quantities of solid waste would be created during the construction period. Excavated soil will be reused as backfill and no spoil is expected. There are no components that would require continuous recycling and there are no processes that would generate a significant amount of waste. The quantities of waste produced would vary significantly from month to month and therefore a quantity cannot be accurately estimated at this stage. However, measures have been included in the EMPr to ensure efficient management of solid waste.

How will the construction solid waste be disposed of (describe)?

Construction solid waste will be dealt with in the Environmental Management Programme (EMPr) which will incorporate waste minimisation strategies including reduction, recycling, and re-use principles where viable. As mentioned above, there are no components that would require continuous recycling and there are no processes that would generate a significant amount of waste.

Where will the construction solid waste be disposed of (describe)?

It is envisaged that the construction waste will be transported to and disposed of at a local licensed landfill. The contractor shall ensure that waste generated at working areas are collected and disposed at a licensed facility at least once a week. Items such a cable spools and excess cable will be returned to the suppliers.

Will the activity produce solid waste during its operational phase?	YES	▶ **NO**
If YES, what estimated quantity will be produced per month?	No waste will be generated	

[4]http://www.eskom.co.za/c/73/ipp-processes/ (accessed 29/10/11)

How will the solid waste be disposed of (describe)?

If the solid waste will be disposed of into a municipal waste stream, indicate which registered landfill site will be used.

Where will the solid waste be disposed of if it does not feed into a municipal waste stream (describe)?

If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Can any part of the solid waste be classified as hazardous in terms of the NEM:WA? YES | NO

If YES, inform the competent authority and request a change to an application for scoping and EIA. An application for a waste permit in terms of the NEM:WA must also be submitted with this application.

Is the activity that is being applied for a solid waste handling or treatment facility? YES | NO

If YES, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA. An application for a waste permit in terms of the NEM:WA must also be submitted with this application.

1.12.2. Liquid effluent

Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system?	YES	▶ NO
If YES, what estimated quantity will be produced per month?	0m³	
Will the activity produce any effluent that will be treated and/or disposed of on site?	YES	▶ NO

If YES, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Will the activity produce effluent that will be treated and/or disposed of at another facility?	▶ YES	NO

If YES, provide the particulars of the facility:

Facility name:	Temporary chemical toilets will be installed during the construction phase. These toilets will be serviced regularly and waste will be disposed of at the Joe Morolong Wastewater Treatment Works. Confirmation from Joe Morolong Municipality has been requested and will be obtained prior to the commencement of the construction phase.		
Contact person:	The Municipal Manager: Joe Morolong Local Municipality: Mr Tshepo Bloom		
Postal address:	Private Bag X117, Kuruman, 8460		
Postal code:	8460		
Telephone:	053 773 9308	Cell:	-
E-mail:	bloomt@joemorolong.gov.za	Fax:	-

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

Minimal water would be required only for the construction phase. The re-use and recycling would not be viable due to the small quantities of water required and the nature of its use.

1.12.3. Emissions into the atmosphere

Will the activity release emissions into the atmosphere other that exhaust emissions and dust associated with construction phase activities?	YES	▶ NO
If YES, is it controlled by any legislation of any sphere of government?	YES	NO

If YES, the applicant must consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

If NO, describe the emissions in terms of type and concentration:

No emissions would be generated during the operational phase. The proposed transmission line, which provide the link between a PV site and the national grid, would facilitate in reducing South Africa's carbon emissions in the long term by contributing positively to the Government's renewable energy target through creation of the connection to route renewable energy to the national grid.

1.12.4. Waste permit

Will any aspect of the activity produce waste that will require a waste permit in terms of the NEM:WA?	YES	▶ NO

If YES, please submit evidence that an application for a waste permit has been submitted to the competent authority

1.12.5. Generation of noise

Will the activity generate noise?	YES	▶ NO
If YES, is it controlled by any legislation of any sphere of government?	YES	▶ NO

If YES, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

If NO, describe the noise in terms of type and level:

Minor and temporary noise generation by construction vehicles, operation of machinery and site staff would be limited to the construction phase. Mitigation measures will be discussed in the EMPr and in Section D below to limit the noise generated during the construction phase.

1.13. Water use

Please indicate the source(s) of water that will be used for the activity by ticking the appropriate box(es):

Municipal ◀	Water board	Groundwater	River, stream, dam or lake	Other ◀[5]	The activity will not use water

[5] *If the municipality are unable to provide water, water will be sourced from a commercial source due to the low volumes required. A services capacity request has been submitted by the applicant and discussions are underway and official confirmation / response is awaited.*

If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month:	litres	
Does the activity require a water use authorisation (general authorisation or water use license) from the Department of Water Affairs?	YES	► NO

If YES, please provide proof that the application has been submitted to the Department of Water Affairs.

1.14. Energy efficiency

Describe the design measures, if any that have been taken to ensure that the activity is energy efficient:

Not applicable due to the nature of the project, which is facilitating the evacuation of electricity generated at a renewable energy site. The facility will not use electricity.

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

The project serves to supply renewable or alternative energy to the national grid

2. SECTION B: SITE/AREA/PROPERTY DESCRIPTION

Important notes: 1. For linear activities (pipelines, etc) as well as activities that cover very large sites, it may be necessary to complete this section for each part of the site that has a significantly different environment. In such cases please complete copies of Section B and indicate the area, which is covered by each copy No. on the Site Plan.

Section B Copy No. (e.g. A):	Please note: The project area is homogenous and therefore only one copy of Section B has been compiled.

Locality:
The town of Hotazel is situated just northwest of the proposed solar facility development. The area on the north-western corner of the property is an existing open cast manganese mine (Devon mine) and a potential expansion area that has been reserved by the mine. Access will be gained directly from the R31, which bounds the northern and eastern sides of the site. The Northern access road alternative (Alternative B1) will run along the manganese mine buffer perimeter. The eastern access road is proposed to run along the proposed site southern boundary of the site.

Short description of the study area:
It was found that there is not much variation in the vegetation for the proposed area and along all the routes it is mostly bushveld dominated by Senegalia mellifera subsp. detinens with open to dense cover. The understorey is dominated by grasses. Vachellia haematoxylon (grey camel thorn) trees are a feature of the transmission line routes where they cross Kathu Bushveld whereas this species is much less prominent to absent in the areas where the transmission line routes cross Gordonia Duneveld. A few Vachellia erioloba trees were encountered, mainly near the Ga Mogara River (Refer to the Botanical Impact Assessment).

The study area is relatively flat and covered in sand, although calcrete is exposed along the banks of the Ga-Mogara River which is crossed by one of the Alternatives. Bush and trees occur widely but in general did not hamper the survey. Some very dense patches along the western power line corridor were impenetrable but this was not a limitation for the assessment. The R31 and R380 roads, a railway and numerous other power lines cross the study area, while a number of manganese mines are operational in the general vicinity.

Aquatic features which occur within the study area include the following:
The Ga-Mogara River which flows to the north-west before discharging into the Kuruman River and then the Molopo River. The Molopo River has its confluence with the Orange River at Riemvasmaak. A few relatively small valley floor depressions or pans occur that are largely associated with the Ga-Mogara River System.

The proposed development site falls within the Savanna Biome and vegetation unit classified as Kathu Bushveld. The main faunal classes of relevance are mammals, reptiles and amphibians. There are no large mammals on the site (except for livestock) yet there is one small mammal species of concern, the Black-footed Cat (Felis nigripes), that could potentially occur on site. This species, an endemic to the arid regions of southern Africa, is listed as vulnerable on the International Union for Conservation of Nature (IUCN) red list of threatened species and is protected under the NEM:BA and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. It is possible that the species may traverse the site while foraging and a transmission line is not expected to have any measurable impact on this species..

The proposed development will be located on a terrain unit of level plains at an altitude of around 1,080 meters. Slopes will be below 1% across the site. The geology is Aeolian sand of recent age (Refer to the Agricultural Impact Assessment).

Figure 5 | View of the typical landscape within the study area (Belcher, 2016)

1. Paragraphs 1 - 6 below must be completed for each alternative.

a) Due to the uniformity of the landscape, paragraphs 1-6 are identical for the three alternative routes. This duplication has therefore not been included.

2. Has a specialist been consulted to assist with the completion of this section? ► **YES** | NO

If YES, please complete the form entitled "Details of specialist and declaration of interest" for each specialist thus appointed and attach it in Appendix I. All specialist reports must be contained in Appendix D.

Property description/physical address:

Province	Northern Cape also refer to Appendix J
District Municipality	John Taolo Gaetsewe District Municipality (Kgalagadi District Municipality)
Local Municipality	Joe Morolong Local Municipality
Ward Number(s)	Ward 4
Farm name and number	→ Annex Langdon, Farm 278 → Hotazel, Farm 280 → Devon, Farm 277 → York A, Farm 279 → Olive Pan, Farm 282
Portion number	→ Annex Langdon, Farm 278, **Portion 0** → Hotazel, Farm 280, **Portion 0** → Devon, Farm 277, **Portion 0** → Devon, Farm 277, **Portion 1 (Railway)** → York A, Farm 279, **Portion 11** → Olive Pan, Farm 282, **Portion 0**
SG Code	See below

Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application including the same information as indicated above.

C	0	4	1	0	0	0	0	0	0	0	0	0	2	7	8	0	0	0	0	0
C	0	4	1	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0	0
C	0	4	1	0	0	0	0	0	0	0	0	0	2	7	7	0	0	0	0	0
C	0	4	1	0	0	0	0	0	0	0	0	0	2	7	7	0	0	0	0	1
C	0	4	1	0	0	0	0	0	0	0	0	0	2	7	9	0	0	0	1	1
C	0	4	1	0	0	0	0	0	0	0	0	0	2	8	2	0	0	0	0	0
1	2			3				4									5			

Current land-use zoning as per local municipality IDP/records:	Current land use zoning is Agriculture I.

In instances where there is more than one current land-use zoning, please attach a list of current land use zonings that also indicate which portions each use pertains to, to this application.

Is a change of land-use or a consent use application required? YES | ► **NO**

2.1. Gradient of the site

Indicate the general gradient of the site.

Alternative S1:

Flat[6] ◄	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

Alternative S2 (if any):

Flat ◄	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

Alternative S3 (if any):

Flat ◄	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

2.2. Location in landscape

Indicate the landform(s) that best describes the site:

2.1 Ridgeline		2.4 Closed valley		2.7 Undulating plain / low hills	
2.2 Plateau		2.5 Open valley		2.8 Dune	
2.3 Side slope of hill/mountain		2.6 Plain	Yes ◄	2.9 Seafront	

2.3. Groundwater, soil and geological stability of the site

Is the site(s) located on any of the following?

	Alternative S1:		Alternative S2 (if any):		Alternative S3 (if any):	
Shallow water table (less than 1.5m deep)	YES	► NO	YES	► NO	YES	► NO
Dolomite, sinkhole or doline areas	YES	► NO	YES	► NO	YES	► NO
Seasonally wet soils (often close to water bodies)	YES	► NO	YES	► NO	YES	► NO
Unstable rocky slopes or steep slopes with loose soil	YES	► NO	YES	► NO	YES	► NO
Dispersive soils (soils that dissolve in water)	YES	► NO	YES	► NO	YES	► NO
Soils with high clay content (clay fraction more than 40%)	YES	► NO	YES	► NO	YES	► NO
Any other unstable soil or geological feature	YES	► NO	YES	► NO	YES	► NO
An area sensitive to erosion	[7] ► YES	NO	► YES	NO	► YES	NO

If you are unsure about any of the above or if you are concerned that any of the above aspects may be an issue of concern in the application, an appropriate specialist should be appointed to assist in the completion of this section. Information in respect of the above will often be available as part of the project information or at the planning sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by the Council for Geo Science may also be consulted.

2.4. Groundcover

Indicate the types of groundcover present on the site. The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

Natural veld - good condition[E]	► Natural veld with scattered aliens[E]	Natural veld with heavy alien infestation[E]	Veld dominated by alien species[E]	Gardens
Sport field	Cultivated land	Paved surface	Building or other structure	Bare soil

If any of the boxes marked with an "[E] "is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

The transmission lines would extend from Kathu Bushveld westwards over a narrow north-south area of Gordonia Duneveld to Kathu Bushveld once again. It was found that there is not much variation in the vegetation and along all the routes it is mostly bushveld dominated by *Senegalia mellifera* subsp. *detinens* with open to dense cover. The understorey is dominated by grasses. *Vachellia haematoxylon* (grey camel thorn) trees are a feature of the transmission line routes where they cross Kathu Bushveld whereas this species is much less prominent to absent in the areas where the transmission line routes cross Gordonia Duneveld. A few *Vachellia erioloba* trees were encountered, mainly near the Ga Mogara River (MacDonald, 2016). Since the habitat in the study area has been used mainly for cattle ranching and has never been ploughed, it is in fair to good condition. It is mostly free of alien invasive plants except around a livestock watering-point in the north-east corner of the site where honey mesquite (*Prosopis glandulosa* var. *torreyana*) is prominent.

2.5. Surface water

Indicate the surface water present on and or adjacent to the site and alternative sites?

Alternative S1: Hotazel

Perennial River	YES	► NO	UNSURE
Non-Perennial River	YES	► NO	UNSURE
Permanent Wetland	YES	► NO	UNSURE
Seasonal Wetland	YES	► NO	UNSURE
Artificial Wetland	YES	► NO	UNSURE
Estuarine / Lagoonal wetland	YES	► NO	UNSURE

Alternative S2: Umtu

Perennial River	► YES	NO	UNSURE
Non-Perennial River	YES	► NO	UNSURE
Permanent Wetland	YES	► NO	UNSURE
Seasonal Wetland	YES	► NO	UNSURE

[6] *Slope is less than 1% according the soil impact assessment (Lanz, 2016)*

[7] *The soils are classified as having low to moderate susceptibility to water erosion (class 5), but because of their sandy texture are classified as highly susceptible (class 1a) to wind erosion (Lanz, 2016)*

Artificial Wetland	YES	▶ NO	UNSURE
Estuarine / Lagoonal wetland	YES	▶ NO	UNSURE

Alternative S3: LILO[8]

Perennial River	YES	▶ NO	UNSURE
Non-Perennial River	YES	▶ NO	UNSURE
Permanent Wetland	YES	▶ NO	UNSURE
Seasonal Wetland	YES	▶ NO	UNSURE
Artificial Wetland	YES	▶ NO	UNSURE
Estuarine / Lagoonal wetland	YES	▶ NO	UNSURE

If any of the boxes marked YES or UNSURE is ticked, please provide a description of the relevant watercourse.

The only aquatic feature within the study area lies in the western extent of the study area, associated with the Ga-Mogara River. This is of relevance to the proposed transmission line that would link to Umtu Substation. The impact is expected at the points at which the transmission line will need to cross the Ga-Mogara River during and after the construction phase. The major impacts are associated with the access road, should it need to cross the river, and relate to loss of riparian and instream habitat and the potential invasive alien plant growth.

2.6. Land use character of surrounding area

Indicate land uses and/or prominent features that currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

▶ **Natural area**	Dam or reservoir	Polo fields
Low density residential	Hospital/medical centre	Filling station [H]
▶ **Medium density residential**	School	Landfill or waste treatment site
High density residential	Tertiary education facility	Plantation
Informal residential [A]	Church	▶ **Agriculture**
Retail commercial & warehousing	Old age home	▶ **River, stream or wetland**
Light industrial	Sewage treatment plant [A]	Nature conservation area
Medium industrial [A,N]	Train station or shunting yard [N]	Mountain, koppie or ridge
Heavy industrial [A,N]	▶ **Railway line** [N]	Museum
Power station	Major road (4 lanes or more) [N]	Historical building
Office/consulting room	Airport [N]	Protected Area
Military or police base/station/compound	Harbour	Graveyard
▶ **Spoil heap or slimes dam** [A]	Sport facilities	Archaeological site
▶ **Quarry, sand or borrow pit**	Golf course	Other land uses (describe)

If any of the boxes marked with an "N" are ticked, how will this impact / be impacted upon by the proposed activity?

Transmission line will pass over the railway lines and associated electrical supplies, as with the other transmission lines in the area. No impact on the railway line and its operation is expected.

If any of the boxes marked with an "A" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

Transmission lines have been routed to follow existing Eskom transmission line routes in the area where possible. This has been done to limit the impact on current and future mining activities that may occur in the area. The presence of existing Eskom lines, which are nearer to the open pit mining and spoil dumps are such that the addition of those proposed here will have no impact (not already imposed by existing lines) on the mining operations or vice versa. The red circle indicates a 500m radius, and show proximity of the transmission line to the Kudumane Manganese Resources mining operations.

If any of the boxes marked with an "H" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

Does the proposed site (including any alternative sites) fall within any of the following:

8 *"The Loop In Loop Out connection depends on technical capacity of the Eskom line before being deemed a feasible alternative. This is considered the least, technically, viable alternative at this stage, though this might change in future"*

Critical Biodiversity Area (as per provincial conservation plan)	YES	▶ NO
Core area of a protected area?	YES	▶ NO
Buffer area of a protected area?	YES	▶ NO
Planned expansion area of an existing protected area?	YES	▶ NO
Existing offset area associated with a previous Environmental Authorisation?	YES	▶ NO
Buffer area of the SKA?	YES	▶ NO

If the answer to any of these questions was YES, a map indicating the affected area must be included in Appendix A.

The activity does **not** fall in a buffer area of the SKA (Astronomy Geographic Advantage Act, No. 21 of 2007):
On 19 February 2010, the Minister of Science and Technology (the Minister) declared the whole of the territory of the Northern Cape province, excluding Sol Plaatje Municipality, as an astronomy advantage area for radio astronomy purposes in terms of Section 5 of the Square Kilometre Array (SKA) Act. On 20 August 2010 the Minister declared the Karoo Core Astronomy Advantage Area for the purposes of radio astronomy.

The Karoo Core Astronomy Advantage area consists of three pieces of farming land of 13,407 hectares in the Kareeberg and Karoo Hoogland Municipalities purchased by the National Research Foundation. The Karoo Core Astronomy Advantage Area will contain the MeerKAT radio telescope and the core planned SKA radio telescope that will be used for the purposes of radio astronomy and related scientific endeavours. The proposed energy facilities and associated transmission lines fall outside of the Karoo Core Astronomy Advantage Area.

The Minister may still declare that activities prescribed in Section 23(1) of the Act may be prohibited within the area, such as the construction, expansion or operation of any fixed radio frequency interference sources and the operation, construction or expansion of facilities for the generation, transmission or distribution of electricity. It is unlikely that the proposed project would have any measurable affect the SKA project due to the distant location of SKA and does not fall within the buffer area. As a precautionary measure the SKA have been included as an I&AP. While the Minister has not yet prohibited these activities it is important that the relevant astronomical bodies are notified of the proposed projects and provided with the opportunity to comment on the proposed projects.

2.7. Cultural/historical features

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or paleontological sites, on or close (within 20m) to the site? If YES, explain:

YES	▶ NO
Uncertain	

N/A

If uncertain, conduct a specialist investigation by a recognised specialist in the field (archaeology or paleontology) to establish whether there is such a feature(s) present on or close to the site. Briefly explain the findings of the specialist:

The National Heritage Resource Act (Act 25 of 1999) (NHRA) requires "any development … which will change the character of a site exceeding 5 000 m^2 in extent", "the construction of a road…powerline, pipeline…exceeding 300 m in length" or "the rezoning of site larger than 10 000 m^2 in extent…" to be subjected to a heritage study in terms of NHRA, and be approved by the relevant heritage authority prior to the commencement of the construction process. Refer to Appendix D for the Heritage Assessment Report. The statement of significance according to the Heritage Assessment Report 2016 states: There do not appear to be any significant heritage resources within the study area and impacts to heritage are likely to be of very low significance. Because heritage resources occur so infrequently in the wider region, cumulative impacts are of no concern.

Will any building or structure older than 60 years be affected in any way?	YES	▶ NO
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?	YES	▶ NO

If YES, please provide proof that this permit application has been submitted to SAHRA or the relevant provincial authority.

2.8. Socio-economic character

2.8.1. Local Municipality

Please provide details on the socio-economic character of the local municipality in which the proposed site(s) are situated.

Level of unemployment:

Only 13.9% of the population in the JMLM is employed, while 24.9% is unemployed and 61.2% is not economically active. Hotazel is one of the main development nodes in JMLM and mining is the predominant economic activity in the area. Two thirds of the population (66%) is employed in Hotazel, while 3.6% is unemployed and 30.4% is not economically active. JMLM's local economy is dominated by mining, making it difficult to incorporate all job seekers (IDP, Draft Integrated Development Plan, 2015/16). Therefore, the high percentage (24.9%) of unemployed people in JMLM, implies there is a need to broaden and diversify economic activities to create more employment opportunities in the area. As a result, future demand for electricity will increase as the areas expand to broaden their economic base.

Table 2: Level of employment

2015	SA	NC	JTGDM	JMLM	Hotazel
Employed	44.8%	42.3%	35.7%	13.9%	66.0%
Unemployed	14.1%	17.2%	19.4%	24.9%	3.6%
Not economically active	41.1%	40.5%	44.9%	61.2%	30.4%

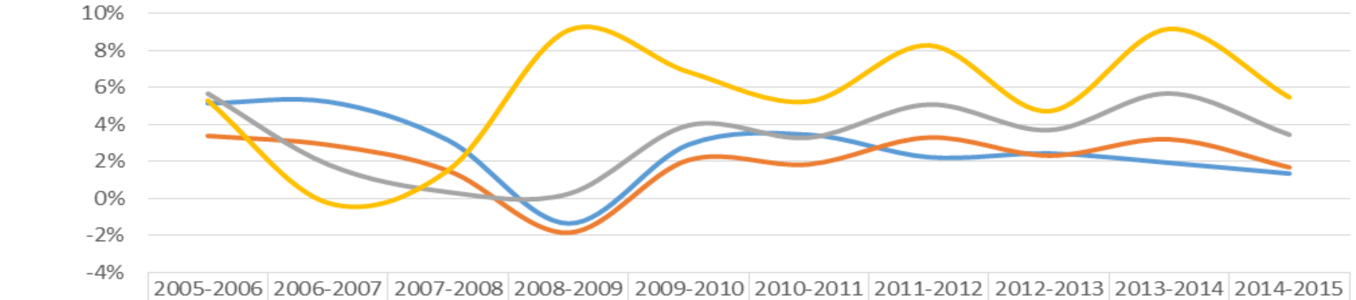
Economic profile of local municipality:

Local Economic Profile
According to the latest 2011 Census, Joe Morolong Local Municipality has a total population of 89 530 people. The majority of the population in the municipality are black African (96,4%), 2,0% are coloured, with the other population groups making up the remaining 1,6%.
There are 23 707 households in the municipality, with an average household size of 3,4 persons per household. Of the households, 6,6% have access to piped water either in their dwelling or in the yard, while 81,8% have access to electricity for lighting

Of those aged 20 years and older, 5,2% have only completed primary school, 27,8% have some secondary education, 13,4% have completed matric and 4,1% have some form of higher education. Of the mentioned age group, 22,9% have no form of schooling[9].

The Socio-Economic Impact Assessment (Appendix D) provided Table 3 below which indicates the GDP growth of the various study areas between 2005 and 2015.

Table 3: GDP growth between 2005-2015



	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
SA	5.2%	5.2%	3.2%	-1.3%	2.9%	3.5%	2.2%	2.4%	1.9%	1.4%
NC	3.4%	2.9%	1.5%	-1.8%	2.1%	1.9%	3.3%	2.3%	3.2%	1.7%
JTGDM	5.7%	1.8%	0.4%	0.3%	4.0%	3.3%	5.1%	3.7%	5.7%	3.5%
JMLM	5.3%	-0.2%	1.5%	9.1%	6.8%	5.3%	8.3%	4.7%	9.2%	5.5%

SA NC JTGDM JMLM

SA and the NC had an average GDP growth rate of 2.7% and 2% respectively between 2005 and 2015. The average GDP growth rate for JMLM and JTGDM was 5.5% and 3.3% respectively between 2005 and 2015. The negative GDP growth from 2008–2009 can be attributed to the global economic recession. South Africa's economy grew by 1.4% in 2015, down from 1.9% in 2014 (Statistics South Africa, 2016), with 0.7% GDP growth forecasted for the year 2016 by the International Monetary Fund (IMF). Agriculture was the prime contributor to the setback in SA GDP during 2015, in which the sector contracted by 8.4% due to the severe drought that initiated a sharp drop in the production of field crops (Statistics South Africa, 2016).

Recent macroeconomic changes have affected the economic outlooks across countries and regions globally. These major macroeconomic changes include the slowdown and rebalancing in China; the further decline in commodity prices, i.e. crude oil, with sizable redistributive consequences across sectors and countries; a related slowdown in investment and trade; and declining capital flows to emerging market and developing economies (IMF, 2016). The prolonged drought in South Africa which started in 2015 is having an impact on the agriculture value chain and together with inflation is having a negative impact on the local economy. These changes, together with a host of non-economic factors, including geopolitical tensions are generating substantial uncertainty. In general, they are consistent with a subdued outlook for the world economy, but risks of much weaker global growth have also risen

The economic sectors that contributed the most to JMLM's GDP in 2015 were:

Mining and quarrying (73.3%)

General government (5.8%)

Wholesale and retail trade, catering and accommodation (4.7%)

Level of education:

In any society, education levels have a significant influence on economic and human development. It is evident that low levels of education translate into a low skills base in an area, therefore supplying a less competitive workforce. However, an area with high levels in education is characterised by a workforce capable of operating industries at a competitive level, producing a skilled and highly skilled population. People increase their earning potential by developing and enhancing their capabilities, reaffirming that household and personal income levels are either positively or adversely affected by education levels. Also, a skilled population does not necessarily aspire to employment but to entrepreneurship, which adds businesses and increases economic activity in an area, consequently increasing the number of jobs available. In Hotazel 21.5% of the population has a Grade 12 qualification and 37.6% have a tertiary qualification. This could be due to the fact that there are so many mines located in Hotazel that require highly skilled employees.

A high percentage of the aged 20+ population in Hotazel (31.8%) and Joe Morolong Local Municipality have secondary education but have not completed Grade 12. This implies there is a low education and skills level in the area, which has a direct impact on the type of employment available to the people and subsequently their earning capacity. In a region driven by a single sector, low education and skills levels retard developments aimed at diversifying and broadening the local economy[10].

2.8.2. Socio-economic value of the activity

What is the expected capital value of the activity on completion?	R 25 000 000 estimated for the power line	
What is the expected yearly income that will be generated by or as a result of the activity?	Confidential information	
Will the activity contribute to service infrastructure?	▶ YES	NO
Is the activity a public amenity?	YES	▶ NO
How many new employment opportunities will be created in the development and construction phase of the activity/ies?	10-40	
What is the expected value of the employment opportunities during the development and construction phase?	R 100,000 – R250,000	
What percentage of this will accrue to previously disadvantaged individuals?	80%	
How many permanent new employment opportunities will be created during the operational phase of the activity?	Unsure (Eskom ownership)	
What is the expected current value of the employment opportunities during the first 10 years?	Unsure (Eskom ownership)	
What percentage of this will accrue to previously disadvantaged individuals?	Unsure (Eskom ownership)	

[9] *http://www.statssa.gov.za/?page_id=993&id=joe-morolong-municipality (Accessed on 16/01/2017)*

[10] *Refer to the Socio-Economic Impact Report 2016*

2.9. Biodiversity

Please note: The Department may request specialist input/studies depending on the nature of the biodiversity occurring on the site and potential impact(s) of the proposed activity/ies. To assist with the identification of the biodiversity occurring on site and the ecosystem status consult http://bgis.sanbi.org or BGIShelp@sanbi.org. Information is also available on compact disc (cd) from the Biodiversity-GIS Unit, Ph (021) 799 8698. This information may be updated from time to time and it is the applicant/ EAP's responsibility to ensure that the latest version is used. A map of the relevant biodiversity information (including an indication of the habitat conditions as per (b) below) and must be provided as an overlay map to the property/site plan as Appendix D to this report.

2.9.1. Indicate the applicable biodiversity planning categories of all areas on site and indicate the reason(s) provided in the biodiversity plan for the selection of the specific area as part of the specific category)

Systematic Biodiversity Planning Category				If CBA or ESA, indicate the reason(s) for its selection in biodiversity plan
Critical Biodiversity Area (CBA)	Ecological Support Area (ESA)	Other Natural Area (ONA)	No Natural Area Remaining (NNR)	The proposed study area does not fall within a Critical Biodiversity Area (CBA) or Ecological Support Area (according to the CBA map of the Northern Cape Province. It falls within an area designated as "Other Natural Vegetation" and the vegetation / habitat is recognized as Least Threatened (Government Gazette, 2011; Driver *et al.* 2012). Refer to Appendix D for the Botanical Impact Report.

2.9.2. Indicate and describe the habitat condition on site

Habitat Condition	Percentage of habitat condition class (adding ≤100%)	Description and additional Comments and Observations (Including additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc).
Natural ◄	30%	The vegetation is relatively uniform across the site, consisting of a mosaic of open areas, vegetated with grasses, herbs and small shrubs, and areas with clusters or thickets of small trees. The vegetation traversed by the transmission line route west of the solar park and around the Ga Moraga River is not markedly different, even in the area of Gordonia Duneveld, from that found in the area of the proposed solar park. A few Vachellia erioloba trees were encountered, mainly near the Ga Mogara River. The most significant impact for all the transmission corridors would be removal of vegetation, especially moderate to tall trees. The corridors would be kept clear of woody vegetation and only a cover of grass would be permitted. The vegetation in the study area is typically bushveld but, although mapped as Kathu Bushveld, the stature of the vegetation and its species composition suggest that it is more correctly described as Gordonia Plains Shrubland than Kathu Bushveld (Rutherford *et al.* 2006).
Near Natural (includes areas with low to moderate level of alien invasive plants)	50%	It was found that there is not much variation in the vegetation and it consists of a mosaic of open areas, vegetated with grasses, herbs and small shrubs, and areas with clusters or thickets of small trees.along all the routes it is mostly bushveld dominated by *Senegalia mellifera* subsp. detinens with open to dense cover. The understorey is dominated by grasses. *Vachellia haematoxylon* (grey camel thorn) trees are a feature of the transmission line routes where they cross Kathu Bushveld whereas this species is much less prominent to absent in the areas where the transmission line routes cross Gordonia Duneveld. A few Vachellia erioloba trees were encountered. The most significant impact for all the transmission corridors would be removal of vegetation, especially moderate to tall trees. The corridors would be kept clear of woody vegetation and only a cover of grass would be permitted. The vegetation in the study area is typically bushveld but, although mapped as Kathu Bushveld, the stature of the vegetation and its species composition suggest that it is more correctly described as Gordonia Plains Shrubland than Kathu Bushveld (Rutherford *et al.* 2006). Since the habitat in the study area has been used mainly for cattle ranching and has never been ploughed, it is in fair to good condition. It is mostly free of alien invasive plants except around a livestock watering-points where honey mesquite (*Prosopis glandulosa* var. *torreyana*) is prominent.
Degraded (includes areas heavily invaded by alien plants)	0%	
Transformed (includes cultivation, dams, urban, plantation, roads, etc) ◄	20%	Roads, transmission lines, railway lines are intercepted along the routes.

c) Complete the table to indicate:
(i) the type of vegetation, including its ecosystem status, present on the site; and
(ii) whether an aquatic ecosystem is present on site.

Terrestrial Ecosystems		Aquatic Ecosystems						
Ecosystem threat status as per the National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	Critical Endangered Vulnerable Least Threatened ◄	Wetland (including **rivers**, depressions, channelled and unchanneled wetlands, flats, seeps pans, and artificial wetlands)			Estuary		Coastline	
		► **YES**	NO	UNSURE	YES	► **NO**	YES	► **NO**

2.9.3. **Please provide a description of the vegetation type and/or aquatic ecosystem present on site, including any important biodiversity features/information identified on site (e.g. threatened species and special habitats)**

Vegetation

Accessibility to the routes of the proposed transmission lines was difficult so a number of accessible points were visited to obtain a record with which to characterize the vegetation. It was found that there is not much variation in the vegetation and along all the routes it is mostly bushveld dominated by *Senegalia mellifera* subsp. *detinens* with open to dense cover. The understorey is dominated by grasses. *Vachellia haematoxylon* (grey camel thorn) trees are a feature of the transmission line routes where they cross Kathu Bushveld whereas this species is much less prominent to absent in the areas where the transmission line routes cross Gordonia Duneveld. A few *Vachellia erioloba* trees were encountered, mainly near the Ga Mogara River.

No species of conservation concern (threatened species) were found during the survey, however, it is possible that regional endemic species may be present. The prevailing dry conditions, however, made finding such species impossible at the time of the site visit.
Of more importance is that both *Vachellia erioloba* (camel thorn) and *Vachellia haematoxylon* (grey camel thorn) are protected species in terms of the National Forests Act 1998 (Act 94 of 1998). Given the abundance of *V. haematoxylon* and the relative scarcity of *V. erioloba* in the study area, estimates of numbers of these trees is not possible without a highly detailed survey that is beyond the scope of this study at this stage. A permit would be required from the Department of Agriculture, Forestry and Fisheries (DAFF) for the removal of these tree species in the area of the footprint of the solar PV installation. It is unlikely that many, if any, of these trees would be removed for the transmission lines.

The proposed Hotazel Solar Park study area does not fall within a Critical Biodiversity Area (CBA) or Ecological Support Area (according to the CBA map of the Northern Cape Province (E. Oosthuizen, pers. comm.). It falls within an area designated as "Other Natural Vegetation" and the vegetation / habitat is recognized as Least Threatened (Government Gazette, 2011; Driver *et al.* 2012).

3. SECTION C: PUBLIC PARTICIPATION

3.1. Advertisement and notice

Publication name	Kathu Gazette	
Date published	7 March 2017	
Site notice position	Latitude	Longitude
	27°14'5.70"S	23° 0'54.51"E
Date placed	29 October 2016 (with the placement of notices associated with the Hotazel Solar Plant EIA Scoping phase	

Include proof of the placement of the relevant advertisements and notices in Appendix E1. The map beneath shows the location of the various notices boards.

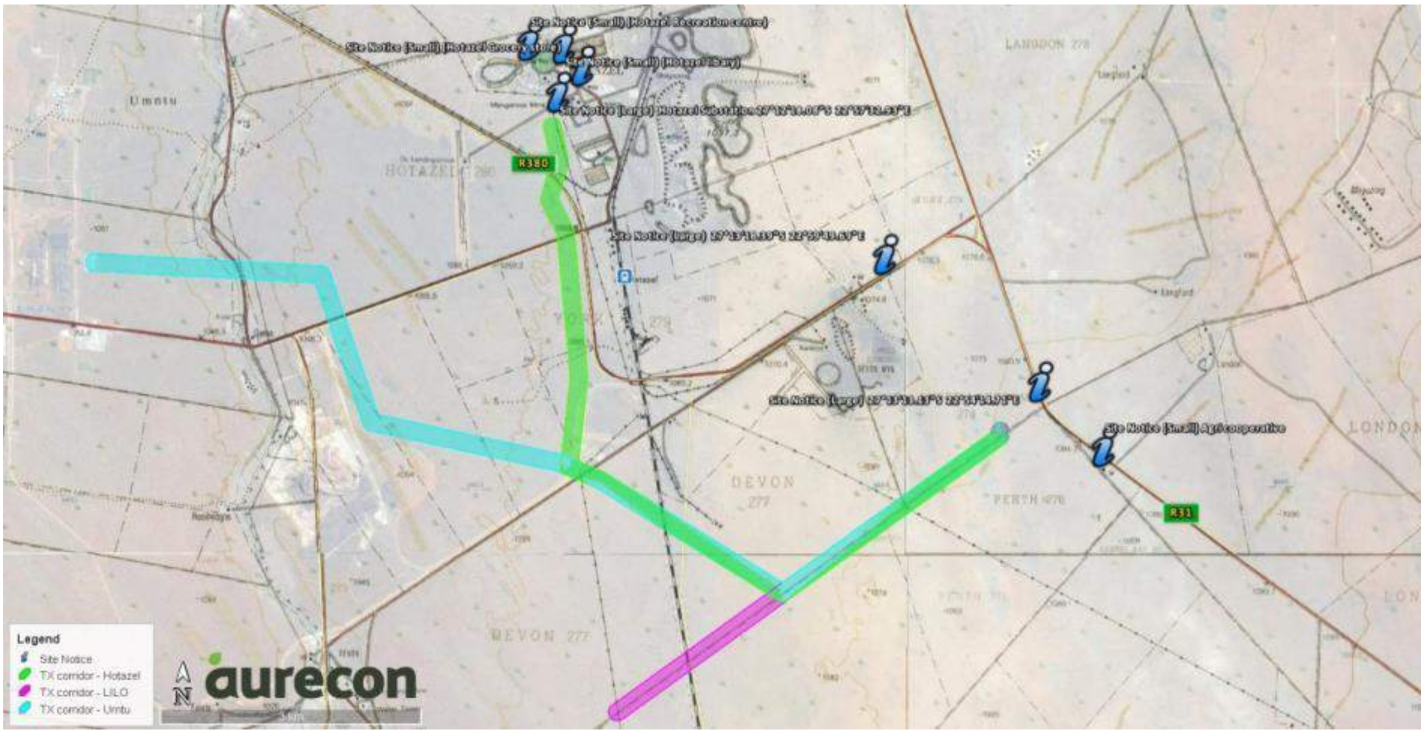


Figure 6 | All site notice locations

3.2. Determination of appropriate measures

Provide details of the measures taken to include all potential I&APs as required by Regulation 41(2)(e) and 41(6) of GN 982.

Key stakeholders (other than organs of state) identified in terms of Regulation 41(2)(b) of GN 982

Title, Name and Surname	Affiliation/ key stakeholder status	
Landowners, adjacent landowners and stakeholders		

Title, Name and Surname	Affiliation/ key stakeholder status	
Landowners, adjacent landowners and stakeholders		
Mr Dawie Fourie	Landowner	053 74 11247 / 083 232 5177
Mr Jacobus Jansen Petrus	Adjacent landowner	053 7411256
Hotazel Manganese Mines (Pty) Ltd	Landowner	012 300 5530 / 083 262 1890
Kudumane Manganese Resources (Pty) Ltd	Landowner	011 706 0888 / 082 547 5975
Kalagadi Manganese (Pty) Ltd (Mr Zakhele Mashile)	Landowner	011 805 0674 / 082 8053863
Hotazel Manganese Mines (Pty) Ltd Emsley Manne Dipico (Director)	Landowner	012 300 5530
Perth Hotazel Farm 276 P0 Mr Ebenhaeser Zikmann Anthinissen	Landowner	053 7411382 / 083 3066021
Kudumane Manganese Resources Mr Neels Cockeran	Landowner	537423500
Hotazel Manganese Mines (Pty) Ltd Ms Dineo Peta	Landowner	011 376 2627
Hotazel Manganese Mines (Pty) Ltd Mr Rudzani Mudau	Landowner	053 742 2174 084 916 2179
Terra Nominees (Samancor Manganese) Ms Dineo Peta	Adjacent landowner	011 376 2627 082 082 5529
Transnet Mr Sam Fiff	Adjacent landowner	051 408 256
Mr Rudzani Madaay	Adjacent landowner	082 495 4409
Mr Andries Mathys van den Berg	Adjacent landowner	082 495 4409
Ntsimbintle Mining Pty Ltd Mr Jeff Leader and Justin pITT	Adjacent landowner	082 499 8001/ 011 483 0840
Dr Adrian Tiplady	South African Square Kilometre Array (SKA) Project	011 442 2434; 083 335 4622
Mr Johan Koegelenberg	Sentech (Planning department)	011 471 4540
Ms Alishea Pretorius	Sentech	011 471 4540
Mr André Bodenstein	Transnet Freight Rail	051 408 2111; 083 553 0714
Mr Koos Pretorius	CAA	011 545 1066; 083 451 2657
Ms Suzanne Erasmus & Mr Morgan Griffiths	WESSA	041 585 9606; 072 4175793
Mr Luke Strugnell	EWT-Wildlife Energy Interaction Group (WEIG)	079 878 3741
Dr Andries Kruger	Weather SA	012 367 6074
Ms Samantha Ralston-Paton	Birdlife South Africa	011 789 1122
Mr Mark Anderson	Birdlife South Africa	011 789 1122
Mdux-ICS (Pty) Ltd (Chief Executive Officer)	Registered I&AP	076 869 5064

Include proof that the key stakeholder received written notification of the proposed activities as **Appendix E2**. This proof may include any of the following:

- e-mail delivery reports
- registered mail receipts;
- courier waybills;
- signed acknowledgements of receipt; and/or
- or any other proof as agreed upon by the competent authority.

3.3. Issues raised by interested and affected parties

Summary of main issues raised by I&APs	Summary of response from EAP
No comments have been received to date. This section will be updated following the 30 day public comment period for the BAR.	This section will be updated following the 30 day public comment period for the BAR.

3.4. Comments and response report

The practitioner must record all comments received from I&APs and respond to each comment before the Draft BAR is submitted. The comments and responses must be captured in a comments and response report as prescribed in the EIA regulations and be attached to the Final BAR as Appendix

3.5. Authority participation

Authorities and organs of state identified as key stakeholders:

Authority/Organ of State	Contact person (Title, Name and Surname)	Tel No	E-mail	Postal address
Authorities (National, Provincial and Local)				
The Municipal Manager: Joe Morolong Local Municipality	Mr Tshepo Bloom	053 773 9300	bloomt@joemorolong.gov.za	Private Bag X117 Mothibistad
Joe Morolong Local Municipality	Mr Moses Mbolekwa	053 773 9300	matshidisot@joemorolong.gov.za	Private Bag X117 Mothibistad
Joe Morolong Local Municipality	Mrs M Schuping	076 411 8956	-	Private Bag X117 Mothibistad
Joe Morolong Local Municipality	Mr S Seleka	537739300	sseleka@webmail.co.za	Private Bag X117 Mothibistad
John Taolo Gaetsewe District Municipality – Municipal Manager	Mrs M Bokgwathile	053 712 8700	bokgwathilem@taologaetsewe.gov.za	P.O. Box 1480 Kuruman

Authority/Organ of State	Contact person (Title, Name and Surname)	Tel No	E-mail	Postal address
Authorities (National, Provincial and Local)				
DEA Department of Environmental Affairs	Mr Coenrad Agenbach	-	Cagenbach@environment.gov.za;	Department of Environmental Affairs, Environment House, 473 Steve Biko Road, Arcadia, Pretoria, 0001
DEA Department of Environmental Affairs: Biodiversity and conservation	Mr. Munzhedzi (*Deputy Director*)		'smunzhedzi@environment.gov.za'	Department of Environmental Affairs, Environment House, 473 Steve Biko Road, Arcadia, Pretoria, 0001
Eskom	Mr John Geerigh	011 516 7233	john.geeringh@eskom.co.za;	GC Land Development, Megawatt Park D1 Y38, P O Box 1091, Johannesburg, 2000
Eskom	Lindiwe Mbhele		MbheleLW@eskom.co.za	
NERSA (National Energy Regulator of South Africa)	Ms P Baleni	-	-	526 Madiba Street, Kulawula House, 7th Floor, Arcadia
Department of Transport	Mr RC Barlow	053 802 5533	ramon@vodamail.co.za; zschmidt@ncpg.gov.za;	45 Schmidtsdrift Road, Kimberley, 8301
DAFF Department of Agriculture, Forestry and Fisheries	Ms Hettie Buys	-	-	Delpen Building, Cnr Annie Botha and Union Street, Riveria
SANRAL	Ms Rene de Kock	021 957 4607	Dekockr@nra.co.za	Parc du Cap Building 5, cnr Mispel Street & Willie van Schoor Avenue, Bellville, Cape Town, 7530
DoE Department of Energy	Director	-	-	192 Cnr of Visagie and Paul Kruger Street, Pretoria
South African Heritage Resource Agency (SAHRA)	Mrs Katie Smuts	021 462 4502	ksmuts@sahra.org.za	P O Box 1930
Department of Environment and Nature Conservation (DENC) – Environmental authorisation	Mr Thukani Mthombeni	053 807 7464	tmthombeni@ncpg.gov.za	-
Department of Water and Sanitation (DWS)	Mr Lebogang Swaratlhe	-	SwaratheL@dwa.gov.za	28 Central Road Kimberley 8300
Department of Mineral Resources (DMR) Northern Cape	Mr E Semenya / Mr R Sekepane	053 807 1700	raisibe.sekepane@dmr.gov.za ephesia.semenya@dmr.gov.za	65 Phakamile Mabija Street Perm Building Kimberley
Department of Agriculture	Mr O Mvula	053 830 4000	-	4-7 Eliott Street Kimberley 8300
Department of Rural Development and Land Reform	Mr R Oliver	053 807 5700	-	-
Department of Public Works, Roads and Transport - Northern Cape	Mr Itumeleng Bulane	053 861 9600	-	P O Box 3132
SKA	Adrian Tiplady	011 442 2434	atiplady@ska.ac.za	-

Include proof that the Authorities and Organs of State received written notification of the proposed activities as Appendix E4.

Refer to **Error! Reference source not found.** for proof of notification to Authorities and Organs of State

In the case of renewable energy projects, Eskom and the SKA Project Office must be included in the list of Organs of State.

Both Eskom and the SKA projects office have been included in the list of Organs of State (Refer to Appendix E 2)

3.6. Consultation with other stakeholders

Note that, for any activities (linear or other) where deviation from the public participation requirements may be appropriate, the person conducting the public participation process may deviate from the requirements of that sub-regulation to the extent and in the manner as may be agreed to by the competent authority.

Proof of any such agreement must be provided, where applicable. Application for any deviation from the regulations relating to the public participation process must be submitted prior to the commencement of the public participation process.

A list of registered I&APs must be included as appendix E5.
Copies of any correspondence and minutes of any meetings held must be included in Appendix E6.

Refer to Appendix E.1: for full list of registered interested and affected parties (I&APs). Copies of all correspondence is included in Appendix E6.

Copies of any correspondence and minutes of any meetings held must be included in Appendix E6.

Based on experience, I&AP meetings in the area are rarely attended in the rural parts of the Northern Cape, and so it was decided that no meetings will be scheduled and to rather liaise with people telephonically on a one on one basis as needed. However, should I&APs request a meeting or there is an observed interest or contentious issues that emerges, one will be scheduled.

4. SECTION D: IMPACT ASSESSMENT

The assessment of impacts must adhere to the minimum requirements in the EIA Regulations, 2014 and should take applicable official guidelines into account. The issues raised by interested and affected parties should also be addressed in the assessment of impacts.

4.1. Impacts that may result from the planning and design, construction, operational, decommissioning and closure phases as well as proposed management of identified impacts and proposed mitigation measures

Provide a summary and anticipated significance of the potential direct, indirect and cumulative impacts that are likely to occur as a result of the planning and design phase, construction, operational and decommissioning (to some extent) phase, including impacts relating to the choice of site/activity/technology alternatives as well as the mitigation measures that may eliminate or reduce the potential impacts listed. This impact assessment must be applied to all the identified alternatives to the activities identified in Section A(2) of this report.

The following provides a summary of the assessment of potential impacts contained in Appendix F per phase (construction, operation and decommissioning) of the proposed developments. This will allow for minor alignment deviations within the corridor to assist in avoiding sensitive features identified. The assessment methodology used in the assessment of the potential impacts is included in Appendix F.

4.1.1. Construction Phase: Impact Assessment for the 3 Alternative Transmission Lines and No go

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[11] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
Impacts on Botany	***Direct impacts:*** Impacts occurring directly on the vegetation of the transmission corridors.	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** Neutral	▪ The corridors should be kept clear of woody vegetation and only a cover of grass would be permitted. This would be required for the safe operation of the transmission lines. (The vegetation would not revert to its natural state after construction since it would be kept in check by systematic and regular clearing). ▪ Care must be taken to not spread alien invasive plant species, particularly *Prosopis glandulosa var. torreyana* (honey mesquite) during construction. Careful monitoring for the occurrence of this species must be implemented and this must be written into the EMPr. Where this species occurs it should be eradicated.	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** Neutral
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Impacts caused by several similar projects, related strategic actions and existing trends.	**Alternative 1-3** Low Negative (-) **No-Go** N/A	▪ The only mitigation possible would be revegetation at places where there is significant disturbance from construction.	**Alternative 1-3** Low Negative (-) **No-Go** N/A
Impacts on Avifauna	***Direct impacts:*** → Displacement due to disturbance and habitat transformation associated with the construction of the transmission lines. →	**Alternatives 1-3** Low (-) **No-Go** N/A	▪ Construction activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of	**Alternatives 1-3** Low (-) **No-Go** N/A

[11] *"The Loop In Loop Out connection depends on technical capacity of the Eskom line before being deemed a feasible alternative. This is considered the least, technically, viable alternative at this stage, though this might change in future"*

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[11] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
			disturbed areas is concerned. ▪ Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of priority species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise. ▪ Bird Flight Diverters must be installed where found to be required in order to limit the potential collision mortality ▪ There is a potential collision risk associated with the ephemeral Ga-Mogara River where it is expected that waterbirds could commute up and down the drainage line when it is flowing or when it contains large pools of standing water, and raptors and vulture could descend to pools in the river to drink and bath. This risk is specifically associated with the Umtu TX corridor which crosses the river near the Umtu Substation.	
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Cumulative avifauna impacts are discussed in the operational phase.	**Alternatives 1-3** Low (-) **No-Go** N/A	▪ The extensive powerline and road network within the 30km radius around Hotazel has led to extensive fragmentation of the natural habitat. The fragmentation of the habitat has an impact that exceeds the mere physical footprint of the infrastructure. However, the short length of the proposed powerline should limit the cumulative impact of displacement due to disturbance and habitat destruction.	**Alternatives 1-3** Low Negative (-) **No-Go** N/A
Impacts on Freshwater	***Direct impacts:*** Aquatic habitat modification	**Hotazel Alternative 1 Very Low (-)** **Umtu Alternative 2** Low (-) **LILO Alternative 3** **Very Low (-)** / Neutral **No-Go Alternative 4** **Very Low (-)** / Neutral	▪ The pylons for the transmission line should be placed outside of the recommended buffer of 100 m from the top of bank on either site of the river. With regards to any access roads to the transmission line for construction and maintenance, existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. If an access road need to be constructed it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.	**Hotazel Alternative 1** **Very Low (-)** / Neutral **Umtu Alternative 2** **Very Low (-)** **LILO Alternative 3** **Very Low (-)** / Neutral **No-Go Alternative 4** **Very Low (-)** / Neutral
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	→ None	None identified
	Cumulative impacts:	**Alternatives 1-3**	▪ Surrounding land use currently consists of	**Alternatives 1-3**

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[11] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
	Aquatic habitat modification	Low Negative (-) **No-Go Alternative 4** N/A	manganese mining activities with some agriculture. Current land/water use impacts on the Ga-Mogara River area are moderate. The proposed renewable energy projects are near the Ga-Mogara River System. ▪ The pylons for the transmission line should be placed outside of the recommended buffer of 100 m from the centreline of the river. The renewable energy projects with mitigation have minimal impact on the surface water. (The largest potential impact of these projects is as a result of the associated infrastructure. These potential impacts can be mitigated such that their impacts on the aquatic ecosystems are of a low significance)	Low Negative (-) **No-Go Alternative 4** N/A
Impacts on Agricultural Potential	***Direct impacts:*** Loss of agricultural production and potential.	**Alternatives 1-3** **Very Low (-)** **No-Go Alternative 4** Neutral	▪ If an activity will mechanically disturb below-surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. ▪ Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. ▪ Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. ▪ During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. ▪ Erosion must be controlled where necessary on top soiled areas. ▪ Implement effective spillage and waste management system.	**Alternatives 1-3** **Very Low (-)** **No-Go Alternative 4** Neutral
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Loss of agricultural production and potential.	**Alternative 1-3** Low (-) **No-Go Alternative 4** Neutral	▪ None	**Alternative 1-3** Low (-) **No-Go Alternative 4** Neutral
Impacts on Heritage and Palaeontological resources	***Direct impacts:*** → Clearing of the surface and construction of the power lines and service road: impacts to archaeology. → Clearing of the surface and construction of the power lines and service road: impacts to palaeontology. → Clearing of the surface and construction of the power lines and service road: impacts to the landscape.	**Alternatives 1-3** **Heritage and Palaeo:** **Very Low (-)** **No-Go Alternative 4** **Heritage and Palaeo:** Zero	▪ It is recommended that the ECO examine all excavations greater than 1 m depth to check for palaeontological material. ▪ Although the chance of finding buried archaeological resources, fossil resources or possibly graves is very low, should any such material be found it should be reported to the project environmental control officer (ECO) who should then report to an archaeologist or palaeontologist as appropriate for assessment and advice on how to proceed. The ECO or heritage practitioner should also report the find to SAHRA. ▪ If any archaeological material, palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would	**Alternatives 1-3** **Heritage and Palaeo:** **Very Low (-)** **No-Go Alternative 4** **Heritage and Palaeo:** N/A

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[11] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
			need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: ▪ Clearing of the surface and construction of the power lines and service road: cumulative impacts to archaeology. ▪ Clearing of the surface and construction of the power lines and service road: cumulative impacts to the landscape.	**Alternatives 1-3 Heritage and Palaeo: Very Low (-)** **No-Go Alternative 4 Heritage and Palaeo:** Zero	→ None	**Alternatives 1-3 Heritage and Palaeo: Very Low (-)** **No-Go Alternative 4 Heritage and Palaeo:** N/A
Visual Impacts	***Direct impacts:*** Visual impact	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2 Medium (-)** **LILO Alternative 3 Very Low (-)** **No-Go Alternative 4** Neutral	▪ Lights at night have the potential to significantly extend the project zone of visual influence. As such, light spillage reduction should be planned at the Pre-construction phase in accordance with the recommendations contained in the annexure to restrict the light spillage to within the local level (2km), ensuring that the current dark sky setting of the surrounding rural agricultural sense of place is retained. ▪ Topsoil excavated from the road footprints should be stockpiled and utilised for rehabilitation of the laydown site. ▪ Windblown dust during construction should be monitored by the ECO. Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the ECO. ▪ Signage on the R31 should be moderated and natural colours used in the signage as much as possible. ▪ Soil erosion measures need to be adequately implemented and routinely monitored by the ECO.	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2 Medium (-)** **LILO Alternative 3 Very Low (-)** **No-Go Alternative 4** Neutral
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Massing effects from numerous power lines.	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2 Medium (-)** **LILO Alternative 3 Very Low (-)** **No-Go Alternative 4**	▪ The route with the least potential to result in Cumulative Effects is the LILO alternative due to the short length, and not treaversing any sensitive areas. (Route mitigation is the best way to influence the potential impacts associated with loss of vegetation or soil erosion from the maintenance track).	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2 Medium (-)** **LILO Alternative 3 Very Low (-)** **No-Go Alternative**

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[11] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
		Neutral		**4** Neutral
Socio-economic impacts	***Direct impacts:*** ▪ Increase in production and GDP-R of the national and local economies due to project capital expenditure	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** N/A	▪ Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for ▪ Establish a local skills desk to determine the potential skills that could be sourced in the area. ▪ Recruit local labour as far as feasible. ▪ Employ labour-intensive methods in construction where feasible. ▪ Sub-contract to local construction companies where possible. ▪ Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering and other services to the construction crew. Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock. ▪ Ensure that maintenance construction workers do not damage property or inflict other losses to the land owners and households residing on the farms. ▪ Negotiate terms and conditions that would guide construction activities/maintenance activities on the properties, as well as behaviour and conduct of the construction/maintenance crew. ▪ A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all construction/maintenance vehicles and construction/maintenance crew; the chosen route should follow the existing roads as far as feasible. ▪ Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property. ▪ Construction vehicles are to follow a safe speed and should mind animals inhibiting the farms. ▪ Construction activity should be undertaken only during working hours.	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** N/A
	▪ Creation of temporary employment in the local communities and elsewhere in the country ▪ Affected Land Owners and Households	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A		**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts:	None identified	▪ None	None identified
Impacts on Hydrology	***Direct impacts:*** Erosion caused by construction of transmission line pylons	**Alternatives 1-3** **Medium (-)** **No-Go Alternative 4** N/A	▪ Place pylons outside of the flood plain of the Ga-Morgara River ▪ Place pylons outside of buffer zones identified by the aquatic ecologist (Around the Ga-Morgara River) ▪ Installation of pylons should not mobilise sediment	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from	None identified	▪ None	None identified

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[11] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
	the original source of impact.			
	Cumulative impacts: Erosion	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A	■ Cumulative impact of pylons from the transmission line would be low if they are kept out of the watercourse floodplain and out of any buffer identified by the aquatic ecologist.	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
Traffic impact	***Direct impacts***	**Alternatives 1-3** Low (-) **No-Go Alternative 4** Low (-)	■ Manage traffic volumes by means of the management of delivery volumes and times. ■ Implement dust control measures during construction as speed limits and regular watering. ■ Ensure delivery drivers are licensed and competent, and vehicles are in good road worthy condition.	**Alternatives 1-3** Low (-) **No-Go Alternative 4** Low (-)
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	■ None	None identified
	Cumulative impacts:	Negligible	■ None	Negligible

4.1.2. Operational Phase

Hotazel Alternative 1: ~12 km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ~17 km transmission line corridor from solar park to Umtu substation
LILO Alternative 3: Loop-in Loop-out with transmission line of < 300 m
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
Impacts on Botany	***Direct impacts:*** None were identified.	None identified	■ None	None identified
	Indirect impacts: No indirect impacts were identified.	None identified	■ None	None identified
	Cumulative impacts: No cumulative impacts were identified.	None identified	■ None	None identified
Impacts on Avifauna	***Direct impacts:*** • Electrocution of priority species on the proposed 132kV powerline	**Alternatives 1-3** High Negative (-) **No-Go Alternative 4** N/A	■ An Eskom approved bird friendly pole design will be used (APPENDIX 3). In addition, if a monopole structure is used, as this report has assumed, a Bird Perch must be installed on top of all poles, to provide safe perching substrate for birds well above the dangerous hardware. ■ Bird flight diverters (BFDs) are to be maintained throughout the operational life. The Avifauna specialist may recommend additional BFDs if the need arises and is supported by monitoring. ■ Install bird flight diverters as per the instructions of the specialist following the site walkthrough. ■ The operational monitoring programme must include regular monitoring of the grid connection power line for collision mortalities.	**Alternatives 1-3** High Negative (-) **No-Go Alternative 4** N/A
	• Collisions of priority species with the earthwire of the proposed line	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A	■ The current HV powerline network is extensive with several hundred kilometres of HV line present within the 30km radius around Hotazel, mostly linked to mining activity. The level of collision mortality on these lines is unknown, but it can be assumed that it is a regular occurrence. However, the short length of the proposed 132kV line should limit the potential for collision mortality, especially if properly mitigated with Bird Flight Diverters.	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts:	None identified	■ None	None

Hotazel Alternative 1: ~12 km transmission line corridor from solar park to Hotazel substation **Umtu Alternative 2:** ~17 km transmission line corridor from solar park to Umtu substation **LILO Alternative 3:** Loop-in Loop-out with transmission line of < 300 m **No-Go Alternative 4:** *Status quo* remains				
Activity	**Impact summary**	**Pre – mitigation Significance**	**Proposed mitigation**	**Post mitigation - Significance**
	No indirect impacts were identified.			identified
	Cumulative impacts: The cumulative impact of a number of renewable projects in the larger region may result in: → Greater chance of collision and electrocution.	**High Negative (-)**	▪ There are hundreds of kilometres of 11kV and 22kV MV lines in the 30km radius around Hotazel. It is not known how bird-friendly these lines are, but it can be assumed that there are bird unfriendly lines which are electrocuting birds, especially large raptors and vultures. However, the proposed 132kV line will not pose an electrocution risk to vultures if fitted with a bird perch as recommended. The cumulative impact of the powerline in terms of potential collision mortality of priority species is therefore rated to be Low.	**Low negative (-)**
Impacts on Freshwater	***Direct impacts:*** No impacts were identified during operation phase.	None identified	▪ None	None identified
	Indirect impacts: No indirect impacts were identified.	None identified	▪ None	None identified
	Cumulative impacts: No impacts were identified during operation phase.	None identified	▪ None	None identified
Impacts on Agricultural Potential	***Direct impacts:*** The agricultural impacts of a transmission line in this environment, which has low agricultural potential and no cultivation, is negligible.	None identified	▪ The only viable agricultural land use in the study area, grazing, can continue entirely unaffected below transmission lines.	None identified
	Indirect impacts: No indirect impacts were identified.	None identified	▪ None	None identified
	Cumulative impacts: No cumulative impacts were identified.	None identified	▪ None	None identified
Impacts on Visual	***Direct impacts:*** Visual (Sense of place)	**Hotazel Alternative 1** Low (-)	▪ The laydown areas, or any areas disturbed during constructions, should be ripped, if needed, to de-compacted top-soil, and then rehabilitated to natural bush-veld vegetation with endemic grass species. ▪ The natural areas along the R31 should be monitored by the ECO on a bi-annual basis to ensure that the area does not become a fire risk. Appropriate measures to reduce deadwood from the area should be implemented ▪ Ongoing erosion control monitoring by the ECO.	**Hotazel Alternative 1** Low (-)
		Umtu Alternative 2 **Medium (-)**		**Umtu Alternative 2** **Medium (-)**
		LILO Alternative 3 **Very Low (-)**		**LILO Alternative 3** **Very Low (-)**
		No-Go Alternative 4 Neutral		**No-Go Alternative 4** Neutral
	Indirect impacts: No Indirect impacts were identified	None identified	▪ None	None identified
	Cumulative impacts: Visual (Sense of place)	**Moderate** Negative (-)	▪ Integration planning with Eskom to assess the possibility of shared power line resources. Though the final determination will rest with Eskom.	**Minor positive (+)**
Impacts on Socio-economic	***Direct impacts:*** → Affected landowners and Households – supply of electricity	**Alternatives 1-3** High Positive (+)	▪ Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock. ▪ Ensure that maintenance workers do not damage property or inflict other losses to the land owners and households residing on the farms. ▪ Negotiate terms and conditions that would guide maintenance activities on the properties, as well as	**Alternatives 1-3** High Positive (+)
		No-Go Alternative 4 N/A		**No-Go Alternative 4** N/A
	→ Affected landowners and	**Alternatives 1-3**		**Alternatives**

Hotazel Alternative 1: ~12 km transmission line corridor from solar park to Hotazel substation **Umtu Alternative 2:** ~17 km transmission line corridor from solar park to Umtu substation **LILO Alternative 3:** Loop-in Loop-out with transmission line of < 300 m **No-Go Alternative 4:** *Status quo* remains				
Activity	**Impact summary**	**Pre – mitigation Significance**	**Proposed mitigation**	**Post mitigation - Significance**
	Households	Low (-) **No-Go Alternative 4** N/A	behaviour and conduct of the maintenance crew. ▪ A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all maintenance vehicles and maintenance crew; the chosen route should follow the existing roads as far as feasible. ▪ Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property. ▪ Maintenance vehicles are to follow a safe speed and should mind animals inhibiting the farms. ▪ Maintenance activity should be undertaken only during working hours.	**1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts: No Indirect impacts were identified	None identified	▪ None	None identified
	Cumulative impacts: None foreseen at this stage	None identified	▪ None	None identified

Please note: Decommissioning of the Transmission lines will have similar impacts as those encountered in the construction phase. The majority of materials are recyclable and will not go to waste. The transmission lines are expected to have an operational lifespan of 20 to 30 years during which they will likely become part of the grid network, through possible expansion of the grid. Decommissioning is therefore deemed unlikely and determining the nature and extent of the impacts associated with the decommissioning of the lines in such a distant future is deemed imprudent. Lastly, the decommissioning of the transmission line is a listed activity in terms of GN R. 983 31(i) and would require assessment and authorisation prior to decommissioning thus the impacts associated with the decommissioning of the transmission lines has not been reported here.

A complete impact assessment in terms of Regulation19 (3) of GN 982 must be included as Appendix F.

Please refer to Appendix F for the assessment methodology applied and Appendix D for the detailed impact assessments undertaken by the specialists.

4.2. Environmental impact statement

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

Please refer to Error! Reference source not found. for a summary of the potential construction and operational impacts anticipated by the proposed projects, before and after mitigation measures have been implemented. Decommissioning of the facility will have similar impacts as those encountered in the construction phase. The transmission lines are expected to have an operational lifespan of 20 to thirty years during which they will become part of the grid network. Decommissioning is therefore deemed unlikely. Determining the nature and extent of the impacts associated with the decommissioning of the lines in such a distant future is deemed imprudent. Lastly, the decommissioning of the transmission line is a listed activity in terms of GN R. 983 31(i) and would require assessment and authorisation prior to decommissioning.

Table 4: Summary of the potential construction and operational impacts

IMPACTS	PROJECT ASPECT	Construction		Operation	
		No Mitigation	With Mitigation	No Mitigation	With Mitigation
Impact on botany	Hotazel Alternative 1	Medium (-)	Medium (-)	None identified	None identified
	Umtu Alternative 2	Medium (-)	Medium (-)	None identified	None identified
	LILO Alternative 3	Low (-)	Low (-)	None identified	None identified
	No-Go Alternative 4	Neutral	Neutral	None identified	None identified
Impact on avifauna	Hotazel Alternative 1	Low (-)	Low (-)	High Negative (-)	High Negative (-)
	Umtu Alternative 2	Low (-)	Low (-)	High Negative (-)	High Negative (-)
	LILO Alternative 3	Low (-)	Low (-)	High Negative (-)	High Negative (-)
	No-Go Alternative 4	N/A	N/A	N/A	N/A
Impact on freshwater	Hotazel Alternative 1	Very Low (-)	Very Low (-) / Neutral	None identified	None identified
	Umtu Alternative 2	Low (-)	Very Low (-)	None identified	None identified
	LILO Alternative 3	Very Low (-) / Neutral	Very Low (-) / Neutral	None identified	None identified
	No-Go Alternative 4	Very Low (-) / Neutral	Very Low (-) / Neutral	None identified	None identified
Impact on agricultural potential	Hotazel Alternative 1	Very Low (-)	Very Low (-)	None identified	None identified
	Umtu Alternative 2	Very Low (-)	Very Low (-)	None identified	None identified
	LILO Alternative 3	Very Low (-)	Very Low (-)	None identified	None identified
	No-Go Alternative 4	Neutral	Neutral	None identified	None identified
Impact on heritage	Hotazel Alternative 1	Very Low (-)	Very Low (-)	None identified	None identified

IMPACTS	PROJECT ASPECT	Construction		Operation	
		No Mitigation	With Mitigation	No Mitigation	With Mitigation
and palaeontological resources	Umtu Alternative 2	Very Low (-)	Very Low (-)	None identified	None identified
	LILO Alternative 3	Very Low (-)	Very Low (-)	None identified	None identified
	No-Go Alternative 4	Zero	N/A	None identified	None identified
Visual impacts	Hotazel Alternative 1	Low (-)	Low (-)	Low (-)	Low (-)
	Umtu Alternative 2	Medium (-)	Medium (-)	Medium (-)	Medium (-)
	LILO Alternative 3	Very Low (-)	Very Low (-)	Very Low (-)	Very Low (-)
	No-Go Alternative 4	Neutral	Neutral	Neutral	Neutral
Socio- economic impacts	Hotazel Alternative 1	Medium (-)	Medium (-)	High Positive (+)	High Positive (+)
	Umtu Alternative 2	Medium (-)	Medium (-)	High Positive (+)	High Positive (+)
	LILO Alternative 3	Low (-)	Low (-)	High Positive (+)	High Positive (+)
	No-Go Alternative 4	N/A	N/A	N/A	N/A
Impacts on hydrology	Hotazel Alternative 1	Medium (-)	Low (-)	None identified	None identified
	Umtu Alternative 2	Medium (-)	Low (-)	None identified	None identified
	LILO Alternative 3	Medium (-)	Low (-)	None identified	None identified
	No-Go Alternative 4	N/A	N/A	None identified	None identified
Traffic impact	Hotazel Alternative 1	Low (-)	Low (-)	None identified	None identified
	Umtu Alternative 2	Low (-)	Low (-)	None identified	None identified
	LILO Alternative 3	Low (-)	Low (-)	None identified	None identified
	No-Go Alternative 4	N/A	N/A	None identified	None identified

5. SECTION E: RECOMMENDATION OF PRACTITIONER

Is the information contained in this report and the documentation attached hereto sufficient to make a decision in respect of the activity applied for (in the view of the environmental assessment practitioner)?	► YES	NO

If "NO", indicate the aspects that should be assessed further as part of a Scoping and EIA process before a decision can be made (list the aspects that require further assessment).

N/A

If "YES", please list any recommended conditions, including mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application.

The proposed mitigation measures listed below are recommended to manage the identified impacts associated with the proposed transmission lines during the construction and operation phases:

Condition 1: The applicant shall appoint an independent ECO to ensure implementation of the EMPr during the construction phase.

Condition 2: The holder of the EA shall appoint an avifaunal specialist to undertake mortality surveys each quarter for a period of no less than two years and the results shall be reported to the DEA. The holder of the EA shall undertake to implement any additional reasonable mitigations measures deemed necessary by the specialist during or at the end of the monitoring period. The findings of the monitoring and any additional mitigation measures recommended by the specialist shall be reported to the DEA.

Motivation for the preferred Alternative:
Hotazel Solar Park proposes and assessed three grid connection alternatives namely;

- Alternative 1: A connection to the existing Hotazel substation at 132kV via a 132 kV power line ~11km.
- Alternative 2: A connection to the existing Umtu substation at 132kV via a 132 kV power line ~14km
- Alternative 3: A LILO connection to the existing Ferrum/Umtu powerline at 132kV via a 132 kV power line. ~5.5km x 2.
- Alternative 4: No go Alternative

The evacuation of generated energy via either of the powerlines carries a low impact significance due to the low environment sensitivity of the area considered for this development. Alternative 2 was the least preferred from a hydrological and freshwater impact perspective, as the route would cross the Ga-Mogora River.. .

The technical ability / suitability to connect the Hotazel Solar Park to each of the connection points was considered and from available technical information and the Eskom Transmission Development Plan (TDP), the connection option most likely to have the technical capacity to accept the generated energy is, in order of preference;

1. Alternative 1. Hotazel substation connection - Preferred
2. Alternative 2. Umtu substation connectionAlternative
3. Ferrum/Umtu LILO connection

Alternative 1 is applied for as the preferred connection to be authorised and is most likely to adequately meet the technical requirement but also carries a lower environmental risk than the Umtu Alternative 2. Connecting the Hotazel Solar Park to the national grid via connection Alternative 1 would require the least technical renovations to absorb the 200MW of energy generated by the solar farm, which improves the technical and economic viability of the project.

Is an EMPr attached?	► YES	NO

The EMPr must be attached as Appendix G.

Refer to Appendix G for the EMPr.

The details of the EAP who compiled the BAR and the expertise of the EAP to perform the Basic Assessment process must be included as Appendix H.

Refer to Appendix H for details of the EAP.

If any specialist reports were used during the compilation of this BAR, please attach the declaration of interest for each specialist in Appendix I.

Refer to **Error! Reference source not found.** for the specialist's declaration of interest.

Any other information relevant to this application and not previously included must be attached in Appendix J.

Refer to **Error! Reference source not found.** for additional information Annexure J1 = Peer review of the Annexure J2 = Peer Review for Annexure J3 = Annexure J3 250m interval centreline coordinates list for the three route alternatives

Patrick Killick

NAME OF EAP

6 March 2017

SIGNATURE OF EAP DATE

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6. SECTION F: APPENDICES

The following Appendices follow

APPENDIX A: MAPS
- APPENDIX A.1: Locality map
- APPENDIX A.2: Route Plan
- APPENDIX A.3: Sensitivity Map

APPENDIX B: PHOTOGRAPHS

APPENDIX C: FACILITY ILLUSTRATION(S)

APPENDIX D: SPECIALIST REPORTS
- APPENDIX D.1: Agriculture
- APPENDIX D.2: Avifauna
- APPENDIX D.3: Botanical
- APPENDIX D.4: Freshwater
- APPENDIX D.5: Heritage
- APPENDIX D.6: Hydrology
- APPENDIX D.7: Socioeconomic
- APPENDIX D.8: Traffic
- APPENDIX D.9: Visual

APPENDIX E: PUBLIC PARTICIPATION
- APPENDIX E.1: DEA Pre-application meeting minutes
- APPENDIX E.2: I&AP Register
- APPENDIX E.3: Site notices
- APPENDIX E.4: Newspaper advertisement

APPENDIX F: IMPACT ASSESSMENT
- APPENDIX F.1: Assessment methodology
- APPENDIX F.2: Environmental Impact Statement

APPENDIX G: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

APPENDIX H: DETAILS AND EXPERTISE OF EAP
- APPENDIX H.1: Patrick Killick
- APPENDIX H.2: Corlie Steyn
- APPENDIX H.3: Diane Erasmus

APPENDIX I: DECLARATIONS OF INTEREST

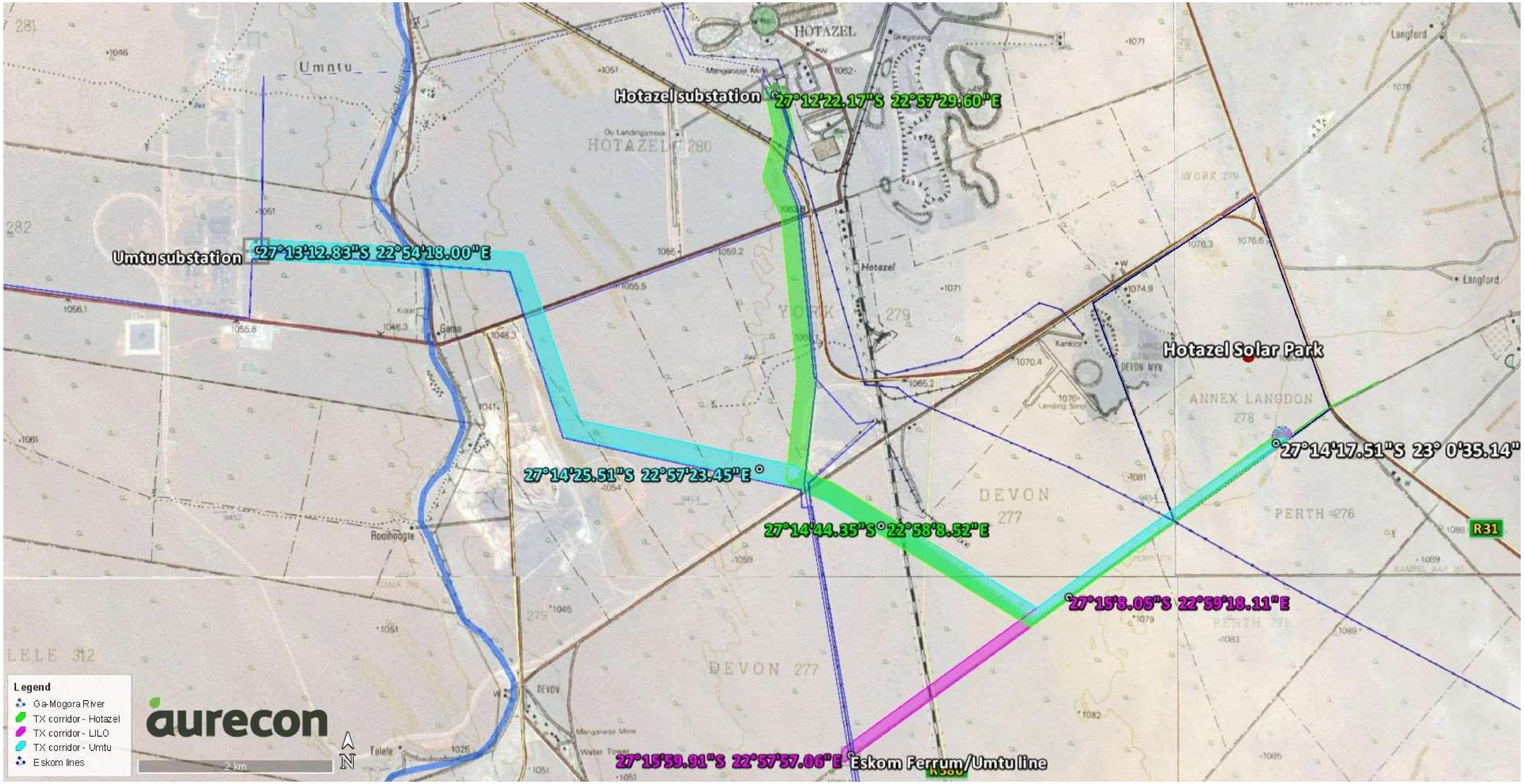
APPENDIX J: ADDITIONAL INFORMATION
- APPENDIX J.1: Hydrology peer review
- APPENDIX J.2: Traffic peer review
- APPENDIX J.3: 250m interval route coordinates for all alternatives

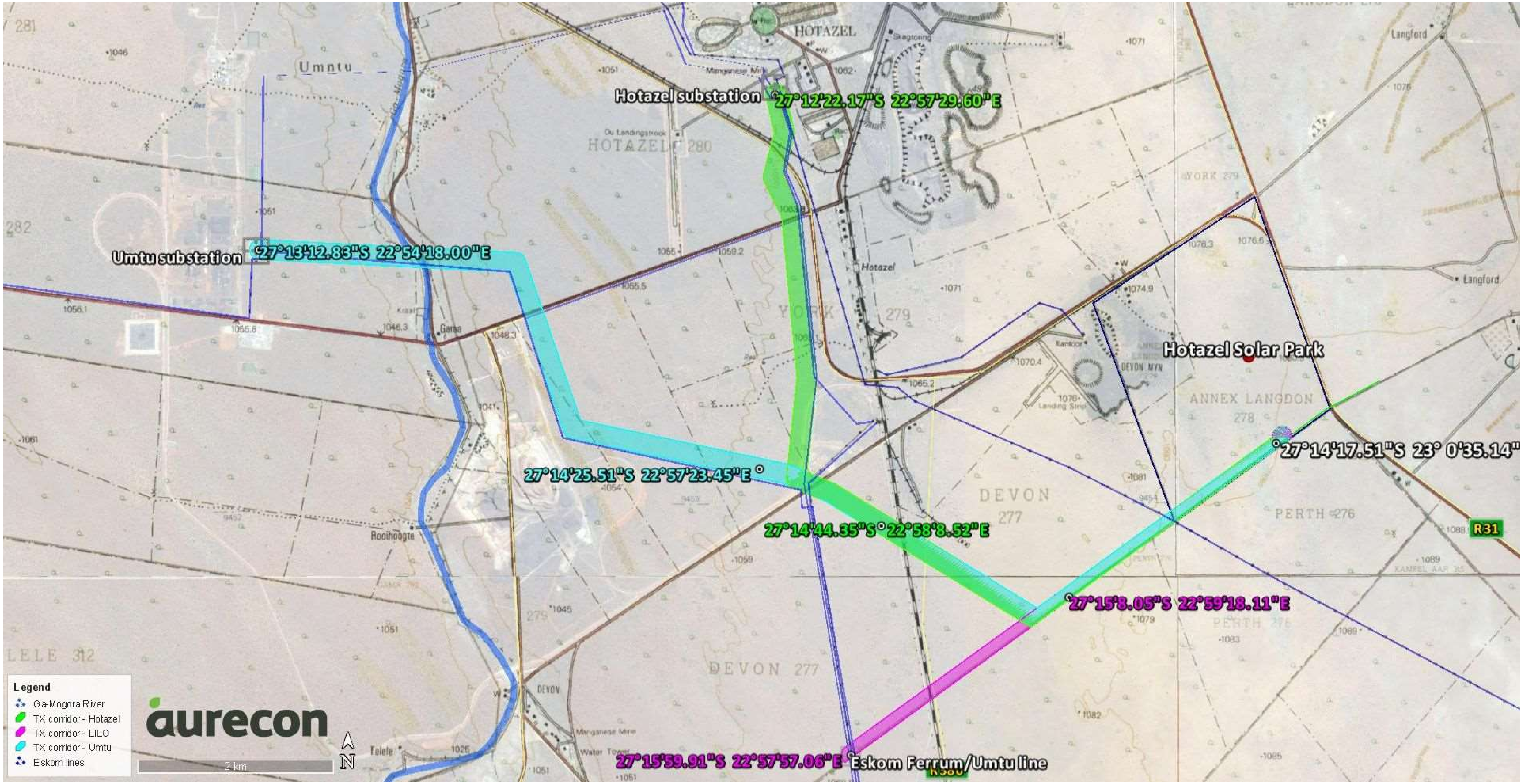
APPENDIX A:

Maps

APPENDIX A.1:

Locality map

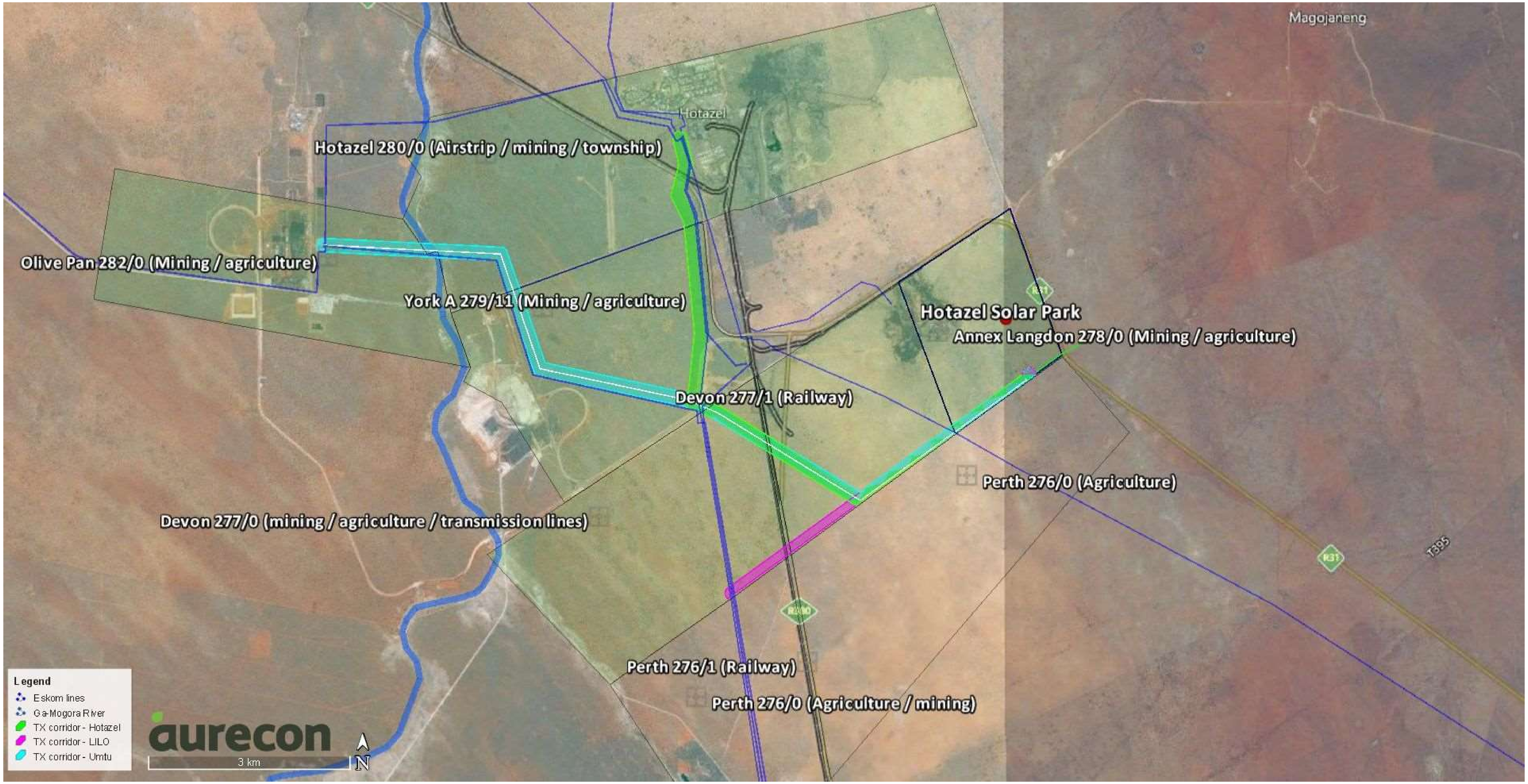

Hotazel substation
27°12'22.17"S 22°57'29.60"E
Umtu substation
27°13'12.83"S 22°54'18.00"E
Hotazel Solar Park
27°14'17.51"S 23° 0'35.14"
27°14'25.51"S 22°57'23.45"E
27°14'44.35"S 22°58'8.52"E
27°15'8.05"S 22°59'18.11"E
27°15'59.91"S 22°57'57.06"E
Eskom Ferrum/Umtu line
Legend
Ga-Mogora River
TX corridor - Hotazel
TX corridor - LILO
TX corridor - Umtu
Eskom lines
aurecon
2 km
N
HOTAZEL
Umntu
YORK
DEVON 277
ANNEX LANGDON 278
PERTH 276
R31



Hotazel substation
27°12'22.17"S 22°57'29.60"E
Umtu substation
27°13'12.83"S 22°54'18.00"E
27°14'25.51"S 22°57'23.45"E
27°14'44.35"S 22°58'8.52"E
27°15'8.05"S 22°59'18.11"E
27°14'17.51"S 23° 0'35.14"
27°15'59.91"S 22°57'57.06"E
Eskom Ferrum/Umtu line
Hotazel Solar Park
Legend
Ga-Mogora River
TX corridor - Hotazel
TX corridor - LILO
TX corridor - Umtu
Eskom lines
2 km
N
aurecon

APPENDIX A.2:

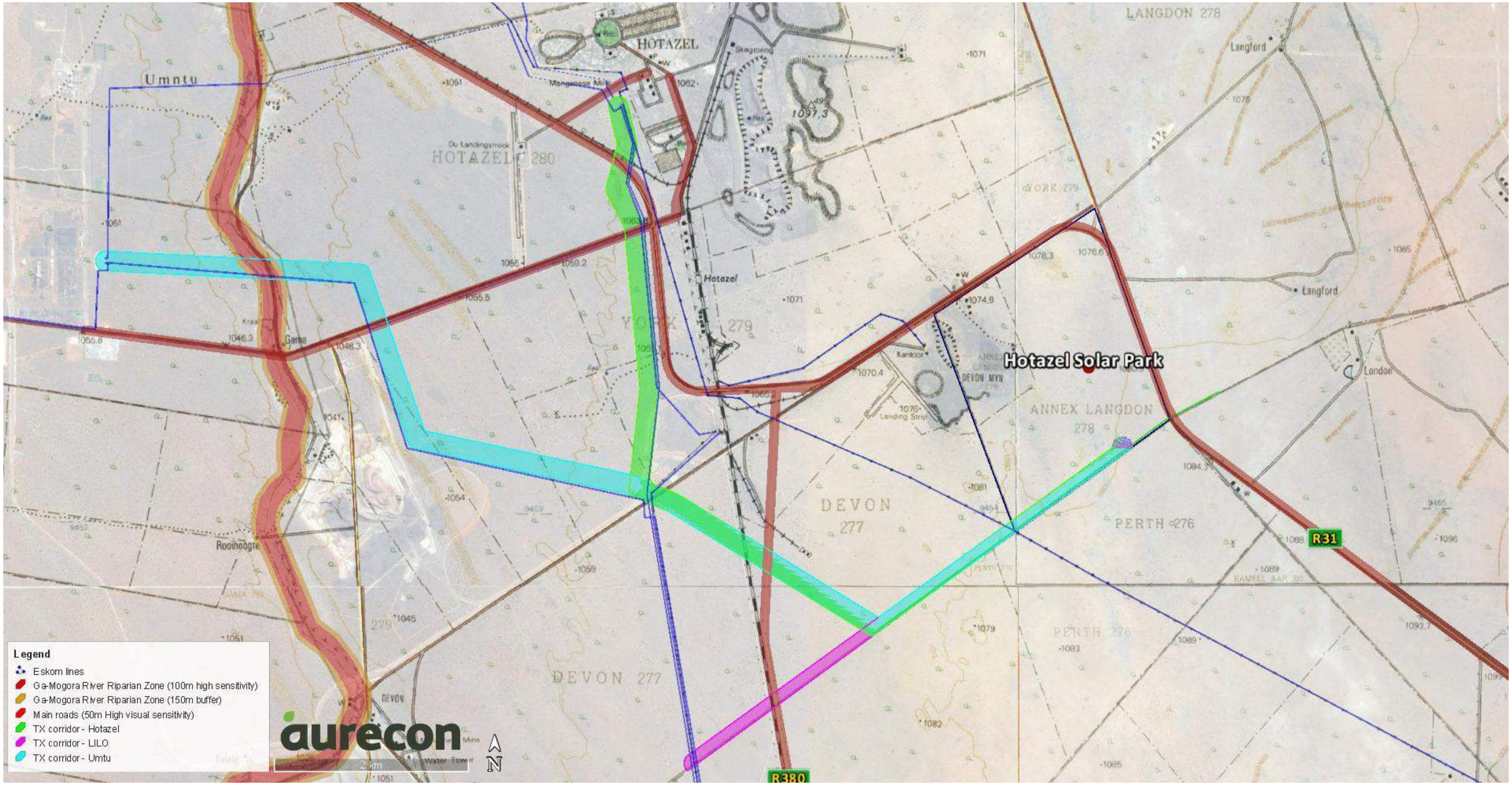
Route Plan



Magojaneng
Hotazel
Hotazel 280/0 (Airstrip / mining / township)
Olive Pan 282/0 (Mining / agriculture)
York A 279/11 (Mining / agriculture)
Hotazel Solar Park
Annex Langdon 278/0 (Mining / agriculture)
Devon 277/1 (Railway)
Perth 276/0 (Agriculture)
Devon 277/0 (mining / agriculture / transmission lines)
Perth 276/1 (Railway)
Perth 276/0 (Agriculture / mining)
Legend
Eskom lines
Ga-Mogora River
TX corridor - Hotazel
TX corridor - LILO
TX corridor - Umtu
aurecon
3 km
N

APPENDIX A.3:

Sensitivity Map


Legend
Eskom lines
Ga-Mogora River Riparian Zone (100m high sensitivity)
Ga-Mogora River Riparian Zone (150m buffer)
Main roads (50m High visual sensitivity)
TX corridor - Hotazel
TX corridor - LILO
TX corridor - Umtu
Hotazel Solar Park
HOTAZEL
Umntu
HOTAZEL 280
YORK 279
DEVON 277
ANNEX LANGDON 278
PERTH 276
LANGDON 278
Langford
R31
R380
2 km
N

APPENDIX B:
Photographs

SITE PHOTOS

From the R31 looking west onto the proposed Hotazel Solar Park site. The Substation and the all three transmission line alternative would commence from a location to the left of image and approximately 1km from the position of this photograph

Photgrph looking south along the R380 to Deben. This is near to the location where the Umtu and Hotazel tranmission line alternatives would cross the road.

SITE PHOTOS

This is the main railway line into Hotazel. This location is approximately 1km north of where the Umtu and Hotazel Transmission lines would cross over the railway and associated electrical supplies, shown in picture.

This is the approximate location where the Umtu and Hotazel transmission lines routes would cross and join with the existing Eskom lines running to the Hotazel and Umtu substation as can be seen in photo. Not seen here as the rail loop is recessed into a cutting, is the short haul railway line from Kudumane Mine, shown in the next photo.

SITE PHOTOS

Recessed Kudumane short haul railway loop in the vicinity of where the Umtu and Hotazel Transmission lines will cross. The existing Eskom lines crossing can be seen in the adjoin photo

SITE PHOTOS

Where the Hotazel (Alternative 1) will cross the R31 close to Hotazel alongside other exisiting tranmission lines

The exisitng Hotazel substation to which preffered Alterntive 1 will conmnect

SITE PHOTOS

The location where the Umtu route will cross the Kudumane road, near the Ga Moraga River, alongside the existing Eskom transmission lines to the Umtu substation.

SITE PHOTOS

A view of the Ga Moraga River cr5ossing *enroute* to the Kudumane mine. And a view up the river channel approximatl;y 900m south of where the Umtu transmission line would cross the river channel

APPENDIX C:
Facility illustration(s)

Eskom will decide whether single circuit or double circuit type pylons will be used. Alternative technologies will be considered and the most appropriate technologies specifically designed for the current environmental conditions (which will be based on technical and topographical factors) as well as Eskom's specifications will be applied.

TRANSMISSION LINE INFRASTRCUTURE

The self-supporting structure or suspension pole (Refer to **Figure 1** below) which is typically used along the straight sections of the transmission line, while the guyed intermediate or guyed suspension and angle strain structures (Refer to **Figure 2**) are used where there is a bend in the transmission line alignment. These monopoles weigh approximately 1,200 kg each and vary in height from approximately 17.4 m to 21 m. The size of the footprint depends on the type of pole, i.e. whether it is a self-supporting, guyed suspension or an angle strain pole structure. The size of the footprint ranges from 0.6 m x 0.6 m to 1.5 m x 1.5 m, with the larger footprint associated with the guyed suspension and angle strain pole used as bend/strain structures. The average span between two towers is 200 m, but can vary between 250 m and 375 m depending on the ground profile (topography) and the terrain to be spanned. <u>The final tower sizes and positions will only be determined once the project has received Environmental Authorisation and after negotiations with landowners has been finalised.</u> Type 261 monopoles on a single circuit (**Figure 3**).

Figure 1: Self-supporting Tower

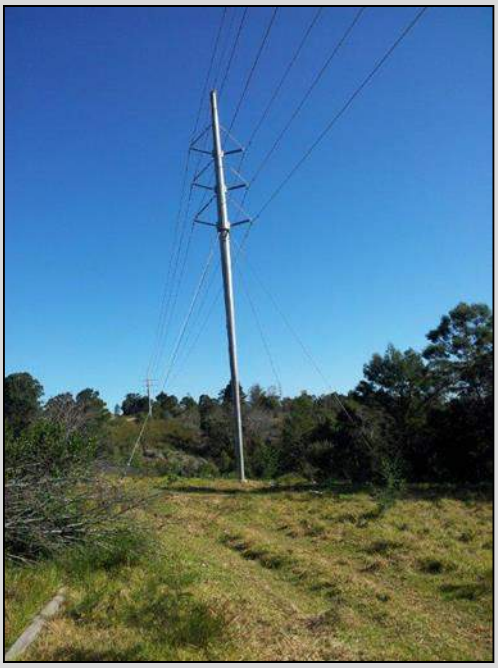


Figure 2: Guyed suspension Tower

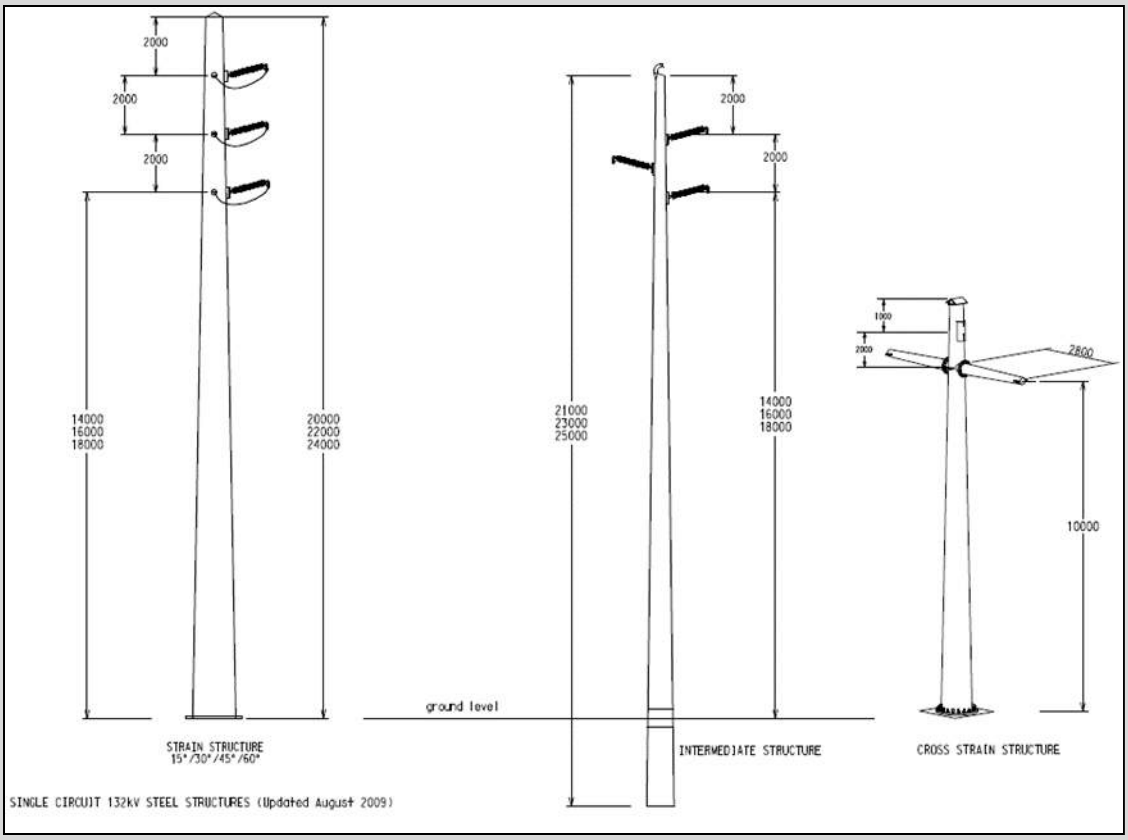


Figure 3: Type 261 monopoles on a single circuit

TRANSMISSION LINE INFRASTRCUTURE

The self-supporting structure or suspension pole (Refer to **Figure 1** above) which is typically used along the straight sections of the transmission line, while the guyed intermediate or guyed suspension and angle strain structures (Refer to **Figure 2** above) are used where there is a bend in the transmission line alignment. These monopoles weigh approximately 1,200 kg each and vary in height from approximately 17.4 m to 21 m. The size of the footprint depends on the type of pole, i.e. whether it is a self-supporting, guyed suspension or an angle strain pole structure. The size of the footprint ranges from 0.6 m x 0.6 m to 1.5 m x 1.5 m, with the larger footprint associated with the guyed suspension and angle strain pole used as bend/strain structures. The average span between two towers is 200 m, but can vary between 250 m and 375 m depending on the ground profile (topography) and the terrain to be spanned. The final tower sizes and positions will only be determined once the project has received Environmental Authorisation and after negotiations with landowners has been finalised. Type 277 monopoles in a double circuit (Refer to **Figure 4**).

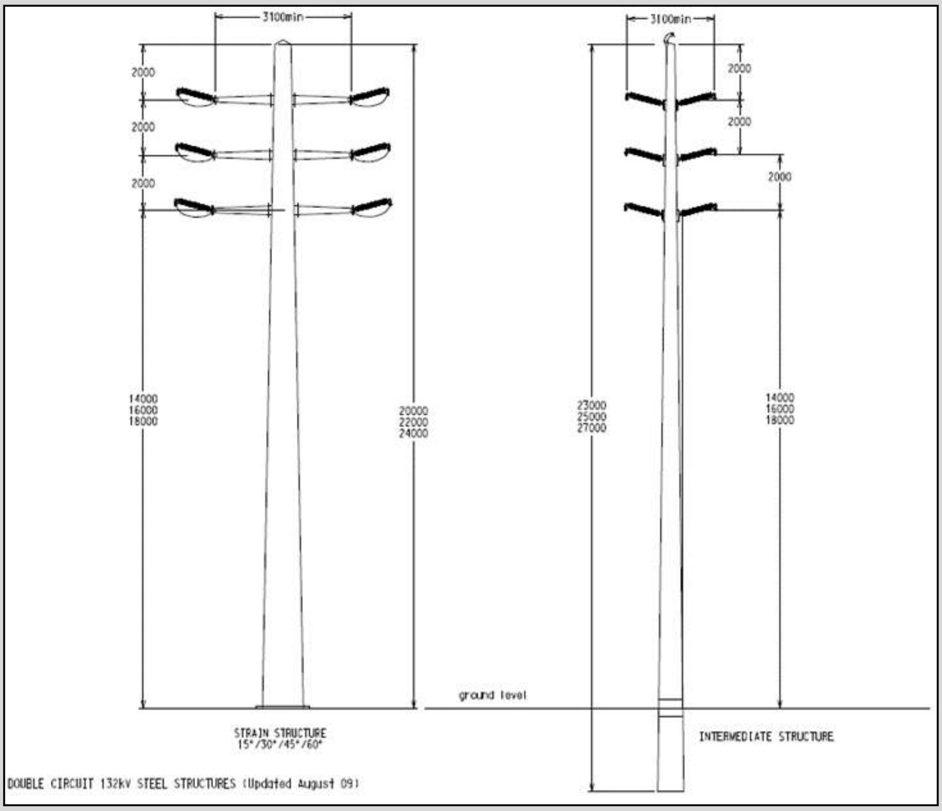
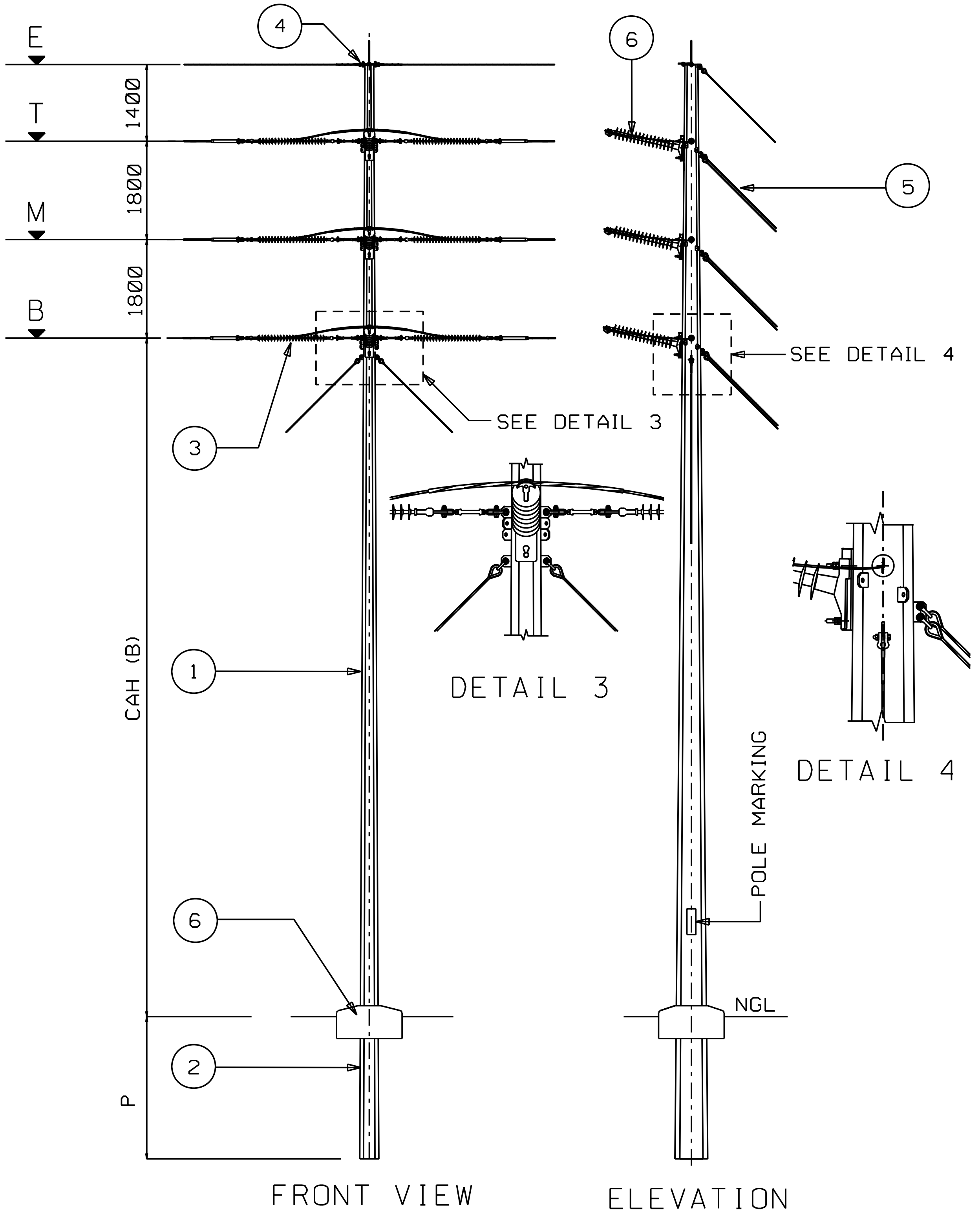


Figure 4: Type 277 monopoles on a double circuit line



2	DRG SHT UPDATED. REFERENCES REVISED. GENERAL REVISION	SLR	RAB	AB	MARCH 2004	
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.

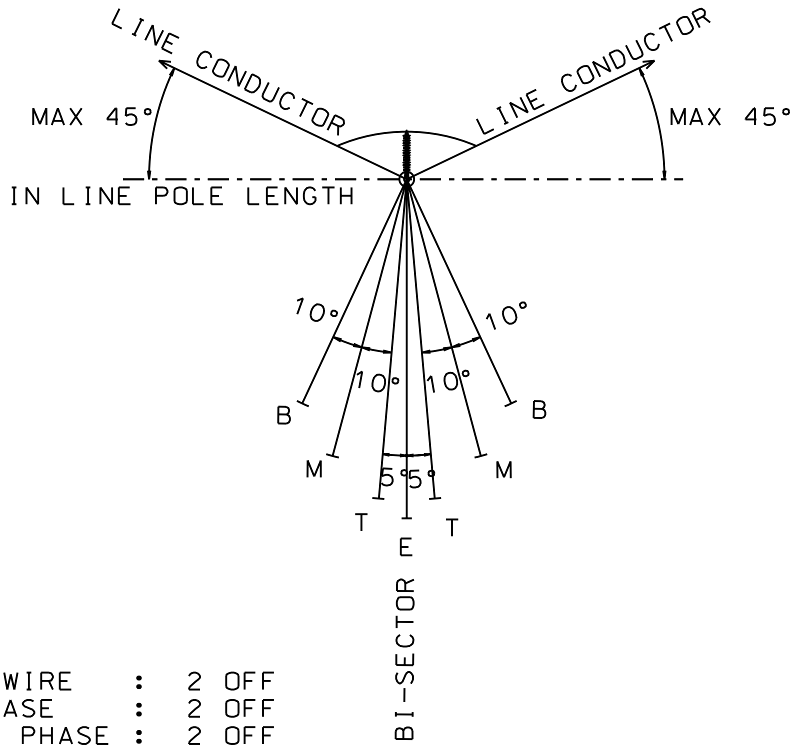
Eskom Distribution

AUTH: A BEKKER
DATE: JAN 2004
CHKD: RAB
DATE: JAN 2004
DRAWN: LMP
DATE: NOV 1998

DISTRIBUTION TECHNOLOGY
RETICULATION/SUB-TRANSMISSION LINES
STAYED ANGLE STRAIN STRUCTURE
GENERAL ARRANGEMENT (0-90°)

D-DT 7615	SET	SHEET	REVISION
	3	1	2

A4L



8 STAYS
E) EARTH WIRE : 2 OFF
T) TOP PHASE : 2 OFF
M) MIDDLE PHASE : 2 OFF
B) BOTTOM PHASE : 2 OFF

TOP VIEW

STAY ARRANGEMENT FOR STAYED STRUCTURES

DESIGN REQUIREMENTS			SCHEDULE FOR CONDUCTOR ATTACHMENT HEIGHTS			
			C A H (m AGL)			
POLE LENGTH L	TIP LOAD (kN)	PLANTING DEPTH P	E	T	M	B
18	23	2.0	16.0	14.6	12.8	11.0
19	23	2.0	17.0	15.6	13.8	12.0
20	23	2.0	18.0	16.6	14.8	13.0
21	23	2.0	19.0	17.6	15.8	14.0
22	23	2.0	20.0	18.6	16.8	15.0
23	23	2.0	21.0	19.6	17.8	16.0
24	23	2.0	22.0	20.6	18.8	17.0

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	DRG SHT UPDATED. REFERENCES REVISED. GENERAL REVISION	SLR	RAB	AB	MARCH 2004	

Eskom Distribution

AUTH: A BEKKER
DATE: JAN 2004
CHKD: RAB
DATE: JAN 2004
DRAWN: LMP
DATE: NOV 1998

DISTRIBUTION TECHNOLOGY
RETICULATION/SUB-TRANSMISSION LINES
STAYED ANGLE STRAIN STRUCTURE
DESIGN CRITERIA & STAYS (0-90°)

DRAWING NO.	SET	SHEET	REVISION
D-DT 7615	3	2	2

A4L

ITEM NØ.	DESCRIPTION	D-DT NØ.
	STRUCTURE	
	TYPE 259D	D-DT 7615
	MANUFACTURER: STRUCTATECH	
	TYPE 261D	D-DT 7615
	MANUFACTURER: CIS	
1	POLE LENGTH (BODY)	
	18m STEEL	D-DT 7104
	19m STEEL	D-DT 7104
	20m STEEL	D-DT 7104
	21m STEEL	D-DT 7104
	22m STEEL	D-DT 7104
	23m STEEL	D-DT 7104
	24m STEEL	D-DT 7104
2	FOUNDATION	
	TYPE 1 (300kPa)	D-DT 7852 SHT 2
	TYPE 2 (150kPa)	D-DT 7852 SHT 3
	TYPE 3 (100kPa)	D-DT 7852 SHT 4
	TYPE 4 (50kPa)	D-DT 7852 SHT 5
	ROCK & SOFT ROCK	D-DT 7852 SHT 1
3	INSULATOR ASSEMBLY	
	STRAIN ASSEMBLY	D-DT 7311
4	EARTH WIRE ASSEMBLIES	
	STRAIN NON INSULATED	D-DT 7323
	STRAIN INSULATED	D-DT 7324
5	STAY ASSEMBLY/LOCATION	D-DT 7325/7346
6	JUMPER ASSEMBLY	D-DT 7321
7	CONCRETE CAP AND EARTHING	D-DT 7857

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	DRG SHT UPDATED. REFERENCES REVISED. GENERAL REVISION	SLR	RAB	AB	MARCH 2004	

Eskom Distribution

AUTH: A BEKKER
DATE: JAN 2004
CHKD: RAB
DATE: JAN 2004
DRAWN: LMP
DATE: NOV 1998

DISTRIBUTION TECHNOLOGY

RETICULATION/SUB-TRANSMISSION LINES
STAYED ANGLE STRAIN STRUCTURE
REFERENCE TABLE (Ø-9Ø°)

D-DT 7615	SET	SHEET	REVISION
	3	3	2

A4L

APPENDIX D:
Specialist reports

APPENDIX D.1:

Agriculture

Johann Lanz
Soil Scientist (Pri.Sci.Nat.)
Reg. no. 400268/12

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PO Box 6209
Uniedal
7612
Stellenbosch
South Africa

AGRICULTURAL AND SOIL IMPACT ASSESSMENT
FOR THE PROPOSED HOTAZEL SOLAR PARK
NEAR HOTAZEL
NORTHERN CAPE PROVINCE

EIA PHASE REPORT

Report by
Johann Lanz

December 2016

Johann Lanz
Professional profile

Education

• M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1997
• B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
• BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
• Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

- **Soil Science Consultant** **Self employed** **2002 - present**

  I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:
- Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; SRK Consulting; Aurecon; Mainstream Renewable Power; SiVEST; Savannah Environmental; Subsolar; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Haw & Inglis; BioTherm Energy; Tiptrans.
- Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Wedderwill Estate; Goedgedacht Olives; Zewenwacht Wine Estate, Lourensford Fruit Company; Kaarsten Boerdery; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.
- I have conducted several recent research projects focused on conservation farming, soil health and carbon sequestration.
- I have project managed the development of soil nutrition software for Farmsecure Agri Science.

- **Soil Science Consultant** **Agricultural Consultors International (Tinie du Preez)** **1998 - end 2001**

  Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

- **Contracting Soil Scientist** **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

  Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

Specialist Declaration

I, Johann Lanz, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of company:	Johann Lanz – Soil Scientist
Professional Registration (including number):	SACNASP Reg. no. 400268/12
Date:	19 December 2016

Table of Contents

EXECUTIVE SUMMARY

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the proposed site is on land which is unsuitable for cultivation due predominantly to climate limitations.

The key findings of this study are:

- Soils on the site are deep, very sandy soils (Hutton and Clovelly soil forms).
- The major limitation to agriculture is the limited climatic moisture availability. The low water holding capacity of the soils is a further limitation.
- As a result, the site is unsuitable for cultivation and agricultural land use is limited to grazing.
- The land capability is classified as Class 7 - non-arable, low potential grazing land. The site has a grazing capacity of 18-21 hectares per large stock unit.
- No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.
- The low agricultural potential of the site limits the significance of all agricultural impacts.
- Four potential negative impacts of the development on agricultural resources and productivity were identified as:
    - Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
    - Loss of topsoil in disturbed areas, causing a decline in soil fertility.
    - Soil Erosion caused by alteration of the surface characteristics.
    - Soil contamination
- One potential positive impact of the development on agricultural resources and productivity was identified as:
    - Generation of additional land use income through land rental by the energy facility, which will improve the financial sustainability of the farming enterprise.
- All impacts are likely to have low significance.
- Recommended mitigation measures include implementation of an effective system of storm water run-off control to mitigate erosion; and topsoil stripping and re-spreading to mitigate loss of topsoil.
- Despite any cumulative regional impact that may occur, it is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.
- None of the transmission route alternatives have significant bearing on agricultural impacts and there is therefore no preferred alternative from an agricultural impact point of view.
- Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site.
- Because of the low agricultural potential, and the consequent low agricultural impact, there are no restrictions relating to agriculture which should preclude authorisation of the proposed development.

1 INTRODUCTION

Development of Hotazel Solar Park is proposed on the farm Hotazel Annex Langdon (F278/0), approximately 5 kilometres south east of the town of Hotazel in the Northern Cape Province (see Figure 1). The facility will deliver a total capacity of 200MWac. It will consist of arrays of photovoltaic panels supported by mounting structures and concrete footings, inverter stations, internal access roads, cabling, fencing, an on-site substation with a 132kV connection to the Eskom grid, buildings for a workshop, storage, and offices, and a battery storage facility. The footprint of the development will utilise 300 hectares, of the total farm portion of 444 hectares. Under a separate basic assessment application, four transmission line alternatives to evacuate power from the facility to the national grid are being assessed and are covered by this report.

The objectives of this study are to identify and assess all potential impacts of the proposed development on agricultural resources, including soils, and agricultural production potential; and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts. Johann Lanz was appointed by Aurecon as an independent specialist to conduct this Agricultural and Soil Impact Assessment.

Figure 1. *Location map of the proposed site, south east of the town of Hotazel.*

2 TERMS OF REFERENCE

The terms of reference for the study fulfills the requirements for a soils and agricultural study as described in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011. The study applies an appropriate level of detail for the agricultural suitability and soil variation on site, which, because it is justified (see section 3.1), is less than the standardised level of detail stipulated in the above regulations.

The above requirements may be summarised as:

- Identify all potential impacts (direct, indirect and cumulative) of the proposed development on soils and agricultural potential to be assessed in the impact assessment phase.
- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site.
- Describe the climate in terms of agricultural suitability.
- Summarise available water sources for agriculture.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine the agricultural potential across the site.
- Determine the agricultural sensitivity to development across the site.
- Provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts.

The report also fulfils the requirements of Appendix 6 of the 2014 EIA Regulations (See Table 1).

Table 1. Compliance with the Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
• A specialist report prepared in terms of these Regulations must contain ◦ details of- ▪ the specialist who prepared the report; and ▪ the expertise of that specialist to compile a specialist report including a curriculum vitae;	Title page CV within report
◦ a declaration that the specialist is independent in a form as may be specified by the competent authority;	At beginning of report
◦ an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 and 2
◦ the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.1
◦ a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 3
◦ the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 6.8
◦ an identification of any areas to be avoided, including buffers;	Section 6.8
◦ a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 3
◦ a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
◦ a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 7 and 8
◦ any mitigation measures for inclusion in the EMPr;	Section 7

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
◦ any conditions for inclusion in the environmental authorisation;	Section 7
◦ any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Not in scoping phase report
◦ a reasoned opinion- ▪ as to whether the proposed activity or portions thereof should be authorised; and ▪ if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 8 Section 7
◦ a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3.1
◦ a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
◦ any other information requested by the competent authority.	Not applicable

3 METHODOLOGY OF STUDY

3.1 Methodology for assessing soils and agricultural potential

The assessment was based largely on existing soil and agricultural potential data for the site. The source of this data was the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the site available on Google Earth was also used for evaluation.

The AGIS data was supplemented by a field investigation. This was aimed at ground-proofing the AGIS data and achieving an understanding of specific soil and agricultural conditions, and the variation of these across the site. The field investigation involved a drive and walk over of the site using assessment of surface conditions and existing excavations and burrows. The field assessment was done on 30 June 2016.

Soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991).

It is my opinion that the level of soil mapping detail in the above DAFF requirements is appropriate for arable land only. It is not appropriate for this site. Detailed soil mapping has little relevance to an assessment of agricultural potential in this environment, where cultivation potential is extremely limited, soil conditions are generally poor and the agricultural limitations are overwhelmingly climatic. In such an environment, even where soils suitable for cultivation may occur, they cannot be cultivated because of the aridity constraints. Conducting a soil assessment at the required level of detail would be unconstructively time consuming, as it would add almost no value to the assessment. The level of soil assessment that was conducted for this report (reconnaissance ground proofing of land type data) is considered more than adequate for a thorough assessment of all agricultural impacts.

An assessment of soils (soil mapping) and long term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the fact that the assessment was done in winter has no bearing on its results.

The field investigation also included a visual assessment of erosion and erosion potential on site, taking into account the proposed development layout.

In field consultation was done with the current farmer of the land, Mr Dawie Fourie to get details of farming activities on the site.

3.2 Methodology for assessing impacts and determining impact significance

All potential impacts were assessed in terms of the following criteria:

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	Regional	Beyond a 10km radius of the proposed site.
	Local	Within a 10km radius of the proposed site.
	Site specific	On site or within 100m of the proposed site.
Magnitude of impact (at the indicated spatial scale)	High	Natural and/ or social functions and/ or processes are severely altered
	Medium	Natural and/ or social functions and/ or processes are notably altered
	Low	Natural and/ or social functions and/ or processes are slightly altered
	Very low	Natural and/ or social functions and/ or processes are negligibly altered
	Zero	Natural and/ or social functions and/ or processes remain unaltered
Duration of impact	Construction period	Up to 1 year
	Short term	Up to 3 years after construction
	Medium term	3-10 years after construction
	Long term	More than 10 years after construction

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	High magnitude with a regional extent and long term duration High magnitude with either a regional extent and medium term duration or a local extent and long term duration Medium magnitude with a regional extent and long term duration
Medium	High magnitude with a local extent and medium term duration High magnitude with a regional extent and construction period or a site specific extent and long term duration High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term Low magnitude with a regional extent and long term duration
Low	High magnitude with a site specific extent and construction period duration Medium magnitude with a site specific extent and construction period duration Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term Very low magnitude with a regional extent and long term duration
Very low	Low magnitude with a site specific extent and construction period duration Very low magnitude with any combination of extent and duration except regional and long term
Neutral	Zero magnitude with any combination of extent and duration

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

IRREPLACEABILITY RATINGS	CRITERIA
Low	The affected resource is not unique and or does not serve an critical function or is degraded
Medium	The affected resource is moderately important in terms of uniqueness and function or in pristine condition
High	The affected resource is important in terms of uniqueness and function and or in pristine condition and warrants conservation / protection

4 ASSUMPTIONS, CONSTRAINTS AND LIMITATIONS OF STUDY

The field investigation for this assessment is considered more than adequate for the purposes of this study (see section 3.1) and is therefore not seen as a limitation. A more detailed soil investigation is not considered likely to have added anything significant to the assessment of agricultural soil suitability for the purposes of determining the impact of the facility on agricultural resources and productivity.

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

The study makes the assumption that water for irrigation is not available across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and none have been exploited in this area.

There are no other specific constraints, uncertainties and gaps in knowledge for this study.

5 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A change of land use (re-zoning) for the development on agricultural land needs to be approved in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). This is required for long term lease, even if no subdivision is required. Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The EIA process covers the required aspects of this. The Department of Agriculture, Forestry and Fisheries reviews and approves applications in terms of these Acts according to their *Guidelines for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011.

6 BASELINE ASSESSMENT OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

6.1 Climate and water availability

Rainfall for the site is given as 343 mm per annum (The World Bank Climate Change Knowledge Portal, accessed 7/10/2016). The average monthly distribution of rainfall is shown in Figure 2. One of the most important climate parameters for agriculture in a South African context is moisture availability. Moisture availability is an indicative measure of the climatic moisture that is available for plant growth in any environment. It is the ratio of rainfall to evapotranspiration and it directly determines the viability of any rain fed agriculture including grazing. Moisture availability is classified into 6 categories across the country (see Table 2). The site falls into the second driest 5th category, which is labelled as a severe limitation to agriculture.

The farm only has limited water available for stock watering. There is no access to water for irrigation.

Table 2. The classification of moisture availability climate classes for summer rainfall areas across South Africa (Agricultural Research Council, Undated)

Climate class	Moisture availability (Rainfall/0.25 PET)	Description of agricultural limitation
C1	>34	None to slight
C2	27-34	Slight
C3	19-26	Moderate
C4	12-18	Moderate to severe
C5	6-12	Severe
C6	<6	Very severe

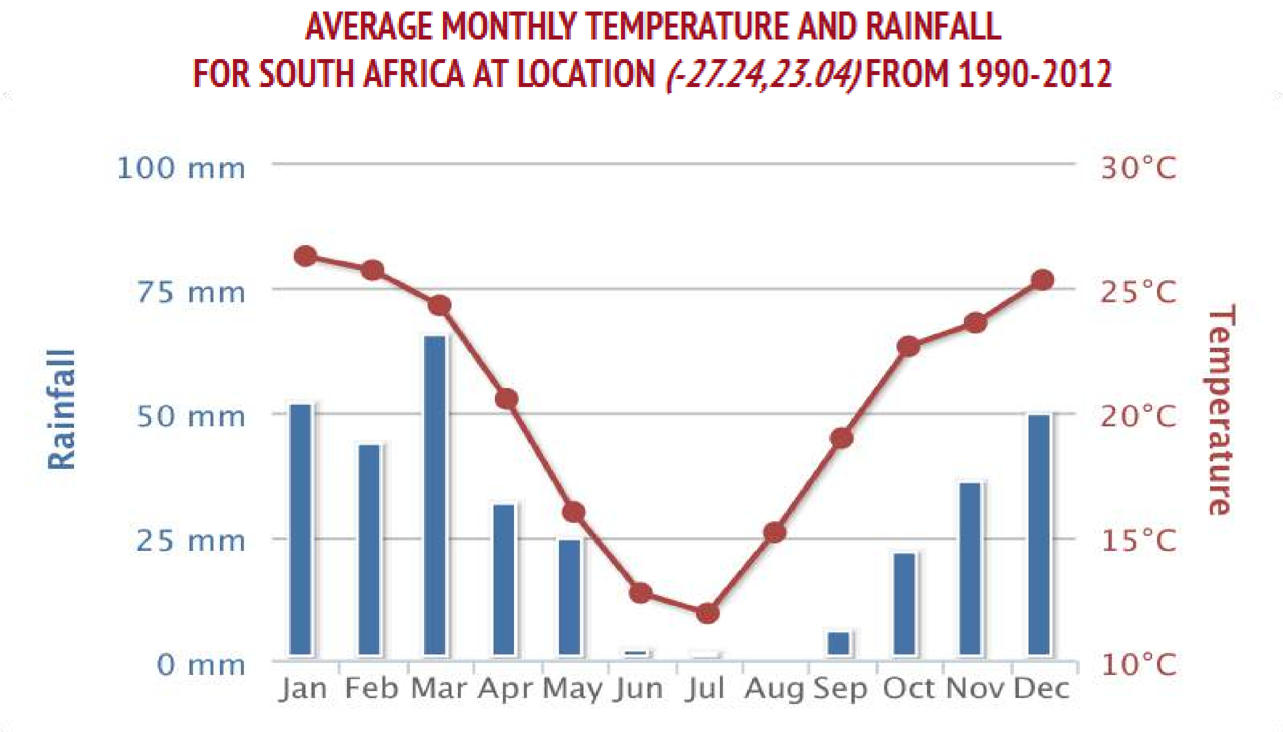

Figure 2. *Average monthly temperature and rainfall for the site (The World Bank Climate Change Knowledge Portal, accessed 7/10/2016).*

6.2 Terrain, topography and drainage

The proposed development is located on a terrain unit of level plains at an altitude of around 1,080 meters. Slope is less than 1% across the site. A satellite image map of the site is shown in Figure 3. A satellite image map of the transmission line alternatives is shown in Figure 4. Photographs of site conditions are shown in Figures 5 to 7.

The geology is aeolian sand of recent age.

There are no water courses on or near the site.

6.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climate conditions into different land types. There is a single land type across the site, namely Ah9. Soils of this land type are almost exclusively deep, well-drained, very sandy red and yellow soils of the Hutton and Clovelly soil forms. The soils fall into the Oxidic soil group according to the classification of Fey (2010). A summary detailing soil data for the land type is provided in Appendix 1, Table A1. The field investigation confirmed that the entire site comprises deep, mostly yellow coloured, very sandy soils.

The soils are classified as having low to moderate susceptibility to water erosion (class 5), but because of their sandy texture are classified as highly susceptible (class 1a) to wind erosion.

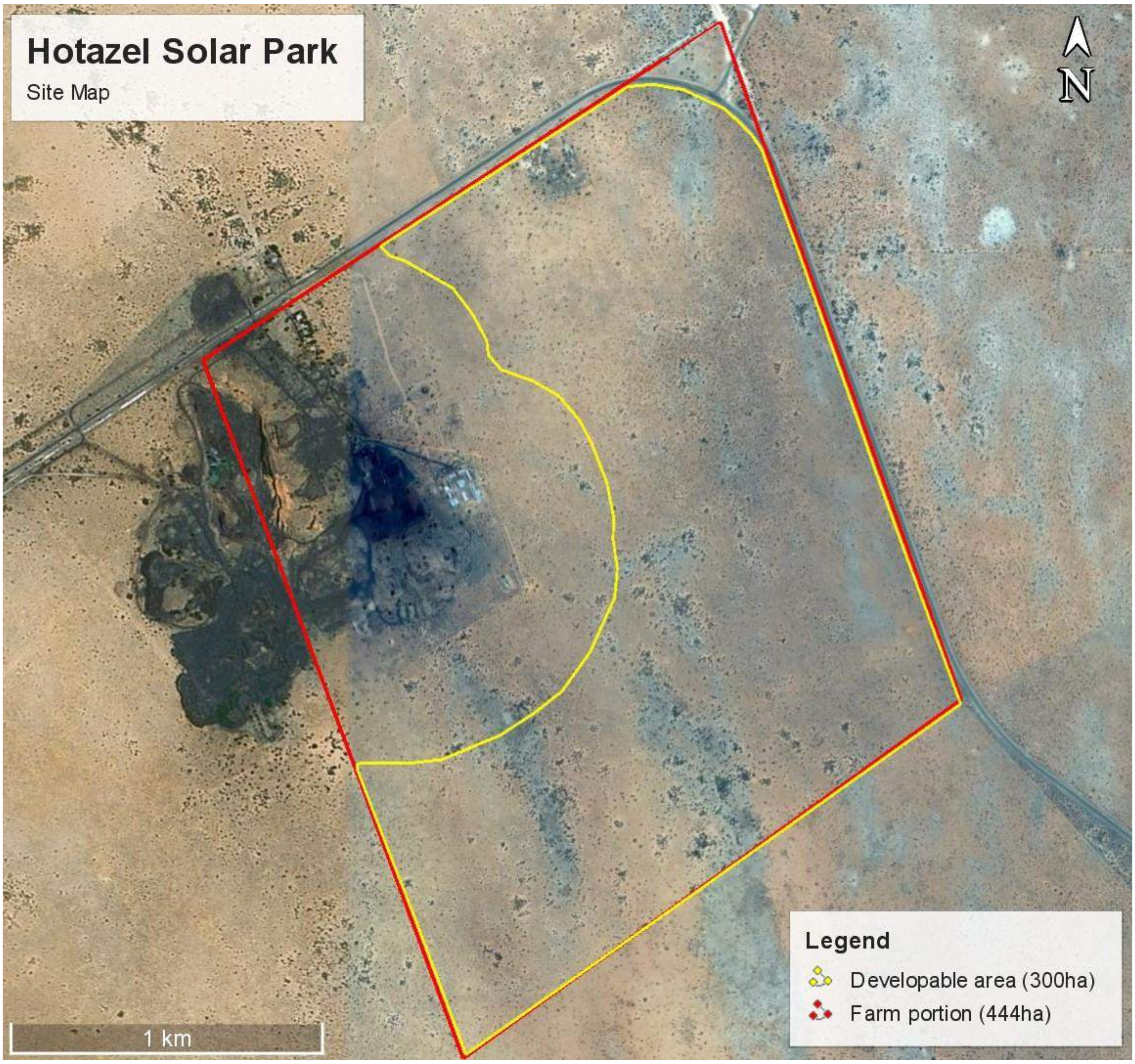

Figure 3. *Satellite image of the proposed site.*

Figure 4. *Satellite image map of transmission line alternatives.*

6.4 Agricultural capability

Land capability is the combination of soil suitability and climate factors. The site and surrounds has a land capability classification, on the 8 category scale, of Class 7 – non-arable, low potential grazing land.

The limitations to agriculture are predominantly climate related. The moisture availability class 5 classification, with high variability of rainfall is a very severe limitation to agriculture, which makes any cultivation without irrigation completely non-viable. The very sandy soils, with very limited water holding capacity are a further limitation. The grazing capacity on AGIS is classified as 18-21 hectares per large stock unit.

Figure 5. *View of typical conditions across the site.*

Figure 6. *View of typical conditions across the site.*

Figure 7. *View of animal burrow excavations showing deep sandy soil profile of the Clovelly soil form.*

6.5 Land use and development on and surrounding the site

The farm is located within a cattle farming agricultural region and currently used only for grazing. There has never been any cultivation on the farm.

There is a group of derelict buildings near the northern boundary of the site. There is no agricultural infrastructure on the site. There is intensive mining activity on the north western part of the farm.

Road access to the site is off the tarred R31.

6.6 Status of the land

The biome classification for the site is Kathu Bushveld and Kuruman Thornveld. The vegetation is grazed and sparse due to low rainfall, but there is no evidence of significant erosion or other land degradation on the site. The mine tenement is heavily impacted by mining activity.

6.7 Possible land use options for the site

Because of, predominantly the, climate limitations, the site is totally unsuitable for cultivated crops, and viable agricultural land use is limited to grazing only.

6.8 Agricultural sensitivity

Agricultural conditions and potential are completely uniform across the site and the choice of placement of infrastructure therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the investigated site and no parts of it therefore need to be avoided by the development. There are no required buffers from an agricultural perspective.

7 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the site by the footprint of the facility
- Constructional activities that disturb the soil profile and vegetation, for example for levelling, excavations, etc.

The following potential impacts of the development on agricultural resources and productivity are identified, and discussed below. The significance of all agricultural impacts is low due to the fact that the proposed site is on land of extremely limited agricultural potential that is only viable for grazing. This also means that cumulative regional effects as a result of other surrounding developments, also have low significance.

All impacts are associated with all the phases of the development - construction, operational, and decommissioning.

The impacts are assessed separately for the solar park development footprint and for the transmission lines.

The no-go alternative anticipates changes to the agricultural environment that would occur in the absence of the proposed development.

7.1 Impacts associated with the Hotazel Solar Park

7.1.1 Loss of agricultural land use

	Preferred Alternative		**No Go Alternative**
Description	Loss of agricultural land use is caused by direct occupation of land by the total footprint of energy facility infrastructure and has the effect of taking affected portions of land out of agricultural production. The impact is reversible after the life of the project, with effective topsoiling of the land during rehabilitation, where necessary.		No loss of agricultural land use is anticipated in the no go alternative.
Assessment			
	Pre-Mitigation	**Post Mitigation**	
Nature	Negative		Neutral
Duration	Long term		
Extent	Site specific		
Magnitude	Low		
Probability	Definite		
Confidence	Certain		
Reversibility	Reversible		
Resource irreplaceability	Low		
Mitigatability	Not possible		
Significance	Low		
Mitigation	None possible		
Cumulative impact assessment	Low		
The significance of loss of agricultural land is low due to the fact that the proposed site is on land of extremely limited agricultural potential.			

7.1.2 Loss of topsoil

	Preferred Alternative		**No Go Alternative**
Description	Loss of topsoil may be caused by poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.) It can have the effect of loss of soil fertility on disturbed areas after rehabilitation.		No loss of topsoil is anticipated in the no go alternative.
Assessment			
	Pre-Mitigation	**Post Mitigation**	
Nature	Negative	Negative	Neutral
Duration	Medium term	Medium term	

Extent	Site specific	Site specific	
Magnitude	Low	Low	
Probability	Probable	Unlikely	
Confidence	Sure	Sure	
Reversibility	Reversible	Reversible	
Resource irreplaceability	Low	Low	
Mitigatability	Yes		
Significance	Low	Low	
Mitigation	If an activity will mechanically disturb below-surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Erosion must be controlled where necessary on topsoiled areas.		
Cumulative impact assessment	Low	Low	

The significance of loss of topsoil is low due to the fact that the proposed site is on land of extremely limited agricultural potential. With mitigation its probability is unlikely.

7.1.3 Erosion

	Preferred Alternative		**No Go Alternative**
Description	Erosion can occur due to alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, presence of panel surfaces, and the establishment of hard standing areas and roads. Erosion will cause loss and deterioration of soil resources. The water erosion risk is low due to the low slope gradients and low erodibility of the soils, but the risk of wind erosion is higher.		No accelerated erosion is anticipated in the no go alternative.
Assessment			
	Pre-Mitigation	**Post Mitigation**	
Nature	Negative	Negative	Neutral
Duration	Medium term	Medium term	
Extent	Site specific	Site specific	
Magnitude	Low	Low	
Probability	Unlikely	Unlikely	
Confidence	Sure	Sure	
Reversibility	Irreversible	Irreversible	
Resource irreplaceability	Low	Low	

Mitigatability	Yes		
Significance	Low	Low	
Mitigation	Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there.		
Cumulative impact assessment	Low	Low	

The significance of erosion is low due to the fact that the proposed site is on land of extremely limited agricultural potential. The low slope gradient mitigates risk of erosion.

7.1.4 Soil contamination

	Preferred Alternative		**No Go Alternative**
Description	Hydrocarbon spillages from construction activities, as well as spillages from the battery storage facility can contaminate soil.		No soil contamination is anticipated in the no go alternative.
Assessment			
	Pre-Mitigation	**Post Mitigation**	
Nature	Negative	Negative	Neutral
Duration	Long term	Long term	
Extent	Site specific	Site specific	
Magnitude	Low	Low	
Probability	Unlikely	Unlikely	
Confidence	Sure	Sure	
Reversibility	Reversible	Reversible	
Resource irreplaceability	Low	Low	
Mitigatability	Yes		
Significance	Low	Low	
Mitigation	Implement effective spillage and waste management system.		
Cumulative impact assessment	Low	Low	

The significance of contamination is low due to the fact that the proposed site is on land of extremely limited agricultural potential. Mitigation can completely reverse the impact.

7.1.5 Generation of additional land use income

	Preferred Alternative	**No Go Alternative**
Description	Generation of additional land use income will occur through rental for energy facility. This is a positive impact for agriculture. It will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.	No generation of additional land use income is anticipated in the no go alternative.
Assessment		

	Pre-Mitigation	Post Mitigation	
Nature	Positive	Positive	Neutral
Duration	Long term	Long term	
Extent	Site specific	Site specific	
Magnitude	Low	Low	
Probability	Definite	Definite	
Confidence	Certain	Certain	
Reversibility	Reversible	Reversible	
Resource irreplaceability	Low	Low	
Mitigatability	None possible		
Significance	Low	Low	
Mitigation	None possible		
Cumulative impact assessment	Low	Low	

The impact is considered low, because although the income generation may be significant to the affected landowner, its impact on agriculture is still low.

7.1.6 Cumulative impacts

There is potential for cumulative impacts to arise as a result of other projects that impact on agricultural land in the area.

Although the loss of individual project portions of land has low significance, the cumulative impact of land loss regionally can become more significant. However, due to the low agricultural potential of the land and the consequent low impact, the cumulative impact is also low. Furthermore it is agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to sites such as this one, with very low agricultural potential. It is preferable to incur a higher cumulative loss in a region with low agricultural potential, than to lose agricultural land with a higher production potential elsewhere in the country.

	Preferred Alternative		**No Go Alternative**
Description	Regional loss of agricultural land use can occur due to the cumulative impact of a number of developments in the surrounding area.		
Assessment			
	Pre-Mitigation	**Post Mitigation**	
Nature	Negative	Negative	Negative
Duration	Long term	Long term	Long term
Extent	Regional	Regional	Regional
Magnitude	Low	Low	Low
Probability	Definite	Definite	Definite
Confidence	Certain	Certain	Certain
Reversibility	Reversible	Reversible	Reversible
Resource irreplaceability	Low	Low	Low
Mitigatability	None possible		
Significance	Low	Low	Low

Mitigation	None possible
The significance of regional loss of land is low due to the fact that the site and surroundings are on land of extremely limited agricultural potential.	

7.2 Impacts associated with the transmission lines

The agricultural impacts of a transmission line in this environment, which has low agricultural potential and no cultivation, is negligible. This is due to the low agricultural potential of the environment and the fact that the footprint of disturbance of a transmission line is minimal, being restricted to the pylon bases. The only viable agricultural land use in the study area, grazing, can continue entirely unaffected below transmission lines.

7.2.1 Loss of agricultural potential

	All 3 Alternatives		**No Go Alternative**
Description	Any loss of agricultural potential due to total agricultural impacts of the development which include loss of topsoil, erosion, soil contamination and veld degradation.		No loss of agricultural potential is anticipated in the no go alternative.
Assessment			
	Pre-Mitigation	**Post Mitigation**	
Nature	Negative	Negative	Neutral
Duration	Long term	Long term	
Extent	Site specific	Site specific	
Magnitude	Very low	Very low	
Probability	Probable	Probable	
Confidence	Sure	Sure	
Reversibility	Irreversible	Irreversible	
Resource irreplaceability	Low	Low	
Mitigatability	Yes		
Significance	Very low	Very low	
Mitigation	If an activity will mechanically disturb below-surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Erosion must be controlled where necessary on topsoiled areas. Implement effective spillage and waste management system.		
Cumulative impact assessment	Low	Low	
The agricultural impacts of a transmission line in this environment is negligible. This is due to the low agricultural potential of the environment and the fact that the footprint of disturbance of a transmission line is very minimal.			

7.2.2 Comparative assessment of alternatives

Because of the very low agricultural impacts of a transmission line in this environment, there is negligible difference between the three alternatives. From an academic point of view the shortest alternative has the lowest impact, but this has no real meaning in practice. There is therefore no preferred alternative from an agricultural impact point of view between the Umtu, Hotazel and LILO connection options.

8 CONCLUSION AND RECOMMENDATIONS

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the investigated site is on land which is of low agricultural potential and is not suitable for cultivation.

No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.

Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site.

There are no conditions resulting from this assessment that need to be included in the environmental authorisation.

Because of the low agricultural potential, and the consequent low agricultural impact, there are no restrictions relating to agriculture which would preclude authorisation of the proposed development.

None of the alternative transmission line routes have significant bearing on agricultural impacts and there is therefore no preferred alternative from an agricultural impact point of view.

9 REFERENCES

- Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

- Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.

- Soil Classification Working Group. 1991. Soil classification: a taxonomic system for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

- The World Bank Climate Change Knowledge Portal available at http://sdwebx.worldbank.org/climateportal/ accessed 7/10/2016.

APPENDIX 1: SOIL DATA

Table A1. Land type soil data for site.

Land type	Land capability class	Soil series (forms)	Depth (cm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ah9	7	Clovelly	>120	2-4	3-6		40
		Hutton	>120	3-6	6-10		17
		Clovelly	>120	3-6	6-10		17
		Hutton	>120	2-4	3-6		11
		Clovelly	>120	2-4	3-6		8
		Mispah	10-25	6-10		R, ca	4
		Fernwood	>120	3-6	4-8		3

Land capability classes: 7 = non-arable, low potential grazing land.
Depth limiting layers: R = hard rock; ca = hardpan carbonate.

APPENDIX D.2:

Avifauna

AVIFAUNAL IMPACT ASSESSMENT

ENVIRONMENTAL IMPACT ASSESSMENT AND BASIC ASSESSMENT FOR THE PROPOSED HOTAZEL SOLAR PARK PROJECT AND ASSOCIATED POWERLINE IN THE NORTHERN CAPE PROVINCE

December 2016

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EXECUTIVE SUMMARY

Hotazel Solar Park PV plant

The proposed Hotazel Solar Park PV facility will have some pre-mitigation impacts on avifauna at a site and local level which will range from High to Low.

The impact of displacement of priority species due to habitat transformation associated with the operation of the plant and associated infrastructure is rated as High. This impact can be partially reversed through mitigation, but it will remain at a Medium level. The impact of displacement due to disturbance during the construction phase is rated as Medium and will remain at a Medium level after mitigation. The remaining envisaged impacts, i.e. mortalities in the operational phase due to collisions with the solar panels and entrapment in perimeter fences are both rated as Low and should be mitigatable to a Very Low level with appropriate mitigation.

The relatively small size of the footprint, coupled with the existing degraded state of the environment at the development area, leads one to the conclusion that the cumulative impact of the facility on priority avifauna should in all likelihood be low, taking into account the current impacts on avifauna within a 30km radius around the development area.

From an avifaunal impact perspective, the proposed development could go ahead, provided the proposed mitigation measures are strictly implemented.

The 132kV powerline

The proposed 132kV powerline will have several pre-mitigation impacts on avifauna at a site and local level which are all rated as Low.

The impact of electrocutions of priority species is rated as Low, but it can be mitigated to a Very Low level. The impact of collisions with the earthwire of the proposed 132kV line is rated as Low, but it can also be mitigated to a Very Low level. The impact of displacement due to habitat destruction and disturbance is rated as Low and it can be further reduced to Very Low through appropriate mitigation.

The relatively small size of the footprint, coupled with the existing degraded state of the environment at the development area, leads one to the conclusion that the cumulative impact of the powerlines on priority avifauna should in all likelihood be Low, taking into account the current impacts of powerlines on avifauna within a 30km radius around the development area.

From an avifaunal impact perspective, the proposed powerline could go ahead, provided the proposed mitigation measures are strictly implemented.

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DETAILS OF THE SPECIALIST AND EXPERTISE TO COMPILE A SPECIALIST REPORT

Chris van Rooyen

Chris has 20 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2016) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman

Albert has an M. Sc. in Conservation Biology from the University of Cape Town, and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several wind farm facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

SPECIALIST DECLARATION

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, and working under the supervision of and in association with Albert Froneman (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence (as well as that of Chris van Rooyen Consulting) as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Aurecon was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Environmental Impact Assessment for the proposed Hotazel Solar Park.

Full Name: Chris van Rooyen

Position: Director

1 OVERVIEW

1.1 Hotazel Solar Farm (EIA)

Aurecon South Africa (PTY) Ltd (Aurecon) were commissioned by juwi Renewable Energies (Pty) Ltd (juwi) as the independent Environmental Assessment Practitioner (EAP) to facilitate the application processes for environmental authorisation in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA).The Hotazel Solar Park project will be handled as a two applications, the first following a Scoping and Environmental Impact Report (S&EIR) process in accordance with the NEMA EIA regulations, 2014, GN R 982 for the solar facility and ancillaries (DEA Case Ref: 14/12/16/3/3/2/987). The second application will follow the basic assessment process in terms of the same regulations for the transmission lines connecting the project to the national power grid. The public engagement process will be conducted as a single process in the impact assessment phase.

1.1.1 Project description

Hotazel Solar Farm 1 (Pty) Ltd, a wholly owned subsidiary of juwi Renewable Energies (Pty) Ltd (juwi), proposes the construction and operation of a 300ha, ≤200MW solar Park on the Farm Hotazel Annex Langdon (F278/0), and associated infrastructure, near Hotazel, in the Joe Morolong Local Municipality, in the Northern Cape Province. Referred to as the Hotazel Solar Park. The project components are described in Table 1 below.

Table 1: Hotazel Solar Farm 1 project description and alternatives summary

Component	Footprint
• **Solar Farm:** A 200MWac solar facility with PV panels on steel mountings with single axis tracking mechanisms and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters.	≤245ha
• **Battery Storage System:** A ≤100MWh battery storage facility for grid storage of maximum height 8mand a maximum of 1120 cubic meters of batteries (dangerous goods) and associated operational, safety and control infrastructure.	≤1ha
• **Access road:** A ≤1.9km long, ≥8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.	≤1.6ha
• **Service roads:** ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	≤7ha)
• **Collector substation:** ≤1ha collector substation to receive, convert and step up electricity from the PV facility to the 132kV grid suitable supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32m telecommunications tower (lattice or monopole type) will be established in the substation area.	≤1ha
• **O&M area**: o ≤1ha hectare O&M laydown area (near / adjacent substation); o Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; o Workshops, storage areas for materials and spare parts; o Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day for 15 months during rest of construction period; ~20kl/day during operation); o Septic tanks and sewer lines to service ablution facilities; and o Central Waste collection and storage area.	≤1ha
• **Other infrastructure:** o Perimeter fencing (0.5m clearance) and internal security fencing and gates as required. o Access control gate and guard house on access road; o ≤3.5km length of small diameter water supply pipeline connecting existing boreholes to storage.	≤0.5ha
• **Temporary infrastructure:** o A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.	≤4ha
• **Open space (excluding the 4ha construction yard)**	≤39ha
Total development footprint	**≤300ha**[1]

[1] Note that the development footprint is estimated at 300ha, the percentage land covered by building and infrastructure is likely to be 80 -90% of the 300ha. These unused spaces arise from solar arrays needing to be orientated in particular direction which is optimised according to sun and not property boundaries, which leaves some unusable spaces. Also space needs to be left around

1.1.2 NEMA Listed activities

Listed activity as described in GN R. 983, GN R. 984 and GN R.985 in terms of NEMA are summarised as follows: GN R. 983 activities 11(i), 24(ii), 28(ii), GN R. 984 activities 1,4 and 15. More detail is provided in the Table to follow.

Table 2 | Listed activities applicable to the Solar PV phases in terms of GN No. 983 of 2014

Listed activities in terms of NEMA regulations potentially applicable to the Solar PV phases	
Listed activity as described in GN R. 983, GN R. 984 and GN R.985	**Description of the activities to be undertaken, including associated structures and infrastructure**
Listed activities in terms of NEMA GN No. 983	
GN No. 983 Activity No. 11 (i): The development of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or	Onsite infrastructure including underground cabling for collection of electricity with a capacity of ≤ 33kV would be required to connect the proposed PV facility to the proposed onsite central 132 kV substation. The proposed facility is situated outside of the urban edge. This activity would therefore be triggered.
GN No. 983 Activity No. 24 (ii): The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	Permanent roads outside the urban area will be required for the proposed PV facility. The width of the proposed access roads including sidings will be ≤8 metres or wider to accommodate heavy two directional traffic, and this activity is thus triggered.
GN No. 983 Activity No. 28 (ii): Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1 April 1998 and where such development - (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	The property is currently being used for informal agriculture in the form of extensive grazing by cattle and ostrich. The north-western corner of the property is used by the Strata-Africa Resources Pty Ltd for manganese prospecting. Historically, the land would have been used for grazing, and thus will need to be rezoned to “Special Zone: Renewable Energy” use and so this activity will thus be triggered.
Listed activities in terms of NEMA GN No. 984	
GN No. 984 Activity No. 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	The proposed PV facilities would have a generation capacity of ≤200MWac each as such this activity is triggered.
GN No. 984 Activity No. 4: The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	A utility scale battery storage facility, which consist of dangerous goods, ≤1120 cubic metres of batteries will be installed for certain alternatives. This activity will thus be triggered. The battery storage facility will cover an area of ≤1ha.
GN No. 984 Activity No. 15: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for - (i) the undertaking of a linear activity; or - (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	More than 20ha of land will be cleared for the solar farm, substation, construction yards, O&M area, access and service roads, approximately 300ha in total. The land is currently used for extensive grazing of cattle and ostrich, whilst there is some degradation and invasive plant species are present, it can be largely considered as indigenous. This activity will thus be triggered.
Listed activities in terms of NEMA GN No. 985 - None	

some buildings and facilities. While these areas will not be developed, they are considered transformed as they no longer render all ecosystem services as they would have if not enclosed by the development, thus they are included in the development footprint.

1.1.3 Alternatives considered

In the scoping phase, specialists collectively assessed the potential impacts associated with a range of project alternatives and assigned preference rankings to the alternatives based on these findings. The alternatives considered are summarised as follows:

- Alternative A1: F**ixed mounting** solar panel array **(Energy score = 100).**
- Alternative A2: S**ingle axis tracking** solar panel array (**Energy rating = 120).**
- Alternative A3: **Fixed mounting** solar panel array **with** battery storage system **(Energy score = 125).**
- Alternative A4: S**ingle axis tracking** solar panel array **with** a battery storage system (**Energy score = 145).**
- Alternative B1: **≤3.2km** long northern site access road.
- Alternative B2: **≤1.9km** long eastern site access road.

Specialist preference rankings were then entered into a matrix, divided into one of three main categories that echo the sustainable development principles. Individual studies (aspects) were weighted by the EAP based on the potential significance of the issues identified by the specialists, so that the potentially more significant issues have a higher influence on the final preference rating. The EAP also recommended the weighting of categories as 40%: 50% :10% ration between the Environmental: Social: and Financial spheres. This was based on the site not being particularly unique or constrained by environmental issues and on the other hand, socio economic issues in the municipality and investment and job opportunities are needed. Given the relatively low environmental sensitivity of the site and the importance of renewable energy and socioeconomic investment. The table below draws on the specialist preference rankings, converted them into percentages and multiplied them out to achieve a weighted contribution to the overall ranking and placed them in weighed categories (see Table 3 below).

Table3: Screening of project alternatives from scoping phase

Category	Category weighting	Aspect	Aspect weighting	Rankings (preference percentage x combined weighting)					
				A1	A2	A3	A4	B1	B2
Environmental	40%	Birds	20%	8%	8%	8%	8%	8%	8%
		Climate Change	15%	0%	2%	4%	6%	0%	6%
		Botany	20%	8%	8%	8%	8%	0%	8%
		Freshwater	5%	2%	2%	2%	2%	2%	2%
		Fauna	10%	4%	4%	4%	4%	0%	4%
		Pollution risk (Battery storage)	10%	4%	4%	3%	3%	4%	4%
		Noise and Dust	10%	4%	4%	4%	4%	0%	4%
		Stormwater	10%	3%	4%	3%	4%	0%	4%
Social	50%	Agriculture	10%	5%	5%	3%	3%	5%	5%
		Heritage	20%	10%	10%	10%	10%	10%	10%
		Socioeconomic	30%	0%	5%	10%	15%	15%	15%
		Traffic	20%	10%	7%	3%	0%	0%	10%
		Visual	20%	10%	10%	10%	10%	10%	0%
Financial	10%	Energy productivity	50%	0%	2%	3%	5%	5%	5%
		Investor feasibility	50%	0%	3%	2%	5%	0%	5%
			Total	**68%**	**78%**	**77%**	**87%**	**59%**	**90%**

Alternative A4 and Alternative B2 have emerged as the preferred alternatives to be comparatively assessed in the impact assessment phase against the "no go" alternative.

1.1.4 Project layout

See below a map indicating the footprint of the facility.

Figure 1: A map indicating the footprint of the proposed facility

1.2 Hotazel Solar Park transmission lines (BA)

Aurecon South Africa (PTY) Ltd (Aurecon) were commissioned by juwi Renewable Energies (Pty) Ltd (juwi) as the independent Environmental Assessment Practitioner (EAP) to facilitate the application processes for environmental authorisation in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA).The Hotazel Solar Park project will be handled as two applications, the first following a Scoping and Environmental Impact Report (S&EIR) process in accordance with the NEMA EIA regulations, 2014, GN R 982 for the solar facility and ancillaries. The second application will follow the basic assessment process in terms of the same regulations for the transmission lines connecting the project to the national power grid. The public engagement process will be conducted as a single process in the impact assessment phase.

1.2.1 Project description and alternatives

Three transmission corridor alternatives to evacuate power from the solar facility to the national grid are being considered by connecting the Solar Facility to the existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-Out (LILO) connection option. These transmission lines will eventually form part of the national grid and therefore fall under the ownership and operation of Eskom. Ownership of this infrastructure to be ceded to Eskom once constructed and must therefore have separate environmental authorisation to allow for the transference of ownership.

The following table provides a summary of the project components and alternatives to be assessed during the Basic Assessment process:

Table 4: Hotazel Solar Farm Transmission corridors project alternatives to be assessed

Transmission line C1: Hotazel substation • A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed • Servitude width 35m • ≤110monopole pylons • ≤12km long and 4m wide service track
Transmission line C2: Umtu substation • A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed • Servitude width 35m • ≤140 monopole pylons • ≤15km long and 4m service track
Transmission Line C3: LILO connection[2] **(please see footnote)** • A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. • Servitude width 35m per line. • ≤60 monopole pylons (i.e. ≤120 pylons in total) • ≤6km long and 4m service track per line
Alternative C4: NO GO • No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

1.2.2 NEMA Listed Activities

Listed activity as described in GN R. 983, GN R. 984 and GN R.985 in terms of NEMA are summarised as follows: GN R. 983 activity 11(i). More detail is provided in the Table to follow.

[2] The Loop In Loop Out connection depends on future improvements of the Eskom line before being deemed feasible alternative. Since this might occur, juwi wants to keep the alternative alive and have it assessed in the Basic Assessment

Table 5 | Listed activities applicable to the Solar PV phases in terms of GN No. 983 of 2014

Listed activities in terms of NEMA regulations potentially applicable to the Solar PV phases	
Listed activity as described in GN R. 983, GN R. 984 and GN R.985	**Description of the activities to be undertaken, including associated structures and infrastructure**
Listed activities in terms of NEMA GN No. 983	
GN No. 983 Activity No. 11 (i): The development of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or	The construction of a double 132 kV transmission line from the proposed Photovoltaic development to the existing Eskom Umtu or Hotazel Substations or LILO which are located outside of the urban edge and therefore triggers this activity.
Listed activities in terms of NEMA GN No. 984 - None	
Listed activities in terms of NEMA GN No. 985 - None	

1.2.3 Project layout

See Figure 2 below for a map outlining the different grid connection options.

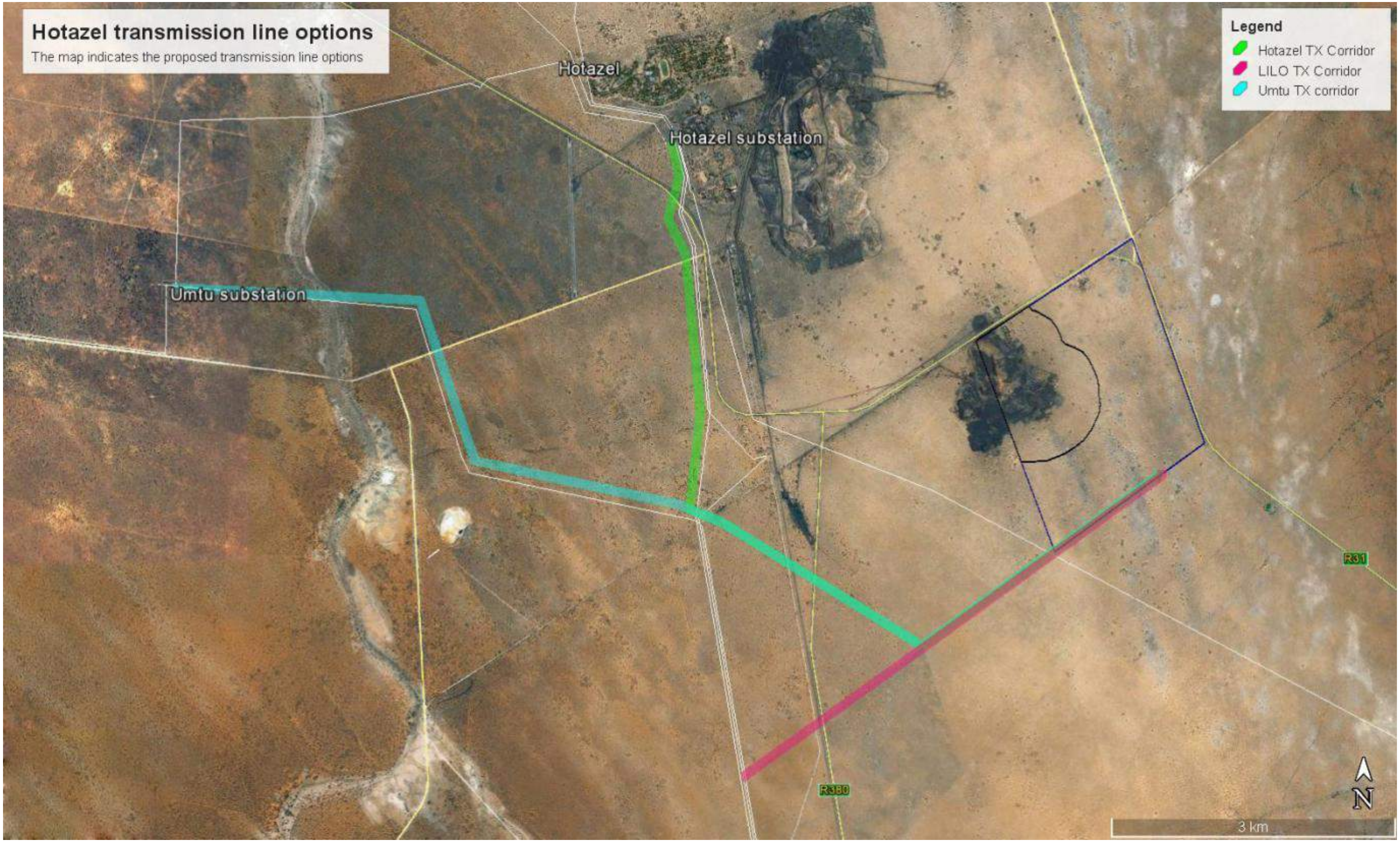

Figure 2: A map indicating the various grid connection options. The white lines are existing HV lines.

2 PROJECT SCOPE

The terms of reference for this assessment report are as follows:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts associated with the solar facilities and associated infrastructure;
- Assess the potential impacts;
- Rank the alternatives in order of preference; and
- Recommend mitigation measures to reduce the impact of the expected impacts.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted in order to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 16 pentads some of which intersect and others that are in the vicinity of the development. The decision to include multiple pentads around the proposed development area was influenced by the fact that many of the pentads in the area have very few completed full protocol surveys. Given that the habitat is largely homogenous the additional pentads and their data augments the otherwise sparse bird distribution data. The 16 pentad grid cells include the following: 2705_2250, 2705_2255, 2705_2300, 2705_2305, 2710_2250, 2710_2255, 2710_2300, 2710_2305, 2715_2250, 2715_2255, 2715_2300, 2715_2305, 2720_2250, 2720_2255, 2720_2300 and 2720_2305 (see Figure). A total of 47 full protocol lists has been completed to date for the 16 pentads where the development area is located (i.e. bird listing surveys lasting a minimum of two hours each). The SABAP2 data was therefore regarded as a conclusive dataset of the avifauna which could occur at the proposed development area, this data was also supplemented by data collected during the site surveys and general knowledge of the area.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al*. 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (2016.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- A desktop investigation was conducted to source information on the impacts of solar facilities on avifauna.
- A visit to the site and general area was conducted on the 10th of July 2016 followed up by on-site surveys on 26 and 27 July 2016. Please see Appendix 1 for the methodology used in the surveys, and the results of the surveys.

Figure 2: Area covered by the 16 SABAP2 pentads. The proposed solar PV facility is indicated by the purple polygon.

4 ASSUMPTIONS AND LIMITATIONS

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- The focus of the study is primarily on the potential impacts on priority species which were defined as follows:
  - South African Red Data species;
  - South African endemics and near-endemics;
  - Waterbirds; and
  - Raptors
- The impact of solar installations on avifauna is a new field of study, with only one scientific study published to date (McCrary *et al*. 1986), and one unpublished scientific study on the impact of PV facilities on avifauna in South Africa (Visser 2016). Strong reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA which have recently (2013 - 2015) commenced with avifaunal monitoring. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.
- The assessment of impacts is based on the baseline environment as it currently exists at the proposed development area.
- Cumulative impacts include all solar PV projects within a 30km radius that currently have open applications or have been approved by the Competent Authority.
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.

5 LEGISLATIVE CONTEXT

There is no specific legislation pertaining specifically to the impact of solar facilities on avifauna. There are best practice guidelines available which were compiled by Birdlife South Africa (BLSA) in 2012 (Smit 2012), which was followed in the compilation of this report. Efforts are currently (September 2016) underway to comprehensively revise these guidelines, however these new guidelines are still in draft form and have not yet been officially adopted by BLSA.

5.1 Agreements and conventions

Table 2 below lists agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna[3].

Table 2: Agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

[3] (BirdLife International (2016) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2016-04-02).

5.2 National legislation

5.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

- (i) prevent pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

5.2.2 The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 107 of 1998 (NEMA) creates the legislative framework for environmental protection in South Africa, and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

5.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

There are no Important Bird Areas (IBA) within a 60km radius around the proposed Hotazel Solar Park PV Facility. It is therefore highly unlikely that the proposed development will have a negative impact on any IBA.

6.2 Biomes and vegetation types

The development area is situated approximately 5km south of the town of Hotazel, in the Northern Cape Province. The development area is located in the savanna biome (Mucina & Rutherford 2006). Two vegetation types occur in the greater area, namely Kathu Bushveld and Gordonia Duneveld (Mucina & Rutherford 2006).

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison et al. 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. The description of the vegetation types occurring in the development area largely follows the classification system presented in the Atlas of southern African birds (Harrison *et al*. 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present.

Savanna (or woodland) is defined as having a grassy under-storey and a distinct woody upper-storey of trees and tall shrubs. Soil types are varied but are generally nutrient poor. The savanna biome contains a large variety of bird species (it is the most species-rich community in southern Africa) but very few bird species are restricted to this biome. In the development area, both vegetation types, namely Kathu Bushveld and Gordonia Duneveld, are classified within the Southern Kalahari and Central Kalahari in Harrison *et al*. 1997. The Central Kalahari vegetation is the predominant vegetation type and is characterised by sparse to dense shrubland or parkland woodland dominated by semi deciduous *Vachellia*, *Terminalia* and *Lonchocarpus* trees as well as *Vachellia* and *Grewia* shrubs on deep Kalahari sands. The amount of grass cover varies and is dependent on rain, grazing pressure and fires. Winters are cold, summers hot and the rainfall highly variable (averaging between 250 – 450mm) mostly in summer. The Southern Kalahari vegetation occurs more to the south and west and is as a result less abundant in the area. The Southern Kalahari vegetation occurs on deep Kalahari sands with rolling dunes, and consists of open shrubland with ridges of grassland and semi-deciduous *Vachellia* trees and Shepherd's Tree *Boscia albitrunca* along intermittent fossil watercourses and interdunal valleys. Tall trees are generally absent, except along some fossil rivers. Grass cover is highly variable dependent on rain and grazing.

The images below depict the typical Central / Southern Kalahari vegetation mosaic within the development area. The habitat within the development area is characterised by low shrubs interspersed with open ground, grass and forbs while larger trees are mostly absent.


Figure 3: Kathu Bushveld interspersed with open soil and grass.


Figure 4: Another view of typical Kathu Bushveld interspersed with open soil and grass.


Figure 5: Kathu bushveld vegetation with some taller trees and shrubs.

Whilst the distribution and abundance of the bird species in the development area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine external modifications to the environment that might have relevance for priority species.
Anthropogenic avifaunal-relevant habitat modifications which could potentially influence the avifaunal community that were recorded within the development area are water troughs and high voltage power lines. These are discussed in more detail below.

6.3 Water troughs

Surface water is of specific importance to avifauna in this arid environment. There are no permanent or ephemeral rivers in the proposed development area. The area does contain some open water troughs that provide drinking water to cattle. These open water troughs are important sources of surface water and could potentially be used extensively by various bird species, including large raptors and vultures, to drink and bath. Troughs will be relocated if need be if the construction of the solar facility goes ahead.

6.4 High voltage lines

High voltage lines are an important potential roosting and breeding substrate for large raptors in the area. Existing high-voltage lines are used extensively by large raptors in arid regions of South Africa e.g. in 2005 an aerial survey of the Ferrum – Garona 275kV line which starts at Kathu and terminates at Garona Substation approximately 16km north of Groblershoop, found a total of 19 Martial Eagle and 7 Tawny Eagle nests on transmission line towers (Van Rooyen 2007). High voltage lines therefore hold a special importance for large raptors, but also for Sociable Weavers which often construct their giant nests within the lattice work or cross-arms of high voltage structures. The greater area is bisected by several high voltage and medium voltage lines. However, no raptor nests or social weavers nests were observed on any of the powerlines in the proposed development area and immediate environment.

Figure 6: The Hotazel-Riries 66kV line which bisects the area just south-west of the proposed solar area.

6.5 Rivers

The Ga-Mogara ephemeral river runs in a north-south direction approximately 6.5km from the development area, and the Umtu TX corridor crosses the river approximately 1.5km from the Umtu Substation. Ephemeral rivers are important habitat for birds in that they act as corridors of microhabitat for waterbirds and in this instance grassland species. Ephemeral rivers generally only flow for short periods in the rainy season, but pools of water can persist for many months and aquatic organisms that occur in those pools could provide potential sources of food for various species. The pools in the Ga - Mogara River could attract a variety of waterbirds. Raptors and vultures, including Martial Eagle, Lappet-faced Vulture and White-backed Vulture could also use the pools in the river for drinking and bathing. During dry periods, the river channel provides an open expanse of grassland which could attract Secretarybird, Black Harrier and Kori Bustard.

Figure 7: The dry river bed of the Ga-Mogara river near the Umtu Substation.

6.6 Avifauna in the development area

The SABAP1 and SABAP2 data indicates that a total of 192 bird species could potentially occur within the proposed development area – Appendix 2 provides a comprehensive list of all the species. Of these, 58 species are classified as priority species (see section 4) and 11 of these are Red Data species.

Table 4 below lists all the priority species and the possible impact on the respective species by the proposed solar energy infrastructure. The following abbreviations and acronyms are used:

- EN = Endangered
- VU = Vulnerable
- NT = Near-threatened
- End = South African Endemic
- N-End = South African near endemic

Species recorded at the development area during surveys are shaded.

Table 4: Priority species potentially occurring at the site, conservation status, priority criteria, SABAP reporting rates, probability of occurrence, habitat use and potential impacts.

											Habitat use				Impacts						
	Name	**Scientific name**	**Status International**	**Status National**	**Endemic - South Africa**	**Waterbird**	**Raptor**	**SABAP2 (Reporting rate)**	**SABAP 1 (Reporting rate)**	**Probability of occurrence**	**Savanna**	**Water troughs**	**Ephemeral rivers**	**High voltage lines**	**PV panel collisions**	**Displacement - disturbance**	**Displacement - habitat loss**	**Drowning**	**Entrapment in fences**	**Powerline electrocutions**	**Powerline collisions**
1	Kori Bustard	*Ardeotis kori*	NT	NT				9.52	14.29	Medium	✓		✓			✓	✓		✓		✓
2	Ludwig's Bustard	*Neotis ludwigii*	EN	EN				0	11.11	Low	✓		✓			✓	✓		✓		
3	Steppe Buzzard	*Buteo buteo*					✓	0	22.22	Medium	✓			✓	✓		✓	✓			
4	South African Cliff-Swallow	*Petrochelidon spilodera*			End			0	5.26	Low	✓										
5	Red-knobbed Coot	*Fulica cristata*				✓		7.69	23.08	Improbable			✓		✓						✓
6	Reed Cormorant	*Phalacrocorax africanus*				✓		4.76	10.71	Improbable			✓		✓						✓
7	Burchell's Courser	*Cursorius rufus*	LC	VU				0	5.26	Low	✓										
8	African Black Duck	*Anas sparsa*				✓		0	11.11	Improbable			✓		✓						✓
9	White-faced Duck	*Dendrocygna viduata*				✓		0	7.69	Improbable			✓		✓						✓
10	Yellow-billed Duck	*Anas undulata*				✓		0	7.69	Improbable			✓		✓	✓					✓
11	Martial Eagle	*Polemaetus bellicosus*	VU	EN			✓	4.76	7.89	Medium	✓	✓	✓	✓		✓	✓	✓			
12	Spotted Eagle-Owl	*Bubo africanus*					✓	4.76	0	Medium	✓					✓	✓	✓			✓
13	Cattle Egret	*Bubulcus ibis*				✓		0	17.65	Medium	✓					✓		✓			✓
14	Little Egret	*Egretta garzetta*				✓		0	7.69	Improbable			✓		✓			✓			
15	Lanner Falcon	*Falco biarmicus*	LC	VU			✓	15.38	14.29	High	✓	✓		✓	✓	✓		✓			
16	Pygmy Falcon	*Polihierax semitorquatus*					✓	0	11.11	Low	✓				✓	✓	✓	✓			
17	Fairy Flycatcher	*Stenostira scita*			N-End			5.41	0	Medium	✓					✓	✓				
18	Fiscal Flycatcher	*Sigelus silens*			N-End			37.84	28.95	High	✓					✓					
19	Egyptian Goose	*Alopochen aegyptiaca*				✓		4.76	0	Improbable			✓		✓						✓
20	Gabar Goshawk	*Melierax gabar*					✓	18.92	10.53	High	✓	✓			✓	✓	✓	✓			
21	Southern Pale Chanting Goshawk	*Melierax canorus*					✓	19.05	24.44	High	✓	✓		✓	✓	✓		✓			
22	Little Grebe	*Tachybaptus ruficollis*				✓		0	5.26	Improbable					✓						✓
23	Common Greenshank	*Tringa nebularia*				✓		0	14.29	Improbable			✓		✓						
24	Hamerkop	*Scopus umbretta*				✓		0	5.26	Improbable			✓		✓						
25	Black Harrier	*Circus maurus*	VU	EN	N-End	✓	✓	0	11.11	Low	✓		✓				✓	✓			
26	Black-headed Heron	*Ardea melanocephala*				✓		0	5.26	Low	✓		✓		✓						✓
27	Grey Heron	*Ardea cinerea*				✓		0	31.58	Improbable			✓		✓						✓
28	African Sacred Ibis	*Threskiornis aethiopicus*				✓		0	7.69	Improbable			✓		✓						✓
29	Glossy Ibis	*Plegadis falcinellus*				✓		0	5.26	Improbable			✓		✓						✓

Table 3: continued…

	Name	Scientific name	Status International	Status National	Endemic - South Africa	Waterbird	Raptor	SABAP2 (Reporting rate)	SABAP 1 (Reporting rate)	Probability of occurrence	Savanna	Water troughs	Epehemeral rivers	High voltage lines	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Drowning	Entrapment in fences	Powerline electrocutions	Powerline collisions
30	Greater Kestrel	*Falco rupicoloides*					✓	30.77	11.54	High	✓	✓		✓	✓	✓		✓			
31	Lesser Kestrel	*Falco naumanni*					✓	0	5.26	Low	✓			✓		✓		✓			
32	Rock Kestrel	*Falco rupicolus*					✓	7.69	20	Medium	✓	✓		✓	✓	✓		✓			
33	Malachite Kingfisher	*Alcedo cristata*				✓		0	7.69	Improbable			✓		✓						
34	Black-shouldered Kite	*Elanus caeruleus*					✓	14.29	10.71	High	✓	✓		✓	✓	✓		✓			
35	Yellow-billed Kite	*Milvus aegyptius*					✓	0	11.11	Medium	✓	✓		✓	✓	✓		✓			
36	Blacksmith Lapwing	*Vanellus armatus*				✓		37.84	28.57	Low			✓		✓			✓			
37	Cape Clapper Lark	*Mirafra apiata*			N-End			7.69	10.71	Medium	✓	✓				✓	✓	✓			
38	Common Moorhen	*Gallinula chloropus*				✓		0	15.38	Improbable			✓		✓						
39	Black-crowned Night-Heron	*Nycticorax nycticorax*				✓		0	5.26	Improbable			✓		✓						✓
40	Pearl-spotted Owlet	*Glaucidium perlatum*					✓	33.33	13.16	Medium	✓					✓	✓				
41	Three-banded Plover	*Charadrius tricollaris*				✓		0	19.23	Improbable			✓		✓						
42	European Roller	*Coracias garrulus*	LC	NT				4.76	11.11	Low	✓					✓	✓	✓			
43	Ruff	*Philomachus pugnax*				✓		0	5.26	Improbable			✓		✓						✓
44	Common Sandpiper	*Actitis hypoleucos*				✓		0	5.26	Improbable			✓		✓						✓
45	Wood Sandpiper	*Tringa glareola*				✓		0	28.57	Improbable			✓		✓						✓
46	Secretarybird	*Sagittarius serpentarius*	VU	VU			✓	0	0	Medium	✓	✓	✓			✓	✓		✓		✓
47	South African Shelduck	*Tadorna cana*				✓		4.76	0	Improbable			✓		✓						✓
48	Shikra	*Accipiter badius*					✓	0	11.11	Low	✓	✓			✓	✓	✓	✓			
49	Black-chested Snake-Eagle	*Circaetus pectoralis*					✓	0	14.29	Medium	✓	✓		✓		✓	✓	✓			
50	African Snipe	*Gallinago nigripennis*				✓		0	7.69	Improbable			✓		✓						✓
51	African Spoonbill	*Platalea alba*				✓		0	10.53	Improbable			✓		✓						✓
52	Pied Starling	*Lamprotornis bicolor*			End			2.7	10	Low	✓	✓				✓		✓			
53	Black Stork	*Ciconia nigra*	LC	VU		✓		0	5.26	Improbable	✓		✓	✓							✓
54	Red-billed Teal	*Anas erythrorhyncha*				✓		7.69	11.54	Improbable			✓		✓						✓
55	Karoo Thrush	*Turdus smithi*			N-End			21.62	0	Medium	✓	✓				✓	✓	✓			
56	Lappet-faced Vulture	*Torgos tracheliotos*	EN	EN			✓	7.69	0	Low	✓	✓				✓	✓	✓		✓	
57	White-backed Vulture	*Gyps africanus*	CR	CR			✓	15.38	0	Medium	✓	✓				✓	✓	✓		✓	
58	Orange River White-eye	*Zosterops pallidus*			N-End			14.29	0	Medium	✓					✓	✓	✓			

6.7 Impacts of solar PV facilities and associated infrastructure on avifauna

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006 WWF Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth, J. & Mallon, K. 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change;
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers bird species at risk of extinction, with estimates of extinction rates varying from 2 to 72%, depending on the region, climate scenario and potential for birds to shift to new habitat.

Using statistical models based on the North American Breeding Bird Survey and Audubon Christmas Bird Count datasets, the National Audubon Society assessed geographic range shifts through the end of the century for 588 North American bird species during both the summer and winter seasons under a range of future climate change scenarios (National Audubon Society 2015). Their analysis showed the following:

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, loss occurs without accompanying range expansion.
- For 188 species, loss is coupled with the potential to colonize new areas.

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi *et al*. 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, one unpublished scientific study has been completed on the impacts of PV plants in a South African context (Visser 2016).

In summary, the potential impacts of PV plants on avifauna which have emerged so far include the following:

- Displacement due to disturbance and habitat transformation associated with the construction of the solar PV plant and associated infrastructure;
- Collisions with the solar panels;
- Entrapment in perimeter fences;
- Collisions with the associated power lines; and
- Electrocutions on the associated power lines.

6.7.1 Impacts associated with PV plants

6.7.1.1 Impact trauma (collisions)

This impact refers to collision-related fatality i.e. fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al*. 1986; Hernandez *et al*. 2014; Kagan *et al*. 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.

Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space. Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called "lake effect" i.e. it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue photovoltaic panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan et al. 2014)[4].

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013 – 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feathers spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions.

In a report by the National Fish and Wildlife Forensic Laboratory (Kagan et al. 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the, 550 MW, 1 600ha Desert Sunlight PV plant. The results of the investigation are tabled below in Table 4:

Table 4: Comparison of avian mortality causes at the Desert Sunlight PV plant (Kagan *et al.* 2014).

[4] This could either result in birds colliding directly with the solar panels, or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g. grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

Cause of death	550 MW Desert Sunlight PV
Solar flux	0
Impact trauma	19
Predation trauma	15
Trauma of undetermined causes	0
Electrocution	0
Emaciation	0
Undetermined (remains in poor condition)	22
No evident cause of death	5
Total	61

Impact trauma emerge as the highest identifiable cause of avian mortality, , but most mortality could not be traced to an identifiable cause.

Walston *et al*. 2015 conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility (44%) may support the "lake effect" hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al*. 2015). However, until such time that enough scientific evidence have been collected to discount the "lake effect" hypothesis, it must be considered as a potential source of impacts.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96 MW Jasper PV solar facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30 km east of Postmasburg in the Northern Cape Province (Visser 2016). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare surveyed per month. All fatalities were inferred from feather spots. The study concluded inter alia that the short study period, and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation and analysis of data from solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser 2016).

It is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

6.7.1.2 Entrapment in perimeter fences

Visser (2016) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. red-crested korhaan *Lophotis ruficrista*) (Visser 2016). Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems likely that the birds panicked when they were approached by observers and thus flew into the fence.

6.7.1.3 Displacement due to disturbance and habitat transformation associated with the construction of the solar PV facility

Ground-disturbing activities affect a variety of processes in arid areas, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the desert landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

The activities listed below are typically associated with the construction and operation of solar facilities and could have direct impacts on avifauna (County of Merced 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;
- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Increased vehicle traffic;
- Short-term construction-related noise (from equipment) and visual disturbance;
- Degradation of water quality in drainages and other water bodies resulting from project runoff;
- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging and roosting in or in close proximity through disturbance and transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault et al. (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser (2016) gathered bird transect data at the 180 hectares, 96 MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. She found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. Her most significant finding was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by its development (Visser 2016).

It is highly likely that the same pattern of reduced avifaunal densities and possible changes in densities and composition favouring grassland species will manifest itself at the proposed Hotazel Solar Park PV Facility.

6.7.2 Impacts associated with powerlines

6.7.2.1 Electrocutions

Negative impacts on birds by electricity infrastructure generally take two forms namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). Birds also impact on the infrastructure through nesting and streamers, which can cause interruptions in the electricity supply (Van Rooyen *et al.* 2002).

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. The tower design likely to be proposedfor this project is the steel monopole (see Appendix 3).

Clearance between phases on the same side of the staggered vertical steel 132kV monopole structure is approximately 2.2m for this type of design, and the clearance on strain structures is 1.8m. The length of the stand-off insulators is approximately 1.6m. This clearance should be sufficient to reduce the risk of phase – phase electrocutions of birds on the towers to negligible for all species except vultures. If vultures attempt to perch on the stand-off insulators, they are potentially able to touch both the conductor and the earthed pole simultaneously potentially resulting in a phase – earth electrocution. This is particularly likely when more than one bird attempts to sit on the same pole, which may happen with vultures. Vultures are unlikely to occur regularly within the study area, but sporadic occurrence cannot be ruled out. The only envisaged high risk scenario would be when a carcass becomes available within a few hundred metres of the line, attracting vultures which may cluster on a few poles. This is likely to be a very rare event in the study area. Furthermore, there are several other higher high voltage lines in the study area which offers a more attractive perching and roosting substrate, due to their height and design.

In summary, it is concluded that the risk of electrocution posed to avifauna by the steel monopole design is likely to be very limited and restricted to vultures, but it cannot be ruled out entirely.

6.7.2.2 Collisions

Collisions are probably the bigger threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). In a recent PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).
Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994)."

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see **Figure 8** below - Jenkins *et al.* 2010).

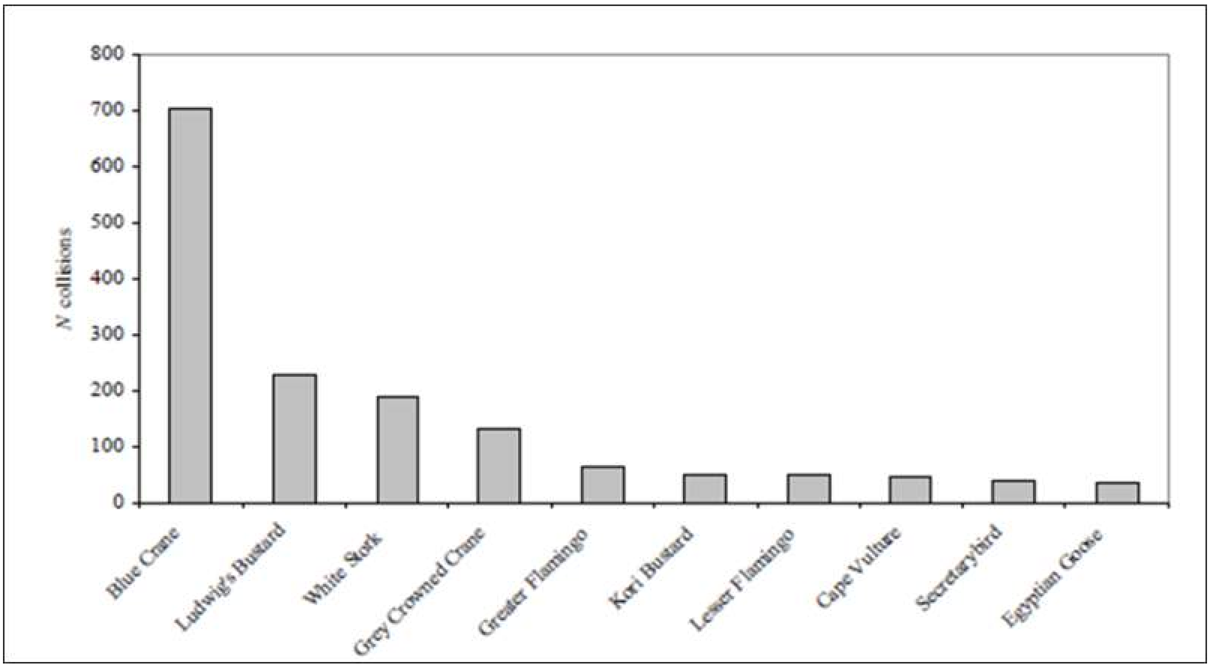

Figure 8: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2008 (Jenkins *et al.* 2010)

Power line collisions are generally accepted as a key threat to bustards (Raab *et al.* 2009; Raab *et al.* 2010; Jenkins & Smallie 2009; Barrientos *et al.* 2012, Shaw 2013). In a recent study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw 2013).

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia*. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (Accipitridae) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to power line collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al.* 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al.* 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced ≤ 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al.* (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

6.7.2.3 Displacement due to habitat destruction and disturbance associated with the construction of the powerlines and substation

During the construction phase and maintenance of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the substation and power line servitudes through transformation of habitat, which could result in temporary or permanent displacement.

Apart from direct habitat destruction, the above-mentioned construction and maintenance activities also impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests.

7 Assessment of the proposed Hotazel Solar Park PV Facility

7.1.1 Displacement due to disturbance associated with the construction and de-commissioning of the solar plant and associated infrastructure (construction and de-commissioning)

The construction (and de-commissioning) of the PV plant and associated infrastructure (roads, substation, battery storage facility, office buildings, workshops, storage areas, pipeline and ablution facilities) will result in a significant amount of movement and noise, which will lead to displacement of avifauna from the site. It is highly likely that most priority species listed in Table 3, if on site, will vacate the area for the duration of these activities, irrespective of which combination of alternatives are implemented.

7.1.2 Displacement due to habitat transformation associated with the PV plant and associated infrastructure (operation)

The construction of the PV plant and associated infrastructure will result in the radical transformation of the existing natural habitat. The vegetation will be cleared prior to construction commencing. Once operational, less sunlight will reach the vegetation below the solar panels, which is likely to result in stunted vegetation growth and possibly complete eradication of some plant species. The natural vegetation is likely to persist in the rows between the solar panels, but it will be different to what was available before the construction of the plant, in that it will be short grassland with few (if any) shrubs. Small to medium-sized birds are often capable of surviving in small pockets of suitable habitat, and are therefore generally less affected by habitat fragmentation than larger species. It is, therefore, possible that many of the smaller and medium-sized priority species (e.g. passerines and francolins) will continue to use the habitat available within the solar facility, albeit at highly reduced densities for some, especially as far as shrubland specialists are concerned. Larger priority species which require contiguous, un-fragmented tracts of suitable habitat (e.g. large raptors, korhaans and bustards) are likely to occur at vastly reduced densities in the proposed plant, or may even be totally displaced. In the case of some priority raptors (e.g. Southern Pale Chanting Goshawk, Lanner Falcon and Pygmy Falcon) the potential availability of carcasses or injured birds due to collisions with the solar panels, and enhanced prey visibility (e.g. insects, reptiles and rodents) in the short grassland between the solar panels may attract them to the area. Table 3 lists the priority species that could potentially be affected by displacement due to habitat transformation.

7.1.3 Collisions with the solar panels (operation)

The priority species that may possibly occur in the development area which could potentially be exposed to collision risk are listed in Table 3. In addition, the so-called "lake effect" could act as a potential attraction to waterbirds. It is not possible to tell whether this will happen until post-construction monitoring reveals actual mortality at the site, but the lack of major waterbodies with large waterbird populations in close vicinity to the proposed development area decreases the probability of the lake effect being a major source of mortality.

7.1.4 Entrapment in perimeter fences

Large-bodied priority such as Kori Bustard, Ludwig's Bustard and Secretarybird may be vulnerable to entrapment between double perimeter fences. Apart from these priority species, several non-priority species such as Red-crested Korhaan and Northern Black Korhaan *Afrotis afraoides* may also be vulnerable to this impact. The possibility of using a single perimeter fence should be investigated. Alternatively, the two fences should be placed far apart enough for birds to able to take off if they somehow end up between the two fences. In addition, staff should be sensitised to not panic birds when they discover them trapped between the fences bit to approach them with caution to give them time to escape by taking off in a lengthwise direction.

7.1.5 Other impacts

Cape Sparrows *Passer melanurus*, Laughing Doves *Spilopelia senegalensis* and other small birds will very likely attempt to nest underneath the solar panels to take advantage of the shade, but this should not adversely affect the operation of the equipment. The support frames and structures below the panels are probably too low for Sociable Weavers to nest on them. However, the telecommunications tower could be an attractant to the weavers due to its height – it would therefore be advisable not to use a lattice-type design but rather a monopole as it would provide less opportunity for the birds to construct a nest.

Another impact that could potentially materialise is the pollution of the solar panels by large birds defecating on them, particularly Pied Crows and raptors, if they regularly perch on the panels. It is expected that the regular cleaning and maintenance activities should prevent this from becoming a problem.

7.2 Assessment of the associated powerlines

7.2.1 Electrocutions

Clearance between phases on the same side of the staggered vertical steel 132kV monopole structure is approximately 2.2m for this type of design, and the clearance on strain structures is 1.8m. The length of the stand-off insulators is approximately 1.6m. This clearance should be sufficient to reduce the risk of phase – phase electrocutions of birds on the towers to negligible for all species except vultures. If vultures attempt to perch on the stand-off insulators, they are potentially able to touch both the conductor and the earthed pole simultaneously potentially resulting in a phase – earth electrocution. This is particularly likely when more than one bird attempts to sit on the same pole, which may happen with vultures. Vultures are unlikely to occur regularly within the study area, but sporadic occurrence cannot be ruled out. The only envisaged high risk scenario would be when a carcass becomes available within a few hundred metres of the line, attracting vultures which may cluster on a few poles. This is likely to be a very rare event in the study area. Furthermore, there are several other higher high voltage lines in the study area which offers a more attractive perching and roosting substrate, due to their height and design.

In summary, it is concluded that the risk of electrocution posed to avifauna by the steel monopole design is likely to be very limited and restricted to vultures, but it cannot be ruled out entirely.

7.2.2 Collisions

See Table 3 for potential candidates for collision mortality in the general woodland habitat on the proposed power line. Collisions are likely to be few and far between, as there are no specific areas where one would expect a concentration of birds in the woodland habitat. Vultures would be most at risk of collision if they descend to a carcass near the line. This is not likely to be a regular event, given the fact that the occurrence of vultures is likely to be the exception rather than the rule. Furthermore, all the alignments are all situated close to busy roads with considerable vehicle and pedestrian traffic, which acts as a natural deterrent to Red Data powerline sensitive species.

There is a potential collision risk associated with the ephemeral Ga-Mogara River where it is expected that waterbirds could commute up and down the drainage line when it is flowing or when it contains large pools of standing water, and raptors and vulture could descend to pools in the river to drink and bath. This risk is specifically associated with the Umtu TX corridor which crosses the river near the Umtu Substation.

Overall, the risk of priority species colliding with the proposed powerline is low. In the case of the Umtu TX corridor, the risk is higher, but still low because the river is mostly dry.

7.2.3 Displacement due to habitat destruction and disturbance associated with the construction of the powerlines and substation

During the construction phase and maintenance of power lines, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads and the clearing of servitudes. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the substation and power line servitudes through transformation of habitat, which could result in temporary or permanent displacement.

The biggest potential impact would be the removal of large trees that could potentially serve as nesting substrate for large Red Data raptors such as Martial Eagle (and many other non-threatened avifauna), but it is noted that reporting rates for large raptors are very low, and that the area where the proposed alignments is situated contains very few (if any) suitable trees. Furthermore, the proximity of many roads and mining operations makes it unlikely that large raptors will breed in the area where the proposed alignments are situated, due to potential disturbance linked to high levels of pedestrian and vehicle traffic. The proposed construction of the new power line should therefore have a very limited habitat transformation impact from an avifaunal perspective. The removal of vegetation in the line servitude will potentially impact smaller woodland priority species, but the impact will highly localised and should not affect any Red Data species.

Apart from direct habitat destruction, the above-mentioned construction and maintenance activities also impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities near a nest could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. The low reporting rates for Red Data species in the study area are an indication that they are not regularly utilising the area for breeding, for reasons already stated. The potential impact of disturbance is therefore likely to be very limited as far as Red Data species are concerned. The impact on smaller non-Red Data species will be highly localised and temporary.

7.3 Impact Rating Criteria

For purposes of the EIA phase, a simplified rating exercise was performed to arrive at a preferred alternative that was, together with inputs from other specialists, used to identify a preferred alternative to be taken forward into the EIA phase for detailed assessment. Alternative A4 and Alternative B2 have emerged as the preferred alternatives to be comparatively assessed in the impact assessment phase against the "no go" alternative.

7.3.1 Method for Assessing the Significance of Potential Impacts

This section outlines the proposed method for assessing the significance of the potential environmental impacts. For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** (severity of impact) and **DURATION** (time scale) are described.

These criteria are used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.[1]

The tables below indicate the scale used to assess these variables, and defines each of the rating categories.

Table 5 | Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	Regional	Beyond a 10km radius of the proposed site.
	Local	Within a 10km radius of the proposed site.
	Site specific	On site or within 100m of the proposed site.
Magnitude of impact (at the indicated spatial scale)	High	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered

[1] The proponent will be requested to indicate at the Final Assessment stage which alternative and mitigation measures they are prepared to implement.

CRITERIA	CATEGORY	DESCRIPTION
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	Construction period	Up to 1 year
	Short Term	Up to 3 years after construction
	Medium Term	3-10 years after construction
	Long Term	More than 10 years after construction

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table 6.

Table 6 | Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	▪ High magnitude with a regional extent and long term duration ▪ High magnitude with either a regional extent and medium term duration or a local extent and long term duration ▪ Medium magnitude with a regional extent and long term duration
Medium	▪ High magnitude with a local extent and medium term duration ▪ High magnitude with a regional extent and construction period or a site specific extent and long term duration ▪ High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration ▪ Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Low magnitude with a regional extent and long term duration
Low	▪ High magnitude with a site specific extent and construction period duration ▪ Medium magnitude with a site specific extent and construction period duration ▪ Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Very low magnitude with a regional extent and long term duration
Very low	▪ Low magnitude with a site specific extent and construction period duration ▪ Very low magnitude with any combination of extent and duration except regional and long term
Neutral	▪ Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring as well as the **CONFIDENCE** in the assessment of the impact would be determined using the rating systems outlined in Table 7 and Table 8, respectively.

It is important to note that the significance of an impact should always be considered in conjunction with the probability of that impact occurring. Lastly, the **REVERSIBILITY** of the impact is estimated using the rating system outlined in Table 9.

Table 7 | Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 8 | Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 9 | Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

Table 10 | Definition of irreplaceability ratings

IRREPLACEABILITY RATINGS	CRITERIA
Low	The affected resource is not unique and or does not serve an critical function or is degraded
Medium	The affected resource is moderately important in terms of uniqueness and function or in pristine condition
High	The affected resource is important in terms of uniqueness and function and or in pristine condition and warrants conservation / protection

7.4 Impact Tables

7.4.1 PV site

Displacement due to disturbance: PV site				
Construction phase				
	Preferred Alternative		No Go Alternative	
Short description	Displacement of priority avifauna due to disturbance associated with the construction of the solar plant and associated infrastructure (construction and de-commissioning)		The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative		
Duration	Short term	Short term		
Extent	Site specific	Site specific		
Magnitude	High	Medium		
Probability	Probable	Probable		
Confidence	Sure	Sure		
Reversibility	Reversible	Reversible		
Resource irreplaceability	Low	Low		
Mitigatability	Low	Low		
Significance	Medium	Medium		
Mitigation	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.			
Cumulative Impact assessment	The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha. The combined footprint of the proposed renewable projects and the existing mining operations comes to about 6 680 ha. This constitutes approximately 2.3% of the available habitat within the 30km radius. The overall cumulative impact of the renewable energy projects, when considered together with mining and overgrazing in terms of displacement of priority avifauna due to habitat destruction and disturbance is therefore rated as Low.			

<table>
<tr><th colspan="5">Displacement due to habitat destruction: PV site</th></tr>
<tr><th colspan="5">Operational phase</th></tr>
<tr><th></th><th colspan="2">Preferred Alternative</th><th colspan="2">No Go Alternative</th></tr>
<tr><td>Short description</td><td colspan="2">Displacement due to habitat transformation associated with the PV plant and associated infrastructure</td><td colspan="2">The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained.</td></tr>
<tr><th colspan="5">Assessment</th></tr>
<tr><th></th><th>Pre-Mitigation</th><th>Post Mitigation</th><th>Pre-Mitigation</th><th>Post Mitigation</th></tr>
<tr><td>Nature</td><td>Negative</td><td>Negative</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Duration</td><td>Long term</td><td>Long term</td><td></td><td></td></tr>
<tr><td>Extent</td><td>Site specific</td><td>Site specific</td><td></td><td></td></tr>
<tr><td>Magnitude</td><td>High</td><td>Medium</td><td></td><td></td></tr>
<tr><td>Probability</td><td>Probable</td><td>Probable</td><td></td><td></td></tr>
<tr><td>Confidence</td><td>Unsure</td><td>Unsure</td><td></td><td></td></tr>
<tr><td>Reversibility</td><td>Irreversible</td><td>Irreversible</td><td></td><td></td></tr>
<tr><td>Resource irreplaceability</td><td>High</td><td>High</td><td></td><td></td></tr>
<tr><td>Mitigatability</td><td>Low</td><td>Low</td><td></td><td></td></tr>
<tr><td>Significance</td><td>High</td><td>Medium</td><td></td><td></td></tr>
<tr><td>Mitigation</td><td colspan="4">• The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of transformed areas is concerned.
• Formal operational phase monitoring should be implemented for one year once the solar panels have been constructed to assess the extent of the displacement of priority species.
• Depending on the severity of the displacement and the species involved, the avifaunal specialist must engage with the management of the facility to discuss ways of reducing the impact of the displacement, including possible vegetation management to enhance the habitat for priority species, if and where possible.</td></tr>
<tr><td>Cumulative Impact assessment</td><td colspan="4">The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha. The combined footprint of the proposed renewable projects and the existing mining operations comes to about 6 680 ha. This constitutes approximately 2.3% of the available habitat within the 30km radius. The overall cumulative impact of the renewable energy projects, mining and overgrazing in terms of displacement of priority avifauna due to habitat destruction and disturbance is therefore rated as Low.</td></tr>
</table>

Collisions with the solar panels: PV site				
Operational phase				
	Preferred Alternative		No Go Alternative	
Short description	Collisions with the solar panels resulting in the mortality of priority species.		The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained.	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	n/a	n/a
Duration	Long term	Long term		
Extent	Site specific	Site specific		
Magnitude	Low	Very low		
Probability	Probable	Probable		
Confidence	Unsure	Unsure		
Reversibility	Reversible	Reversible		
Resource irreplaceability	Low	Low		
Mitigatability	Medium?	Medium?		
Significance	Low	Very low		
Mitigation	• Formal operational phase monitoring should be implemented for one year once the solar panels have been constructed. This should be supplemented with monthly carcass searches to search the ground between solar panels. • Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, at the time. What is considered to be significant will have to be established on a species-specific basis by the avifaunal specialist, in consultation with BirdLife South Africa. • The exact protocol to be followed for the carcass searches and operational phase monitoring must be compiled by the avifaunal specialist in consultation with the plant operator before the commencement of operations.			
Cumulative Impact assessment	The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha, which comes to less than 1% of the available habitat. The overall cumulative impact of the proposed renewable energy projects in terms of mortality of priority avifauna due to collision with the PV panels is therefore rated as Low**.**			

Entrapment in perimeter fences: PV site				
Operational phase				
	Preferred Alternative		No Go Alternative	
Short description	Entrapment in perimeter fences resulting in the mortality of priority species.		The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained.	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	n/a	n/a
Duration	Long term	Long term		
Extent	Local	Local		
Magnitude	Very low	Very low		
Probability	Probable	Unlikely		
Confidence	Unsure	Unsure		
Reversibility	High	High		
Resource irreplaceability	Low	Low		
Mitigatability	High	High		
Significance	Low	Very low		
Mitigation	A single perimeter fence should be used. Alternatively, the two fences should be at least 4 metres apart to allow medium to large birds enough space to take off.			
Cumulative Impact assessment	The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha, which comes to less than 1% of the available habitat. The overall cumulative impact of the proposed renewable energy projects in terms of mortality of priority avifauna due to entrapment in perimeter fences is therefore rated as Low.			

<table>
<tr><th colspan="5">Displacement due to disturbance: PV site</th></tr>
<tr><th colspan="5">Decommissioning phase</th></tr>
<tr><th></th><th colspan="2">Preferred Alternative</th><th colspan="2">No Go Alternative</th></tr>
<tr><td>Short description</td><td colspan="2">The de-commissioning of the PV plant and associated infrastructure will result in a significant amount of movement and noise, which will lead to displacement of avifauna from the site due to disturbance. It is highly likely that most priority species will vacate the area</td><td colspan="2">The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained.</td></tr>
<tr><th colspan="5">Assessment</th></tr>
<tr><th></th><th>Pre-Mitigation</th><th>Post Mitigation</th><th>Pre-Mitigation</th><th>Post Mitigation</th></tr>
<tr><td>Nature</td><td>Negative</td><td>Negative</td><td></td><td></td></tr>
<tr><td>Duration</td><td>Short term</td><td>Short term</td><td></td><td></td></tr>
<tr><td>Extent</td><td>Site specific</td><td>Site specific</td><td></td><td></td></tr>
<tr><td>Magnitude</td><td>High</td><td>Medium</td><td></td><td></td></tr>
<tr><td>Probability</td><td>Probable</td><td>Probable</td><td></td><td></td></tr>
<tr><td>Confidence</td><td>Sure</td><td>Sure</td><td></td><td></td></tr>
<tr><td>Reversibility</td><td>Reversible</td><td>Reversible</td><td></td><td></td></tr>
<tr><td>Resource irreplaceability</td><td>Low</td><td>Low</td><td></td><td></td></tr>
<tr><td>Mitigatability</td><td>Low</td><td>Low</td><td></td><td></td></tr>
<tr><td>Significance</td><td>Low</td><td>Low</td><td></td><td></td></tr>
<tr><td>Mitigation</td><td colspan="4">• Activity should be restricted to the immediate footprint of the infrastructure.
• Measures to control noise and dust should be applied according to current best practice in the industry.
• Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
• The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the footprint and rehabilitation of disturbed areas is concerned.</td></tr>
<tr><td>Cumulative Impact assessment</td><td colspan="4">The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha. The combined footprint of the proposed renewable projects and the existing mining operations comes to about 6 680 ha. This constitutes approximately 2.3% of the available habitat within the 30km radius. The overall cumulative impact of the renewable energy projects, mining and overgrazing in terms of displacement of priority avifauna due to habitat destruction and disturbance is therefore rated as Low.</td></tr>
</table>

7.4.2 Powerlines

Electrocutions: Powerlines								
Operational phase								
	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	Electrocution of priority species on the proposed 132kV powerline		Electrocution of priority species on the proposed 132kV powerline		Electrocution of priority species on the proposed 132kV powerline		The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	N/a	N/a
Duration	Long term	Long term	Long term	Long term	Long term	Long term		
Extent	Regional	Regional	Regional	Regional	Regional	Regional		
Magnitude	High	High	High	High	High	High		
Probability	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely		
Confidence	Sure	Sure	Sure	Sure	Sure	Sure		
Reversibility	Low	Low	Low	Low	Low	Low		
Resource irreplaceability	High	High	High	High	High	High		
Mitigatability	High	High	High	High	High	High		
Significance	Low	Very Low	Low	Very Low	Low	Very Low		
Mitigation	An Eskom approved bird friendly pole design will be used (APPENDIX 3). In addition, if a monopole structure is used, as this report has assumed, a Bird Perch must be installed on top of all poles, to provide safe perching substrate for birds well above the dangerous hardware.							
Cumulative Impact assessment	There are hundreds of kilometres of 11kV and 22kV MV lines in the 30km radius around Hotazel. It is not known how bird-friendly these lines are, but it can be assumed that there are bird unfriendly lines which are electrocuting birds, especially large raptors and vultures. However, the proposed 132kV line will not pose an electrocution risk to vultures if fitted with a bird perch as recommended, therefore the cumulative impact of the powerline in terms of potential electrocutions of priority species is rated to be **Low**.							
Conclusion:	The TX LILO line is the preferred option as it is the shortest in length.							

Collisions: Powerlines								
Operational phase								
	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	Collisions of priority species with the earthwire of the proposed line		Collisions of priority species with the earthwire of the proposed line		Collisions of priority species with the earthwire of the proposed line		The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	N/a	N/a
Duration	Long term	Long term	Long term	Long term	Long term	Long term		
Extent	Local	Local	Local	Local	Local	Local		
Magnitude	High	High	High	High	High	High		
Probability	Probable	Unlikely	Probable	Unlikely	Probable	Unlikely		
Confidence	Sure	Sure	Sure	Sure	Sure	Sure		
Reversibility	Low	Low	Low	Low	Low	Low		
Resource irreplaceability	High	High	High	High	High	High		
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium		
Significance	Low	Very Low	Low	Very Low	Low	Very Low		
Mitigation	• An avifaunal specialist must conduct a site walk through of final pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required. • Install bird flight diverters as per the instructions of the specialist following the site walkthrough. • The operational monitoring programme must include regular monitoring of the grid connection power line for collision mortalities.							
Cumulative Impact assessment	The current HV powerline network is extensive with several hundred kilometres of HV line present within the 30km radius around Hotazel, mostly linked to mining activity. The level of collision mortality on these lines is unknown, but it can be assumed that it is a regular occurrence. However, the short length of the proposed 132kV line should limit the potential for collision mortality, especially if properly mitigated with Bird Flight Diverters. The cumulative impact of the powerline in terms of potential collision mortality of priority species is therefore rated to be Low.							
Conclusion:	The TX LILO line is the preferred option as it is the shortest in length.							

Displacement due to disturbance and habitat destruction: Powerlines								
Construction phase								
	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	Displacement of priority species due to disturbance and habitat destruction associated with the construction of the powerlines		Displacement of priority species due to disturbance and habitat destruction associated with the construction of the powerlines		Displacement of priority species due to disturbance and habitat destruction associated with the construction of the powerlines		The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	N/a	N/a
Duration	Long term	Long term	Long term	Long term	Long term	Long term		
Extent	Site specific	Site specific	Site specific	Site specific	Site specific	Site specific		
Magnitude	Low	Low	Low	Low	Low	Low		
Probability	Probable	Unlikely	Probable	Unlikely	Probable	Unlikely		
Confidence	Sure	Sure	Sure	Sure	Sure	Sure		
Reversibility	Reversible to some extent	Reversible to some extent	Reversible to some extent	Reversible to some extent	Reversible to some extent	Reversible to some extent		
Resource irreplaceability	Low	Low	Low	Low	Low	Low		
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium		
Significance	Low	Very low	Low	Very low	Low	Very low		
Mitigation	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. • Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of priority species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.								
Cumulative Impact assessment	The extensive powerline and road network within the 30km radius around Hotazel has led to extensive fragmentation of the natural habitat. The fragmentation of the habitat has an impact that exceeds the mere physical footprint of the infrastructure. However, the short length of the proposed powerline should limit the cumulative impact of displacement due to disturbance and habitat destruction. This impact is therefore rated as Low.								
Conclusion:	The TX LILO line is the preferred option as it is the shortest in length.								

7.5 Cumulative impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore need to considered for all renewable energy developments (wind and solar) within a 30-km radius of the proposed site. Developments that were considered here include:

- Developments currently undergoing an EIA process;
- Developments which have received Environmental Authorisation; and

- Developments under construction or in existence.

Table 8 below sets out the renewable energy developments currently registered with DEA in a 30km radius around the development:

Table 8 | Renewable energy developments within a 30km radius around Hotazel

Proposed Development	DEA Reference	Current Status of Project	Capacity	Footprint	Mitigation for impacts on avifauna
Proposed Rhodes Two Solar Park PV project	14/12/16/3/3/2/615	Approved	75MW	210 ha	None stated
Proposed East Solar Park PV project	14/12/16/3/3/2/664	In process	75MW	180 ha	Could not source EIA report
Proposed Adams PV Solar project	12/12/20/2567	Approved	150MW	555 ha	None stated
Proposed Shirley PV Solar project	14/12/16/3/3/2/616	Approved	75MW	210 ha	None stated
Proposed Perth – Kuruman PV Solar Project	14/12/16/3/3/2/761	In process	75MW	130 ha	None stated

Currently there is no agreed method for determining significant adverse cumulative impacts on ornithological receptors. The Scottish Natural Heritage (2005) recommends a five-stage process to aid in the ornithological assessment:

- Define the species/habitat to be considered;
- Consider the limits or 'search area' of the study;
- Decide the methods to be employed;
- Review the findings of existing studies; and
- Draw conclusions of cumulative effects within the study area.

Table 9 below sets out the criteria applied to rank potential cumulative impacts.

Table 9: Framework for assessing significance of cumulative effects.

Significance	Effect
Severe	Effects that the decision-maker must consider because the receptor/resource is irretrievably compromised, resulting in a fatal flaw.
Major	Effects that may become a key decision-making issue, potential fatal-flaw.
Moderate	Effects that are unlikely to affect the viability of the project, but mitigation might be required.
Minor	Effects which might be locally/site significant, but probably insignificant for the greater study area.
Not Significant	Effects that are within the ability of the resource to absorb such change both at local/site level and within the greater study area.

7.5.1 Current impacts on avifauna

In the current instance, not all the criteria proposed above by the Scottish Natural Heritage can be met in assessing the cumulative impact of the proposed solar PV facility. In the absence of comprehensive scientifically verified data, general knowledge and experience will have to suffice. The following impacts on avifauna can reasonably be assumed in the greater area:

- Overgrazing results in degradation of habitat, potentially reducing populations of wide-ranging species such as bustards, which depend on large foraging areas.
- Extensive opencast mining activities in the area lead to habitat loss, disturbance and high levels of dust pollution. The current footprint of mining activities in the 30km radius area is approximately 5 525 ha.

- Invasive alien plants are a continuing threat, especially along drainage lines.
- Historically, poisons were used extensively in the region to control damage-causing predators, such as Black-backed Jackal *Canis mesomelas* and Caracal *Caracal caracal*. Poison use may be continuing in the surrounding livestock farming areas, but is likely to be at a lower level than previously. The potential impacts of poison use on several threatened raptor species has not been quantified.
- Ludwig's Bustard, and Kori Bustard are killed through collisions with the existing powerline network. The extent of this mortality factor is unknown, but it can be assumed that it is a regular occurrence (Shaw 2013). The current HV powerline network is extensive with several hundred kilometres of HV line present within the 30km radius around Hotazel, mostly linked to mining activity.

7.5.2 The cumulative impact of the proposed Hotazel Solar Park PV Facility on avifauna

7.5.2.1 Displacement of priority species due to habitat transformation and disturbance

The difficulties associated with the quantification of cumulative impacts of the renewable energy facilities have already been explained above. The current dominant land use, namely stock farming, is not displacing any priority species although it may be that periodic overgrazing might have an impact on the habitat and therefore the densities of some species. However, that cannot be categorically confirmed without more research. The current footprint of mining activities in the 30km radius area is approximately 5 525 ha.

The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 285 ha, which amounts to less than 1% of the available habitat within the 30km radius. The combined footprint of the proposed renewable projects and the existing mining operations comes to about 6 810 ha. This constitutes approximately 2.4% of the available habitat within the 30km radius. The overall cumulative impact of the renewable energy projects, mining and overgrazing in terms of displacement of priority avifauna due to habitat destruction and disturbance is therefore rated as **Low**.

7.5.2.2 Potential mortality due to collisions with the proposed photovoltaic panels

Collisions with the solar PV panels are a possible threat to priority species known to potentially occur at the development area. The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha, which comes to less than 1% of the available habitat. The overall cumulative impact of the proposed renewable energy projects in terms of mortality of priority avifauna due to collision with the PV panels is therefore rated as **Low**.

7.5.2.3 Entrapment in perimeter fences

Entrapment in perimeter fences is a possible threat to priority species known to potentially occur at the development area. The combined footprint of the proposed renewable projects in the 30km radius around Hotazel comes to about 1 155 ha, which comes to less than 1% of the available habitat. The overall cumulative impact of the proposed renewable energy projects in terms of mortality of priority avifauna due to entrapment in perimeter fences is therefore rated as **Low**.

7.5.3 The cumulative impact of the proposed 132kV powerline associated with the Hotazel PV facility

7.5.3.1 Electrocutions of priority avifauna

There are hundreds of kilometres of 11kV and 22kV MV lines in the 30km radius around Hotazel. It is not known how bird-friendly these lines are, but it can be assumed that there are bird unfriendly lines which are electrocuting birds, especially large raptors and vultures. However, the proposed 132kV line will not pose an electrocution risk to vultures if fitted with a bird perch as recommended, therefore the cumulative impact of the powerline in terms of potential electrocutions of priority species is rated to be **Low**.

7.5.3.2 Collision mortality of priority avifauna

The current HV powerline network is extensive with several hundred kilometres of HV line present within the 30km radius around Hotazel, mostly linked to mining activity. The level of collision mortality on these lines is unknown, but it can be assumed that it is a regular occurrence. However, the short length of the proposed 132kV line should limit the potential for collision mortality, especially if properly mitigated with Bird Flight Diverters. The cumulative impact of the powerline in terms of potential collision mortality of priority species is therefore rated to be **Low**.

7.5.3.3 Displacement due to disturbance and habitat destruction

The extensive powerline and road network within the 30km radius around Hotazel has led to extensive fragmentation of the natural habitat. The fragmentation of the habitat has an impact that exceeds the mere physical footprint of the infrastructure. However, the short length of the proposed powerline should limit the cumulative impact of displacement due to disturbance and habitat destruction. This impact is therefore rated as **Low**.

7.5.4 No-Go Alternative

The no-go alternative will result in the current status quo being maintained as far as the avifauna is concerned. Given the extensive mining practices which are currently active in the area, and the associated powerline network, it can be surmised that significant anthropogenic impacts on avifauna already exist around Hotazel. However, apart from the impacts of mining and powerlines, the low human population in the area is definitely advantageous to avifauna. The no-go option would therefore reduce the impact on the ecological integrity of the proposed development area as far as avifauna is concerned, but it must be stressed that the ecological integrity of the proposed development area and its immediate surroundings has already been severely compromised by existing industrial activities.

8 CONCLUSIONS

8.1 Hotazel Solar Park PV plant

The proposed Hotazel Solar Park PV facility will have some pre-mitigation impacts on avifauna at a site and local level which will range from High to Low.

The impact of displacement of priority species due to habitat transformation associated with the operation of the plant and associated infrastructure is rated as High. This impact can be partially reversed through mitigation, putting it at a Medium level, after mitigation. The impact of displacement due to disturbance during the construction phase is rated as Medium and will remain at a Medium level despite after mitigation. The remaining envisaged impacts, i.e. mortalities in the operational phase due to collisions with the solar panels and entrapment in perimeter fences are both rated as Low and should be mitigatable to a Very Low level with appropriate mitigation.

The relatively small size of the footprint, coupled with the existing degraded state of the environment at the development area, leads one to the conclusion that the cumulative impact of the facility on priority avifauna should in all likelihood be Low, taking into account the current impacts on avifauna within a 30km radius around the development area.

From an avifaunal impact perspective, the proposed development could go ahead, provided the proposed mitigation measures are strictly implemented.

8.2 The 132kV powerline

The proposed 132kV powerline will have several pre-mitigation impacts on avifauna at a site and local level which are all rated as Low.

The impact of electrocutions of priority species is rated as Low, but it can be mitigated to a Very Low level. The impact of collisions with the earthwire of the proposed 132kV line is rated as Low, but it can also be mitigated to a Very Low level. The impact of displacement due to habitat destruction and disturbance is rated as Low and it can be further reduced to Very Low through appropriate mitigation.

The relatively small size of the footprint, coupled with the existing degraded state of the environment at the development area, leads one to the conclusion that the cumulative impact of the powerlines on priority avifauna should in all likelihood be Low, taking into account the current impacts of powerlines on avifauna within a 30km radius around the development area.

From an avifaunal impact perspective, the proposed powerline could go ahead, provided the proposed mitigation measures are strictly implemented.

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APPENDIX 1: FIELD SURVEYS

1 Methodology

Monitoring was conducted in the following manner:

- Field surveys were conducted on 26 and 27 July 2016.
- Two walk transects were identified totalling 1km each in the proposed 280ha PV development area (see Figure 1 below).
- One observer walking slowly recorded all species on both sides of the transect. The observer stopped at regular intervals to scan the environment with binoculars.
- Each transect was counted eight times, with counts taking place between 8h30 and 16h30.
- The following variables were recorded:
  - Species;
  - Number of birds;
  - Date;
  - Start time and end time;
  - Distance from transect (0-50 m, 50-100 m, >100 m);
  - Wind direction;
  - Wind strength (estimated Beaufort scale 1 - 7);
  - Weather (sunny; cloudy; partly cloudy; rain; mist);
  - Temperature (cold; mild; warm; hot);
  - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying- foraging; flying-commute; foraging on the ground.

Figure 1: Walk transects (white lines) used during field surveys

2 Results

Figure 2 below presents the species recorded during the walk transects as an index of kilometric abundance (birds/km). Table 1 shows the results of the walk transects for each iteration.

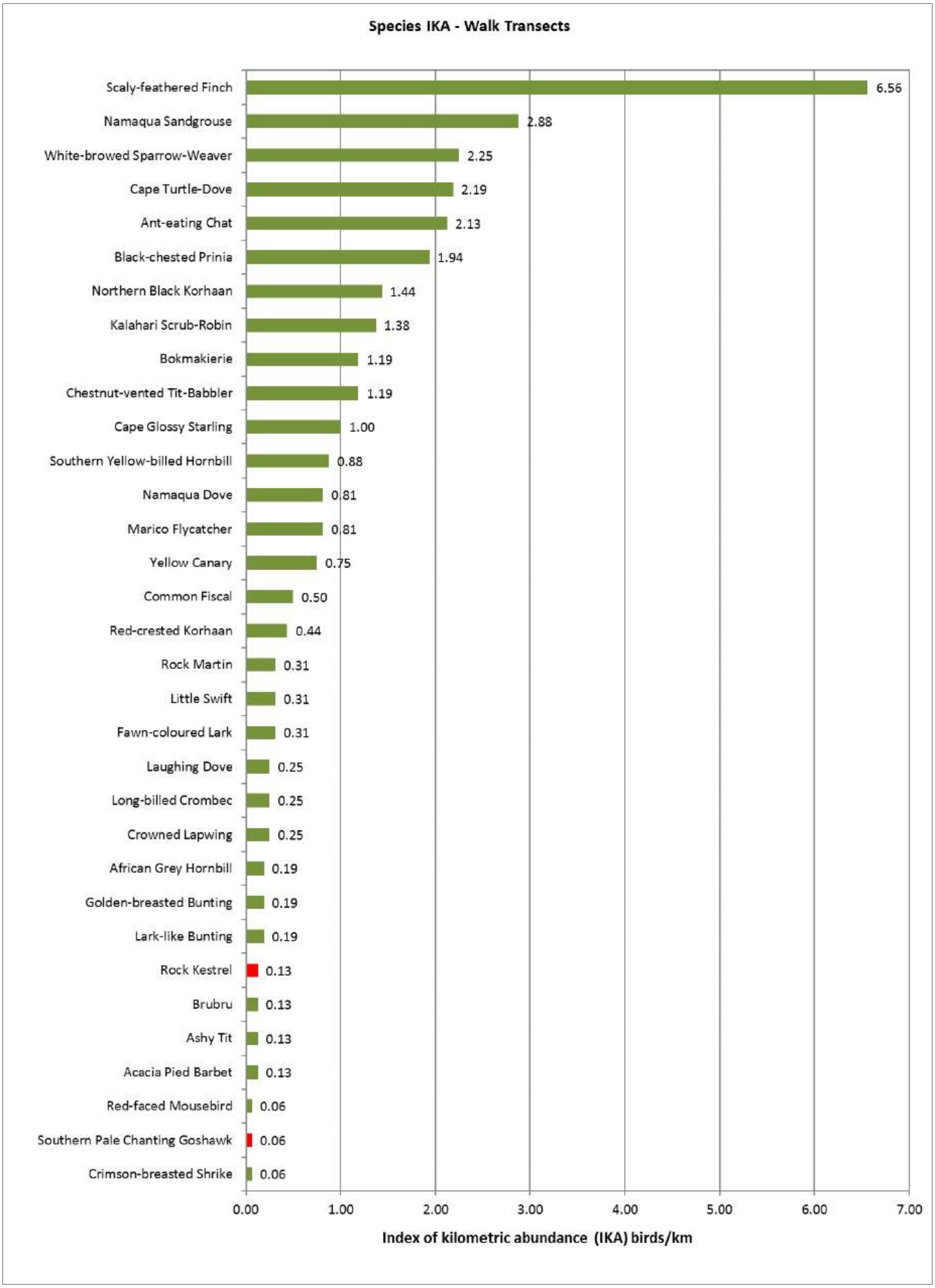


Figure 2: Index of kilometric abundance for birds recorded at the proposed Hotazel Solar Park PV site during field surveys. Priority species are indicated in red.

Table 1: The results of the walk transects conducted on 26 and 27 July 2016 at the proposed Hotazel Solar Park PV facility. Transects were counted 8 times (W1 – W8).

Hotazel PV Site												
Species composition												
All Species									33			
									Number of replications		8	
Total count	W1	W2	W3	W4	W5	W6	W7	W8	Total	Mean	StDev	StErr
Walk transects	106	74	56	42	86	52	59	25	500	62.50	25.55	9.03
Species	W1	W2	W3	W4	W5	W6	W7	W8	Total	Mean	StDev	StErr
Acacia Pied Barbet	0	0	2	0	0	0	0	0	2	0.25	0.71	0.25
African Grey Hornbill	0	0	1	0	0	0	1	1	3	0.38	0.52	0.18
Ant-eating Chat	5	6	4	3	9	2	3	2	34	4.25	2.38	0.84
Ashy Tit	2	0	0	0	0	0	0	0	2	0.25	0.71	0.25
Black-chested Prinia	6	3	4	3	5	3	5	2	31	3.88	1.36	0.48
Bokmakierie	5	4	1	2	4	1	2	0	19	2.38	1.77	0.63
Brubru	0	0	0	1	1	0	0	0	2	0.25	0.46	0.16
Cape Glossy Starling	1	0	2	1	4	6	0	2	16	2.00	2.07	0.73
Cape Turtle-Dove	1	5	9	4	6	6	4	0	35	4.38	2.88	1.02
Chestnut-vented Tit-Babbler	3	3	2	4	0	5	0	2	19	2.38	1.77	0.63
Common Fiscal	1	1	0	1	2	1	1	1	8	1.00	0.53	0.19
Crimson-breasted Shrike	1	0	0	0	0	0	0	0	1	0.13	0.35	0.13
Crowned Lapwing	0	0	0	0	1	3	0	0	4	0.50	1.07	0.38
Fawn-coloured Lark	3	0	0	1	1	0	0	0	5	0.63	1.06	0.38
Golden-breasted Bunting	1	0	0	0	0	0	2	0	3	0.38	0.74	0.26
Kalahari Scrub-Robin	4	7	3	2	3	1	0	2	22	2.75	2.12	0.75
Lark-like Bunting	0	0	0	0	3	0	0	0	3	0.38	1.06	0.38
Laughing Dove	1	2	0	0	0	0	1	0	4	0.50	0.76	0.27
Little Swift	1	4	0	0	0	0	0	0	5	0.63	1.41	0.50
Long-billed Crombec	1	3	0	0	0	0	0	0	4	0.50	1.07	0.38
Marico Flycatcher	2	0	1	0	3	6	1	0	13	1.63	2.07	0.73
Namaqua Dove	0	0	3	2	5	2	0	1	13	1.63	1.77	0.63
Namaqua Sandgrouse	13	3	0	2	22	6	0	0	46	5.75	7.91	2.80
Northern Black Korhaan	4	2	2	2	3	1	6	3	23	2.88	1.55	0.55
Red-crested Korhaan	1	1	0	1	2	1	0	1	7	0.88	0.64	0.23
Red-faced Mousebird	1	0	0	0	0	0	0	0	1	0.13	0.35	0.13
Rock Kestrel	0	0	0	0	2	0	0	0	2	0.25	0.71	0.25
Rock Martin	0	1	0	1	0	0	2	1	5	0.63	0.74	0.26
Scaly-feathered Finch	44	25	13	4	0	2	16	1	105	13.13	15.25	5.39
Southern Pale Chanting Goshawk	1	0	0	0	0	0	0	0	1	0.13	0.35	0.13
Southern Yellow-billed Hornbill	0	0	0	0	1	0	13	0	14	1.75	4.56	1.61
White-browed Sparrow-Weaver	3	4	7	7	2	6	2	5	36	4.50	2.07	0.73
Yellow Canary	1	0	2	1	7	0	0	1	12	1.50	2.33	0.82
Grand Total	106	74	56	42	86	52	59	25	500	62.50	25.55	9.03

APPENDIX 2: AVIFAUNAL SPECIES POTENTIALLY OCCURRING AT THE DEVELOPMENT AREA

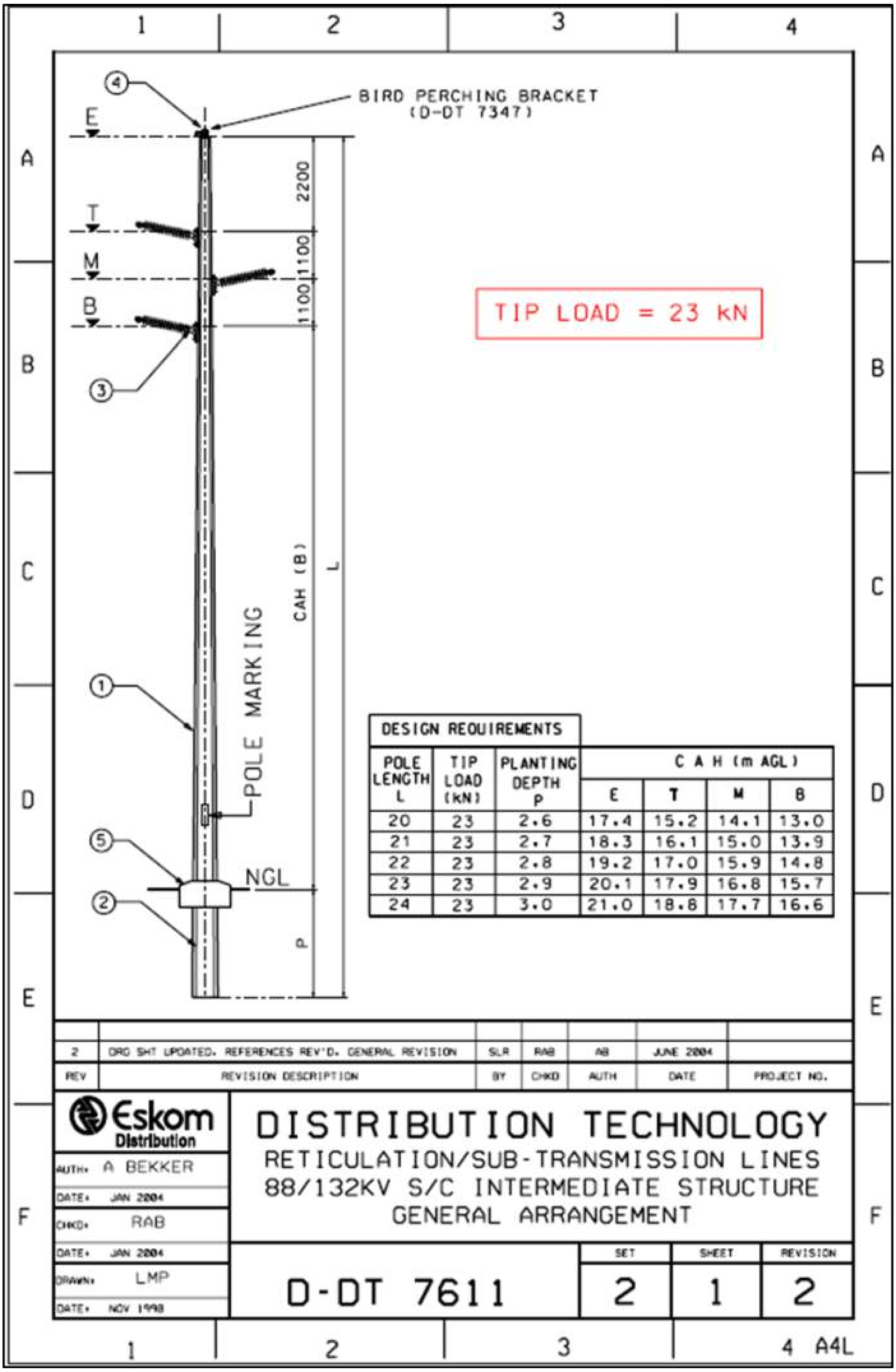
Name	Scientific name	Global Status (IUCN 2016)	Regional Status (Taylor *et al*. 2015)	SABAP2 reporting rate %	SABAP 1 reporting rate %
Babbler, Southern Pied	*Turdoides bicolor*			38.1	34.29
Barbet, Acacia Pied	*Tricholaema leucomelas*			78.38	46.67
Barbet, Crested	*Trachyphonus vaillantii*			14.29	0
Batis, Pririt	*Batis pririt*			28.57	37.78
Bee-eater, European	*Merops apiaster*			40.54	21.05
Bee-eater, Swallow-tailed	*Merops hirundineus*			47.62	24.44
Bishop, Southern Red	*Euplectes orix*			0	12.5
Bokmakierie	*Telophorus zeylonus*			0	13.33
Brubru	*Nilaus afer*			33.33	19.23
Buffalo-weaver, Red-billed	*Bubalornis niger*			28.57	0
Bulbul, African Red-eyed	*Pycnonotus nigricans*			72.97	51.11
Bunting, Cinnamon-breasted	*Emberiza tahapisi*			2.7	0
Bunting, Golden-breasted	*Emberiza flaviventris*			23.81	19.23
Bunting, Lark-like	*Emberiza impetuani*			5.41	17.78
Bustard, Kori	***Ardeotis kori***	***Near threatened***	***Near threatened***	**9.52**	**14.29**
Bustard, Ludwig's	***Neotis ludwigii***	***Endangered***	***Endangered***	**0**	**11.11**
Buzzard, Steppe	***Buteo buteo***			**0**	**22.22**
Canary, Black-throated	*Crithagra atrogularis*			16.22	22.22
Canary, Yellow	*Crithagra flaviventris*			69.23	46.67
Chat, Anteating	*Myrmecocichla formicivora*			28.57	46.67
Chat, Familiar	*Cercomela familiaris*			64.86	31.11
Cisticola, Desert	*Cisticola aridulus*			23.08	14.29
Cisticola, Levaillant's	*Cisticola tinniens*			0	15.38
Cisticola, Zitting	*Cisticola juncidis*			0	14.29
Cliff-swallow, South African	***Petrochelidon spilodera***			**0**	**5.26**
Coot, Red-knobbed	***Fulica cristata***			**7.69**	**23.08**
Cormorant, Reed	***Phalacrocorax africanus***			**4.76**	**10.71**
Courser, Burchell's	***Cursorius rufus***	***Least concern***	***Vulnerable***	**0**	**5.26**
Courser, Double-banded	*Rhinoptilus africanus*			4.76	11.11
Crombec, Long-billed	*Sylvietta rufescens*			14.29	11.11
Crow, Pied	*Corvus albus*			30.77	0
Cuckoo, African	*Cuculus gularis*			4.76	11.11
Cuckoo, Black	*Cuculus clamosus*			7.69	11.11
Cuckoo, Diderick	*Chrysococcyx caprius*			15.38	17.86
Cuckoo, Great Spotted	*Clamator glandarius*			9.52	0
Cuckoo, Jacobin	*Clamator jacobinus*			19.05	12.5
Cuckoo, Levaillant's	*Clamator levaillantii*			0	11.11
Dove, Laughing	*Streptopelia senegalensis*			89.19	77.78
Dove, Namaqua	*Oena capensis*			30.77	55.56
Dove, Red-eyed	*Streptopelia semitorquata*			48.65	10.53
Dove, Rock	*Columba livia*			7.69	0
Drongo, Fork-tailed	*Dicrurus adsimilis*			80.95	57.78
Duck, African Black	***Anas sparsa***			**0**	**11.11**
Duck, White-faced	***Dendrocygna viduata***			**0**	**7.69**
Duck, Yellow-billed	***Anas undulata***			**0**	**7.69**
Eagle, Martial	***Polemaetus bellicosus***	***Vulnerable***	***Endangered***	**4.76**	**7.89**
Eagle-owl, Spotted	***Bubo africanus***			**4.76**	**0**
Egret, Cattle	***Bubulcus ibis***			**0**	**17.65**
Egret, Little	***Egretta garzetta***			**0**	**7.69**
Eremomela, Yellow-bellied	*Eremomela icteropygialis*			15.38	15.56
Falcon, Lanner	***Falco biarmicus***	***Least concern***	***Vulnerable***	**15.38**	**14.29**

Name	**Scientific name**	**Global Status (IUCN 2016)**	**Regional Status (Taylor *et al*. 2015)**	**SABAP2 reporting rate %**	**SABAP 1 reporting rate %**
Falcon, Pygmy	***Polihierax semitorquatus***			**0**	**11.11**
Finch, Red-headed	*Amadina erythrocephala*			29.73	31.11
Finch, Scaly-feathered	*Sporopipes squamifrons*			64.86	48.89
Firefinch, Red-billed	*Lagonosticta senegala*			5.41	0
Fiscal, Common	*Lanius collaris*			46.15	77.78
Flycatcher, Chat	*Bradornis infuscatus*			38.46	46.67
Flycatcher, Fairy	***Stenostira scita***			**5.41**	**0**
Flycatcher, Fiscal	***Sigelus silens***			**37.84**	**28.95**
Flycatcher, Marico	*Bradornis mariquensis*			69.23	42.22
Flycatcher, Spotted	*Muscicapa striata*			18.92	15.38
Goose, Egyptian	***Alopochen aegyptiaca***			**4.76**	**0**
Goshawk, Gabar	***Melierax gabar***			**18.92**	**10.53**
Goshawk, Southern Pale Chanting	***Melierax canorus***			**19.05**	**24.44**
Grebe, Little	***Tachybaptus ruficollis***			**0**	**5.26**
Greenshank, Common	***Tringa nebularia***			**0**	**14.29**
Guineafowl, Helmeted	*Numida meleagris*			40.54	20
Hamerkop	***Scopus umbretta***			**0**	**5.26**
Harrier, Black	***Circus maurus***	***Vulnerable***	***Endangered***	**0**	**11.11**
Heron, Black-headed	***Ardea melanocephala***			**0**	**5.26**
Heron, Grey	***Ardea cinerea***			**0**	**31.58**
Honeyguide, Greater	*Indicator indicator*			9.52	0
Hoopoe, African	*Upupa africana*			33.33	37.5
Hornbill, African Grey	*Tockus nasutus*			47.62	31.58
Hornbill, Southern Yellow-billed	*Tockus leucomelas*			61.9	42.22
Ibis, African Sacred	***Threskiornis aethiopicus***			**0**	**7.69**
Ibis, Glossy	***Plegadis falcinellus***			**0**	**5.26**
Ibis, Hadeda	*Bostrychia hagedash*			19.05	0
Kestrel, Greater	***Falco rupicoloides***			**30.77**	**11.54**
Kestrel, Lesser	***Falco naumanni***			**0**	**5.26**
Kestrel, Rock	***Falco rupicolus***			**7.69**	**20**
Kingfisher, Malachite	***Alcedo cristata***			**0**	**7.69**
Kingfisher, Striped	*Halcyon chelicuti*			0	14.29
Kite, Black-shouldered	***Elanus caeruleus***			**14.29**	**10.71**
Kite, Yellow-billed	***Milvus aegyptius***			**0**	**11.11**
Korhaan, Northern Black	*Afrotis afraoides*			23.81	33.33
Korhaan, Red-crested	*Lophotis ruficrista*			19.05	28.57
Lapwing, Blacksmith	***Vanellus armatus***			**37.84**	**28.57**
Lapwing, Crowned	*Vanellus coronatus*			69.23	37.78
Lark, Cape Clapper	***Mirafra apiata***			**7.69**	**10.71**
Lark, Dusky	*Pinarocorys nigricans*			0	14.29
Lark, Eastern Clapper	*Mirafra fasciolata*			4.76	10.71
Lark, Fawn-coloured	*Calendulauda africanoides*			38.46	22.22
Lark, Red-capped	*Calandrella cinerea*			23.08	11.11
Lark, Sabota	*Calendulauda sabota*			14.29	35.56
Lark, Spike-heeled	*Chersomanes albofasciata*			0	8.57
Martin, Banded	*Riparia cincta*			0	14.29
Martin, Brown-throated	*Riparia paludicola*			15.38	26.92
Martin, Rock	*Hirundo fuligula*			56.76	13.33
Masked-weaver, Southern	*Ploceus velatus*			83.78	48.89
Moorhen, Common	***Gallinula chloropus***			**0**	**15.38**
Mousebird, Red-faced	*Urocolius indicus*			38.1	31.11
Mousebird, White-backed	*Colius colius*			54.05	36.84
Myna, Common	*Acridotheres tristis*			40.54	0
Neddicky	*Cisticola fulvicapilla*			7.69	0
Night-Heron, Black-crowned	***Nycticorax nycticorax***			**0**	**5.26**

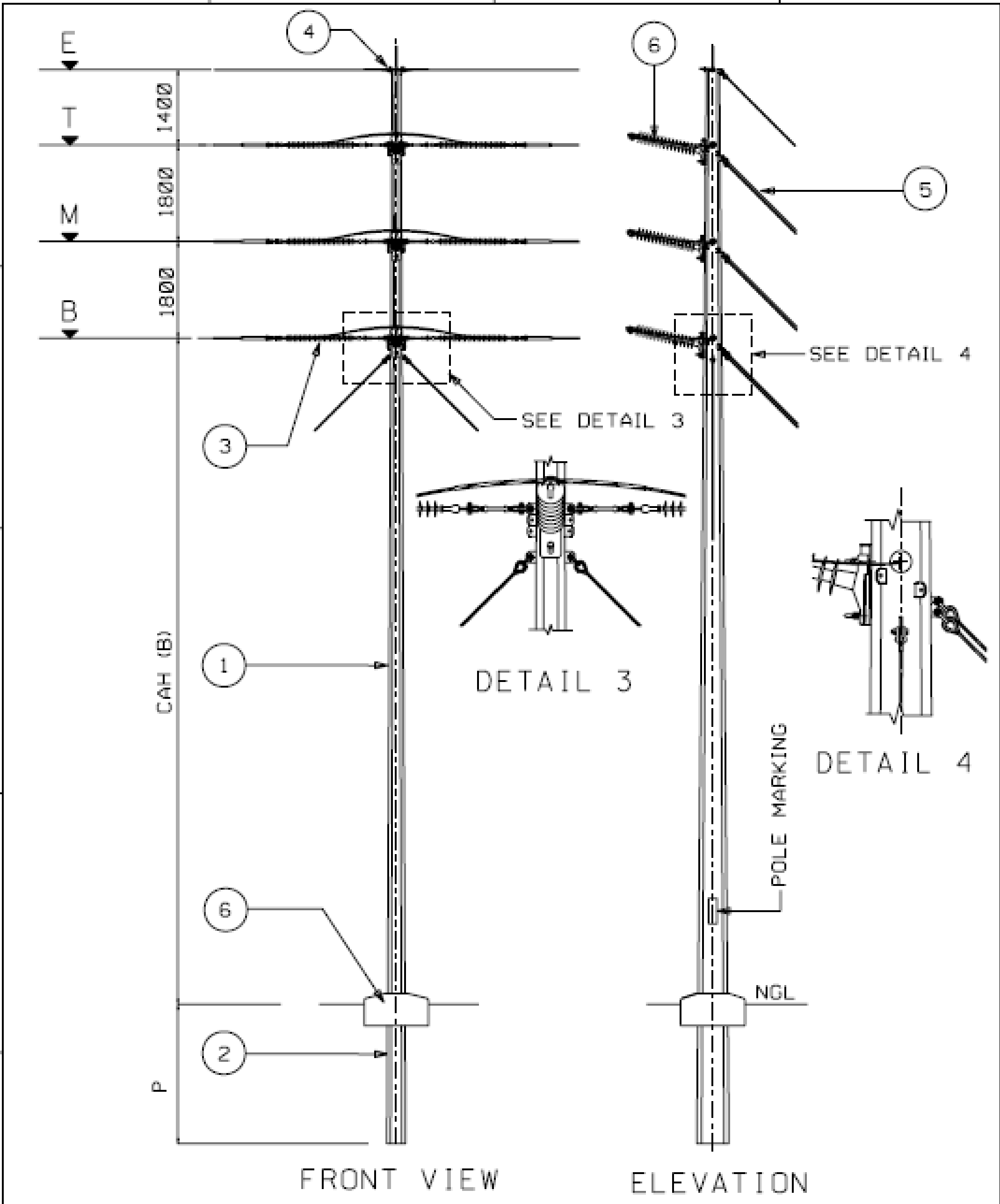
Name	Scientific name	Global Status (IUCN 2016)	Regional Status (Taylor *et al*. 2015)	SABAP2 reporting rate %	SABAP 1 reporting rate %
Ostrich, Common	*Struthio camelus*			15.38	10.53
Owlet, Pearl-spotted	***Glaucidium perlatum***			**33.33**	**13.16**
Palm-swift, African	*Cypsiurus parvus*			16.22	0
Penduline-tit, Cape	*Anthoscopus minutus*			9.52	11.54
Pigeon, Speckled	*Columba guinea*			43.24	17.14
Pipit, African	*Anthus cinnamomeus*			23.08	10.71
Pipit, Buffy	*Anthus vaalensis*			4.76	18.75
Plover, Three-banded	***Charadrius tricollaris***			**0**	**19.23**
Prinia, Black-chested	*Prinia flavicans*			81.08	57.78
Pytilia, Green-winged	*Pytilia melba*			10.81	17.14
Quail, Common	*Coturnix coturnix*			0	11.11
Quailfinch, African	*Ortygospiza fuscocrissa*			0	10
Quelea, Red-billed	*Quelea quelea*			24.32	8.57
Reed-warbler, African	*Acrocephalus baeticatus*			0	5.26
Robin-chat, Cape	*Cossypha caffra*			9.52	0
Rock-thrush, Short-toed	*Monticola brevipes*			7.69	0
Roller, European	***Coracias garrulus***	***Least concern***	***Near threatened***	**4.76**	**11.11**
Roller, Lilac-breasted	*Coracias caudatus*			38.1	31.11
Roller, Purple	*Coracias naevius*			10.81	5.26
Ruff	***Philomachus pugnax***			**0**	**5.26**
Sandgrouse, Burchell's	*Pterocles burchelli*			8.11	13.16
Sandgrouse, Double-banded	*Pterocles bicinctus*			0	5.26
Sandgrouse, Namaqua	*Pterocles namaqua*			30.77	24.44
Sandpiper, Common	***Actitis hypoleucos***			**0**	**5.26**
Sandpiper, Wood	***Tringa glareola***			**0**	**28.57**
Scimitarbill, Common	*Rhinopomastus cyanomelas*			23.08	34.29
Scrub-robin, Kalahari	*Erythropygia paena*			84.62	53.33
Scrub-robin, Karoo	*Erythropygia coryphoeus*			0	10
Secretarybird	***Sagittarius serpentarius***	***Vulnerable***	***Vulnerable***	**0**	**0**
Shelduck, South African	***Tadorna cana***			**4.76**	**0**
Shikra	***Accipiter badius***			**0**	**11.11**
Shrike, Crimson-breasted	*Laniarius atrococcineus*			61.9	35.56
Shrike, Lesser Grey	*Lanius minor*			23.08	24.44
Shrike, Red-backed	*Lanius collurio*			30.77	17.78
Snake-eagle, Black-chested	***Circaetus pectoralis***			**0**	**14.29**
Snipe, African	***Gallinago nigripennis***			**0**	**7.69**
Sparrow, Cape	*Passer melanurus*			32.43	46.67
Sparrow, House	*Passer domesticus*			48.65	24.44
Sparrow, Southern Grey-headed	*Passer diffusus*			47.62	22.86
Sparrowlark, Grey-backed	*Eremopterix verticalis*			9.52	14.29
Sparrow-weaver, White-browed	*Plocepasser mahali*			71.43	73.33
Spoonbill, African	***Platalea alba***			**0**	**10.53**
Spurfowl, Red-billed	*Pternistis adspersus*			38.1	7.14
Starling, Cape Glossy	*Lamprotornis nitens*			81.08	48.89
Starling, Pale-winged	*Onychognathus nabouroup*			23.08	8.57
Starling, Pied	***Lamprotornis bicolor***			**2.7**	**10**
Starling, Wattled	*Creatophora cinerea*			14.29	20
Stork, Black	***Ciconia nigra***	***Least concern***	***Vulnerable***	**0**	**5.26**
Sunbird, Dusky	*Cinnyris fuscus*			9.52	23.08
Sunbird, Marico	*Cinnyris mariquensis*			54.05	17.78
Sunbird, White-bellied	*Cinnyris talatala*			4.76	0

Name	**Scientific name**	**Global Status (IUCN 2016)**	**Regional Status (Taylor *et al*. 2015)**	**SABAP2 reporting rate %**	**SABAP 1 reporting rate %**
Swallow, Barn	*Hirundo rustica*			14.29	40
Swallow, Greater Striped	*Cecropis cucullata*			48.65	18.42
Swallow, Red-breasted	*Cecropis semirufa*			4.76	10.53
Swallow, White-throated	*Hirundo albigularis*			0	11.43
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*			0	14.29
Swift, Bradfield's	*Apus bradfieldi*			0	11.11
Swift, Common	*Apus apus*			9.52	0
Swift, Little	*Apus affinis*			40.54	14.29
Swift, White-rumped	*Apus caffer*			13.51	11.11
Tchagra, Brown-crowned	*Tchagra australis*			14.29	24.44
Teal, Red-billed	***Anas erythrorhyncha***			**7.69**	**11.54**
Thick-knee, Spotted	*Burhinus capensis*			4.76	11.54
Thrush, Groundscraper	*Turdus litsitsirupa*			52.38	18.42
Thrush, Karoo	***Turdus smithi***			**21.62**	**0**
Tit, Ashy	*Parus cinerascens*			43.24	28.89
Tit-babbler, Chestnut-vented	*Sylvia subcaerulea*			69.23	53.33
Turtle-dove, Cape	*Streptopelia capicola*			80.95	62.22
Vulture, Lappet-faced	***Torgos tracheliotos***	***Endangered***	***Endangered***	**7.69**	**0**
Vulture, White-backed	***Gyps africanus***	***Critically endangered***	***Critically endangered***	**15.38**	**0**
Wagtail, Cape	*Motacilla capensis*			14.29	31.43
Warbler, Icterine	*Hippolais icterina*			0	10.53
Warbler, Rufous-eared	*Malcorus pectoralis*			7.69	19.23
Warbler, Willow	*Phylloscopus trochilus*			4.76	0
Waxbill, Black-faced	*Estrilda erythronotos*			23.81	17.14
Waxbill, Common	*Estrilda astrild*			0	7.14
Waxbill, Violet-eared	*Uraeginthus granatinus*			45.95	35.56
Weaver, Sociable	*Philetairus socius*			0	7.89
Wheatear, Capped	*Oenanthe pileata*			15.38	17.78
Wheatear, Mountain	*Oenanthe monticola*			0	10.53
White-eye, Cape	***Zosterops virens***			**14.29**	**0**
White-eye, Orange River	*Zosterops pallidus*			15.38	0
Whydah, Shaft-tailed	*Vidua regia*			9.52	31.43
Wood-hoopoe, Green	*Phoeniculus purpureus*			4.76	0
Woodpecker, Cardinal	*Dendropicos fuscescens*			15.38	33.33
Woodpecker, Golden-tailed	*Campethera abingoni*			23.81	33.33

APPENDIX 3: POWERLINE DESIGN



POLE LENGTH L	TIP LOAD (kN)	PLANTING DEPTH P	C A H (m AGL) E	T	M	B
20	23	2.6	17.4	15.2	14.1	13.0
21	23	2.7	18.3	16.1	15.0	13.9
22	23	2.8	19.2	17.0	15.9	14.8
23	23	2.9	20.1	17.9	16.8	15.7
24	23	3.0	21.0	18.8	17.7	16.6



2	DRG SHT UPDATED. REFERENCES REVISED. GENERAL REVISION	SLR	RAB	AB	MARCH 2004	
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.

Eskom Distribution

AUTH: A BEKKER
DATE: JAN 2004
CHKD: RAB
DATE: JAN 2004
DRAWN: LMP
DATE: NOV 1998

DISTRIBUTION TECHNOLOGY
RETICULATION/SUB-TRANSMISSION LINES
STAYED ANGLE STRAIN STRUCTURE
GENERAL ARRANGEMENT (0-90°)

D-DT 7615	SET	SHEET	REVISION
	3	1	2

A4L

APPENDIX D.3:

Botanical

Botanical Impact Assessment for the proposed Hotazel Solar Park, on Annex Farm Langdon, Hotazel, Northern Cape Province

bergwind
Botanical Surveys & Tours

Report by Dr David J. McDonald
Bergwind Botanical Surveys & Tours CC.
14A Thomson Road, Claremont, 7708
Tel: 021-671-4056
Fax: 086-517-3806

Report prepared for Aurecon South Africa (Pty) Ltd
January 2017

National Legislation and Regulations governing this report

This is a 'specialist report' and is compiled in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, and the Environmental Impact Assessment Regulations, 2014.

Appointment of Specialist

David J. McDonald of Bergwind Botanical Surveys & Tours CC was appointed by Aurecon South Africa (Pty) Ltd to provide specialist botanical consulting services to inform the environmental application process for the proposed Hotazel Solar Park. The consulting services comprise an assessment of potential impacts on the flora and vegetation in the designated study area due to the proposed development activities.

Details of Specialist

Dr David J. McDonald Pr. Sci. Nat.
Bergwind Botanical Surveys & Tours CC
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Claremont
7708
Telephone: 021-671-4056
Mobile: 082-876-4051
Fax: 086-517-3806
e-mail: dave@bergwind.co.za
Professional registration: South African Council for Natural Scientific Professions No. 400094/06

Expertise

Dr David J. McDonald:

- Qualifications: BSc. Hons. (Botany), MSc (Botany) and PhD (Botany)
- Botanical ecologist with over 35 years' experience in the field of Vegetation Science.
- Founded Bergwind Botanical Surveys & Tours CC in 2006
- Has conducted over 300 specialist botanical / ecological studies.
- Has published numerous scientific papers and attended numerous conferences both nationally and internationally (details available on request)

Independence

The views expressed in the document are the objective, independent views of Dr McDonald and the survey was carried out under the aegis of, Bergwind Botanical Surveys and Tours CC. Neither Dr McDonald nor Bergwind Botanical Surveys and Tours CC have any business, personal, financial or other interest in the proposed development apart from fair remuneration for the work performed.

Conditions relating to this report

The content of this report is based on the author's best scientific and professional knowledge as well as available information. Bergwind Botanical Surveys & Tours CC, its staff and appointed associates, reserve the right to modify the report in any way deemed fit should new, relevant or previously unavailable or undisclosed information become known to the author from on-going research or further work in this field, or pertaining to this investigation

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of the report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorization and waste management license in terms of the-
(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and
(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

Project title:	Hotazel Solar Park (Impact Assessment Phase)		
Specialist:	Bergwind Botanical Surveys & Tours CC		
Contact person:	Dr D.J. McDonald		
Postal address:	14A Thomson Road, Claremont		
Postal code:	7708	**Cell:**	082-876-4051
Telephone:	021-671-4056	**Fax:**	
E-mail:	dave@bergwind.co.za		
Professional affiliation(s) (if any)	SACNASP Reg. No. 400094/06		
Project Consultant	Aurecon South Africa (Pty) Ltd		
Contact person:	Patrick Killick		
Postal address:	PO Box 509, George		
Postal code:	6530	**Cell:**	072 446 8005
Telephone:	044 805 5432	**Fax:**	044 805 5454
E-mail:	Patrick.killick@aurecongroup.com		

4.2 The specialist appointed in terms of the Regulations

I, **David Jury McDonald** declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realize that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

DJ McDonald

Signature of Specialist

Bergwind Botanical Surveys & Tours CC
Company

17 January 2017

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I **David Jury McDonald**, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 982) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 48 of GN No. R. 982.

Note: The terms of reference must be attached.

Signature of the specialist:

Bergwind Botanical Surveys & Tours CC

Name of company:

12 January 2017

Date:

CONTENTS

1. INTRODUCTION

The Northern Cape Province has uniform landscapes over large areas (so-called 'wide open spaces') and is well endowed with high levels of solar radiation. It is thus well suited to solar-generated renewable energy. A solar farm or solar park is proposed for the farm Annex Langdon (F278/0), near the small mining town Hotazel in the Joe Morolong Municipality, Northern Cape Province. The proponent of the project, juwi Renewable Energies (Pty) Ltd ("juwi") proposes the construction and operation of a ≤ 200 MWac solar facility with associated infrastructure under the aegis of a company registered as Hotazel Solar Farm 1 (Pty) Ltd. The Scoping Assessment determined that Alternative 4 (tracking with Battery Storage System (BSS)) would be the preferred alternative

The project is described as follows in Table 1.

Table 1: Project components of the Hotazel Solar Park: Alternative 4 with Alternative B2 for the Access Road

Component	Dimensions
Solar Farm: A 200MWac solar facility with PV panels on steel mountings with single axis tracking mechanisms and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters. Alternative A4 energy production will be ~120% with up to 25% or ≤100MWh retained for controlled energy release.	≤300ha footprint ≤250ha solar panel surface (remainder is roads, cables runs, and other ancillaries)
Battery Storage System: A ≤100MWh battery storage facility for grid storage in stacked containers or multi-storey building housing up to up to 1120 cubic meters of batteries (dangerous goods) and associated operational, safety and control infrastructure.	≤1ha ≤8m building height ≤1120m^3 of batteries
Access road: A ≤1.9km long, ≤8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.	≤1.9km long, ≤8m wide ≤1.52ha
Service roads: ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	≤20kms, 4m wide gravel roads Footprint included in solar farm footprint (≤8ha)
Collector substation: ≤1ha collector substation to receive, convert and step up electricity from the PV facility to a grid suitable power supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32m telecommunications tower (lattice or monopole type) will be established in the substation area.	≤1ha Substation infrastructure up to 10m height 32m telecommunications tower
O&M area: ≤1ha hectare O&M laydown area (near / adjacent substation); Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; Workshops, storage areas for materials and spare parts; Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day during rest of construction period; ~20kl/day during operation); Septic tanks and sewer lines to service ablution facilities; and Central Waste collection and storage area.	≤1ha Single storey office, ablutions, workshop complex (up to 4m height)
Other infrastructure: Perimeter fencing and internal security fencing and gates as required. Access control gate and guard house on access road; ≤3.5km length of small diameter water supply pipeline connecting existing boreholes to storage.	1.8m high jackal fence with barbed wire
Temporary infrastructure: A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.	≤4ha (Temporary)

The botanical impact assessment reported here is required to inform the environmental application process in accordance with the NEMA EIA regulations 2014, GN R 982. The potential impacts of the solar park, as outlined in Table 1 are assessed for an EIA. The application for authorisation to construct the Hotazel Solar park transmission lines to connect the solar park to the national grid is by way of a separate Basic Assessment. The description for this separate assessment for the transmission lines is given in Section 10 of this report. The physiographic information provided pertains equally to the Hotazel Solar Park as to the Transmission Line Corridors.

The overall assessment process takes careful note of the general requirements and recommendations of the Department of Environment and Nature Conservation (Northern Cape) and the Botanical Society of South Africa for proactive assessment of biodiversity of proposed development sites and follows published guidelines for evaluating potential impacts on the natural vegetation in an area earmarked for some form of development (Brownlie, 2005). **Particular note was taken of the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) and Regulations (2011).**

2. TERMS OF REFERENCE

The terms of reference are the following:

- Take cognizance of the substantive content requirements outlined within Appendix 6 of GN R982, which outlines the legal minimum requirements for specialist studies in terms of the 2014 NEMA EIA Regulations.

- The local and regional context of the vegetation communities and plant species within the affected areas, taking cognizance of the relevant biodiversity plans, bioregional planning documents, Environmental Management Frameworks etc.
- Undertake a detailed analysis to the site to determine to the fullest extent possible the vegetation communities occurring on the proposed site;
- The ecosystem status and conservation value of the vegetation communities, including the whether the site comprises any critically endangered, endangered, or threatened ecosystem(s) listed in terms of Section 52 of the NEMBA;
- Any rare, endangered or protected species encountered or likely to be present;
- The presence of or proximity of the proposed site to protected area(s) identified in terms of NEMPAA and proximity to a Biosphere Reserve (where relevant).
- A description of the direct, indirect and cumulative botanical impacts (both before and after mitigation) and an assessment of the significance of the impacts (on a nominal scale of neutral, very low, low, medium, and high) by evaluating: (a) magnitude, frequency of occurrence, extent, duration and probability of impacts, (b) the local, regional, national and international significance of predicted impacts, (c) the level of confidence in findings relating to potential impacts, (d) reversibility of potential impacts (i.e. the degree to which the impact can be reversed); and (e) the degree to which the impact may cause irreplaceable loss of resources.
- An indication of the degree to which the impacts can be mitigated, a description of the measures to mitigate any impacts, and an indication of whether or not the measures (if implemented) would change the significance of the impact, for the construction and operational phases of the project.
- Take cognizance of the Department of Environmental Affairs (DEA) and Department of Environment and Nature Conservation (Northern Cape) requirements for Involving Biodiversity Specialists in the EIA Process and the requirements of the Botanical Society of South Africa (BotSoc) in developing an approach to the botanical investigation.
- In terms of biodiversity, identify all relevant legislation, permits, standards or licensing requirements that would apply to the proposed project.

3. STUDY AREA

3.1 Locality

The study area on Annex Langdon Farm (F278/0), is located in a ‘corner’ south and west of the R31 between Kuruman and Hotazel and approximately 8 km from the town of Hotazel (Figures 1—3). The study area is approximately 300 ha in extent and centroid for the study area is S 27.229888 E 23.007695.

Figure 1. The location of the study area alongside the R31 between Kuruman and Hotazel in the Northern Cape Province.

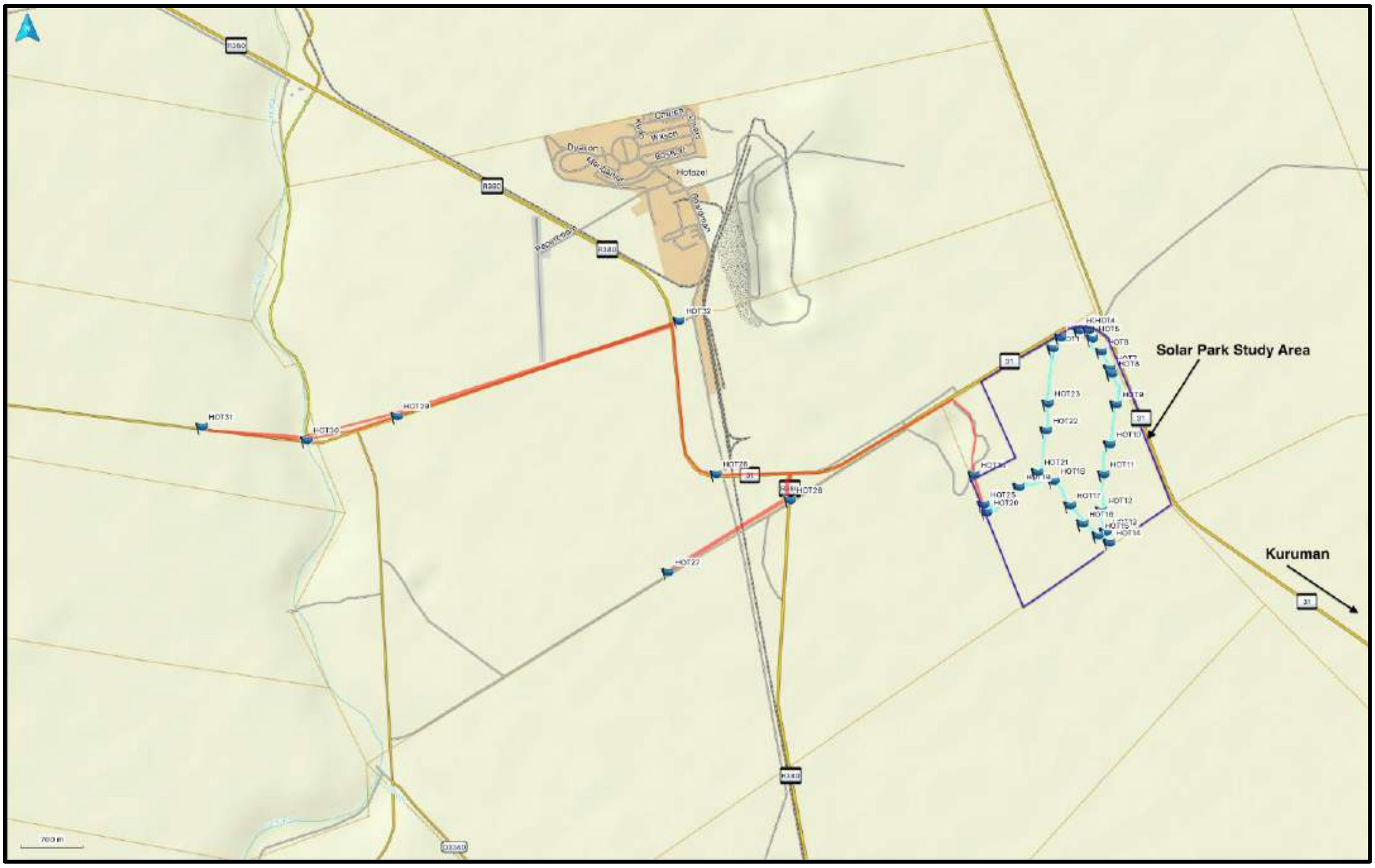

Figure 2. Detailed map of the Hotazel Solar Park study area (dark blue boundary) with the botanical survey track (light blue) and sample waypoints (blue flags – HOT#). The red line represents the track followed during the survey of the transmission lines.

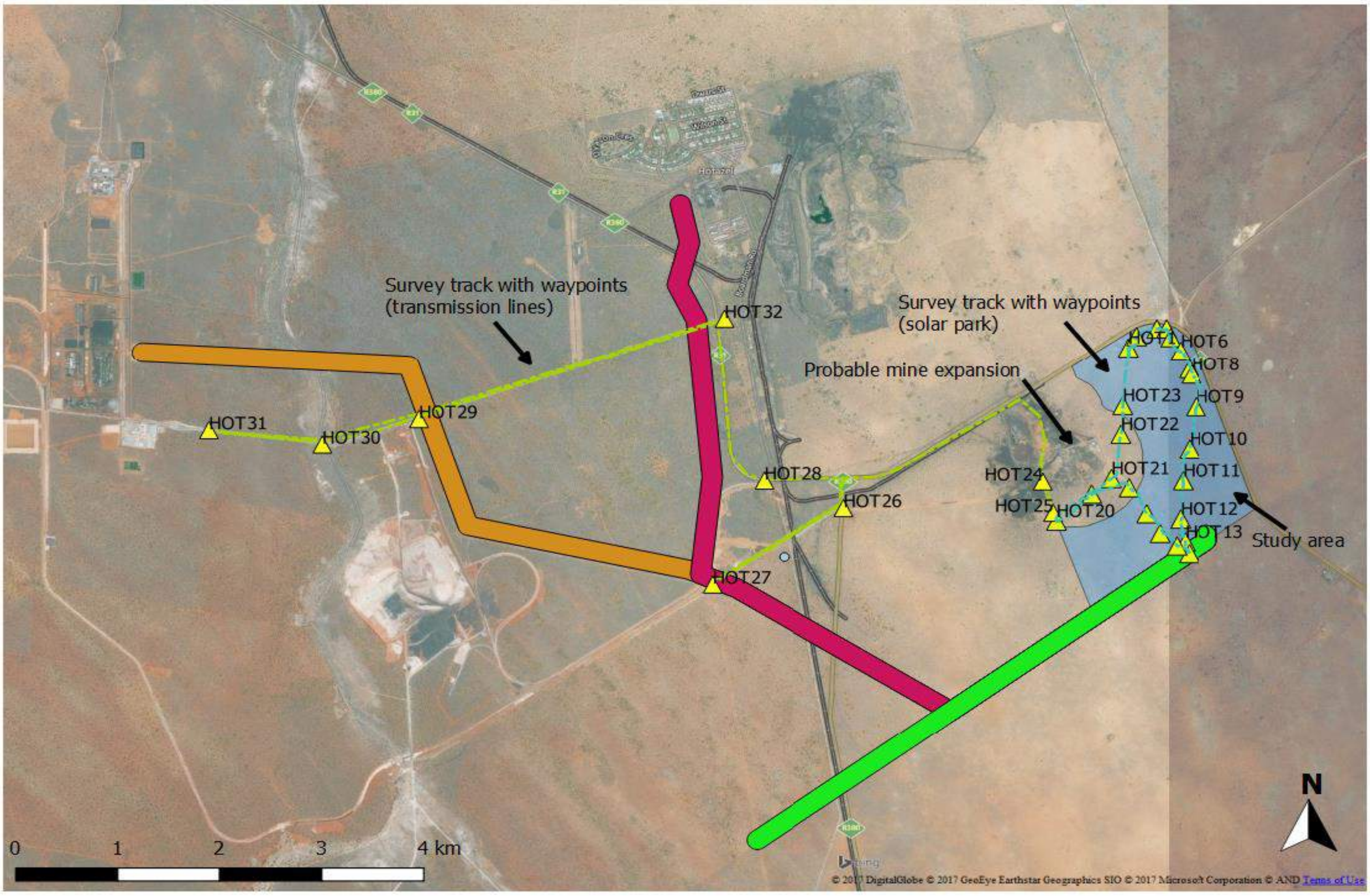

Figure 3. Aerial image (Google Earth ™) showing the proposed area for the Hotazel Solar Park with the revised boundary (blue to accommodate expansion of the mine. The survey track (light blue) with waypoints (blue pins) for the solar park and the survey track with waypoints (red with yellow diamonds) for the transmission lines are superimposed on the image.

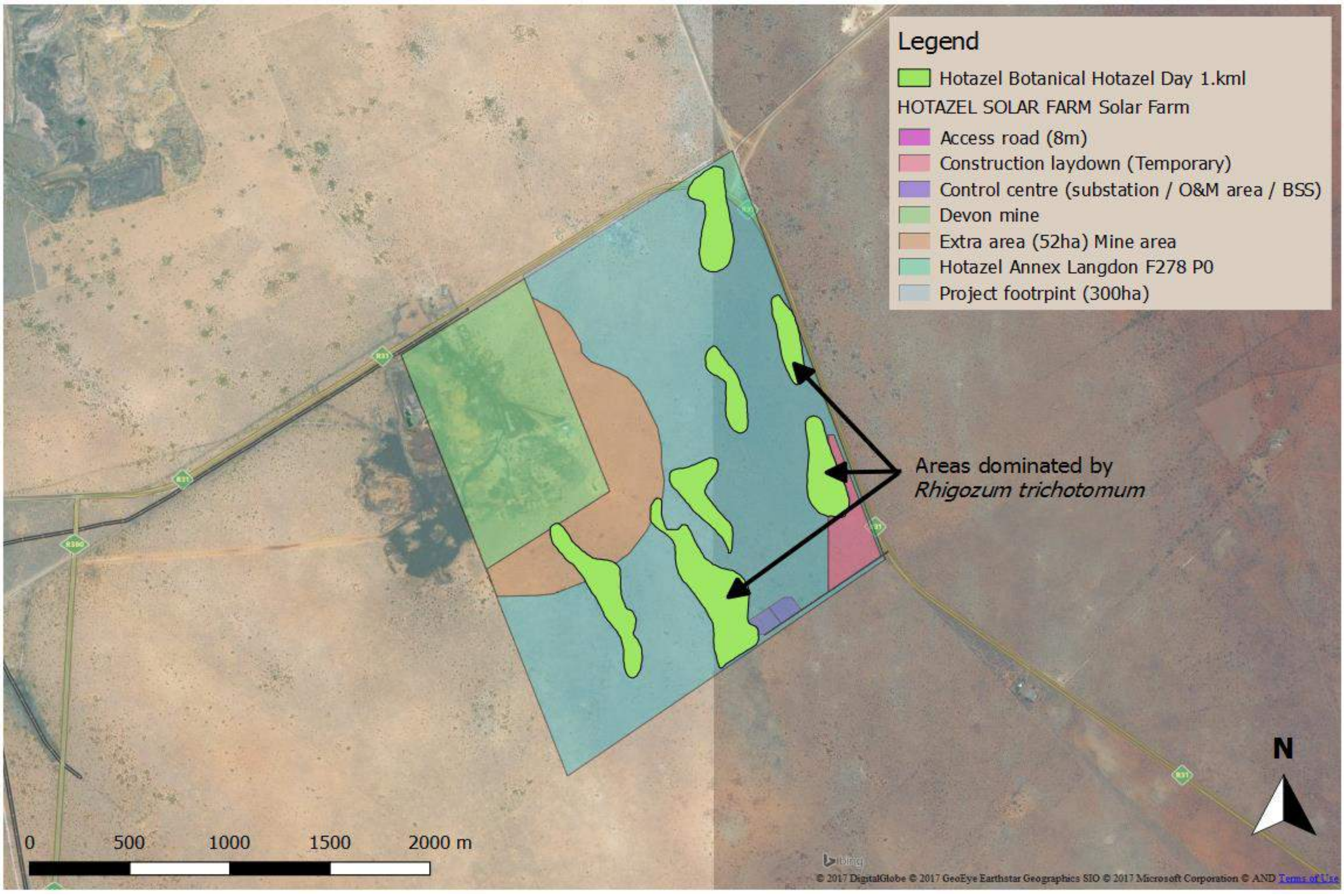

Figure 4. Aerial image (Google Earth ™) showing the proposed area for the Hotazel Solar Park with the proposed infrastructure and yellow-shaded areas where *Rhigozum trichotomum* (three-thorn) is dominant.

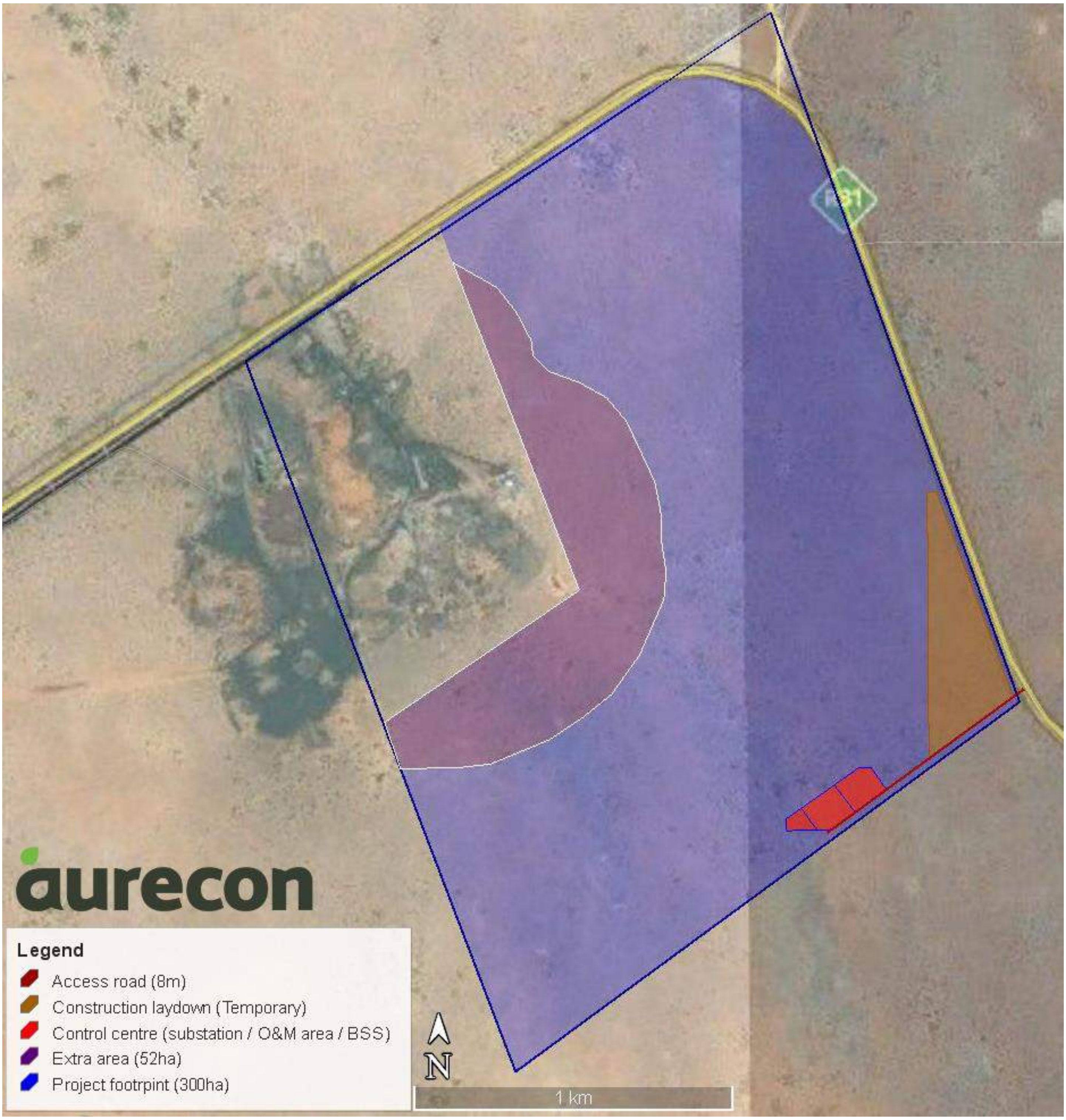

Figure 5. Footprint of the proposed Hotazel Solar Park

3.2 Topography, Geology and Soils

The Hotazel Solar Park site is relatively flat with a very slight slope southward. The soils are shallow wind-blow (Aeolian) sands of Recent age. No rivers or streams are found on the site and outcrops of calcrete, silcrete and sandstone were not noted during the survey. The study area falls within the Ah9 land type that has a flat terrain profile, classified as an A1 terrain. The soils are generally more than 1200 mm deep except for Mispah form soil that ranges from 100—250 mm deep (Figure 6). (Land Type Survey Staff, 1972--2006).

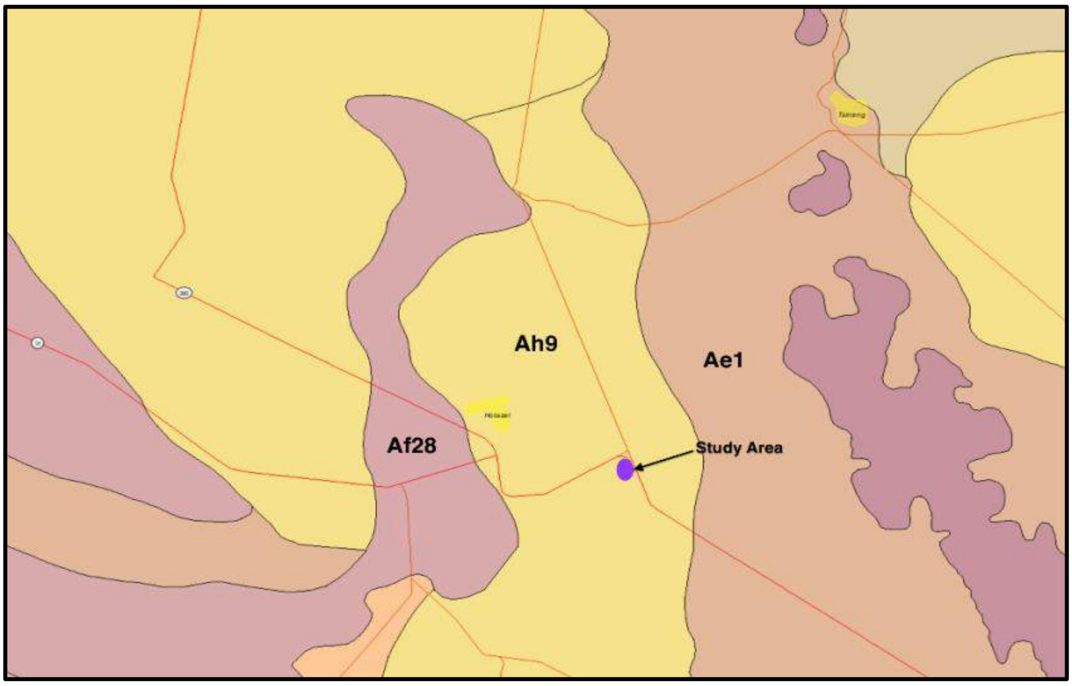

Figure 6. Land type map showing that the study area (purple oval) is entirely in the Ah9 land-type (Source: http://www.agis.agric.za/agisweb/viewer.htm?pn=2015).

3.3 Climate

The climate of Hotazel is typical of the Kalahari. It receives rain in the summer to autumn months (October to April) with very little precipitation falling from May to September (Figure 7). It receives no rainfall in July and the highest rainfall(80mm) in February. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Hotazel range from 17°C in June and July to 30°C in January. The Hotazel district is the coldest during June and July when the temperature drops to 1°C on average during the night (Figure 8).

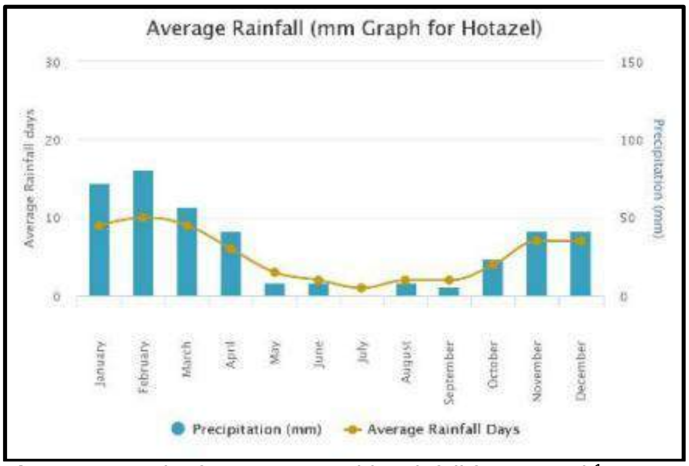

Figure 7. Graph of average monthly rainfall for Hotazel.[1]

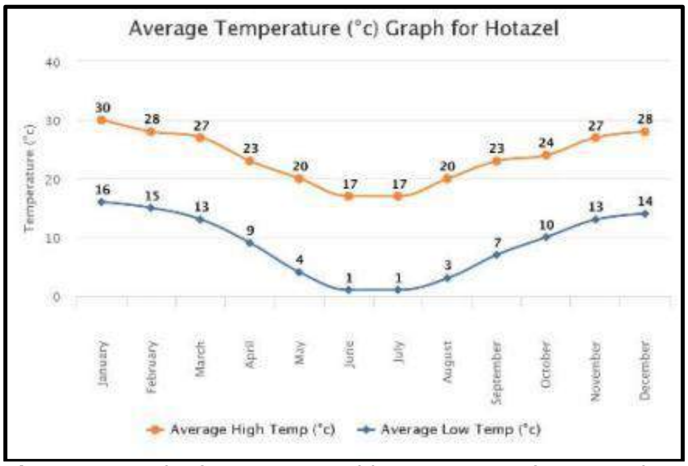

Figure 8. Graph of average monthly temperature for Hotazel

[1]*Source: https://www.worldweatheronline.com/hotazel-weather/north-western-province/za.aspx*

A climate diagram for Kathu Bushveld presented by Rutherford *et al.* (2006) (in Mucina & Rutherford, 2006) (Figure 9) shows that mean annual potential evaporation (MAPE) is higher (2883 mm) than mean annual precipitation (MAP) (300 mm). This indicates a relatively dry climate that is well reflected in the type of vegetation found.

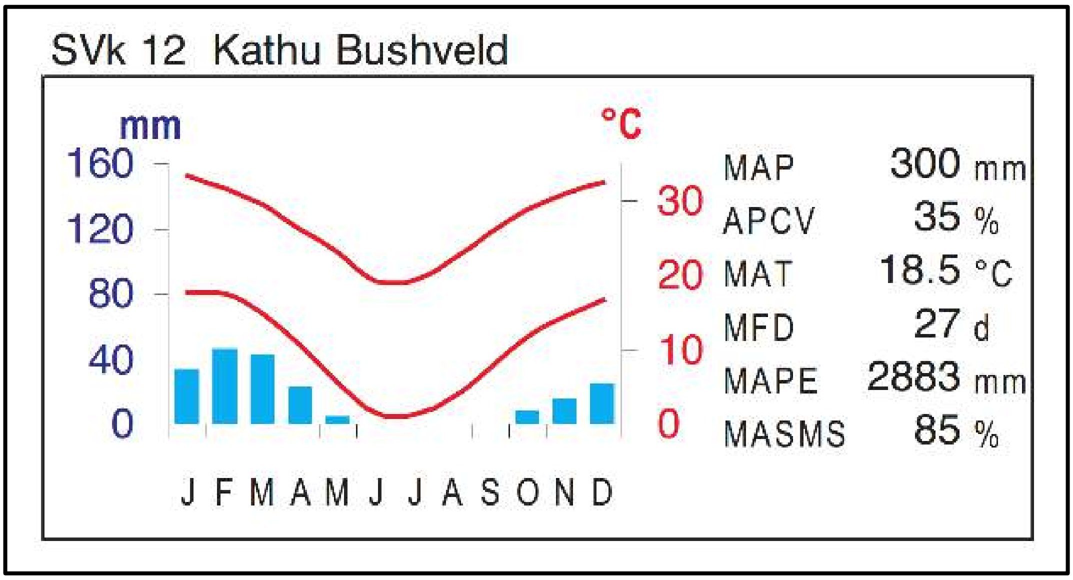

Figure 9. Climate diagram for Kathu Bushveld (from Rutherford *et al.* 2006 in Mucina & Rutherford, 2006) showing MAP – Mean Annual Precipitation; ACPV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMA = Mean Annual Soil Moisture Stress.

4. EVALUATION METHOD

A rapid assessment, plot-less method was employed. A hand-held Garmin ® GPSMap 62s was used to record 'sample' waypoints of which there were 23 on the first day of survey and a further eight on the second. The route followed (sample track) at the site of the proposed solar park and for the transmission lines is shown in Figures 2 & 3. The waypoints for investigation of the transmission line routes are shown in Figure 3.

At the sample waypoints, specific details of the surrounding vegetation and features of habitat were recorded and photographs taken to support the general observations made. No attempt was made to cover the whole property but sampling was focused so as to obtain the best overall understanding of the landscape and biodiversity conditions. Extrapolation from the sample points was carried out using aerial imagery. The site is not complex in terms of landscape of vegetation pattern and the sampling intensity was more than enough to draw conclusions with a high level of confidence. This obviated the need to 'cover' the whole site during field sampling.

5. LIMITATIONS AND ASSUMPTIONS

The study area was visited on 24 and 25 July 2016 in fine winter weather. This was not the ideal season since, notwithstanding the winter season, the prolonged drought had caused the area to be very dry. The result was that most of the herbs and low forbs were either dried out or dormant. The vegetation was thus characterized and assessed based on the shrub and small tree component.

It should be noted that a single visit to a site, whenever it is undertaken, has limitations. However, by using a habitat-based approach and with most of the shrubby vegetation identifiable, a high degree of confidence was achieved in the survey of the study area given the single site visit.

6. THE VEGETATION

6.1 General description

The site proposed for the Hotazel Solar Park is in the summer rainfall region, in the Savannah Biome and more specifically the Eastern Kalahari Bioregion. The Savannah Biome stretches across the Northern Cape Province, into the Northwest and Limpopo Provinces and then southwards in a band inland of the eastern seaboard of South Africa (Rutherford, Mucina & Powrie, 2006). According to Rutherford *et al.* (2006) and the SANBI (2012) vegetation map, the vegetation in the study area is Kathu Bushveld. The distribution of this vegetation is from Kathu and Dibeng (Deben) northwards past Hotazel to Frylinckspan and the Botswana border between VanZylsrus and McCarthy's Rest. The altitude is between 960 and 1300 m above mean sea level.

The transmission lines would extend from Kathu Bushveld westwards over a narrow north-south area of Gordonia Duneveld to Kathu Bushveld once again (Figure 10).

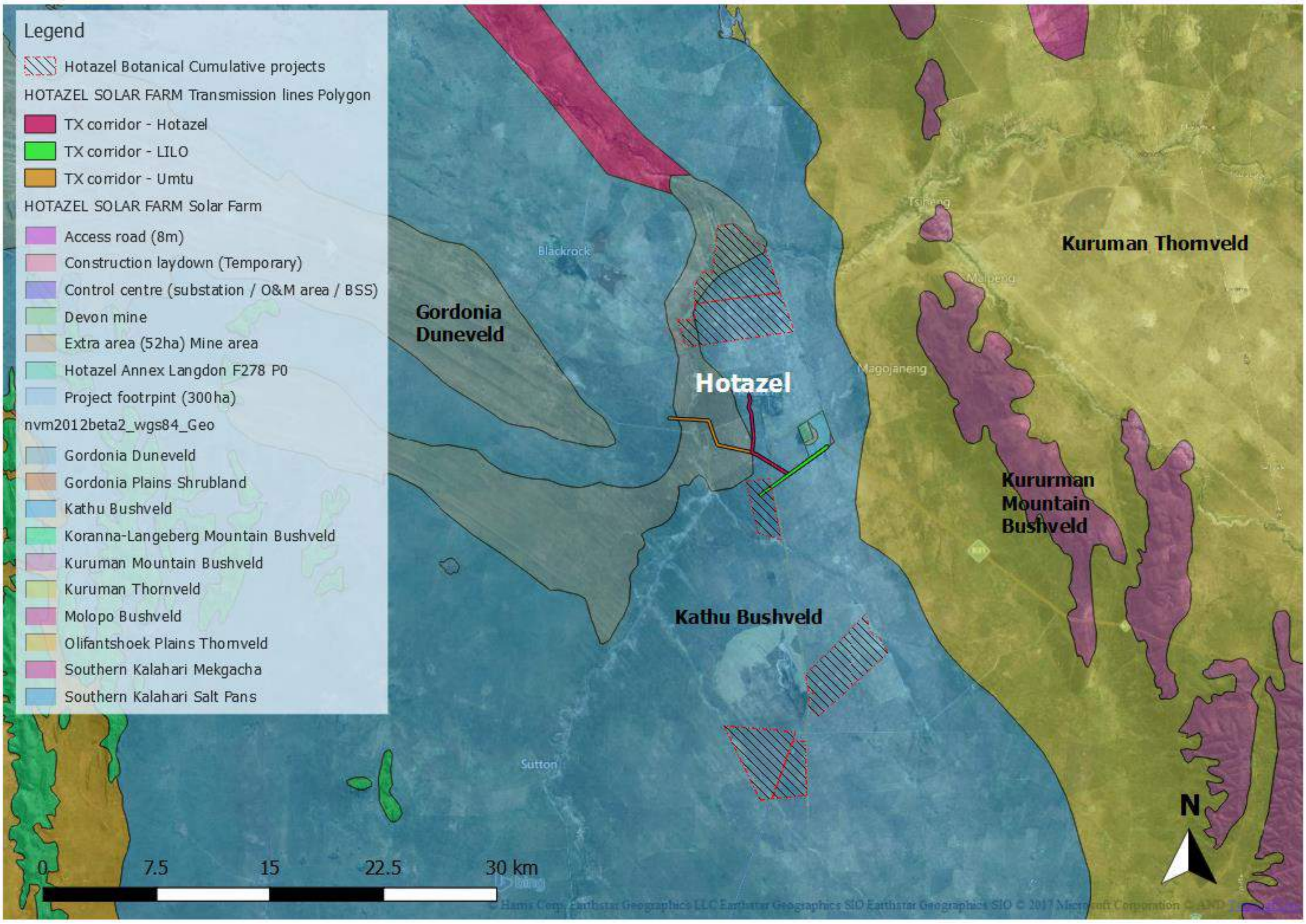

Figure 10. Portion of the Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2012) for the Hotazel district where the proposed Hotazel Solar Park study area is located in Kathu Bushveld, with proposed transmission lines extending through Gordonia Duneveld.

6.2 The vegetation of the study area at farm Annex Langdon (F278/0), Hotazel (the Solar Park)

In most circumstances vegetation responds strongly to land-type since the latter is a combination of soil type, terrain and climate. The vegetation in the study area is no exception. Comparison of Figure 5, the land type map where the land-type is given as **Ah9**, with Figure 9, the vegetation map, shows that Kathu Bushveld occurs on the **Ah** land-type and at the study area, more specifically on land-type **Ah9**.

The vegetation in the study area is typically bushveld but, although mapped as Kathu Bushveld, the stature of the vegetation and its species composition suggest that it is more correctly described as Gordonia Plains Shrubland than Kathu Bushveld (Rutherford *et al.* 2006). The vegetation is relatively uniform across the site, consisting of a mosaic of open areas, vegetated with grasses, herbs and small shrubs, and areas with clusters or thickets of small trees (Figure 11). The vegetation traversed by the transmission line route west of the solar park is not markedly different, even in the area of Gordonia Duneveld, from that found in the area of the proposed solar park.

Figure 11. A typical view of the relatively flat landscape at Annex Langdon Farm, the site of the proposed Hotazel Solar Park.

The widespread shrub, *Rhigozum trichotomum* (driedoring; three-thorn) is well-represented on the site in areas of moderately deep sandy soil. It is said to form dense thickets in overgrazed veld (Van Rooyen *et al.* 2001) and this is typically the case in the study area (Figures 12 & 13). The areas of dense three-thorn thickets are discernible on aerial imagery and have been mapped in Figure 4.

Figure 12. A dense stand of *Rhigozum trichotomum* (three-thorn) that occurs on shallow calcareous soil.

Figure 13. Typical three-branched stems of *Rhigozum trichotomum* with Scaly-feathered Finch.

Another thicket-forming species of note is *Vachellia hebeclada* subsp. *hebeclada* [formerly *Acacia hebeclada* subsp. *hebeclada*] (candle-pod thorn). This species can develop into a sizeable tree but in the study area it is found as shrubs with many shoots arising at ground-level and forming dense thorny masses usually on elevated mounds of sand (Figures 14 & 15).

Figure 14. *Vachellia hebeclada* subsp. *hebeclada* with pods.

Figure 15. Dense mid-high thicket of *Vachellia hebeclada* subsp. *hebeclada.*

The shrub to small tree *Vachellia haematoxylon* [formerly *Acacia haematoxylon*] (grey camel thorn; giraffe thorn) is common in the study area (Figure 16). This species is more characteristic of areas where 'Kalahari sand' is prevalent and from personal observations of the vegetation around the town of Kathu, *V. haematoxylon* is almost absent except for at a few places. Nowhere in the study area are there large trees of *V. haematoxylon* (Figure 17) as found in the Auob River valley on the road to Mata Mata in the Kgalagadi Transfrontier Park. This is ascribed to the likelihood that fire has occurred from time to time in the study area that has prevented large trees from developing. On the study site *V. haematoxylon* is co-dominant with the other prominent tree species in the study area, *Senegalia mellifera* subsp. *detinens* [formerly *Acacia mellifera* subsp. *detinens*] (swarthaak; black thorn) (Figure 18). *S. mellifera* subsp. *detinens*, although natural, tends to favour areas that are disturbed by heavy grazing where it encroaches and in places forms dense impenetrable thickets (Figure 19).

Figure 16. Mid-high to tall shrubs (small trees) of *Vachellia haematoxylon,* a dominant shrub in the study area. This species is protected under the National Forests Act 1998.

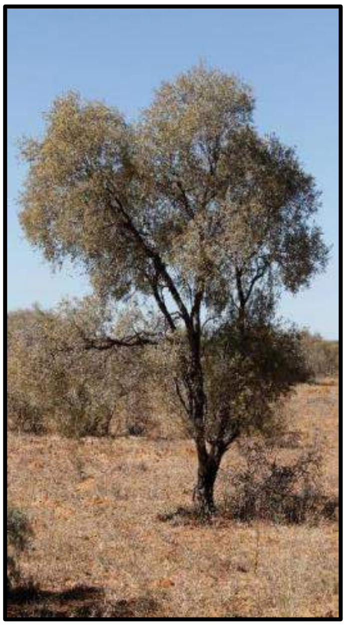

Figure 17. A well-developed small tree of *Vachellia haemato*xylon (grey camel thorn). This species is protected under the National Forests Act 1998.

Figure 18. A large specimen of *Senegalia mellifera* subsp. *detinens* at rear with a juvenile specimen of *Vachellia erioloba* in the foreground and shrubs of *Vachellia haematoxylon* (grey leaves) in the mid-ground, left and right.

Figure 19. Dense thickets of *Senegalia mellifera* subsp. *detinens* found in the study area.

Vachellia erioloba [formerly *Acacia erioloba*] (kameeldoring; camel thorn) occurs sporadically across the study area either as solitary individuals (Figure 20) or as clusters of small trees (Figure 21). Only a few moderate-sized trees of this species were noted and on the whole the vegetation is not characterized by its presence.

Figure 20. *Vachellia erioloba* – solitary individual. This species is protected under the National Forests Act 1998.

Figure 21. A cluster of even-aged young trees of *Vachellia erioloba* (camel thorn).

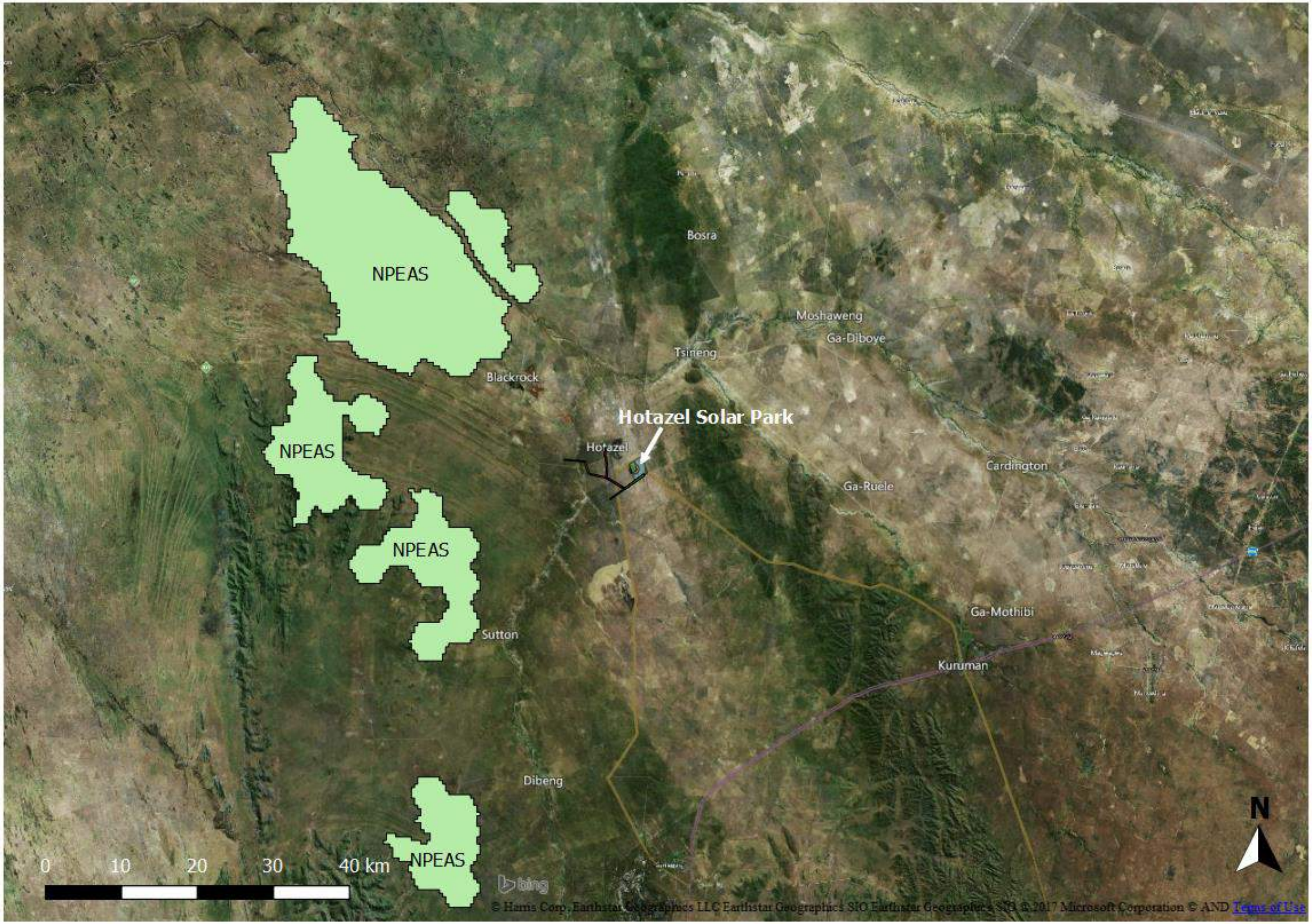

Figure 22. Aerial image from Google Earth ™ showing the study area of the proposed Hotazel Solar Park and associated infrastructure in relation to the closest focus areas (green) of the National Protected Area Expansion Strategy.

7. CRITICAL BIODIVERSITY AREAS AND NATIONAL PROTECTED AREA EXPANSION STRATEGY 'FOCUS AREAS'

The proposed Hotazel Solar Park study area does not fall within a Critical Biodiversity Area (CBA) or Ecological Support Area (according to the CBA map of the Northern Cape Province (E. Oosthuizen, pers. comm.). It falls within an area designated as "Other Natural Vegetation" and the vegetation / habitat is recognized as Least Threatened (Government Gazette, 2011; Driver *et al.* 2012). In terms of the National Protected Area Expansion Strategy, the area of interest is some distance from the nearest focus areas for this national scheme (Figure 21).

8. PROTECTED PLANT SPECIES

No species of conservation concern (threatened species) were found during the survey, however, it is possible that regional endemic species may be present. The prevailing dry conditions, however, made finding such species impossible at the time of the site visit.

Of more importance is that both *Vachellia erioloba* (camel thorn) and *Vachellia haematoxylon* (grey camel thorn) are protected species in terms of the National Forests Act 1998 (Act 94 of 1998). Given the abundance of *V. haematoxylon* and the relative scarcity of *V. erioloba* in the study area, determination of the exact number of these trees present is not possible without a highly detailed survey. It is estimated that there are less the 50 *V. erioloba* trees in the study area and most of them are small. A permit would be required from the Department of Agriculture, Forestry and Fisheries (DAFF) for the removal of these tree species in the area of the footprint of the solar PV installation. It is unlikely that many, if any, of these trees would be removed for the transmission lines.

9. IMPACT ASSESSMENT: HOTAZEL SOLAR PARK

9.1 Assessed impacts: Hotazel Solar Park

The assessment of the impacts is considered for the 'No Go' alternative and the preferred alternative as follows:

- Alternative A4: Single axis PV with tracking mechanism, with storage.
- Alternative B2: Eastern access: a ≤ 1.9 km long, ≥ 8m wide gravel road running from the R31 along the southern boundary of Annex Langdon Farm.

Associated infrastructure:

- Service roads
- Collector substation
- Operations and Maintenance area
- Other infrastructure – perimeter fencing; access control gate and guard house; water storage tanks or lined ponds; water supply line (small diameter, ≤ 3.5 km); septic tanks and sewer lines to ablution facilities; a ≤ 4 ha construction yard and laydown area (to be rehabilitated after construction).

Three types of impacts are assessed:

- **Direct impacts:** Impacts occurring directly on the vegetation of the site as a result of the solar farm development.
- **Indirect impacts:** Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.
- **Cumulative impacts**: Impacts caused by several similar projects, related strategic actions and existing trends.

9.2 'No Go' Alternative

In the 'No Go' scenario there would be no construction of a Solar PV facility at Annex Langdon Farm. The area would continue to be used for grazing livestock (cattle) and the impacts of that activity would not change the character of the site in the short to medium term. In the long-term continued grazing pressure may cause further encroachment of *Senegalia mellifera* subsp. *detinens*, a species that tends to increase with overgrazing. The 'No Go' alternative would apply throughout and is rated as **Low Negative**.

9.3 Direct Impacts and Mitigation: Alternative A4.

The principal (and only) factor assessed for direct impacts of the proposed Solar PV facility is loss of natural vegetation and habitat. It is anticipated that within the site (study area) there would be almost complete removal of the existing vegetation no matter what alternative is proposed. Solar PV systems require open ground with low vegetation. The only vegetation permissible would be grasses. All shrubs would be removed. The greatest impact would thus be on the footprint of the Solar PV installation, regardless of technology applied. Owing mainly to the fact that protected plant species are present, the impact would be **High Negative** without mitigation and **Medium Negative** with mitigation (Table 2). On-site mitigation would be somewhat restricted. The areas between the solar PV panels should be kept vegetated to assist with dust control as well as to ensure good penetration of water during rainy periods. The only other on-site mitigation would be limited rehabilitation of the 4 ha construction laydown area.

9.4 Direct Impacts and Mitigation: Alternative B2.

The Alternative B2 access road would have **Medium Negative** impact without mitigation and **Low Negative** with mitigation (Table 3).

9.5 Direct Impacts and Mitigation: Associated Infrastructure.

Individually the proposed associated infrastructure would mainly have **Medium Negative** impacts without mitigation and **Low Negative** impacts with mitigation. However, this infrastructure would be within the footprint of the proposed solar park so it would not cause additional negative impacts above those identified for the footprint of the installation as a whole (Table 2).

TABLE 2: Impact of the preferred alternative for the Hotazel Solar Park

	Preferred Alternative (A4)		No Go Alternative	
Short description	Single axis PV with storage: (Alternative A4). with maximum of 100MWh energy storage retained for controlled energy release.		*Status quo* remains and no PV installation would be built	
Overview	Removal of vegetation on footprint of PV modules as well as associated infrastructure. For "no-go" it is assumed that ongoing extensive grazing practices would continue and lead to vegetation structure modifications.			
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Neutral
Duration	Long-term	Long-term	Long-term	Long-term
Extent	Local	Local	Local	Local
Magnitude	High negative	Medium negative	Very low	Neutral
Probability	Definite	Definite	Unlikely	Unlikely
Confidence	Certain	Certain	Certain	Certain
Reversibility	Irreversible	Irreversible	Reversible	N/A
Resource irreplaceability	Low	Low	Low	Low
Mitigability	Low	Low	Low	N/A
Significance	High negative	Medium negative	Very-low negative	Neutral
Mitigation	Only limited on site mitigation would be possible by revegetation of some disturbed areas.			
Cumulative Impact assessment	A number of solar PV installations are proposed within a 30 km radius of the Hotazel Solar Park (see Figure 10). They are also in Kathu Bushveld and since this is a Least Threatened vegetation type the cumulative impacts would be **Low Negative**.			

TABLE 3. Impacts for the access road, Hotazel Solar Park (Alternative B2)

	Preferred Alternative		No Go Alternative	
Short description	Access road along southern boundary of Annex Langdon Farm		*Status quo* remains and no access road (Alternative B2) would be required	
Overview	Removal of vegetation along a ≤ 1.9 km x 8 m wide strip for the access road			
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Neutral	Neutral
Duration	Long-term	Long-term	Long-term	Long-term
Extent	Local	Local	Local	Local
Magnitude	Medium negative	Low negative	Neutral	Neutral
Probability	Definite	Definite	Definite	Definite
Confidence	Certain	Certain	Certain	Certain
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Low	Low	Low	Low
Mitigability	Low	Low	N/A	N/A
Significance	Medium negative	Low negative	Neutral	Neutral
Mitigation	No on-site mitigation would be possible since all the vegetation along the access road route would be lost. The only mitigation possible would be revegetation of disturbed areas not used for the road.			
Cumulative Impact assessment	The cumulative impact would form part of the development of the Hotazel Solar Park as a whole. The construction of the road would not add much negative impact to Kathu Bushveld and the cumulative impact would be Low Negative.			

9.6 Indirect Impacts: Hotazel Solar park

No indirect impacts were identified as applicable to the vegetation and flora of the study area and surrounds.

9.7 Cumulative Impacts: Hotazel Solar Park

Kathu Bushveld (or as determined in this study, Gordonia Plains Shrubland), is widespread in the Eastern Kalahari Bioregion. Three other solar energy facilities area proposed both north and south of the proposed Hotazel Solar Park, mostly within Kathu Bushveld but the northern one transgresses into Gordonia Duneveld (Figure 22). Collectively these solar energy facilities would have a **Low Negative impact** on Kathu Bushveld, a Least Threatened vegetation type.

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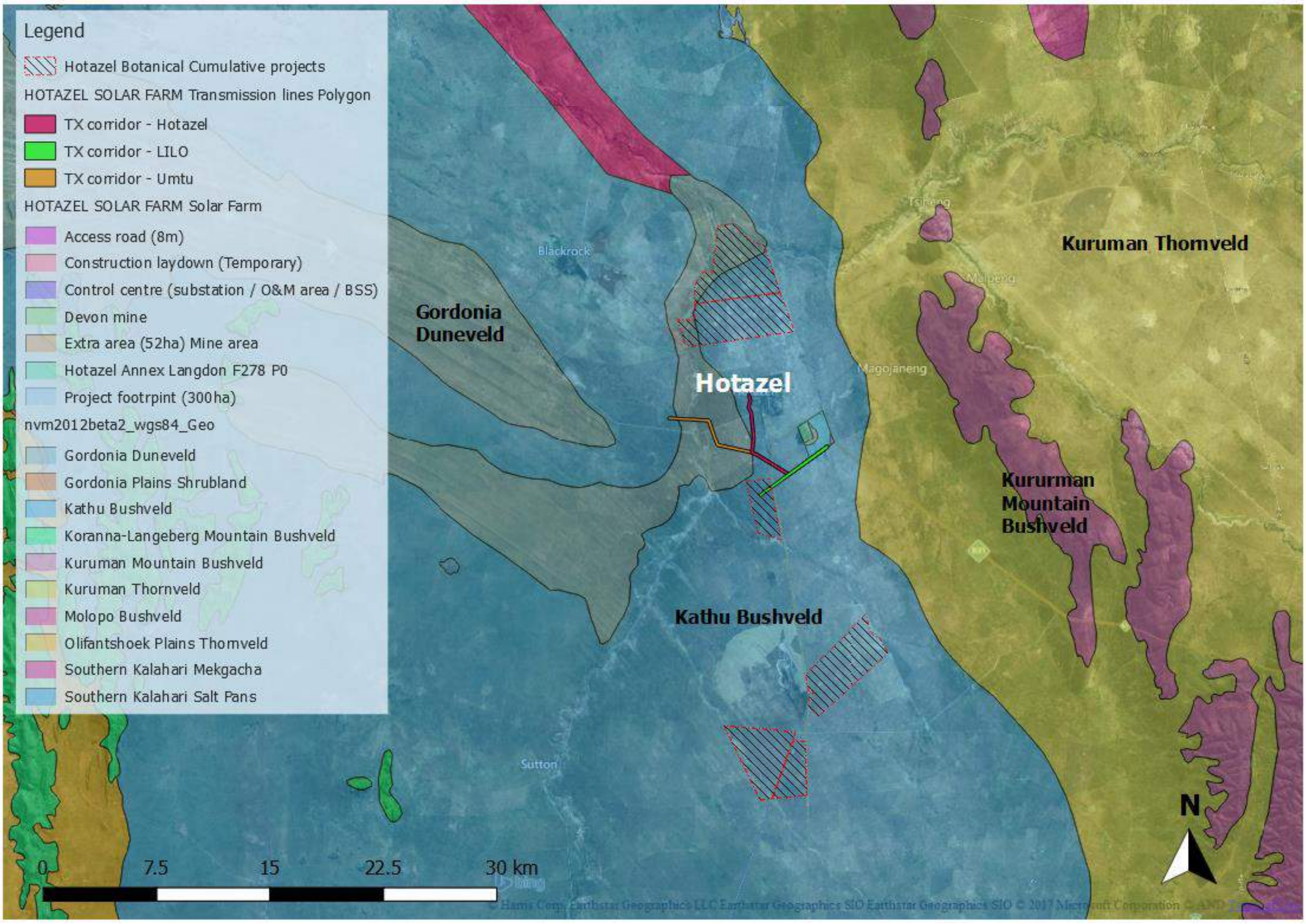

Figure 22. Portion of the Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2012) for the Hotazel district indicating the location of the study area and other proposed solar energy facilities. They are mostly in Kathu Bushveld but one transgresses into Gordonia Duneveld.

9.8 Mitigation

On-site mitigation would be limited, however, the following mitigation measures may be possible:

- A first mitigation strategy would be to raise *Vachellia erioloba* and *Vachellia haematoxylon* trees from seed and to actively plant these at a suitable location that would not be affected by the solar park.
- The second mitigation that is mainly applicable to laydown areas (and perhaps the access road where necessary) is to implement revegetation and rehabilitation.

9.9 Habitat Condition

Since the habitat in the study area has been used mainly for cattle ranching and has never been ploughed, it is in fair to good condition (Table 4). It is mostly free of alien invasive plants except around a livestock watering-point in the north-east corner of the site where honey mesquite (*Prosopis glandulosa* var. *torreyana*) [Figure 23 & 24] is prominent. This leguminous species is spread by livestock that eat the pods and disperse the seeds. It also favours disturbed areas such as the trampled surrounds of the water point. In the northern part of the site, around the derelict buildings (see Figure 4) there are numerous exotic syringa trees (*Melia azedarach*) as well as many invasive herbaceous weeds and grasses. These plants occur in this area due to intense disturbance. An impression of what could happen if care is not taken to control invasive plant species in the footprint of the solar park is illustrated in Figure 25.

Figure 23. Leaves and pods of honey mesquite (*Prosopis glandulosa* var. *torreyana*)

Figure 24. Multi-stemmed shrubs of honey mesquite (*Prosopis glandulosa* var. *torreyana*) in the foreground with *Vachellia erioloba* (camel thorn) behind. This location is near the watering-point in the northeast corner of the study area.

Figure 25. The highly disturbed area around the derelict buildings in the northern part of the study area. A few moderate-sized *Vachellia erioloba* trees are found here but most of the trees are exotics.

Table 4. Habitat condition of the study area at Annex Langdon Farm, Hotazel

Habitat Condition	Percentage of habitat condition class (adding up to 100%)	Description and additional Comments and Observations (including additional insight into condition, e.g. poor land management practises, presence of quarries, grazing / harvesting regimes etc.)
Natural	98%	Undisturbed apart from grazing
Near Natural (includes areas with low to moderate level of alien invasive plants)	1%	Disturbed area around watering –point. Invasion by honey mesquite.
Degraded (includes area heavily invaded by alien plants)	1%	Area in the northern part of the site that is highly disturbed and invaded by exotic trees and herbaceous plants.
Transformed (includes cultivation, dams, urban, plantation, roads, etc.)	0%	No areas are transformed

10. CONCLUSIONS AND RECOMMENDATIONS: HOTAZEL SOLAR PARK

- The natural vegetation type found at Annex Farm Langdon near Hotazel is mapped by SANBI (2012) as Kathu Bushveld. Analysis of the data collected in this study suggest that the vegetation should more correctly be classified as Gordonia Plains Shrubland. According to the National Biodiversity Assessment (Driver *et al.* 2001) and the List of Threatened Terrestrial Ecosystems (Government Gazette, 2011), both these vegetation types (ecosystems) are Least Threatened.
- The study area for the proposed Hotazel Solar Park does not fall within or near any Critical Biodiversity Area or Ecological Support Area. In addition, it is far from any NPAES Focus Area.
- In general, the study area is not botanically sensitive except for the presence of two protected tree species, *Vachellia erioloba* and *Vachellia haematoxylon*. The impact of the removal of these trees is a major focus of the Environmental Impact Assessment. Their removal would require permits from the Department of Agriculture, Forestry and Fisheries
- The principal impact would be clearing of vegetation for the footprint and associated infrastructure of the solar park. Owing mainly to the presence of two protected tree species, the impact is rated as **High Negative** without mitigation. Opportunities for mitigation are limited but would mostly involve rehabilitation. It may be possible to raise the protected trees from seed and use the seedlings for rehabilitation purposes. With mitigation this would result in a Medium Negative impact.
- The associated infrastructure would mostly have **Medium Negative** impacts without mitigation since they would be within the boundary of the property earmarked for the solar park.
- No other plant species of conservation concern were recorded but the precautionary principle is invoked since the site was very dry at the time of sampling.
- Care must be taken to not spread alien invasive plant species, particularly *Prosopis glandulosa* var. *torreyana* (honey mesquite) during construction. Careful monitoring for the occurrence of this species must be implemented and this must be written into the EMPr. Where this species occurs it should be eradicated.
-
- There is no compelling reason from a botanical viewpoint to prevent the proposed Hotazel Solar Park from being constructed at Annex Farm Langdon, near Hotazel, and the application is supported.

11. TRANSMISSION LINE CORRIDORS

Three transmission line corridor alternatives are proposed to evacuate power from the solar facility to the national grid either by connecting the Hotazel Solar Park to the existing Eskom substations, namely the Hotazel and Umtu substations or by implementing a shorter Loop-in Loop-Out (LILO) connection option.. The latter option would be the most environmentally feasible option but cannot be put forward as the preferred option due to its uncertainty on the technical feasibility of this option. The transmission lines would form part of the national grid and therefore would fall under the ownership and operation of Eskom. Ownership of this infrastructure would be ceded to Eskom once constructed and must therefore have separate environmental authorization to allow for the transferal of ownership.

The following table provides a summary of the project components and alternatives assessed in the Basic Assessment process.

Table 5: Hotazel Solar Farm Transmission Corridors - Project Alternatives assessed

Transmission line C1: Hotazel substation • A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed • Servitude width 35m • ≤110monopole pylons • ≤12km long and 4m wide service track
Transmission line C2: Umtu substation • A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed • Servitude width 35m • ≤140 monopole pylons • ≤15km long and 4m service track
Transmission Line C3: LILO connection[2] **(please see footnote)** • A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. • Servitude width 35m per line. • ≤60 monopole pylons (i.e. ≤120 pylons in total) • ≤6km long and 4m service track per line
Alternative C4: NO GO • No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

11.1 The vegetation of the transmission corridors

Accessibility to the routes of the proposed transmission lines was difficult so a number of accessible points were visited to obtain a record with which to characterize the vegetation. It was found that there is not much variation in the vegetation and along all the routes it is mostly bushveld dominated by *Senegalia mellifera* subsp. *detinens* with open to dense cover. The understorey is dominated by grasses. *Vachellia haematoxylon* (grey camel thorn) trees are a feature of the transmission line routes where they cross Kathu Bushveld, whereas this species is much less prominent to absent in the areas where the transmission line routes cross Gordonia Duneveld. A few *Vachellia erioloba* trees were encountered, mainly near the Ga Mogara River.

Table 6. Sample waypoints, brief descriptions of the vegetation and illustrations for the transmission corridors[4]

Waypoint	Co-ordinates	Description	Illustration
HOT24[5]	S 27° 13' 57.1 E 22° 59' 38.8"	This location is at the mine near the solar park, from where access was gained to the originally proposed transmission line route at the	No illustration

[2] *The Loop In Loop Out connection depends on future improvements of the Eskom line before being deemed feasible alternative. Since this might occur, juwi wants to keep the alternative alive and have it assessed in the Basic Assessment*
[4] *Note that due to amendments to transmission line corridors since the site visit some areas do no exactly bisect the corridors. The images have however been left in the report to contextualize the study area.*
[5] *Waypoints are illustrated in Figure 3 on page 10.*

Waypoint	Co-ordinates	Description	Illustration
		boundary of the farm portion.	
HOT25	S 27º 14’ 07.8” E 22º 59’ 42.5”	At a junction of farms camps on the west boundary of the farm where the originally proposed transmission line would have run along the fence-line. This route was changed subsequent to the field survey but the vegetation along the proposed route as shown in Figure 3 is the same type with similar condition to that illustrated.	
HOT26	S27º 14’ 06.2” E 22º 58’ 28.0”	On Kathu Road (R380) at the location where the transmission line route across Devon Farm would reach the R380. An existing powerline is in place and the same servitude could (and should) be used.	 

Waypoint	Co-ordinates	Description	Illustration
HOT27	S 27º 14’ 32.3” E 22º 57’ 41.1”	This location is along the gravel road from the R380 to Deben at a point where a number of power-lines cross the road. The proposed power-line from the Hotazel Solar park would bend at this point to follow the existing power-line servitude in a NW direction to Kudumani Mine. The vegetation on the north side of the road is not sensitive. It has been disturbed, with large soil heaps, due to excavations for the railway lines. The vegetation is hardly affected by the power-lines.	 
		View SE along the power-line servitude from the road to Kalagadi Manganese Mine. The spoil heap of the Kudumani Mine is seen on the right-hand-side of the image. The servitude has been cleared of trees. The surrounding vegetation is typically bushveld with *Senegalia mellifera* subsp. *detinens* dominant.	

Waypoint	Co-ordinates	Description	Illustration
HOT28	S 27º 13’ 56.8” E 22º 57’ 59.5”	On the bridge over the railway on the R380 near Hotazel. The view is northwards along and existing power-line servitude in the direction of the Hotazel Substation. The vegetation is bushveld with *Senegalia mellifera* subsp. *detinens* dominant.	
HOT29	S 27º 13’ 35.8” E 22º 55’ 56.7”	At power-line servitude on road to Kalagadi Manganese Mine at a location north of the Kudumani Mine. The servitude has been cleared of trees (high vegetation) and now has a dense cover of grass.	
HOT30	S 27º 13’ 44.5” E 22º 55’ 21.9”	At the Ga Mogara River low-level bridge. The river was dry at the time of sampling. A few scattered *Vachellia erioloba* trees are found near the river. The river watercourse is heavily infested by alien invasive mesquite (*Prosopis glandulosa* var. *torreyana*).	
HOT31	S 27º 13’ 39.6” E 22º 54’41.6”	This waypoint is at the entrance to the Kalagadi Manganese Mine (restricted access). The proposed power-line would terminate at the UMTU substation on the mine premises. All the vegetation is typically bushveld with scattered *Vachellia erioloba* but dominated by *Senegalia mellifera* subsp. *detinens*.	

Waypoint	Co-ordinates	Description	Illustration
HOT32	S 27º 13' 01.2" E 22º 57' 45.3"	At the entrance to Hotazel town where a power-line crosses the road. The power-line extends from south to north in a cleared servitude that is now dominated by grass. The uncleared vegetation adjacent to the servitude is dominated by *Senegalia mellifera* subsp. *detinens*.	

Figure 26. Transmission line alternatives to evacuate power from Hotazel Solar Park (Map supplied by Aurecon).

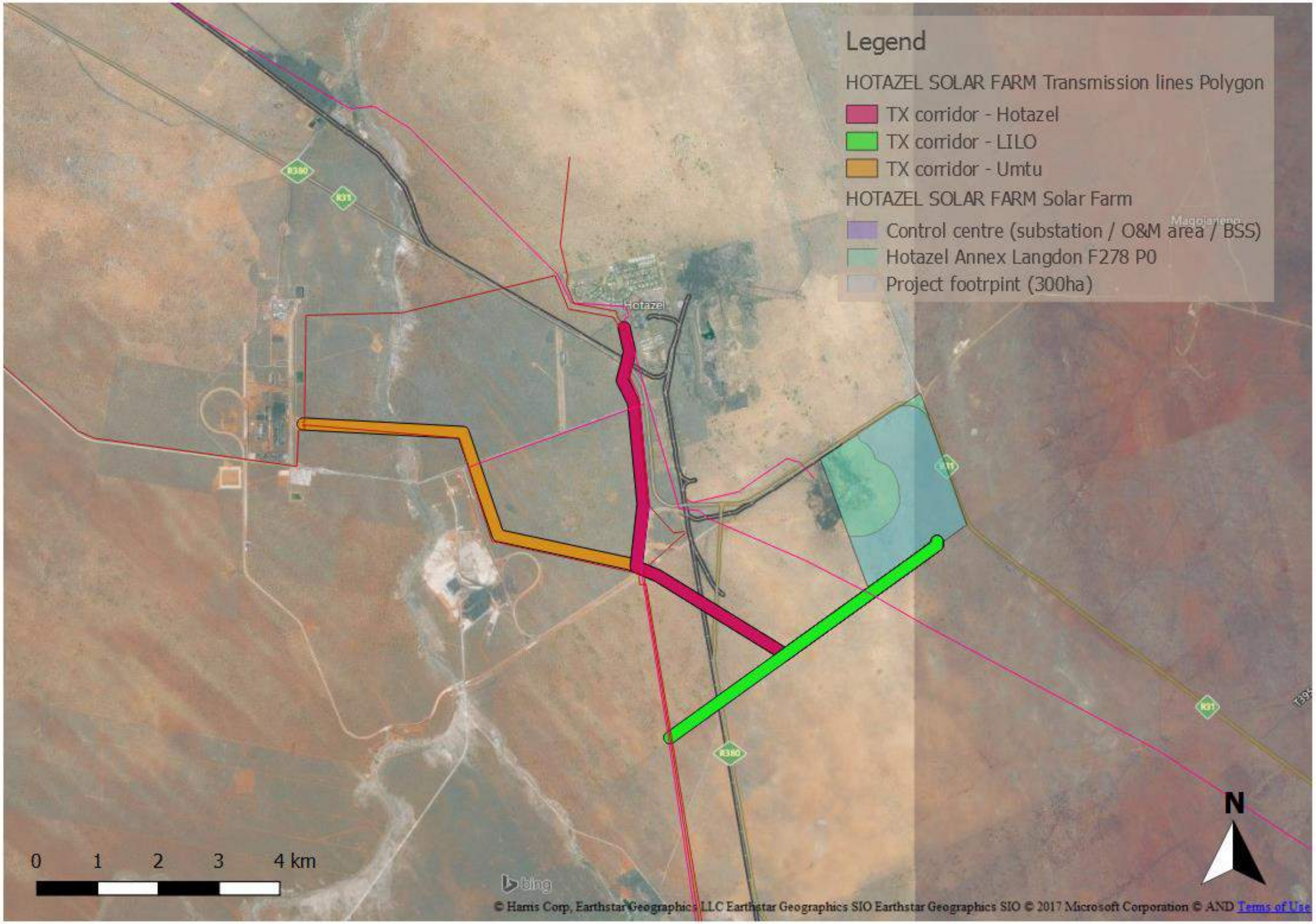

Figure 27. Transmission line corridor from Hotazel Solar Park to Hotazel Substation, Hotazel Solar Park to Umtu Substation and Loop-in Loop-out transmission line superimposed on an aerial image (Map supplied by Aurecon).

12. IMPACT ASSESSMENT: TRANSMISSION CORRIDORS

12.1 Assessed impacts: Transmission Corridors

The assessment of the impacts is considered for the 'No Go' alternative and three transmission alternatives:

- **Transmission line C1: Hotazel substation**
- **Transmission line C2: Umtu substation**
- **Transmission Line C3: LILO connection**
- **Alternative C4: NO GO**

Three types of impacts are assessed:

- **Direct impacts:** Impacts occurring directly on the vegetation of the transmission corridors.
- **Indirect impacts:** Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.
- **Cumulative impacts**: Impacts caused by several similar projects, related strategic actions and existing trends.

The most significant impact for all the transmission corridors would be removal of vegetation, especially moderate to tall trees. The servitude corridors would be kept clear of woody vegetation and only a cover of grass would be permitted (see HOT32 in Table 6). This would be required for the safe operation of the transmission lines. Consequently, the vegetation would not revert to its natural state after construction since it would be kept in check by systematic and regular clearing. Given that the vegetation type is widespread and least threatened the local and cumulative impacts are but at the most **Medium Negative**. No significant mitigation measures could be implemented therefore the pre- and post-mitigation condition would be much the same so the impacts would remain unchanged (Table 7). This is particularly applicable to Alternatives C1 and C2. Comparison of Alternatives C1 and C2 shows that C1 would be more desirable since it would be shorter and it would not cross the Ga Mogara River where there is the potential to affect tall trees of *Vachellia erioloba*.

In the case of Alternative C3, if the technical feasibility of the powerline is affirmed by Eskom it would be the most desirable from a botanical perspective since it would involve the removal of the least vegetation. The No Go alternative would have a neutral to low positive impact since no vegetation would be impacted.

TABLE 7. Impacts of the respective transmission corridors and the No Go alternative.

	Alternative C1		Alternative C2		Alternative C3		No Go Alternative	
Short description	~ 11 km transmission line corridor from solar park to Hotazel substation		~ 14 km transmission line corridor from solar park to Umtu substation		Loop-in Loop-out with transmission line of < 5.5km		*Status quo* remains	
Overview								
Assessment								
	Pre-mitigation	**Post mitigation**	**Pre-mitigation**	**Post mitigation**	**Pre-mitigation**	**Post mitigation**	**Pre-mitigation**	**Post mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	Neutral	Neutral
Duration	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term	Long-term
Extent	Regional	Regional	Regional	Regional	Local	Local	Local	Local
Magnitude	Medium negative	Medium negative	Medium negative	Medium negative	Low negative	Low negative	Neutral	Neutral
Probability	Definite	Definite	Definite	Definite	Definite	Definite	Definite	Definite
Confidence	Certain	Certain	Certain	Certain	Certain	Certain	Certain	Certain
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Reversible	Reversible	N/A	N/A
Irreplaceability	Low	Low	Low	Low	Low	Low	N/A	N/A
Mitigability	Low	Low	Low	Low	Medium	Medium	N/A	N/A
Significance	Medium negative	Medium negative	Medium negative	Medium negative	Low negative	Low negative	Neutral	Neutral
Mitigation	The only mitigation possible would be revegetation at places where there is significant temporary disturbance from construction where bare and compact soils should be rehabilitated to support grasses and herbaceous vegetative cover.						No mitigation required	
Cumulative Impact assessment	Low negative	Low negative	Low negative	Low negative	Low negative	Low negative	N/A	N/A

13. CONCLUSIONS AND RECOMMENDATIONS: TRANSMISSION CORRIDORS

- The Alternative C1 (Hotazel Substation) and Alternative C2 (Umtu Substation) transmission corridors would have similar levels of impact on vegetation types of low sensitivity. The impact would be **Medium Negative** at the most but would not change since no significant mitigation could be applied.
- Comparably Alternative C1would be more desirable than Alternative C2 because it would be shorter in length, therefore affecting less vegetation, and it would not be necessary to cross the Ga Mogara River as would be necessary with Alternative C2.
- The LILO option, Alternative C3 would be the most desirable option since it would have the lowest negative impact on any vegetation.
- The No Go scenario would result in a neutral effect in terms of impacts on the vegetation.
- Cumulative impacts of any of the proposed alternatives would be **Low Negative**.

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Report submitted: 17 January 2017; reviewed 15 February 2017

APPENDIX 1: IMPACT ASSESSMENT METHODOLOGY (AURECON)

This section therefore outlines the proposed method for assessing the significance of the potential environmental impacts. For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** (severity of impact) and **DURATION** (time scale) would be described.

These criteria would be used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure (s) in place. The mitigation described would represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.

The tables below indicate the scale used to assess these variables, and defines each of the rating categories.

Table A1: Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	Regional	Beyond a 10km radius of the proposed site.
	Local	Within a 10km radius of the proposed site.
	Site specific	On site or within 100m of the proposed site.
Magnitude of impact (at the indicated spatial scale)	High	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	Construction period	Up to 1 year
	Short Term	Up to 3 years after construction
	Medium Term	3-10 years after construction
	Long Term	More than 10 years after construction

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table 2.

Table A2: Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	High magnitude with a regional extent and long term duration High magnitude with either a regional extent and medium term duration or a local extent and long term duration Medium magnitude with a regional extent and long term duration
Medium	High magnitude with a local extent and medium term duration High magnitude with a regional extent and construction period or a site specific extent and long term duration High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term Low magnitude with a regional extent and long term duration
Low	High magnitude with a site specific extent and construction period duration Medium magnitude with a site specific extent and construction period duration Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term Very low magnitude with a regional extent and long term duration
Very low	Low magnitude with a site specific extent and construction period duration Very low magnitude with any combination of extent and duration except regional and long term
Neutral	Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring as well as the **CONFIDENCE** in the assessment of the impact would be determined using the rating systems outlined in Table 3and Table 4, respectively.

It is important to note that the significance of an impact should always be considered in conjunction with the probability of that impact occurring. Lastly, the **REVERSIBILITY** of the impact is estimated using the rating system outlined in Table 5.

Table 3 | Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 4 | Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 5 | Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

Table 6 | Definition of irreplaceability ratings

IRREPLACEABILITY RATINGS	CRITERIA
Low	The affected resource is not unique and or does not serve a critical function or is degraded
Medium	The affected resource is moderately important in terms of uniqueness and function or in pristine condition
High	The affected resource is important in terms of uniqueness and function and or in pristine condition and warrants conservation / protection

Cumulative Impact Assessment

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore will be considered for all renewable energy developments (wind and solar) within a 30 km radius of the proposed site. The impact assessment methodology used in the previous section shall be applied to cumulative impacts. Developments that would be considered here include:

- Developments currently undergoing an EIA process;
- Developments which have received Environmental Authorization; and
- Developments under construction or in existence.

APPENDIX 2: CURRICULUM VITAE

Dr David Jury McDonald Pr.Sci.Nat.

Name of Firm: Bergwind Botanical Surveys & Tours CC. (Independent consultant)
Work and Home Address: 14 A Thomson Road, Claremont, 7708
Tel: (021) 671-4056 **Mobile:** 082-8764051 **Fax:** 086-517-3806
E-mail: dave@bergwind.co.za
Website: www.bergwind.co.za
Profession: Botanist / Vegetation Ecologist / Consultant / Tour Guide
Date of Birth: 7 August 1956

Employment history:

- 19 years with National Botanical Institute (now SA National Biodiversity Institute) as researcher in vegetation ecology.
- Five years as Deputy Director / Director Botanical & Communication Programmes of the Botanical Society of South Africa
- Ten years as private independent Botanical Specialist consultant (Bergwind Botanical Surveys & Tours CC)

Nationality:

- South African (ID No. 560807 5018 080)

Languages:

- English (home language) – speak, read and write
- Afrikaans – speak, read and write

Membership in Professional Societies:

- South Africa Association of Botanists
- International Association for Impact Assessment (SA)
- South African Council for Natural Scientific Professions (**Ecological Science, Registration No. 400094/06**)
- Field Guides Association of Southern Africa

Key Qualifications :

- Qualified with a M. Sc. (1983) in Botany and a PhD in Botany (Vegetation Ecology) (1995) at the University of Cape Town.
- Research in Cape fynbos ecosystems and more specifically mountain ecosystems.
- From 1995 to 2000 managed the Vegetation Map of South Africa Project (National Botanical Institute)
- Conducted botanical survey work for AfriDev Consultants for the Mohale and Katse Dam projects in Lesotho from 1995 to 2002. A large component of this work was the analysis of data collected by teams of botanists.
- **Director: Botanical & Communication Programmes** of the Botanical Society of South Africa (2000—2005), responsible for communications and publications; involved with conservation advocacy particularly with respect to impacts of development on centres of plant endemism.
- Further tasks involved the day-to-day management of a large non-profit environmental organisation.
- **Independent botanical consultant** (2005 – to present) over 400 projects have been completed related to environmental impact assessments in the Western, Southern and Northern Cape, Karoo and Lesotho. A list of reports (or selected reports for scrutiny) is available on request.

Higher Education

Degrees obtained and major subjects passed:

- B.Sc. (1977), University of Natal, Pietermaritzburg
- Botany III
- Entomology II (Third year course)
- B.Sc. Hons. (1978) University of Natal, Pietermaritzburg
- Botany (Ecology /Physiology)
- M.Sc. - (Botany), University of Cape Town, 1983.
- Thesis title: 'The vegetation of Swartboschkloof, Jonkershoek, Cape Province'.
- PhD (Botany), University of Cape Town, 1995. Thesis title: 'Phytogeography endemism and diversity of the fynbos of the southern Langeberg'.
- Certificate of Tourism: Guiding (Culture: Local) Level: 4 Code: TGC7 (Registered Tour Guide: WC 2969).

Employment Record:

January 2006 – present: Independent specialist botanical consultant and tour guide in own company: **Bergwind Botanical Surveys & Tours CC**

- August 2000 - 2005: Deputy Director, later Director Botanical & Communication Programmes, Botanical Society of South Africa
- January 1981 – July 2000:Research Scientist (Vegetation Ecology) at National Botanical Institute

- January 1979—Dec 1980 : National Military Service

Further information is available on my company website: www.bergwind.co.za

APPENDIX D.4:

Freshwater

FRESHWATER IMPACT ASSESSMENT FOR THE PROPOSED HOTAZEL SOLAR PARK NEAR HOTAZEL IN THE JOE MOROLONG LOCAL MUNICIPALITY, NORTHERN CAPE

FEBRUARY 2017

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TITLE:	FRESHWATER IMPACT ASSESSMENT FOR THE PROPOSED HOTAZEL SOLAR PARK NEAR HOTAZEL IN THE JOE MOROLONG LOCAL MUNICIPALITY, NORTHERN CAPE
PROJECT NUMBER:	P366-Oct 16
AUTHORS:	Toni Belcher and Dana Grobler
REPORT STATUS:	Freshwater Impact Assessment Report (February 2017)
Client project reference	

USE OF THIS REPORT: This report may not be copied or used unless full reference is made as follows: Belcher Toni and Grobler DF, 2017: Freshwater Impact Assessment for the proposed Hotazel Solar Park near Hotazel in the Joe Morolong Local Municipality, Northern Cape

APPROVED BY Mr Dana Grobler

……………………………………..

APPROVED by Client

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EXECUTIVE SUMMARY

This freshwater assessment is intended to inform the environmental and water use authorisation process for the proposed Hotazel Solar Park near Hotazel in the Joe Morolong Local Municipality within the Northern Cape Province.

Aquatic features which occur within the study area include the following:

- *The Ga-Mogara River which flows to the north-west before discharging into the Kuruman River and then the Molopo River. The Molopo River has its confluence with the Orange River at Riemvasmaak.*
- *A few relatively small valley floor depressions or pans occur that are largely associated with the Ga-Mogara River System.*

All of these freshwater features tend to be ephemeral, mostly only carrying water for short periods of time during the rainy season (November to March). The topography within the proposed development site for the PV facility consists of lower lying areas that contain vegetation which indicates an increased dampness within these areas however no aquatic ecosystems are considered to be present in this area.

The Ga-Mogara River is considered to be in a moderately modified ecological condition and is of moderate to low ecological importance and sensitivity. In terms of aquatic biodiversity conservation importance, the Ga-Mogara River and its catchment have been mapped as an Upstream Catchment to the Kuruman River which has been identified as a Freshwater Ecosystem Priority Area river. No wetland clusters occur within the study area, only wetland areas associated with the river upstream and downstream of the study area.

HOTAZEL SOLAR PARK

There are no freshwater constraints associated with the proposed Hotazel Solar Park. Due to the very limited potential freshwater impact of the proposed project, particularly with mitigation, there is very little difference from a freshwater perspective between the proposed project and the no-go alternative. In addition, the potential cumulative freshwater impacts that would result for the proposed and other renewable energy projects in the area are of a low significance.

Providing that the recommended mitigation measures are implemented (minimising the impacts of stormwater runoff), the significance of the impact is expected very low to negligible. A water use authorization is unlikely to be required from the Department of Water and Sanitation: Northern Cape Regional Office for any possible Section 21 c&i water use aspects of the proposed activities associated with the Hotazel Solar Park. This is due to the fact that there are no freshwater features that are likely to be impacted by the proposed activities.

HOTAZEL SOLAR PARK TRANSMISSION LINES

The proposed transmission line alternative that would link to Umtu Substation is the only component of the proposed project that is located near the aquatic feature within the study area, the Ga-

Mogara River. In terms of this transmission line, it is recommended that a buffer of 100 from the top of bank on either side of the river. Access to this transmission line for construction and maintenance should, as far as possible, be via existing road infrastructure. If an access road needs to be constructed for the transmission line, it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Providing that the above-mentioned recommended mitigation measures are implemented the significance of the impact for all of the alternative transmission lines is expected to be very low to neutral. The LILO Alternative, followed by the Hotazel Alternative will have the least potential freshwater impacts.

A water use authorization may need to be obtained from the Department of Water and Sanitation: Northern Cape Regional Office for the water use aspects of the proposed activities. It is however likely that the activities could be authorised in terms of the General Authorisations for Section 21(c) and (i) water use.

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1. BACKGROUND TO FRESHWATER ASSESSMENT

juwi Renewable Energies (Pty) Ltd ('juwi') proposes the construction and operation of a ≤200MWac solar PV park (referred to as the Hotazel Solar Park) on the Farm Hotazel Annex Langdon (F278/0), together with its associated infrastructure, near Hotazel in the Joe Morolong Local Municipality in the Northern Cape Province (Figure 1). Hotazel Solar Farm 1 (Pty) Ltd has been established and registered for the project.

The Hotazel Solar Park project will be handled as two applications, the first following a Scoping and Environmental Impact Report process in accordance with the NEMA EIA regulations, 2014, GN R 982 for the solar facility and ancillaries (DEA Case Ref: 14/12/16/3/3/2/987). The second application will follow the basic assessment process in terms of the same regulations for the transmission lines connecting the project to the national power grid. The public engagement process will be conducted as a single process in the impact assessment phase. This freshwater impact assessment report is intended to inform the environmental impact assessment phase of the project in terms of the freshwater impacts and recommended mitigation measures for the project.

2. TERMS OF REFERENCE

The suggested and agreed upon work programme based on the above terms of reference were:

Task 1: Freshwater Assessment

Task 1.1: Literature Review and assessment of existing information

Conduct a review of existing studies, reports and data of the area and the detail on the proposed Hotazel Solar Park.

Task 1.2: Site Assessment of the freshwater ecosystems that may be impacted upon by the proposed development activities.

Task 1.3.1: Compilation of the report: Freshwater and Wetland Impact Assessment

Based on the data and information collected in the previous tasks, describe ecological characteristics of the freshwater systems to be impacted. Evaluate the proposed development activities and their potential impacts, and propose mitigation measures for the development. Describe the potential impacts, the significance of those impacts, and weigh and rank each impact during the project life cycle stages, according to the assessment, ranking, weighting and scaling criteria as laid out in the EIA Regulations. Write up findings and recommendations for EIA process in a report and use in the water use licence.

Task 1.3.2: Undertake risk assessment for the proposed project: Assess the various project activities according to the risk assessment matrix of the Department of Water and Sanitation (DWS)

Task 1.4: Review reports and findings in line with alternative options presented.

3. LIMITATIONS AND ASSUMPTIONS OF THE STUDY

Input into this report was informed by a combination of desktop assessments of existing aquatic ecosystem information for the study area and catchment, as well as by a more detailed assessment of the freshwater features at the site. The site was visited in July 2016, during the dry season which was not ideal for a freshwater assessment. An additional freshwater assessment during the wet season is however not deemed necessary.

During the field visit, the characterisation and integrity assessments of the freshwater features were undertaken. Mapping of the freshwater features was undertaken using a Garmin Colorado 300 GPS and mapped in PlanetGIS and Google Earth Professional. The SANBI Biodiversity GIS website was also consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping as well as possible freshwater features mapped in the Freshwater Ecosystem Priority Areas maps. This information/data was used to inform the resource protection related recommendations.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following techniques and methodologies were utilized to undertake this study:

- The river health assessments were undertaken according to methodologies developed as part of the national River Health Programme;
- The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by DWAF (2005) was followed for the delineation of the riparian and wetland areas. According to the delineation procedure, the wetlands were delineated by considering the following wetland indicators: terrain unit indicator; Soil form indicator; Soil wetness indicator; and vegetation indicator.
- The ecological importance and sensitivity assessment was conducted according to the guidelines as developed by DWAF (1999).
- Recommendations are based on professional opinion and best practise guidelines.

The level of aquatic and water quality assessments undertaken was considered to be adequate for this study.

4. USE OF THIS REPORT

This report reflects the professional judgment of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

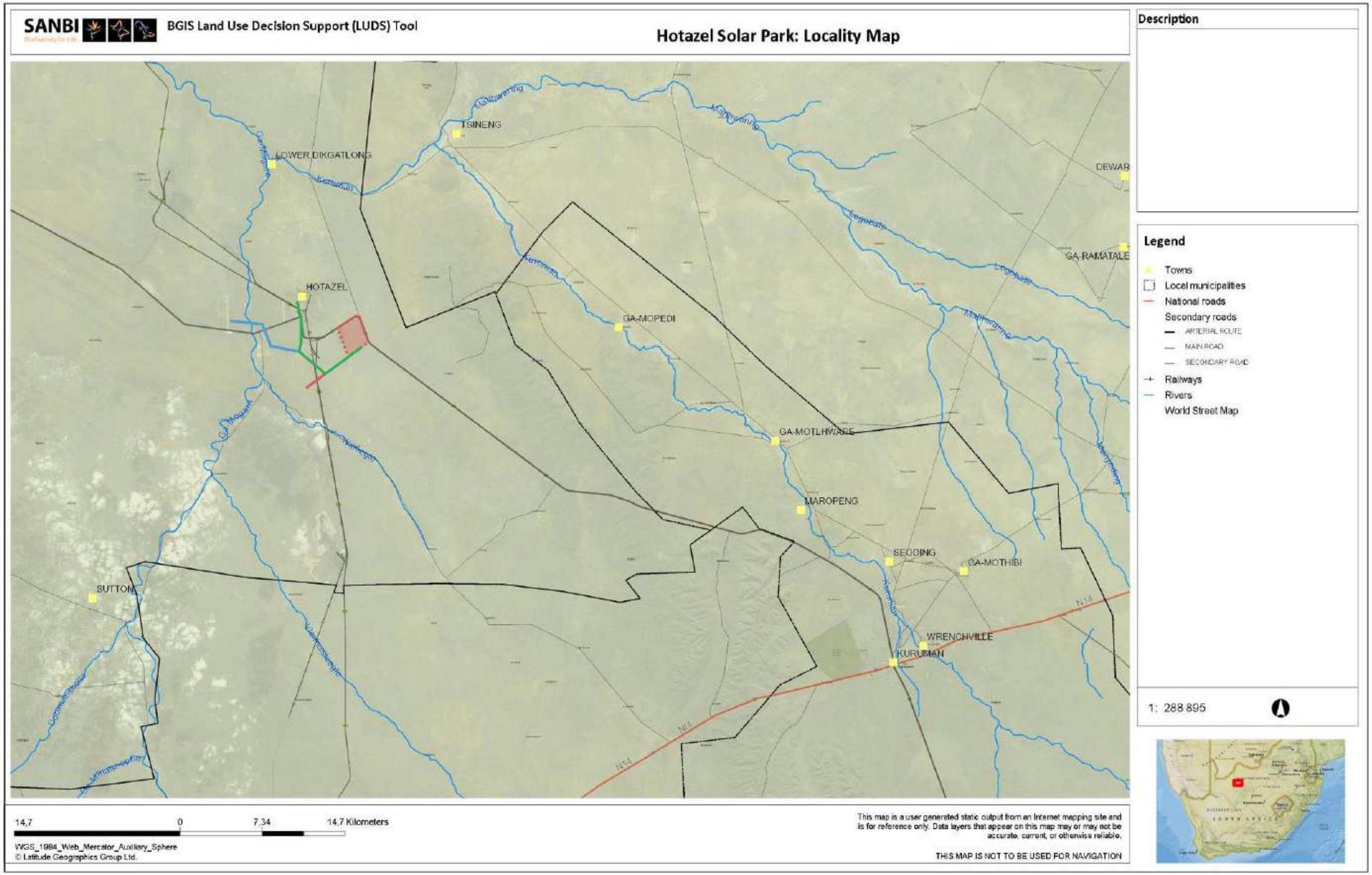


Figure 1: Locality map of the proposed Hotazel Solar Park as well as the proposed alternative routes for the transmission lines (SANBI BiodiversityGIS, 2016)

5. OVERVIEW OF THE PROJECT AND STUDY AREA

5.1. OVERVIEW OF THE STUDY AREA

The study area is located within the Savanna Biome. The landscape consists of flat plains with red wind-blown sands and dunes in the western portion, along the Ga-Mogara River. The vegetation is a mix of grassland dominated by *Stipagrostis amabilis* with closed shrub cover (*Lycium* spp.) and an open tree layer (*Acacia mellifera)*.

In terms of freshwater features, the study area lies primarily in the upper catchment of the north-west flowing river Ga-Mogara River which discharges into the Kuruman and Molopo Rivers before it too reaches the Orange River at Riemvasmaak. A few relatively small valley floor depressions or pans occur that are largely associated with the Ga-Mogara River System. Table 1 provides a summary of the main features of the freshwater and hydrological features of the area.

Table 1: Summary of key information related to the water resources which may be impacted by the proposed activities

Descriptor	Name / details	Notes
Water Management Area	Lower Vaal WMA	
Catchment Area	Ga-Mogara Tributary of the Molopo River	
Quaternary Catchment	D41K	
Present Ecological state	C (Moderately modified)	DWA 2013 (Appendix C)
EISC – Ecological Importance and Sensitivity	Moderate/Very Low	
Type of water resource	River	
Latitude	27°13'47.47"S	Location of Centre of Proposed development site
Longitude	23° 0'8.67"E	
Status of Environmental authorisation process	This freshwater assessment report is prepared as input into the EIA process	**Patrick Killick** Environmental Services, Aurecon **T** +27 44 8055432; **F** +27 44 8055454 Patrick.Killick@aurecongroup.com
Site visit	Mr Dana Grobler and Ms Toni Belcher	18 July 2016

5.2. ACTIVITY DESCRIPTION

It is proposed to construct and operate an approximate 200MWac solar facility with 250ha of PV panels (Referred to as the Hotazel Solar Park). The layout map in Figure 3 provides a general layout and assessment footprint for the project. Three transmission lines alternatives to evacuate power from the solar facility to the national grid are being considered by connecting the Solar Facility to the existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-Out (LILO) connection option. These transmission lines would form part of the national grid and therefore fall under the ownership and operation of Eskom. Tables 2 and 3 provide a summary of the project components.

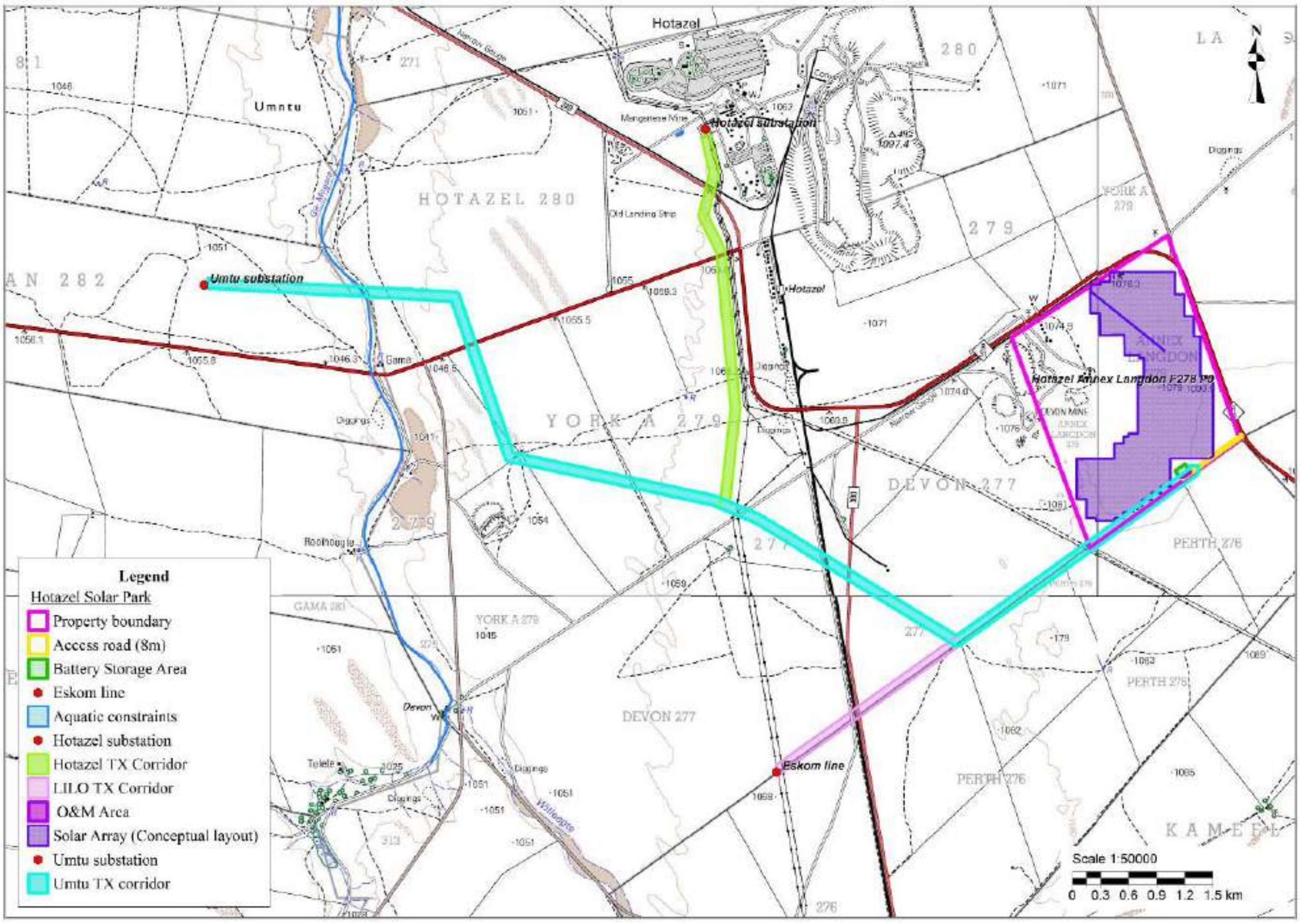


Figure 2: Locality map for the study area and the three alternative transmission line routes

The alternatives considered in the scoping phase are summarised as follows:

Alternative A1: **Fixed mounting** solar panel array;
Alternative A2: **Single axis tracking** solar panel array;
Alternative A3: **Fixed mounting** solar panel array **with** battery storage system;
Alternative A4: **Single axis tracking** solar panel array **with** a battery storage system;
Alternative B1: **≤3.2km** long northern site access road; and
Alternative B2: **≤1.9km** long eastern site access road.

Alternative A4 and Alternative B2 emerged as the preferred alternatives to be assessed in the Environmental Impact Assessment phase.

Table 2: Hotazel Solar Farm 1 project description and alternatives summary

Component	Dimensions
Solar Farm: A 200MWac solar facility with PV panels on steel mountings with single axis tracking mechanisms and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters. Alternative A4 energy production will be ~120% with up to 25% or ≤100MWh retained for controlled energy release.	≤300ha footprint ≤250ha solar panel surface (remainder is roads, cables runs, and other ancillaries)
Battery Storage System: A ≤100MWh battery storage facility for grid storage in stacked containers or multi-storey building housing up to up to 1120 cubic meters of batteries (dangerous goods) and associated operational, safety and control infrastructure.	≤1ha ≤8m building height ≤1120m³ of batteries
Access road: A ≤1.9km long, ≤8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.	≤1.9km long, ≤8m wide ≤1.52ha
Service roads: ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	≤20kms, 4m wide gravel roads Footprint included in solar farm footprint (≤8ha)
Collector substation: ≤1ha collector substation to receive, convert and step up electricity from the PV facility to a grid suitable power supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32m telecommunications tower (lattice or monopole type) will be established in the substation area.	≤1ha Substation infrastructure up to 10m height 32m telecommunications tower
O&M area: ≤1ha hectare O&M laydown area (near / adjacent substation); Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; Workshops, storage areas for materials and spare parts; Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day during rest of construction period; ~20kl/day during operation); Septic tanks and sewer lines to service ablution facilities; and Central Waste collection and storage area.	≤1ha Single storey office, ablutions, workshop complex (up to 4m height)
Other infrastructure: Perimeter fencing and internal security fencing and gates as required. Access control gate and guard house on access road; ≤3.5km length of small diameter water supply pipeline connecting existing boreholes to storage.	1.8m high jackal fence with barbed wire
Temporary infrastructure: A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.	≤4ha (Temporary)

Table 3: Hotazel Solar Farm Transmission corridors project alternatives to be assessed

Transmission line C1: Hotazel substation • A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed • Servitude width 31m • ≤110monopole pylons • ≤12km long and 4m wide service track
Transmission line C2: Umtu substation • A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed • Servitude width 31m • ≤140 monopole pylons • ≤15km long and 4m service track
Transmission Line C3: LILO connection[1] **(please see footnote)** • A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. • Servitude width 31m per line. • ≤60 monopole pylons (i.e. ≤120 pylons in total) • ≤6km long and 4m service track per line

[1] The Loop In Loop Out connection depends on of the Eskom line capacity before being deemed feasible alternative. Since this might occur, juwi wants to keep the alternative alive and have it assessed in the Basic Assessment

Alternative C4: NO GO
No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

Figure 3: Plan for the Hotazel Solar Park and the alternative routes under consideration for the transmission line

6. LEGAL REQUIREMENTS

The following Acts, regulations and ordinances are applicable to the proposed development:

6.1. THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

Chapter Seven of the NEMA states that:

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".

The Act also clearly states that the landowner, or the person using or controlling the land, is responsible for taking measures to control and rectify any degradation. These may include measures to:

> "(a) investigate, assess and evaluate the impact on the environment;
> (b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment:
> (c) cease, modify or control any act, activity or process causing the pollution or degradation:
> (d) contain or prevent the movement of pollutants or degradation: or
> (e) eliminate any source of pollution or degradation: or
> (f) remedy the effects of the pollution or degradation."

NEMA ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS

NEMA provides for the identification of activities which will impact the environment, in terms of Section 24. These activities were promulgated in terms of Government Notice No. R. 983, 984 and 985, dated 4 December 2014 and require environmental authorisation. The impacts of the listed activities must be investigated, assessed and reported to the competent authority before authorisation to commence with such listed activities can be granted.

6.2. NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The purpose of the National Water Act is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The National Water Act also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

REGULATIONS REQUIRING THAT A WATER USER BE REGISTERED, GN R.1352 (1999)

Regulations requiring the registration of water users were promulgated by the Minister of the Department of Water Affairs (DWA) in terms of provision made in section 26(1)(c), read together with section 69 of the National Water Act, 1998. Section 26(1)(c) of the Act allows for registration of all water uses including existing lawful water use in terms of section 34(2). Section 29(1)(b)(vi) also states that in the case of a general authorisation, the responsible authority may attach a condition requiring the registration of such water use. The Regulations (Art. 3) oblige any water user as defined under section 21 of the Act to register such use with the responsible authority and effectively to apply for a Registration Certificate as contemplated under Art.7(1) of the Regulations.

GENERAL AUTHORISATION IN TERMS OF S. 39 OF THE NATIONAL WATER ACT

According to the preamble to Part 6 of the NWA, "*This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette…*" *"The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary…"*

The General Authorisations for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA have recently been revised (Government Notice R509 of 2016). Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of a General Authorisations (GA). It is likely that the proposed activities associated with the aquatic ecosystems in the area can be authorised in terms of the new GA.

7. DESCRIPTION OF THE STUDY AREA

7.1. VISUAL CHARACTERISTICS

The proposed Hotazel Solar Park is located approximately 5 km south-east of Hotazel, lying west and south of the R31 road between Kuruman and Hotazel. The majority of the landscape consists of slightly undulating plains while the landscape is relatively undisturbed, much of the topography north and west of the study area around Hotazel has been significantly altered by the mining activities, with large excavations and waste rock dumps. A railway line servicing the mining areas is located west of the site. There are also a number of powerlines crossing the landscape to the west of the site.

The vegetation cover consists of a mix of bushveld and duneveld. The Ga-Mogara River Valley contains shallow pools for short periods of time during the rainy season (November to March) which provides some habitat for biota but is usually subject to cycles of degradation and regeneration as a result of grazing of livestock.

Figure 4: View of the typical landscape within the study area

7.2. CLIMATE

Hotazel normally receives about 250mm of rain per year, mostly during summer. On average, the lowest rainfall occurs in July and the highest in February. The average annual evaporation rate in the region is more than 5 times greater than the annual rainfall. The prevailing wind direction is from the northeast and southwest. The average midday temperatures for the area range from 19°C in June to 33°C in January. The region is the coldest during July when the mercury drops below 1°C on average during the night.

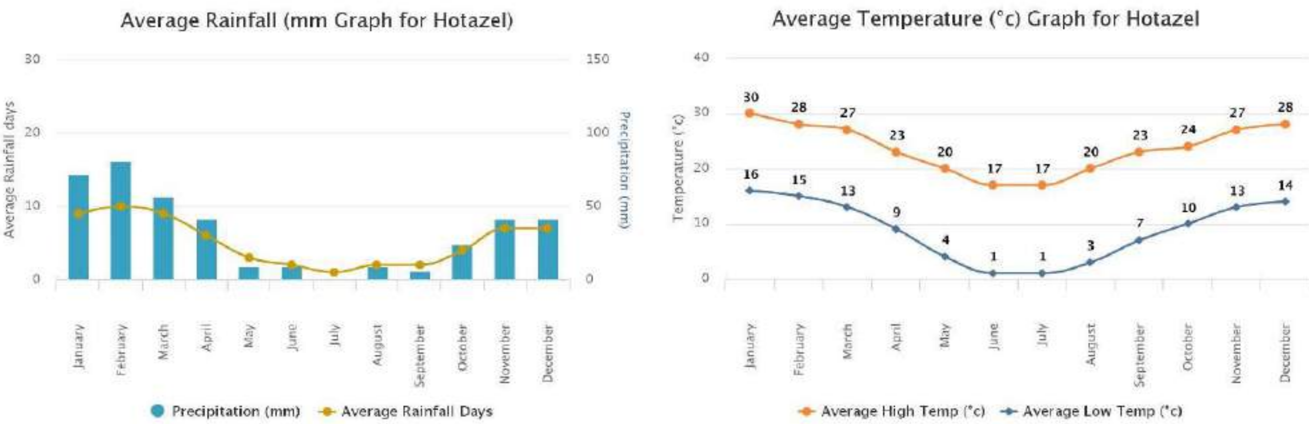


Figure 5: Average monthly rainfall and temperature graphs for Hotazel (worldweatheronline, 2016)

7.3. GEOLOGY AND SOIL

The geology in the area consists of Aeolian sand underlain by superficial silcretes and calcretes of the Cenozoic Kalahari Group. In general the soils within the site are freely drained, structure-less red soils with a high base status that may have restricted soil depth, excessive drainage, high erodibility and low natural fertility. Along the river valley (cream in Figure 6) red, excessively drained sandy soils with high base status, occur, mainly as dunes.

7.4. FLORA

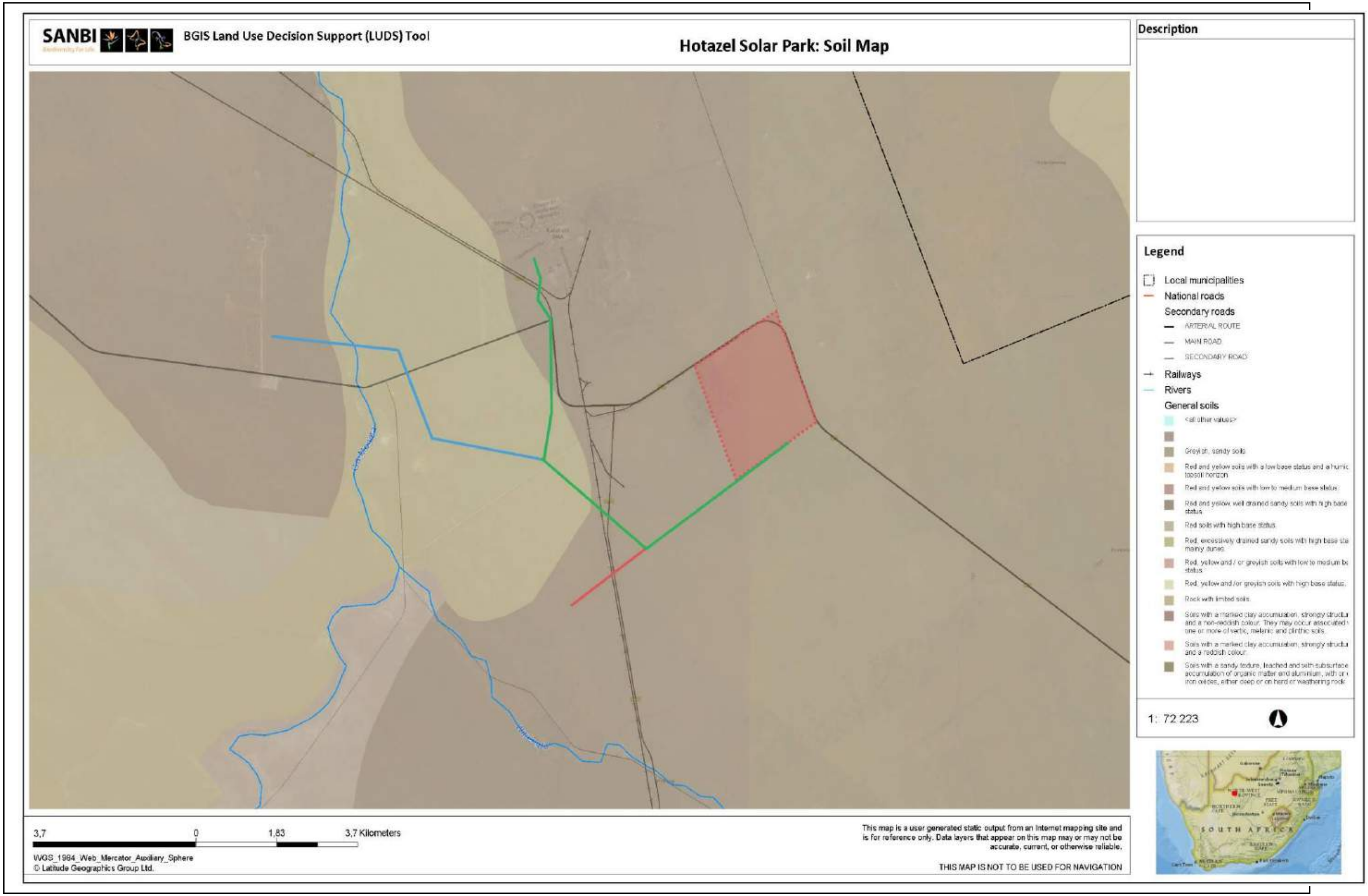
The study area falls within the Savanna Biome. The natural vegetation types found in the area comprises Kathu Bushveld (SVk12 - light green in Figure 7) with Gordonia Duneveld (SVkd1 – cream in Figure 7) occurring along the Ga-Mogara River. Kathu Bushveld occurs at the site and the surrounding area. Large portions of these vegetation types still remain and as a result they are all considered to be Least Threatened vegetation types.

The riparian vegetation along the Ga-Mogara River is still in a largely natural to moderately modified condition as a result of the activities taking place along the river. More detail on the vegetation occurring associated with the river within the study area is provided in the following section.

7.5. AQUATIC FEATURES AND FAUNA

The Ga-Mogara River is the main aquatic feature within the study area (Figure 9). The river originates approximately 100 km to the south-east of the site near Danielskuil and flows in a north-westerly direction for about 150 km before discharging into the Kuruman and Molopo Rivers. The Molopo River has its confluence with the Orange River at Riemvasmaak. A few relatively small valley floor depressions associated with the Ga-Mogara River System occur along the river corridor outside of the immediate study area. These freshwater features tend to be ephemeral (Figure 8), mostly only carrying water for short periods of time during the rainy season (November to March).

While the topography within the proposed development site for the PV facility consists of lower lying areas that contain vegetation which indicates an increased dampness within these areas, no aquatic ecosystems are considered to be present in this area.


SANBI
BGIS Land Use Decision Support (LUDS) Tool
Hotazel Solar Park: Soil Map
Description
Legend
Local municipalities
National roads
Secondary roads
ARTERIAL ROUTE
MAIN ROAD
SECONDARY ROAD
Railways
Rivers
General soils
<all other values>
Greyish, sandy soils
Red and yellow soils with a low base status and a humic topsoil horizon
Red and yellow soils with low to medium base status
Red and yellow, well drained sandy soils with high base status
Red soils with high base status
Red, excessively drained sandy soils with high base sta mainly dunes
Red, yellow and / or greyish soils with low to medium bε status
Red, yellow and /or greyish soils with high base status.
Rock with limited soils
Soils with a marked clay accumulation, strongly structu and a non-reddish colour. They may occur associated one or more of vertic, melanic and plinthic soils
Soils with a marked clay accumulation, strongly structu and a reddish colour
Soils with a sandy texture, leached and with subsurface accumulation of organic matter and aluminium, with or iron oxides, either deep or on hard or weathering rock
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© Latitude Geographics Group Ltd.
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.
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SOUTH AFRICA

Figure 6: Soils map for the area and surroundings (SANBI Biodiversity GIS, 2016)

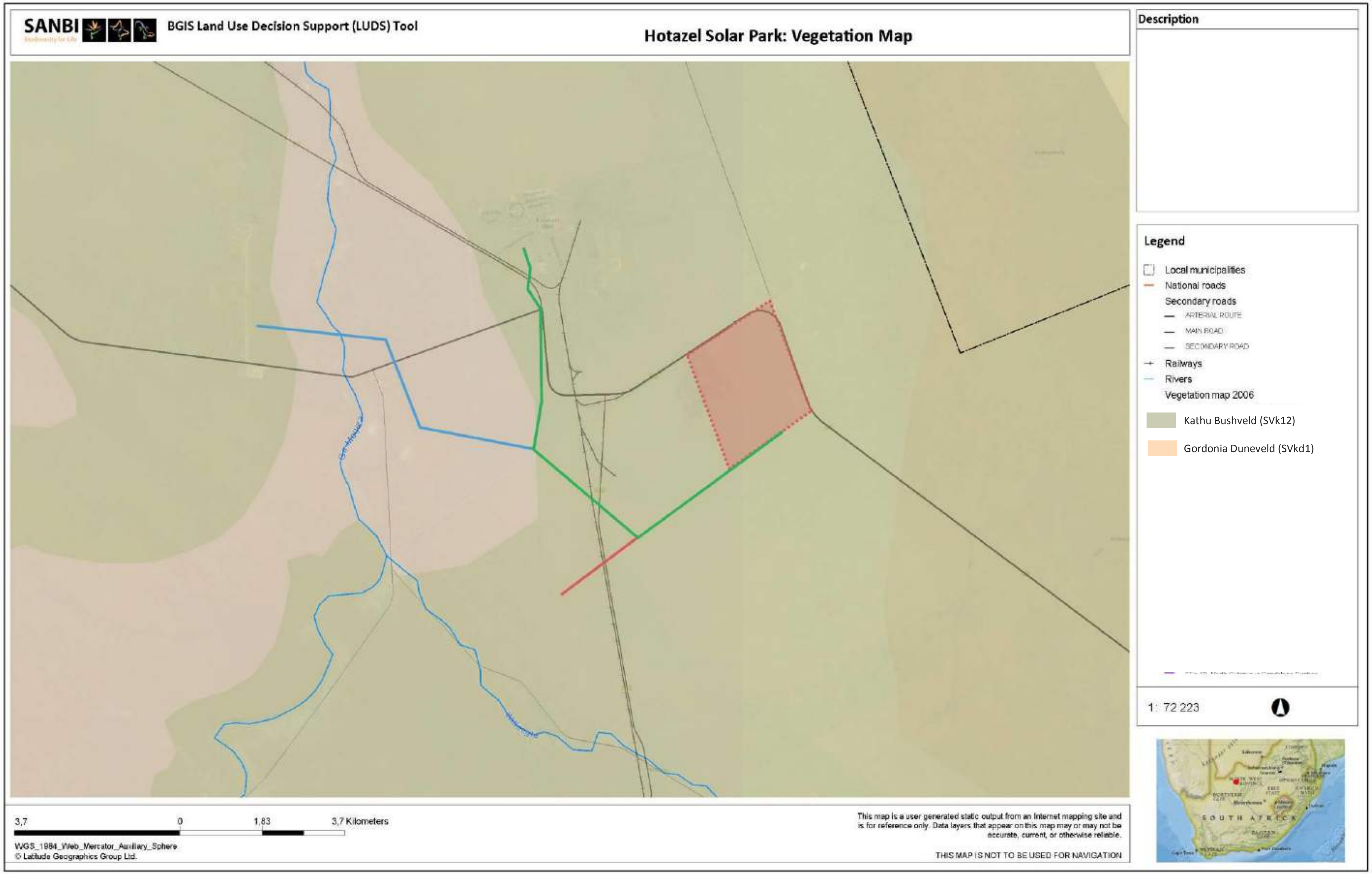

Figure 7: Vegetation map for the area (SANBI Biodiversity GIS)

Figure 8: The Ga-Mogara River near the crossing of the proposed transmission line to Umtu Substation

7.6. PROTECTED AREAS

In South Africa two sets of mapping initiatives are available for the study area that are of relevance to the conservation and biodiversity importance of the aquatic ecosystems, that is, the Critical Biodiversity Areas (CBA) map and the Freshwater Ecosystem Priority Areas (FEPA) map. Currently no CBA map exists for the study area. Mapping of the threatened ecosystems has been utilized instead to identify conservation worthy areas. This mapping is however largely associated with terrestrial vegetation types. All of the vegetation types in the area are however considered to be least threatened vegetation types.

In terms of FEPAs (Figure 10), the Ga-Mogara River and its catchment have been mapped as an Upstream Catchment (light green areas in Figure 11) to the Kuruman River which has been identified as a FEPA river. Upstream Management Areas are catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.

No wetland clusters occur within the study area, only wetland areas associated with the river upstream and downstream of the study area (blue areas in Figure 11). Although wetland condition was a factor in selection of wetland FEPAs, wetlands selected were not necessarily in a good condition (A or B ecological category) to be chosen as a FEPA. Wetland FEPAs currently in an A or B ecological condition should be managed to maintain their good condition. Those currently in a condition lower than A or B, as is the case in the study area, should be rehabilitated to the best attainable ecological condition.

7.7. LAND USE

Land use within the study area consists largely of natural areas (pale green areas in Figure 12). The town of Hotazel (grey area in Figure 11) is located approximately 5 km north west of the site. Mining (dark brown areas in Figure 11) takes place mostly in the north of the study area near Hotazel. The surrounding areas are mapped as degraded landscapes (light brown in Figure 11). A number of Eskom power lines already transect the wider study area.

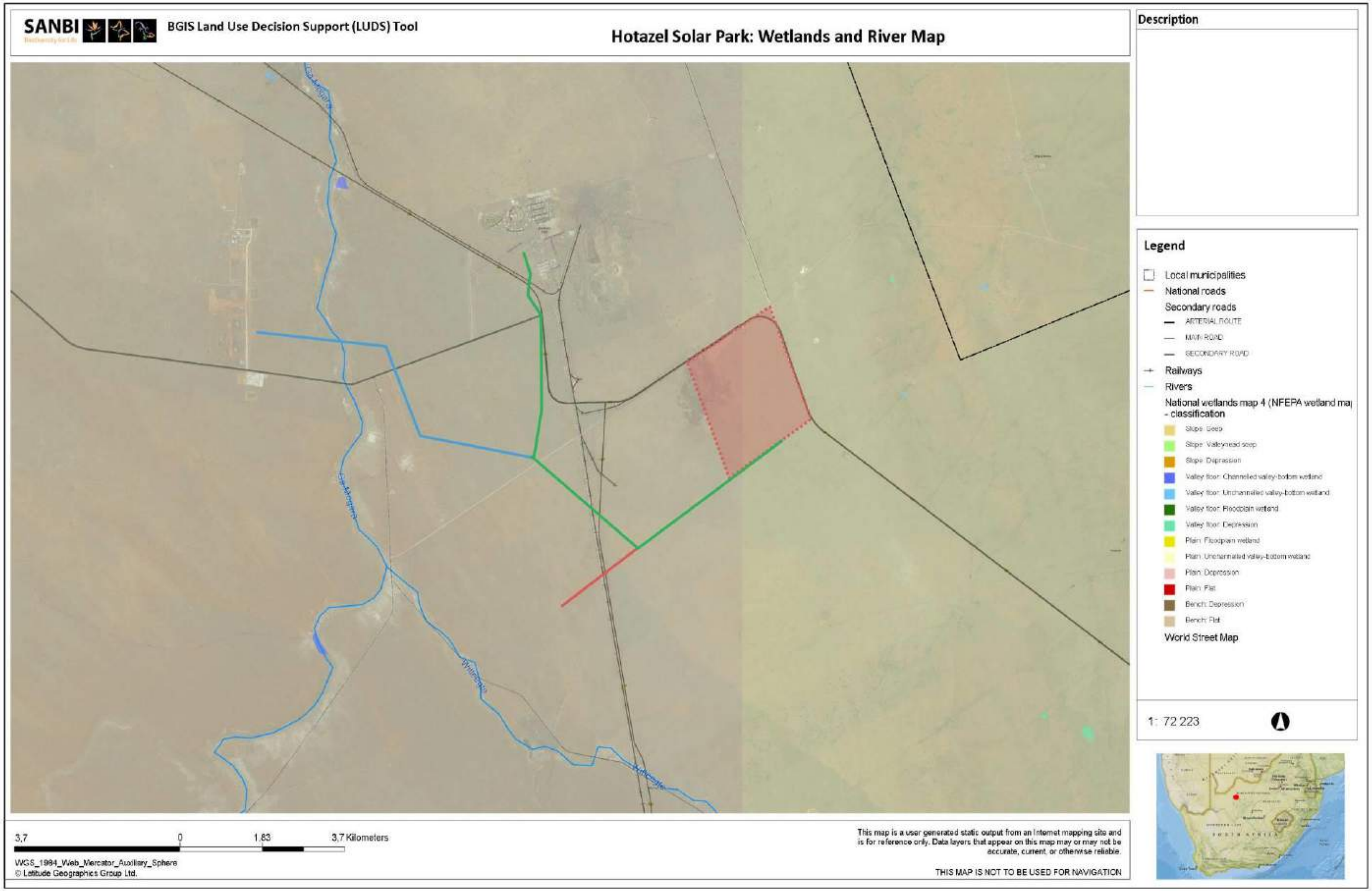

Figure 9: Wetland and river features within the study area

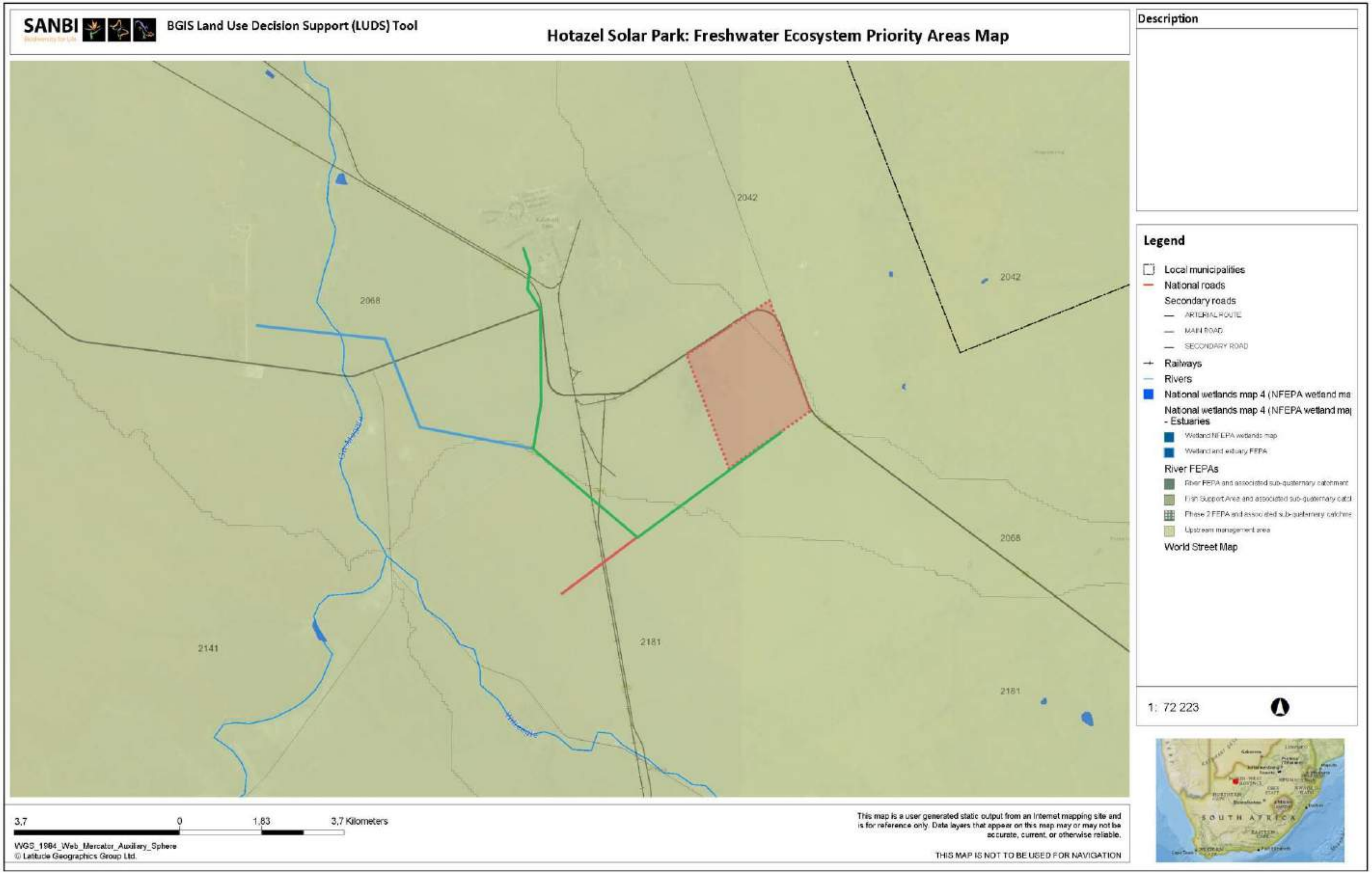

Figure 10: FEPA and threatened ecosystems map for the study area

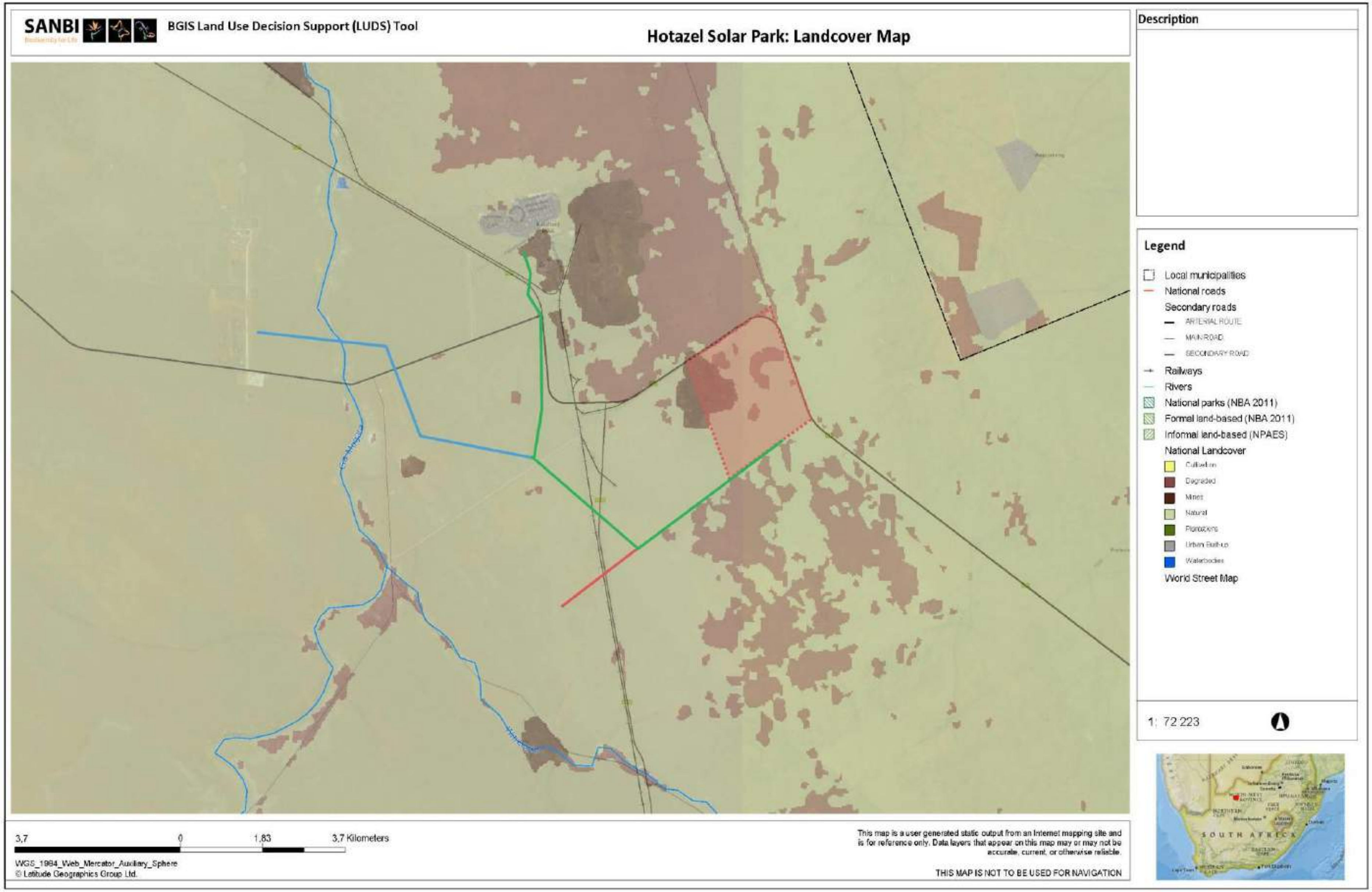

Figure 11: Land cover map for the area (SANBI Biodiversity GIS, 2016)

8. AQUATIC ASSESSMENT FOR THE STUDY AREA

The purpose of the freshwater assessment is to determine the relative importance, sensitivity and current condition (ecological state) of the significant freshwater features in order to assess the impact of the proposed Hotazel Solar Park and its associated infrastructure on those freshwater resources. The assessment is also required to make recommendations in terms of mitigation measures that can be used to prevent or minimise the impact on the freshwater resources. This assessment of the Ga-Mogara River within the study area is based on existing information as well as the field assessment.

8.1. RIVER TYPING AND CHARACTERISATION

The Index for Habitat Integrity (IHI) and Site Characterisation assessments were utilised to provide information on the ecological condition and physical characteristics of the freshwater features in the study area (Table 4).

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river/stream condition should only be done between rivers or streams that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers/streams provides the basis for assessing their ecological condition and allows comparison between similar river/stream types. The primary classification of rivers and streams is a division into Ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers and streams within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation (DWAF 1999). For the purposes of this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used. The area lies within the Southern Kalahari Ecoregion.

***Characteristics of the Southern Kalahari Ecoregion**: Lowlands, open hills and mountains with moderate to high relief and plains with low relief. Altitude varies from 500 – 1700m amsl. The natural terrestrial vegetation is a mixture of bushveld types. Rainfall varies from 0 - 500 mm per annum and mean annual temperature is between 14 - 22 °C.*

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important (Rowntree and Wadeson 1999). The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota.

Table 4: Geomorphological and Physical features for the Ga-Mogara River within the study area

River	Ga-Mogara River
Geomorphological zone	Foothill river
Lateral mobility or entrenchment	Largely unconfined
Channel form	Simple channel
Channel pattern	Single thread: low sinuosity
Channel type	Alluvium
Hydrological Type	Seasonal to ephemeral

8.2. HABITAT INTEGRITY

The evaluation of Habitat Integrity (HI) provides a measure of the degree to which a river or stream has been modified from its natural state. The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of degradation of a river. The severity of each impact is ranked using a six-point scale from 0 (no impact) to 25 (critical impact).

The Habitat Integrity Assessment is based on assessment of the impacts of two components of the river, the riparian zone and the instream habitat. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (Table 5).

Table 5: Habitat Integrity categories (From DWAF, 1999)

Category	Description	Score (%)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. Large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In worst instances, basic ecosystem functions have been destroyed and changes are irreversible.	0

Table 6: Instream and Riparian Habitat Integrity Assessment of the tributaries in the study area

Instream Habitat Integrity	Ga-Mogara River	Riparian Zone Habitat Integrity	Ga-Mogara River
Water Abstraction	10	Vegetation Removal	9
Flow Modification	8	Exotic Vegetation	5
Bed Modification	7	Bank Erosion	8
Channel Modification	7	Channel Modification	7
Water Quality	9	Water Abstraction	10
Inundation	4	Inundation	4
Exotic Macrophytes	0	Flow Modification	8
Exotic Fauna	0	Water Quality	9
Rubbish Dumping	7		
Integrity Category	**C**	**Integrity Category**	**C**

The Ga-Mogara River is considered to be in a moderately modified state largely due to upstream activities as the river passes the areas of Kathu and Deben. The riparian habitat of the river tends to be more impacted by the surrounding land use activities.

8.3. ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS assessment considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity (Table 9). The determinants are rated according to a scale (Table 7). The median of the resultant score is calculated to derive the EIS category (Table 8).

Table 7: Scale used to assess biotic and habitat determinants indicate either importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table 8: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	Median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 9: Results of the EIS assessment for the tributaries within the study area

Biotic Determinants	Ga-Mogara River
Rare and endangered biota	1
Unique biota	1
Intolerant biota	0.5
Species/taxon richness	0.5
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	1.5
Refuge value of habitat type	1
Sensitivity of habitat to flow changes	1
Sensitivity of flow related water quality changes	1
Migration route/corridor for instream and riparian biota	1.5
National parks, wilderness areas, Nature Reserves, Natural Heritage sites & areas, PNEs	0
Median	0.9
EIS CATEGORY	**Moderate/low**

The ecological importance and sensitivity of the rivers within the study area is deemed to be moderate to low.

9. FRESHWATER CONSTRAINTS

HOTAZEL SOLAR PARK

The proposed Hotazel Solar Park comprises four alternative layouts for the PV panels (each up to 250 ha module footprint) as described in Table 2 of this report and shown in Figure 12. Included in the facilities within the site, over and above the PV panels, are a 1 ha battery storage facility; approximately 8 m wide gravel access road (two alternatives) and approximately 4 m wide internal service roads; a 1 ha collector substation, a 1 ha Operation and Maintenance area as well as offices, workshops, waste collection and parking areas; and water and sewer pipelines. A temporary +4 ha construction yard and laydown area will also be required that will be rehabilitated afterwards. There are no freshwater constraints associated with the proposed Hotazel Solar Park and its various alternatives.

HOTAZEL SOLAR PARK TRANSMISSION LINES

Three transmission lines alternatives to evacuate power from the solar facility to the national grid are being considered by connecting the Solar Facility to the existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-Out (LILO) connection option.

The only aquatic feature within the study area lies in the western extent of the study area, associated with the Ga-Mogara River. This is of relevance to the proposed transmission line that would link to Umtu Substation.

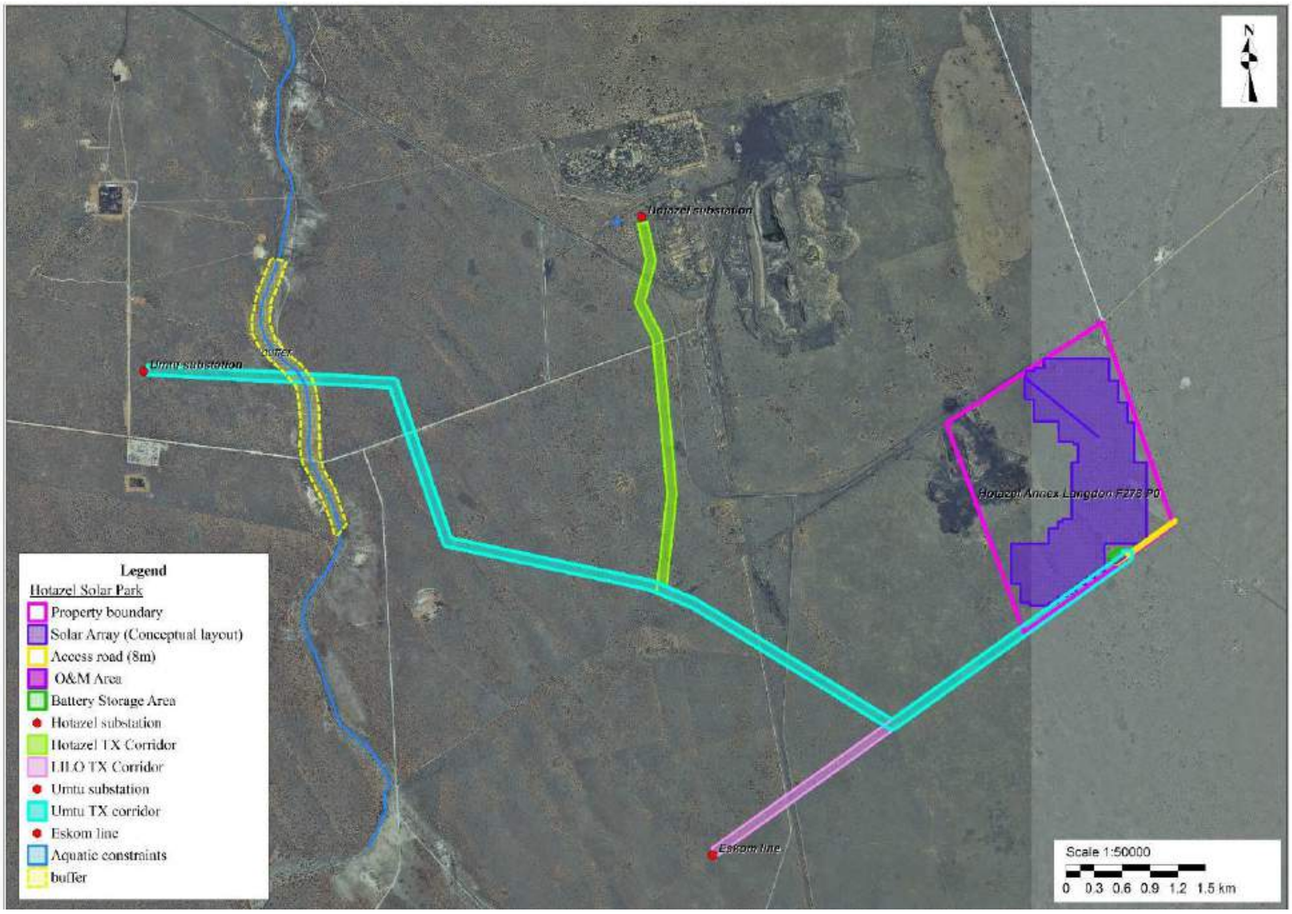

Figure 12: Orthophotograph with the proposed Hotazel Solar Park, its various components and the proposed project alternatives, as well as the aquatic features and the recommended buffer adjacent to the river

10. POTENTIAL IMPACTS OF PROPOSED ACTIVITIES AND THE ALTERNATIVES

10.1. POTENTIAL IMPACT OF PROPOSED SOLAR PARK

PREFERRED PROJECT

The proposed Hotazel Solar Park is located outside of any aquatic features. There are thus no potential freshwater impacts that may result from the proposed activity.

NO-GO ALTERNATIVE

The No-go Alternative implies that the PV facility would not be established within the area and that the land adjacent to the existing mining tenement would continue to remain largely unused with only gazing of livestock taking place. Due to the very limited potential impacts of the proposed project, particularly with mitigation, there is very little difference from a freshwater perspective between the proposed project and the no-go alternative.

Impact table for the Hotazel Solar Park:

	Preferred Alternative		No Go Alternative	
Short description	Single axis PV with storage: Energy production ~120% with up to 25% (≤100MWh) retained for controlled energy release. 1.9km Eastern access road and eastern construction laydown area		No development alternative	
Overview	Comprises PV panels, a +1 ha battery storage facility; a +8 m wide gravel access road and +4 m wide internal service roads; a +1 ha collector substation, a + 1 ha O&M area as well as offices, workshops, waste collection and parking areas; and water and sewer pipelines. A temporary +4 ha construction yard and laydown area that will be rehabilitated afterwards. There are no freshwater constraints associated with the proposed Hotazel Solar Park.		PV facility would not be established within the area and that the land adjacent to the existing mining tenement would continue to remain largely unused with only gazing of livestock taking place. Due to the very limited potential impacts of the proposed project, particularly with mitigation, there is little between the proposed project and the no-go alternative.	
Assessment				
	Pre-Mitigation	Post Mitigation	Pre-Mitigation	Post Mitigation
Nature	Degradation of habitat integrity, flow/water quality modification		No impact	
Duration	Long term	Long term	Long term	Long term
Extent	Site	Site	Site	Site
Magnitude	Low	Very low/zero	Very low/Zero	Very low/Zero
Probability	Low	Low	Unlikely	Unlikely
Confidence	Medium/High	Medium/High	Medium/High	Medium/High
Reversibility	Reversible	Reversible	Reversible	Reversible
Resource irreplaceability	Medium	Medium	Medium	Medium
Mitigatability	Low/Medium	Low/Medium	High	High
Significance	**Very low**	**Negligible /Neutral**	Negligible /Neutral	Negligible /Neutral
Mitigation	Implement measures to minimise the impacts of stormwater runoff			
Cumulative Impact assessment	Surrounding land use currently consists of manganese mining activities with some agriculture. Current land/water use impacts on the Ga-Mogara River area are moderate. The proposed renewable energy project are near the Ga-Mogara River System (refer to page 30). The renewable energy projects with mitigation have minimal impact on the surface water. The largest potential impact of these projects is as a result of the associated infrastructure. These potential impacts can be mitigated such that their impacts on the aquatic ecosystems are of a low significance.			

10.1. POTENTIAL IMPACT OF PROPOSED SOLAR PARK TRANSMISSION LINES

HOTAZEL SUBSTATION

The transmission corridor that links up to the Hotazel Substation does not contain any aquatic features. There is only small depression wetland area located between the substation and the entrance road into the town that appear to have been a borrow pit for the road construction. The depression lies outside of the corridor assessed. There are thus no potential freshwater impacts that may result from this alternative transmission line route.

UMTU SUBSTATION

An impact of very limited significance is expected at the points at which the transmission line will need to cross of the Ga-Mogara River during and after the construction phase. The major impacts are associated with the access road should it need to cross the river and relate to loss of riparian and instream habitat and the potential invasive alien plant growth. Thus a localized short and longer term impacts of medium to low intensity is expected that will have a low overall significance in terms of the impact on the identified aquatic ecosystems in the area.

Proposed mitigation: The pylons for the transmission line should be placed outside of the recommended buffer of 100 from the top of bank on either site of the river. With regards to any access roads to the transmission line for construction and maintenance, existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. If an access road need to be constructed it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

LILO CONNECTION

The Loop-In Loop-Out transmission connection does not contain any aquatic features. There are thus no potential freshwater impacts that may result from this alternative transmission line route.

NO-GO ALTERNATIVE

The No-go Alternative implies that no transmission line would be constructed and that the land within the proposed transmission line corridors would continue to remain largely unused. The only alternative with any freshwater constraints is the Umtu Substation alternative which can easily be mitigated by adequately spanning the Ga-Mogara River channel that there would be negligible impacts on the aquatic ecosystem of the river. There is thus little difference from a freshwater perspective between the transmission line alternatives and the no-go alternative. Connecting the solar park up with the national grid however an essential component of the proposed project. Thus the no-go alternative would not be feasible if the project is approved.

Impact table for the Transmission lines:

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	200m wide transmission corridor from Hotazel Solar Park to Hotazel Substation		200m wide transmission corridor from Hotazel Solar Park to Umtu Substation		200m wide transmission Loop-In Loop-Out connection to existing line		No lines	
Assessment								
	Pre-Mitigation	Post Mitigation	Pre-Mitigation	Post Mitigation	Pre-Mitigation	Post Mitigation	Pre-Mitigation	Post Mitigation
Nature	Degradation of habitat integrity, flow/water quality modification						No impact	
Duration	Long term	Long term	Long term	Long term	Long term	Long term	Long term	Long term
Extent	Site	Site	Site	Site	Site	Site	Site	Site
Magnitude	Low/Very low	Very low/zero	Low	Very low	Very low/zero	Very low/zero	Very low/zero	Very low/zero
Probability	Unlikely	Unlikely	Probable	Probable	Unlikely	Unlikely	Unlikely	Unlikely
Confidence	High	High	High	High	High	High	High	High
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Resource irreplaceable	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Mitigatability	High	High	High	High	High	High	High	High
Significance	Very low	Very low/ Neutral	Low	Very low	Very low/ Neutral	Very low/ Neutral	Very low/ Neutral	Very low/ Neutral
Mitigation	The pylons for the transmission line should be placed outside of the recommended buffer of 100 from the top of bank on either site of the river. With regards to any access roads to the transmission line for construction and maintenance, existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. If an access road need to be constructed it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.							
Cumulative Impact assessment	Surrounding land use currently consists of manganese mining activities with some agriculture. Current land/water use impacts on the Ga-Mogara River area are moderate. The proposed renewable energy projects are near the Ga-Mogara River System. The renewable energy projects with mitigation have minimal impact on the surface water. The largest potential impact of these projects is as a result of the associated infrastructure. These potential impacts can be mitigated such that their impacts on the aquatic ecosystems are of a low significance.							
Conclusion:	The LILO Alternative, followed by the Hotazel Alternative will have the least potential freshwater impacts. All of the alternative transmission lines will have a very low to neutral potential freshwater impacts if properly mitigated.							

10.3. CUMULATIVE IMPACT OF THE PROPOSED PROJECTS ON FRESHWATER ECOSYSTEMS

Land use in the area surrounding Hotazel currently consists of manganese mining activities with some agriculture. Current land and water use impacts on the Ga-Mogara River within the larger study area are moderate. Within the wider area (Figure 13), all of the proposed renewable energy projects are proposed adjacent to the Ga-Mogara River or its tributaries. The nature of renewable energy projects however allows them to have minimal impact on the surface water features as the project activities can be placed far enough away from the freshwater features so as to not impact on them. The largest potential impact of these projects is as a result of the associated infrastructure (transmission lines, access roads, and water and sewerage infrastructure). These potential impacts can be mitigated such that their impacts on the aquatic ecosystems are of a low significance.

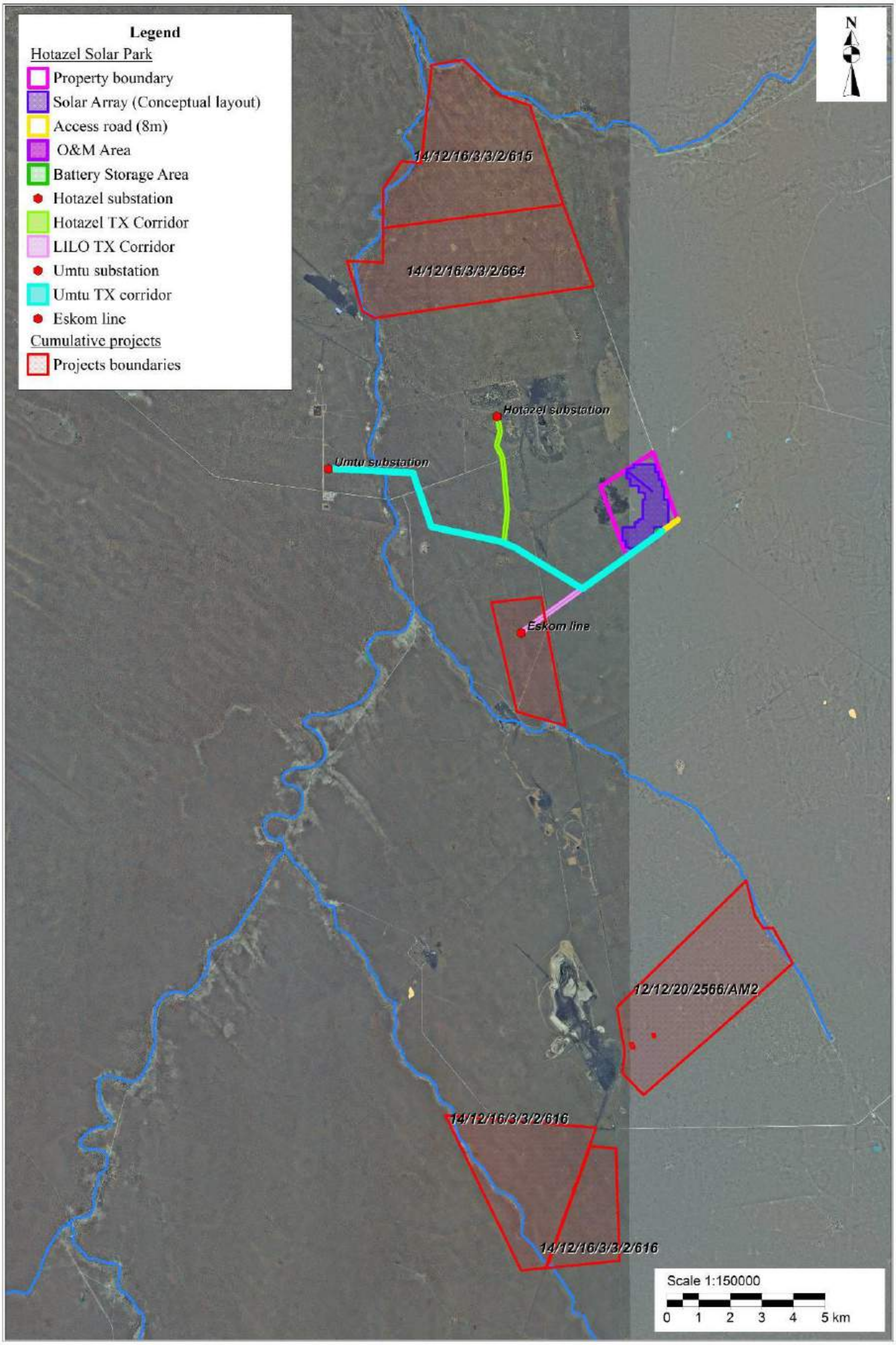

Figure 13. Image showing the current proposed renewable energy projects for the area

One could thus expect that the cumulative impact of the proposed projects would not be significant provided mitigation measures are implemented. Availability of water is usually the limiting factor on the further development of this area although the water requirements (20 kl per day during operation), particularly during the operation phase for the projects will be low.

11. RISK ASSESSMENT

A risk assessment was carried out for the proposed transmission line to Umtu Substation as the only project activities that will be undertaken near a freshwater feature. The assessment indicates the level of risk certain activities pose to freshwater resources where the outcomes are used to guide decisions regarding water use authorisation of the proposed activity. A summary of the potential risks can be seen in Table 10 and the full assessment table is contained in Appendix D. These risk rating classes can be seen in Table 11.

Table 10: Summary risk assessment for the proposed project

Phases	Activity	Aspect	Impact	Significance	Risk Rating
Construction	Construction works associated with the transmission line	Transmission Line to Umtu Substation	Loss of biodiversity & habitat; flow modification; water quality impacts; invasive plant invasion	22.75	L
Operation	Operational activities associated with the transmission line	Maintenance of Transmission Line to Umtu Substation adjacent to aquatic ecosystems		36	L

Table 11: Risk rating classes for the Risk Assessment

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

The risk associated with the shorter term construction and longer term maintenance related activities are deemed to be very low provided that the mitigation measures as recommended are implemented. The findings of the risk assessment imply that the water use activities associated with the proposed project could be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

12. CONCLUSIONS AND RECOMMENDATIONS

The Ga-Mogara River is the main aquatic feature within the study area. A few relatively small valley floor depressions associated with the Ga-Mogara River System occur along the river corridor outside of the immediate study area. These freshwater features tend to be ephemeral mostly only carrying water for short periods of time during the rainy season (November - March). The topography within the proposed development site for the PV facility consists of lower lying areas that contain vegetation which indicates an increased dampness within these areas however no aquatic ecosystems are considered to be present in this area.

The Ga-Mogara River is considered to be in a moderately modified ecological condition and is of moderate to low ecological importance and sensitivity. In terms of aquatic biodiversity conservation importance, the Ga-Mogara River and its catchment have been mapped as an Upstream Catchment to the Kuruman River which has been identified as a Freshwater Ecosystem Priority Area river. No wetland clusters occur within the study area, only wetland areas associated with the river upstream and downstream of the study area.

HOTAZEL SOLAR PARK

Due to the very limited potential freshwater impact of the proposed project, particularly with mitigation, there is very little difference from a freshwater perspective between the proposed project and the no-go alternative. In addition, the potential cumulative freshwater impacts that would result for the proposed and other renewable energy projects in the area are of a low significance.

Providing that the recommended mitigation measures are implemented (minimising the impacts of stormwater runoff), the significance of the impact is expected very low to negligible. A water use authorization is unlikely to be required from the Department of Water and Sanitation: Northern Cape Regional Office for any possible Section 21 c&i water use aspects of the proposed activities associated with the Hotazel Solar Park. This is due to the fact that there are no freshwater features that are likely to be impacted by the proposed activities.

HOTAZEL SOLAR PARK TRANSMISSION LINES

The proposed transmission line alternative that would link to Umtu Substation is the only component of the proposed project that is located near the aquatic feature within the study area, the Ga-Mogara River. In terms of this transmission line, it is recommended that a buffer of 100m from the top of bank on either site of the river. Access to this transmission line for construction and maintenance should, as far as possible, be via existing road infrastructure. If an access road needs to be constructed for the transmission line, it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Providing that the above-mentioned recommended mitigation measures are implemented the significance of the impact for all of the alternative transmission lines are expected to be very low to neutral. The LILO Alternative, followed by the Hotazel Alternative will have the least potential freshwater impacts.

A water use authorization may need to be obtained from the Department of Water and Sanitation: Northern Cape Regional Office for the water use aspects of the proposed transmission line to Umtu Substation. It is however likely that this activity could be authorised in terms of the General Authorisations for Section 21(c) and (i) water use as the associated risk of degradation of the Ga-Mogara River as a result of the construction and operation of the transmission line is deemed to be low. A water use authorization is unlikely to be required from the Department of Water and Sanitation: Northern Cape Regional Office for any possible Section 21 c&i water use aspects associated with the other transmission line alternatives.

13. REFERENCES

Department of Water Affairs and Forestry. (1999). *Resource Directed Measures for Protection of Water Resources. Volume 3: River Ecosystems Version 1.0*. Resource Directed Measures for Protection of Water Resources, Pretoria, South Africa.

Department of Water Affairs and Forestry. (2005). A practical field procedure for identification and delineation of wetlands and riparian areas. Department of Water Affairs and Forestry, Pretoria.

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Kleynhans CJ, Louw MD, Graham M. (2008). *Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Section 1, Technical manual)* Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08

Mucina, L. and M. Rutherford. *Eds.* (2006). Vegetation map of South Africa, Lesotho, and Swaziland. *Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

SANBI Biodiversity GIS: http://bgis.sanbi.org/

APPENDIX A: QUALIFICATIONS OF SPECIALIST CONSULTANTS

Contact details: PO Box 455, Somerset Mall, 7137

Name: Mr Dana Grobler and Ms Antonia Belcher

Profession: Mr Dana Grobler (Environmental Scientist – *Pr. Sci. Nat 400058/93*) and Ms Antonia Belcher (Aquatic Scientist *Pr. Sci. Nat.* 400040/10);

Fields of Expertise: Specialist in environmental water requirements, river and wetland monitoring and reporting.

Relevant work experience:

Due to Ms Belcher's involvement in the development and implementation of the River Health Programme as well as the Resource Directed Measures (RDM) directorate of the Department of Water Affairs in the Western Cape, she have been a key part of the team that has undertaken six catchment or area wide 'state-of-river' assessments as well as routine monitoring and specialised assessments of rivers and wetlands in all the major catchments in the Western Cape. Ms Belcher and Mr Grobler have also undertaken the River Health Monitoring for the Free State Region in 2011 and 2012.

Relevant publications:

- Freshwater Assessment for the proposed Eskom Kimberley Strengthening Phase 4 Project: Beta to Boundary; Boundary to Ulco; Ulco to Manganore; and Manganore to Ferrum, 2014.
- Desktop Freshwater Assessment: Proposed Garob Wind Energy Facility, Located near Copperton in the Northern Cape Province. 2014.
- Freshwater Review of the Proposed Augrabies Photovoltaic Power Project at Farm Rooipad 15 Portion 9, Augrabies, Northern Cape Province, 2012.
- Freshwater Assessment for the Proposed Mulilo Photovoltaic and Wind Energy Facilities near De Aar. 2012.
- Freshwater Assessment for the Proposed construction of two 132kV transmission lines from the Maanhaarberg and Damfontein Wind Energy Facilities (De Aar 1) near De Aar, Northern Cape, 2012.
- Freshwater Assessment for the Proposed construction of two 132kV transmission lines from the South & North Wind Energy Facilities on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape, 2012.
- Freshwater Review of the Proposed Augrabies Photovoltaic Power Project at Farm Rooipad 15 Portion 9, Augrabies, Northern Cape Province. 2012.
- Freshwater Assessment for the Proposed Wind and Solar Energy Facilities near Springbok. 2012.

APPENDIX B: DECLARATION OF INDEPENDENCE (MS ANTONIA BELCHER)

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-
(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and
(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

Project title:	Hotazel Solar Park (Scoping Phase)		
Specialist:	BlueScience (Pty) Ltd		
Contact person:	Toni Belcher		
Postal address:	PO Box 455, Somerset Mall		
Postal code:	7137	**Cell:**	0828838055
Telephone:	021 855 0555	**Fax:**	-
E-mail:	toni@bluescience.co.za		
Professional affiliation(s) (if any)	SACNSP 400040/10 (Environmental and Ecological Sciences)		
Project Consultant	Aurecon South Africa (Pty) Ltd		
Contact person:	Patrick Killick		
Postal address:	PO Box 509, George		
Postal code:	6530	**Cell:**	072 446 8005
Telephone:	044 805 5432	**Fax:**	044 805 5454
E-mail:	Patrick.killick@aurecongroup.com		

4.2 The specialist appointed in terms of the Regulations

I, Antonia Belcher, declare that –
- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

BLUESCIENCE 9PTY) LTD
Name of company (if applicable):

7 OCTOBER 2016
Date:

APPENDIX C: PES AND EIS OF THE GA-MOGARA RIVER (DWA, 2013)

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
D41K-02068	Ga-Mogara	21.28	3	y		MODERATELY MODIFIED	C
MEAN EI CLASS	**MEAN ES CLASS**	**DEFAULT ECOLOGICAL CATEGORY (EC)**	**RECOMMENDED ECOLOGICAL CATEGORY (REC)**				
MODERATE	VERY LOW	C					

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	NONE	**FISH SPP/SQ**		**INVERT TAXA/SQ**		**FISH PHYS-CHEM SENS DESCRIPTION**	
RIP/WETLAND ZONE CONTINUITY MOD	MODERATE	**FISH: AVERAGE CONFIDENCE**		**INVERT AVERAGE CONFIDENCE**		**FISH NO-FLOW SENSITIVITY DESCRIPTION**	
POTENTIAL INSTREAM HABITAT MOD ACT.	NONE	**FISH REPRESENTIVITY PER SECONDARY:**		**INVERT REPRESENTIVITY PER SECONDARY,**		**INVERT PHYS-CHEM SENS DESCRIPTION**	
RIPARIAN-WETLAND ZONE MOD	MODERATE	**FISH REPRESENTIVITY PER SECONDARY: CLASS**		**INVERT RARITY PER SECONDARY: CLASS**		**INVERTS VELOCITY SENSITIVITY**	
POTENTIAL FLOW MOD ACT.	SMALL	**FISH RARITY PER SECONDARY: CLASS**		**ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING**	LOW	**RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION**	VERY LOW
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	SMALL	**ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX**	LOW	**HABITAT DIVERSITY CLASS**	VERY LOW	**STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION**	LOW
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	**HABITAT SIZE (LENGTH) CLASS**	VERY LOW	**RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION**	**VERY LOW**
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	VERY LOW	**INSTREAM MIGRATION LINK CLASS**			
				RIPARIAN-WETLAND ZONE MIGRATION LINK	HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	HIGH		
				INSTREAM HABITAT INTEGRITY CLASS			

APPENDIX D: IMPACT ASSESSMENT METHODOLOGY

This section outlines the proposed method for assessing the significance of the potential environmental impacts. For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** (severity of impact) and **DURATION** (time scale) would be described.

These criteria would be used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described would represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.[1]

The tables below indicate the scale used to assess these variables, and defines each of the rating categories.

Table 1 | Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	Regional	Beyond a 10km radius of the proposed site.
	Local	Within a 10km radius of the proposed site.
	Site specific	On site or within 100m of the proposed site.
Magnitude of impact (at the indicated spatial scale)	High	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	Construction period	Up to 1 year
	Short Term	Up to 3 years after construction
	Medium Term	3-10 years after construction
	Long Term	More than 10 years after construction

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table 2.

Table 2 | Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	▪ High magnitude with a regional extent and long term duration ▪ High magnitude with regional extent and medium term duration or local extent and long term duration ▪ Medium magnitude with a regional extent and long term duration
Medium	▪ High magnitude with a local extent and medium term duration ▪ High magnitude with regional extent and short term or site specific extent and long term duration ▪ High magnitude with either a local extent and short term or a site specific extent and medium term ▪ Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Low magnitude with a regional extent and long term duration
Low	▪ High magnitude with a site specific extent and construction period duration ▪ Medium magnitude with a site specific extent and construction period duration

[1] The proponent will be requested to indicate at the Final Assessment stage which alternative and mitigation measures they are prepared to implement.

	■Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term ■Very low magnitude with a regional extent and long term duration
Very low	■Low magnitude with a site specific extent and construction period duration ■Very low magnitude with any combination of extent and duration except regional and long term
Neutral	■Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring as well as the **CONFIDENCE** in the assessment of the impact would be determined using the rating systems outlined in Table 3 and Table 4, respectively.

It is important to note that the significance of an impact should always be considered in conjunction with the probability of that impact occurring. Lastly, the **REVERSIBILITY** of the impact is estimated using the rating system outlined in Table 5.

Table 3 | Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 4 | Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 5 | Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

Table 6 | Definition of irreplaceability ratings

IRREPLACEABILITY RATINGS	CRITERIA
Low	The affected resource is not unique and or does not serve an critical function or is degraded
Medium	The affected resource is moderately important in terms of uniqueness and function or in pristine condition
High	The affected resource is important in terms of uniqueness and function and or in pristine condition and warrants conservation / protection

CUMULATIVE IMPACT ASSESSMENT

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore will be considered for all renewable energy developments (wind and solar) within a 30 km radius of the proposed site. The impact assessment methodology used in the previous section shall be applied to cumulative impacts. Developments that would be considered here include:

- Developments currently undergoing an EIA process;
- Developments which have received Environmental Authorisation; and
- Developments under construction or in existence.

APPENDIX E: RISK ASSESSMENT FOR TRANSMISSION LINE TO UMTU SUBSTATION

ASPECTS AND IMPACT REGISTER/RISK ASSSESSMENT FOR WATERCOURSES INCLUDING RIVERS, PANS, WETLANDS, SPRINGS,DRAINAGE LINES
COMPILED BY: Toni Belcher (SACNASP 400040/10), BlueScience
PROJECT: Hotazel Solar Park - Transmission Line to Umtu Substation

					Severity																	
Nr.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Physico & Chemical (Water Quality)**	**Habitat (Geomorph+ Vegetation)**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Control Measures**	**Watercourse; PES; EIS**	**Confidence**
1	Construction	Construction works associated with the transmission	Transmission Line to Umtu Substation	Loss of biodiversity & habitat; flow modification; water quality impacts; invasive plant invasion	1	1	2	1	1.25	1	1	**3.25**	1	2	1	3	**7**	**22.75**	**L**	See Freshwater Assessment Report	Ga-Mogara River: Moderately Modified PES, Moderate/Low EIS	Medium to High
	Operation	Operational activities associated with the transmission line	Maintenance of Transmission Line to Umtu Substation adjacent to aquatic ecosystems		1	1	1	1	1	1	4	**6**	1	1	1	3	**6**	**36**	**L**			Medium

APPENDIX D.5:
Heritage

HERITAGE IMPACT ASSESSMENT FOR PROPOSED POWER LINES NEAR HOTAZEL, KURUMAN MAGISTERIAL DISTRICT, NORTHERN CAPE

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report for:

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On behalf of:

HOTAZEL SOLAR FARM 1 (PTY) LTD
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1st draft: 25 November 2016
Final report: 06 February 2016

EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by Aurecon South Africa (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed construction of a power line to link the proposed Hotazel Solar Park to the national electricity grid. The study area is centred on S27°14'22.9" E22°58'6.6". Three alternatives have been proposed for assessment and are described below. The farm portions potentially implicated by the various alternatives are Annex Langdon 278/remainder, Hotazel 280/remainder, Devon 277/remainder, York 279/11 and Olive Pan 282/remainder.

The study area is relatively flat and covered in sand, although calcrete is exposed along the banks of the Ga-Mogara River which is crossed by one of the Alternatives. Bush and trees occur widely but in general did not hamper the survey. Some very dense patches along the western power line corridor were impenetrable but this was not a limitation for the assessment. The R31 and R380 roads, a railway and numerous other power lines cross the study area, while a number of manganese mines are operational in the general vicinity.

A desktop assessment was carried out and the site was physically surveyed for heritage resources. Heritage resources were found to be scarce in the broader landscape and, when present, tend to be isolated and of very low cultural significance. A scatter of stone artefacts was observed along the banks of the Ga-Mogara River but these are attributable to background scatter and are not dense enough to be significant. The landscape is also a heritage resource but is deemed to be of low significance because the dominant cultural contribution is from the mining industry and associated activities which date to the mid-twentieth century. No palaeontological material was seen on the site, although a small chance of finding such remains during deep excavations (>1 m) is noted.

There do not appear to be any significant heritage resources within the study area and impacts to heritage are likely to be of very low significance. Because heritage resources occur so infrequently in the wider region, cumulative impacts are of no concern.

Because of the very limited potential for impacts to heritage resources, it is recommended that the power line project be authorised with any of the three alternatives. The following condition should be included in the authorisation:

- If any archaeological material, palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Holocene: The geological period spanning the last approximately 10 000 to -12 000 years.

Hominid: a group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

CRM: Cultural Resources Management

DEA: Department of Environmental Affairs

ECO: Environmental Control Officer

EIA: Environmental Impact Assessment

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

LMS: London Missionary Society

LSA: Later Stone Age

MSA: Middle Stone Age

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25) of 1999

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by Aurecon South Africa (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed construction of a power line to link the proposed Hotazel Solar Park to the national electricity grid. The study area is centred on S27°14'22.9" E22°58'6.6". Three alternatives have been proposed for assessment and are described below. The farm portions potentially implicated by the various alternatives are Annex Langdon 278/rem, Hotazel 280/rem, Devon 277/rem, York 279/11 and Olive Pan 282/rem.

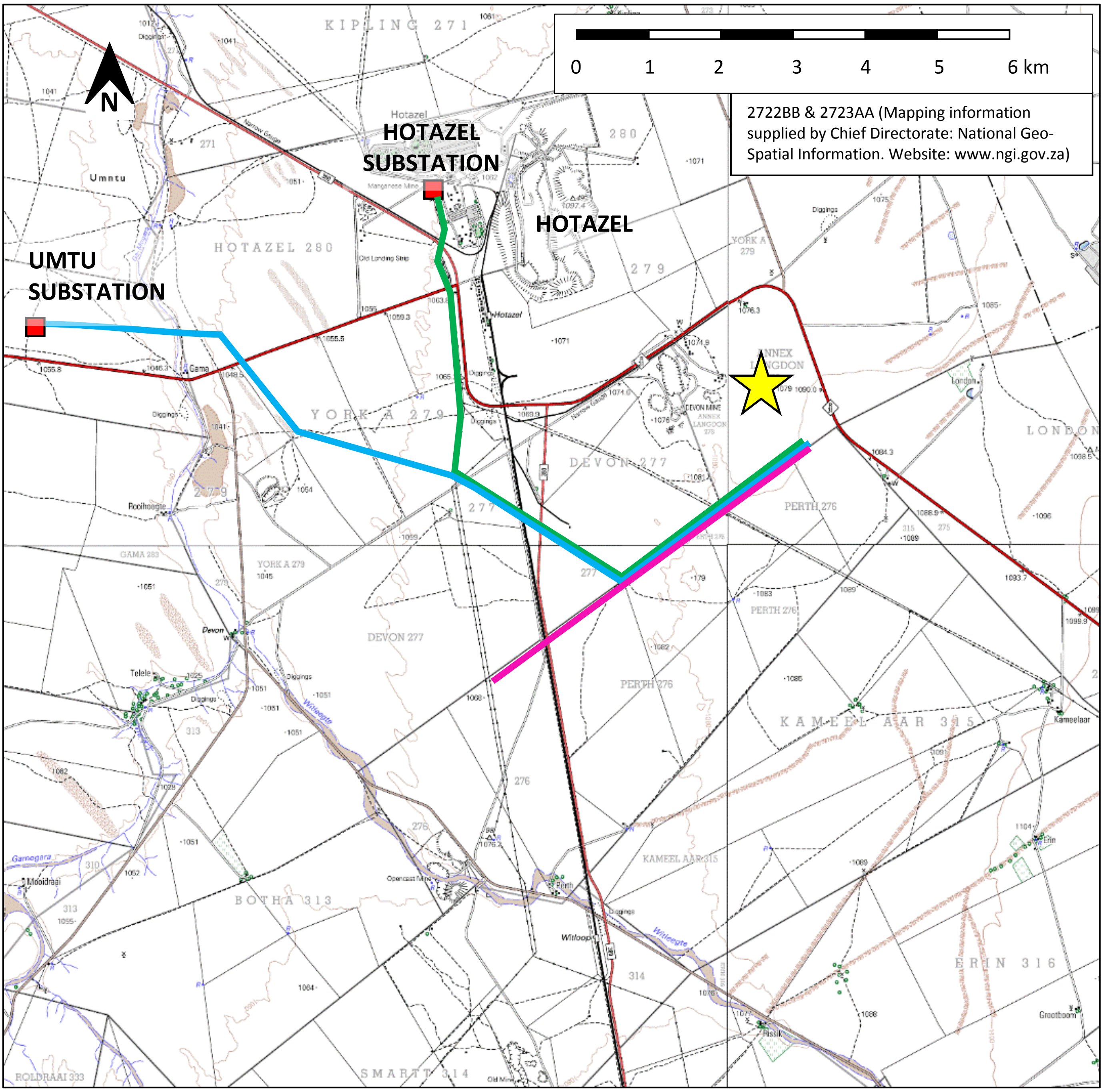

Figure 1: *Map showing the location of the site to the south of Hotazel. The green line indicates Alternative C1 running to the Hotazel Substation, the turquoise line is Alternative C2 running to the Umtu Substation, while the pink line is Alternative C3 involving a Loop-In Loop-Out line on an existing Eskom power line. The yellow star indicates the position of the proposed PV facility which has been assessed under a separate process.*

1.1. Project description

Three alternatives are being considered for assessment as follows and are mapped in Figures 1 and 2:

1.1.1. Transmission line C1: Hotazel substation

- A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed
- Servitude width 35m
- ≤110monopole pylons
- ≤12km long and 4m wide service track

1.1.2. Transmission line C2: Umtu substation

- A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed
- Servitude width 35m
- ≤140 monopole pylons
- ≤15km long and 4m service track

1.1.3. Transmission Line C3: LILO connection (please see footnote)

- A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site.
- Servitude width 35m per line.
- ≤60 monopole pylons (i.e. ≤120 pylons in total)
- ≤6km long and 4m service track per line

1.1.4. Alternative C4: NO GO

- No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

Figure 2: *Aerial view of the study area showing the proposed power line routes. The green line indicates Alternative C1, the turquoise line is Alternative C2, while the pink is Alternative C3. Created in Google Earth using the Bing overlay available from http://ge-map-overlays.appspot.com/bing-maps/aerial).*

1.2. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since excavations for foundations and/or services may impact on archaeological and/or palaeontological remains, while all above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

1.3. Terms of reference

ASHA Consulting was asked to provide a Heritage Impact Assessment (HIA) for the proposed project. The assessment was to follow the impact assessment methodology provided to all specialists.

It should also be noted, however, that following S.38(3) of the National Heritage Resources Act (No. 25 of 1999), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

1.4. Scope and purpose of the report

A heritage impact assessment (HIA) is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued by them for consideration by the National Department of Environmental Affairs (DEA) who will review the Basic Assessment Report (BAR) and grant or refuse authorisation. The HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.5. The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in the Western Cape and Northern Cape provinces of South Africa since 2004 (Please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

1.6. Declaration of independence

ASHA Consulting (Pty) Ltd and its consultants have no financial or other interest in the proposed development and will derive no benefits other than fair remuneration for consulting services provided.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;

- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: "any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith";
- Palaeontological material: "any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace";
- Archaeological material: a) "material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures"; b) "rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation"; c) "wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation"; and d) "features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";
- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a BAR. Ngwao-Boswa Ya Kapa Bokoni (Heritage Northern Cape; for built environment and cultural landscapes) and the South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:50 000 maps were sourced from the Chief Directorate: National Geo-Spatial Information.

3.2. Field survey

The proposed power line corridors and the PV site (the latter assessed in a separate report) were subjected to a foot survey over three days from 29th June to 1st July 2016. This was in mid-winter, but in such dry areas the season has little influence on the amount of plant cover and hence on visibility of the surface. During the survey the positions of finds were recorded on a hand-held GPS receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

3.3. Specialist studies

A separate specialist assessment of palaeontological heritage has been carried out and is referenced within the present HIA. The palaeontological report can be found in Appendix 2.

3.4. Impact assessment

For consistency, the impact assessment was conducted through application of a methodology supplied by Aurecon.

3.5. Grading

S.7(1) of the NHRA provides for the grading of heritage resources into those of National (Grade I), Provincial (Grade II) and Local (Grade III) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade I and II resources are intended to be managed by the national and provincial heritage resources authorities respectively, while Grade III resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended under S.7(2) that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. SAHRA (2007) has formulated its own system for use in provinces where it has commenting authority. In this system sites of high local significance are given Grade IIIA (with the implication that site should be preserved in its entirety) and Grade IIIB (with the implication that part of the site could be mitigated and part preserved as appropriate) while sites of lesser significance are referred to as having 'General Protection' and rated with an A (high/medium significance, requires mitigation), B (medium significance, requires recording) or C (low significance, requires no further action).

3.6. Consultation

The NHRA requires consultation as part of an HIA but, since the present study falls within the context of an EIA which includes a public participation process (PPP), no dedicated consultation was undertaken as part of the HIA.

3.7. Assumptions and limitations

The field study was carried out at the surface only and hence any completely buried archaeological sites would not be readily located. Similarly, it is not always possible to determine the depth of archaeological material visible at the surface. Part of the study area was within the security fence of a mine and was not available for study in the field. The shared section of the route was realigned further south and Alternative 3 was extended after the field survey – these areas were thus not covered. In some areas, especially along the power line corridor to the west, thick thorn bushes prevented easy access. However, these limitation are highly unlikely to have affected the outcome of the assessment because of the uniform nature of the surface and general lack of heritage resources in the area.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The study area lies to the southwest, south and southeast of the town of Hotazel. It is crossed by the R31 and R380 roads as well as by a railway line servicing the manganese mines of the area (Figures 2 & 3). Two substations occur in the north and west and form the termini of two of the alternatives. A number of power lines also already traverse the area, including those for the railway lines.

Figure 3: *View towards the south from the road bridge over the railway showing infrastructure already present in the area.*

4.2. Site description

The general area around Hotazel is relatively flat with the only major landscape feature in the study area being the incision housing the Ga-Mogara River. This crosses Alternative C2 in the far west of the study area. The general environment is sandy with grass, thorn bushes and thorn trees being common. Thorn bushes were noted to be especially common immediately outside the existing power line servitude in the north, no doubt because cleared bushes dropped their seed there. Figures 4 to 8 show a selection of views of the landscape through which the proposed project would run.

Figure 4: *View of the vicinity of the Hotazel Substation where Alternative C1 terminates.*

Figure 5: *View towards the north alongside the existing power lines followed by Alternative C1.*

Figure 6: *View towards the east along the existing power line followed by Alternative C2.*

Figure 7: *View of the area close to where Alternatives C1 and C2 meet.*

Figure 8: *View towards the southwest and west along the Alternative C2 corridor and across the Ga-Mogara River channel.*

5. HERITAGE CONTEXT

This section of the report contains the desktop study and establishes what is already known about heritage resources in the vicinity of the study area. What was found during the field survey may then be compared with what is already known in order to gain an improved understanding of the significance of the newly reported resources.

5.1. Archaeological aspects

Although a large number of applications have been lodged on SAHRIS for areas surrounding the present study area, very few heritage reports have been compiled. Van Schalkwyk (2010, 2016) examined sites just south of the present study area and just west of Hotazel town and found no cultural resources to be present in either location. Other studies further afield (e.g. Fourie 2013) have found a similar paucity of archaeological material in open, sandy areas. However, along the margins of the Kuruman River stone artefacts have been reported (Hutten & Hutten 2013). These artefacts are low density and appear to be largely from the Middle Stone Age (MSA), although some may be Later Stone Age (LSA). They are likely attributable to background scatter. Early Stone Age (ESA) material seems to be largely absent, despite how common it is at Kathu, 50 km to the south, where extensive research has been carried out (e.g. Chazan et al. 2012; Porat et al. 2010).
De Jongh (2010) reports that Iron Age occupation did not extend into this area. It is thus of no further concern.

5.2. Palaeontological aspects

Almond (2016) notes that the site is underlain by sediments of the Kalahari Group. These include the Pleistocene-aged red sands of the Gordonia Formation as well as the underlying calcretes of the Mokolanen Formation. Fossils occur in both but are expected to be sporadic and widespread. Although mammalian bones, teeth and horn cores may occur in these sediments, their distribution is likely to be very sparse.

5.3. Historical aspects

De Jongh (2010) notes that Western Sotho communities who originated from Late Iron Age communities to the east occupied the broader area around Kathu when white farmers (trekboers) and missionaries arrived in the early 19th century. Here, as was the case over much of the country, this meeting of people and interests resulted in conflict over land. Lovett (1899) describes the beginnings of Kuruman, started by the London Missionary Society (LMS). In 1815 four missionaries were sent from London to work at a place known as Lattakoo. Although only two arrived there on 11th January 1816, one departed fairly soon. The remaining missionary, Robert Hamilton, was soon joined by James Read on 28th December 1816. Read obtained approval from the local chief, Mothibi of the Batlaping, to start a settlement. In June 1817 Mothibi moved his tribe to a better location along the Kuruman River which was initially known as New Lattakoo but then soon became Kuruman. Robert Moffat, a well-known LMS missionary, reached Lattakoo on 17th May 1821. The mission station was moved from Lattakoo to Kuruman in 1824.

The area was very sparsely populated until the 20th century when the farms of the area were surveyed. The Surveyor General diagrams show that Devon 277 was surveyed in 1914 with Annex Langdon having been a deduction from Devon in 1928.

When manganese was discovered in the area during the mid-20th century by Van Rensburg, who was seeking water on the farm Hotazel, the farm was bought by SA Manganese. After testing the ore they set up a mining operation and small town (initially 30 houses and some offices and stores. An official opening was held in November 1959 (Hocking 1983).

More recently, during the apartheid years in South Africa, the Bophutatswana Territorial Authority was set up in 1961. It became a self-governing state in 1971 and was given independence from South Africa in 1977. In 1994, however, it was reincorporated into South Africa (SAHO 2015).

6. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project. Figure 9 shows the walk-paths recorded during the survey and the position of the findings discussed in this section.

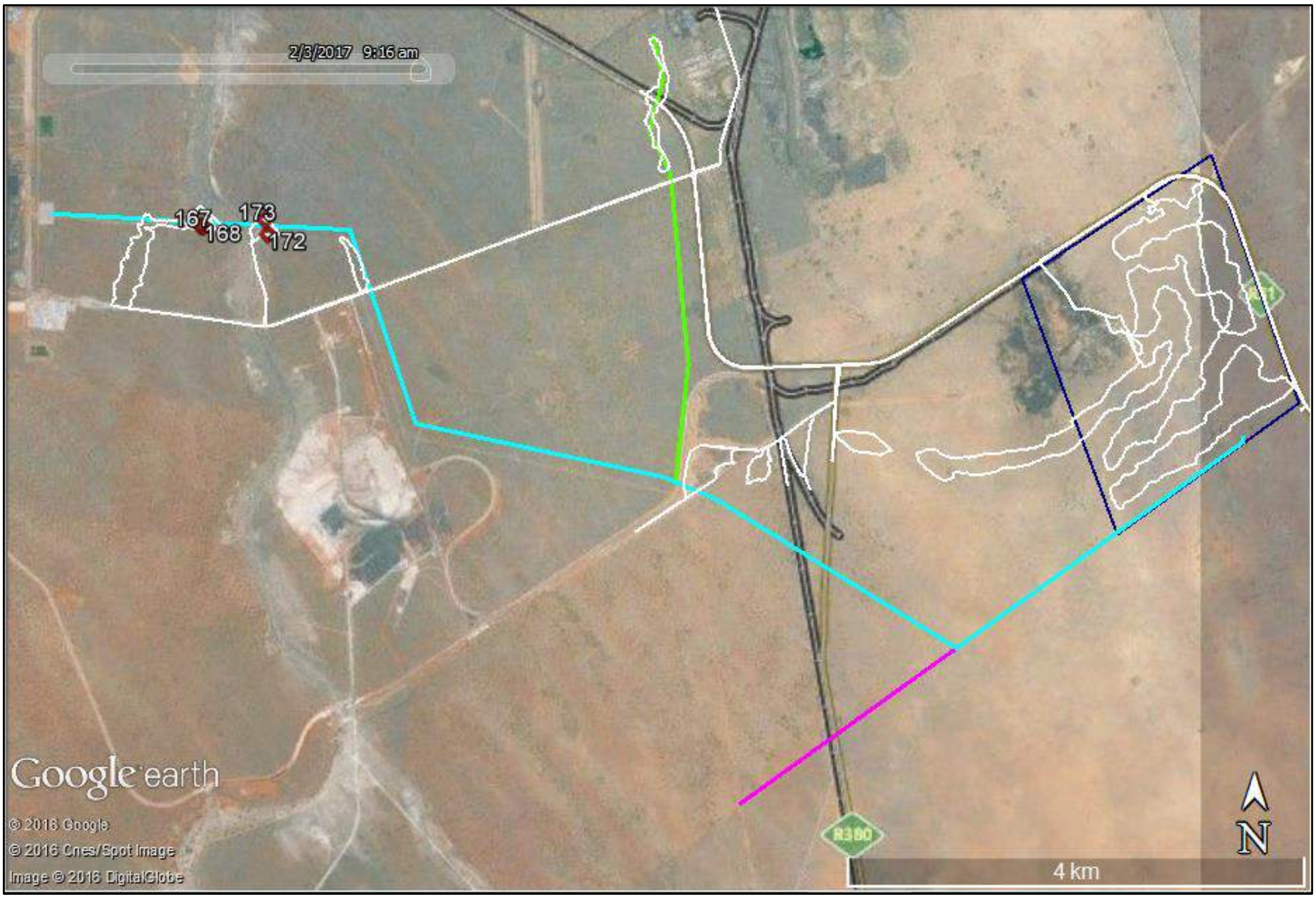

Figure 9: *Aerial view of the study area showing the walk-paths recorded during the survey (white lines) and the positions of finds (numbered symbols). Note that the tracks reflect an earlier layout and that some areas could not be accessed at the time of the survey. Created in Google Earth using the Bing overlay available from http://ge-map-overlays.appspot.com/bing-maps/aerial).*

6.1. Archaeology

Archaeological material in the form of stone artefacts was seen in two places only. These were on the opposite banks of the Ga-Mogara River where the surface sands have been eroded away and the underlying calcrete exposed. On the west bank of the river artefacts were seen at S27° 13’ 16.2” E22° 55’ 05.4” and S27° 13’ 16.4” E22° 55’ 06.4”, and on the east bank at S27° 13’ 18.6” E22° 55’ 26.8” and S27° 13’ 14.5” E22° 55’ 26.1”. It seemed clear that the artefacts are naturally located at or close to the interface between the sand and calcrete and have been exposed through the down-cutting of the river channel. They probably occur extensively along the river channel. The artefacts appear to be from the MSA and were made mostly from quartzite and CCS. At least one quartz artefact was also seen. Figures 10 and 11 show examples of the artefacts found. These are no doubt attributable to the general background scatter that lies buried beneath the sand.

Figure 10: *Selection of stone artefacts from Waypoint 167 on the western bank of the Ga-Mogara River. They are made from quartzite, quartz and CCS. Scale in cm.*

Figure 11: *Selection of stone artefacts from Waypoint 172 on the eastern bank of the Ga-Mogara River. They are made from quartzite and CCS. Scale in cm.*

6.2. Palaeontology

The SAHRIS Palaeosensitivity map indicates that the study area is of moderate sensitivity from the point of view of fossil heritage and that at least a desktop study should be conducted (Figure 12). The study produced by Dr John Almond (2016) indicated that the Kalahari Sands and underlying calcretes are not sensitive from a palaeontological point of view because the types of fossils expected to be found are common and widespread within the region. These include invertebrate burrows and root and reed castes.

These sorts of fossils are the only ones recorded by Almond in other nearby areas (see references in Almond 2016).

Figure 12: *Extract from the SAHRIS Palaeosensitivity map showing the project area (green, turqoise and pink lines) to be of moderate sensitivity (green shading). Source: http://www.sahra.org.za/sahris/map/palaeo.*

6.3. The cultural landscape

The landscape has two primary components. The first and older one is the rural cultural landscape. The cultural aspects of this landscape are not strongly developed, largely because of the very low carrying capacity of the area. The only aspects making a contribution are fences and occasional farm track leading to houses. The second aspect is the more modern mining layer that has been superimposed on the rural landscape. It is of no cultural significance and does not require further discussion.

6.4. Statement of significance

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ''cultural significance'' means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

The archaeological resources are deemed to have low cultural significance for their scientific value.

The cultural landscape has low significance for its aesthetic, historical and social value.

6.5. Summary of heritage indicators and provisional grading

The archaeological material seen along the Ga-Mogara River is not very significant and can be assigned a provision grading of 'General Protection C'. There are no palaeontological resources worthy of grading and the landscape does not warrant grading[1].

[1] Note that the SAHRA grading system has, in any case, only been proposed for use for archaeological resources.

7. ASSESSMENT OF IMPACTS

7.1. Impacts to archaeological resources

Impacts to archaeological heritage would be direct negative impacts and would occur primarily during the construction phase of the project. Operational phase impacts are largely irrelevant since they would involve minor movement or damage to artefacts in the service roads which would have already been substantially disturbed. Archaeological artefacts were only seen in one area – along the banks of the Ga-Mogara River. Although it is likely that more similar artefacts will occur at the interface of sand and the underlying calcrete, the chances of impacting on significant scatters during construction of the power lines is minimal. The assessed significance before mitigation is **very low**. Because the archaeological remains are considered to be of very low cultural significance, no mitigation is suggested. There are no fatal flaws in terms of archaeology. The impacts are assessed in Table 1.

Because of the very limited amount of archaeology in the broader landscape and its generally buried nature, the cumulative impacts are regarded as being of **very low** significance. In the event that mitigation were required at one or other development in the region it is likely that there would be no change to the significance rating.

7.2. Impacts to palaeontological resources

Impacts to palaeontological heritage would be direct negative impacts and would occur only during the construction phase of the project. However, no palaeontological material was seen during the site inspection and thus the chances of impacts to these resources occurring are very low. Although such material could be buried beneath the covering sands, the chances of intersecting significant fossils are very low. The assessed significance before mitigation is therefore **very low**. Because palaeontological remains were not seen and the chances of significant resources being present are so low, no mitigation is suggested. There are no fatal flaws in terms of palaeontology. The impacts are assessed in Table 2.

Because of the very limited amount of palaeontology in the broader landscape, the cumulative impacts are regarded as being of **very low** significance. In the event that mitigation were required at one or other development in the region it is likely that there would be no change to the significance rating.

7.3. Impacts to the cultural landscape

The landscape is a heritage resource but its cultural aspects are almost exclusively recent and related mostly to the mining industry. As such they have very low cultural significance. Because of the general tree cover in the surrounding area and the degree of modern landscape alteration from mining, the impacts would be localised to the site and its immediate surrounds. In addition, there are already numerous power lines in the area. The significance of potential impacts is rated as being of **very low** significance before mitigation. No practical mitigation measures can be suggested. The impacts are assessed in Table 3.

The general landscape around the study area is already compromised through the presence of several mining facilities and other linear infrastructure including many power lines. It is noted that the other facilities proposed around the Hotazel area are all within reasonably close proximity of mining areas and that their associated power lines would simply be additional to those already present. It is considered that the impacts to the landscape would thus be fairly well concentrated around Hotazel and the various industrial and mining facilities in the immediate area. The cumulative impacts to the landscape are thus rated as being of **very low** significance. The probability of these impacts is seen as probable because there is doubt over whether all the proposed projects would be constructed.

Table 1: *Impact assessment table for the power lines and service road: archaeology.*

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description								
Overview	Negative impacts to archaeology from clearing of the surface and construction of the power lines and service road.		Negative impacts to archaeology from clearing of the surface and construction of the power lines and service road.		Negative impacts to archaeology from clearing of the surface and construction of the power lines and service road.		Retention of the status quo (i.e. livestock grazing / vacant land)	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	Neutral	Neutral
Duration	Long term	Long term	Long term	Long term	Long term	Long term	Long term	Long term
Extent	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific
Magnitude	Very low	Very low	Very low	Very low	Very low	Very low	Zero	Zero
Probability	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable
Confidence	Sure	Sure	Sure	Sure	Sure	Sure	Sure	Sure
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Resource irreplaceability	High	High	High	High	High	High	High	High
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Significance	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low
Mitigation	• **None required**							
Cumulative Impact assessment	**The nature of the archaeological material present in the vicinity suggests that impacts to archaeology are likely to always remain of very low significance, even if a site worthy of mitigation were to be encountered and mitigated in another development.**							
Conclusion:	**Due only to the shorter length of construction required, the LILO option is preferred. This is followed by the Hotazel Tx line with the Umtu Tx line, which crosses the river where some archaeology was observed, being least preferred.**							

Table 2: *Impact assessment table for the power lines and service road: palaeontology.*

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description								
Overview	Negative impacts to palaeontology from clearing of the surface and construction of the power lines and service road.		Negative impacts to palaeontology from clearing of the surface and construction of the power lines and service road.		Negative impacts to palaeontology from clearing of the surface and construction of the power lines and service road.		Retention of the status quo (i.e. livestock grazing / vacant land)	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	Neutral	Neutral
Duration	Long term	Long term	Long term	Long term	Long term	Long term	Long term	Long term
Extent	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific	Site-specific
Magnitude	Very low	Very low	Very low	Very low	Very low	Very low	Zero	Zero
Probability	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Confidence	Sure	Sure	Sure	Sure	Sure	Sure	Sure	Sure
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Resource irreplaceability	Low	Low	Low	Low	Low	Low	Low	Low
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Significance	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low
Mitigation	• **None required**							
Cumulative Impact assessment	**The nature of the palaeontological material present in the vicinity suggests that impacts to palaeontology are likely to always remain of very low significance, even if fossils worthy of mitigation were to be encountered and mitigated in another development.**							
Conclusion:	**Due only to the shorter length of construction required, the LILO option is preferred. This is followed by the Hotazel Tx line with the Umtu Tx line, which crosses the river where calcrete outcrops occur, being least preferred.**							

Table 3: *Impact assessment table for the power lines and service road: landscape.*

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description								
Overview	Negative impacts to the landscape from clearing of the surface and construction of the power lines and service road.		Negative impacts to the landscape from clearing of the surface and construction of the power lines and service road.		Negative impacts to the landscape from clearing of the surface and construction of the power lines and service road.		Retention of the status quo (i.e. livestock grazing / vacant land)	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	Neutral	Neutral
Duration	Long term	Long term	Long term	Long term	Long term	Long term	Long term	Long term
Extent	Local	Local	Local	Local	Local	Local	Site-specific	Site-specific
Magnitude	Very low	Very low	Very low	Very low	Very low	Very low	Zero	Zero
Probability	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Confidence	Sure	Sure	Sure	Sure	Sure	Sure	Certain	Certain
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Resource irreplaceability	Low	Low	Low	Low	Low	Low	Low	Low
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Significance	Very low	Very low	Very low	Very low	Very low	Very low	Very low	Very low
Mitigation	• **None required**							
Cumulative Impact assessment	**The nature of the archaeological material present in the vicinity suggests that impacts to archaeology are likely to always remain of very low significance, even if a site worthy of mitigation were to be encountered and mitigated in another development.**							
Conclusion:	**Due only to the shorter length of construction required, the LILO option is preferred. This is followed by the Hotazel Tx line with the Umtu Tx line, which crosses the river (the only prominent landscape feature in the area), being least preferred.**							

8. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

There are no mitigation measures for this project, but there are some management measures that should be written into the project Environmental Management Program (EMPr). These are discussed here.

It is recommended that the ECO examine all excavations greater than 1 m depth to check for palaeontological material.

Although the chance of finding buried archaeological resources, fossil resources or possibly graves is very low, should any such material be found it should be reported to the project environmental control officer (ECO) who should then report to an archaeologist or palaeontologist as appropriate for assessment and advice on how to proceed. The ECO or heritage practitioner should also report the find to SAHRA.

9. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

In this instance the heritage significance of the study area is very low which means that the social and economic benefits (provision of jobs and electricity) far outweigh the impacts to heritage resources.

10. PUBLIC CONSULTATION

This HIA forms part of a BAR which will be subjected to the legally required public consultation process. As such, no specific consultation has been undertaken as part of the heritage process.

11. CONCLUSIONS

There are no significant heritage indicators related to this project or its footprint area. No significant impacts are expected, although there is always the remote possibility that buried archaeological material, palaeontological material or isolated graves could be found. Such finds cannot be predicted and do not materially affect the decision to proceed with the project.

12. RECOMMENDATIONS

Because of the very limited potential for impacts to heritage resources, it is recommended that the project be authorised. The following condition should be included in the authorisation:

- If any archaeological material, palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 6A Scarborough Road, Muizenberg, 7945
Telephone: (021) 788 8425
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Memberships and affiliations:

South African Archaeological Society Council member	2004 –
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
ASAPA Cultural Resources Management Section member	2007 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP)

- Accredited Professional Heritage Practitioner

Fieldwork and project experience:

Extensive fieldwork as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

APPENDIX 2 – Palaeontological desktop study

APPENDIX D.6:

Hydrology

aurecon

Environmental Impact Assessment Process: Proposed Photovoltaic Facility near Hotazel, Northern Cape
Surface Water EIA Report
juwi Renewable Energies (Pty) Ltd

8 March 2017
Revision: 3
Reference: 112667

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Document control record

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Document control					aurecon	
Report title		Surface Water EIA Report				
Document ID			**Project number**		112667	
File path		C:\Users\dirk.pretorius\Desktop\Hotazel_Temp\Specialist reports\REP_ Hydrology EIA Report_REV02_DP.docx				
Client		juwi Renewable Energies (Pty) Ltd	**Client contact**		Nazley Towfie	
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
1	9 December 2016	Draft	NJ Walker			
2	14 December 2016	Draft	NJ Walker			
3	8 March 2017	Final	NJ Walker	PK		
Current revision		**3**				

Approval			
Author signature		Approver signature	
Name	NJ Walker	Name	
Title	Hydrologist	Title	

Please Note: The DEA requested that all specialist's studies undertaken in-house by Aurecon be subjected to an independent peer review. The peer review for this report was undertaken by Liezl du Plooy of DECA and can be found appended to the main EIAr, following this report. This report has been updated in response to the peer reviewer's comments, where necessary.

Contents

Figures

Tables

EXECUTIVE SUMMARY

Hotazel Solar Farm 1 (Pty) Ltd, a wholly owned subsidiary of juwi Renewable Energies (Pty) Ltd (juwi), proposes the construction and operation of a 300ha, ≤200MWac solar Park on the Farm Annex Langdon (F278/0), and associated infrastructure, near Hotazel, in the Joe Morolong Local Municipality, in the Northern Cape Province. The planned infrastructure includes:

- 200MWac solar facility with Photovoltaic (PV) panels on steel mountings, single axis tracking and concrete footings;
- A ≤100MWh battery storage facility;
- 1.9 km long, 8m wide gravel access road;
- 17km's (4m wide) of service roads;
- On-site collector substation: and
- ≤1ha Operation and maintenance laydown area.

The surface water assessment was undertaken within the legal framework of the National Environmental Management Act (Act no. 107 of 1998) and the National Water Act (Act no. 36 of 1998). The surface water study includes the following components:

1. Data Collection and Review;
2. Site Visit;
3. Baseline Assessment; and
4. Impact Identification and Assessment.

The site visit was conducted on the 30th June 2016 and deep sandy soils were identified at the site. The high permeability of the soils produces a very low stream density in the area. On the site itself no evidence of existing drainage channels were found. Studies have shown that solar panels do not have a significant effect on the runoff volumes if there is enough space between the rows to allow infiltration. Therefore, as there are no watercourses on the site the main potential impacts from the proposed PV infrastructure are localised erosion from removing vegetation and disturbing soils and possible increased runoff from the hardened gravel access road.

The mitigating measures should as far as possible mimic natural hydrology with the use of non-structural techniques. Stormwater management may be provided in a cost-effective manner by allowing adequate spacing between rows of panels for infiltration which permits runoff to infiltrate over the vegetated areas between the individual rows. This approach works best in undisturbed soils where existing vegetation is retained as far as possible. Allowing for infiltration of water between and underneath the panels is a key element.

Hotazel and LILO are the preferred routes for transmission lines as they do not cross a watercourse. However the Umtu route is acceptable if the pylons are placed outside of the Ga- Morgara River channel and flood terraces with the overhead powerline spanning the river channel. Disturbance of the river channel and flood terraces is therefore not anticipated.

1 Overview

1.1 HOTAZEL SOLAR FARM (EIA)

The Hotazel Solar Park project will be handled as two applications, the first following a Scoping and Environmental Impact Report (S&EIR) process in accordance with the NEMA EIA regulations, 2014, Government Notice (GN) R 982 for the solar facility and ancillaries (DEA Case Ref: 14/12/16/3/3/2/987). The second application will follow the basic assessment process in terms of the same regulations for the transmission lines connecting the project to the national power grid. The public engagement process will be conducted as a single process in the impact assessment phase.

1.1.1 Project description

Aurecon South Africa (PTY) Ltd (Aurecon) were commissioned by juwi Renewable Energies (Pty) Ltd (juwi) as the independent Environmental Assessment Practitioner (EAP) to facilitate the application processes for environmental authorisation in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA).

Hotazel Solar Farm 1 (Pty) Ltd, a wholly owned subsidiary of juwi Renewable Energies (Pty) Ltd (juwi), proposes the construction and operation of a 300ha, ≤200MWac solar Park on the Farm Hotazel Annex Langdon (F278/0), and associated infrastructure, near Hotazel, in the Joe Morolong Local Municipality, in the Northern Cape Province. Referred to as the Hotazel Solar Park (see **Figure 1** and **Figure 2**). The project components are described in **Table 1** below.

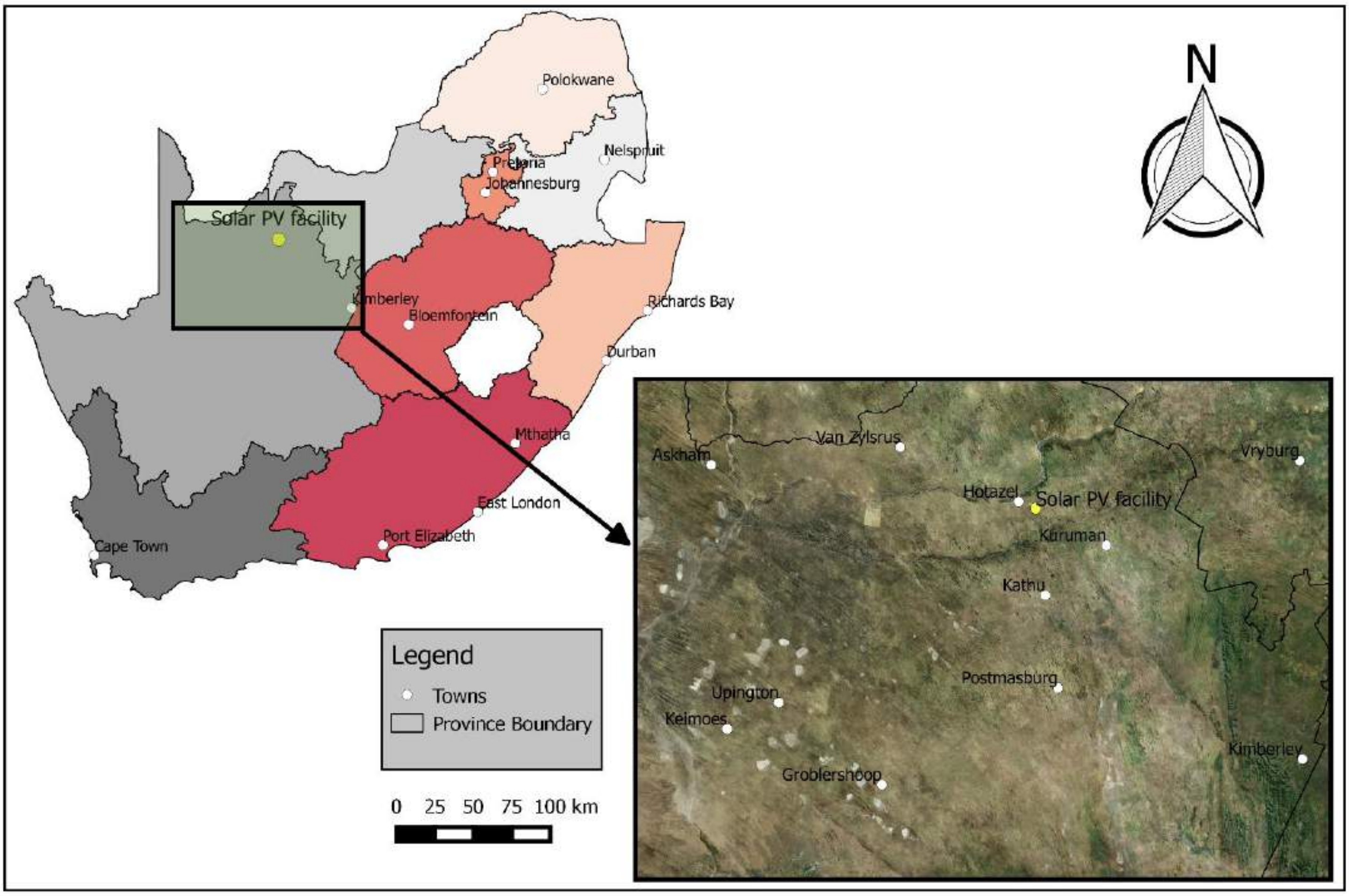

Figure 1 Location map of the proposed Solar Facility on Farm Hotazel Annex Langdon (F278/0)

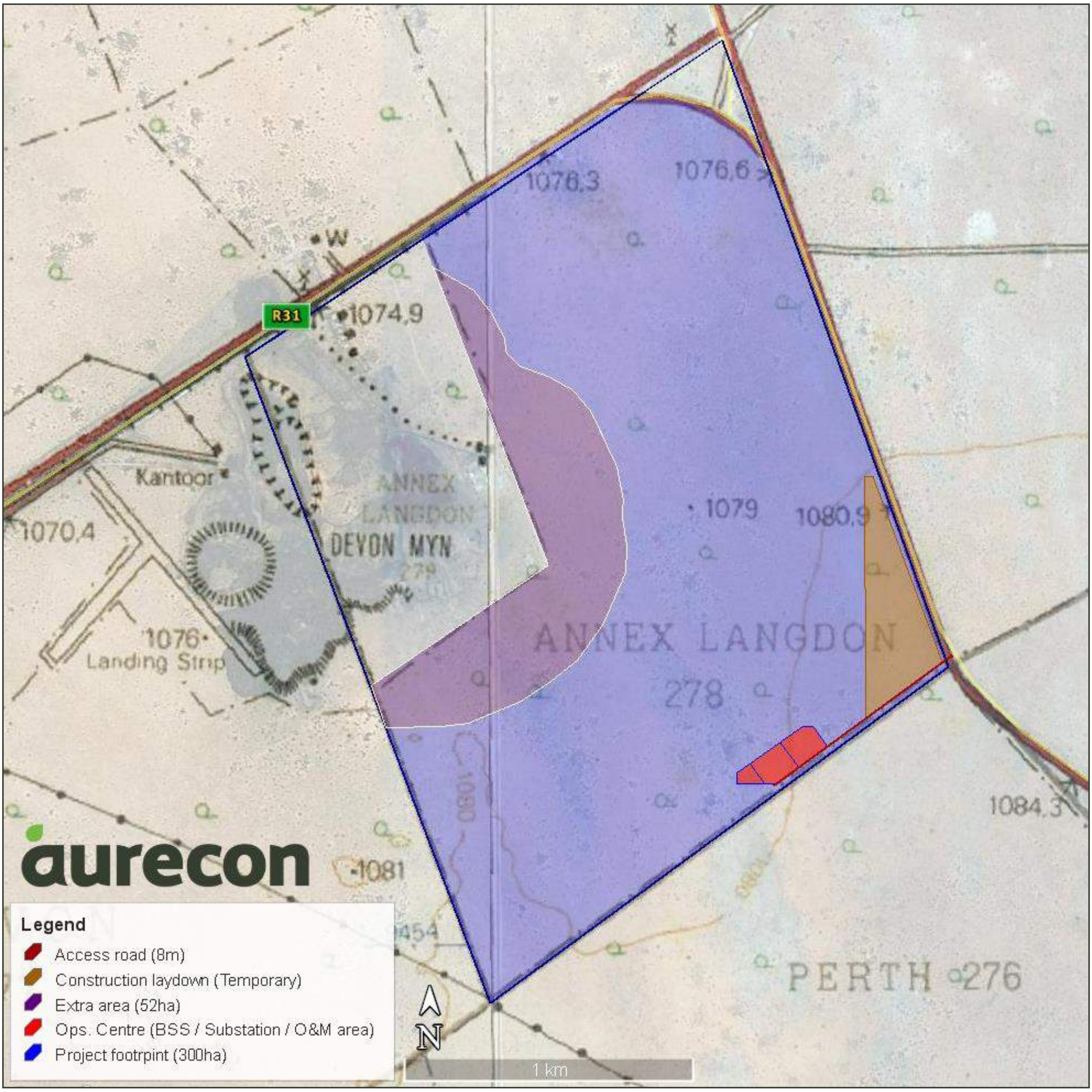

Figure 2 Solar Facility on Farm Annex Langdon (F278/0)

Table 1 Hotazel Solar Farm 1 project description and alternatives summary

Component	Dimensions
• **Solar Farm:** A 200MWac solar facility with PV panels on steel mountings with single axis tracking mechanisms and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters.	• ≤250ha solar panels, service roads, cables runs, and other ancillaries and some open space)
• **Battery Storage System:** A ≤100MWh battery storage facility for grid storage of maximum height 8m and a maximum of 1120 cubic meters of batteries (dangerous goods) and associated operational, safety and control infrastructure.	• ≤1ha • ≤8m building height • ≤1120m³ of batteries
• **Access road:** A ≤1.9km long, ≥8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.	• ≤1.9km long, ≤8m wide • ≤1.52ha
• **Service roads:** ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	• ≤17kms, 4m wide gravel roads • Footprint included in solar farm footprint (≤6.8ha)

• **Collector substation:** ≤1ha collector substation to receive, convert and step up electricity from the PV facility to the 132kV grid suitable supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32m telecommunications tower (lattice or monopole type) will be established in the substation area.	• ≤1ha • Substation infrastructure ≤10m height • 32m telecommunications tower
• **O&M area**: o ≤1ha hectare O&M laydown area (near / adjacent substation); o Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; o Workshops, storage areas for materials and spare parts; o Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day for 15 months during rest of construction period; ~20kl/day during operation); o Septic tanks and sewer lines to service ablution facilities; and o Central Waste collection and storage area.	• ≤1ha • Single storey office, ablutions, workshop complex (4m height)
• **Other infrastructure:** o Perimeter fencing and internal security fencing and gates as required. o Access control gate and guard house on access road; o ≤3.5km length of small diameter water supply pipeline connecting existing boreholes to storage.	• 1.8m high jackal fence with barbed wire
• **Temporary infrastructure:** o A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.	• ≤4ha (Temporary)
Total development footprint	**≤300ha**[1]

1.1.2 NEMA Listed activities

Listed activity as described in GN R. 983, GN R. 984 and GN R.985 in terms of NEMA are summarised as follows: GN R. 983 activities 11(i), 24(ii), 28(ii), GN R. 984 activities 1, 4 and 15. More detail is provided in **Table 2**.

Table 2 Listed activities applicable to the Solar PV phases in terms of GN No. 983, 984, 985 of 2014

Listed activities in terms of NEMA regulations potentially applicable to the Solar PV phases	
Listed activity as described in GN R. 983, GN R. 984 and GN R.985	**Description of the activities to be undertaken, including associated structures and infrastructure**
Listed activities in terms of NEMA GN No. 983	
GN No. 983 Activity No. 11 (i): The development of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or	Onsite infrastructure including underground cabling for collection of electricity, with a capacity of ≤33kV would be required to connect the proposed PV facility to the proposed onsite central 132 kV substation. The proposed facility is situated outside of the urban edge. This activity would therefore be triggered.
GN No. 983 Activity No. 24 (ii): The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	Permanent roads outside the urban area will be required for the proposed PV facility. The width of the proposed access roads including sidings will be 8 metres and to accommodate heavy two directional traffic require road reserve of 15m, and this activity is thus triggered.
GN No. 983 Activity No. 28 (ii): Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1 April 1998 and where such development - (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	The property is currently not being used for any formal agriculture. The north western corner of the property is used by the Strata-Africa Resources Pty Ltd for manganese prospecting. Historically, the land would have been used for low intensity mixed grazing, and thus will need to be rezoned to "Special Zone: Renewable Energy" use and so this activity will thus be triggered.
Listed activities in terms of NEMA GN No. 984	

[1] Note that the development footprint is estimated at 300ha, the percentage land covered by building and infrastructure is likely to be 80 -90% of the 300ha. These unused spaces arise from solar arrays needing to be orientated in particular direction which is optimised according to sun and not property boundaries, which leaves some unusable spaces. Also space needs to be left around some buildings and facilities. While these areas will not be developed, they are considered transformed as they no longer render all ecosystem services as they would have if not enclosed by the development, thus they are included in the development footprint.

Listed activities in terms of NEMA regulations potentially applicable to the Solar PV phases	
Listed activity as described in GN R. 983, GN R. 984 and GN R.985	**Description of the activities to be undertaken, including associated structures and infrastructure**
GN No. 984 Activity No. 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	The proposed PV facilities would have a generation capacity of ≤200MWac each; as such this activity is triggered.
GN No. 984 Activity No. 4: The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	A utility scale battery storage facility, which consists of dangerous goods, ≤1120 cubic metres of batteries will be installed for certain alternatives. This activity will thus be triggered. The battery storage facility will cover an area of 1ha.
GN No. 984 Activity No. 15: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for - (i) the undertaking of a linear activity; or - (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	More than 20ha of land will be cleared for the solar farm, substation, construction yards, O&M area, access and service roads, 300ha in total. The land is currently used for grazing of cattle and ostrich, whilst there is some degradation and invasive plant species are present, it can be largely considered as indigenous. This activity will thus be triggered.
Listed activities in terms of NEMA GN No. 985 - None	

1.2 APPROACH TO STUDY

The surface water assessment consists of the following:

1. Data Collection and Review;
2. Site Visit;
3. Baseline Assessment; and
4. Impact Identification and Assessment.

1.2.1 Data Collection and Review

The objective of the project inception is to collect and review available data, agree on the interfaces with other specialist investigations, develop an understanding of the nature of the infrastructure being planned, and clarify hydrological issues related to the development. Relevant data to support the hydrological and erosion analysis will be collected and reviewed.

1.2.2 Site Visit

A visit was conducted on the 30th June 2016 to familiarise the hydrologist with the topography, drainage network and general physical characteristics of the study site. The hydrologist was also able to identify potential erosion impacts.

1.2.3 Baseline Assessment

The baseline assessment entails the synthesis and analysis of the hydro-meteorological and other relevant spatial data that were collected during the initial stage of the project. Attributes to be considered include drainage network, topography, land use, rainfall, soils and vegetation.

1.2.4 Impact Identification and Assessment

Identify and evaluate predicted impacts of the proposed development using the criteria of extent, temporal scale and magnitude, in order to determine the significance of the potential impact, as per the methodology provided by Aurecon. Suggest potential mitigation to identified impacts

1.2.5 Details of Specialist

Dr Nicholas Walker is currently employed as a Principle Consultant in Aurecon's Cape Town office, where he is involved in water resource projects. These include hydrological catchment modelling, floodline analysis and hydrological studies for environmental impact assessments (EIAs).

He has more than twelve years of research and consulting experience, including his time served as a postdoctoral fellow jointly at the Department of Botany, the University of Cape Town (UCT) and the South African National Biodiversity Institute (SANBI). Nicholas has researched the links between geomorphology, ecology, soils and hydrology. He also has experience in eco-hydrology, crop modelling, modelling the impacts of climate change, environmental water requirements (EWRs) and water supply feasibility studies.

Nicholas obtained a Doctor of Philosophy in Hydrology from the University of KwaZulu-Natal, South Africa, in 2005. He also holds a Master of Science in Irrigation Engineering from the University of Southampton in the United Kingdom (UK), as well as a Bachelor of Science with Honours in Environmental Science from the University of Brighton in the UK, in 1999 and 1994, respectively. Nicholas is a registered professional natural scientist with the South African Council for Natural Scientific Professions (SACNASP) and a member of the International Association of Hydrological Sciences (IAHS).

2 Legislative Context

This section describes the policy and legal framework within which the surface water assessment is undertaken.

2.1 PROPOSED NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

NEMA, as amended, establishes the principles for decision-making on matters affecting the environment. Section 2 of the Act sets out the National Environmental Management principles that apply to the actions of organs of state that may significantly affect the environment. Furthermore, Section 28(1) states that “every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring”. If such pollution or degradation cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution or degradation.

2.2 NATIONAL WATER ACT (ACT NO 36 OF 1998)

The National Water Act (NWA) (Act No 36 of 1998) provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. Section 21 of the NWA specifies the water uses that require authorisation from the Department of Water and Sanitation (DWA) in terms of the NWA before they may commence.

The NWA also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources. The authorisation may need to be applied for the following water use activities should they be triggered: Sections 21 (a) - abstraction, 21 (c) – impeding or diverting the flow of water in a watercourse, (i) altering the bed, banks, course or characteristics of a watercourse.

3 Surface Water Baseline

The proposed Hotazel Solar Park is situated in Quaternary Catchment D41K. The Kuruman River is 11 km to the east and the Ga-Mogara River is 7 km to the west. The Hotazel Solar Park is in the Ga-Mogara River catchment.

3.1 RAINFALL AND EVAPORATION

The mean monthly evaporation for Quaternary Catchment D41K are presented in **Table 3**. The study area has a Mean Annual Precipitation (MAP) of 344 mm (Lynch, 2004). **Figure 3** shows the annual precipitation for the Quaternary Catchment D41K from 1920 to 2009 (Bailey and Pitman, 2015). The study area has a semi-arid climate with a rainfall regime confined to summer months (**Figure 4**), with approximately 85% of the rainfall occurring between November and April.

Table 3 Mean monthly evaporation (S-pan) in mm for Quaternary catchment D41K (Bailey and Pitman, 2015)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
270	284	294	277	210	193	144	115	91	106	154	213

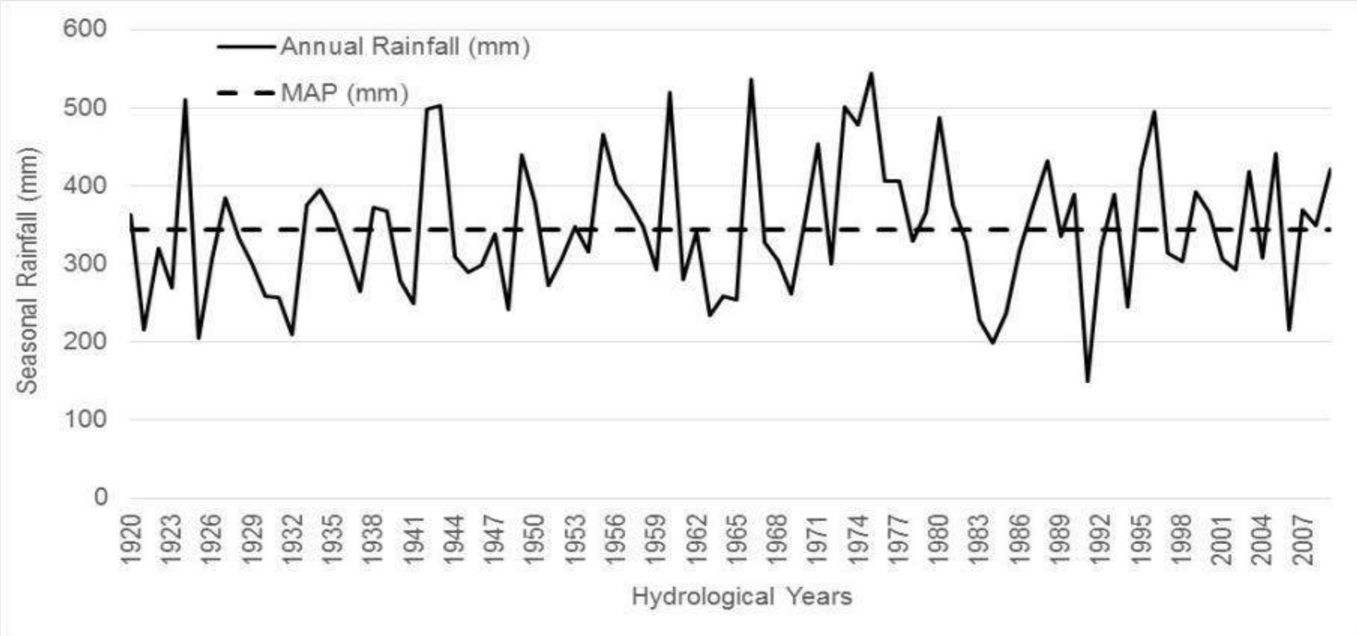

Figure 3 **Annual precipitation for Quaternary Catchment D41K (1920-2009)**

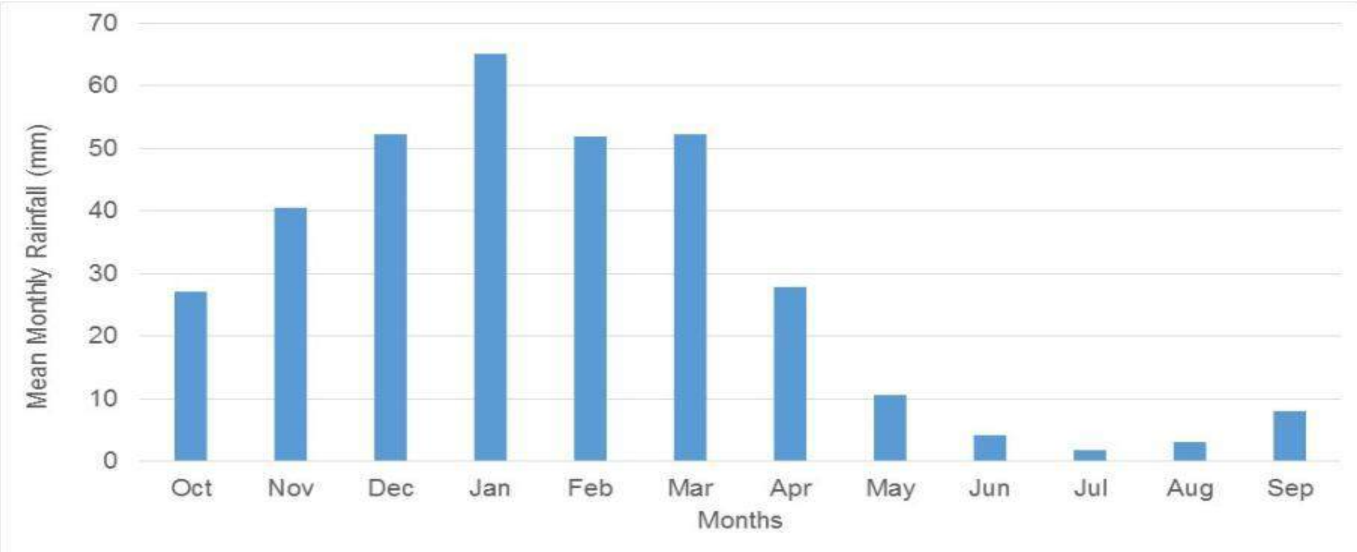

Figure 4 **Mean monthly precipitation for Quaternary Catchment D41K (1920-2009)**

3.2 SOILS AND LAND USE

The soils in the area have been classified as deep Arenosols with Aeolian origin, underlain by Calcrete (WRB, 2007), usually with less than 10% clay (Sandhage-Hofmann et al., 2015). . These well-drained soils are mostly yellow soils of the Hutton and Clovelly soil forms. The vegetation in the area is described as a Savanna biome, populated primarily by the Kalahari Thornveld and shrub bushveld vegetation (Tainton, 1999). The vegetation is categorised as Kalahari Mixed Thornveld A16 (Mucina and Rutherford, 2006), with a moderately developed tree layer (Sandhage-Hofmann et al., 2015) (see Figure 8 and Figure 9). The land use of the study site is currently low density grazing for cattle. Should the vegetation be removed from the site, wind erosion could become an issue due to the sandy soils particularly in the drier winter months.

4 Hotazel Solar Park

4.1 SITE CHARACTERISATION

The site is relatively flat (slope less than 1%) and there is a decreasing slope across the site in a north and north-westerly direction. There are uniformly deep, very sandy and highly permeable soils (Lanz, 2016) (see **Figure 5** and **Figure 6**).

The high permeability of the soils produces a very low stream density in the area, with the nearest watercourse being approximately 6.3 km away (Witleegte River) . On the site itself no evidence of existing drainage channels were found.

The site is bordered to the east and north by the R31 road which is raised by approximately 1m from the surrounding landscape (**Figure 7**) and as there are no culverts in this section of the road, runoff is prevented from entering the site from the east.

Figure 5 South western part of the site

Figure 6 North-east area of the site

Figure 7 R31 border of the site

Figure 8 Proposed northern access road

Figure 9 South-western site ground cover

Figure 10 Typical ground cover on the site

4.2 STORMWATER AT HOTAZEL SOLAR PARK

There are no clear watercourses or drainage lines on the site. The high infiltration of the soil results in limited surface runoff with sub-surface flow being a dominant process. The infiltration rate of this type of soil is well in excess of 20mm.hr up to saturation point (Schmidt and Schulze, 1987). **Table 4** contains design rainfall estimates for the Hotazel site (Smithers and Schulze, 2002). Given the deep sandy soil and no drainage lines on the site it can be deduced that the saturation point of the soil is rarely reached, which means that the site has a low potential for producing runoff. If rainfall intensity exceeds the infiltration rate, given the topography, water will either pond for a few minutes before infiltrating or runoff as sheet flow for a short distance before infiltrating.

Table 4 Design rainfall for Hotazel Solar Park

Recurrence Interval	I hr design rainfall (mm)	6 hour design rainfall (mm)	24 hour design rainfall (mm)
1:2 year	27	44	58
1:5 year	37	62	83
1:10 year	45	75	100
1:20 year	53	88	118
1:50 year	63	106	142

The rainfall in the area is primarily convectional and a typical storm will produce intense rainfall for short durations. When this type of rainhits a solar panel, which is impervious, it runs across the panel to the dripline, where it falls to the underlying surface. This water can infiltrate or runoff downslope towards the next row of panels.

Mitigating measures should as far as possible mimic natural hydrology with the use of non-structural techniques. Non-structural stormwater management techniques may be provided in a cost-effective manner by allowing adequate spacing between each row for infiltration which allows runoff to infiltrate over the vegetated areas between the individual rows. This approach works best in undisturbed soils thus existing vegetation should be retained as far as possible in order to maintain the high levels of infiltration on the site (NCDEQ, 2017; MDE, 2010). A study by Cook and McCuen(2013) showed that the solar panels themselves do not have a significant effect on the runoff volumes, peaks, or times to peak and that the angle of the solar panel do not add to the stormwater volume. The biggest impact was the ground cover (i.e. changing from natural or grazed vegetation to bare ground or gravel) (Cook and McCuen, 2013). Therefore, if the soil and vegetation remain intact, then the stormwater should not be impacted. Allowing for infiltration of water between and underneath the panels is the key element in ensuring the runoff is not increased.

The current natural drainage of the site should be retained. The natural vegetation (**Figure 10**) is important in maintaining the soil structure and any permanent removal of the vegetation should be minimised in order to maintain soil structure. If the natural vegetation is not retained then the site is likely to experience erosion of the soil by stormwater during storm events and wind erosion in the dry season. If the ground cover under the panels becomes bare ground, owing to design decisions or lack of maintenance, the runoff and erosion potential will increase and structural stormwater management maybe required e.g. gravel to prevent erosion and maintain infiltration. In addition, the kinetic energy of the flow that drains from the panels is greater than that of the rainfall, which could cause erosion at the base of the panels (Cook and McCuen, 2013), so again the disturbance of soil structure and vegetation under the panels need to be minimised.

4.2.1 Cumulative Stormwater Impact

A cumulative impact can be described as an impact from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative impacts considers all renewable energy developments within a 30 km radius of the proposed site and takes cognisance of other activities that have impacted hydrological function. Developments that were considered here include:

- Developments currently undergoing an EIA process;
- Developments which have received Environmental Authorisation; and
- Developments under construction or in existence.

The Hotazel Solar Park site is characterised by highly permeable deep sandy soil with water movement being by subsurface flow (see **Section 4.2)**. As a result there will be minimal stormwater runoff leaving the site; i.e. the stormwater will infiltrate into the soil on the site and will not cause an increase in runoff. It can be concluded that the Hotazel Solar Park will have a very low cumulative impact on stormwater runoff taking into account the current impacts on stormwater and other proposed solar energy facilities in a 30km radius around the site.

There are five other Solar Energy Facilities (SEFs) proposed within a 30km radius of the Hotazel Solar Park, namely:

- Proposed Rhodes Two Solar Park PV, 210 ha footprint;
- Proposed East Solar Park PV project, 180 ha;

- Proposed Perth, 566ha
- Proposed Adams PV Solar project, 555 ha footprint; and,
- Proposed Shirley PV Solar project, 210 ha footprint.

If the existing natural vegetation is retained at these sites then there would a low cumulative impact on combined runoff peaks for the Ga-Morgara River and other watercourses or drainage lines. However, if the vegetation is completely stripped at these sites then there would a localised increase in runoff and increased potential for erosion.

4.3 IMPACT TABLES

There are no watercourses or drainage lines on the site so the likely impacts relate to erosion caused by the possible concentration of stormwater by the solar farm infrastructure. A brief description of the infrastructure is given below, a more complete description is given in Table 1. Table 5 and Table 6 include a cumulative impact assessment which refers to cumulative impacts of the approved and prosed solar farms described in Section 4.2.1.

.Alternative A4 and Alternative B2 are the preferred alternatives to be comparatively assessed in the impact assessment phase against the "no go" alternative.

- Alternative A4: Single axis tracking solar panel array with a battery storage system, laydown area, substation laydown area, and

- Alternative B2: ≤1.9km long eastern site access road and internal service roads.

The "no go" alternative refers to continued low density livestock farming.

Table 5 Impact table Hotazel Solar Park – Increased hardened surface from solar farm infrastructure

<table>
<tr><th></th><th colspan="2">Preferred Alternative</th><th>No Go Alternative</th></tr>
<tr><td>Short description</td><td colspan="2">Single axis tracking solar panel array with a battery storage system.</td><td>Agriculture - Continued low density grazing</td></tr>
<tr><td>Overview</td><td colspan="2">Possibility of concentrating flow and causing erosion.</td><td>No hardening of surface</td></tr>
<tr><td colspan="4">Assessment</td></tr>
<tr><td></td><td>Pre-Mitigation</td><td>Post Mitigation</td><td>No Go - Status Quo</td></tr>
<tr><td>Nature</td><td>Negative: On-going damage to natural system components and species</td><td>Negative: Damage to natural system components and species</td><td>Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected.</td></tr>
<tr><td>Duration</td><td>Beyond project life</td><td>Project Life</td><td>Project Life</td></tr>
<tr><td>Extent</td><td>Local</td><td>Limited</td><td>Very Limited</td></tr>
<tr><td>Magnitude</td><td>Medium</td><td>Low</td><td>Low</td></tr>
<tr><td>Probability</td><td>Likely</td><td>Likely</td><td>Likely</td></tr>
<tr><td>Confidence</td><td>High</td><td>High</td><td>High</td></tr>
<tr><td>Reversibility</td><td>Reversible</td><td>Reversible</td><td>Reversible</td></tr>
<tr><td>Resource irreplaceability</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Mitigatability</td><td>Low</td><td>High</td><td>N/a</td></tr>
<tr><td>Significance</td><td>Medium</td><td>Low</td><td>Very Low</td></tr>
<tr><td>Mitigation</td><td colspan="3">• Allow adequate spacing between each row of panels for runoff to infiltrate over the vegetated areas under panels and between the individual rows. This approach works best in undisturbed soils and vegetated areas should be maintained.
• Individual PV panels in the array are arranged to allow the controlled growth of vegetation under and between rows of panels.
• The mountings of solar panels should occupy minimal space.</td></tr>
<tr><td>Cumulative Impact assessment</td><td colspan="3">It is unlikely that there will be an increase in the cumulative runoff volume and peak from the proposed Solar Energy Facilities if as far as possible, the existing vegetation is retained.</td></tr>
</table>

Table 6 Impact table Hotazel Solar Park – Increased hardened surface from access road and service roads

	Preferred Alternative	No Go Alternative

Short description	≤1.9km long, ≥8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.		No hardened surface
Overview	Possibility of concentrating flow and causing erosion.		No hardened surface
Assessment			
	Pre-Mitigation	**Post Mitigation**	**No Go - Status Quo**
Nature	Negative: On-going damage to natural system components and species	Negative: Damage to natural system components and species	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected.
Duration	Beyond project life	Project Life	Project Life
Extent	Local	Limited	Very Limited
Magnitude	Medium	Low	Low
Probability	Likely	Likely	Likely
Confidence	High	High	High
Reversibility	Reversible	Reversible	Reversible
Resource irreplaceability	Low	Low	Low
Mitigatability	N/A	Medium	N/a
Significance	Medium	Low	Very Low
Mitigation	• The gravel roads should have a crowned driving surface and a shoulder area that slopes directly away from the edge of the driving surface. Heavy traffic on gravel roads should be kept to a minimum to avoid compaction of the gravel. • Buffer strip on the side of the road to allow runoff from the hardened road surface to infiltrate into the soil.		
Cumulative Impact assessment	It is unlikely that there will be an increase in the cumulative runoff volume and peak from the proposed Solar Energy Facilities if as far as possible the existing vegetation is retained.		

5 Transmission Lines for Hotazel Solar Park

Three transmission corridor alternatives to evacuate power from the solar facility to the national grid are being considered by connecting the Solar Facility to the existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-Out (LILO) connection option (See **Figure 11**). The LILO option would be the most environmentally feasible option, but cannot currently be put forward as the preferred option due to the uncertainty of the powerline capacity. Therefore the preferred option is the Hotazel line, as this alternative does not need to cross any rivers, as is the case with the Umtu power line. These transmission lines would form part of the national grid and therefore fall under the ownership and operation of Eskom. Ownership of this infrastructure to be ceded to Eskom once constructed and must therefore have separate environmental authorisation to allow for the transference of ownership.

The following table provides a summary of the project components and alternatives to be assessed during the Basic Assessment process.

Table 7 Hotazel Solar Farm Transmission corridors project alternatives to be assessed

Transmission line C1: Hotazel substation
• A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed • Servitude width 31m • ≤110 monopole pylons • ≤12km long and 4m wide service track
Transmission line C2: Umtu substation
• A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed • Servitude width 31m • ≤140 monopole pylons • ≤15km long and 4m service track
Transmission Line C3: LILO connection[2] (please see footnote)

[2] The Loop In Loop Out connection depends on future improvements of the Eskom line before being deemed feasible alternative. Since this might occur, juwi wants to keep the alternative alive and have it assessed in the Basic Assessment

- A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom Ferrum-Umtu line located to the west of the site.
- Servitude width 31m per line.
- ≤60 monopole pylons (i.e. ≤120 pylons in total)
- ≤6km long and 4m service track per line

Alternative C4: NO GO

- No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

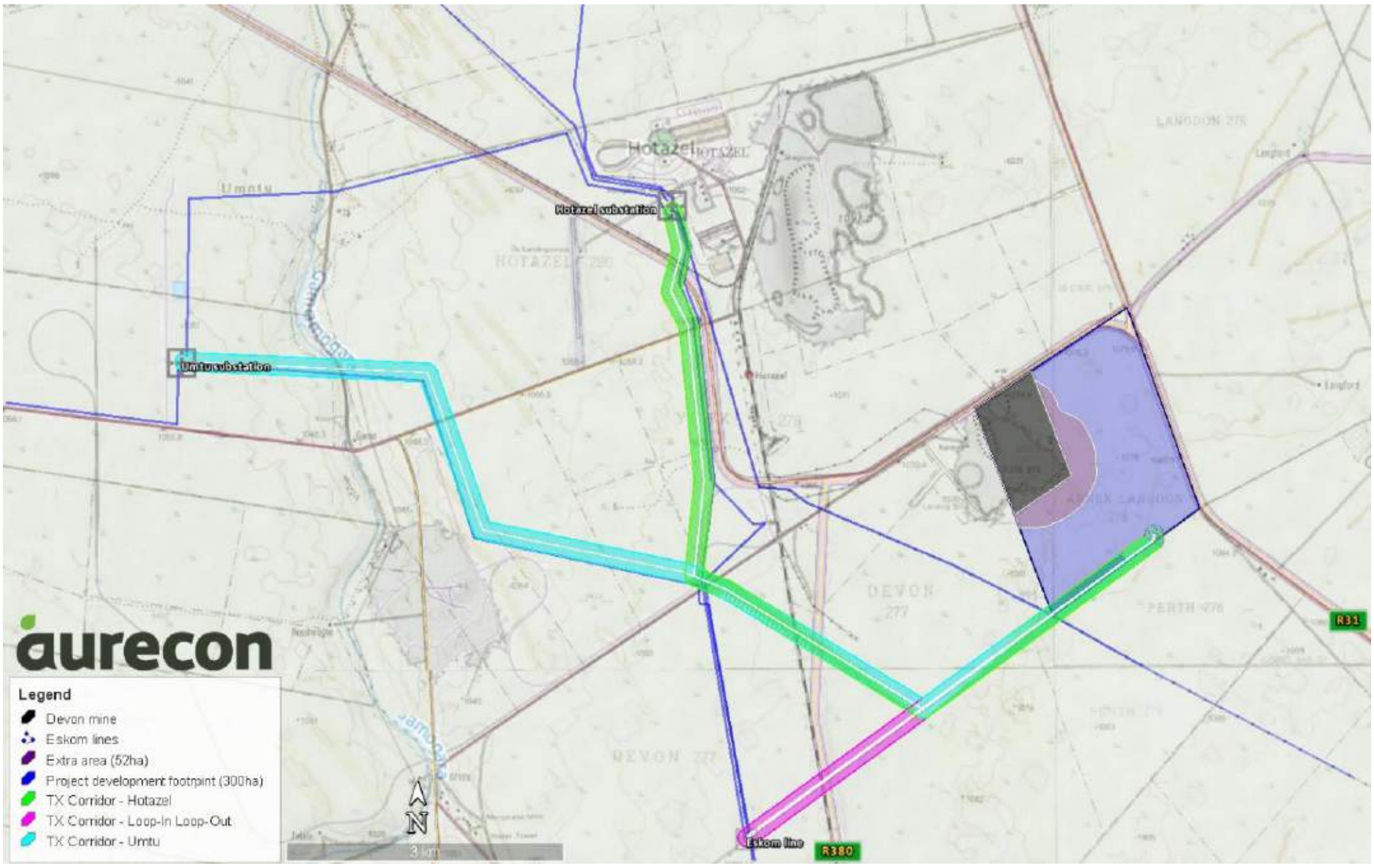

Figure 11 Transmission line routes

The LILO and Hotazel transmission line options do not cross any watercourses. The Umtu transmission line route crosses the Ga- Morgara River (**Figure 12)**. Water quality can be impacted not only by work within a waterway but also by nearby vegetation clearing and construction activities. It can also increase erosion of adjacent soils causing sediment to be deposited into the river channel, particularly during high intensity rainfall events. The existing transmission line pylons have been placed outside of the Ga-Morgara River floodplain (**see Figure 13** and **Figure 14**). Looking downstream the existing pylons are 93m from the river channel on the right hand-side and 180m from river channel on the left hand side (the variation in distance is due to the topography). It is recommended that pylons for the Umtu route be placed outside of the floodplain, the 100m buffer from the top of the river channel identified by the freshwater specialist (aquatic ecologist) would be sufficient.

Figure 12 Road crossing of the Ga-Mogara River close to Eskom servitude

Figure 13 Eskom servitude to Umtu substation

Figure 14 Existing transmission line crossing the Ga-Mogara River

5.1 IMPACT ASSESSMENT – TRANSMISSION LINES

Table 8 Impact table Hotazel Solar Park transmission lines – Erosion caused by construction of transmission line pylons

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative
Short description	A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed, in a servitude width 31m, comprising ≤110 monopole pylons and ≤12km long and 4m wide service track		A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed in a servitude width 31m and comprise of ≤140 monopole pylons and ≤15km long and 4m service track		A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom Ferrum-Umtu line located to the west of the site and will comprise of a servitude width 31m per line, ≤60 monopole pylons (i.e. ≤120 pylons in total) and ≤6km long and 4m service track.		No pylons
Overview	Localised erosion.		Possibility of restricting flow and causing erosion.		Localised erosion.		No erosion potential.
Assessment							
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**No Go - Status Quo**
Nature	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected	Negative: Damage to natural system components and species	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected species	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected	Negative: Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected.
Duration	Beyond project life	Project Life	Beyond project life	Project Life	Beyond project life	Project Life	Project Life
Extent	Limited	Very Limited	Local	Very Limited	Local	Very Limited	Very Limited
Magnitude	Low	Very Low	Medium	Very Low	Low	Very Low	Low
Probability	Likely	Likely	Likely	Likely	Likely	Likely	Likely
Confidence	High	High	High	High	High	High	High
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Resource irreplaceability	Low	Low	Low	Low	Low	Low	Low
Mitigatability	N/A	High	N/A	High	N/A	High	N/a
Significance	Low	Very Low	Low	Very Low	Low	Very Low	Very Low
Mitigation	• Place pylons outside Ga-Morgara River channel identified by the freshwater specialist.						
Cumulative Impact assessment	Pylons would only have an impact of surface water runoff in the area (30km radius) if they are placed either in the channel of a watercourse or in the floodplain of a watercourse or a preferential flow path not identified on 1:50 000 mapping. Pylons of the existing power lines have been placed outside of the river floodplains. If the pylons of the power lines of the posed solar energy facilities in a 30km radius are also place outside of the river floodplains then the cumulative impact on surface water would be very low to negligible.						
Conclusion:	Hotazel and LILO routes are the preferred routes as they do not cross a watercourse. However the Umtu route impact is very low if pylons are placed outside of 100m buffer zone.						

6 Summary

On the site itself no evidence of existing drainage channels were found. Guidelines for stormwater management for solar panels (MDE, 2010; Cook and McCuen, 2013; NCDEQ, 2017) state that solar panels do not have a significant effect on the runoff volumes if there is enough space between the rows to allow infiltration. Therefore, as there are no watercourses on the site the main potential impacts from the proposed PV infrastructure are localised erosion from removing vegetation and disturbing soils and possible erosion and increased runoff from the hardened gravel access road.

The mitigating measures should as far as possible mimic natural hydrology with the use of non-structural techniques. Stormwater management may be provided in a cost-effective manner by allowing adequate spacing between each row for infiltration which allows runoff to infiltrate over the vegetated areas between the individual rows. This approach works best in undisturbed soils and as far as possible the natural vegetation should be retained. Allowing for infiltration of water between and underneath the panels is the key element.

Hotazel and LILO are the preferred routes for transmission lines as they do not cross a watercourse. However the Umtu route is acceptable if the pylons are placed outside of the Ga- Morgara River floodplain with the overhead powerline spanning the river channel. Disturbance of the river channel is therefore not anticipated.

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APPENDIX D.7:

Socioeconomic

SOCIO-ECONOMIC IMPACT ASSESSMENT OF THE HOTAZEL SOLAR PV PROJECT

March 2017

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Brief profile: Nianda van der Westhuizen started her employment at Urban-Econ in 2008 and in 2013 was made a shareholder and office manager of the Cape Town office. Nianda obtained her degree in Town and Regional Planning at the North-West University (Potchefstroom Campus) in 2007 and during her employment completed her Masters in Development Studies at the University of the Free State in 2012. Nianda van der Westhuizen has wide-ranging knowledge and experience in development economics. Her special field of interests includes socio-economic analysis, economic impact assessments as well as monitoring and evaluation impact assessments. Nianda has been involved in a number of studies during her employment with Urban-Econ. She has worked successfully on large projects teams as well as individually as the project manager on various projects.

Angelique de Bruyn

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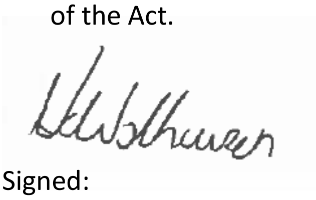
Qualifications: BPhil in Sustainable Development Planning and Management, BAHons in Public and Development Management, BA in Development and Environment
Experience: 8 years
Brief profile: Angelique De Bruyn joined Urban-Econ in 2008. She qualified at the University of Stellenbosch with a BA degree in Development and Environment, and majored in Public and Development Management and Geography. She also has a BA Honours degree in Public and Development Management majoring in project management, public and development management, public policy analysis and sustainable development. In 2010 she completed her BPhil degree in Sustainable Development Planning and Management at the University of Stellenbosch's Sustainable Institute in the fields of sustainable development; ecological design for community building; applied economics; biodiversity and sustainable agriculture; renewable energy systems; governance; development planning and environmental analysis; corporate citizenship; and sustainable cities. She has been extensively trained in-house at Urban-Econ and has successfully completed a number of development projects focusing on economic impact analysis, economic development potential, property market analysis, feasibility studies, socio-economic analysis, and economic development within the REIPP within the renewable energy sector.

Declaration of Independence

I, Nianda van der Westhuizen, declare that:

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- All the particulars furnished by me in this form are true and correct.
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.



Signed: Date: 09 December 2016

Declaration of Independence

I, Angelique de Bruyn, declare that:

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
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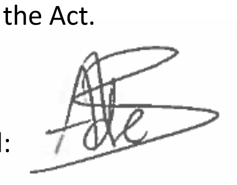
- All the particulars furnished by me in this form are true and correct.
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signed:  Date: 09 December 2016

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Acronyms

CAPEX	Capital Expenditure
DOE	Department of Energy
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GDP-R	Gross Domestic Product per Region
GGP	Gross Geographical Product
GVA	Gross Value Added
IDP	Integrated Development Plan
IRP	Integrated Resource Plan
JMLM	Joe Morolong Local Municipality
JTGDM	John Taolo Gaetsewe District Municipality
KMF	Kalahari Manganese Field
LED	Local Economic Development
LILO	Loop-in Loop-out
LM	Local Municipality
NC	Northern Cape Province
OPEX	Operational Expenditure
PV	Photovoltaic
SA	South Africa
SDF	Spatial Development Framework
SLP	Social Labour Plan
WSDP	Water Services Development Plan

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1: Introduction

1.1. Introduction

This document is prepared by Urban-Econ Development Economists in a request by Aurecon South Africa (Pty) Ltd (Aurecon) on behalf of Hotazel Solar Farm 1 (Pty) Ltd, a subsidiary of juwi Renewable Energies (Pty) Ltd, to undertake a Socio-Economic Impact Study for the proposed solar park near the town of Hotazel, in the Northern Cape Province. The impact study is conducted as part of the Environment Impact Assessment process as prescribed in the National Environmental Management Act (NEMA) of 1998 and its subsequent amendments. This report is covering two applications, namely, the EIA which focuses on the Hotazel Solar Park and associated infrastructure; and the BA which focuses on the transmission lines.

1.2. Scope of the Study

The purpose of the socio-economic impact assessment is to determine the potential socio-economic implications of the project activities and associated infrastructure, and to compare its effects with the "no-go" alternative. The "no go" alternative assumes that the solar park is not established, which means that it represents the status of the environment, including the socio-economic situation.

The socio-economic impact assessment study builds on the analysis undertaken during the scoping phase. Its scope is defined as follows:

- Assess and evaluate any opportunities and constraints posed by the receiving environment/operating context on the proposed development.
- Contribution to economic growth in the region (direct and indirect) – Gross Domestic Product (GDP).
- Impact on productivity and production (new business sales, etc.) of existing firms.
- Impact on infrastructure and resources in the region.
- Impact on employment.
- Impact on social lives of local communities.
- Predict, assess and evaluate potentially significant direct, indirect and cumulative impacts, both with and without management actions. The evaluation of significance should be linked to thresholds of significance.

1.3. Project Description & Study Area Delineation

The project (Hotazel Solar Park) involves the construction and operation of a ≤200MWac solar PV park on the Farm Hotazel Annex Langdon (F278/0), transmission lines and associated infrastructure, near Hotazel, in the Joe Morolong Local Municipality (JMLM), in the John Taolo Gaetsewe District Municipality (JTGDM), in the Northern Cape Province (NC). The Hotazel Solar Park consists of the following:

- **Preferred alternative – Single axis PV with storage:** a 200MWac solar facility with ~250ha of PV panels on steel mountings with single axis tracking mechanisms (max 5m height) and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters. Alternative A4 energy production will be ~120% with up to 25% or 100MWh retained for controlled energy release.
- The **battery storage facility** will involve a ≤100MWh battery storage facility for energy storage located next to inverters, or next to collector substation, or next to central substation covering ≤1ha and ≤8m building height (stacked containers or multi-storey building). These are assessed as part of the alternatives above.

There will be three transmission line alternatives to evacuate power from the solar facility to the national grid via existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-out (LILO) connection option. These transmission lines will eventually form part of the national grid and therefore fall under the ownership and operation of Eskom. Therefore, ownership of these power lines will need to be ceded to Eskom in future.

The three alternative transmission lines that will be considered:

- ***Transmission line C1 to the Hotazel substation***
    - A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed
    - Servitude width 35m
    - ≤110 monopole pylons
    - ≤12km long and 4m wide service track

- ***Transmission line C2: Umtu substation***
    - A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed
    - Servitude width 35m
    - ≤140 monopole pylons
    - ≤15km long and 4m service track

- ***Transmission Line C3: LILO connection***
    - A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site.
    - Servitude width 35m per line.
    - ≤60 monopole pylons (i.e. ≤120 pylons in total)
    - ≤6km long and 4m service track per line

There is one access road alternatives that have been considered:

- **Preferred Access:** A ≤1.55km long, ≤8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.

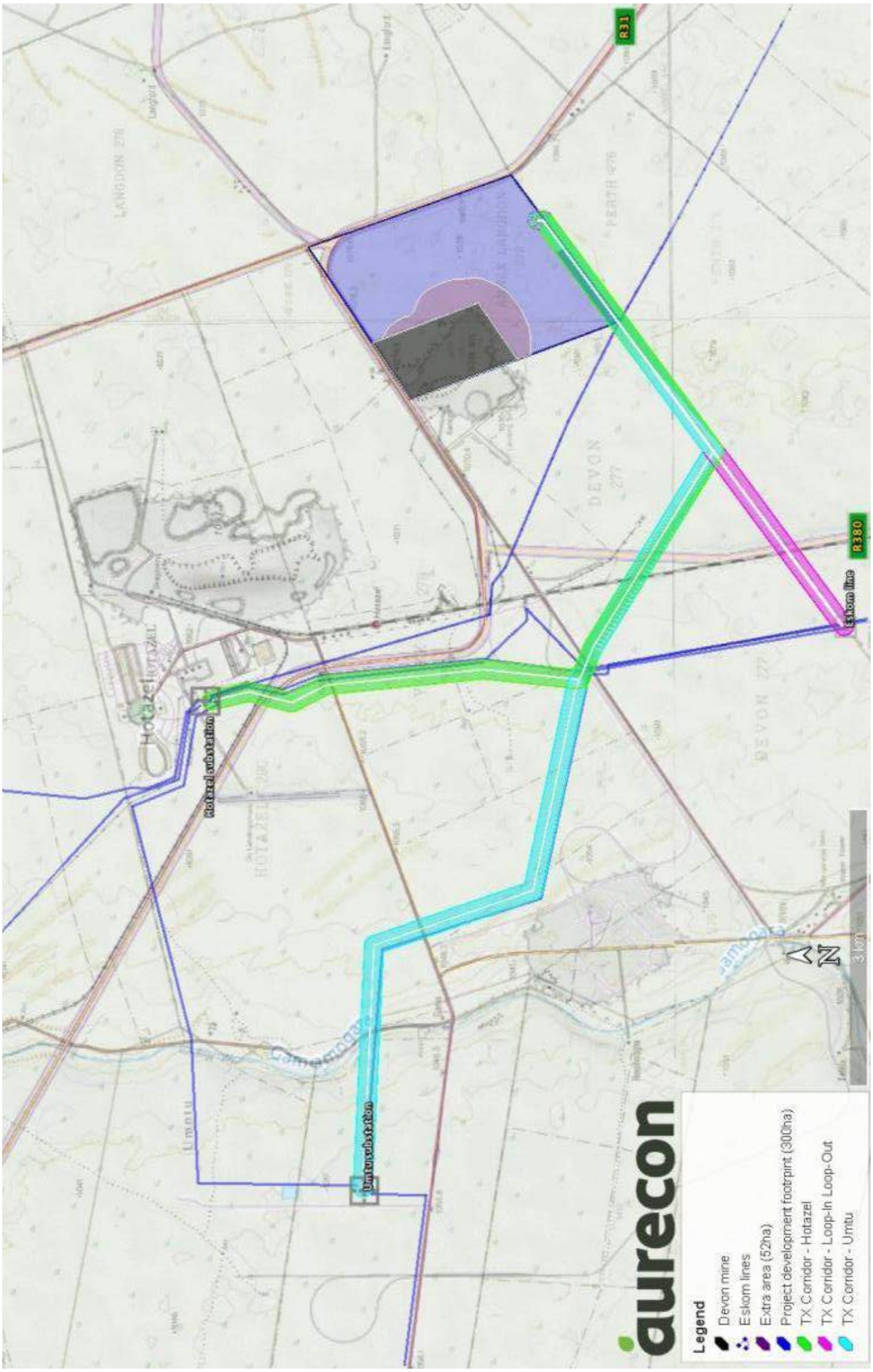
The service roads which do not fall under alternatives considered for access to the site will consist of: ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel fields. Roads fitted with traffic control systems and stormwater controls as required.

Other infrastructure includes:

- **Collector substation:** ≤1ha collector substation to receive, convert and step up electricity from the PV facility to a grid suitable power supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer.
- **Operations and maintenance area (near / adjacent substation):**
    - ≤1ha hectare laydown area;
    - Parking, reception area, offices and ablutions facilities for operational staff, security and visitors;
    - Workshops, storage areas for materials and spare parts; and
    - Central Waste collection and storage area.
- **Other infrastructure:**
    - Perimeter fencing and internal security fencing and gates as required.
    - Access control gate and guard house on access road;
    - Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day during rest of construction period; ~20kl/day during operation
    - ≤3.5km small diameter water supply pipeline connecting existing boreholes to storage.
    - Septic tanks and sewer lines to service ablution facilities
- **Temporary infrastructure**:

- A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.

Map 1.3.1 indicates the Hotazel Solar Park project components.



Map 1.3.1: Hotazel Solar Park Components[1]

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[1] (Aurecon, 2016)

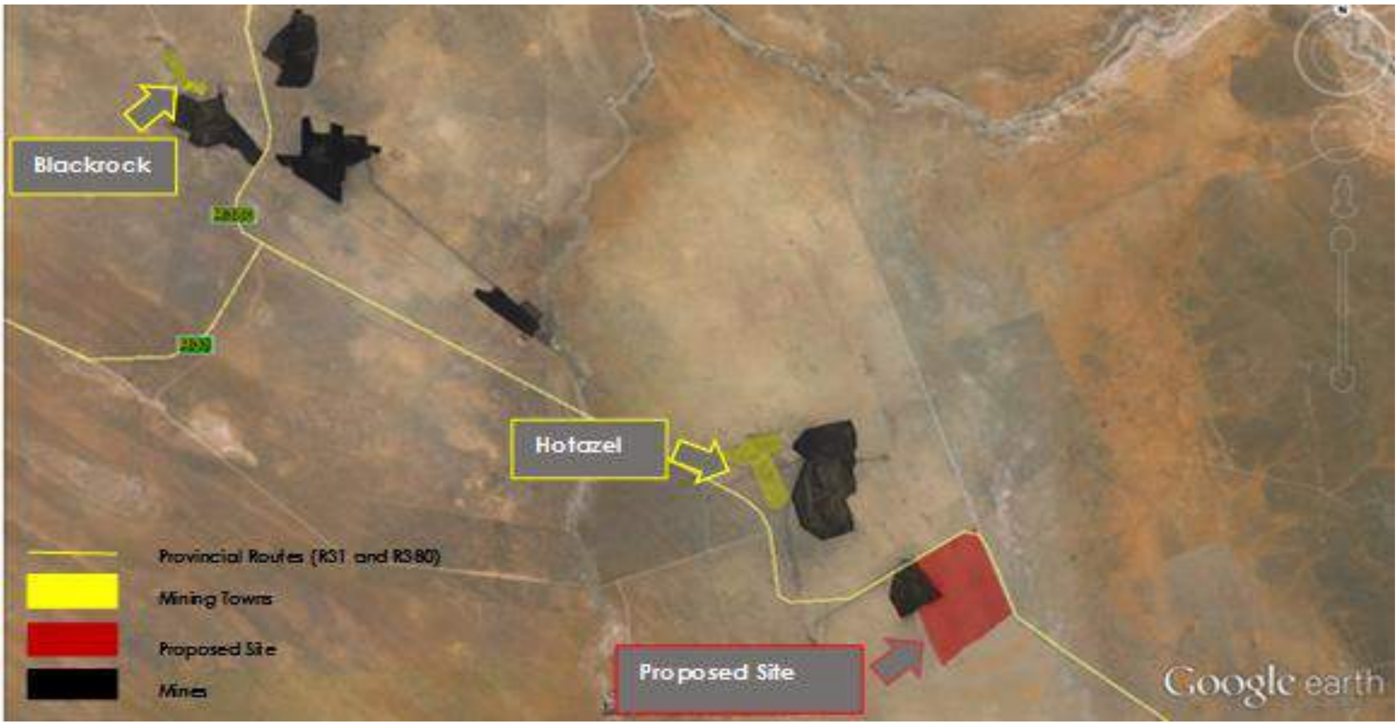
The proposed Hotazel Solar Park is located in JMLM in JTGDM in the Northern Cape (Map 1.3.2) and the project will be located next to a mining area (Hotazel Annex Langdon-Devon mine). The site is next to a mine approximately 5 km south-east of Hotazel, 18 km south-east of Blackrock, and 100 km south-east of Vanzylsrus. The site is also surrounded by mines forming part of the Kalahari Manganese Field (Hotazel mine, Wessels mine, Borwa mine, Gloria mine, Devon mine, Annex Langdon mine and Blackrock mine) (mindat, 2016). Map 1.3.3 depicts the location of the proposed site, in the context of mining towns (Hotazel and Blackrock), and some of the mines forming part of the Kalahari Manganese Field (KMF).

Transport infrastructure within the Northern Cape is located in pockets across the province. The proposed project, despite being located in an isolated locality, has good accessibility to routes such as:

- The provincial route (R31) which connects Kimberley with the Namibian border via Kuruman and Hotazel.
- The provincial route (R380) that connects Kathu to the Botswana border at McCarthy's Rest via Hotazel.
- The national route (N14), which is approximately 50km South-East from the site and connects via R31 in Kuruman.

Map 1.3.2: Location of Hotazel Solar Park[2]

[2] (GoogleEarth, 2016)



Map 1.3.3: Hotazel Solar Park Study Area[3]

In order to delineate the study area, it is important to understand the concept of socio-economic impacts. The socio-economic impacts on the project area and surrounds are dependent on the activity and the structure and composition of the locality. The more diversified the immediate locality of the project is in terms of its socio-economic variables, the more concentrated the impact will be in that area. Understanding the potential distribution and concentration of impacts is important to determine the magnitude and significance of these impacts in the context of spatial units.

JMLM is accessible via national infrastructure through the N14 and covers 20 172 km^2 of land constituting one semi-urban area, villages and commercial farms. The municipal area is characterised by rural settlements connected by gravel roads and comprises 168 schools, four police stations, 24 clinics and three community health centres (IDP, Intergrated Development Plan (Draft), 2015-2016). Mining, agriculture and community services form part of JMLM's primary economic activities and the municipality is regarded as the poorest in the JTGDM (IDP, Intergrated Development Plan (Draft), 2015-2016). The nearest major town to Hotazel is Kuruman (72 km away) in the Ga-Segonyana Local Municipality in JTGDM, therefore the communities that will be effected by the Hotazel Solar Park project will be Hotazel and the mines that surround Hotazel.

1.4. Methodology

The following methodology was used for the SEIA:

- **Determining Socio-Economic Impacts:** This step involved undertaking a modelling exercise to determine economic impacts of the project, which include the impact of the project in terms of employment creation, income generation, and regional production stimulus, etc. which will be introduced into the study area and therefore represent the direct effects. Modelling of impacts was done using the national Social Accounting Matrix (SAM) updated to 2016 figures. The SAM is a comprehensive, economy-wide database that contains information about the flow of resources that takes place between the different economic agents in an

[3] (GoogleEarth, 2016)

economy. Using the SAM, it was possible to identify direct, indirect and induced effects of the construction and operational expenditure of the proposed development.

- **Interpretation:** This step involved identifying the implications of the proposed project on the affected economies and communities. The results of the impact analysis and investigation of implications from a socio-economic perspective were interpreted and unpacked to create a comprehensive description of potential socio-economic impact of the project throughout its life-cycle.
- **Mitigation Guidelines:** This step involved providing management guidelines to minimise any negative impacts as well as guidelines to maximise the positive socio-economic and economic impacts. The management and mitigation options include identifying alternative ways of meeting needs, bringing about changes in plans, improving monitoring and management, improving negative perceptions, etc

1.5. Report Outline

The remainder of the report is structured as follows:

Section 2: Policy Review – this section focusses on providing the legislative framework in which the proposed development will function.

Section 3: Socio-Economic Profile – this section provides an overview of the main socio-economic characteristics of the study area and surrounding area.

Section 4: **Economic Modelling** – this section presents the findings of the SAM modelling process.

Section 5: Impact Assessment – this section assesses the socio-economic impacts of the proposed development.

Section 6: Conclusion - this section concludes the report based on the findings of the previous sections

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2: Policy Review

2.1. Introduction

The review of the policy environment provides valuable insight into the government's priorities and plans. This will assist in determining the importance and alignment of the Hotazel Solar Park with regard to the developmental objectives of various government spheres, as well as in identifying potential developmental conflicts and socio-economic impacts that the project might create.

Policies from all sectors of government within the specified delineated areas – local, regional, and national – will be examined to ensure alignment of the project with agendas of relevant government entities. The integration of the policy objectives from a national to local entity is fundamental when developing a sustainable and positive socio-economic approach to the proposed development.

The following policies will be examined in detail further in the study:

- National Level (South Africa)
    - National Spatial Development Framework (2006)
    - White Paper on Renewable Energy (2003)
    - Energy Security Master Plan: Electricity (2007-2025)
    - National Integrated Resource Plan for Electricity (2010-2030)
    - South African Renewables Initiatives (2010)
    - South African Renewable Energy Policy Roadmap (2010)
    - South African New Economic Growth Plan (2011)
    - National Climate Change response (2011)
    - National Development Plan (2030)
    - National Infrastructure Plan (2012)
    - Carbon Tax Policy (2013)
    - National Green Economy Policy (2013)
    - Industrial Policy Action Plan (2013-2016)
    - Department of Energy Strategic Plan (2011/12-2015/16)
- Provincial Level (Northern Cape)
    - Northern Cape Growth and Development Strategy (2004-2014)
    - Economic Potential in South Africa's Arid Areas: A Selection of Niche products and Services (2008)
    - Northern Cape Municipal Local Economic Development Framework (2010)
    - Northern Cape Provincial Spatial Development Framework (2012)
    - Northern Cape Renewable Energy Strategy (2013)
- District Level (John Taolo Gaetsewe District Municipality)
    - Kgalagadi District Municipality Spatial Development Framework (2006/7)
    - John Taolo Gaetsewe District Municipality Local Economic Development strategy (2009)
    - John Taolo Gaetsewe District Municipality Reviewed Integrated Development Plan (2010/11)
    - Environmental Management Framework for John Taolo Gaetsewe District Municipality (2011)
- Local Level (Joe Morolong Local Municipality)
    - Joe Morolong Draft Integrated Development Plan (2016/17)
    - Joe Morolong Local Municipality Land Development Plan (Spatial Development Framework) (2012)

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2.2. National Policy Review

National government aims to stimulate and maintain economic growth in order to create jobs in the national economy. Government also recognises that social and economic development is mutually reinforcing and therefore aims to utilise the latter to strengthen the former. One of the main recurring themes in national policy is the concept of sustainable development, government recognises that sustainable development encompasses three spheres namely economic, social and environmental and that overall sustainability requires sustainable development in all three spheres as each of the spheres are inextricably linked.

To ensure sustainable development under the United Nations Environmental Program Definition of "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", sustainable development has been included in government economic development and infrastructure development policies. The four main policies with regards to this project is the National Climate Change Response policy (2012), the National Infrastructure Plan (2012), the Energy Security Master Plan: Electricity (2007-2025) and the Integrated Resource Plan for Electricity (2010-2030). The focus of these policies is on economic development and development of energy infrastructure focusing on electricity generation, distribution and the sustainability of the overall economy and thus advocates for a greater share of renewable sources of energy.

Other national level policies that are relevant to this project (as listed in the previous section of this chapter) can act as supportive measures to the four main policies stated above. These policies outline action plans for the implementation of sustainable economic and social development. Some of the most significant policies are the Carbon Tax policy (2013) which aims to mitigate climate change through the imposition of a tax on carbon emissions, the National Green Economy policy (2013) which outlines the philosophy and plans for the 'greening' of the South African economy through the employment of cleaner, carbon neutral technologies and processes, and finally there is the National Renewable Energy Policy Roadmap (2010) which gives an outline of South Africa's renewable energy needs through a discussion of projected scenarios which takes into account South Africa's international agreements, economic growth potential and developmental needs. The policies listed in the previous section are broader developmental plans that makes only a passing mention of sustainability and the desire for renewable sources of energy.

2.3. Provincial Policy Review

The NC's developmental goals are very similar to the national policy goals with the added aim of unlocking the latent potential of the province in terms of its arid region, desert type economy as well as its resource potential. The Province recognises the potential in solar resource and the possibility of renewable generation of electricity from this source through the Northern Cape Renewable Energy Strategy (2013) as well as the Economic Potential in South Africa's Arid Areas: A Selection of Niche Products and Services (2008). The Renewable Energy Strategy goes further by establishing a target for diversifying the provincial energy mix which is to have 25% of energy generation from renewables by 2020. Carbon neutrality in terms of electricity generation is another main objective of this policy along with becoming a net exporter of electricity sourced from renewables by 2030. Another main policy with regard to this project is the Provincial Spatial Development Framework (2012), this framework acts as a subset of the national Spatial Development Framework (2006) which aims to give direction to the spatial development of South Africa with the objective of connecting social infrastructure (and superstructure) with economic infrastructure. The Provincial Spatial Development Framework (2012) makes explicit mention of its objective to maintain long term sustainable economic growth as this is the only plausible means to improve social development. Thus the concept of sustainability is central to provincial economic policies as well as its social development agenda.

The solar energy sector is seen as a priority industry for provincial government due to the recognition that there is considerable latent potential in the generation of solar energy in the province. An objective of the Provincial Growth and Development Strategy (2004-2014) is to enhance infrastructure for economic growth and social development. Economic infrastructure such as electricity infrastructure that supports industry is therefore high on the Northern Cape government's agenda. This agenda together with the goals set out in the Renewable Energy Strategy (2013) of driving solar power generation as part of the diversification of the energy mix contributes to creating a very attractive policy environment for the provision of renewable solar power infrastructure in the province.

2.4. District Policy Review

The John Taolo Gaetsewe Municipality aims to enhance social development and the living standards of its citizens through the sustainable management of economic growth and the sustainable provision of support infrastructure. These goals are echoed in the municipality's main high level policies, which include the District Municipality Spatial Development Framework (2006/7) and Environmental Management Framework for John Taolo Gaetsewe District Municipality (2011) among others. The Municipal Spatial Development Framework (2006/7) aims to provide a spatial plan to direct economic and social activities in the municipality. Some of the main objectives of this policy include sustainable management and to promote regional connectivity, the key outcomes with regards to these objectives is to have a sustainable environment, with an accessible municipality and an efficient community structure.

The Municipal Environmental Management Framework (2011) aims to ensure that the resilience of the natural, economic and social environment is maintained whilst meeting the needs of development and at the same time limiting the negative effects on the environment. The requirements to meeting this aim is given as 'to maintain ecological functioning, livelihoods and environmental quality. Another important aspect that one needs to note is the outline of environmental management zones. According to this policy there are 5 types of environmental management zones in the municipality that needs to be taken into account when a development takes place as each zone has their own development requirements and/or restrictions. These zones range from the conservation zone where conservation is the main objective and where developments is extremely limited, to the urban zone where densification and development is encouraged. Knowing in which zone this project falls will give further clarity on what the development requirements are. These policies derive their mandate from the Municipal Integrated Development Plan (2010/11) and is further supported by the Municipal Local Economic Development Strategy (2009).

2.5. Local Policy Review

The two most relevant policies from the Joe Morolong Municipality is the Land Development Plan (Spatial Development Framework) (2012) and the Integrated Development Plan (IDP) Draft (2016/17). One of the main focus areas of these documents is the promotion of job creation and the fostering of economic development. To this end the Spatial Development Framework (2012) proposes the creation of access to strategic surrounding areas and the spatial concentration of economic activities in strategic locations. The IDP on the other hand proposes investment in infrastructure and the use of labour intensive methods to create jobs in the local municipality.

Sustainable development in terms of the protection of natural assets and the efficient use of resources also feature prominently in the two policy documents mentioned above. The IDP advocates a more sustainable management system for the natural environment by excluding natural assets from development, whereas the Spatial Development Framework focuses more on spatial integration of the built and natural environment, this resonates in the human settlements and local economic visions for the municipality. Another important recurring theme in the above mentioned documents is the concept of spatial and economic inclusion and integration. As mentioned above the IDP advocates economic inclusion through the promotion of labour intensive infrastructure projects (mostly through the expanded public works programs) whereas the SDF takes a more spatial approach by seeking to connect human settlements with accessible nodes of economic activities and also encouraging the development of economic nodal spaces. Furthermore, it is envisioned that spatial integration with the surrounding areas will contribute to economic development by improving mobility and encourage the flow of goods and services in the district.

2.6. Conclusion

From the brief review of the above-mentioned documents, it can be concluded that the proposed Hotazel Solar Park is aligned with the national, regional, and local policies. Objectives of government that need to be considered are sustainable development through job creation as well as the reduction of harmful emissions. The four main policies with regards to this project include the National Climate Change Response policy (2012), the National Infrastructure Plan (2012), the Energy Security Master Plan: Electricity (2007-2025) and the Integrated Resource Plan for Electricity (2010-2030). The NDP in particular recognises the economy as “electricity intensive”, and given the effect of the 2008 energy crisis observed in the country the importance of adequate and uninterrupted supply of electricity is evident. The development of renewable energy infrastructure, particularly solar systems, within the Joe Morolong LM is considerably recognised as an important facet concerning sustainable development in South Africa.

The development of alternative electricity generation techniques which are able to efficiently service mining towns such as Hotazel, alleviates dependence on the national grid and reduce the possibility of production cuts due to insufficient power supply, therefore stimulating local economic development. An objective of the Provincial Growth and Development Strategy (2004-2014) is to enhance infrastructure for economic growth and social development. Economic infrastructure such as electricity infrastructure that supports industry is therefore high on the Northern Cape Provincial Government’s agenda. Given the reviewed documentation, it is evident that no fatal flaws from an economic policy perspective exist in the implementation of the Hotazel Solar Project. The policies reviewed are therefore a guideline which needs to be adhered to in implementing the project. Further details on the policies will be discussed later on in the report.

3: Socio-Economic Profile

3.1. Introduction

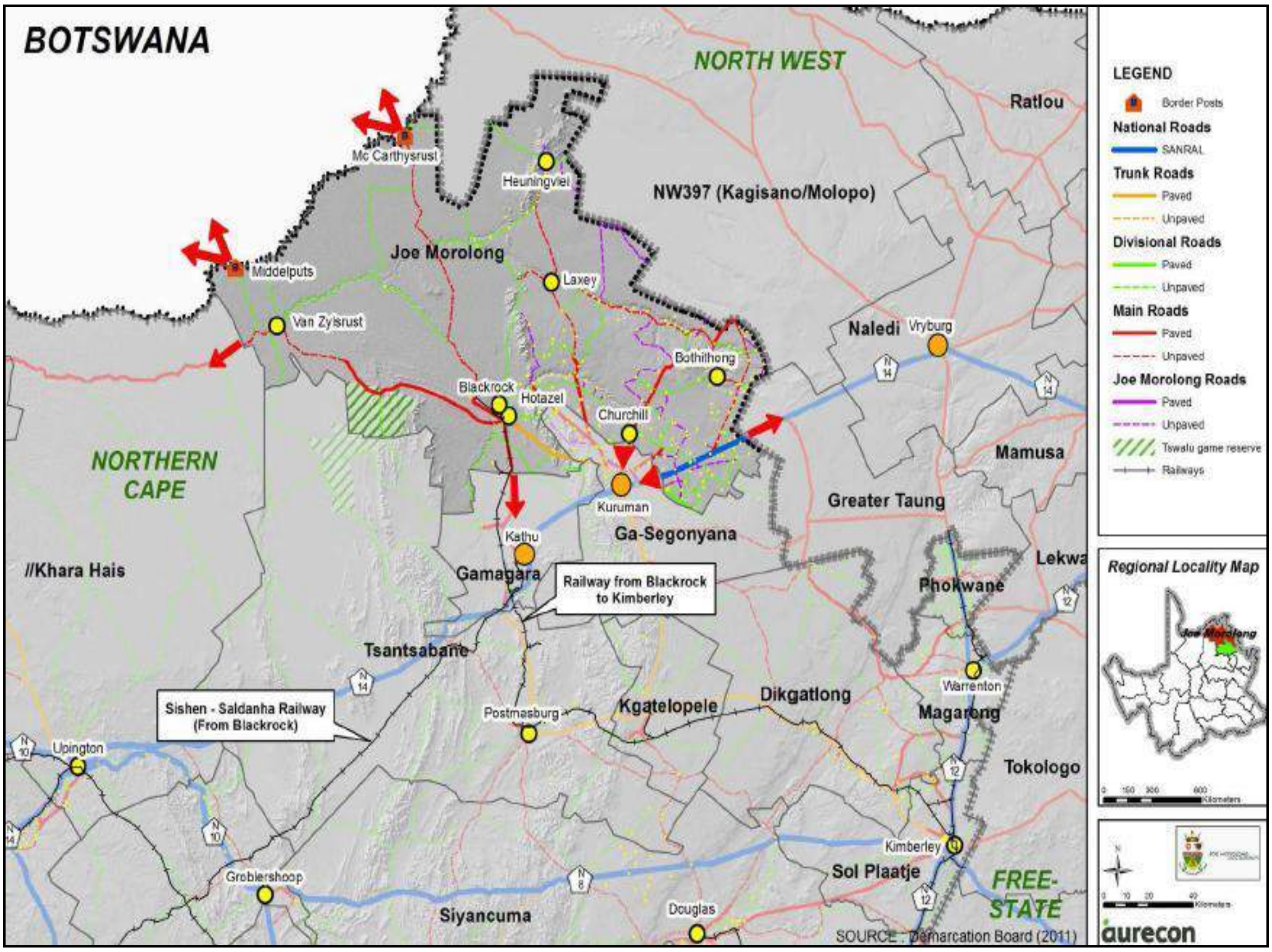
This chapter examines key socio-economic characteristics of the study area, as per delineation provided in the previous chapter. This is essential as it provides both qualitative and quantitative data related to the economies under observation, creating a baseline against which the impacts can be assessed. It should be noted that where possible information is provided for up until 2015. The following socio-economic indicators are analysed in this chapter:

- Spatial composition and land-use
- Demographic profiling
- The economy and its structure
- Labour force and employment structure
- Status of access to services and infrastructure

3.2. Spatial Composition & Land Use

The Northern Cape is spatially the largest province within South Africa with a total land mass of 361,830km^2 equating to approximately 30.5% of South Africa's spatial composition. It holds the smallest population of 1.1 million people which is equal to 2.2% of the total national population. The Northern Cape is a hot and dry region with low rainfall and scarce water resources, exceptional mineral wealth, and scattered urban and quasi-urban population clusters. The proposed project site is located in JMLM within JTGDM (DALRRD, 2012). JMLM covers approximately 20,173 km^2 of land and consists of approximately 185 traditional settlements (DALRRD, 2012). The Municipality is characterised by rural establishments where traditional leaders play a critical role in decision making.

The N14 (1,200km in length) is the only national road crossing JMLM's southern edge, and it connects the Municipality to Pretoria, Lichtenburg, Vryburg, Kuruman, Upington and Springbok. Kuruman in the Ga-Segonyana LM is situated south on the N14, and Vryburg in the Naledi LM is also situated south on the N14, are the major service centres for the traditional settlements in JMLM. JMLM also has two minor Ports of Entry into Botswana, across the non-perennial Molopo River in the North, namely McCarthy's Rest and Middleputs. Map 3.2.1 depicts JMLM in the context of the region.

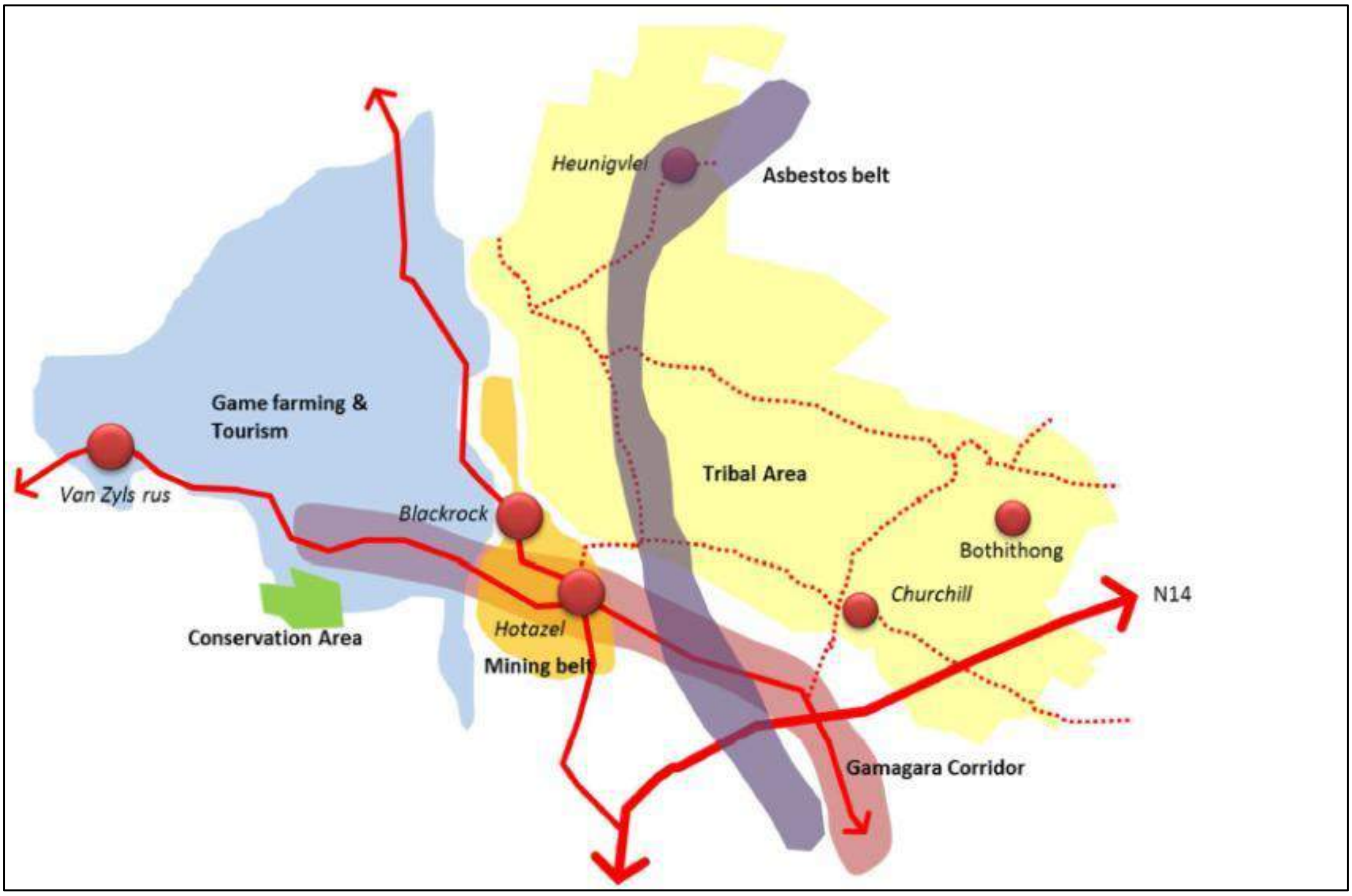


Map 3.2.1: Joe Morolong Local Municipality[4]

JMLM consists of rural villages with three main regional nodes, where relatively more economic activity occurs. The local nodes include Hotazel, Vanzylsrus and Blackrock, of which two (Hotazel and Blackrock) serve as mining towns. Mining is the predominant economic activity in JMLM, where the Gamagara mining corridor cuts across the municipality. The Gamagara corridor is the mining belt (iron ore and manganese) in JTGDM and Siyanda District Municipality, running from Lime Acres and Danielskuil to Hotazel (DALRRD, 2012). Public and private investment should be focused on alternative economic activities as to diversify the economy and provide for more employment opportunities in the area. Most development projects implemented in JMLM were funded by government grants and mining houses Social Labour Plan's (SLP), as the municipality can't generate enough revenue to implement their own projects (IDP, Intergrated Development Plan (Draft), 2015-2016).

A large area extending across the western landscape of JMLM is mainly rural and characterised by agricultural and tourism activities. Game farming and hunting are the prominent tourism activities in JMLM and are also associated with other substantial agricultural activities. These activities have a significant impact on job creation and economic stability in JMLM. Tribal areas form a large part of the Municipality and they are isolated and characterised by subsistence farming activities. One of the most prevalent challenges in JMLM and in the tribal areas, is the lack of access to public facilities and empowerment opportunities for the residents (DALRRD, 2012). Map 3.2.2 depicts the location of the development nodes, mining belt and the composition of JMLM.

[4] (DALRRD, 2012)
Red arrows in above map indicate movement direction



Map 3.2.2: Joe Morolong LM Development Concept[5]

According to the Department of Energy (2016) approximately 90% of South Africa's electricity is generated in coal-fired power stations, with nuclear (5%) and hydroelectric and pumped storage schemes (5%) contributing 10% to total capacity (DOE, basic electricity, 2016). South Africa promotes investment in renewable energy projects, to curb the adverse effects of carbon emissions generated from burning coal on the environment. Increased demand in electricity from industrial sectors and residences has applied pressure on Eskom's capacity, therefore creating the need for extra capacity to be fed into the national grid. The South African government set targets for the procurement of new generation capacity from renewable energy at 3,725MW by 2016, 3,200MW by 2020 and 6,300MW by 2025 (DOE, State of renewable energy in South Africa, 2015). These amounts were derived from the Integrated Resource Plan (IRP) 2010-2030 target of 17,800MW.

3.3. Demographic Profile

3.3.1. Population & Access to Services

The population in any geographical area is the mainspring of development, as it influences economic growth through the provision of labour and entrepreneurialism, and determines the demand for production output. Analysing population trends is crucial in gaining insight and understanding of the people who are likely to be affected by the proposed project. The consumption of electricity is done at a household level and therefore the analysis of household data and trends provides important indicators for the current study. This information is also useful for determining the magnitude of economic impact that will be created by the proposed project. Table 3.3.1.1 indicates the population and household totals for the various study areas.

Table 3.3.1.1: Population & Household Totals[6]

[5] (DALRRD, 2012)

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2015	Population Total	Average Population Growth (2005-2015)	Households Total	Average Household Size
SA	54 956 508	1.5%	15 681 632	3.6
NC	1 175 780	0.6%	318 312	3.7
JTGDM	235 183	2.5%	64 962	3.6
JMLM	93 650	1.5%	25 038	3.7
Hotazel	2 033	3.7%	783	2.6

The population in Hotazel is approximately 2,000 people, with a total of ±780 households consisting an average size of 3 individuals per household. Hotazel experienced an average population growth rate of 3.7% between 2005 and 2015, which was more than double the average growth rate of JMLM which was 1.5% for the same period.

According to the South African Constitution (1996), all households are entitled to a minimum level of services defined as an electricity connection to each dwelling; clean safe drinking water within 200m; and availability of a ventilated pit toilet. Within the various study areas:

- The majority (82%-92%) of the population in the study areas (JTGDM, JMLM and Hotazel) have access to electricity as a source of energy for lighting. Whilst the remaining population depend either on solar, gas, paraffin or candles, as a source of energy for lighting.
- The majority (89%) of the population in Hotazel have access to piped water in their dwelling, whilst 11% have access to pipe water within 200m. A selected minority of the population in JTGDM and JMLM have access to piped water in their dwelling, only 9% and 23% respectively. Whilst (7%-50%) of the population in JTGDM and JMLM have access to piped water within 200m.
- The majority (98%) of the population in Hotazel have access to a flush toilet connected to a sewage system, whilst in JMLM and JTGDM only a minority of the population have access to a flush/chemical toilet, 7% and 30% respectively. Majority of the population in JMLM (56%) and JTGDM (77%) have access to pit latrines.

A significant majority of the population in these study areas has access to the minimum standard levels of electricity, water and sanitation. An average of 8.7% of the population in the study areas has neither a flush toilet, chemical toilet nor a bucket/pit latrine. JMLM has a shortage in water infrastructure, which presents challenges for the municipality in providing adequate sanitation and piped water in communities (IDP, Draft Integrated Development Plan, 2015/16). The municipality is characterised by a high percentage in pit latrines, with the possibility of contamination in the underground water resource (IDP, Draft Integrated Development Plan, 2015/16). Water is delivered to 68 villages by trucks (IDP, Draft Integrated Development Plan, 2015/16), and according to the Joe Morolong Local Municipality Status of Water Services Development Plan (WSDP), the majority of communities in the municipality are still not receiving water supplies (IDP, Draft Integrated Development Plan, 2015/16). Hotazel and Vanzylsrus are the only areas with a water borne system in the municipality and water projects are currently carried out in 12 of the 15 wards in JMLM (IDP, Draft Integrated Development Plan, 2015/16).

3.3.2. Energy Used for Lighting

The level of access to energy supply and social infrastructure gives an indication of the standard of living in households. The availability of the different energy sources creates a baseline against which the potential impacts of the proposed project can be assessed. Table 3.3.2.1 indicates the energy supply used for lighting in the various study areas.

Table 3.3.2.1: Energy Used for Lighting[7]

[6] (Quantec, 2016)

[7] (Quantec, 2016)

2015	SA	NC	JTGDM	JMLM	Hotazel
Solar	0.7%	1.5%	0.9%	1.3%	0.0%
Electricity	84.6%	85.5%	87.3%	82.1%	96.6%
Gas	0.2%	0.2%	0.2%	0.2%	0.0%
Paraffin	3.0%	1.7%	1.0%	0.7%	0.0%
Candles	11.5%	11.1%	10.5%	15.7%	3.4%

The majority (96.6%) of households in Hotazel have access to electricity with very few (3.4%) only having access to candles for lighting. These statistics are higher than the average statistics for JTGDM and JMLM. The NC has an average of 1.5% households using solar energy for lighting, which is considerably higher than the national average of 0.7%. JMLM is in the process of acquiring a licence to distribute electricity across the whole Municipality. Electrification projects in JMLM are implemented by Eskom and the Department of Energy (DOE). In the 2014/15 financial year JMLM recorded a total backlog of 3,710 households still to receive electrical connections (IDP, Draft Integrated Development Plan, 2015/16). Currently JMLM is distributing electricity for Hotazel and Vanzylsrus, which form part of the Municipality's main nodes.

3.3.3. Level of Education

In any society, education levels have a significant influence on economic and human development. It is evident that low levels of education translate into a low skills base in an area, therefore supplying a less competitive workforce. However, an area with high levels in education is characterised by a workforce capable of operating industries at a competitive level, producing a skilled and highly skilled population. People increase their earning potential by developing and enhancing their capabilities, reaffirming that household and personal income levels are either positively or adversely affected by education levels. Also, a skilled population does not necessarily aspire to employment but to entrepreneurship, which adds businesses and increases economic activity in an area, consequently increasing the number of jobs available. Table 3.3.3.1 depicts the level of education in the various study areas.

Table 3.3.3.1: Level of Education (Aged 20+)[8]

2015	SA	NC	JTGDM	JMLM	Hotazel
No Schooling	10.8%	12.7%	15.0%	20.1%	2.2%
Some Primary Education	22.2%	26.3%	30.5%	37.6%	6.2%
Grade 7	5.4%	6.7%	5.7%	6.0%	0.8%
Some Secondary Schooling	31.8%	31.9%	28.7%	24.7%	31.8%
Grade 12	20.9%	16.8%	14.2%	8.6%	21.5%
Less than matric & cert/dipl.	0.4%	0.2%	0.2%	0.1%	No Information Available
Higher	8.5%	5.3%	5.7%	2.9%	37.6%

JTGDM and JMLM have a high percentage of people with no schooling (15% and 20.1% respectively), while a low percentage of people with higher tertiary qualification (5.7% and 2.9% respectively). In Hotazel, almost the opposite is true, where 21.5% of the population has a Grade 12 qualification and 37.6% have a tertiary qualification. This could be due to the fact that there are so many mines located in Hotazel that require highly skilled employees.

A high percentage of the aged 20+ population in Hotazel (31.8%), JMLM (24.7%), and JTGDM (28.7%) have secondary education but have not completed Grade 12. This implies there is a low education and skills level in the area, which has a direct impact on the type of employment available to the people and subsequently their earning capacity. In a region driven by a single sector, low education and skills levels retard developments aimed at diversifying and broadening the local economy.

[8] (Quantec, 2016)

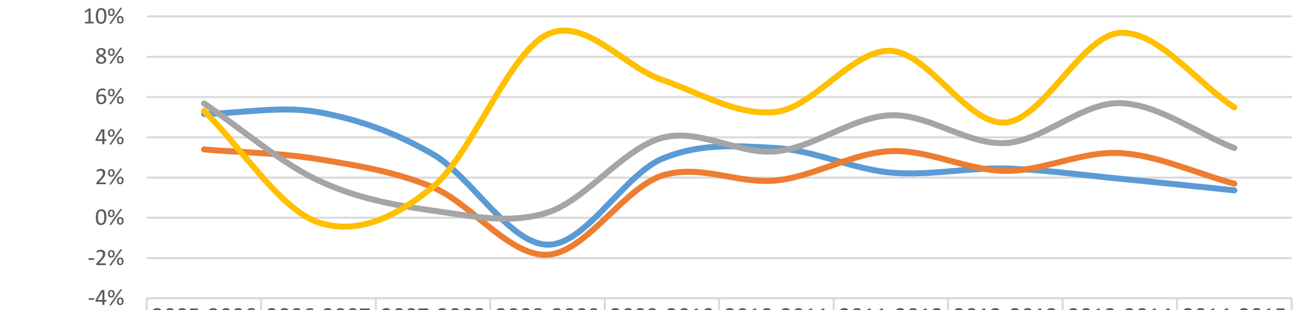
3.4. Local Economic Profile

3.4.1. GDP

Conducting an analysis of the local economy is imperative for gaining insight and understanding the impact of a proposed activity on output and trends in various economic sectors. The structure of an economy also gives an indication of its vulnerabilities and reliance on particular sectors, also the extent to which it reacts to fluctuations in global and regional markets. Gross Domestic Product (GDP) comprises the value of all final goods and services, produced during a year, within the boundaries of a specific region and is commonly used to measure the level of economic activity in a specific area. For analytical purposes, GDP is utilised as an important indicator of economic activity. Generally, if the economy as a whole is performing well, demand for electricity will also intensify.

GVA (Gross Value Added) is linked as a measurement to GDP. The relationship is defined as: GDP = GVA + Taxes – Subsidies. As the total aggregates of taxes on products and subsidies on products are only available at whole economy level, GVA is used for measuring Gross Regional Domestic Product and other measures of the output of entities smaller than a whole economy. GVA is the difference between output and intermediate consumption for any given sector/industry. That is the difference between the value of goods and services produced and the cost of raw materials and other inputs which are used up in production. Figure 3.4.1.1 indicates the GDP growth of the various study areas between 2005 and 2015.

Figure 3.4.1.1: GDP Growth (2005-2015)[9]



	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
SA	5.2%	5.2%	3.2%	-1.3%	2.9%	3.5%	2.2%	2.4%	1.9%	1.4%
NC	3.4%	2.9%	1.5%	-1.8%	2.1%	1.9%	3.3%	2.3%	3.2%	1.7%
JTGDM	5.7%	1.8%	0.4%	0.3%	4.0%	3.3%	5.1%	3.7%	5.7%	3.5%
JMLM	5.3%	-0.2%	1.5%	9.1%	6.8%	5.3%	8.3%	4.7%	9.2%	5.5%

SA NC JTGDM JMLM

SA and the NC had an average GDP growth rate of 2.7% and 2% respectively between 2005 and 2015. The average GDP growth rate for JMLM and JTGDM was 5.5% and 3.3% respectively between 2005 and 2015[10]. The negative GDP growth from 2008–2009 can be attributed to the global economic recession. South Africa's economy grew by 1.4% in 2015, down from 1.9% in 2014 (Statistics South Africa, 2016). GDP Growth for 2017 was forecasted to grow by 0.8% for the year 2017 by the International Monetary Fund (IMF). Agriculture was the prime contributor to the setback in SA GDP during 2015, in which the sector contracted by 8.4% due to the severe drought that initiated a sharp drop in the production of field crops (Statistics South Africa, 2016).

Recent macroeconomic changes have affected the economic outlooks across countries and regions globally. These major macroeconomic changes include the slowdown and rebalancing in China; the further decline in commodity

[9] (Quantec, 2016)

[10] GDP data for 2016 is currently unavailable in Quantec.

prices, i.e. crude oil, with sizable redistributive consequences across sectors and countries; a related slowdown in investment and trade; and declining capital flows to emerging market and developing economies (IMF, 2016). The prolonged drought in South Africa which started in 2015 is having an impact on the agriculture value chain and together with inflation is having a negative impact on the local economy. These changes, together with a host of non-economic factors, including geopolitical tensions are generating substantial uncertainty. In general, they are consistent with a subdued outlook for the world economy, but risks of much weaker global growth have also risen

The economic sectors that contributed most to the study areas' GDP are highlighted in Table 3.4.1.2.

Table 3.4.1.2: GDP Contribution (2015)[11]

2015	SA	NC	JTGDM	JMLM
Agriculture, forestry and fishing.	2,3%	7,5%	3,2%	2,9%
Mining and quarrying.	7,9%	22,7%	42,2%	73,3%
Manufacturing.	13,1%	3,4%	2,6%	1,0%
Electricity, gas and water.	3,6%	4,3%	2,9%	1,9%
Construction.	4,0%	2,9%	2,9%	2,0%
Wholesale and retail trade, catering and accommodation.	15,0%	12,8%	12,7%	4,7%
Transport, storage and communication.	10,2%	12,5%	9,4%	3,7%
Finance, insurance, real estate and business services.	21,1%	10,9%	7,0%	1,9%
Community, social and personal services.	5,9%	5,9%	5,4%	2,7%
General government.	16,9%	17,2%	11,6%	5,8%

The economic sectors that contributed the most to JMLM's GDP in 2015 were:

- Mining and quarrying (73.3%)
- General government (5.8%)
- Wholesale and retail trade, catering and accommodation (4.7%)

3.4.2. Employment Status

The employment profile of the study area is an important indicator of human development, but also of the level of disposable income and subsequently the expenditure capacity of the residing population. The employment rate refers to those economically active people who are unemployed and looking for work as well as persons who are unemployed and not looking for work but would accept work if it was offered to them. This category also includes the not economically active population, which are people who are not working, but are housewives, scholars/full-time students, pensioners, disabled people and people not wishing to work. Table 3.4.2.1 indicates the employment status of the various study areas.

Table 3.4.2.1: Employment Status[12]

2015	SA	NC	JTGDM	JMLM	Hotazel
Employed	44.8%	42.3%	35.7%	13.9%	66.0%
Unemployed	14.1%	17.2%	19.4%	24.9%	3.6%
Not economically active	41.1%	40.5%	44.9%	61.2%	30.4%

Only 13.9% of the population in the JMLM is employed, while 24.9% is unemployed and 61.2% is not economically active. Hotazel is one of the main development nodes in JMLM and mining is the predominant economic activity in the area. Two thirds of the population (66%) is employed in Hotazel, while 3.6% is unemployed and 30.4% is not economically active. JMLM's local economy is dominated by mining, making it difficult to incorporate all job seekers (IDP, Draft Integrated Development Plan, 2015/16). Therefore, the high percentage (24.9%) of unemployed people in JMLM, implies there is a need to broaden and diversify economic activities to create more employment

[11] (Quantec, 2016)

[12] (Quantec, 2016)

opportunities in the area. As a result, future demand for electricity will increase as the areas expand to broaden their economic base.

3.4.3. Employment Per Sector

Table 3.4.3.1 indicates the employment per sector in the various study areas.

Table 3.4.3.1: Employment Per Sector[13]

2015	SA	NC	JTGDM	JMLM
Agriculture, forestry and fishing	6,5%	18,0%	9,4%	12,4%
Mining and quarrying	3,1%	3,7%	10,3%	30,3%
Manufacturing	8,7%	4,3%	4,4%	2,4%
Electricity, gas and water	0,4%	0,4%	0,4%	0,4%
Construction	8,0%	7,4%	7,2%	7,4%
Wholesale and retail trade, catering and accommodation	23,5%	21,2%	22,7%	15,7%
Transport, storage and communication	5,6%	4,0%	4,2%	3,2%
Finance, insurance, real estate and business services	15,6%	9,4%	9,3%	4,5%
Community, social and personal services	16,0%	14,7%	16,2%	12,5%
General Government	12,5%	16,9%	15,8%	11,3%

The majority of the population in the JMLM is employed in:

- Mining and quarrying (30.3%)
- Wholesale and retail trade, catering and accommodation (15.7%)
- Community, social and personal services (12.5%)

Even though mining is the predominant economic activity in JMLM, a high percentage (15.7%) of the population is working in the wholesale and retail trade, catering and accommodation sector. This could be an indication of a growing trend in tertiary sector industries in the municipality, where the economy is currently resource based.

3.4.4. Skills Level

Skills levels of the labour force have an impact on the level of income earned (i.e. the higher the skills level the higher the annual income that could be earned). Table 3.4.4.1 indicates the skills level of the various study areas.

Table 3.4.4.1: Skills Level (2015)[14]

2015	SA	NC	JTGDM	JMLM
Skilled	24,5%	18,0%	17,4%	13,8%
Semi-skilled	46,7%	43,7%	44,6%	50,8%
Low skilled	28,7%	38,3%	38,0%	35,5%

The majority of the population in JMLM (50.8%) are semi-skilled, while 35.5% are low skilled and 13.8% are skilled. The semi-skilled population is higher than that of the South African and Northern Cape average. To fulfil their development goals, JMLM needs to implement a skills development strategy to reduce the high percentage of low skilled people. A population with low skills has a limited earning capacity, therefore focusing investment only on infrastructure development projects in the area, will not have a significant impact on the people's welfare. Furthermore, skills development will also expedite the transition of the economy, from an economy historically driven by primary industries, to a more diverse and resilient economy.

[13] (Quantec, 2016)

[14] (Quantec, 2016)

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3.4.5. Household Income

In order to determine people's living standards and understand their livelihoods, we need to analyse the income levels of the employed population. This is done with the objective to establish affordability constraints in acquiring basic services such as water, electricity and sanitation. Generally, analysing household income levels is one of the methods used to determine poverty levels in a community. Additionally, the income levels of a particular area provide some insight into the economic behaviour of a particular community, i.e. the purchasing power of that community, the potential poverty levels that a community might be experiencing and vulnerability to changes in the economy.

Households that have either no income or a low-income fall within the poverty level (R0 – R47,885 per annum); indicating that they experience difficulties in meeting their basic needs. High levels of poverty create a social dependency on government, which places a burden on the government budget. A middle-income is classified as earning R47,886 – R383,081 per annum, and a high-income is classified as earning R383,082 or more per annum. Table 3.4.5.1 indicates the annual household income of the various study areas.

Table 3.4.5.1: Annual Household Income (2015)[15]

2015	SA	NC	JTGDM	JMLM	Hotazel	
No income	14.9%	12.0%	15.9%	18.0%	5.5%	Low Income
R1 – R5 986	4.5%	3.6%	4.9%	6.2%	1.2%	
R5 987 – R11 971	7.4%	6.2%	9.4%	13.2%	1.0%	
R11 972 – R23 943	17.1%	19.4%	18.7%	24.6%	6.7%	
R23 944 – R47 885	19.0%	21.2%	18.7%	20.6%	9.4%	
R47 886 – R95 770	13.1%	14.6%	11.9%	7.8%	11.4%	Middle Income
R95 771 – R191 541	9.3%	10.5%	9.4%	4.7%	21.2%	
R191 542 – R383 081	7.2%	7.3%	6.6%	3.3%	23.7%	
R383 082 – R766 163	4.7%	3.7%	3.1%	1.1%	14.2%	High Income
R766 164 - R1 532 326	1.9%	1.0%	1.0%	0.2%	2.5%	
R1 532 327 – R3 064 651	0.6%	0.3%	0.3%	0.2%	2.7%	
R3 064 652 and more	0.3%	0.2%	0.1%	0.04%	0.5%	

Table 3.4.5.2 below depicts the population distribution of the study areas in each income category.

Table 3.4.5.2: Summary of Annual Household Income[16]

2015	NC	JTGD	JMLM	Hotazel
Low Income	62.4%	67.6%	82.6%	23.7%
Middle Income	32.4%	28.0%	15.8%	56.4%
High Income	5.2%	4.4%	1.6%	19.9%

The majority (56.4%) of households in Hotazel are middle income earners which implies that approximately 76.3% (56.4% middle income earners + 19.9% high income earners) of households in Hotazel are able to pay for basic services such as water, electricity and sanitation. JMLM has a high percentage (82.6%) of low income earners, which gives an indication of the standard of living for the majority of households (grant depended) and the prevalence of a weak financial base for the municipality to collect revenue.

The level and type of employment taken up by the population of an area directly affects the income levels of its people. A high poverty level has social consequences, for example, not being able to pay school fees, not having enough food in the house, not affording proper medical care, etc. Income categories will not improve unless skills and knowledge of the population improve through training and better education attainment opportunities and job creation in higher skilled economic sectors.

[15] (Quantec, 2016)

[16] (Quantec, 2016)

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3.5. Conclusion

The preceding sections provided an outline of the socio-economic environment that will affect the proposed Hotazel Solar Park. The trends illustrated should be borne in mind when considering the socio-economic impacts that might be derived from the project. The following main trends have been identified:

- JMLM consists of rural villages with three main regional nodes, where relatively more economic activity occurs. The local nodes include Hotazel, Vanzylsrus and Blackrock, of which two (Hotazel and Blackrock) serve as mining towns. Mining is the predominant economic activity in JMLM, where the Gamagara mining corridor cuts across the municipality. Most development projects implemented in JMLM were funded by government grants and mining houses Social Labour Plan's (SLP).
- The population in Hotazel is approximately 2,000 people (±780 households) and the majority of the population in these study areas has access to the minimum standard levels of electricity, water and sanitation. The population in Hotazel has been growing by an average of 3.7% between 2005 and 2015, which was more than double the average growth rate of JMLM which was 1.5% for the same period.
- The average GDP growth rate for JMLM and JTGDM was 5.5% and 3.3% respectively between 2005 and 2015[17]. South Africa's economy grew by 1.4% in 2015 and is forecasted to only grow by 0.8% in 2017 (IMF), and agriculture is considered the prime contributor to this setback as the sector in South Africa overall contracted by 8.4% in 2015 due to the severe drought.
- In JMLM, the mining and quarrying sector contributed 73.3% to the economy in 2015 and employed 30.3% of the working population. The other major sectors in JMLM are the general government sector and the wholesale and retail trade, catering and accommodation sector.
- Only 13.9% of the population in the JMLM is employed, while 24.9% is unemployed and 61.2% is not economically active. In Hotazel, two thirds of the population (66%) is employed in Hotazel, while 3.6% is unemployed and 30.4% is not economically active.
- The majority (56.4%) of households in Hotazel are middle income earners which implies that approximately 76.3% (56.4% middle income earners + 19.9% high income earners) of households in Hotazel are able to pay for basic services such as water, electricity and sanitation. This is reflected in the fact that in Hotazel, 21.5% of the population has a Grade 12 only qualification and 37.6% have a tertiary qualification.
- Thus from a socio-economic perspective the study area is highly sensitive to the proposed Hotazel Solar Park and the Park would have a positive impact.

[17] GDP data for 2016 is currently unavailable in Quantec.

4: Economic Impact Assessment

4.1. Introduction

The purpose of this section is to develop a better understanding of the potential economic impact of the proposed development in the study area. Economic impact refers to the effect on the level of economic activity in a given area as a result of some form of external intervention in the economy. In the case of this study, the local impacts will be impacted on a regional level. These impacts are measured because of the capital investment in the proposed development. This analysis focuses on the changes that could be expected in the economy and community and can be estimated by using a technique called the Social Accounting Matrix (SAM) model (discussed below).

4.2. Understanding the SAM Model

While there are many methods of regional economic impact analysis, the SAM modelling approach has proven to be a particularly effective method for evaluating the implications of introducing an exogenous change to the economy. The modelling approach is recognised and accepted both nationally and internationally. A SAM represents flows of all economic transactions that take place within an economy (regional or national). SAMs refers to a single year providing a static picture of the economy, based on national accounting statistics and input-output tables that are compiled and published by Statistics South Africa (Stats SA), using primarily South African Reserve Bank Accounts data. The model has however been amended to include the local conditions.

SAMs refers to a single year providing a static picture of the economy, based on national accounting statistics and Input-Output tables that are compiled and published by Statistics South Africa (StatsSA), using primarily South African Reserve Bank Accounts data. The sectoral parameters utilised in the model are therefore strictly compatible with the macro national accounting data published by the South African Reserve Bank and StatsSA on a regular basis.

Importantly, it is the matrices that can be derived from the model that are used as instruments for economic analysis. The fundamental assumptions regarding the model, as well as the use of this model for analytical purposes, are:

- Production activities in the economy are grouped in homogeneous sectors.
- The mutual interdependence of sectors is expressed in meaningful input functions.
- Each sector's inputs are only a function of the specific sector's production.
- The production by different sectors is equal to the sum of the separate sectors' of production.
- The technical coefficients remain constant for the period over which forecast the projections is made.
- There will be no major change in technology.

It should also be noted that:

- All the Rand values in this report represent 2016 Rand values (cost excluding 14% VAT).
- The different measures of economic impact (jobs, Gross Geographic Product (GGP) and new business sales) cannot be added together and should be interpreted as separate economic impacts.
- The model quantifies direct and indirect economic impacts for a specific amount of time. Therefore, the estimates that are derived do not refer to gradual impacts over time.

Two types of economic impacts can be measured, namely, direct and indirect impacts:

- **Direct Impacts** – changes in local business activity occurring as a direct result or consequence of public or private sector capital expenditure. Direct economic effects are generated when the new business creates

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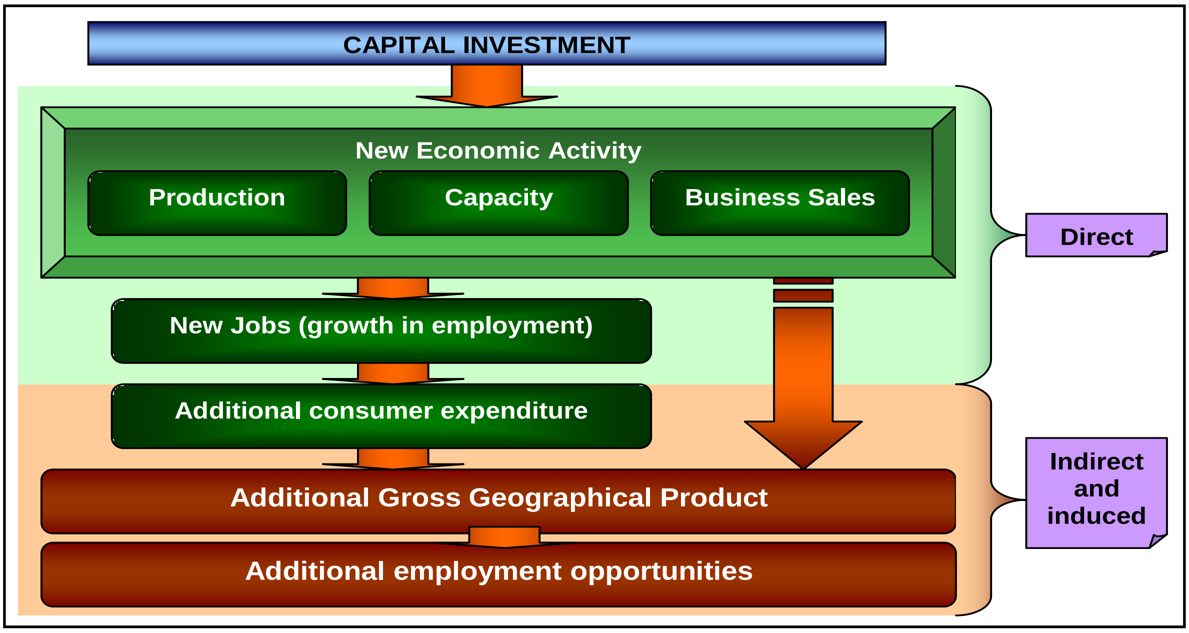
new jobs and purchases goods and services to operate the new facility. Direct impacts result in an increase in job creation, production, business sales, and household income.

- The multiplicative effects can be grouped into two distinct effects, namely:
  - ✓ **Indirect Impacts** – occur when the suppliers of goods and services to the new business experience larger markets and potential to expand. Indirect impacts result in an increase in job creation, GDP, and household income.
  - ✓ **Induced Impacts** – represent further shifts in spending on food, clothing, shelter and other consumer goods and services as a consequence of the change in workers and payroll of directly and indirectly affected businesses. This leads to further business growth/decline throughout the local economy. Examples include the income of employees and shareholders of the project as well as the income arising through the backward linkages of this spending in the economy. The impact is sometimes confused with the forward linkages of a project.

Figure 4.2.1 indicates direct, indirect and induced impacts in more detail.

Figure 4.2.1: Impact of Capital Investment



Economic impacts can also be viewed in terms of their duration, or the stage of life cycle in which the development takes place, (1) the construction phase (CAPEX), (2) the operational phase (OPEX) and (3) the decommissioning phase[18]. Due to the duration of these phases, the impacts are separated into those observed during the construction phase and those experienced during the operational phase. The construction phase economic impacts are of a temporary nature, and therefore have a temporary effect. On the other hand, the operational phase of the proposed project would last decades; hence the impacts during this stage would be of a sustainable nature.

The economic impacts during construction and operational phases can be viewed in terms of a change in the following:

- **Job creation** – the number of additional jobs created by economic growth. This includes jobs in planning and constructing the facility and sustainable jobs at the facility once it is operational. Indirect and induced job creation will also occur as a result of direct job and income creation.

[18] Impacts for the decommissioning phase will be similar to construction phase impacts.

- **Value-added (or GGP)** – the value of all final goods and products produced during a one-year period within the boundaries of a specific area, as a direct, indirect and induced result of activities for/at the precinct during planning, construction and operation.
- **Business output (or sales volume)** – the value of all inter- and intra-sectoral business sales generated in the economy as a consequence of the planning, construction and operation of the development.

Any of these measures can be an indicator of improvement in the economic well-being of residents, which is generally the goal of any investment project. The net economic impact is usually viewed as the expansion or contraction of an area's economy, resulting from the induced changes. The precise quantum of these impacts will be influenced by changes in the project (such as precise land-use mix, technologies employed, imported versus local goods and services, timing and funding options, amongst others) and changes in the project environment (such as property market cycles, interest rates, legislation, the structure of the economic sectors primarily influencing and affected by the development and the labour market, amongst others).

Table 4.2.1: Impacts Modelled

Impact on:	CAPEX	OPEX
Additional new business sales (NBS) (additional production/output generated by the development)	The construction work on the infrastructure and buildings will lead to the expansion of business sales for existing businesses located within the area, as well as the broader Northern Cape region. For example, materials used in the construction process such as PV modules, racking, fencing, concrete, building sand, and so on will be purchased, as well as services such as engineers and other specialists. These changes are measured in terms of new business sales, i.e. new sales that will be generated in the economy as a direct result of the capital investment in the development project.	The increased need for goods and services, as a result of the construction of infrastructure and the operation of different activities in the proposed development, particularly as a result of maintenance and upkeep of the proposed project will result in an overall sustainable expansion of the business sales/annual turnover.
Additional GGP	One of the most important indicators used to indicate economic growth and value is the GGP. The GGP measures the value of all final goods and services produced/provided within one year of the area's economy.	The generation of additional business sales and employment opportunities will initiate an on-going ripple effect through the sub-region, resulting in an increase in product and service value (measured in GGP).
Additional employment (direct and indirect)	Construction activities will result in direct jobs being created on site and other directly related sectors such as the transport and manufacturing sectors. Indirect jobs are also created due to the multiplier effect in the economy. For example, an additional number could lead to an increased number of jobs being created in these businesses, i.e. in order to increase the output of these businesses.	As a result of the new activities on the site, it can be estimated that the study area will be able to eventually sustain a substantial number of new employment opportunities.

4.3. Project Assumptions

The following assumptions were made for the economic models:

- The CAPEX accurately reflects the real situation.
- Production activities in the economy are grouped into homogeneous sectors.
- The mutual interdependence of sectors is expressed in meaningful input factors.
- Each sector's inputs are a function of its production, comparative advantage, and location.

- Production by different sectors is equal to the sum of the production of separate sectors'.
- The technical coefficients of the SAM model remain constant for the period over which forecast projection is made, i.e. no structural changes in the economy are experienced.
- Total project cost R1,035,000,000[19]
- Portion total project cost spent in South Africa R621,000,000[20]
- Note: The project investment estimates used in the SAM modelling were conservative. The potential increase in investment will not result in a major change in impact significance and will not change any of the significance rating categories allocated to specific impacts presented in this report.

4.4. CAPEX

This sub-section focuses on the potential economic impacts of the CAPEX for the proposed ≤200MWac solar PV park. It is important to note that the estimated impacts are for the duration of the construction and development process, including potential leverage effects which refer to the secondary economic influence of the initial CAPEX. This implies that the impact during the construction phase will fade once the development has been completed. Table 4.4.1 indicates the impacts during the construction phase.

Table 4.4.1: Impact During Construction Phase[21]

Impact on:	Direct (construction)	Indirect (suppliers)	Induced (salaries & wages)	Total
CAPEX				
Production (@ 2016 R-value)	R803 million	R845 million	R610 million	R2.258 billion[22]
GGP (@ 2016 R-value)	R200 million	R265 million	R259 million	R724 million
Jobs	600	1000	927	2527
Household Income (@ 2016 R-value)	R346 million	R146 million	R118 million	R610 million
No Go Option				
There will be no impact on production, GGP, jobs and household income.				

The following can be concluded:

- The construction of the Hotazel PV Project will generate R2,258 billion in new business sales (of this R803 million will be created through direct effects).
- The increase in production, or new business sales, will result in an increase in the gross value added in the country to the value of R724 million.
- The Hotazel PV Project will create 2527 (direct and indirect) employment opportunities during the construction period.
- The Hotazel PV Project will increase household income by R610 million over the construction period.

The following table indicates the results if the impact modelling exercise for the construction period on each SIC[23] sector.

Table 4.4.2: Impacts During Construction Phase on Each Sector[24]

[19] Data input assumptions required for Social Accounting Matrix Calculations provided by the applicant
[20] Data input assumptions required for Social Accounting Matrix Calculations provided by the applicant
[21] Urban Econ Calculations 2016
[22] Production value impact based in the project cost of R1,035,000,000
[23] "SIC Sectors" are the main categories of the South African Standard Classification of all Economic Activities (SIC) of 1993 (CSS, 1993).
[24] Urban Econ Calculations 2016

Sector:	Total Impact on Production	Total Impact on GDP	Total Impact on Employment	Total Impact on Household Income
CAPEX: Hotazel and Rest of Province				
Agriculture	1,9%	2,6%	9,6%	0,4%
Mining	0,6%	0,9%	0,2%	0,2%
Manufacturing	6,2%	4,3%	8,2%	1,2%
Electricity	0,5%	0,7%	0,2%	0,2%
Water	0,1%	0,1%	0,0%	0,0%
Building and Construction	57,3%	44,9%	54,9%	82,0%
Trade and accommodation	5,8%	7,9%	9,8%	2,7%
Transport and storage	9,0%	9,9%	2,4%	2,7%
Financing	4,8%	8,0%	3,4%	2,5%
Real estate and business services	4,0%	6,3%	2,8%	0,6%
Government services, social and personal services	5,4%	6,8%	4,6%	3,0%
Other	4,5%	7,7%	3,9%	4,4%
CAPEX: Rest of South Africa				
Agriculture	1,1%	1,3%	4,3%	0,8%
Mining	4,6%	7,7%	6,9%	6,4%
Manufacturing	41,7%	24,5%	29,7%	36,4%
Utilities	1,8%	3,2%	0,7%	1,8%
Construction	25,8%	23,1%	6,2%	21,3%
Wholesale and Trade	6,0%	9,7%	16,1%	9,2%
Transport	4,5%	6,6%	3,9%	4,2%
Financial Intermediation	6,5%	11,4%	4,0%	8,3%
Research	0,0%	0,0%	0,0%	0,0%
Computer Activities	2,3%	2,9%	11,9%	4,0%
Other Community Activities	0,1%	0,3%	0,3%	0,5%
Education	0,9%	1,3%	2,0%	1,1%
Health and Social Work	0,8%	1,0%	1,8%	0,9%
Other Services Necessary	3,7%	7,0%	12,2%	5,1%

As can be seen from the table above the proposed development will, during construction, in Hotazel and the rest of the Province, have the biggest impact on the following economic sectors:

- Manufacturing
- Building and Construction
- Trade and Accommodation
- Transport and Storage

Additionally, as can be seen from the table above the proposed development will, during construction, rest of South Africa, have the biggest impact on the following economic sectors:

- Manufacturing
- Construction
- Wholesale and Trade
- Financial Intermediation
- Computer Activities

4.5. OPEX

It is generally known that after the construction of a development or facility, on-going economic impacts (expenditure, output and job creation) will be sustained following the commencement of the economic activities on site. These activities expand the markets for goods and services, increase the labour market and serve as an impetus for new commercial development. The economic impact is determined by the level of economic activity generated or lost because of development that will require and/or induce on-going operational and maintenance activities. As with the construction phase, the proposed development is assessed in terms of new business sales, Gross Geographic Product (GGP) and employment opportunities generated. The following table indicates the results of the impact modelling exercise for the operational period. The results are given in total for the duration of the operation period.

Table 4.5.1: Impacts During Operational Phase[25] [26]

Impact on:	Direct (construction)	Indirect (suppliers)	Induced (salaries & wages)	Total
OPEX				
Production (@ 2016 R-value)	R112 million	R88 million	R57 million	R257 million
GGP (@ 2016 R-value)	R69 million	R 42 million	R24 million	R135 million
Jobs	50	150	93	293
Household Income (@ 2016 R-value)	R19 million	R16 million	R10 million	R45 million
No Go Option				
There will be no impact on production, GGP, jobs and household income.				

The following can be concluded:

- The Hotazel PV Project will generate R257 million in new business sales[27] (of this R112 million will be created through direct effects) in total during the operation period.
- The increase in production, or new business sales, will result in an increase in the gross value added in the country to the value of R135 million in total during the operation period.
- The Hotazel PV Project will create 293 (direct and indirect) employment opportunities in total during the operation period.
- The Hotazel PV Project will increase household income by R45 million in total during the operation period.

The following table indicates the results if the impact modelling exercise for the construction period on each SIC[28] sector.

Table 4.5.2: Impacts During Operation Phase on Each Sector[29]

Sector:	Total Impact on Production	Total Impact on GDP	Total Impact on Employment	Total Impact on Household Income
Opex: Hotazel, Rest of Province				
Agriculture	1,3%	2,6%	9,6%	0,4%
Mining	1,7%	1,3%	0,9%	0,4%
Manufacturing	3,7%	2,9%	0,1%	1,1%
Electricity	4,1%	1,4%	0,5%	0,8%
Water	53,9%	66,6%	0,1%	80,8%
Building and Construction	0,2%	0,1%	0,0%	0,0%
Trade and accommodation	0,7%	0,3%	95,5%	0,2%
Transport and storage	5,5%	4,1%	1,0%	2,5%
Financing	10,1%	6,1%	0,3%	3,0%
Real estate and business services	5,5%	5,1%	0,4%	2,9%

25 Urban Econ Calculations 2016
26 The reader should be aware that the investment benefits is likely to be higher than those reported here.
27 Please see table 4.2.1 for business sale definition
28 "SIC Sectors" are the main categories of the South African Standard Classification of all Economic Activities (SIC) of 1993 (CSS, 1993).
29 Urban Econ Calculations 2016

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Sector:	Total Impact on Production	Total Impact on GDP	Total Impact on Employment	Total Impact on Household Income
Government services, social and personal services	4,3%	3,7%	0,3%	0,6%
Other	5,7%	4,0%	0,5%	3,3%
Opex: Rest of South Africa				
Agriculture	1,1%	0,8%	4,5%	0,7%
Mining	3,3%	3,7%	6,0%	3,3%
Manufacturing	11,7%	5,1%	8,5%	9,6%
Utilities	54,1%	62,9%	6,4%	50,7%
Construction	0,1%	0,0%	0,1%	0,1%
Wholesale and Trade	3,7%	3,6%	10,5%	5,1%
Transport	3,8%	3,5%	3,4%	3,2%
Financial Intermediation	16,5%	14,7%	38,5%	19,3%
Research	0,0%	0,0%	0,0%	0,0%
Computer Activities	1,8%	1,4%	10,0%	2,9%
Other Community Activities	0,1%	0,2%	0,4%	0,5%
Education	0,4%	0,4%	1,0%	0,4%
Health and Social Work	0,9%	0,7%	2,2%	1,0%
Other Services Necessary	2,4%	2,9%	8,5%	3,1%

As can be seen from the table above the proposed development will, during operation, in Hotazel and the rest of the Province, have the biggest impact on the following economic sectors:

- Water
- Trade and Accommodation
- Financing
- Real Estate and Business Services

Additionally, as can be seen from the table above the proposed development will, during operation, rest of South Africa, have the biggest impact on the following economic sectors:

- Manufacturing
- Utilities
- Wholesale and Trade
- Financial Intermediation

4.5. Decommissioning Phase

It is not envisaged that the proposed development will be decommissioned[30]. Should it be decided not to re-power the proposed project after the 20-year operation phase the site will be decommissioned. In order to assess the impacts of the proposed project it is assumed that the facility will be completely decommissioned at the end of the official agreement, unless a new PPA (Power Purchaser's Agreement) is signed (expected lifespan 20 years from the date of commissioning).

Impacts during the decommissioning phase would include:

- Impact on production
- GGP
- Jobs
- Household income

[30] Determining significance of decommissioning is to into far in the future to determine.

It can be assumed that the proposed development will have, during its decommissioning, the biggest impact on the following economic sectors:

- Manufacturing
- Building and construction
- Trade and accommodation
- Real estate and business services

After decommissioning the proposed project, various components would be disassembled, removed and recycled as far as possible. The aim would be to restore the land to its original substratum characteristics (or as near as possible).

4.6. Conclusion

The impact modelling exercise involves calculation and assessment of the socio-economic direct, indirect, and induced impacts during the construction and operational phases of the proposed development. The proposed development could provide a significant amount of new economic activity, both during the construction phase as well as during the ongoing operation of the development. The impact was modelled in terms of new business sales, GDP and job creation. From the modelling in the above section it is evident that the development will have a significant positive impact on the local and regional economies.

The SAM Model has been peer reviewed internationally as well as by the Department of Treasury. Please contact Ben van der Merwe at Urban Econ in Pretoria (*012 342 8686*) or via email: ben@urban-econ.com should a better understanding of the SAM Model be required.

Construction Phase

Total additional NBS	Total additional GGP	Total additional Employment	Total additional HH income
Direct: **R803 million**	Direct: **R200 million**	Direct: **600**	Direct: **R346 million**
Indirect: **R845 million**	Indirect: **R265 million**	Indirect: **1000**	Indirect: **R146 million**
Induced: **R610 million**	Induced: **R259 million**	Induced: **927**	Induced: **R118 million**

The above impacts are impacts for the duration of the construction period.

- Increased demand for products services leads to increased business sales for local businesses in the area mainly relating to construction
- Increase in business productivity will lead to increase in economic activity which is indicated as GGP
- Job opportunities are semi-permanent (only for the duration of the construction phase of the development)
- Additional incomes in the households that are employed directly or indirectly during the construction period

Operational Phase

Total additional NBS	Total additional GGP	Total additional Employment	Total additional HH Income
Direct: **R112 million**	Direct: **R69 million**	Direct: **50**	Direct: **R19 million**
Indirect: **R88 million**	Indirect: **R42 million**	Indirect: **150**	Indirect: **R16 million**
Induced: **R57 million**	Induced: **R24 million**	Induced: **93**	Induced: **R10 million**

The above impacts are determined for a one year period

- Sustainable demand for goods and services leads to increase in business sales
- Sustained business productivity leads to increase in GGP
- Job opportunities are permanent and sustainable
- Sustained increased additional household income

Figure 6.6.1: Summary of Total Economic Impacts

5: Impact Assessment

5.1. Introduction

The Hotazel Solar PV project will have various impacts as discussed in previous sections. The purpose was to identify possible impacts which could occur because of activities which will take place during the construction and operational phase of the development. The following section will describe the various types of impacts which have been identified and describe their relevance to the development.

The assessment of the additional new business sales, additional gross geographic product and additional employment are measured against the baseline numbers as indicated in the Socio-Economic Profile. As previously explained, these impacts are determined as direct impacts and indirect impacts for both the construction and operational phases of the proposed development. Only the direct impacts were used to establish the impact on the study area. The main reason for not using the total numbers is because it would be very difficult to determine which percentage of the indirect impacts would also be felt within the study area that would mean that the total impacts would than need to be measured against the national economy and the national employment numbers. However, one must remember that in addition to what has been presented there will be significant indirect impacts.

The project investment estimates used in the SAM modelling were conservative estimates taken in the early stages of the impact assessment process and updated estimates put the potential capital expenditure 73% higher than these estimates with 60% still being spent within South Africa. This increase in investment potential will not result in a major change in impact significance ratings and will not change any of the significance rating categories allocated to specific impacts assessed in this report.

Each of the economic and social outputs will be evaluated in terms of the following criteria:

- Duration
- Extent
- Magnitude
- Significance
- Probability
- Confidence
- Reversibility
- Irreplaceability

5.2. Impact Table

The following section will use the impact table to illustrate what the impacts of the development activities will be during construction and operation of the proposed development. The impacts will be rated using the specific impact criteria. The following table indicates the impacts that form part of the assessment. Table 7.2.1 provides an overview of the impacts identified for the Hotazel Solar PV project, while table 7.2.2 provides an overview of the impacts identified for the transmission lines.

Table 5.2.1: Impact Table Hotazel Solar PV project (excluding transmission lines)

Positive Impacts	Negative Impacts
Construction Phase	
Increase in production and GDP-R of the national and local economies due to project capital expenditure	Change in demographics of the area due to influx of workers and job seekers[31]
Creation of temporary employment in the local communities and	Added pressure on basic services and social and economic

[31] Even with a high obligation to employ locals as well as the verification of local status, this impact could occur, however with a low probability.

Positive Impacts	Negative Impacts
elsewhere in the country	infrastructure
Skills development due to the creation of new employment opportunities	
Improved standard of living of households directly or indirectly benefiting from created employment opportunities	
Increase in government revenue due to investment	
Operation Phase	
Increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply	
Sustainable increase in production and GDP-R of the national and local economies through operation and maintenance activities	
Creation of long-term employment in local and national economies through operation and maintenance activities	
Skills development due to the creation of new sustainable employment opportunities	
Improved standard of living of households directly or indirectly benefiting from created employment opportunities	
Increase in government revenue stream	
Investment in the local communities and economic development projects as part of a Social Economic Development and Enterprise Development Plan	

Table 5.2.2: Impact Table for Transmission Lines

Positive Impacts	Negative Impacts
Construction Phase	
Increase in production and GDP-R of the national and local economies due to project capital expenditure	Affected land owners and households due to onsite activity[32]
Creation of temporary employment in the local communities and elsewhere in the country	
Operation Phase	
Supply of electricity	Affected land owners and households due to onsite activity

Each of the identified impacts will be evaluated according to the following criteria:

Table 5.2.3: Assessment criteria for the evaluation of impacts

Criteria	Category	Description
Extent or spatial influence of impact	**Regional**	Beyond a 10km radius of the proposed site.
	Local	Within a 10km radius of the proposed site.
	Site specific	On site or within 100m of the proposed site.
Magnitude of impact	**High**	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	**Construction period**	Up to 1 year
	Short Term	Up to 3 years after construction
	Medium Term	3-10 years after construction
	Long Term	More than 10 years after construction

Table 5.2.4: Definition of significance ratings

32 Pre mitigation this impact would be negative, however through mitigation measures, it could change to positive.

Significance Ratings	Level of Criteria Required
High	▪ High magnitude with a regional extent and long term duration ▪ High magnitude with either a regional extent and medium term duration or a local extent and long term duration ▪ Medium magnitude with a regional extent and long term duration
Medium	▪ High magnitude with a local extent and medium term duration ▪ High magnitude with a regional extent and construction period or a site specific extent and long term duration ▪ High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration ▪ Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Low magnitude with a regional extent and long term duration
Low	▪ High magnitude with a site specific extent and construction period duration ▪ Medium magnitude with a site specific extent and construction period duration ▪ Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Very low magnitude with a regional extent and long term duration
Very low	▪ Low magnitude with a site specific extent and construction period duration ▪ Very low magnitude with any combination of extent and duration except regional and long term
Neutral	▪ Zero magnitude with any combination of extent and duration

Table 5.2.5: Definition of probability ratings

Probability Ratings	Criteria
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 5.2.6: Definition of confidence ratings

Confidence Ratings	Criteria
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 5.2.7: Definition of reversibility ratings

Reversibility Assessment	Criteria
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

Table 5.2.8: Definition of irreplaceability ratings

Irreplaceability Ratings	Criteria
Low	The affected resource is not unique and or does not serve a critical function or is degraded
Medium	The affected resource is moderately important in terms of uniqueness and function or in pristine condition
High	The affected resource is important in terms of uniqueness and function and or in pristine condition and warrants conservation / protection

The impacts are discussed in more detail below:

5.3. Hotazel Solar PV Project Construction Phase Impacts

5.3.1. Increase in production and GDP-R of the national and local economies due to project capital expenditure

The impacts on GDP during construction would only be temporary whereas the impacts during operation would be long-term. Table 5.3.1.1 indicates the direct net regional economic gain in production and GDP during the construction of the Hotazel Solar PV project.

Table 5.3.1.1: Impact on Production & GDP (Construction)

Impact on:	Direct (construction)
Production (@ 2016 R-value)	R803 million
GGP (@ 2016 R-value)	R200 million

Table 5.3.1.2 highlights the Increase in production and GDP-R of the national and local economies due to project capital expenditure during construction.

Table 5.3.1.2: Increase in production and GDP-R of the national and local economies due to project capital expenditure

	Preferred Alternative		No Go Alternative	
Short description	Increase in production and GDP-R of the national and local economies due to project capital expenditure		The no-go alternative represents the current status of the environment, including the socio-economic situation	
Overview	The biggest effects on production and GDP stimulated during construction activities will be created through the multiplier effects, specifically through production and consumption induced effects. The former refers to the impacts generated along backward linkages when the project creates the demand for goods and services required for construction, which in turn stimulates the business sales of the suppliers of inputs that are required to produce these goods and services. The latter refers to effects of household spending, which is derived from an increase in salaries and wages directly and indirectly stimulated by the project's expenditure. Besides the value added that could be generated by the local construction businesses through sub-contracting agreements and employment of freelancers, the sectors that are expected to benefit the most from the production and consumption induced effects are tertiary services such as trade, accommodation, transport services, personal services, etc.		No increase in production and GDP-R of the national and local economies due to project capital expenditure will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Construction period	Construction period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	High	High	N/A	N/A
Probability	Definite	Definite	N/A	N/A
Confidence	Certain	Certain	N/A	N/A
Reversibility	Irreversible	Irreversible	N/A	N/A
Resource irreplaceability	High	High	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	High	High	N/A	N/A
Mitigation	▪ The developer should encourage the EPC contractor to increase the local procurement practices and employment of people from local communities as far as feasible to maximise the benefits to the local economies.			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved			

	by government then there would be: ▪ Demand for goods and services required for construction of similar facilities would grow; this could provide sufficient economies of scale and thus open opportunities for the establishment of new industries in the country and new businesses in the local area, specifically in the sectors that are not well represented in the local economy.

5.3.2. Creation of temporary employment in the local communities and elsewhere in the country

The impacts on employment during construction would only be temporary whereas the impacts during operation would be long-term. Table 5.3.2.1 indicates the number of jobs that will be created during construction of the proposed development.

Table 5.3.2.1: Creation of temporary employment in the local communities and elsewhere in the country (Construction)

Impact on:	Direct (construction)	Indirect (suppliers)	Induced (salaries and wages)	Total
Jobs	600	1000	927	2527

Table 5.3.2.2 highlights the impact on the creation of temporary employment in the local communities and elsewhere in the country during construction.

Table 5.3.2.2: Creation of temporary employment in the local communities and elsewhere in the country

	Preferred Alternative		No Go Alternative	
Short description	Creation of temporary employment in the local communities and elsewhere in the country		The no-go alternative represents the current status of the environment, including the socio-economic situation	
Overview	In addition to direct jobs, jobs will also be created indirectly (among suppliers) and induced jobs will be created through greater income circulation. Due to the nature of work that needs to be performed, a significant amount of employment opportunities exists for unskilled and semi-skilled workers. Amongst others, construction involves activities that require unskilled labour for which locals could be employed. These include clearance of vegetation, digging trial pits at main foundation points, excavation of foundation where access is poor, mixing of concrete where access is poor, rehabilitation of land, site security, and other activities requiring laborer's.		No creation of temporary employment in the local communities and elsewhere in the country will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Construction period	Construction period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	High	High	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	High	High	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Medium	High	N/A	N/A
Mitigation	▪ Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for. ▪ Establish a local skills desk to determine the potential skills that could be sourced in the area. ▪ Recruit local labour as far as feasible. ▪ Employ labor-intensive methods in construction where feasible. ▪ Sub-contract to local construction companies where possible.			

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	▪ Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering and other services to the construction crew.
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Improved labour productivity and employability of construction workers for similar projects. ▪ Possible development of local skills and expertise in R&D and manufacturing industries related to solar technologies.

5.3.3. Skills development due to the creation of new employment opportunities

Table 5.3.3.1 highlights the impact on the increase in skills development due to the creation of new employment opportunities during construction.

Table 5.3.3.1: Skills development due to the creation of new employment opportunities

	Preferred Alternative		No Go Alternative	
Short description	Skills development due to the creation of new employment opportunities		Creation of temporary employment in the local communities and elsewhere in the country	
Overview	The establishment of the Hotazel Solar PV project gives way to a host of skills transfer and skills development opportunities particularly for the labour force in the local municipality. The development of the project will allow for the transfer of construction-related skills to the local communities. This will increase the employability of the local labour and their chances of finding employment opportunities on similar projects or other construction projects. People employed at businesses along the supply chain will also benefit from this activity as they will be offered an opportunity. The impact takes place during construction and will last beneficiaries for an entire lifetime.		No skills development due to the creation of new employment opportunities will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Construction period	Construction period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Definite	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Medium	Medium	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Medium	High	N/A	N/A
Mitigation	▪ Facilitate knowledge and skills transfer between workers during the construction phases			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Development of new skills and expertise in the country to support the PV Solar Energy industry development.			

5.3.4. Improved standard of living of households directly or indirectly benefiting from created employment opportunities

Table 5.3.4.1 highlights the impact on the improved standard of living of households directly or indirectly benefiting from created employment opportunities during construction.

Table 5.3.4.1: Improved standard of living of households directly or indirectly benefiting from created employment opportunities

	Preferred Alternative		No Go Alternative	
Short description	Improved standard of living of households directly or indirectly benefiting from created employment opportunities		The no-go alternative represents the current status of the environment, including the socio-economic situation	
Overview	The Hotazel Solar PV project will create employment positions during construction generating revenue for the affected households in the country through direct, indirect and induced effects. Of this revenue, money will be paid out in the form of salaries and wages to those individuals directly employed during the construction phase. Additionally, households' earnings will be generated through indirect and induced effects resulting from project expenditure. Although temporary, this increase in household earnings would have a positive effect on nutrition, living conditions, access to better health care, access to more options regarding education, and improved ability to make economic choices.		No improved standard of living of households directly or indirectly benefiting from created employment opportunities will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Construction period	Construction period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Irreversible	Irreversible	N/A	N/A
Resource irreplaceability	Medium	Medium	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Medium	Medium	N/A	N/A
Mitigation	▪ Recruit local labour as far as feasible to increase the benefits to the local households; ▪ Employ labour intensive methods in construction where feasible, such as methods in terms of time, cost and technical site specific requirements; ▪ Sub-contract to local construction companies where possible; ▪ Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews.			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Improved standard of living of the affected households.			

5.3.5. *Impact on* increase in government revenue due to investment

Table 5.3.5.1 highlights the impact on the increase in government revenue due to investment during construction.

Table 5.3.5.1: Impact on increase in government revenue due to investment

	Preferred Alternative	No Go Alternative
Short description	Impact on increase in government revenue due to investment	The no-go alternative represents the current status of the environment, including the socio-economic situation
Overview	The investment from the Hotazel Solar PV project will generate revenue for the government through a combination of personal income tax, VAT, companies tax etc. Government earnings will be distributed by national	No impact on increase in government revenue due to investment will occur

	government to cover public spending which includes amongst others the provision and maintenance of transport infrastructure, health and education services as well as other public goods.			
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Construction Period	Construction Period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Irreversible	Irreversible	N/A	N/A
Resource irreplaceability	Medium	Medium	N/A	N/A
Mitigatability	Low	Low	N/A	N/A
Significance	Medium	Medium	N/A	N/A
Mitigation	▪ None foreseen at this stage			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Increase in government revenue.			

5.3.6. Impact on the change in demographics of the area due to influx of workers and job seekers

Table 5.3.6.1 highlights the impact on the change in demographics of the area due to the influx of workers and job seekers during construction.

Table 5.3.6.1: Impact on the change in demographics of the area due to influx of workers and job seekers

	Preferred Alternative	No Go Alternative
Short description	Impact on the change in demographics of the area due to the influx of workers and job seekers.	The no-go alternative represents the current status of the environment, including the socio-economic situation
Overview	Large construction projects generally attract people in search of employment to the area. The job seekers may decide to stay in the area regardless of whether they find employment or not. Often, job seekers are accompanied by their families or they may decide to follow at a later stage. The construction of the Hotazel Solar PV project is expected to create employment opportunities, which attract workers from within and outside the local municipality. Hotazel Solar PV project is one of several proposed projects in the area, the cumulative effect of the project on migration patterns is expected to further increase or at least sustain the rate of inward migration to the local municipality. The people migrating to the area for the purpose of seeking employment are expected to mostly be males, who could either decide to move their families to the area depending on their chances of finding employment post-construction or move to other parts of the country seeking new employment opportunities. This inward migration trend could lead to an increase in the local population with the proportion of male population within the working age growing, ultimately changing the local demographics.	No impact on the change in demographics of the area due to the influx of workers and job seekers will occur

Assessment				
	Pre-Mitigation	Post Mitigation	Pre-Mitigation	Post Mitigation
Nature	Negative	Negative	Negative	Negative
Duration	Construction Period	Construction Period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Low	Low	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	High	High	N/A	N/A
Mitigatability	Low	Low	N/A	N/A
Significance	Low	Low	N/A	N/A
Mitigation	▪ Clear communications of all positions available to minimize influx of workers			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Increase in male population which may lead to social conflicts.			

5.3.7. Added pressure on basic services and social and economic infrastructure

Table 5.3.7.1 highlights the impact on added pressure on basic services and social and economic infrastructure during construction.

Table 5.3.7.1: Impact on the added pressure on basic services and social and economic infrastructure

	Preferred Alternative	No Go Alternative
Short description	Added pressure on basic services and social and economic infrastructure	The no-go alternative represents the current status of the environment, including the socio-economic situation
Overview	Given that workers and job seekers may require accommodation and other services there is likely to be an increase in the demand for rental accommodation, social services and access to water and electricity. The effects of the project on road infrastructure should also be considered as it is likely that the development will lead to an increase in traffic volumes in surrounding areas. This could lead to a deterioration of local road conditions which could place additional financial burden on the Local Municipality through additional maintenance costs. This may add additional operating costs to surrounding land users in the area due to delays in deliveries and damage to vehicles. A traffic impact assessment was conducted and the significance was considered to be low. It is expected that the housing and accommodation situation, basic service provision, health facilities and road infrastructure would be put under additional strain during the construction period.	No added pressure on basic services and social and economic infrastructure will occur

	Pre-Mitigation	Post Mitigation	Pre-Mitigation	Post Mitigation
Nature	Negative	Negative	N/A	N/A
Duration	Construction Period	Construction Period	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Low	Low	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Certain	Certain	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource	Medium	Medium	N/A	N/A

irreplaceability				
Mitigatability	Low	Low	N/A	N/A
Significance	Low	Low	N/A	N/A
Mitigation	▪ The client should be aware of potential demands on social and basic services created by the potential migration of workers; ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations; and ▪ The plan should be reviewed on an annual basis and where necessary updated.			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Increased number of job seekers and lead to movement of more migrant workers to the area, resulting in an increased pressure on accommodation, road infrastructure, social services, water and electricity			

5.4. Hotazel Solar PV Project Operation Phase Impacts

5.4.1. Increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply

Table 5.4.1.1 highlights the impact on the increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply during construction.

Table 5.4.1.1: Impact on the increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply

	Preferred Alternative		No Go Alternative	
Short description	Increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply		The no-go alternative represents the current status of the environment, including the socio-economic situation	
Overview	The proposed Hotazel Solar PV project will be able to contribute to supplying the demand for energy. South Africa relies primarily on coal generated electricity and informal and rural households with no electricity make use of wood or gas, adding to the province's harmful emissions. A review of the applicable national and provincial RE policies and strategies revealed that the development and advancement of renewable energy sources is supported within these spheres of government. Reliable, i.e. uninterrupted, supply of electricity to the country is one of the prerequisites for development and economic growth as businesses cannot function without electricity, while the quality of social services without access to electricity is poor.		No increase in the generation capacity in the province as well as the no advancement of the RE sector in achieving long term, sustainable supply will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Certain	Certain	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	High	High	N/A	N/A
Mitigatability	Low	Low	N/A	N/A
Significance	High	High	N/A	N/A
Mitigation	▪ None foreseen at this stage			

Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply.

5.4.2. Sustainable increase in production and GDP-R of the national and local economies through operation and maintenance activities

The impacts on GDP during construction would only be temporary whereas the impacts during operation would be long-term. Table 5.4.2.1 indicates the direct net regional economic gain in production and GDP during the operation of the Hotazel Solar PV project.

Table 5.4.2.1: Impact on Production and GDP (Operation)

Impact on:	Direct (operation)
Production (@ 2016 R-value)	R112 million
GGP (@ 2016 R-value)	R69 million

Table 5.4.2.2 highlights the Increase in production and GDP-R of the national and local economies due to project capital expenditure during construction.

Table 5.4.2.2: Sustainable increase in production and GDP-R of the national and local economies through operation and maintenance activities

	Preferred Alternative		No Go Alternative	
Short description	Sustainable increase in production and GDP-R of the national and local economies through operation and maintenance activities		The no-go alternative represents the current status of the environment, including the socio-economic situation	
Overview	Production and consumption induced multiplier effects of the project are relatively small compared to conventional electricity generating industries. This is because the energy source used to produce electricity by the proposed photovoltaic facility is free, unlike in conventional power stations where coal and transportation thereof comprise a significant portion of operating expenditure. It is because of the free energy source that the facility is a highly attractive business venture.		No sustainable increase in production and GDP-R of the national and local economies through operation and maintenance activities will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Certain	Certain	N/A	N/A
Reversibility	Irreversible	Irreversible	N/A	N/A
Resource irreplaceability	High	High	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	High	High	N/A	N/A
Mitigation	▪ The operator of the proposed development should be encouraged to procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy as far as possible.			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved			

	by government then there would be: ▪ Improved energy supply in the country. ▪ Reduced carbon emissions in generation of electricity. ▪ If other renewable energy projects are established around the SLM area, sufficient economies of scale could be created to establish new businesses in the local economies that would supply goods and services required for the operation and maintenance of the facilities that cannot be acquired in the area currently. It is envisaged that this would contribute to the local economies' growth and development.

5.4.3. Creation of long-term employment in local and national economies through operation and maintenance activities

The impacts on employment during construction would only be temporary whereas the impacts during operation would be long-term. Table 5.4.3.1 indicates the number of jobs that will be created during construction of the proposed development.

Table 5.4.3.1: Impact on Employment (Operation)

Impact on:	Direct (construction)	Indirect (suppliers)	Induced (salaries and wages)	Total
Jobs	50	150	93	293

Table 5.4.3.2 highlights the impact on the creation of temporary employment in the local communities and elsewhere in the country during operation.

Table 5.4.3.2: Creation of long-term employment in local and national economies through operation and maintenance activities

	Preferred Alternative		No Go Alternative	
Short description	Creation of long-term employment in local and national economies through operation and maintenance activities		The no-go alternative represents the current status of the environment, including the socio-economic situation	
Overview	The Hotazel Solar PV project will create 50 employment positions that will be retained for the project life cycle. In addition to direct employment opportunities created through the facility, approximately 242 jobs will be created through indirect and induced effects. This number is small compared to the number of jobs to be created during construction. Nevertheless, the former are long-term jobs and ensure that affected households have sustainable income over the project life cycle. Overall, the proposed Hotazel Solar PV project will create and support about 47 jobs in Hotazel and the rest of the Province.		No creation of long-term employment in local and national economies through operation and maintenance activities would occur	
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Low	Low	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	High	High	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Low	Low	N/A	N/A
Mitigation	▪ Where possible, local labour should be considered for employment to increase the positive impact of the local economy ▪ Local Small and Medium Enterprises should be approached to investigate the opportunities for supplying inputs			

	required for the maintenance and operation of the facility, as far as feasible.
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Improved living standards of the directly and indirectly affected households.

5.4.4. Skills development due to the creation of new sustainable employment opportunities

Table 5.4.4.1 highlights the impact of skills development due to the creation of new sustainable employment opportunities during operation.

Table 5.4.4.1: Skills development due to the creation of new sustainable employment opportunities

	Preferred Alternative		No Go Alternative	
Short description	Skills development due to the creation of new sustainable employment opportunities		The no-go alternative represents the current status of the environment, including the socio-economic situation.	
Overview	The establishment and operation of the proposed development, could result in improved skills among due to on the job training. It should, however, be noted that most of the jobs required to support operations of the development are unskilled and semi-skilled jobs that do not present significant opportunities for skills transfer (i.e. panel cleaners and security personnel). Nonetheless, most of the required skills during the operational phase could be taught to staff through day-to-day operations if required.		No skills development due to the creation of new sustainable employment opportunities will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Low	Low	N/A	N/A
Probability	Probable	Definite	N/A	N/A
Confidence	Sure	Certain	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Medium	Medium	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Low	Low	N/A	N/A
Mitigation	▪ None foreseen at this stage			
Cumulative Impacts	There are numerous renewable energy facilities within the study area. It is highly likely there would be an increase in the development of new skills and expertise in the country to support the PV Solar Energy industry development.			

5.4.5. Improved standard of living of households directly or indirectly benefiting from created employment opportunities

Table 5.4.5.1 highlights the impact on improved standard of living of households directly or indirectly benefiting from created employment opportunities.

Table 5.4.5.1: Impact on improved standard of living of households directly or indirectly benefiting from created employment opportunities

	Preferred Alternative	No Go Alternative
Short description	Improved standard of living of households directly or indirectly benefiting from created employment opportunities	The no-go alternative represents the current status of the environment, including the socio-economic situation.
Overview	The proposed development will create employment positions throughout the country which will generate	No improved standard of living of households directly or indirectly benefiting from created employment

	personal income and will be sustained for the entire duration of the project's lifespan. The sustainable income generated because of the proposed developments' operation will positively affect the nutrition, living conditions, access to better health care, access to more options regarding education, and improved ability to make economic choices		opportunities will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Certain	N/A	N/A
Reversibility	Irreversible	Irreversible	N/A	N/A
Resource irreplaceability	Low	Low	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Low	Low to Medium	N/A	N/A
Mitigation	▪ Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy. ▪ As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Improved productivity of workers. ▪ Improved health and living conditions of the affected households. Development of new skills and expertise in the country to support the Solar Energy industry development.			

5.4.6. Impact on increase in government revenue stream

Table 5.4.6.1 highlights the impact on the increase in the government revenue stream during operation.

Table 5.4.6.1: Impact on increase in government revenue stream

	Preferred Alternative		**No Go Alternative**	
Short description	The increase in government revenue stream		The no-go alternative represents the current status of the environment, including the socio-economic situation.	
Overview	The Hotazel Solar PV project would contribute to local government through payments for utilities used in the operation of the facility. The revenue derived by the project during its operations, as well as payment of salaries and wages to the permanent employees will contribute to the national fiscus. Although it is impossible to trace exactly how such revenue is allocated, it all adds to the government revenue stream that is then spent on providing public goods and services.		There would be no increase in government revenue stream will occur	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Low	Low	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Irreversible	Irreversible	N/A	N/A

Resource irreplaceability	Medium	Medium	N/A	N/A
Mitigatability	Low	Low	N/A	N/A
Significance	Medium	Medium	N/A	N/A
Mitigation	▪ None foreseen at this stage			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Increase the value of taxes collected. ▪ Lower government debt and servicing costs.			

5.4.7. Impact on investment in the local communities and economic development projects as part of a Social Economic Development and Enterprise Development Plan

Table 5.4.7.1 highlights the impact investment in local communities and economic development projects as part of a Social Economic Development and Enterprise Development Plan

Table 5.4.7.1: Impact on investment in local communities and economic development projects as part of a Social Economic Development and Enterprise Development Plan

	Preferred Alternative		No Go Alternative	
Short description	Investment in local communities and economic development projects as part of a Social Economic Development and Enterprise Development Plan		The no-go alternative represents the current status of the environment, including the socio-economic situation.	
Overview	The project will form part of the Independent Power Producer Procurement Programme; that implies that the operating company allocates a certain percentage of the project's revenue towards community development. Although the exact percentage to be allocated towards socio-economic responsibilities is not yet known, regardless of the amount it will spent on uplifting the lives of local communities throughout the entire operational period.		The project will not form part of the Independent Power Producer Procurement Programme; that implies that the operating company will not allocate a certain percentage of the project's revenue towards community development.	
Assessment				
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	N/A	N/A
Extent	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	N/A	N/A
Probability	Probable	Probable	N/A	N/A
Confidence	Sure	Sure	N/A	N/A
Reversibility	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Medium	Medium	N/A	N/A
Mitigatability	Medium	Medium	N/A	N/A
Significance	Medium	Medium	N/A	N/A
Mitigation	▪ None foreseen at this stage			
Cumulative Impacts	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Decreased levels of poverty ▪ Improved standards of living			

5.5. Transmission Line Construction Phase Impacts

5.5.1. Increase in production and GDP-R of the national and local economies due to project capital expenditure

Table 5.5.1.1 highlights the impact on the increase in production and GDP-R of the national and local economies due to project capital expenditure during construction.

Table 5.5.1.1: Increase in production and GDP-R of the national and local economies due to project capital expenditure

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	▪ A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤110 monopole pylons ▪ ≤12km long and 4m wide service track		▪ A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤140 monopole pylons ▪ ≤15km long and 4m service track		▪ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ▪ Servitude width 35m per line. ▪ ≤60 monopole pylons (i.e. ≤120 pylons in total) ▪ ≤6km long and 4m service track per line		No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.	
Overview	The biggest effects on production and GDP stimulated during construction activities will be created through the multiplier effects, specifically through production and consumption induced effects. The former refers to the impacts generated along backward linkages when the project creates the demand for goods and services required for construction, which in turn stimulates the business sales of the suppliers of inputs that are required to produce these goods and services. The latter refers to effects of household spending, which is derived from an increase in salaries and wages directly and indirectly stimulated by the project's expenditure. Besides the value added that could be generated by the local construction businesses through sub-contracting agreements and employment of freelancers, the sectors that are expected to benefit the most from the production and consumption induced effects are tertiary services such as trade, accommodation, transport services, personal services, real estate, and insurance.						No effects on production and GDP stimulated during construction activities will be created.	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	Positive	Positive	Positive	Positive	N/A	N/A
Duration	Construction period	Construction period	Construction period	Construction period	Construction period	Construction period	N/A	N/A
Extent	Regional	Regional	Regional	Regional	Regional	Regional	N/A	N/A
Magnitude	Medium	Medium	Medium	Medium	Low	Low	N/A	N/A
Probability	Definite	Definite	Definite	Definite	Definite	Definite	N/A	N/A
Confidence	Certain	Certain	Certain	Certain	Certain	Certain	N/A	N/A
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	N/A	N/A
Resource	High	High	High	High	High	High	N/A	N/A

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
irreplaceability								
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A
Significance	Medium	Medium	Medium	Medium	Low	Low	N/A	N/A
Mitigation	▪ None foreseen at this stage							
Cumulative Impact assessment	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Decreased levels of poverty ▪ Improved standards of living							
Conclusion:	Umtu transmission line represents the highest capital expenditures and therefore investment which will benefit the socio-economic benefits of the project.							

5.5.2. Creation of temporary employment in the local communities and elsewhere in the country

Table 5.5.2.2 highlights the impact on the creation of temporary employment in the local communities and elsewhere in the country during construction.

Table 5.5.2.2: Creation of temporary employment in the local communities and elsewhere in the country

	Hotazel TX line	Umtu TX line	LILO TX line	No Go Alternative
Short description	▪ A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤110 monopole pylons ▪ ≤12km long and 4m wide service track	▪ A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤140 monopole pylons ▪ ≤15km long and 4m service track	▪ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ▪ Servitude width 35m per line. ▪ ≤60 monopole pylons (i.e. ≤120 pylons in total) ▪ ≤6km long and 4m service track per line	No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.
Overview	In addition to direct jobs, jobs will also be created indirectly (among suppliers) and induced jobs will be created through greater income circulation. Due to the nature of work that needs to be performed, a significant amount of employment opportunities exists for unskilled and semi-skilled workers. Amongst others, construction involves activities that require unskilled labour for which locals could be employed. These include clearance of vegetation, digging trial	In addition to direct jobs, jobs will also be created indirectly (among suppliers) and induced jobs will be created through greater income circulation. Due to the nature of work that needs to be performed, a significant amount of employment opportunities exists for unskilled and semi-skilled workers. Amongst others, construction involves activities that require unskilled labour for which locals could be employed. These include clearance of vegetation, digging trial pits at main foundation	In addition to direct jobs, jobs will also be created indirectly (among suppliers) and induced jobs will be created through greater income circulation. Due to the nature of work that needs to be performed, a significant amount of employment opportunities exists for unskilled and semi-skilled workers. Amongst others, construction involves activities that require unskilled labour for which locals could be employed. These include clearance of vegetation, digging trial pits at main foundation	No employment opportunities during construction activities will be created.

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
	pits at main foundation points, excavation of foundation where access is poor, mixing of concrete where access is poor, rehabilitation of land, site security, and other activities requiring labourers'.		points, excavation of foundation where access is poor, mixing of concrete where access is poor, rehabilitation of land, site security, and other activities requiring labourers'.		points, excavation of foundation where access is poor, mixing of concrete where access is poor, rehabilitation of land, site security, and other activities requiring labourers'.			
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	Positive	Positive	Positive	Positive	N/A	N/A
Duration	Construction period	Construction period	Construction period	Construction period	Construction period	Construction period	N/A	N/A
Extent	Regional	Regional	Regional	Regional	Regional	Regional	N/A	N/A
Magnitude	Low	Low	Low	Low	Low	Low	N/A	N/A
Probability	Probable	Probable	Probable	Probable	Probable	Probable	N/A	N/A
Confidence	Certain	Certain	Certain	Certain	Certain	Certain	N/A	N/A
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A
Significance	Low	Low	Low	Low	Low	Low	N/A	N/A
Mitigation	▪ Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for ▪ Establish a local skills desk to determine the potential skills that could be sourced in the area. ▪ Recruit local labour as far as feasible. ▪ Employ labour-intensive methods in construction where feasible. ▪ Sub-contract to local construction companies where possible. ▪ Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering and other services to the construction crew.							
Cumulative Impact assessment	Considering the potential for solar projects in JTGDM and the Northern Cape Province in general and that there are numerous renewable energy facilities within the study area. It is highly likely that if the proposed projects are approved by government then there would be: ▪ Improved labour productivity and employability of construction workers for similar projects.							
Conclusion:	Umtu transmission line represents as it would represent the highest capital expenditures and result in more employment opportunities than Hotazel and LILO transmission line alternatives.							

5.5.3. Affected Landowners and Households

Table 5.5.3.1 highlights the impact on affected land owners and households during construction.

Table 5.5.3.1: Affected Land Owners and Households

	Hotazel TX line	Umtu TX line	LILO TX line	No Go Alternative
Short description	▪ A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed	▪ A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed	▪ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will	No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power

	▪ Servitude width 35m ▪ ≤110 monopole pylons ▪ ≤12km long and 4m wide service track		▪ Servitude width 35m ▪ ≤140 monopole pylons ▪ ≤15km long and 4m service track		be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ▪ Servitude width 35m per line. ▪ ≤60 monopole pylons (i.e. ≤120 pylons in total) ▪ ≤6km long and 4m service track per line		generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.	
Overview	Construction activities on the servitude will imply outside people accessing the site temporarily. Movement of vehicles and people on the properties could lead to damages to the property, loss of livestock due to accidents or theft, and loss of personal belongings due to burglaries.		Construction activities on the servitude will imply outside people accessing the site temporarily. Movement of vehicles and people on the properties could lead to damages to the property, loss of livestock due to accidents or theft, and loss of personal belongings due to burglaries.		Construction activities on the servitude will imply outside people accessing the site temporarily. Movement of vehicles and people on the properties could lead to damages to the property, loss of livestock due to accidents or theft, and loss of personal belongings due to burglaries.		No impact on land owners and households during construction activities	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Positive	Negative	Positive	Negative	Positive	N/A	N/A
Duration	Construction period	Construction period	Construction period	Construction period	Construction period	Construction period	N/A	N/A
Extent	Site Specific	Site Specific	Site Specific	Site Specific	Site Specific	Site Specific	N/A	N/A
Magnitude	Low	Low	Low	Low	Low	Low	N/A	N/A
Probability	Probable	Probable	Probable	Probable	Probable	Probable	N/A	N/A
Confidence	Certain	Certain	Certain	Certain	Certain	Certain	N/A	N/A
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Low	Low	Low	Low	Low	Low	N/A	N/A
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A
Significance	Low	Low	Low	Low	Low	Low	N/A	N/A
Mitigation	▪ The landowner in agreeing to the powerline and/or Solar park, would receive compensation. ▪ Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock. ▪ Ensure that maintenance construction workers do not damage property or inflict other losses to the land owners and households residing on the farms. ▪ Negotiate terms and conditions that would guide construction activities/maintenance activities on the properties, as well as behaviour and conduct of the construction/maintenance crew. ▪ A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all construction/maintenance vehicles and construction/maintenance crew; the chosen route should follow the existing roads as far as feasible. ▪ Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property. ▪ Construction vehicles are to follow a safe speed and should mind animals inhibiting the farms. ▪ Construction activity should be undertaken only during working hours.							

Cumulative Impact assessment	▪ Non-foreseen at this stage
Conclusion:	LILO transmission line is recommended as it impacts the least number of farms.

5.6. Transmission Line Operation Phase Activities

5.6.1. Supply of Electricity

Table 5.6.1.1 highlights the impact on the supply of electricity during operation.

Table 5.6.1.1: Supply of Electricity

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	▪ A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤110 monopole pylons ▪ ≤12km long and 4m wide service track		▪ A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤140 monopole pylons ▪ ≤15km long and 4m service track		▪ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ▪ Servitude width 35m per line. ▪ ≤60 monopole pylons (i.e. ≤120 pylons in total) ▪ ≤6km long and 4m service track per line		No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.	
Overview	The proposed transmission line is meant to strengthen the transmission network, meeting growing demand for electricity in the area and improving service quality and reliability. Reliable, i.e. uninterrupted, supply of electricity to the country is one of the prerequisites for development and economic growth as businesses cannot function without electricity, while the quality of social services such as clinics and/ or hospitals, without access to electricity is poor.		The proposed transmission line is meant to strengthen the transmission network, meeting growing demand for electricity in the area and improving service quality and reliability. Reliable, i.e. uninterrupted, supply of electricity to the country is one of the prerequisites for development and economic growth as businesses cannot function without electricity, while the quality of social services such as clinics and/ or hospitals, without access to electricity is poor.		The proposed transmission line is meant to strengthen the transmission network, meeting growing demand for electricity in the area and improving service quality and reliability. Reliable, i.e. uninterrupted, supply of electricity to the country is one of the prerequisites for development and economic growth as businesses cannot function without electricity, while the quality of social services such as clinics and/ or hospitals, without access to electricity is poor.		No supply of electricity into the grid will occur	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Positive	Positive	Positive	Positive	Positive	Positive	N/A	N/A
Duration	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term	N/A	N/A

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Extent	Regional	Regional	Regional	Regional	Regional	Regional	N/A	N/A
Magnitude	High	High	High	High	High	High	N/A	N/A
Probability	Definite	Definite	Definite	Definite	Definite	Definite	N/A	N/A
Confidence	Certain	Certain	Certain	Certain	Certain	Certain	N/A	N/A
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A
Mitigatability	Low	Low	Low	Low	Low	Low	N/A	N/A
Significance	High	High	High	High	High	High	N/A	N/A
Mitigation	▪ None foreseen at this stage							
Cumulative Impact assessment	▪ None foreseen at this stage							
Conclusion:	No preference between transmission line alternatives as they all would supply electricity into the grid.							

5.6.2. Affected Landowners and Households

Table 5.6.2.2 highlights the impact on affected land owners and households during operation.

Table 5.6.2.2: Affected Land Owners and Households

	Hotazel TX line		Umtu TX line		LILO TX line		No Go Alternative	
Short description	▪ A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤110 monopole pylons ▪ ≤12km long and 4m wide service track		▪ A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed ▪ Servitude width 35m ▪ ≤140 monopole pylons ▪ ≤15km long and 4m service track		▪ A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. ▪ Servitude width 35m per line. ▪ ≤60 monopole pylons (i.e. ≤120 pylons in total) ▪ ≤6km long and 4m service track per line		No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.	
Overview	The movement of the servitude maintenance crew could be difficult to control and could lead to damages to the property or loss of assets. These impacts can be successfully mitigated, especially if there is a formal agreement signed between the maintenance company and the property owners that would protect the rights of the parties.		The movement of the servitude maintenance crew could be difficult to control and could lead to damages to the property or loss of assets. These impacts can be successfully mitigated, especially if there is a formal agreement signed between the maintenance company and the property owners that would protect the rights of the parties.		The movement of the servitude maintenance crew could be difficult to control and could lead to damages to the property or loss of assets. These impacts can be successfully mitigated, especially if there is a formal agreement signed between the maintenance company and the property owners that would protect the rights of the parties.		No impact on land owners and households during operation activities	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Positive	Negative	Positive	Negative	Positive	N/A	N/A
Duration	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term	N/A	N/A
Extent	Site Specific	Site Specific	Site Specific	Site Specific	Site Specific	Site Specific	N/A	N/A
Magnitude	Low	Low	Low	Low	Low	Low	N/A	N/A
Probability	Probable	Probable	Probable	Probable	Probable	Probable	N/A	N/A
Confidence	Certain	Certain	Certain	Certain	Certain	Certain	N/A	N/A
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	N/A	N/A
Resource irreplaceability	Low	Low	Low	Low	Low	Low	N/A	N/A
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	N/A	N/A
Significance	Low	Low	Low	Low	Low	Low	N/A	N/A
Mitigation	▪ The landowner in agreeing to the powerline and/or Solar park, would receive compensation.							

	▪ Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock. ▪ Ensure that maintenance workers do not damage property or inflict other losses to the land owners and households residing on the farms. ▪ Negotiate terms and conditions that would guide maintenance activities on the properties, as well as behaviour and conduct of the maintenance crew. ▪ A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all maintenance vehicles and maintenance crew; the chosen route should follow the existing roads as far as feasible. ▪ Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property. ▪ Maintenance vehicles are to follow a safe speed and should mind animals inhibiting the farms. ▪ Maintenance activity should be undertaken only during working hours.
Cumulative Impact assessment	▪ Non-foreseen at this stage
Conclusion:	LILO transmission line is recommended as it impacts the least number of farms.

5.7. Decommissioning Phase

Upon the expiry of the Hotazel Solar PV project lifespan, the facility may be decommissioned, if the contract is not extended or an interested third party does not purchase the project, or if the contract is renewed and continues subject to some refurbishment or upgraded / expanded or sold as a going concern to a third-party. Ideally the facility would be upgraded to maintain and prolong the lifespan of the facility. If the facility is decommissioned, the land will be rehabilitated to return it to pre-project conditions. This also means that all impacts whether positive or negative, which take place during the operational phase will cease to exist. At the same time spending on the disassembly of the components and rehabilitation of land will increase the demand for construction services and other industries, thus stimulating economic activity in the local area, albeit over a temporary period.

Socio-economic impacts stimulated during the decommissioning phase are expected to be similar to those that took place during the construction phase. They will also be temporary in nature, but most likely will take a much shorter time than the construction phase. They will also be associated with some expenditure, although it will be considerably less than the investment required during the development phase.

5.8. Conclusion

The Hotazel Solar PV project will have various impacts both positive and negative as discussed in previous sections. The purpose was to identify possible impacts that could occur because of activities which will take place during both the construction and operational phase the Hotazel Solar PV project and the transmission lines (Alternatives 1 to 3). From this section, it is evident that the proposed development will result in a significant growth in GDP of the regional economy (not as significant with the transmission lines) and decrease the unemployment numbers of the local community. This will further result in the community being able to obtain jobs and in return can earn an income, which would place the community in a position to provide for their basic needs.

6: Conclusion

Urban-Econ Development Economists has been appointed by Aurecon South Africa (Pty) Ltd (Aurecon) on behalf of juwi Renewable Energies (Pty) Ltd to undertake a Socio-Economic Impact Study for a proposed solar park. The Hotazel Solar Park involves the construction and operation of a ≤200MW solar PV park on the Farm Hotazel Annex Langdon (F278/0), transmission lines and associated infrastructure, near Hotazel, in the JMLM, in the JTGDM, in the NC.

The proposed Hotazel Solar Park is aligned with the national, regional, and local policies. The development of renewable energy infrastructure, particularly solar systems, within the JMLM is considerably recognised as an important facet concerning sustainable development in South Africa. Given the reviewed documentation, it is evident that no fatal flaws from an economic policy perspective exist in the implementation of the Hotazel Solar Project.

The population in Hotazel is approximately 2,000 people with most the population in these study areas having access to the minimum standard levels of electricity, water and sanitation. Additionally, only 13.9% of the population in the JMLM is employed, while 24.9% is unemployed and 61.2% is not economically active. In Hotazel, two thirds of the population (66%) is employed in Hotazel, while 3.6% is unemployed and 30.4% is not economically active. From a socio-economic perspective, the study area is highly sensitive to the proposed Hotazel Solar Park and the Park would have a positive impact.

The socio-economic impact analysis indicates that the construction of the proposed Hotazel Solar Park and associated transmission lines would have an overall positive impact. This impact may be maximised through the employment of local workers. Once construction is completed, the economic stimulus of the expenditure will be lost, as well as employment opportunities created during this phase would cease to exist. The establishment of the proposed Hotazel Solar Park and associated transmission lines would assist in improving the supply of electricity to the region, as well as the country which would allow it to continue developing. However, some potential negative impacts could result, such as increased pressure on social and economic infrastructure; potential change in demographics in the area due to an influx of workers and job seekers[33] as well as the effect on land owners and households. Through with various mitigation measures these negative impacts can be minimised.

The project investment estimates used in the SAM modelling were conservative estimates taken in the early stages of the impact assessment process and updated estimates put the potential capital expenditure 73% higher than these estimates with 60% still being spent within South Africa. This increase in investment potential will not result in a major change in impact significance ratings and will not change any of the significance rating categories allocated to specific impacts assessed in this report.

Indicated in the tables below is an overview of the impact assessment conducted on the Hotazel Solar Park and associated transmission line options.

Table 6.1: Hotazel Solar Park Impacts

Impact	Pre-Mitigation	Post Mitigation
Construction Phase		
Increase in production and GDP-R of the national and local economies due to project capital expenditure	High Positive	High Positive
Creation of temporary employment in the local communities and elsewhere in the country	Medium Positive	High Positive
Skills development due to the creation of new employment opportunities	Medium Positive	High Positive
Improved standard of living of households directly or indirectly benefiting from created employment opportunities	Medium Positive	Medium Positive

[33] Change in the demographics in an area due to an influx of workers may occur (low probability)

Impact	Pre-Mitigation	Post Mitigation
Increase in government revenue due to investment	Medium Positive	Medium Positive
Change in demographics of the area due to influx of workers and job seekers	Low Negative	Low Negative
Added pressure on basic services and social and economic infrastructure	Low Negative	Low Negative
Operation Phase		
Increase in generation capacity in the province as well as the advancement of the RE sector in achieving long term, sustainable supply	High Positive	High Positive
Sustainable increase in production and GDP-R of the national and local economies through operation and maintenance activities	High Positive	High Positive
Creation of long-term employment in local and national economies through operation and maintenance activities	Low Positive	Low Positive
Skills development due to the creation of new sustainable employment opportunities	Low Positive	Low Positive
Improved standard of living of households directly or indirectly benefiting from created employment opportunities	Low Positive	Low Positive
Increase in government revenue stream	Medium Positive	Medium Positive
Investment in the local communities and economic development projects as part of a Social Economic Development and Enterprise Development Plan	Medium Positive	Medium Positive

Table 6.2: Transmission Line Impacts

Impact	Pre-Mitigation	Post Mitigation
Hotazel		
Construction Phase		
Increase in production and GDP-R of the national and local economies due to project capital expenditure	Medium Positive	Medium Positive
Creation of temporary employment in the local communities and elsewhere in the country	Low Positive	Low Positive
Affected land owners and households due to onsite activity	Low Negative	Low Positive
Operation Phase		
Supply of Electricity	High Positive	High Positive
Affected land owners and households due to onsite activity	Low Negative	Low Positive
Umtu		
Construction Phase		
Increase in production and GDP-R of the national and local economies due to project capital expenditure	Medium Positive	Medium Positive
Creation of temporary employment in the local communities and elsewhere in the country	Low Positive	Low Positive
Affected land owners and households due to onsite activity	Low Negative	Low Positive
Operation Phase		
Supply of Electricity	High Positive	High Positive
Affected land owners and households due to onsite activity	Low Negative	Low Positive
LILO		
Construction Phase		
Increase in production and GDP-R of the national and local economies due to project capital expenditure	Low Positive	Low Positive
Creation of temporary employment in the local communities and elsewhere in the country	Low Positive	Low Positive
Affected land owners and households due to onsite activity	Low Negative	Low Positive
Operation Phase		
Supply of Electricity	High Positive	High Positive
Affected land owners and households due to onsite activity	Low Negative	Low Positive

The preferred option is the **Umtu** transmission line as due to its length it would provide the opportunity for the most employment opportunities and have a greater impact on GDP and production in the economy. However, due to its length when compared to Hotazel and LILO transmission lines, more farms will be impacted on. Landowners will be compensated for construction and access to predetermined transmission line routes. However, land owners should be adequately compensated for any potential unforeseen damage to property or loss of assets such as livestock due the movement of people on the land owners site.

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APPENDIX D.8:

Traffic

aurecon

Hotazel Solar Park

DESKTOP TRANSPORT AND TRAFFIC IMPACT ASSESSMENT

Reference: 112667

Prepared for: Hotazel Solar Park (Pty) Ltd.

Revision: 3

22 March 2017

Document control record

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Document control						aurecon
Report title		DESKTOP TRANSPORT AND TRAFFIC IMPACT ASSESSMENT				
Document ID		JUWI\HOTAZEL\TTMP	**Phase number**		112667	
File path		P:\Projects_RSK Projects\PRCPTTRA01\Renewable Energy\Hotazel Solar Park\Hotazel Transport Study\Hotazel Solar Park_R1A.docx				
Client		Hotazel Solar Park (Pty) Ltd.	**Client contact**		**Nazley Towfie**	
Rev	**Date**	**Revision details/status**	**Prepared by**	**Author**	**Verifier**	**Approver**
1	**9 December 2016**	First Draft	SHL	SHL	HS	JHBC
2	**9 March 2017**	Revised with Client Comments	SHL	SHL	HS	JHBC
3	**22 March 2017**	Revised with Peer review Comments	SHL	SHL	HS	JHBC
Current Revision		**3**				

Approval			
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Hotazel Solar Park

Date 22 March 2017
Reference 112667
Revision 3

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Please Note: The DEA requested that all specialist's studies undertaken in-house by Aurecon be subjected to an independent peer review. The peer review for this report was undertaken by Liezl du Plooy of DECA and can be found appended to the main EIAr, following this report. This report has been updated in response to the peer reviewer's comments, where necessary.

Contents

Figures

Tables

1 Introduction

Hotazel Solar Farm 1 (Pty) Ltd, a wholly owned subsidiary of juwi Renewable Energies (Pty) Ltd, proposes the construction and operation of a 200MWac solar PV farm on the Farm Hotazel Annex Langdon (F278/0) and associated infrastructure, near Hotazel, in the Joe Morolong Local Municipality, in the Northern Cape Province, collectively referred to as the Hotazel Solar Park. juwi appointed Aurecon South Africa (Pty) Ltd (Aurecon) as the independent environmental consultant to undertake the requisite environmental authorisation process in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA). Supplementary to the appointment, Aurecon were also appointed to undertake a desktop Transport and Traffic Impact Assessment. The project is situated approximately 5km South-East of the town of Hotazel, along the R31 in the Northern Cape Province. The site location is indicated in Figure 1 below:

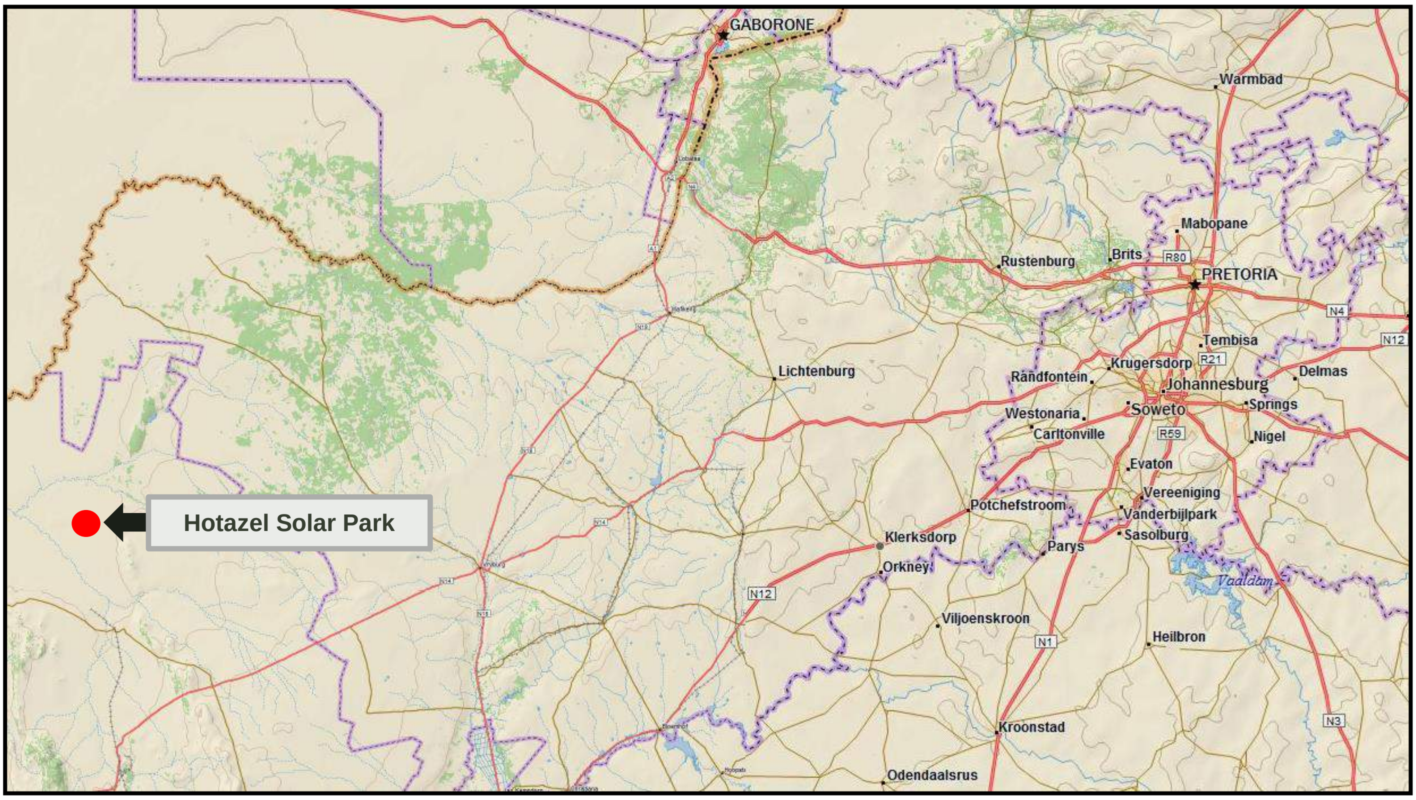


Figure 1: Locality Plan - Hotazel Solar Park

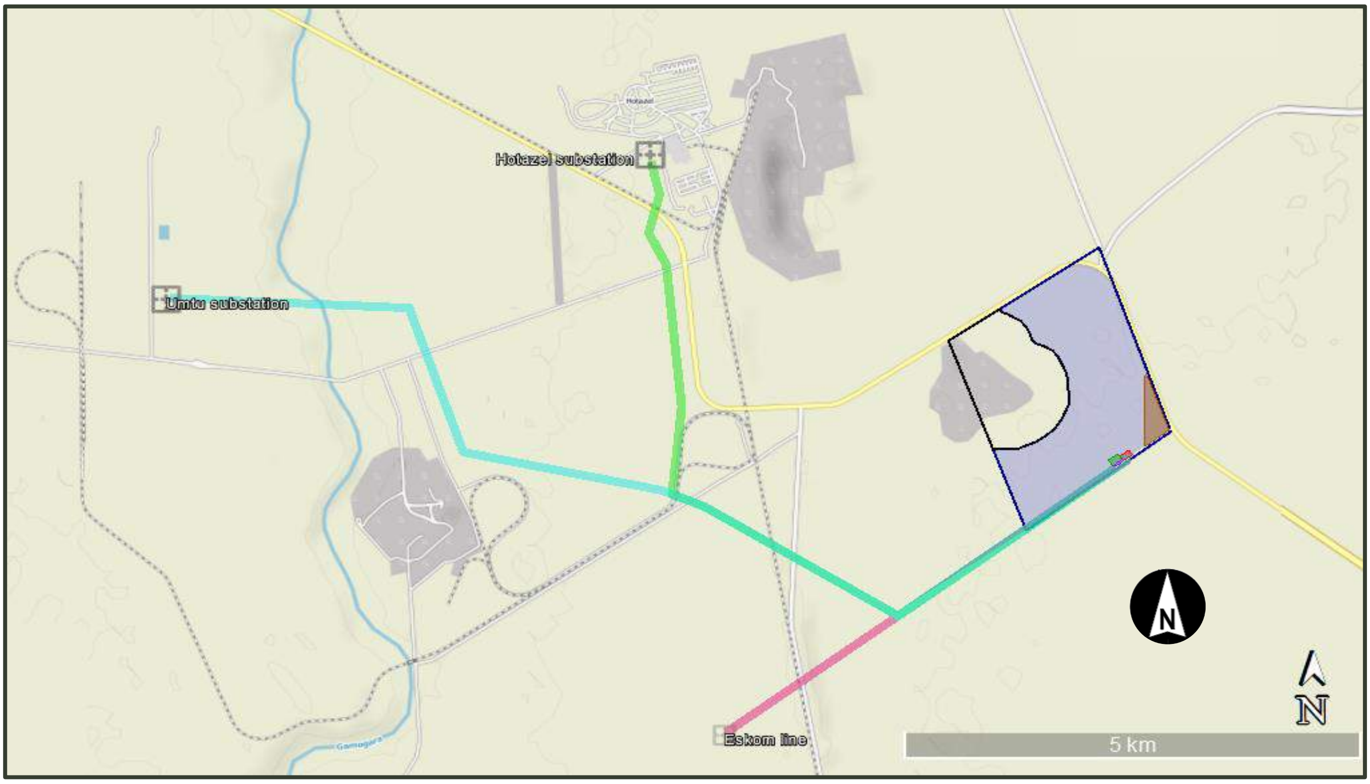


Figure 2: Key Plan - Proposed Hotazel Solar Park & Associated Grid Connection Options

The proposed Solar PV facility will be developed to a 200MWac capacity with 100MWh battery storage facility and associated grid connections. This plant is to comprise of the following components and routes options:

Table 1: Hotazel Solar Farm 1 Project Description & Alternatives Summary

Component	Dimensions
• **Solar Farm:** A 200MWac solar facility with PV panels on steel mountings with single axis tracking mechanisms and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters.	• ≤250ha solar panels, service roads, cables runs, and other ancillaries and some open space)
• **Battery Storage System:** A ≤100MWh battery storage facility for grid storage of maximum height 8m and a maximum of 1120 cubic meters of batteries (dangerous goods) and associated operational, safety and control infrastructure.	• ≤1ha • ≤8m building height • ≤1120m^3 of batteries
• **Access road:** A ≤1.9km long, ≥8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.	• ≤1.9km long, ≤8m wide • ≤1.52ha
• **Service roads:** ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	• ≤17kms, 4m wide gravel roads • Footprint included in solar farm footprint (≤6.8ha)
• **Collector substation:** ≤1ha collector substation to receive, convert and step up electricity from the PV facility to the 132kV grid suitable supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32m telecommunications tower (lattice or monopole type) will be established in the substation area.	• ≤1ha • Substation infrastructure up to 10m height • 32m telecommunications tower
• **O&M Area**: o ≤1ha hectare O&M laydown area (near / adjacent substation); o Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; o Workshops, storage areas for materials and spare parts;	• ≤1ha • Single storey office, ablutions, workshop complex (4m height)

Component	Dimensions
o Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day for 15 months during rest of construction period; ~20kl/day during operation); o Septic tanks and sewer lines to service ablution facilities; and o Central Waste collection and storage area.	
• **Other Infrastructure:** o Perimeter fencing and internal security fencing and gates as required. o Access control gate and guard house on access road; o ≤3.5km length of small diameter water supply pipeline connecting existing boreholes to storage.	• 1.8m high jackal fence with barbed wire
• **Temporary Infrastructure:** o A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.	• ≤4ha (Temporary)
Total development footprint	**≤300ha**[1]

Table 2: Hotazel Solar Farm Transmission Corridors Project Alternatives

Transmission line C1: Hotazel substation • A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed • Servitude width 35m • ≤110monopole pylons • ≤12km long and 4m wide service track
Transmission line C2: Umtu substation • A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed • Servitude width 35m • ≤140 monopole pylons • ≤15km long and 4m service track
Transmission Line C3: LILO connection • A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site. • Servitude width 35m per line. • ≤60 monopole pylons (i.e. ≤120 pylons in total) • ≤6km long and 4m service track per line
Alternative C4: NO GO • No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

The scope of this study is to assess the Transport and Traffic Impact during the development of the proposed Hotazel Solar Park. In order to ensure that the requirements from DEA for the relevant Environmental Assessment Process are met, the following will be included:

- Assessment of the access road entry to the site;
- Determining the access freight routes between points of delivery and departure for the components,
- Determining traffic volumes generated through the transportation of equipment and personnel;
- Proposing measures to minimise impact on local commuters;
- Considering the impact of the development on the existing road infrastructure and indicate what maintenance measures may be required during construction and decommissioning of the facility;

[1] Note that the development footprint is estimated at 300ha, the percentage land covered by building and infrastructure is likely to be 80 -90% of the 300ha. These unused spaces arise from solar arrays needing to be orientated in particular direction which is optimised according to sun and not property boundaries, which leaves some unusable spaces. Also space needs to be left around some buildings and facilities. While these areas will not be developed, they are considered transformed as they no longer render all ecosystem services as they would have if not enclosed by the development, thus they are included in the development footprint.

- Confirming the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites;
- Confirming freight and transport requirements during construction and maintenance phases;
- Determining origins and destinations of equipment;
- Determining whether Abnormal Freight Permits will be required; and
- Proposing traffic accommodation measures during construction of the access with the Provincial Road.

2 DEFINITIONS / ASSUMPTIONS

The following assumptions are made:

- Imported elements are shipped to and transported to the site from the nearest and most practical South African Port.
- Certain elements will be transported from manufacturing centres within South Africa.
- Material for supports and road construction will be obtained locally from closest available commercial source(s).
- The largest potential load will be a single 80MVA transformer, with a payload of approximately 80t.
- Freight will be transported predominantly on surfaced roads.
- Foundations for the PV panels will ultimately be dictated by site geotechnical conditions, which may have an impact on the type of material, volume and method of transport to site. It is assumed to comprise of small driven steel piles to reduce risk of failures due to varying conditions for the developer.

3 EVALUATION OF SITE TRANSPORT

3.1 General Freight Requirements

3.1.1 Legislation

All freight transported in South Africa is regulated by the Road Traffic Act, 1996 (ACT No 93 of 1996) as amended. The applicable regulations are inter alia:

Table 3: Applicable Legislation

REGULATION	DESCRIPTION
DIMENSIONS OF VEHICLES	
221	Overall length of vehicle
222	Restriction on combination of motor vehicles
223	Overall width of vehicle
224	Overall height of vehicle and load
LOADS OF VEHICLES	
234	Permissible maximum axle massload of vehicle
235	Permissible maximum axle unit massload of vehicle
236	Permissible maximum vehicle mass
237	Permissible maximum combination mass
238	Load on tyres
239	Gross vehicle mass, gross axle massload, gross axle unit massload, gross combination mass, power to mass ratio and axle massload of driving axle to total mass ratio not to be exceeded
240	Massload carrying capacity of road
241	Massload carrying capacity of bridges
242	Distribution of axle massload and wheel massload on vehicle fitted with pneumatic tyres

Currently, the general limitations as stated in the various regulations on road freight transport are:

- Axle load limitation of 7,7t on front axle, 9,0t on single rear axles.
- Axle unit limitations are 18t for dual axle unit and 24t for three axle unit.
- Bridge formula requirements to limit concentration of loads and to regulate load distribution on the vehicle.
- Gross vehicle mass of 56t. This means a typical payload of about 30t.
- Maximum vehicle length of 22m for interlinks, 18,5m for horse and trailer and 13,5m for a single unit.
- Width limit of 2,6m.
- Height limit 4,3m.

Abnormal permits are required for vehicles exceeding these limits.

3.1.2 Solar Facility Freight

Materials and equipment transported to the site during the construction phase will comprise of:

- Building materials (concrete aggregates, cement and gravel).
- Construction equipment such as piling rigs and cranes.
- Solar panels (panels and frames).
- Transformers and cables.
- Inverters (possibly containerised) and other electrical equipment.
- Batteries and associated electrical equipment.
- Transmission line pylons and cable.

The following is anticipated:

a) Building materials comprising of concrete materials for strip footings or steel piles will be transported using conventional trucks which should adhere to legal loading limits.

b) Solar Panels and frames will probably be transported in containers using conventional heavy vehicles within the legal limits from nearest South African port. The number of loads will be a function of the capacity of the solar farm and the extent of the frames.

c) Transformers will most probably be transported by abnormal vehicles from the nearest South African port.

3.2 Traffic Statement

The traffic volumes will have three different patterns during, the construction, operational and de-commissioning stages of the project, respectively.

3.2.1 Traffic during the Construction Phase

Based on figures obtained from similar projects, it is estimated that the number of heavy vehicles per 1MW installation will be between 15 and 20 trips, depending on the site condition and foundation requirements. The total number of trips for a 200 MW plant with battery storage for <100MW would be between 3000 and 4000 heavy vehicle trips. These trips would be made over an estimated period of 18 months.

In the worst case scenario, and during the peak period of construction phase, the number of heavy vehicle trips per day will be in the order of 15 to 30 trips. The impact of this on the general traffic would therefore be negligible as the additional peak hour traffic would be at most six trips.

It is estimate that approximately 600 persons will be employed during the peak construction period and that they will most likely reside in Hotazel or Kuruman as the closest community or alternatively in a compound on site or close by. It is recommended that the majority of construction personnel are transported to and from site by means of shared transport, which most likely will have to be provided or arranged.

Assuming that busses with an average of 20 passengers will be used to transport personnel, the personnel transport will contribute to approximately 20 to 30 daily trips of which 50% is assumed to be within the traffic peak hour.

The additional peak hour trips during construction would therefore be in the order of 10 to 20 vehicles (two transporting equipment and 15 transporting construction personnel).

Access to the site will be from the R31. No traffic data is available for the roads in the area around the proposed site. However it can be assumed that traffic on the R31 is relatively low (<1500 AADT, <200 Veh/h). These assumptions are based on the current road cross section and the general associated road class characteristics as well as data interpolated from SANRAL traffic counts in the greater Vryburg area for similar class regional roads.

It can therefore be stated that the construction traffic of less than 20 vehicles during the peak hour (<10% impact) will have a negligible impact on existing traffic patterns and road safety in the project area.

3.2.2 Traffic during the Construction of Grids/Power lines

The transmission lines to be constructed during the project, connecting the solar park with the national grid system, will involve double circuit 132kV overhead power lines. The main components being the pylons, cables, connectors, and transformers. All the required components will be transported by means of general freight. Aurecon is of opinion that the impact for this construction activity on traffic patterns and road safety will be minimal and that the additional generated traffic is deemed negligible based on the expected volume of components spread over a wide area using only general freight transport vehicles.

3.2.3 Traffic during the Operational Phase

After construction, the site-generated traffic will be limited to operational and maintenance support, with only a few light vehicles per day. Consequently the impact of the site-generated traffic on existing traffic patterns and road safety will be negligible.

3.2.4 Traffic during the De-commissioning Phase

It is expected that traffic volumes and traffic flow patterns during this phase will be very similar to that of the construction phase. The impact of this phase’s traffic on the general traffic will therefore also be considered negligible.

3.2.5 Cumulative Impact Assessment

The cumulative impact of other Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in the area (refer to Figure 3) will only have a noticeable impact if the construction timelines as well as type of components, manufacturing centre, importation ports, transportation routes and methods, etc. are exactly aligned, which is unlikely to occur. Even in the worst case will the impact still be considered as negligible and does not warrant detailed assessment beyond the scope of this desktop assessment.

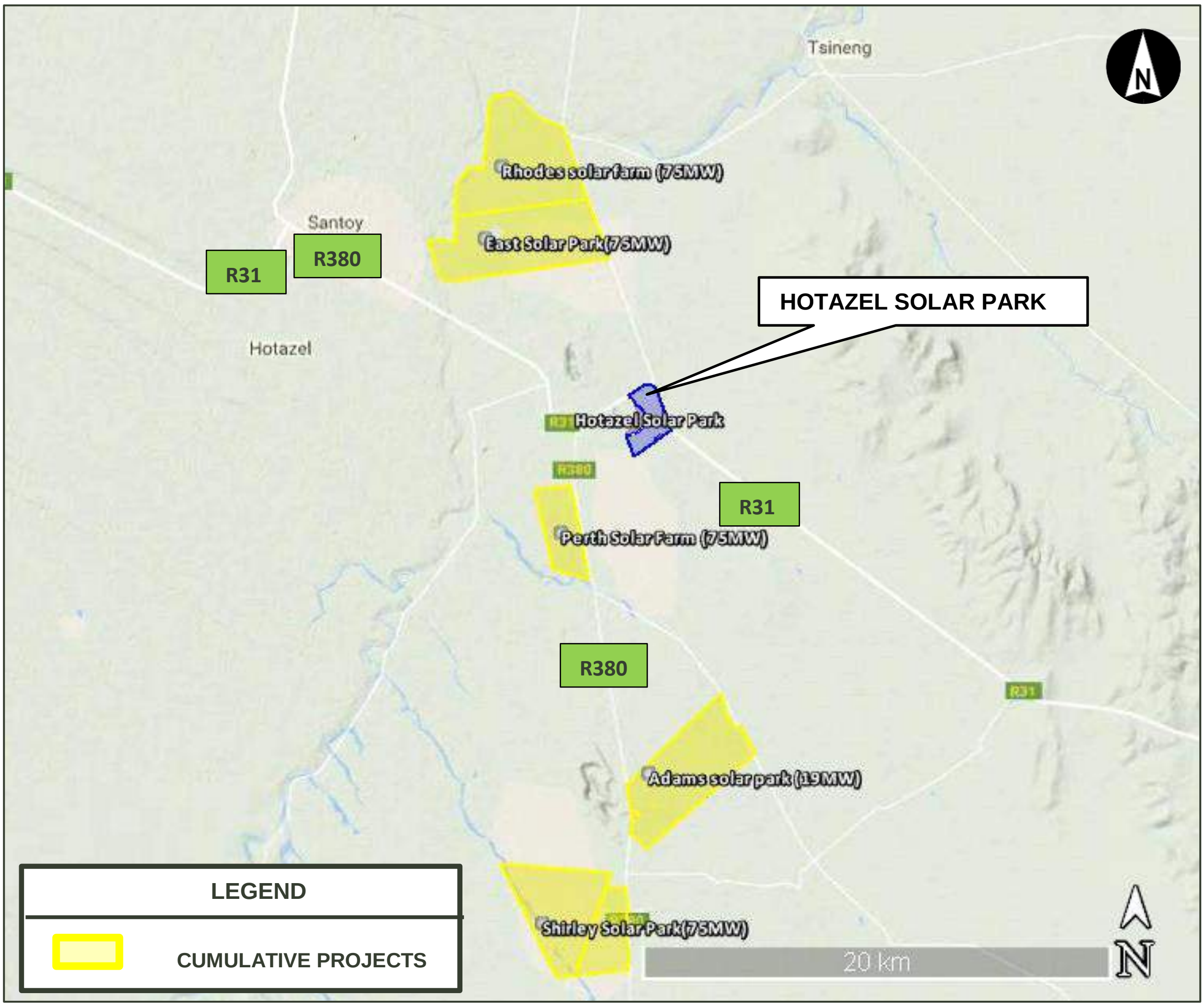


Figure 3: Cumulative Projects in the Area

3.2.6 Traffic Impact Rating Table

This technical study of traffic during the construction phase also has to inform the EIA process, where an environmental significance scale is used to evaluate the importance of a particular impact. Table 4 and Table 5 indicate the impacts associated with the traffic and how their significance ratings will be affected by the respective phases. When looking at Table 4 and Table 5, it can be concluded that all impacts will have a “Low” significance. The operational phase’s impacts on traffic and safety are deemed to have a lower impact compared to the construction and de-commissioning phases and is thus considered negligible.

Table 4: Traffic Impact for the Hotazel Solar Park

<table>
<tr><th colspan="5">Impact : Traffic impact of additional traffic on existing routes</th></tr>
<tr><th colspan="5">Construction/ De-commission Phase</th></tr>
<tr><td></td><td colspan="2">Preferred Alternative</td><td colspan="2">No Go Alternative</td></tr>
<tr><td>Short Description</td><td colspan="2">A Single axis PV with storage: A 200MWac solar facility with ~250ha of PV panels on steel mountings with single axis tracking mechanisms (max 5m height) and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters. Alternative A4 energy production will be ~120% with up to 25% (or 100MWh) retained for controlled energy release.</td><td colspan="2">Status Quo – No positive or negative impacts</td></tr>
<tr><td>Overview</td><td colspan="2">The transport of the necessary materials, equipment and personnel for the preferred alternative solar facility using major routes such as the N3, N5, R34, N14 & R31.</td><td colspan="2">Status Quo – No positive or negative impacts</td></tr>
<tr><td colspan="5">Assessment</td></tr>
<tr><td></td><td>Pre-Mitigation</td><td>Post Mitigation</td><td>Pre-Mitigation</td><td>Post Mitigation</td></tr>
<tr><td>Nature</td><td>Negative</td><td>Negative</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Duration</td><td>Short term</td><td>Short term</td><td>Long term</td><td>Long term</td></tr>
<tr><td>Extent</td><td>Local</td><td>Local</td><td>Local</td><td>Local</td></tr>
<tr><td>Magnitude</td><td>Low</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Probability</td><td>Probable</td><td>Probable</td><td>Probable</td><td>Probable</td></tr>
<tr><td>Confidence</td><td>Sure</td><td>Sure</td><td>Sure</td><td>Sure</td></tr>
<tr><td>Reversibility</td><td>Reversible</td><td>Reversible</td><td>Reversible</td><td>Reversible</td></tr>
<tr><td>Resource irreplaceability</td><td>Low</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td>Mitigatability</td><td>Medium</td><td>Medium</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Significance</td><td>Low</td><td>Low</td><td>Very Low</td><td>Very Low</td></tr>
<tr><td>Mitigation</td><td colspan="4">▪ Manage traffic volumes by means of the management of delivery volumes and times by distributing it throughout the day.
▪ Implement dust control measures during construction with speed limits and regular watering for gravel roads.
▪ Hard surface (tar or paved short section of the access road at its intersection with the R31 to protect the surfaced area of the access/main road.
▪ Ensure delivery drivers are licensed and competent, and vehicles are in good road worthy condition.</td></tr>
<tr><td>Cumulative Impact assessment</td><td colspan="4">The cumulative impact of other Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in the area (refer to Figure 3) will only have a noticeable impact if the construction timelines as well as type of components, manufacturing centre, importation ports, transportation routes and methods, etc. are exactly aligned, which is unlikely to occur. Even in the worst case will the impact still be considered as negligible and does not warrant detailed assessment beyond the scope of this desktop assessment.</td></tr>
</table>

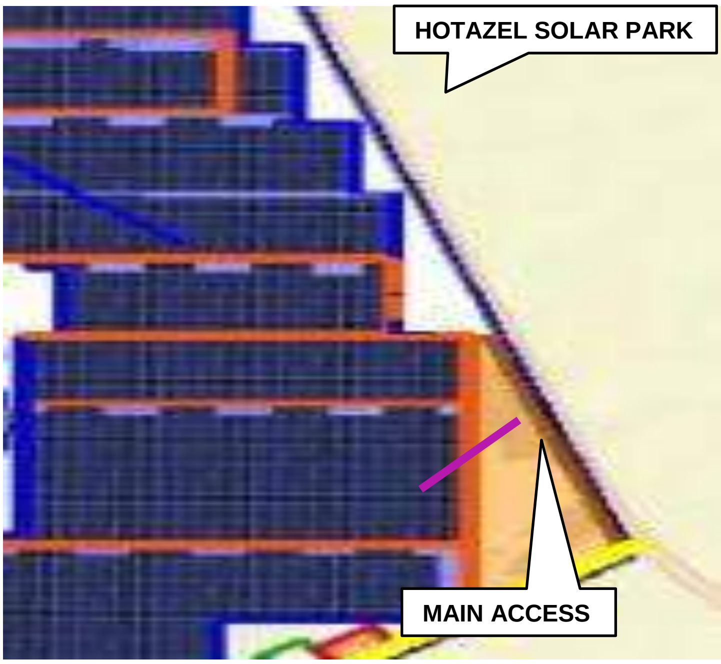
Table 5: Traffic Impact for the Transmission lines

Impact : Traffic impact of additional traffic on existing routes								
Construction/ De-commission Phase								
	Hotazel TX line		**Umtu TX line**		**LILO TX line**		**No Go Alternative**	
Short Description	Hotazel Substation 132kV Corridor –11km		Umtu Substation 132kV Corridor – 14km		Loop-in Loop-out 132kV Corridor –5.5m		Status Quo – No positive or negative impacts	
Overview	The transport of the necessary materials, equipment and personnel for the construction of a new double circuit 132kV overhead power lines – 7.5km length.		The transport of the necessary materials, equipment and personnel for the construction of a new double circuit 132kV overhead power lines – 11km length.		The transport of the necessary materials, equipment and personnel for the construction of a new double circuit 132kV overhead power lines – 300m length.		Status Quo – No positive or negative impacts	
Assessment								
	Pre-Mitigation	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Duration	Short term	Short term	Short term	Short term	Short term	Short term	Short term	Short term
Extent	Local	Local	Local	Local	Local	Local	Local	Local
Magnitude	Low	Low	Low	Low	Low	Low	Low	Low
Probability	Probable	Probable	Probable	Probable	Probable	Probable	Probable	Probable
Confidence	Sure	Sure	Sure	Sure	Sure	Sure	Sure	Sure
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Resource irreplaceability	Low	Low	Low	Low	Low	Low	Low	Low
Mitigatability	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Significance	Low	Low	Low	Low	Low	Low	Low	Low
Mitigation	▪ Manage traffic volumes by means of the management of delivery volumes and times. ▪ Implement dust control measures during construction as speed limits and regular watering. ▪ Ensure delivery drivers are licensed and competent, and vehicles are in good road worthy condition.							
Cumulative Impact assessment	The cumulative impact of other REIPPPP in the area will only have a noticeable impact if the construction timelines as well as components, manufacturing centre, importation ports, etc. are exactly aligned, which is highly unlikely. Even in that case will the impact still be considered as negligible. OHL lines are in general shared between a number of REIPPPP projects in an area.							
Conclusion:	All alternatives will have the same impact on traffic, which is considered negligible**.**							

3.3 Hotazel Solar Park - Access Route

3.3.1 Site Description

The proposed site to be developed as seen in Figure 3:



Location	27°22'98.44"S 23°00'08.12"E
Distance from	Kuruman - 73 km Vryburg - 213 km
Generation Capacity	200MW 100MW Battery Storage
Distance from Ports	**Durban -** 1028 km **Port Elizabeth/Coega** - 1013 km **Saldanha** - 1026 km
Farm	F278P0

Figure 4: Site Description for Hotazel Solar Park

3.3.2 Preferred Route from Port

The route for transportation of imported equipment is either from Port Elizabeth/Coega or Durban with both routes having a distance of 1020km. Durban was identified as the preferred route, seeing that the route avoids busy towns such as Kimberley and predominantly makes use of National Roads. When taking the renewable projects operations currently underway in the Eastern Cape region with Port Elizabeth/Coega Port into consideration, especially considering the expected volume of wind turbine components, Durban is again the obvious choice as the preferred port because of capacity concerns. The preferred route follows the following roads **-** N3 to Harrismith, N5 to Bethlehem, R76 to N1 near Kroonstad, R34 to R713 to R30 to Bothaville, R504 to Schweizer-Reneke, R34 to Vryburg, N14 to Kuruman & R31 to Site.

An alternative route from the port of Durban is indicated in red in Figure 5 below can also be utilised if the preferred route is unavailable due to maintenance or any other reason. The two routes are similar in length, where the alternative route passes through Kroonstad, Bothaville and Wolmaransstad.

It should be noted that the Ports Authority also has preferences on freight import, which should be considered.

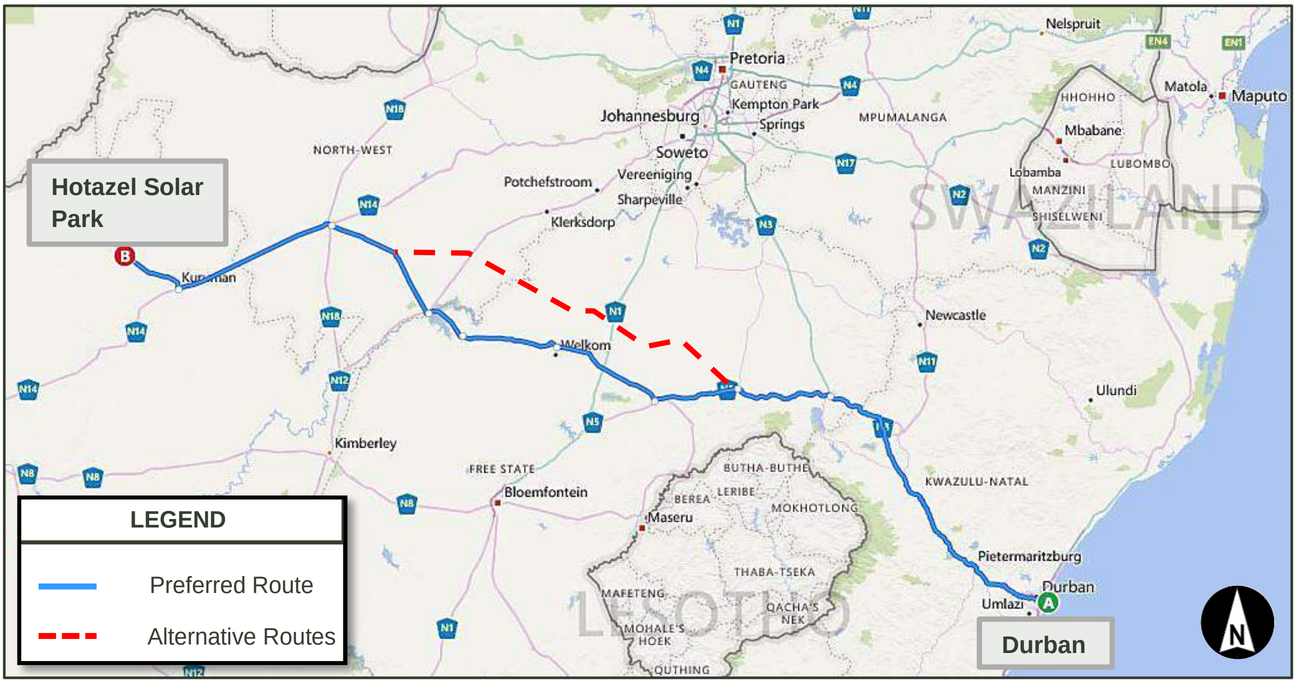


Figure 5: Preferred Route from Durban Port

3.3.3 Route from Alternative Port

Should the preferred port not be available for any reason, then the Port Elizabeth/Coega Port could be used as alternative. The route from Port Elizabeth (a distance of 925km) is shown in Figure 6.

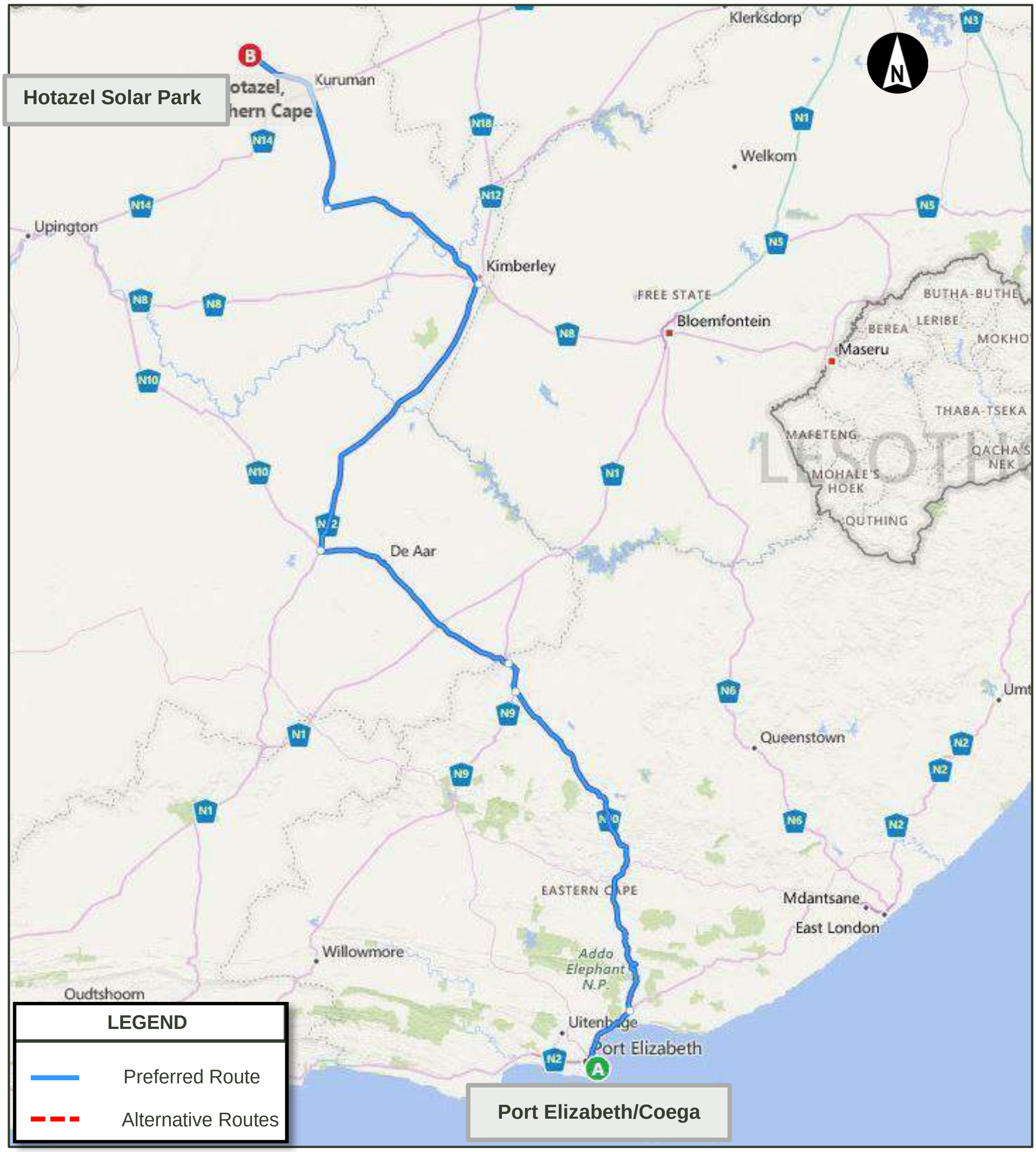


Figure 6: Alternative Port Route

3.3.4 Route for Construction Materials

Material sources for road building and concrete works is available in Kuruman and/or Vryburg and all material will most likely be transported from these and possibly other surrounding towns on the National and Provincial roads. If not it will have to be transported from larger manufacturing centres discussed in section 3.3.5.

3.3.5 Routes from other Larger Manufacturing Centres

The other main manufacturing centres include

- Greater Johannesburg area (Modderfontein, Edenvale, Nigel, Germiston, Brakpan, Elandsfontein) for inverters and support structures.
- Cape Town – greater metropolitan area for some of the components.

The routes to the site from these centres are predominantly on Provincial and National roads. There are no limitations on normal freight within the legal limits on these routes.

3.3.6 Authority and Permit Requirements

The following is noted:

a) Toll fees are required on the routes from the preferred port (Durban). On the routes from the other manufacturing centres certain portions of the national routes are also tolled which will require toll fees.

b) Abnormal Freight Permit(s) will be required for the transport of the transformer by the logistics contractor for each province as these are issued by each Provincial Authority. The estimated total permit value will be a function of the actual vehicle configuration as well as the convoy requirements.

3.3.7 Route Limitations of the Preferred Route from the Port

The identified routes have possible limitations that will require more detailed investigations once the exact equipment type, size, mass, etc. are known to determine the level of upgrading that will be required (if any) to accommodate the abnormal load(s). Possible limitations might include: overhead power and telecommunication lines with an insufficient ground clearance, substandard road geometry and stormwater_drainage issues. However this development will most likely have the transformer as the only abnormal load, which should not have any limitations on route from port of manufacturing centre.

3.3.8 Site Access Road

3.3.8.1 Access to Road Network

The access to the site is proposed off the Regional Road R31. The proposed access road is a newly constructed ≤1.9km long, ≥8m wide gravel road running from the R31, westward along the southern boundary of Annex Langdon Farm. It is anticipated that the Department of Roads and Public Works Northern Cape will approve the access road, as sufficient sight distance (stopping and shoulder) is available at the proposed intersecting position, which is indicated in Figure 7. The location of the new_access road relative to the solar farm is shown in Figure 8. Figure 7 also indicates two existing services – Powerline (possibly 11kV) and telecommunication lines – which will have to be either raised or changed to an underground duct and cable crossing for the new main access road.

Figure 7: Hotazel Solar Park - Access Option 1

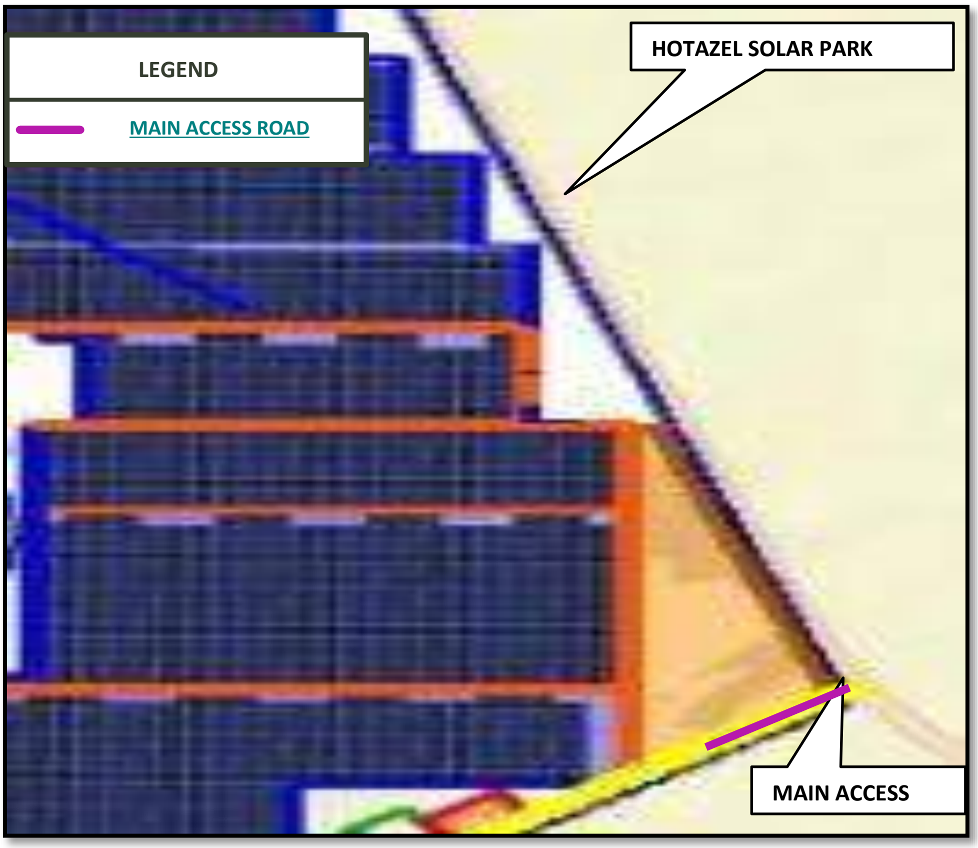


Figure 8: Access Road Location

3.3.8.2 Structures and Services

Existing structures and services such as drainage structures and pipelines will be evaluated at crossings and suitably strengthened if required.

Suitable drainage elements will be provided on the access road to ensure minimal disturbance of the existing drainage patterns.

3.3.9 Accommodation of Traffic during Construction

During construction of the access road, traffic will have to be accommodated as per South African Road Traffic Signs Manual requirements. The following typical minimum signage requirements will have to be implemented to ensure safety if the road needs closure or partial closure during construction on the public road. Complete closure of the road is unlikely to be required.

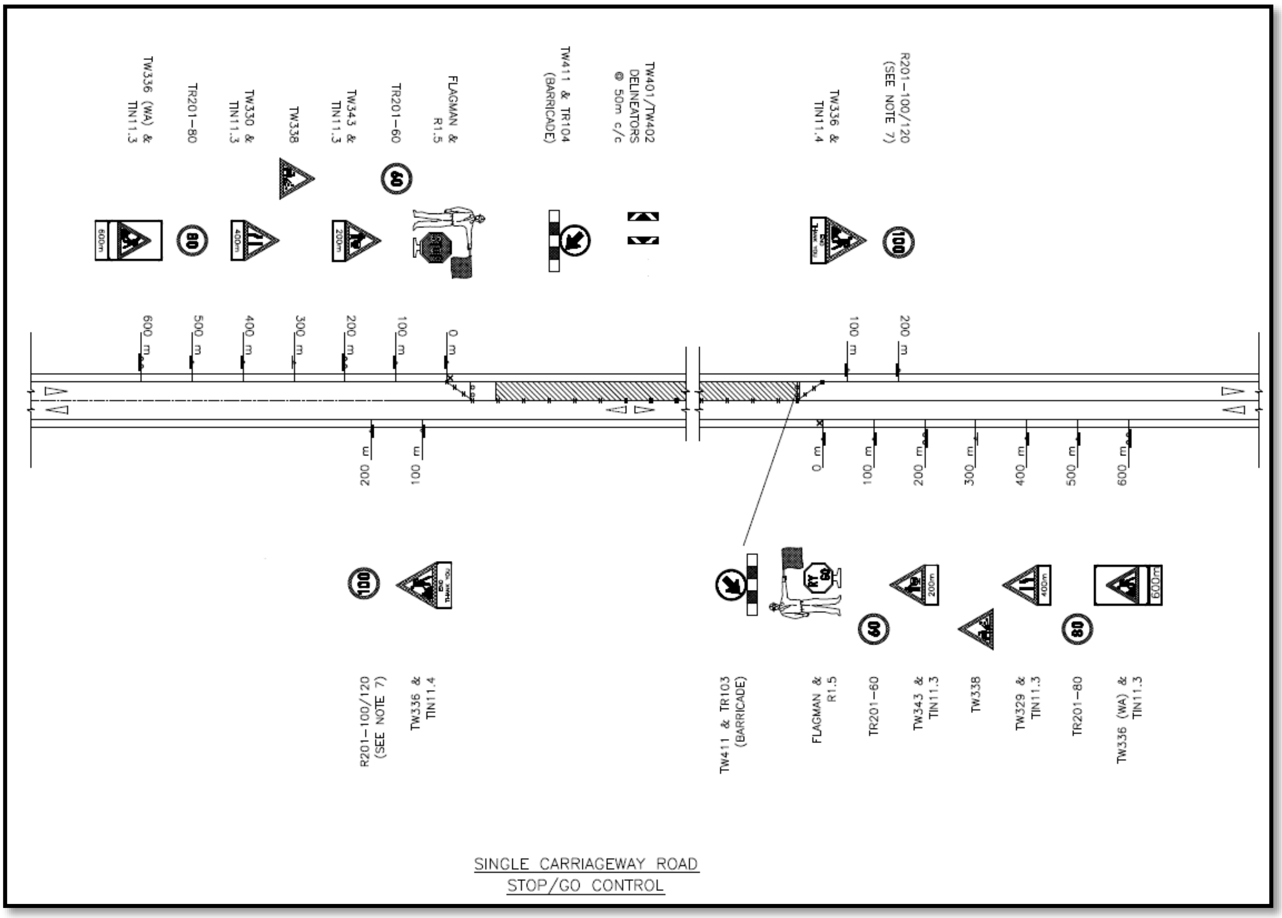


Figure 9: Accommodation of Traffic - Typical Layout

3.3.10 Mitigation Measures during construction

Although traffic volumes during the construction phase are considered to be negligible, is it recommended that construction traffic should be distributed throughout the day. In order to achieve this, the arrival of material, equipment, and personnel should be planned and assigned specific timeslots for arrival on site. This will minimize the impact on the existing traffic patterns in the project area.

4 CONCLUSION

The transport needs for the proposed Hotazel Solar Park, with a generating capacity of 200MWac with 100MW battery storage on farm portion F278P0 near Hotazel, were investigated to confirm access route alternatives and site access for the development of a solar facility.

The general requirements are:

- Legal limits for normal heavy vehicle freight;
- Abnormal Freight Permits required for transport of transformers; and
- Maximum vertical clearance on most routes is 5,2m for Abnormal Load but should preferably be limited to 4,8m to limit risk of possible unpassable structures.

The general freight for the solar farms will comprise of building materials, solar panels and frames and transformers. The imported freight will be transported from South African ports to the site. Building materials will be transported from sources in surrounding towns while certain elements will be transported from various manufacturing centres in South Africa.

The current preferred import origin of the elements required for the proposed Hotazel Solar Park will be from the Port of Durban. The distance of 1028km between origin and destination comprises of surfaced roads all the way. However, should the Durban Port not be available to handle the imported freight, the Port of Port Elizabeth/Coega could be used as an alternative port. The transport distance in this case is similar to the preferred route.

Toll fees will be payable on the route from the preferred port. Abnormal Freight Permits will be required for transportation of the transformer regardless of the route selected. Traffic generated by the Solar Park project during construction and operational phases will have a negligible impact on existing and future traffic.

The preferred route from the preferred port to the site follows predominantly National and Provincial Roads with suitable standards for the transportation of container freight. The roads are also suitable for abnormal loads with permits. There is a possibility of limited risk of delays due to normal routine maintenance works on the road network (repairs and reseals) depending of the time of transport and scheduling of roads contracts.

The transportation of elements from manufacturing centres within South Africa to the site will be predominantly along National and Provincial roads, where no limitations apply to normal freight.

The proposed access roads from the R31 to the site is situated on the eastern side of the proposed Solar Park and has to be constructed from scratch. The intersection between the access road and the R31 is at an acceptable safe point with sufficient sight distance and should be acceptable to The Department of Roads and Public Works Northern Cape. There are however two existing services – power lines (possibly 11kV) and telecommunication lines – which will have to be either raised or moved to an underground ducts and cable crossing underneath the new main access road. This can be amended with relatively ease as required.

There is a limited risk of delays to the various deliveries required for the construction of the facility, due to potential routine maintenance works (such as repairs and reseals) that may take place along any route. The impact of such activities is dependent on the scheduling of deliveries and of roads contracts, and may be mitigated by the use of the alternative routes proposed in this report.

In general, no obvious problems are expected with freight transport along the proposed routes to the site necessary for the construction and maintenance of the site.

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Philippines, Qatar, Singapore, South Africa,
Swaziland, Tanzania, Thailand, Uganda,
United Arab Emirates, Vietnam.

APPENDIX D.9:

Visual

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED HOTAZEL SOLAR PARK, NORTHERN CAPE PROVINCE, SOUTH AFRICA

SPECIALIST REPORT: VISUAL IMPACT

DRAFT1: 08 February 2017

Document prepared for Aurecon South Africa (Pty) Ltd;

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GLOSSARY

Best Practicable Environmental Option (BPEO)
This is the option that provides the most benefit, or causes the least damage, to the environment as a whole, at a cost acceptable to society, in the long, as well as the short, term.
Cumulative Impact
The impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person, undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.
Impact (visual)
A description of the effect of an aspect of a development on a specified component of the visual, aesthetic or scenic environment, within a defined time and space.
Issue (visual)
Issues are concerns related to the proposed development, generally phrased as questions, taking the form of "what will the impact of some activity be on some element of the visual, aesthetic or scenic environment?"
Key Observation Points (KOPs)
KOPs refer to receptors (people affected by the visual influence of a project) located in the most critical locations surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.
Management Actions
Actions that enhance the benefits of a proposed development, or avoid, mitigate, restore or compensate for, negative impacts.
Receptors
Individuals, groups or communities who would be subject to the visual influence of a particular project.
Sense of Place
The unique quality or character of a place, whether natural, rural or urban.
Scenic Corridor
A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route.
Scoping
The process of determining the key issues, and the space and time boundaries, to be addressed in an environmental assessment.
Viewshed
The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area in which, or the extent to which, the landscape modification is likely to be seen.
Zone of Visual Influence (ZVI)
The ZVI is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.'
Glare and Glint
Glare is defined in the Oxford dictionary (http://www.oxforddictionaries.com) as 'shine with a strong or dazzling light'. Glint is defined as the circumstance relating to 'reflect small flashes of light'

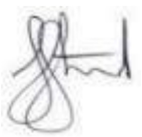
LIST OF ACRONYMS

APHP	Association of Professional Heritage Practitioners
BLM	Bureau of Land Management (United States)
BPEO	Best Practicable Environmental Option
CALP	Collaborative for Advanced Landscape Planning
DEA	Department of Environmental Affairs (National)
DEA&DP	Department of Environmental Affairs and Development Planning (Western Cape Province)
DEM	Digital Elevation Model
DoC	Degree of Contrast
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographic Information System
I&APs	Interested and Affected Parties
IEMA	Institute of Environmental Management and Assessment (United Kingdom)
IEMP	Integrated Environmental Management Plan
KOP	Key Observation Point
MAMSL	Metres above mean sea level
NELPAG	New England Light Pollution Advisory Group
PSDF	Provincial Spatial Development Framework
SAHRA	South African National Heritage Resources Agency
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management
ZVI	Zone of Visual Influence

This document was completed by Silver Solutions 887 cc trading as VRM Africa, a Visual Impact Study and Mapping organisation located in George, South Africa. VRM Africa cc was appointed as an independent professional visual impact practitioner to facilitate this VIA.

This document was undertaken by the following team:

Stephen Stead	Director/ Visual Impact	APHP accredited VIA Practitioner
Lisa Schultz	Editing and Contrast Rating	Bachelor of Arts, Fine Art



Stephen Stead
APHP accredited VIA Specialist

1 INTRODUCTION

Visual Resource Management Africa CC (VRMA) was appointed by Aurecon South Africa (Pty) Ltd to undertake a ***Visual Impact Assessment*** for the proposed Hotazel Solar Park on behalf of juwi Renewable Energies (Pty) Ltd. A site visit was undertaken on the 8th of June 2016.

1.1 Terms of Reference

The scope of this study is to cover the entire proposed project area and the terms of reference for the study are as follows:

- Scoping Assessment:
  - Undertake a site visit of the full site extent, as well as of areas where potential impacts may occur beyond the site boundaries.
  - Collate and analyse all available secondary data relevant to the affected proposed project area.
  - Reviewing the legal framework that may have implications for visual/scenic resources.
  - Quantifying and assessing existing scenic resources/visual characteristics on, and around, the proposed site.
  - Determining viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
  - Evaluation and classification of the site landscape in terms of sensitivity to a changing land use.
  - Determining visual issues, including those identified in the public participation process that are to be assessed in detail in the impact assessment phase.
  - Determine a visually preferred alternative via a comparative assessment of available alternatives.
- Impact Assessment:
  - During Impact Assessment, assessing the significance of potential visual impacts resulting from the preferred project alternative for the construction, operation and decommissioning phases of the proposed project.
  - Assessing the potential cumulative impacts associated with the visual impact.
  - Identifying possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental Management Programme (EMPr).

1.2 Assumptions and Limitations

- Information pertaining to the specific heights of activities proposed for the development was limited and, where required, generic heights were used to define the visibility of the project.
- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The use of open source satellite imagery was utilised for base maps in the report.
- The viewsheds were generated using ASTER elevation data. (NASA, 2009)
- Some of the mapping in this document was created using Bing Maps (previously *Live Search Maps*, *Windows Live Maps*, *Windows Live Local*, and *MSN Virtual Earth*) and powered by the Enterprise framework. Open Source Mapping data is also utilised in the assessment which may not reflect recent changes to the landscape.
- Determining visual resources can be a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure (Lange, 1994). However, subjectivity is limited due to the implementation of the Visual Resource Management assessment technique (refer to methodology summary) that is specifically designed to increased objectivity and consistency by using standard assessment criteria.
- The project deliverables, including electronic copies of reports, maps, data, shape files and photographs are based on the author's professional knowledge, as well as available information. This study is based on assessment techniques and investigations that are limited by time and budgetary

constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

1.3 Visual Impact Methodology Summary

The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method (USDI., 2004). This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria. The VRM process involves the systematic classification of the broad-brush landscape types within the receiving environment into one of four VRM Classes. Each VRM Class is associated with management objectives that serve to guide the degree of modification of the proposed site. The Classes are derived by means of a simple matrix with the three variables being the scenic quality, the expected receptor sensitivity to landscape change, and the distance of the proposed landscape modification from key receptor points. The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity, where they represent the relative value of the visual resources of an area. Classes I and II are the most valued, Class III represents a moderate value; and Class IV is of least value.

To determine impacts, a degree of contrast exercise is required. This is an assessment of the expected change to the receiving environment in terms of the form, line, colour and texture, as seen from the surrounding Key Observation Points. This is to determine if the proposed project meets the visual objectives defined for each of the Classes. If the expected visual contrast is strong, mitigations and recommendations are made to assist in meeting the visual objectives. To assist in the understanding of the proposed landscape modifications, visual representation, such as photomontages or photos depicting the impacted areas, can be generated. There is an ethical obligation in the visualisation process, as visualisation can be misleading if not undertaken ethically.

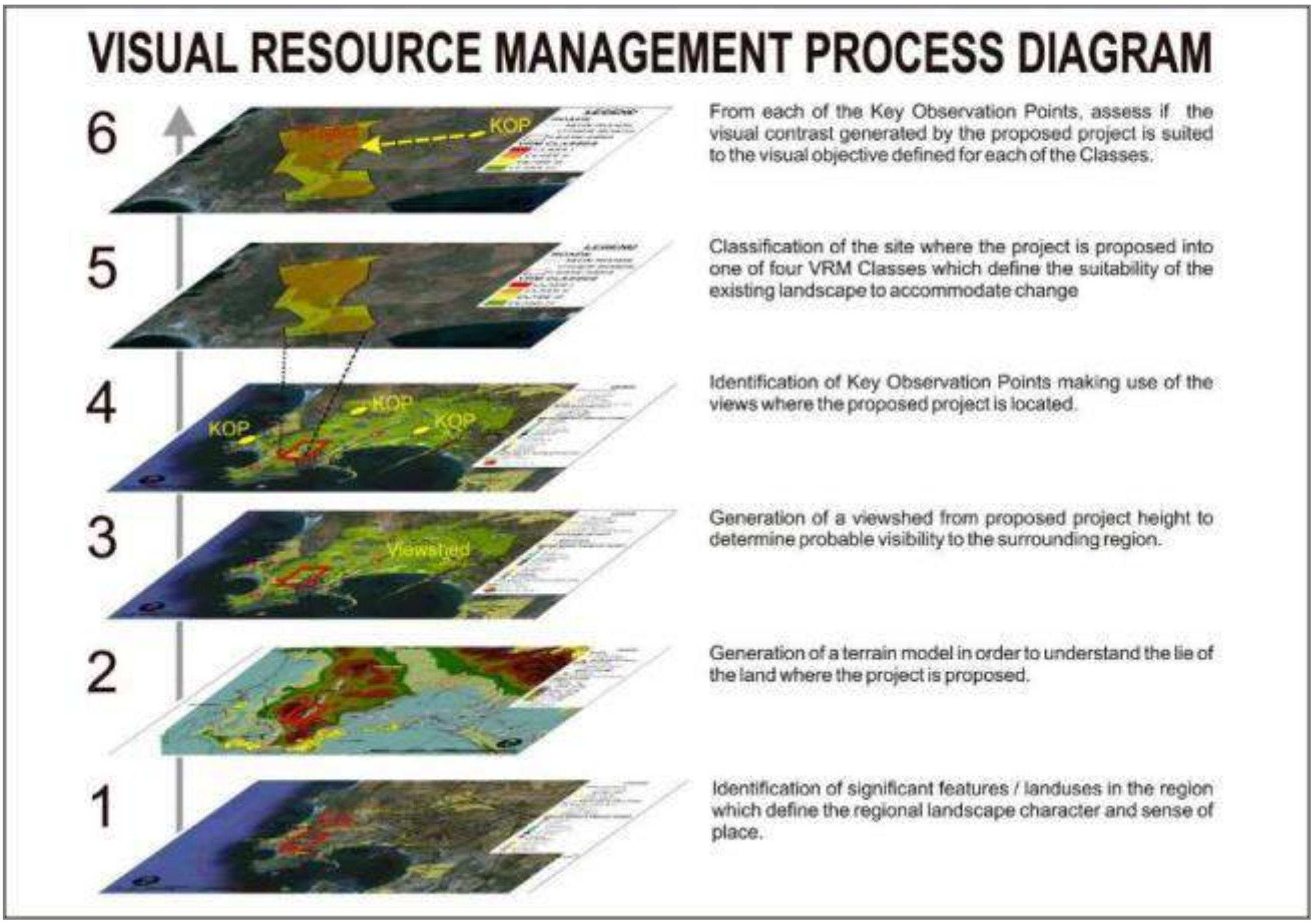


Figure 1: VRM process diagram

2 Project Description

Aurecon provided the following project description with regard to the proposed project. "juwi Renewable Energies (Pty) Ltd (juwi) proposes the construction and operation of a ≤200MW solar PV park on the Farm Hotazel Annex Langdon (F278/0), transmission lines and associated infrastructure, near Hotazel, in the Joe Morolong Local Municipality, in the Northern Cape Province. Referred to as the Hotazel Solar Park. A special project vehicle, namely Hotazel Solar Farm 1 (Pty) Ltd, has been registered and all applications will be made in the name of this SPV".

The proposed Hotazel project and associated ancillary infrastructure would consist of the following:

- A photovoltaic component comprising of numerous rows of PV modules and associated support infrastructure (6m height);
- An onsite substation from where electricity will be evacuated to the national electricity grid. The onsite substation will also include a telecommunications tower(32m) and lightning rod;
- Underground cabling to connect the PV facility to the onsite central substation;
- A battery storage system housed in structures up to 8m in height;
- Overhead 132 kV transmission line alternatives;
- Numerous inverters to convert the DC power generated by the PV panels to AC power;
- Numerous transformers to transform the power from low to medium voltage;
- Access roads for servicing and maintenance of the site;
- Water supply infrastructure;
- Storm water infrastructure;
- Buildings, including a connection building, control building, guard cabin, electrical substations and solar resource measuring substation;
- Lighting;
- Security fencing.

The following detailed project description was provided by Aurecon (Aurecon, 2016):

Table 1: Hotazel Solar Farm 1 project description and alternatives summary

Component	Dimensions
• **Solar Farm:** A 200MWac solar facility with PV panels on steel mountings with single axis tracking mechanisms and concrete footings, below ground electrical cables connecting the PV systems to the onsite collector substation and inverters.	• ≤250ha solar panels, service roads, cables runs, and other ancillaries and some open space)
• **Battery Storage System:** A ≤100MWh battery storage facility for grid storage of maximum height 8mand a maximum of 1120 cubic meters of batteries (dangerous goods) and associated operational, safety and control infrastructure.	• ≤1ha • ≤8m building height • ≤1120m^3 of batteries
• **Access road:** A ≤1.9km long, ≥8m wide gravel access road running from the R31, west ward along the southern boundary of Annex Langdon Farm.	• ≤1.9km long, ≤8m wide • ≤1.52ha
• **Service roads:** ≤17km of ≤4m wide gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	• ≤17kms, 4m wide gravel roads • Footprint included in solar farm footprint (≤6.8ha)
• **Collector substation:** ≤1ha collector substation to receive, convert and step up electricity from the PV facility tothe 132kV grid suitable supply. The facility will house control rooms and grid control yards for both Eskom and the Independent Power Producer. A 32m telecommunications tower (lattice or monopole type) will be established in the substation area.	• ≤1ha • Substation infrastructure up to 10m height • 32m telecommunications tower
• **O&M area**: o ≤1ha hectare O&M laydown area (near / adjacent substation); o Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; o Workshops, storage areas for materials and spare parts;	• ≤1ha • Single storey office, ablutions, workshop complex (4m height)

o Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day for 15 months during rest of construction period; ~20kl/day during operation); o Septic tanks and sewer lines to service ablution facilities; and o Central Waste collection and storage area.	
• **Other infrastructure:** o Perimeter fencing and internal security fencing and gates as required. o Access control gate and guard house on access road; o ≤3.5km length of small diameter water supply pipeline connecting existing boreholes to storage.	• 1.8m high jackal fence with barbed wire
• **Temporary infrastructure:** o A ≤4ha construction yard and laydown area to be used for the construction period and rehabilitated afterwards.	• ≤4ha (Temporary)
Total development footprint	**≤300ha**[1]

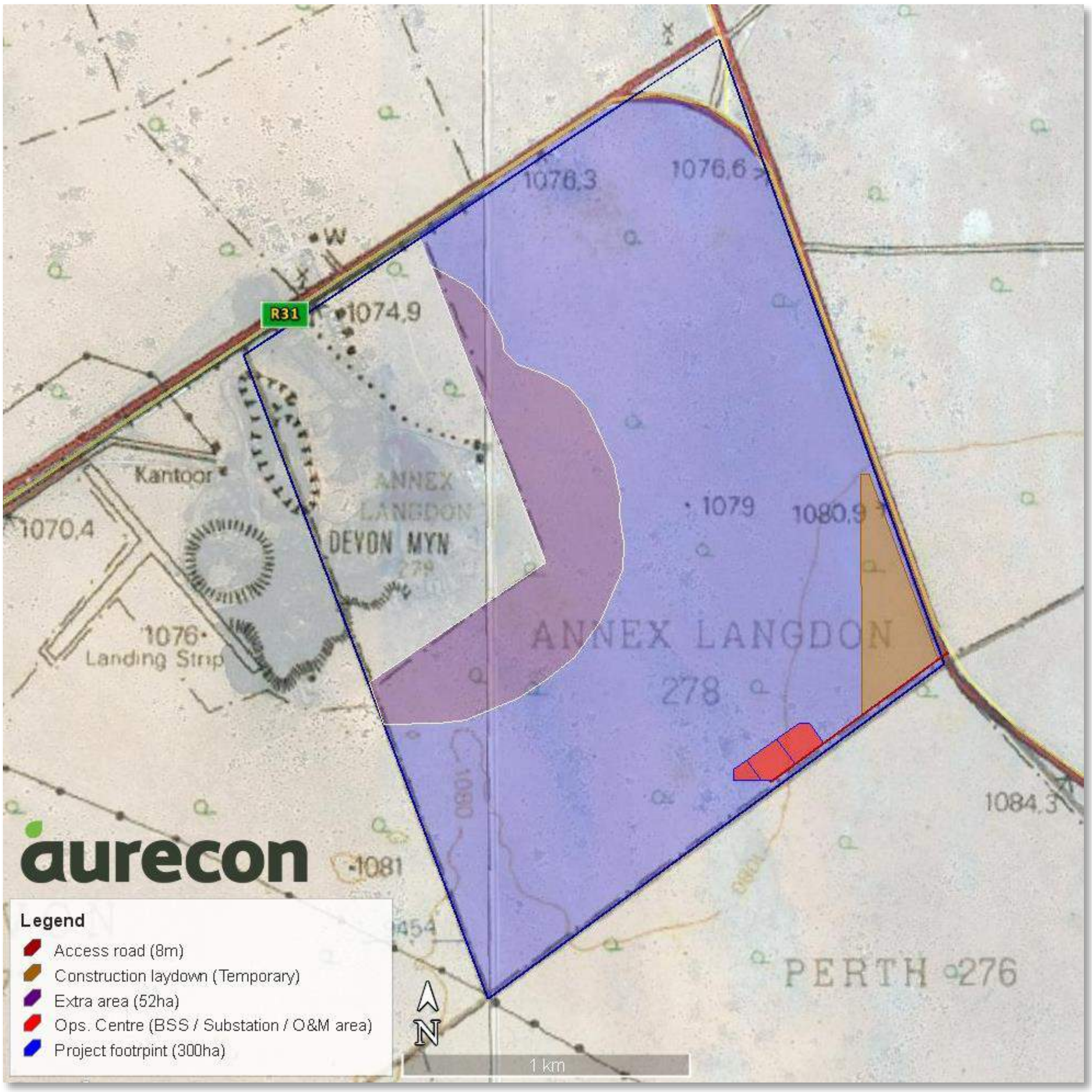


Figure 2: Final Layout Plan

[1] Note that the development footprint is estimated at 300ha, the percentage land covered by building and infrastructure is likely to be 80 -90% of the 300ha. These unused spaces arise from solar arrays needing to be orientated in particular direction which is optimised according to sun and not property boundaries, which leaves some unusable spaces. Also space needs to be left around some buildings and facilities. While these areas will not be developed, they are considered transformed as they no longer render all ecosystem services as they would have if not enclosed by the development, thus they are included in the development footprint.

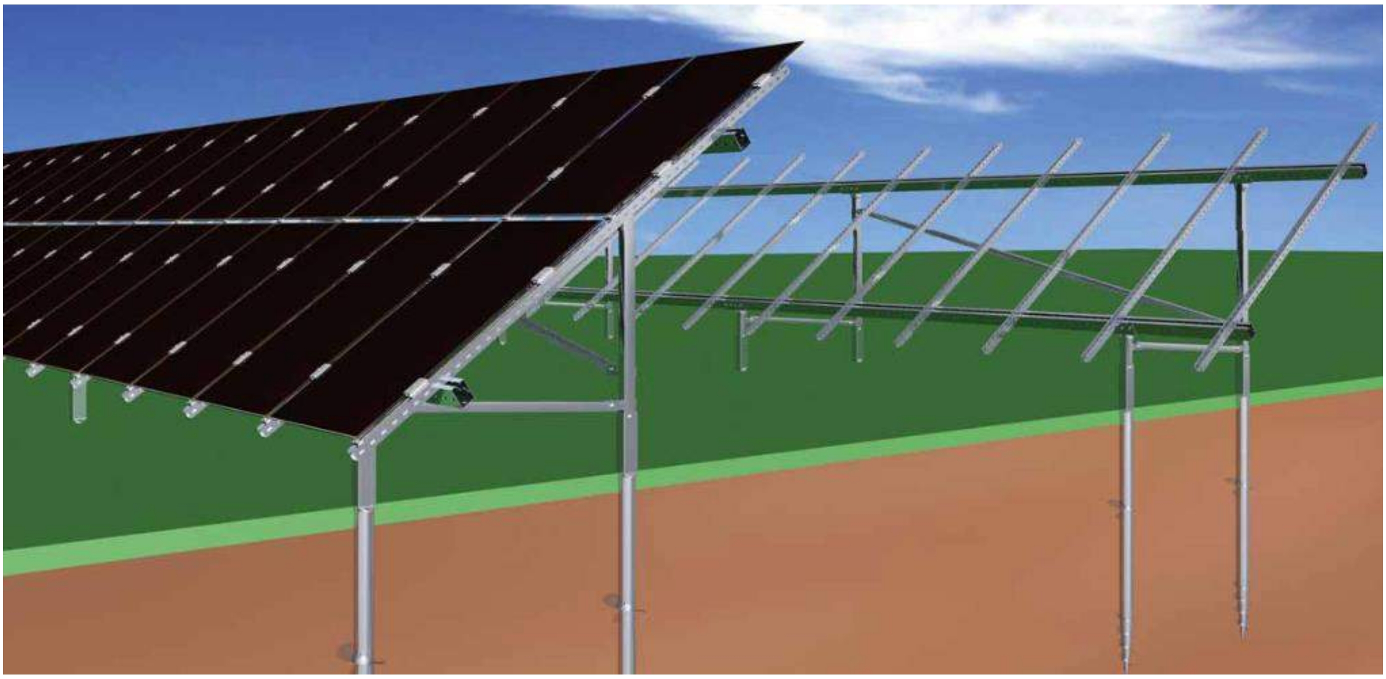


Figure 3: 3D model example of a Fixed PV technology

Figure 4: Photographic example of a Single Access Tracking PV technology (Solar Professional)

2.1 Legislative and Planning Context

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which planning policies govern the proposed property area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The proposed landscape modifications must be viewed in the context of the planning policies from the following organisations guidelines:

2.1.1 *International Finance Corporation (IFC)*

The IFC prescribes eight performance standards (PS) on environmental and social sustainability. The first is to identify and evaluate the environmental and social risks and impacts of a project, as well as to avoid, minimise or compensate for any such impacts. Under PS 6, ecosystem services are organised into four categories, with visual / aesthetic benefits falling into the category of cultural services, which are the non-material benefits people obtain from ecosystems (IFC, 2012).

2.1.2 *DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes*

As there is no national guideline related to visual and aesthetic best practice, use of the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in EIA processes will be utilised. This states that the Best Practicable Environmental Option (BPEO) should address the following:

- Ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The BPEO must also ensure that development must be located to prevent structures from being a visual intrusion (i.e. to retain open views and vistas).
- Long term protection of important scenic resources and heritage sites.
- Minimisation of visual intrusion in scenic areas.
- Retention of wilderness or special areas intact as far as possible.
- Responsiveness to the area's uniqueness, or sense of place. (Oberholzer, 2005)

2.1.3 *DEA&DP Guideline for the Management of Development on Mountains, Hills and Ridges in the Western Cape.*

The following environmental characteristics will serve as key indicators of environmental sensitivity for the directorates. As such they will serve as critical factors in the Directorate's decision-making process when determining whether to authorise or refuse a development application made in terms of the EIA Regulations:

- Development on steep slopes (i.e. steeper than 1:4) will be strongly discouraged as such areas are subject to erosion and instability. Slope steepness will be evaluated for the area of the site where development is being proposed and not for the site as a whole. As a principle, development should be located on lower-lying or gently sloping portions of a site.
- Development on the crest of a mountain, hill or ridge will be strongly discouraged.
- Development in an area, which has been declared a mountain catchment area in terms of the Mountain Catchment Areas Act, Act 63 of 1970 will be strongly discouraged.

(Western Cape Government, 2002)

3 Baseline: The Nature of the Receiving Environment

3.1 Broad Brush Landscape Context

3.1.1 *Locality*

The proposed development site is located in the Northern Cape Province in the Joe Morolong Local Municipality (formerly known as Moshaweng Local Municipality). It is located within John Taolo Gaetsewe District Municipality (previously Kgalagadi District Municipality). The nearest large towns to the proposed project are Kuruman, which is located approximately 50km to the southeast, and Kathu located approximately 70km to the south. The small mining village of Hotazel is located approximately 5km to the northwest of the proposed site. The proposed site is accessed via the R31 that connects the town of Hotazel to Kuruman.

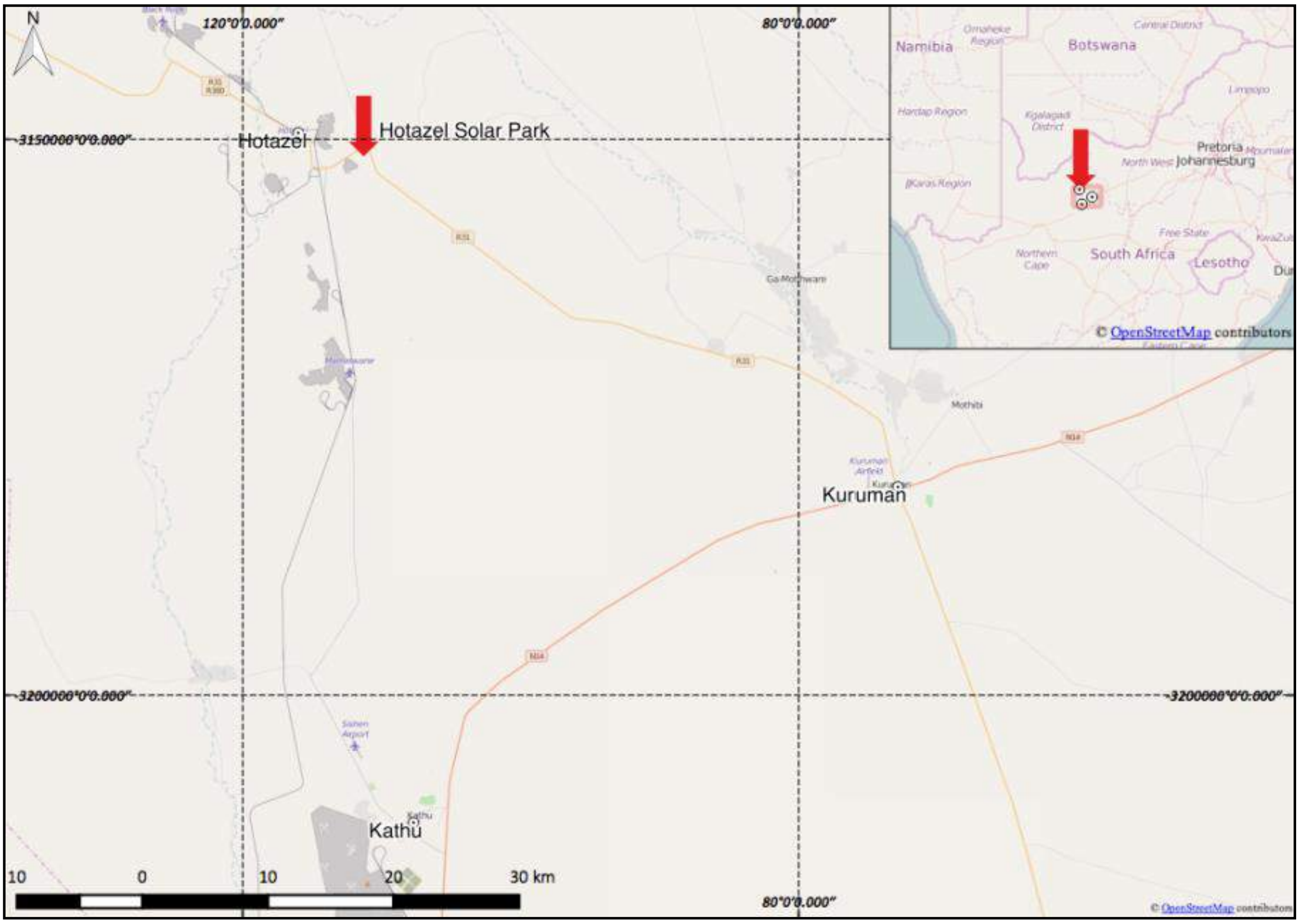


Figure 5: Regional locality map

3.1.2 *Regional Topography*

A regional Digital Elevation Model (DEM) was generated using NASA ASTER 90m DEM data (NASA, 2009). The data is generalised and used to better understand the broader terrain. Graphical representation of the terrain was also implemented with two profile lines cutting through the study area and extending beyond the area approximately 15km on either side as indicated on Figure 4 below.

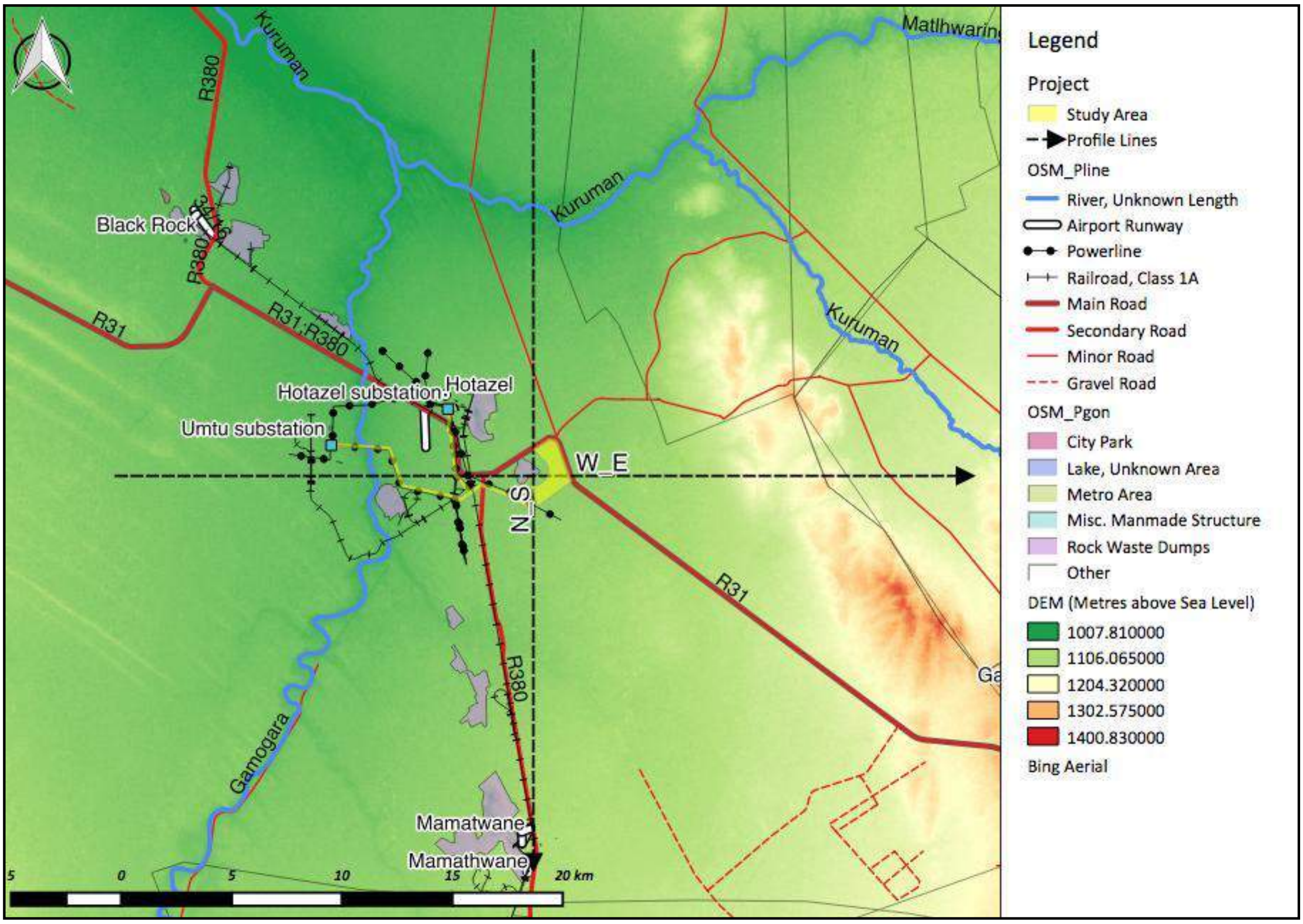


Figure 6: Regional Digital Elevation Model Map

The North to South Terrain Profile indicates the study area located within the 1070mamsl range, with flatter terrain around the study area. Over 15km to the north, the elevation drops 50m down to the Kuruman River Valley. To the south the elevation remains within a similar range, but drops slightly into a shallow depression, before continuing with a gentle increase in elevation up to a high point of 1100mamsl.

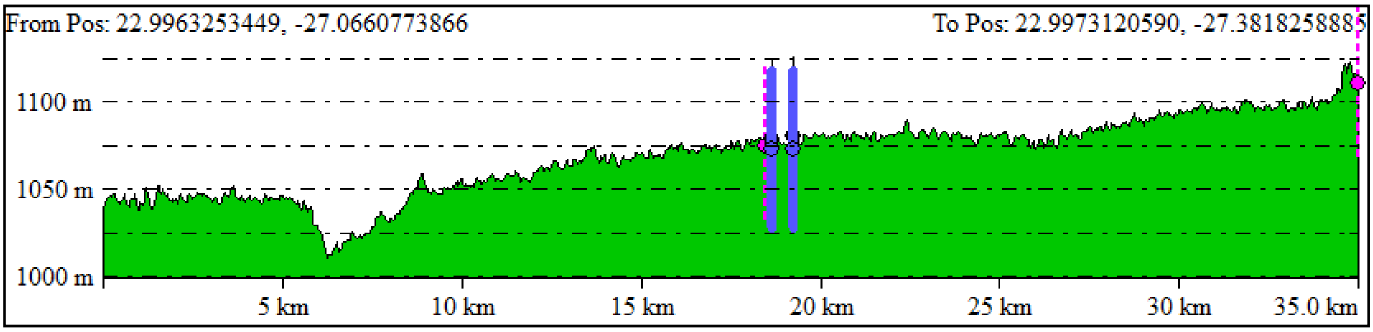


Figure 7: North to South Terrain Profile Graph

The West to East Terrain Profile places the study area within the 1070m range, with a similar terrain surrounding the study area. The drainage is to the West, dropping to a low of 1050mamsl in the Gamogara River Valley. To the east, the terrain gradually increases in elevation, with a sudden increase in elevation as the profiles crosses the northern reaches of the Kuruman Hills which are approximately 100m in height. The profile of the Kuruman Hills is depicted in the photograph below which was taken from the R31 towards the east. The hills feature low in profile and rounded in nature, and does not create a dominating natural feature in the landscape.

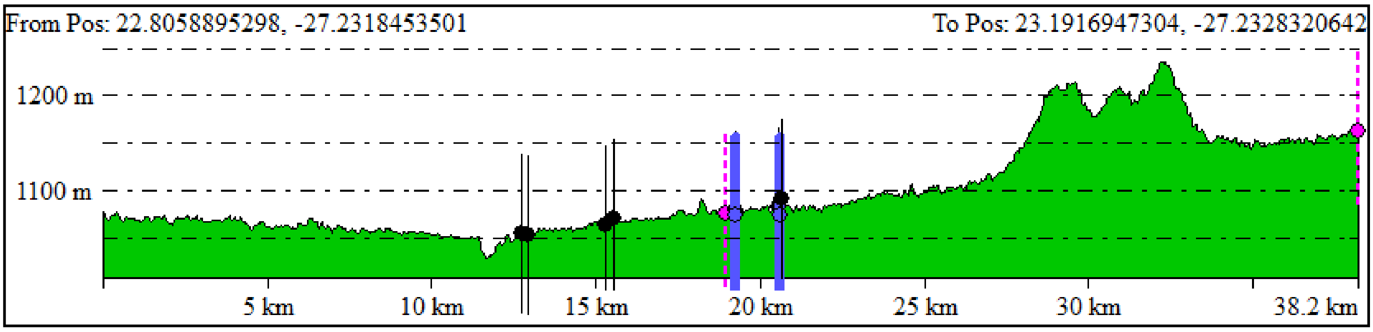


Figure 8: West to East Terrain Profile Graph (black markers indicate existing power lines)

Figure 9: View east from the proposed site of the northern extents of the Kuruman Hills.

As can be seen in the Digital Elevation Model map above, the topography of the greater area surrounding the study area is relatively flat with the exception of the low hill range to the east. The main drainage of the greater region is to the north via the Gamogara River (approx. 7km west), which is a tributary of the larger Kuruman River located approximately 10km to the north. The only natural topographic feature within the greater area are the Kuruman Hills that are located approximately 15km to the southeast of the study site and rise approximately 100m above the generated terrain.

3.1.3 *Vegetation*

According to the South African National Biodiversity Institute (SANBI) 2012 Vegetation Map of South Africa, Lesotho and Swaziland, the vegetation biome within which the study area is located is defined as the Savanna Biome. Two main vegetation types were listed as intersecting with the study area: Gordonia Duneveld to the west, and Kathu Bushveld to the east. (South African National Biodiversity Institute, 2012)

According to the SANBI website, "the Savanna Biome is the largest Biome in southern Africa, occupying 46% of its area, and over one-third the area of South Africa. It is well developed over the Lowveld and Kalahari region of South Africa and is also the dominant vegetation in Botswana, Namibia and Zimbabwe". The advantage of this Biome is that it is characterized by "a grassy ground layer and a distinct upper layer of woody plants" which can assist in visual screening. The vegetation screening would be limited by local environmental factors such as elevations and inland localities where frost may occur from 0 to 120 days per year as well as lack of sufficient rainfall. The lack of rain tends to prevent the upper vegetation layer from dominating, which coupled with fires and grazing, keep the grass layer dominant. "The shrub-tree layer may vary from 1 to 20m in height, but in Bushveld typically varies from 3 to 7m. The shrub-tree element may come to dominate the vegetation in areas which are being overgrazed." (South African National Biodiversity Institute, 2012) In the vicinity of the study area, medium height Bushveld vegetation was identified which, in relation to the flatter terrain, could assist in reducing the zone of visual influence.

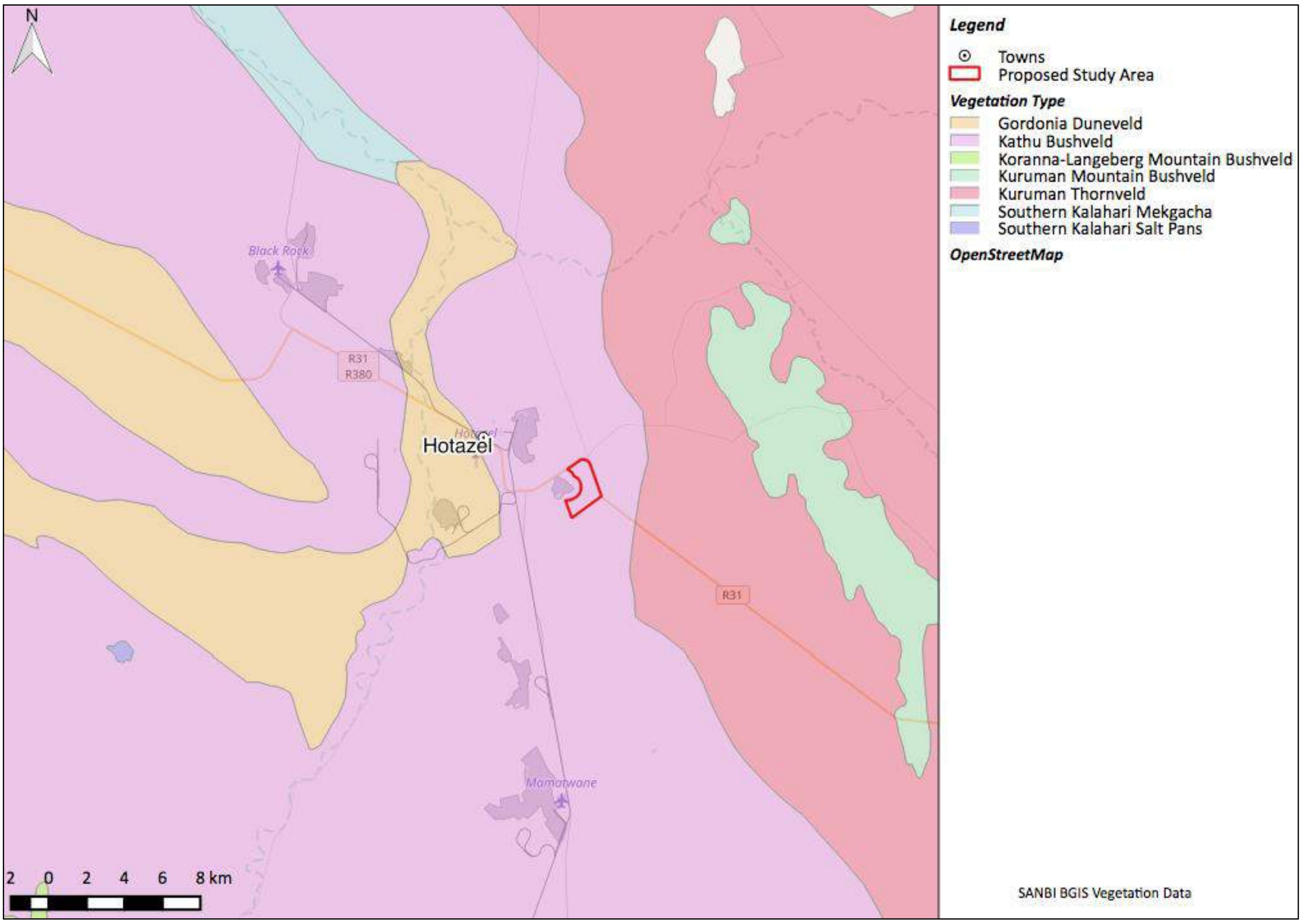


Figure 10: Vegetation Biome Map (South African National Biodiversity Institute, 2012)

However, it is important to note that the area is arid, with high summer temperature averages. The low rainfall of the region results in vegetation being low in profile, which in relation to the flat terrain creates a uniform broad-brush landscape that has a low local visual absorption capacity, but can assist in reducing medium and background views.

3.1.4 *Key Manmade Landmarks and Infrastructure*

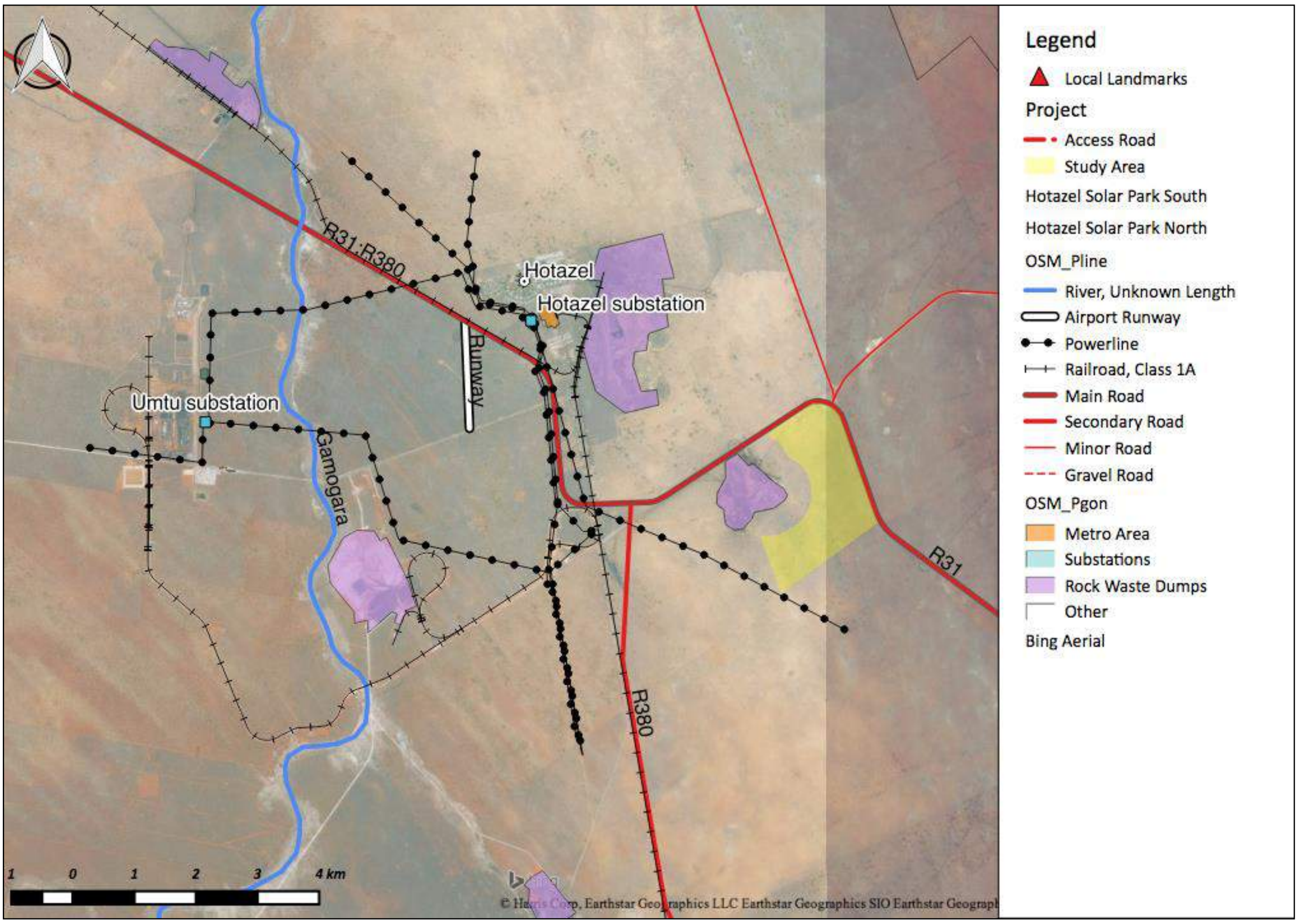


Figure 11: Key Landmarks and Infrastructure Map

A key factor also influencing the local landscape character is infrastructure that has been developed for the extraction of Manganese. As indicated by the purple areas in Figure 9 above, numerous waste rock dumps are located within the vicinity of the proposed project associated with large Manganese Mines which require large structures and generate large waste rock dumps. Also influencing the regional landscape is the associated electrical power and railway infrastructure required by the mines. These include two Eskom Substations (Hotazel and Umtu), multiple railway lines and multiple power lines. The Intertek Mine is an open pit type mine that is located directly west of the proposed PV study area. Located to the west of the power line study area is the Kalagadi Manganese Mine. As depicted in the photographs below, the mining structures and associated waste rock dumps are large in size and clearly dominate the attention of the casual observer. Due to the lower rainfalls of the area, rehabilitation of old rock dumps is limited and the dumps in the area do degrade the local landscape character.

The combination of the surrounding mining landscapes which include large structures and waste rock dumps, in conjunction with the overhead railway structures and power lines, results in some degradation of the general landscape. This is especially experienced when the mines and infrastructures are viewed in close proximity, a strong level of visual contrast results. Due to the close proximity of the study area to the Intertek Mine site, as well as large power line infrastructure, the value of the study visual resources are reduced.

Figure 12: Photograph of the Kalagadi Manganese Mine as seen from the mine access road.

Figure 13: Photograph from the R31 south towards the Intertek Mine that is located adjacent to the west of the proposed site.

Figure 14: Photograph of the strong levels of contrast created by the combined railway line and power line infrastructure as seen from the proposed Umtu Power Line Routing.

3.1.5 *Other Renewable Projects*

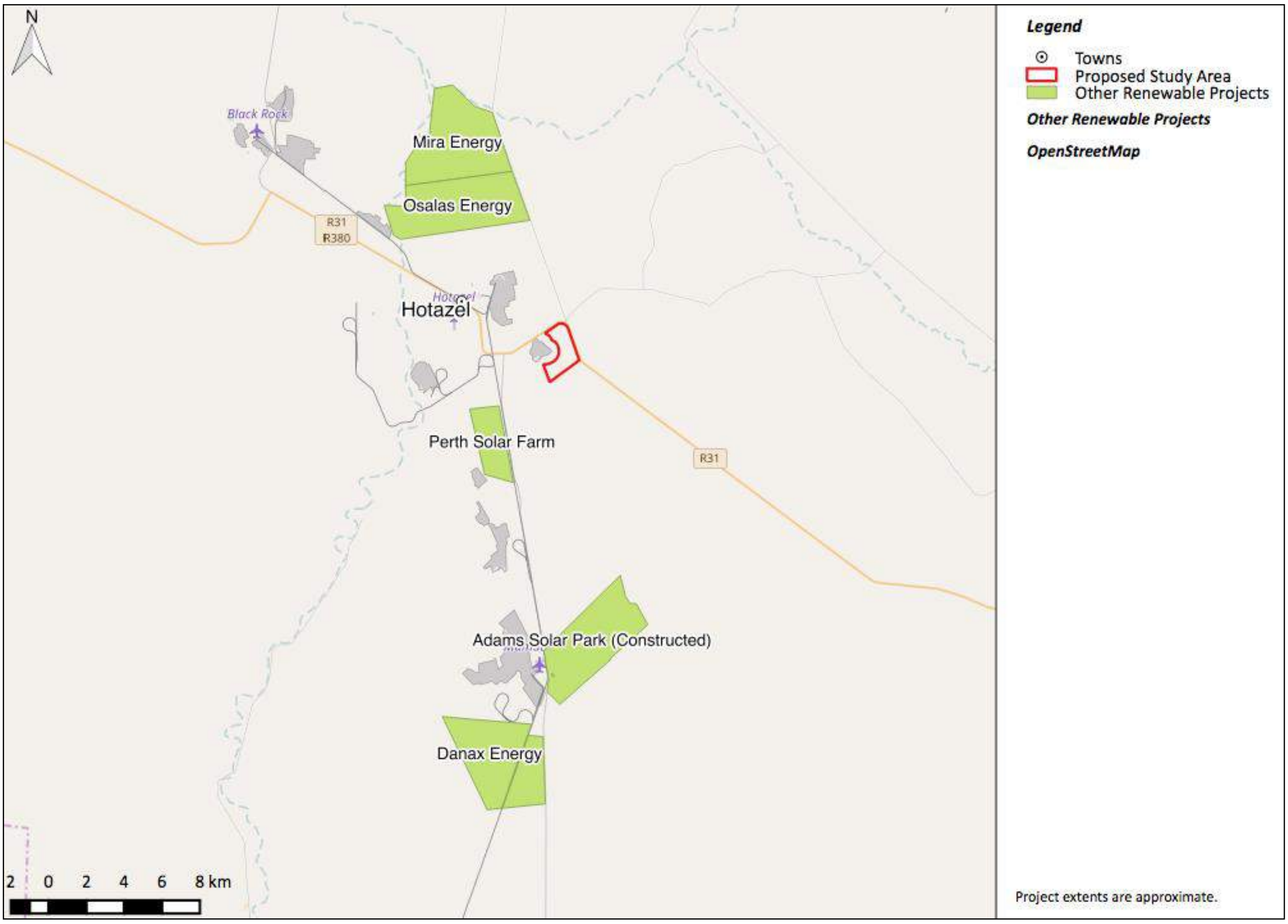


Figure 15: Map depicting the Renewable Energy mapping in relation to the approximate development area of the project.

A spatial query on the DEA Renewable Energy mapping found that there are five other projects proposed within 30 km. The two nearest developments are located approximately 10km to the north, and 4 km south-west of the study area. Of the five proposed projects, Adams Solar Park appears to be the only project that has been constructed. One of the visual issues that needs to be addressed is negative cumulative massing effects created by PV intervisibility which has the potential to dominate the local sense of place. In order to better understand this cumulative effect, a viewshed area map was generated which was overlaid with the exposure buffers of the surrounding proposed (or constructed) PV projects. As indicated in Figure ## below, the viewshed of the proposed PV project is very unlikely to intersect with the high (2km) and medium (4km) exposure areas around the other PV projects. This effect was confirmed during the site visit where no visual incidence of the other proposed project area was found. This is due to the surrounding bushveld vegetation which tends to localise the landscapes. , Further motivation for cumulative negative effects of intervisibility degrading the regional landscape character is that the surrounding areas are already dominated by the larger mining waste rock dump features. As such, the potential for negative cumulative assocatied with degrading the landscape of the surrounding area is rated as Low.

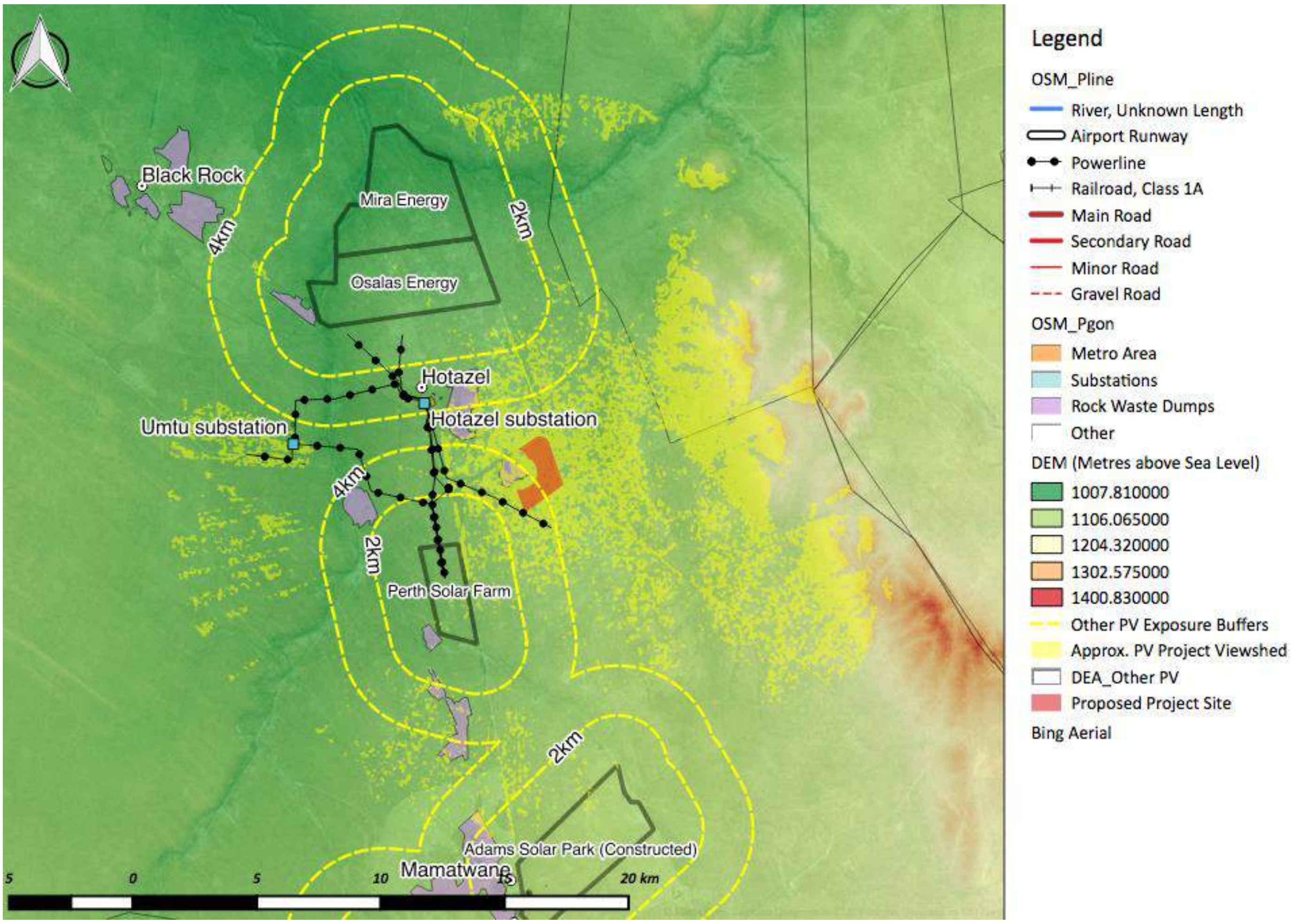


Figure 16: Map depicting the Renewable Energy project in relation to the approximate development viewshed of the PV project.

3.1.6 *Other Landuse*

Other land use identified in the area include limited residential / commercial landuse, and widespread cattle farming. The town of Hotazel was developed to house the workers of the adjacent Hotazel mining area and is located approximately four kilometres to the northwest of the PV study area. The town is small in size and does include some limited commerce. Views from the Hotazel residents towards the proposed study area are limited by the Bushveld vegetation, and by the location of the Hotazel Mine Waste Rock dumps between the town and the PV study site.

The Bushveld vegetation is well suited to cattle based agriculture. Due to the limited carrying capacity of the vegetation, farms are large in size and the farm dwellings are limited. Due to the Bushveld vegetation, views the associated rural farmstead dwellings were limited.

Also located in the area are game farms which could offer some tourism potential. Other than possible game farming, no evidence of tourism activities were identified in the area.

Figure 17: Photograph an isolated farmhouse as seen from the R31.

3.2 Project Visibility

The visible extent, or viewshed, is "the outer boundary defining a view catchment area, usually along crests and ridgelines" (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level as indicated in Table 1 below, making use of open source NASA ASTER Digital Elevation Model data (NASA, 2009). The extent of the viewshed analysis was restricted to a defined distance that represents the approximate zone of visual influence (ZVI) of the proposed activities, which takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988).

Table 2: Proposed Project Heights Table

Proposed Activity	Approx. Height (m)	Viewshed Extent (km)
PV Panels	4 - 6m	12
Structures	8m	12
Power lines	25m	6

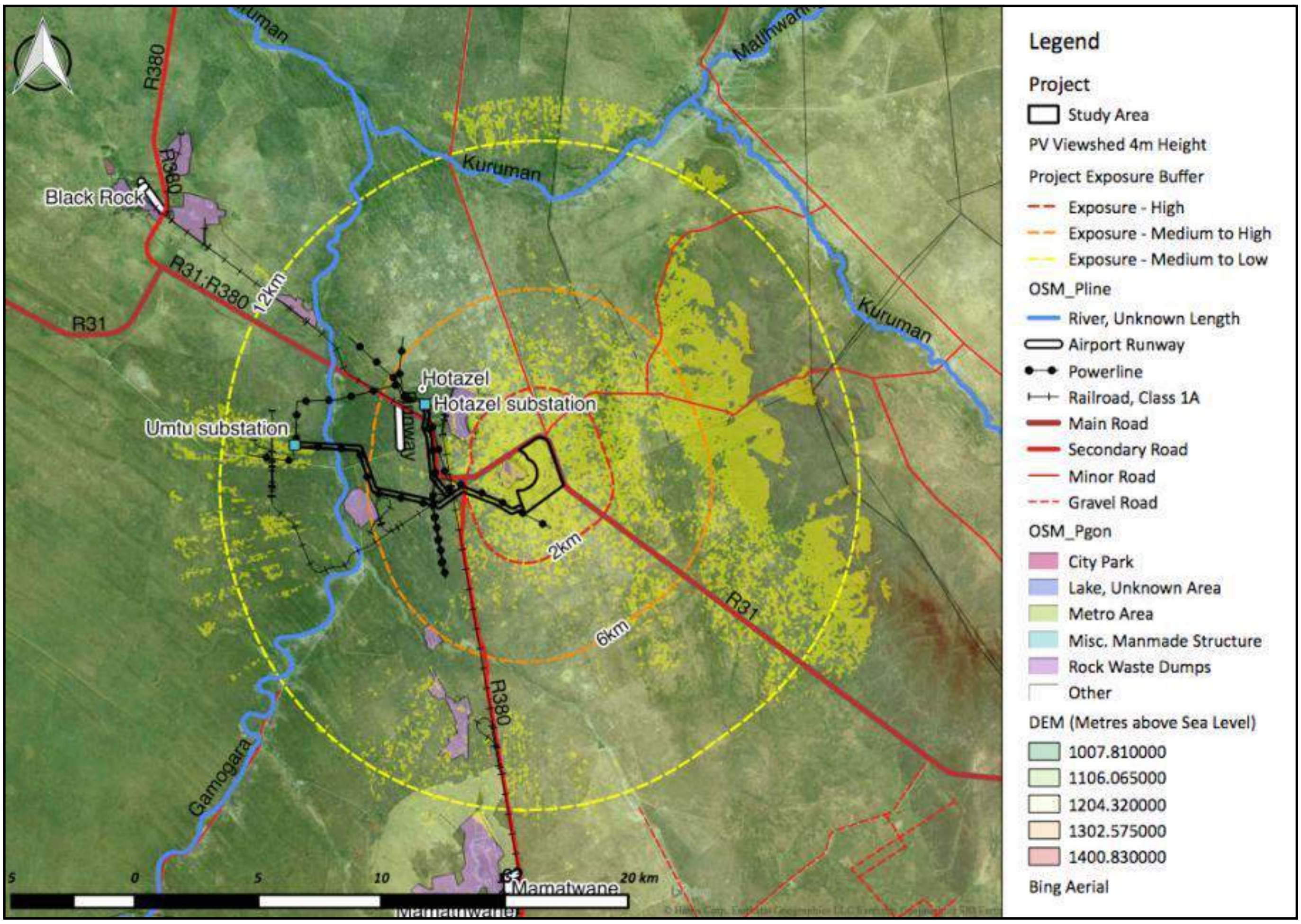


Figure 18: Phase 1 approximate visibility map generated from a 6m Offset.

3.2.1 *Proposed PV Area Visibility Analysis*

A viewshed analysis was undertaken for the site making use of ASTER 90m Digital Elevation Model data. It is important to note that the terrain model ***excludes vegetation and structural screening***. The Offset value was set at 6m above ground to represent the approximate height of the proposed PV panels.

As indicated in Figure 15 above, within the high exposure 2km buffer area visible incidence is most likely as a result of the mainly flat terrain of the study area and immediate surrounds. Due to the medium sized Bushveld vegetation that is found in the area, it is likely that a 6m high structure would be partially visible to the surrounding receptors.

Within the medium to low distance zone, visibility is shaped mainly to the east, with some fragmented views possible from higher ground to the west. Located in this eastern area are the northern extents of the Kuruman Hills. Located 10km to the east, views from this elevated location would be subjected to atmospheric influences reducing clarity of view. This area is also remote and has very few receptors.

Although the nature of the surrounding terrain is mainly flat, the Visual Extent is likely to be ***Regional***. However, due to the Bushveld vegetation and surrounding mining landscapes, the Zone of Visual Influence of a 6m PV type landscape modification is likely to be ***Local*** in influence.

3.2.2 *Proposed PV Area Exposure*

The High Exposure areas (2km) receptors include the R31 Road for the proposed PV site. The small town of Hotazel is located within the Medium to High distance zone. However, visual incidence of the proposed PV structures is unlikely due to the high VAC levels of the local Bushveld vegetation and mining landscapes. Due to the close proximity of the R31 which is routed adjacent to the proposed project areas, the Visual Exposure to the R31 is rated High

3.3 Site Landscape Character

In terms of VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and distance of the proposed landscape modification from key receptor points. These three criteria are rated in terms of the VRM Scenic Quality and Receptor Sensitivity Questionnaires that are appended to the addendum. The Classes are not prescriptive and are utilised as a guideline to determine the carrying capacity of a visually preferred landscape that is utilised to assess the suitability of the landscape change associated with the proposed project.

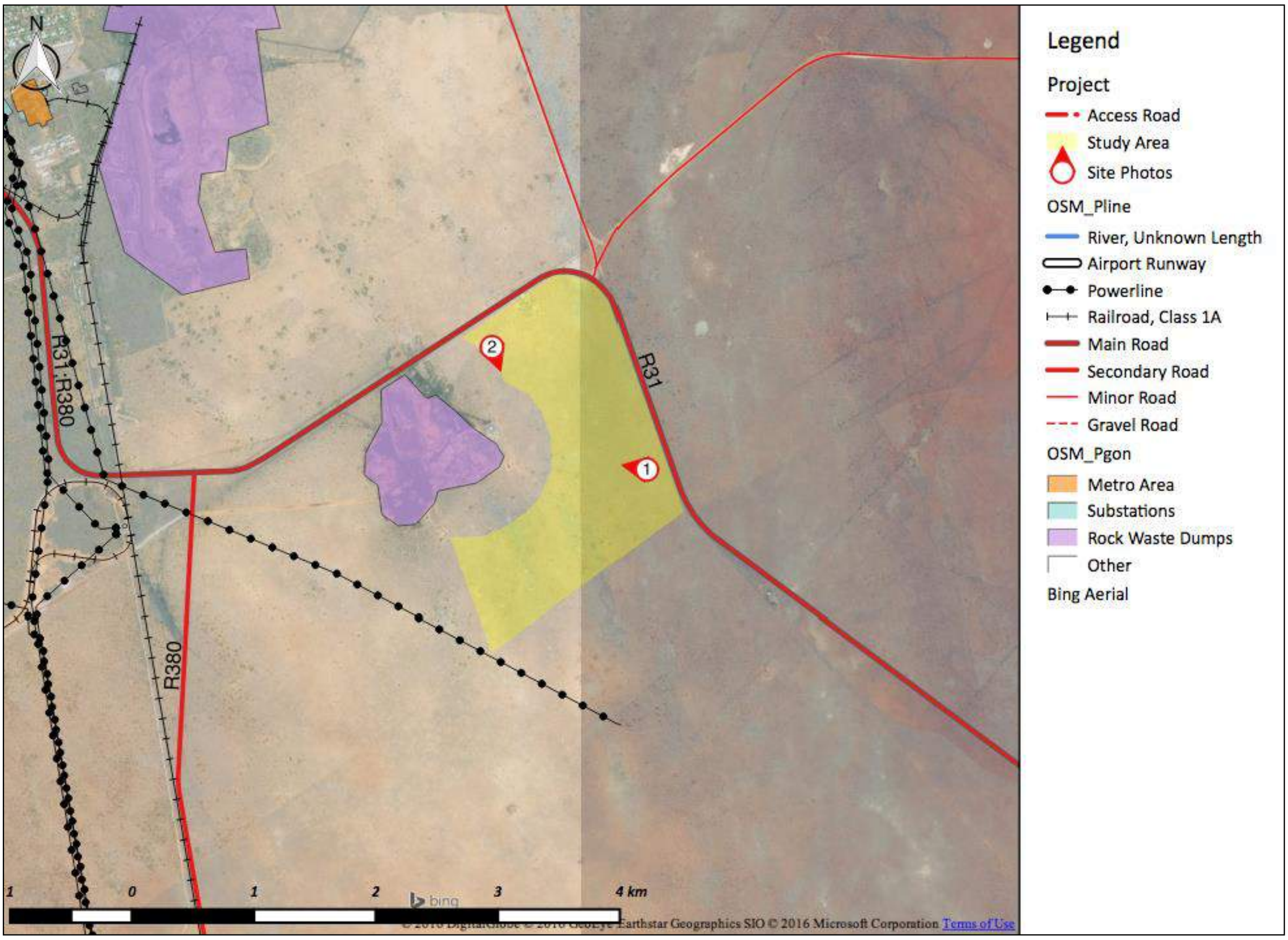


Figure 19: Site photograph locality and direction points overlay onto Bing satellite image map.

Figure 20: Photograph 1 of the low to medium sized Kathu Bushveld vegetation with the low waste rock dump of the Intertek Mine in the background.

Figure 21: Photograph 2 of sparse Kathu Bushveld vegetation to the north of the proposed PV site.

3.3.1 *Scenic Quality*

The Scenic Quality is determined making use of the VRM Scenic Quality Questionnaire (refer to addendum) that rates the different broad-brush landscape found within the study area. Two broad-brush landscapes were identified during the site visit that are listed and mapped below:

- Kathu Bushveld.
- Kathu Bushveld High Exposure: Areas that have high exposure to the R31 Road.

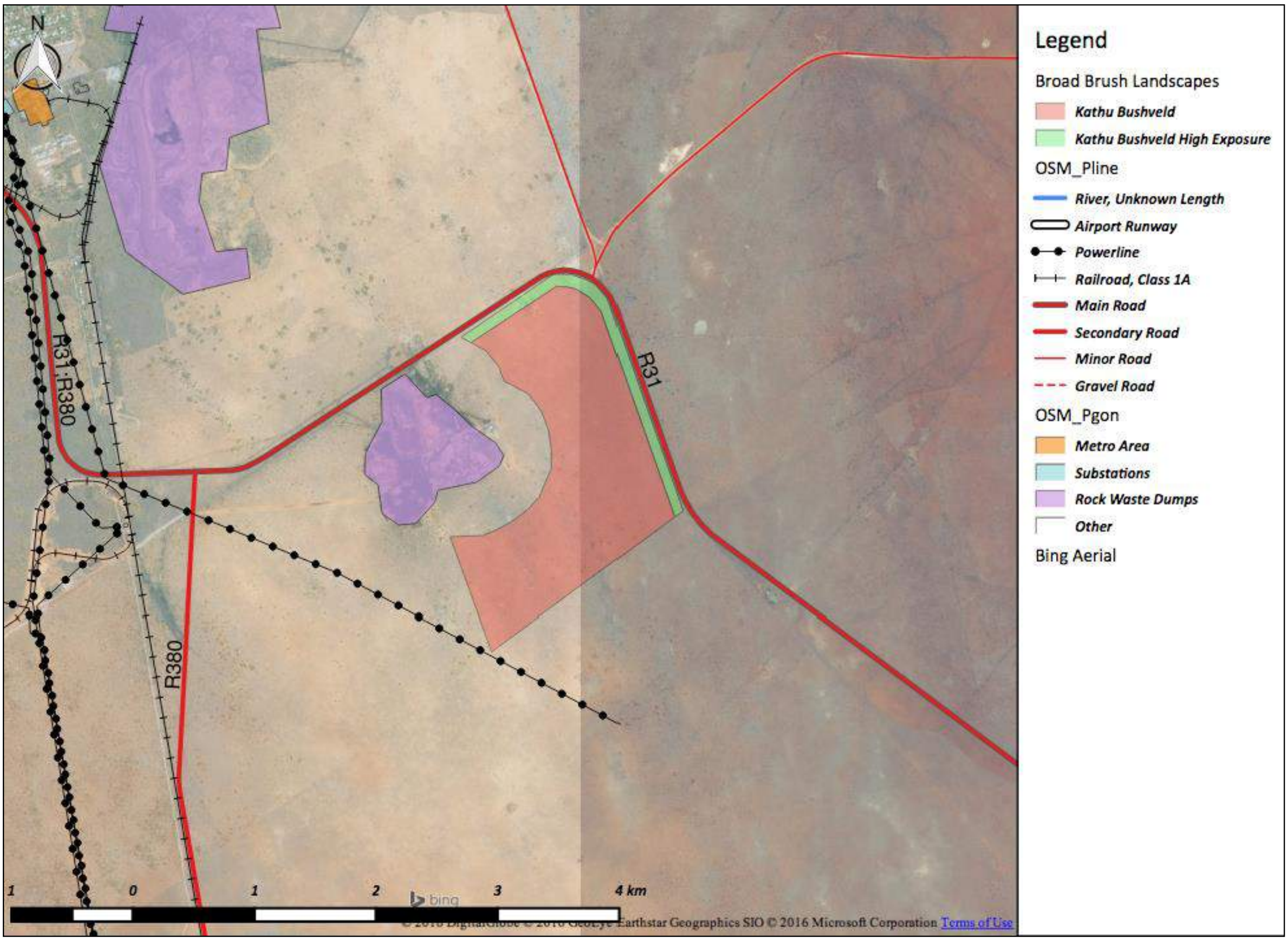


Figure 22: Broad Brush Landscapes

Seven scenic quality criteria area scored on a 1 (low) to 5 (high) scale with the exception of Cultural Modification, which can be scored in the negative depending on the intensity of the visual intrusion. The scores are totalled and assigned a A (High), B (Medium) or C (low) based on the following split:

A= scenic quality rating of ≥19;

B = rating of 12 – 18,

C= rating of ≤11

Table 3: Landscape Scenic Quality rating table.

Landscape	Kathu Bushveld	Kathu Bushveld High Exposure
Landform	1	1
Vegetation	1	1
Water	0	0
Colour	3	3
Adjacent scenery	2	2
Scarcity	1	1
Cultural modifications	-2	0
Score	6	8
Category	C	C

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)

3.3.2 *Receptor Sensitivity*

Sensitivity levels are a measure of public concern for change in the scenic quality of a landscape. Receptor sensitivity to landscape change is determined by rating the following factors rated in terms of Low to High:

Table 4: Landscape Receptor Sensitivity rating table.

Landscape	Kathu Bushveld	Kathu Bushveld High Exposure
Type of user	Low	Low
Amount of use	Low	Medium
Public interest	Low	Low
Adjacent land users	Low	Low
Special areas	Low	Medium
Score	Low	Medium

3.4 Visual Resource Management (VRM) Classes

According to the Bureau of Land Management (BLM), U.S. Department of Interior, landscape significance is assessed by differentiating between those landscapes of recognised or potential significance or sensitivity to modification and landscapes that have low sensitivity and scenic value. “Different levels of scenic values require different degrees of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using standard assessment criteria to describe and evaluate landscapes, and to also describe proposed projects.” (USDI., 2004)

The BLM has defined four Classes that represent the relative value of the visual resources of an area and are defined making use of the VRM Matrix below:
Classes I and II are the most valued
Class III represent a moderate value
Class IV is of least value

Table 5: VRM Class Matrix Table

		VISUAL SENSITIVITY LEVELS								
		High			Medium			Low		
SCENIC QUALITY	A (High)	II	II	II	II	II	II	II	II	II
	B (Medium)	II	III	III/ IV *	III	IV	IV	IV	IV	IV
	C (Low)	III	IV	IV	IV	IV	IV	IV	IV	IV
DISTANCE ZONES		Fore/middle ground	Background	Seldom seen	Fore/middle ground	Background	Seldom seen	Fore/middle ground	Background	Seldom seen

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

Table 6: VRM Class Summary Table

Landscape Area	Distance Zone	Scenic Quality	Visual sensitivity	Visual Inventory	Visual Resource Management
Significant vegetation / Drainage Lines	NA				Class I
Kathu Bushveld	Background	Low	Low	Class IV	Class IV
Kathu Bushveld High Exposure	Foreground	Low	Medium	Class IV	Class III

3.4.1 *Class I*

Class I is assigned when legislation restricts development in certain areas. The visual objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low, and must not attract attention. A Class I visual objective was assigned to the following features within the proposed development area due to their protected status within the South African legislation:

- Any river / streams and associated flood lines buffers identified as significant in terms of the EIA process.
- Any wetlands identified as significant in terms of the EIA process.
- Any ecological areas (or plant species) identified as having a high significance.
- Any heritage area identified as having a high significance.

3.4.2 *Class II*

Due to the Low Scenic Quality of the site which is located adjacent to a mine site, and the Medium to Low sensitivity to landscape change, no Class II Visual Resource Management areas were defined.

3.4.3 *Class III*

Class III visual objectives were assigned to the following landscapes:

- Kathu Bushveld with High Exposure

The Kathu Bushveld Vegetation with High Exposure was rated low scenic quality due to degraded vegetation and close proximity to the Intertek Mine, but having medium receptor sensitivity due to the close proximity of to the R31 Road. As such this landscape was assigned Visual Inventory Class IV. However, due to the close proximity of the proposed industrial type landscape to the R31, the Visual

Resource Management Class III was assigned this landscape to ensure that cumulative visual influences of high exposure views to PV types landscapes is contained as much as possible. The Class III visual objective is to partially retain the existing character of these rural landscapes, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

3.4.4 *Class IV*

Class IV visual objectives were assigned to the following features:

- Kathu Bushveld

The Kathu Bushveld area was rated Class IV due to the degraded vegetation, close proximity to the Intertek Mine and lower proximity to the R31 Road. The Class IV objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention, subject to the applicable zoning regulations and rights of the surrounding land uses.

4 FINDINGS

4.1 Landscape Context

As can be seen in the Digital Elevation Model map above, the topography of the greater area surrounding the study area is relatively flat with the exception of the low hill range to the east. The main drainage of the greater region is to the north via the Gamogara River (approx. 7km west), which is a tributary of the larger Kuruman River located approximately 10km to the north. The only natural topographic feature within the greater area are the Kuruman Hills that are located approximately 15km to the southeast of the study site and rise approximately 100m above the generated terrain.

According to the South African National Biodiversity Institute 2012 Vegetation Map of South Africa, Lesotho and Swaziland, the vegetation biome within which the study area is located is defined as Savanna. Two main vegetation types were listed as intersecting with the study area; Gordonia Duneveld to the west, and Kathu Bushveld to the east. However, it is important to note that the area is arid, with high summer temperature averages. The low rainfall of the region results in vegetation being low in profile, which in relation to the flat terrain creates a uniform broad-brush landscape that has a low local visual absorption capacity, but can assist in reducing medium and background views.

A key factor also influencing the local landscape character is infrastructure that has been developed for the extraction of Manganese. These include four large Manganese Mines which require large structures and generate large waste rock dumps. Also influencing the regional landscape is the associated electrical power and railway infrastructure required by the mines. These include two Eskom Substations (Hotazel and Umtu), multiple railway lines and multiple power lines. The combination of the surrounding mining landscapes which include large structures and waste rock dumps, in conjunction with the overhead railway structures and power lines, results in some degradation of the general landscape. This is especially experienced when the mines and infrastructures are viewed in close proximity as strong levels of visual contrast result. Due to the close proximity of the study area to the Intertek Mine site, as well as large existing power line infrastructure, the value of the area visual resources are reduced.

4.2 Project Visibility and Exposure

Due to the Bushveld vegetation and surrounding mining landscapes, the Zone of Visual Influence of a 6m PV type landscape modification is likely to be ***Local*** in influence. Background views could also be extended to rural farmsteads, however due to the remoteness of the location and Bushveld vegetation, this is unlikely. Due to the close proximity of the proposed project areas to the R31 located adjacent the site, the Visual Exposure to the proposed project is rated as ***High***.

4.3 Site Scenic Quality

Four broad-brush landscapes were identified during the site visit and are listed and mapped below:

- Kathu Bushveld.
- Kathu Bushveld High Exposure: Areas that have high exposure to the R31 Road.

Based on the VRM rating criteria, the overall scenic quality of the site is rated as ***Medium to Low.*** This was mainly due to the close proximity of the study area to the adjacent Intertek Mine, which degrades the local visual resources. Landform for all the landscapes was rated Low due to the flat terrain that has few interesting landscape features. Vegetation for the Kathu Bushveld areas was rated Low as the bush vegetation is sparse, leaving mainly veld grasses. Colour is rated Medium mainly due to the variation of colours of the Bushveld and veld grass vegetation. As the Kathu Bushveld vegetation is widespread and appears to be degraded by previous agricultural practice, the study area was rated Low as a Scarce Landscape.

4.4 Receptor Sensitivity

Based on the VRM rating criteria, the overall Receptor Sensitivity to the site is rated as ***Medium to Low.*** This is due to the relatively remote location of the site, and the close proximity to existing mining landscapes. Other than game farming, no tourism activities were identified during the site visit. The Kathu Bushveld areas are in close proximity to the Intertek Mine and infrastructures landscapes, which have higher VAC levels, but are mainly buffered from clear views by the adjacent road receptors due to the surrounding Bushveld vegetation. The exceptions were the section of the Kathu Bushveld adjacent the R31, which was rated Medium due to the possibility of strong levels of landscape change detracting from the existing rural agricultural landscapes to the east of the site.

5 IMPACT ASSESSMENTS

The contrast rating, or impacts assessment phase, is undertaken to determine if the VRM Class Objectives are met as seen from the defined Key Observation Points. The suitability of the landscape modification is assessed by comparing the degree of potential contrast from the proposed activity to unique visual features created by the existing landscape. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture and form, in relation to the visual objectives defined for the area.

5.1 Key Observation Points

Key Observation Points (KOPs) are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the degree of contrast that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property.

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation;
- Number of viewers;
- Length of time the project is in view;
- Relative project size;
- Season of use;
- Critical viewpoints, e.g. views from communities, road crossings; and
- Distance from property.

Based on the above information, the following visual issues identified in the scoping report are addressed in the impact assessment phase:

- Views as seen from the R31 Road receptors where close proximity clear views of the PV panels would generate strong levels of contrast;
- Cumulative visual effects of multiple local solar energy facilities being visible from a single location that would detract from the greater Bushveld sense of place which is dominant in the region.

5.2 Aurecon Impact Methodology

This section outlines the proposed method for assessing the significance of the potential environmental impacts. For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** (severity of impact) and **DURATION** (time scale) are described.

These criteria are used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described would represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.

The tables below indicate the scale used to assess these variables, and defines each of the rating categories.

Table 7: Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	**Regional**	Beyond a 10km radius of the candidate site.
	Local	Within a 10km radius of the candidate site.
	Site specific	On site or within 100m of the candidate site.
Magnitude of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	**Construction period**	Up to 1 year
	Short Term	Up to 3 years after construction
	Medium Term	3-10 years after construction
	Long Term	More than 10 years after construction

Table 8: Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral	• Zero magnitude with any combination of extent and duration

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring as well as the **CONFIDENCE** in the assessment of the impact would be determined using the rating systems outlined in Table 9 and Table 10 respectively. It is important to note that the significance of an impact should always be considered in conjunction with the probability of that impact occurring. Lastly, the **REVERSIBILITY** and **IRREPLACEABILITY** of the impact is estimated using the rating system outlined in Table 11 and Table 12.

Table 9: Definition of probability ratings

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 10: Definition of confidence ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 11: Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

Table 12: Definition of irreplaceability ratings

REVERSIBILITY RATINGS	CRITERIA
Low	The affected resource is not unique and or does not serve an critical function or is degraded
Medium	The affected resource is moderately important in terms of uniqueness and function or in pristine condition
High	The affected resource is important in terms of uniqueness and function and or in pristine condition and warrants conservation / protection

5.3 Solar Park Impacts

In PV projects, there is often a marked change in landscape character if there is a change in landuse from that of bushveld farming to that of a semi-industrial landscape. This is due to the clearing of the vegetation and construction of a large scale PV facility that is likely to dominate the attention of the casual observer should no mitigation be implemented. This is due to strong levels of contrast which will be generated by the dark colours of the PV panels contrasting strongly with the greens and browns of the surrounding Bushveld vegetation.

Table 13: PV Alternatives Impact Table

Alternatives	Preferred Alternative		No-Go Alternative	
Assessment	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	-ve	-ve	-ve	-ve
Duration	Long Term	Short Term	Long Term	Long Term
Extent	Local	Local	Site	Site
Magnitude	Medium	Low	Null	Null
Probability	Probable	Probable	Unlikely	Unlikely
Confidence	Certain	Certain	Unsure	Unsure
Reversibility	Reversible	Reversible	Reversible	Reversible
Resource irreplaceability	Low	Low	Low	Low
Mitigatability	Partial	Effective	NA	NA
Significance	Medium	Low	Neutral	Neutral
Cumulative effects	Medium	Low	Neutral	Neutral

5.3.1 *Nature of the Impact*

The nature of both the Preferred and No-Go Alternatives are rated Negative. The proposed PV landscape has the potential to generate strong levels of colour, form, texture and line contrast to the existing landscape. In the No-Go option the area is degraded by previous farming practices and the area is located adjacent to a mine which has the potential to expand.

5.3.2 *Duration of the Impact*

The Preferred Alternative pre-mitigation is rated Long Term, as the impact will be clearly visible for the project lifetime. The Preferred Alternative post-mitigation is rated Short Term as the impact will be partially visible during construction phase, reducing visual intensity once the existing trees adjacent to the R31 become more established. Duration of the No-Go impacts of the degraded landscape, are expected to be Long Term as no active farm management is taking place on the property.

5.3.3 *Extent of the Impact*

Due to the surrounding Bushveld vegetation, in relation to the medium height of the proposed PV panels, and the isolated location of the proposed 8m-battery storage facility, the Extent for the Preferred Alternative is rated Local, pre and post mitigation. The Visual Extent of the status quo property is rated Local, as the surrounding Bushveld trees restrict views of the existing property to some degree.

5.3.4 *Magnitude of the Impact*

The Magnitude of the Preferred Alternative pre-mitigation is rated Medium as, although the views of the PV panels as seen from the adjacent R31 District Road will generate strong levels of visual contrast, the proposed site is located adjacent to an open cast mine where expansion may be possible. Post-mitigation, the Preferred Alternative Magnitude is rated Low, as sufficient space is available between the proposed PV footprint and the R31 road to allow the existing Bushveld trees along the road fence line to grow. As the Bushveld trees are low in height, they are unlikely to detract from the efficiency of the PV in terms of creating shadow. The Magnitude of the status quo property is rated Null, as no landscape change is envisaged.

5.3.5 *Probability of the Impact*

Probability of the Preferred Alternative visual impacts taking place is defined as Probable .The proposed project is large in scale and will be noticeable to some degree within the local area, but with the intensity of the landscape change varying in relation to the mitigation applied. The Status Quo scenario is unlikely to result in a noticeable landscape change as the existing landscape is rural agricultural.

5.3.6 *Confidence of the Impact*

The impact ratings for the Preferred Alternative were defined as Certain as sufficient information was provided regarding the nature of the landscape modification in relation to the main key observation points. Due to the lack of knowledge regarding the future changes to the status quo, the confidence was rated Unsure.

5.3.7 *Reversibility of the Impact*

Due to the limited necessity for major earthworks in the construction of the PV project, the Preferred Alternative was defined as Reversible, as the existing agricultural landscape could be re-established to some degree with the removal of all the panels. It is likely that natural Bushveld vegetation would re-establish over time. The existing Bushveld sense of place of the property could be reversed should all the trees be removed and intensive farming practices be implemented.

5.3.8 *Resource Irreplaceability of the Impact*

The existing property is degraded to some degree by the adjacent open cast mine, and may become further degraded with the possible expansion of the adjacent mine. The Bushveld biome extends over a wide area and as such is not unique. There are possibly some protected tree species on site, however, these would be identified by the botanical specialist and effectively managed in terms of the EMP. As such, the existing landscape as a visual resource is rated Low as it is not unique and is degraded.

5.3.9 *Mitigability of the Impact*

Although there are project components that would be taller than the surrounding Bushveld vegetation such as the battery storage facility and telecommunication mast (32m), these components are well set back from the key observation points which are local and lower in elevation allowing the Bushveld vegetation adjacent the road to effectively screen views of these landscape modifications. Due to the existing Bushveld vegetation along the eastern boundary of the site, the stepped design of the PV footprint, and the potential from screening from trees within the road reserve, the Mitigatability of the Pre-Mitigation alternative is defined as Partial. Retaining a 5m buffer area on the property along the R31 road boundary where existing Bushveld vegetation is retained and allowed to grow, would be an effective measure to reduce the high contrast that would be generated by long views of the PV panels as seen from the road receptors.

5.3.10 *Visual Significance of the Impact*

The Visual Significance of the Preferred Alternative Pre-mitigation was rated Medium as the local sense of place is already defined to some degree by the adjacent mine and is likely to become further degraded if expanded. Existing trees within the R31 would offer some partial screening, but the proposed landscape modification would still dominate the attention of the casual observer, creating a semi-industrial landscape context. Further moderation of the impact is due to the contained project zone of visual influence. This is due to the surrounding Bushveld vegetation which is prolific in the area, the relatively flat terrain which restricts clear views as seen from farm residential receptors, and the main access routes being located further away from the project. The Visual Significance of the Preferred Alternative Post-mitigation was rated Low. If a buffer of existing vegetation is retained along the R31 the high exposure views as seen from the R31 road receptors would be effectively screened. As the magnitude of the status quo is rated Zero (it remains the same), the Visual Significance of the No-go Alternative is rated Neutral.

5.3.11 *Cumulative Impact Assessment*

Negative cumulative effects are mainly related to the degradation of the surrounding landscapes due to potentially strong visual contrast generated by structural intrusion and visual massing where large areas of PV panels are viewed, and where multiple PV projects with their semi-industrial landscape character are visible from a single location. In these instances, the sense of place in the landscape can be dominating, degrading the surrounding visual resources. If these visual resources are utilised for eco-tourism activities, landuse conflict can occur.

Within the proposed project zone of visual influence, the landscape character is mainly dominated by Bushveld vegetation and isolated mines. Due to the Bushveld trees surrounding the proposed PV development sites in the area, inter-visibility potential is significantly reduced. The Hotazel area is an established mining area with four large mining landscapes. These landscapes include waste rock dumps, mine headgear as well as large structures. As indicated in Section 3.1.5, the potential for negative Cumulative visual effects in relation to the proposed PV project are rated Low. Retaining a buffer along the road for the existing Bushveld trees will assist in breaking up clear views of the PV panels, and further growth within this buffer zone would further reduce visibility.

5.4 Transmission Line Routing Impacts

Three transmission corridor alternatives to evacuate power from the solar facility to the national grid are being considered by connecting the Solar Facility to the existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-Out (LILO) connection option. These transmission lines would form part of the national grid and therefore fall under the ownership and operation of Eskom. Ownership of this infrastructure to be ceded to Eskom once constructed and must therefore have separate environmental authorisation to allow for the transference of ownership". (Aurecon, 2016)

The following table provides a summary of the project components and alternatives to be assessed during the Basic Assessment process.

Table 14: Hotazel Solar Farm Transmission corridors project alternatives to be assessed

Transmission line C1: Hotazel substation • **A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed** • **Servitude width 35m** • **≤110monopole pylons** • **≤12km long and 4m wide service track**
Transmission line C2: Umtu substation • **A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed** • **Servitude width 35m** • **≤140 monopole pylons** • **≤15km long and 4m service track**
Transmission Line C3: LILO connection3 (please see footnote) • **A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site.** • **Servitude width 35m per line.** • **≤60 monopole pylons (i.e. ≤120 pylons in total)** • **≤6km long and 4m service track per line**
Alternative C4: NO GO • **No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.**

As indicated above, three transmission line routings are proposed: a connection to the Hotazel Substation; a connection to the Umtu Substation and a LILO connection to the existing 132kV line that is located to the west of the site. Possible changes in landscape character related to the proposed transmission line development includes a linear clearing of tree vegetation along the length of the routing, and structural intrusion. Where this cuts through thick Bushveld vegetation in places where the corridor is visible to the surrounding receptors, strong linear contrast can be generated by the removal of the vegetation. The monopole type structures also create a colour and texture contrast, but due to the limited visual footprint of the structure, the zone of visual influence of the monopoles and cabling is usually contained to within two kilometres from site. However, if the structures are placed on prominent locations visibility of the landscape modification would be extended. As none of the routing alternatives are routed over prominent terrain, the zone of visual influence is likely to be localised.

Longer term impacts associated with the transmission line development can also include soil erosion from the maintenance road, especially where this passes over a river system or on steeper terrain. Due to the small footprint of the structure, the monopoles can be removed, and existing Bushveld vegetation would grow back but only after a long period of time. Due to specific design requirements for the structures, mitigation potential is limited, with route mitigation being the best manner to influence the potential impacts associated with loss of vegetation or soil erosion from the maintenance track. With this in mind, pre-

[3] The Loop In Loop Out connection depends on future improvemnets of the Eskom line before being deemed feasible alternative. Since this might occur, juwi wants to keep the alternative alive and have it assessed in the Basic Assessment

mitigation and post-mitigation are rated the same. Regarding cumulative visual impacts, the main issue relating to cumulative effects are related to the landscape cluttering where multiple power lines are viewed from a single location, or where a new power line is constructed which then sets a new routing precedent for future power line routings due to the advantages of not having to remove as much vegetation (as the existing line vegetation has already been cleared). Routing preference are for routes which follow existing routes, which would allow less vegetation to be cut and hence not create linear cluttering effects.

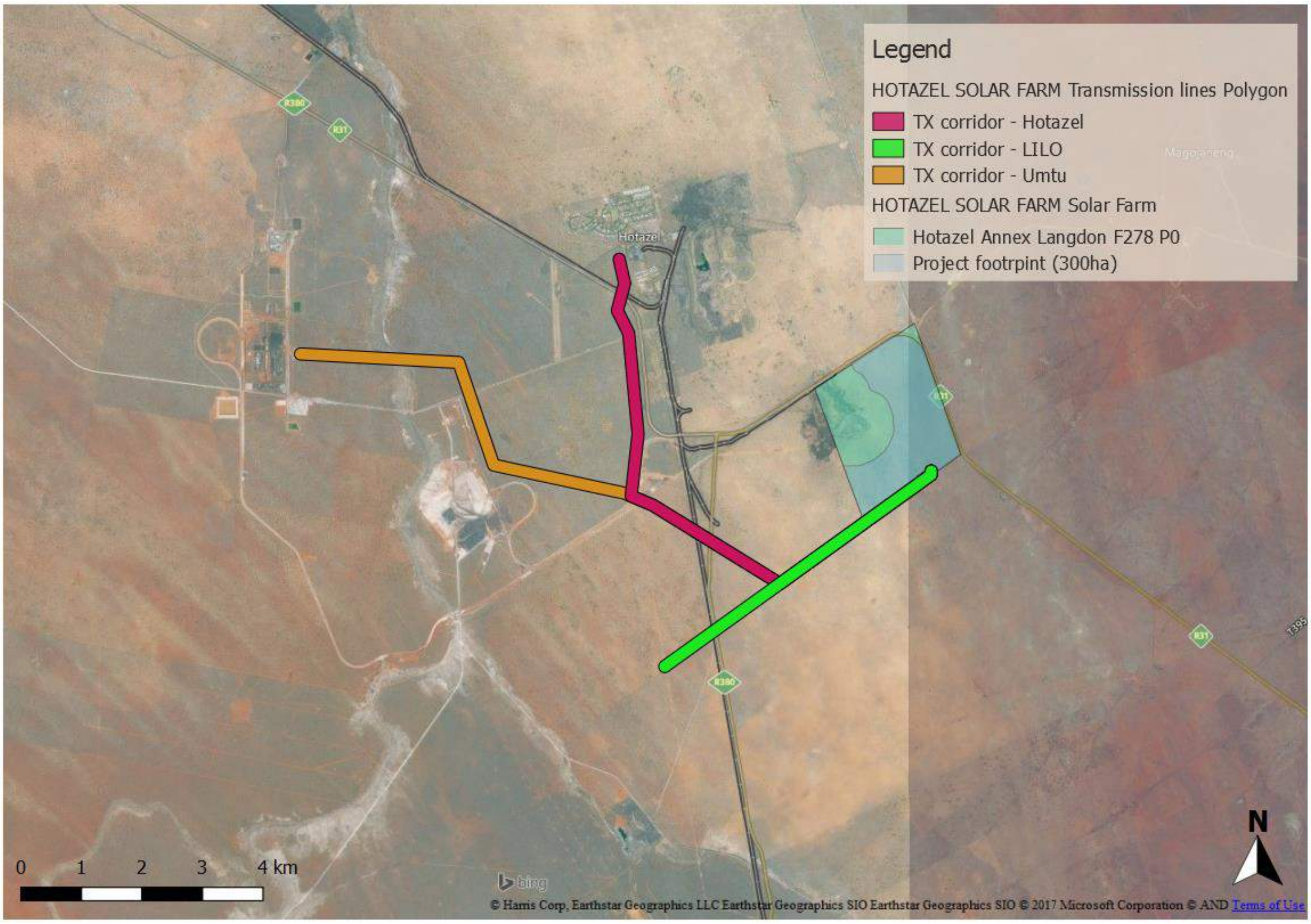


Figure 23: Hotazel, Umtu and LILO Transmission line routing alternatives

Table 15: Transmission Line Alternatives Impact Table

Alternatives	**Hotazel**		**Umtu**		**LILO**		**No-Go Alternative**	
Assessment	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**	**Pre-Mitigation**	**Post Mitigation**
Nature	-ve	-ve	-ve	-ve	-ve	-ve	Neutral	Neutral
Duration	Long	Long	Long	Long	Long	Long	Long	Long
Extent	Local	Local	Local	Local	Local	Local	Site	Site
Magnitude	Low	Low	Medium	Medium	Very Low	Very Low	Zero	Zero
Probability	Definite	Definite	Definite	Definite	Probabl	Probabl	Unlikely	Unlikely
Confidence	Sure	Sure	Sure	Sure	Sure	Sure	Unsure	Unsure
Reversibility	Revers	Revers	Revers	Revers	Revers	Revers	Revers	Revers
Resource	Replace	Replace	Replace	Replace	Replace	Replace	Replace	Replace

irreplaceability	able	able	able	able	able	able	able	able
Mitigatability	Low	Low	Low	Low	Low	Low	NA	NA
Significance	Low	Low	Medium	Medium	Very Low	Very Low	Neutral	Neutral
Cumulative Effects	Low	Low	Medium	Medium	Very Low	Very Low	Neutral	Neutral

5.4.1 *Nature of the Impact*

The natures of all the proposed power line routings are rated negative as all these landscape modifications will require the removal of vegetation, or have the potential to be visually discordant with the environment setting a precedent for future power line routings. In the No-Go option, the status quo is rated positive as the existing vegetation along the route adds to the landscape character.

5.4.2 *Duration of the Impact*

All the proposed power line routings are rated Long Term as they will be given over to the management of Eskom and will be used in the National Grid.

5.4.3 *Extent of the Impact*

The Extent of the Hotazel and Umtu alternatives were rated Local, as their visibility is likely to be contained within the ten kilometre distance zone. These routes follow existing transmission routings to the existing Hotazel and Umtu substations (which increase the visual absorption capacity), and the new line contrast will be viewed against the existing line contrast created by the existing power line infrastructure. Due to the very short length of the LILO routing that is adjacent to an existing power line, the zone of visual influence for this option is expected to be site contained.

5.4.4 *Magnitude of the Impact*

Existing transmission routing to the existing Hotazel and Umtu substations will moderate the magnitude of the visual impact of these new routes. The Hotazel routing is rated Low as the routing follows an existing transmission line route for most of the length of the route, with the rest of the route following an existing railway line. Massing effects are avoided by the route deviating from the existing 66kV line which crosses the R380 and R31 in close proximity to an elevated railway line bridge which would result in high visual intrusion should this route be followed. From the 66kV line, the route follows the railway line and then routes north to cross another existing 66kV line. This places the routing further away from the R31 and behind the existing power line route that masks the visual contrast to some degree. The vegetation along the northern section of the route appears less well established due to closer proximity to a road and existing power line.

The Umtu Route Magnitude is rated Medium. This option is routed through well-established Gordonia Duneveld and crosses a river, but also follows an existing 66kV and then a 132kV power line to the existing Umtu substation. There is a single road crossing but in a suitable location following an existing road which runs adjacent to the railway line.

Due to the very small routing length, the LILO alternative is rated Very Low for Magnitude. The route is in close proximity to the existing 66kV line, and is visually well buffered from road and farm residential receptors. The route is also within the visual context of the open cast mine that already degrades the surrounding landscape to some degree.

The Magnitude for the No-go option was rated Zero as no impact is apparent.

5.4.5 *Probability of the Impact*

The Probability of the Visual Impact taking place was rated Definite for both the Hotazel and Umtu power line route alternatives. In both cases, Bushveld or Duneveld vegetation would have to be removed, which although unlikely to be visually dominating, will detract from local visual resources. The Probability of Impact of the LILO alternative was rated Probably, as a new visual structure will be added to the local context, which due to the height in relation to the surrounding vegetation, could be noticed. The Probability for the No-go option was rated Unlikely, as the area is rural agricultural and mainly used for cattle farming that would not require major landscape modifications.

5.4.6 *Confidence of the Impact*

Confidence for all alternatives was rated Sure as sufficient information was provided and with the site visit, a relatively sound understanding of the environmental factors was obtained. Due to limited knowledge on the No-Go option, this alternative was rated Unsure.

5.4.7 *Reversibility of the Impact*

Due to the small footprint of the structure all the alternatives were defined as Reversible. The monopoles can be removed, and existing Bushveld vegetation would grow back, but only after a long period of time. Rehabilitation and restoration would be required. Any changes to the status quo are likely to be small in scale and agricultural in nature which are likely to be Reversible as well.

5.4.8 *Resource Irreplaceability of the Impact*

The existing area is degraded to some degree by the adjacent open cast mine, three power line, a railway line as well as two roads. Certain areas closer to the proposed PV site are likely to become further degraded with the proposed expansion of the mine. The Bushveld biome extends over a wide area and although there could be protected tree species on site, these would be identified by the botanical specialist and effectively managed in terms of the EMP. As such, the existing landscape as visual resource is rated Low. It is not unique and has a higher visual absorption capacity due to the existing similar infrastructure.

5.4.9 *Mitigability of the Impact*

Due to specific design requirements for the structures, mitigation potential is limited. Route mitigation is the best way to influence the potential impacts associated with loss of vegetation or soil erosion from the maintenance track. With this in mind, pre-mitigation and post-mitigation are rated the same.

5.4.10 *Visual Significance of the Impact*

The Visual Significance of the Hotazel routing is rated Low. As indicated in the Magnitude section, this routing follows an existing transmission line route for most of the length of the route, with the remainder following an existing railway line.

The Visual Significance of the Umtu alternative is rated Medium. The routing is through well-established Gordonia Duneveld and crosses a river, but also follows an existing 66kV and then a 132kV power line to the existing Umtu substation. There is a single road crossing but in a suitable location following an existing road which runs adjacent to the railway line.

Due to the very small routing length, the LILO alternative is rated Very Low for Visual Significance. The route is in close proximity to the existing 66kV line, and is visually well buffered from road and farm residential receptors. The route is also within the visual context of the open cast mine that already degrades the surrounding landscape to some degree.

The Magnitude for the No-go option was rated Neutral, as no impact is apparent.

5.4.11 *Cumulative Effects*

The main issue relating to cumulative effects is landscape cluttering when multiple power lines are viewed from a single location, or where a new power line is constructed which then sets a new routing precedent for future power line routings. This occurs because of the advantages of not having to remove as much vegetation (as the existing line vegetation has already been cleared).

In this instance, the routing preference is for routes which follow existing routes, which would allow less vegetation to be cut and would not create linear cluttering effects. As such, the potential for Cumulative Effects from the Hotazel Routing is rated Low as the route follows a well-established infrastructure corridor, and runs behind the existing 66kV line which would mask the visual contrast to some degree. The Umtu route is rated Medium as the route follows a less well-established infrastructure corridor thought Gordonia Duneveld vegetation. The route with the least potential to result in Cumulative Effects is the LILO alternative due to the short length, the close proximity to the existing power line and open case mine where the surrounding landscape context is degraded to some degree.

5.4.12 *Routing Preference*

The visual preference for the proposed transmission line routing is the LILO, followed by the Hotazel Routing, with the Umtu routing being the least preferred. The short routing length in close proximity to the existing open cast mine and limited exposure to receptors makes this route a clear preference. The Hotazel routing Visual Significance is rated Low as the route successfully avoids potential massing effects. Due to the routing of the Umtu through well-established Gordonia Duneveld and over a river system and along a less well-established infrastructure corridor, the Umtu routing is least preferred.

6 ENVIRONMENTAL MANAGEMENT PLAN

6.1 Solar Park

6.1.1 *Pre-Construction Phase*

<u>General Planning</u>

- The areas adjacent to the R31 not included in the PV or road access footprint should be retained as natural Bushveld vegetation (with suitable buffer to ensure that the area does not become a fire risk to the proposed PV project). These areas should be fenced in with the greater PV project and retained as natural areas. At the discretion of the ECO, any trees that grow to a size that causes shadow to fall on the PV panels can be felled and processed into fire-wood or chipped into a mulch. This mitigation should screen off at least 70% of the views of the proposed PV project as seen from the adjacent R31 road.
- The laydown areas should be designed such that a minimum of a 5m buffer from the road reserve is retained as a No-Go area in order to retain the existing bush-veld vegetation as a tree screening buffer.
- Lights at night have the potential to significantly extend the project zone of visual influence. As such, light spillage reduction should be planned at the Pre-construction phase in accordance with

the recommendations contained in the annexure to restrict the light spillage to within the local level (2km), ensuring that the current dark sky setting of the surrounding rural agricultural sense of place is retained.

6.1.2 *Construction Phase*

- Topsoil excavated from the road footprints should be stockpiled and utilised for rehabilitation of the laydown site.
- Wind blown dust during construction should be monitored by the ECO. Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the ECO.
- Signage on the R31 should be moderated and natural colours used in the signage as much as possible.
- Any plant rescue identified measures, identified by the botanical Specialist need to be implemented.
- Topsoil from the building footprints should be stockpiled and utilised for rehabilitation of the laydown site (or the area around the buildings).
- The buildings and battery storage facility should be painted a grey-brown colour to assist in reducing colour contrast.
- Fencing should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked on a monthly basis for the collection of litter caught on the fence.
- Light spillage measures designed during pre-construction phase should be implemented and monitored by the EO to ensure that light spillage does not create a glowing effect;
- Soil erosion measures need to be adequately implemented and routinely monitored by the appointed Environmental Officer.

6.1.3 *Operation Phase*

- The laydown areas should be ripped to restored de-compacted top-soil, and then rehabilitated to natural bush-veld vegetation.
- Soil erosion measures need to be adequately monitored
- The natural areas along the R31 should be monitored by the site manager on a bi-annual basis to ensure that the area does not become a fire risk. Appropriate measures to reduce deadwood from the area should be implemented.

6.1.4 *Closure Phase*

- All structures not required for agricultural purposes post-closure should be removed and where possible, recycled.
- Building structures should be broken down (including foundations).
- The rubble should be managed according to NEMWA and deposited at a registered landfill if it cannot be recycled or reused.
- All compacted areas should be ripped and then rehabilitated according to a rehabilitation specialist.
- Monitoring for soil erosion should be undertaken on a bi-annual basis for a year following the completion of closure phase.

6.2 Transmission Line

6.2.1 *Construction Phase*

- Strict access control to a single track along the route making use of existing farm tracks for access from the road where possible.
- Soil erosion management to be implemented where required.
- Strict litter control.
- Any extra soil should be shaped to appear natural and re-vegetated.

6.2.2 *Operation Phase*

- On-going erosion control monitoring by the ECO.

6.2.3 *Closure Phase*

- Removal of all structures and recycling of the structure and cables.
- Removal of any foundations and filling of holes created.
- Shape footprint area to reflect natural landscape.
- Rehabilitation and restoration of the footprint and track according to a rehabilitation specialist.

7 Opportunities and Constraints

7.1.1 *Solar Park*

Opportunities

- The general Bushveld vegetation surrounding the site consists of small to medium sized trees, which have the potential to assist in vegetation screening of the PV from outside of the high exposure areas. This would result in a moderate zone of visual influence.
- The greater landscape is strongly associated with Manganese mining and has limited tourism potential.
- The study area is in close proximity to the Intertek Mine, which is associated with a degraded mining landscape and where the study area visual resources are limited.
- The Kathu Bushveld Vegetation in certain areas of the study area appears to be fairly degraded (subject to Botanical Specialist findings).
- Other Renewable Energy projects in the area would not be visible from this location reducing potential cumulative effects from massing of PV infrastructures.

Constraints

- High visual exposure to the R31 Road Receptors.

7.2 Transmission Line

7.2.1 *Hotazel Alternative*

Opportunities

- Follows a well-established infrastructure which has a high visual absorption capacity.
- Routed through a mining landscape that is associated with large mine structures and infrastructure.
- Less pristine vegetation is likely, due to close proximity to the infrastructure corridor and possible Kathu Bushveld interface.
- Shorter than the Umtu routing in length.

Constraints

- Potential for Low magnitude visual impact.

7.2.2 *Umtu Alternative*

Opportunities

- Follows an existing 132kV transmission line route to the existing Umtu substation.
- Routed through a mining landscape that is associated with large mine structures and infrastructure.
- Limited exposure to road receptors.

Constraints

- Potential for Medium magnitude visual impact.

7.2.3 *LILO Alternative*

Opportunities

- Very short length reduces visual impact ratings and potential for cumulative effects;

Constraints

- Potential for Very Low magnitude visual impact.

8 CONCLUSION

Visual Resource Management Africa CC (VRMA) was appointed by Aurecon (Pty) Ltd to undertake a ***Visual Impact Assessment*** for the proposed Hotazel Solar Park on behalf of Juwi Renewable Energies (Pty) Ltd. A site visit was undertaken on the 8th of June 2016. The proposed PV alternative was assessed against the No-Go (status quo) alternative, and the three transmission line routings were compared with the No-Go (status quo) alternative. The opportunities identified for the study area outweigh the constraints, and no Fatal Flaws were identified.

The **Visual Significance** of the Preferred Alternative Pre-mitigation was rated **Medium** as the local sense of place is degraded to some degree by the adjacent mine and is likely to become further degraded by possible expansion. Existing trees along the R31 would offer some partial screening, but the proposed landscape modification would still dominate the attention of the casual observer, creating a semi-industrial landscape context. Further modification of the impact is due to the contained project zone of visual influence. This contained zone of visual influence is due to the surrounding Bushveld vegetation that is prolific in the area, and the relatively flat terrain, which restricts clear views as seen from farm residential receptors, with the main access routes located further away from the project. The Visual Significance of the Preferred Alternative Post-mitigation was rated **Low.** The retention of a natural vegetation buffer along the R31, would effectively screen the high exposure views as seen from the R31 road receptors. As the magnitude of the status quo is rated Zero (it remains the same), the Visual Significance of the No-go Alternative is rated Neutral.

Cumulative visual impacts associated with the proposed PV projects is the potential degradation of the surrounding landscapes due to strong visual contrast generated by the structural intrusion and visual massing where large areas of PV panels are viewed. Within the proposed project zone of visual influence, the landscape character is mainly dominated by Bushveld vegetation and isolated mines, as such the potential for landscape degradation is reduced to some degree. The Hotazel area is an established mining area within which there are four large mining landscapes. These landscapes include waste rock dumps, mine headgear as well as large structures. The potential for Cumulative Effects for the Alternative Preference pre-mitigation was rated **Medium**. This is due to the partially degraded nature of the site which is in close proximity to an open cast mine, but with potentially high levels of visual intrusion generated by the long views of the PV panels along almost three kilometres of road located adjacent the proposed PV site. The Alternative Preference post-mitigation was rated **Low** for Cumulative effects. The retention of a buffer along the road of the existing Bushveld trees will assist in breaking up clear views of the PV panels, and further growth within this buffer zone would further reduce visibility. Due to the Bushveld trees surrounding the proposed PV development sites in the area, inter-visibility potential is significantly reduced.

The **Visual Significance** of the Hotazel Transmission Line routing was rated **Low**. As indicated in the Magnitude section, this line would follow an existing transmission line route for most of its length, with the remainder following an existing railway line. The Visual Significance of the Umtu alternative is rated **Medium** as the routing is through well-established Gordonia Duneveld and crosses a river. However, this is moderated by it following a 132kV power line to the existing Umtu substation. There is a single road crossing but in a suitable location and it follows an existing road which runs adjacent to the railway line. Due to the relatively short routing length, the LILO alternative is rated **Very Low** for Visual Significance. The route is cadastral aligned and is routed over a single road (the R380). The bushveld vegetation would further localise the visual extent. The eastern section of the route is also within the visual context of the open cast mine that does degrade the surrounding landscape to some degree. For these reasons, the LILO alternative is visually preferred.

The potential for Cumulative Visual Impacts relating to landscape cluttering (where multiple power lines are viewed from a single location), or setting an inappropriate routing precedent, was rated Low. This is due to the strong precedent for existing power line infrastructure in the vicinity which increase the vertical line contrast in the landscape. The route with the least potential to result in Cumulative Effects is the LILO alternative which is rated **Very Low**. This is due to the relatively short length, the close proximity to the existing power line and mine, where the surrounding landscape context is degraded to some degree.

9 REFERENCES

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10 ANNEXURE 1: SPECIALIST DECLARATION OF INDEPENDENCE

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

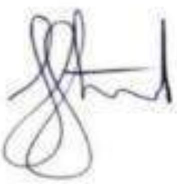
Specialist:	VRM AFRICA CC		
Contact person:	STEPHEN STEAD		
Postal address:	P.O BOX 7233, BLANCO		
Postal code:	6531	Cell:	083 560 9911
Telephone:	044 874 0020	Fax:	086 653 3738
E-mail:	steve@vrma.co.za		
Professional affiliation(s) (if any)	Association of Professional Heritage Practitioners South Africa (APHP)		

The specialist appointed in terms of the Regulations

I, **STEPHEN STEAD**, declare that ---

General declaration:

- I act as the independent specialist in this application
  I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

SILVER SOLUTIONS TRADING AS VRM AFRICA

10.1 Curriculum Vitae

Curriculum Vitae (CV)

Position: ***Owner / Director***
Name of Firm: ***Visual Resource Management Africa cc*** **(www.vrma.co.za)**
Name of Staff: ***Stephen Stead***
Date of Birth: ***9 June 1967***
Nationality: ***South African***
Contact Details: **Tel: +27 (0) 44 876 0020**
Cell: +27 (0) 83 560 9911
Email: steve@vrma.co.za

Educational qualifications:

- University of Natal (Pietermaritzburg):
- Bachelor of Arts: Psychology and Geography
- Bachelor of Arts (Hons): Human Geography and Geographic Information Management Systems

Professional Accreditation

- Association of Professional Heritage Practitioners (APHP) Western Cape
  - Accredited VIA practitioner member of the Association (2011)

Association involvement:

- International Association of Impact Assessment (IAIA) South African Affiliate
  - Past President (2012 - 2013)
  - President (2012)
  - President-Elect (2011)
  - Conference Co-ordinator (2010)
  - National Executive Committee member (2009)
  - Southern Cape Chairperson (2008)

Conferences Attended:

- IAIAsa 2012
- IAIAsa 2011
- IAIA International 2011 (Mexico)
- IAIAsa 2010
- IAIAsa 2009
- IAIAsa 2007

Continued Professional Development:

- Integrating Sustainability with Environment Assessment in South Africa (IAIAsa Conference, 1 day)
- Achieving the full potential of SIA (Mexico, IAIA Conference, 2 days 2011)
- Researching and Assessing Heritage Resources Course (University of Cape Town, 5 days, 2009)

Countries of Work Experience:

- South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

Relevant Experience:

Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa that specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. In association with ILASA qualified landscape architect Liesel Stokes, he has assessed of over 100 major landscape modifications throughout southern and eastern Africa. The business has been operating for eight years and has successfully established and retained a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Mellium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

Languages:

- English – First Language
- Afrikaans – fair in speaking, reading and writing

Projects:

A list of ***some*** of the large scale projects that VRMA has assessed has been attached below with the client list indicated per project (Refer to www.vrma.co.za for a full list of projects undertaken).

YEAR	NAME	DESCRIPTION	LOCATION
2014	Joram Solar	Solar Energy	Northern Cape
2014	RERE PV Postmasberg	Solar Energy	Northern Cape
2014	RERE CPV Upington	Solar Energy	Northern Cape
2014	Rio Tinto RUL Desalinisation Plant	Industrial	Namibia
2014	NamPower PV	Solar Energy	Namibia
2014	Pemba Oil and Gas Port Expansion	Industrial	Mozambique
2014	Brightsource ## Upington	Solar Energy	Northern Cape
2013	Cape Winelands DM Regional Landfill	Industrial	Western Cape
2013	Drennan PV Solar Park	PV Solar Energy	Eastern Cape
2013	Eastern Cape Mari-culture	Mari-culture	Eastern Cape
2013	Eskom Pantom Pass Substation	Substation /Tx lines	Knysna
2013	Frankfort Paper Mill	Plant	Free State
2013	Gibson Bay Wind Farm Transmission lines	Tranmission lines	Eastern Cape
2013	Houhoek Eskom Substation	Substation /Tx lines	Western Cape
2013	Mulilo PV Solar Energy Sites (x4)	PV Solar Energy	Northern Cape
2013	Namies Wind Farm	Wind Energy	Northern Cape
2013	Rössing Z20 Pit and WRD	Mining	Namibia
2013	SAPPI Boiler Upgrade	Plant	Mpumalanga
2013	Tumela WRD	Mine	North West
2013	Weskusfleur Substation (Koeburg)	Substation /Tx lines	Western Cape
2013	Yzermyn coal mine	Mine	Mpumalanga
2012	Afrisam	Mine	Saldana
2012	Bitterfontein	PV Energy	N Cape
2012	Bitterfontein slopes	Slopes Analysis	N Cape
2012	Kangnas PV	Energy	N Cape
2012	Kangnas Wind	Energy	N Cape
2012	Kathu ## ##	Solar Power	Northern Cape
2012	Kobong Hydro	Hydro & Powerline	Lesotho
2012	Letseng Diamond Mine Upgrade	Mine	Lesotho
2012	Lunsklip Windfarm	Windfarm	Stilbaai
2012	Mozambique Gas Engine Power Plant	Plant	Mozambique
2012	Ncondezi Thermal Power Station	Substation /Tx lines	Mozambique
2012	Sasol ## ##	Solar Power	Free State
2012	Sasol Upington ## ##	Solar Power	Northern Cape
2011	Beaufort West PV Solar Power Station	Power Station	Beaufort West
2011	Beaufort West Wind Farm	Wind Energy	Beaufort West
2011	De Bakke Cell Phone Mast	Mast	Western Cape
2011	ERF 7288 PV	PV	Beaufort West
2011	Gecko Industrial park	Industrial	Namibia
2011	Green View Estates	Residential	Mossel Bay
2011	Hoodia Solar	PV expansion	Beaufort West
2011	Kalahari Solar Power Project	Solar Power	Northern Cape
2011	Khanyisa Power Station	Power Station	Western Cape
2011	Laingsburg Windfarm	Level 4	Mpumalanga
2011	Olvyn Kolk PV	Solar Power	Northern Cape
2011	Otjikoto Gold Mine	Mining	Namibia
2011	PPC Rheebieck West Upgrade	Industrial	
2011	Slopes analysis Erf 7288 Beaufort West	Slopes	Beaufort West
2011	Southern Arterial	Road	George
2010	Bannerman Etango Uranium Mine	Mining	Namibia

YEAR	NAME	DESCRIPTION	LOCATION
2010	Bantamsklip Transmission Revision	Transmission	Eastern Cape
2010	Beaufort West Urban Edge	Mapping	Beaufort West
2010	Bon Accord Nickel Mine	Mine	Barbeton
2010	Herolds Bay N2 Development Baseline	Residential	George
2010	MTN Lattice Hub ##	Structure	George
2010	N2 Herolds Bay Residental	Residential	Herolds Bay
2010	Onifin(Pty) Ltd Hartenbos Quarry Extension	Mining	Mossel Bay
2010	Rössing South Board Meeting	Mining	Namibia
2010	Still Bay East	Mapping	SA, WC
2010	Vale Moatize Coal Mine and Railwayline	Mining_rail	Mozambique
2010	Vodacom Mast	Structure	Reichterbosch
2010	Wadrif Dam	Dam	Beaufort West
2009	Asazani Zinyoka UISP Housing	Residential Infill	Mossel Bay
2009	Bantamsklip GIS Mapping	Mappig	Western Cape
2009	Eden Telecommunication ##	Structure ##	George
2009	George Landscape Characterisation	George SDF	George
2009	George Western Bypass	Structure Road	George
2009	Rössing Uranium Mine Phase 2	Mining	Namibia
2009	Sun Ray Wind Farm	Wind Energy	Still Bay
2008	Bantamsklip Transmission Lines Scoping	Transmission	Western Cape
2008	Erf 251 Damage Assessment	Residential VIA	Great Brak
2008	Erongo Uranium Rush SEA	SEA	Namibia
2008	Evander South Gold Mine Preliminary VIA	Mining	Mpumalanga
2008	George Open Spaces System	George SDF	George
2008	GrooteSchuur Heritage Mapping	Mapping	Cape Town
2008	Hartenbos River Park	Residential VIA	Hartenbos
2008	Kaaimans Project	Residential	Wilderness
2008	Lagoon Garden Estate	Residential VIA	Great Brak
2008	Moquini Beach Hotel	Resort	Mossel Bay
2008	NamPower Coal fired Power Station	Power Station	Namibia
2008	Oasis Development	Residential VIA	Plettenberg Bay
2008	RUL Sulpher Handling Facility	Mining	Walvis Bay
2008	Stonehouse Development	Residential VIA	Plettenberg Bay
2008	Walvis Bay Power Station	Structure	Namibia.
2007	Calitzdorp Retirement Village	Residential VIA	Calitzdorp
2007	Calitzdorp Visualisation	Visualisation	Calitzdorp
2007	Camdeboo Estate	Residential VIA	Graaff Reinet
2007	Destiny Africa	Residential	George
2007	Droogfontein Farm 245	Residential VIA	Danabaai
2007	Floating Liquified Natural Gas Facility	Structure tanker	Mossel Bay
2007	George Municipality Densification	George SDF	George
2007	George Municipality SDF	George SDF	George
2007	Kloofsig Development	Residential VIA	Vleesbaai
2007	OCGT Power Plant Extension	Structure Power Plant	Mossel Bay
2007	Oudtshoorn Municipality SDF	Mapping	Oudtshoorn
2007	Oudtshoorn Shopping Complex	Structure Mall	Oudtshoorn
2007	Pezula Infill (Noetzie)	Residential VIA	Knysna
2007	Pierpoint Nature Reserve	Residential VIA	Knysna
2007	Pinnacle Point Golf Estate	Golf/Residential	Mossel Bay
2007	Rheebok Development Erf 252 Apeal	Residential VIA	Great Brak
2007	Rössing Uranium Mine Phase 1	Mining	Namibia
2007	Ryst Kuil/Riet Kuil Uranium Mine	Mining	Beaufort West
2007	Sedgefield Water Works	Structure	Sedgefield

YEAR	NAME	DESCRIPTION	LOCATION
2007	Sulpher Handling Station Walvis Bay Port	Industrial	Namibia
2007	Trekkopje Uranium Mine	Mining	Namibia
2007	Weldon Kaya	Residential VIA	Plettenberg Bay
2006	Fancourt Visualisation Modelling	Visualisation	George
2006	Farm Dwarsweg 260	Residential VIA	Great Brak
2006	Fynboskruin Extention	Residential VIA	Sedgefield
2006	Hanglip Golf and Residential Estate	Golf/Residential	Plettenberg Bay
2006	Hansmoeskraal	Slopes Analysis	George
2006	Hartenbos Landgoed Phase 2	Residential VIA	Hartenbos
2006	Hersham Security Village	Residential VIA	Great Brak
2006	Ladywood Farm 437	Residential VIA	Plettenberg Bay
2006	Le Grand Golf and Residential Estate	Golf/Residential	George
2006	Paradise Coast	Residential VIA	Mossel Bay
2006	Paradyskloof Residential Estate	Residential VIA	Stellenbosch
2006	Riverhill Residential Estate	Residential VIA	Wilderness
2006	Wolwe Eiland Access Route	Road	Victoria Bay
2005	Harmony Gold Mine	Mining	Mpumalanga.
2005	Knysna River Reserve	Residential VIA	Knysna
2005	Kruisfontein Infill	Mapping	Knysna
2005	Lagoon Bay Lifestyle Estate	Residential VIA	Glentana
2005	Outeniquabosch Safari Park	Residential	Mossel Bay
2005	Proposed Hotel Farm Gansevallei	Resort	Plettenberg Bay
2005	Uitzicht Development	Residential VIA	Knysna
2005	West Dunes	Residential VIA	Knysna
2005	Wilderness Erf 2278	Residential VIA	Wilderness
2005	Wolwe Eiland Eco & Nature Estate	Residential VIA	Victoria Bay
2005	Zebra Clay Mine	Mining	Zebra
2004	Gansevallei Hotel	Residential VIA	Plettenberg Bay
2004	Lakes Eco and Golf Estate	Golf/Residential	Sedgefield
2004	Trekkopje Desalination Plant	Structure Plant	Namibia
1995	Greater Durban Informal Housing Analysis	Photogrametry	Durban

11 Annexure 2: Questionnaires and VRM Terminology

11.1 Methodology Detail (USDI., 2004)

Viewshed

The visible extent, or viewshed, is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' *(Oberholzer, 2005).* This reflects the area, or extent, where the landscape modification would probably be seen. However, visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature. Therefore the views of a landscape modification would not necessarily influence the landscape character within all areas of the viewshed. The information for the terrain used in the 3D computer model on which the visibility analysis is based on the Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer Data, a product of Japan's Ministry of Economy, Trade and Industry (METI) and National Aeronautics and Space Administration (NASA) in USA. (NASA, 2009)

Receptor Exposure

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K. Institute of Environmental Management and Assessment's (IEMA) *'Guidelines for Landscape and Visual Impact Assessment'* as 'the area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'

The inverse relationship of distance and visual impact is well recognised in visual analysis literature *(Hull, R.B. and Bishop, I.E., 1988)*. According to Hull and Bishop, exposure, or visual impact, tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2 km from the site of the landscape modification. Thus the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases due to atmospheric conditions prevalent at a location, which causes the air to appear greyer, thereby diminishing detail. For example, viewed from 1000 m from a landscape modification, the impact would be 25% of the impact as viewed from 500 m from a landscape modification. At 2000m it would be 10% of the impact at 500 m. The relationship is indicated in the following graph generated by Hull and Bishop.

The VRM methodology also takes distance from a landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land Management. The distance zones are:

i. ***Foreground / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
ii. ***Background areas***, from 6km to 24km, where there is some potential for change in the sense of place, but where change would only occur in the case of very large landscape modifications; and
iii. ***Seldom seen areas***, which fall within the Foreground / Middle ground area but, as a result of no receptors, are not viewed or are seldom viewed.

Scenic Quality

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and distance of the proposed landscape modification from key receptor points. The scenic quality is determined making use of the VRM scenic quality questionnaire (refer to addendum). Seven scenic quality criteria area scored on a 1 (low) to 5 (high) scale. The scores are totalled and assigned a A (High), B (Moderate) or C (low) based on the following split:

A= scenic quality rating of ≥19;
B = rating of 12 – 18,
C= rating of ≤11

The seven scenic quality criteria are defined below:

Land Form: Topography becomes more of a factor as it becomes steeper, or more severely sculptured.

Vegetation: Primary consideration given to the variety of patterns, forms, and textures created by plant life.

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
Colour: The overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) are considered as they appear during seasons or periods of high use.
Scarcity: This factor provides an opportunity to give added importance to one, or all, of the scenic features that appear to be relatively unique or rare within one physiographic region.
Adjacent Land Use: Degree to which scenery and distance enhance, or start to influence, the overall impression of the scenery within the rating unit.
Cultural Modifications: Cultural modifications should be considered, and may detract from the scenery or complement or improve the scenic quality of an area.

Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:
Type of Users: Visual sensitivity will vary with the type of users, e.g. recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
Amount of Use: Areas seen or used by large numbers of people are potentially more sensitive.
Public Interest: The visual quality of an area may be of concern to local, or regional, groups. Indicators of this concern are usually expressed via public controversy created in response to proposed activities.
Adjacent Land Uses: The interrelationship with land uses in adjacent lands. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be as visually sensitive.
Special Areas: Management objectives for special areas such as Natural Areas, Wilderness Areas or Wilderness Study Areas, Wild and Scenic Rivers, Scenic Areas, Scenic Roads or Trails, and Critical Biodiversity Areas frequently require special consideration for the protection of their visual values.
Other Factors: Consider any other information such as research or studies that include indicators of visual sensitivity.

Visual Resource Management (VRM) Classes

The VRM Classes represent the relative value of the visual resources of an area and are determined making use of the VRM Class Matrix see Table 8 below:

Classes I and II are the most valued;
Class III represents a moderate value; and
Class IV is of least value.

The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity. The Visual Inventory Classes are defined using the matrix below and with motivation, can be adjusted to Visual Resource Management Classes:

The visual objectives of each of the classes is listed below:
The Class I objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low, and must not attract attention. Class I is assigned when a specialist decision is made to maintain a natural landscape.
The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
The Class III objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The Class IV objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

Key Observation Points (KOPs)

KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the Degree of Contrast (DoC) that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property.

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:
Angle of observation;
Number of viewers;
Length of time the project is in view;
Relative project size;
Season of use;
Critical viewpoints, e.g. views from communities, road cRössings; and
Distance from property.

Contrast Rating

The contrast rating, or impacts assessment phase, is undertaken to determine if the VRM Class Objectives are met. The suitability of landscape modification is assessed by comparing the degree of potential contrast from the proposed activity in comparison to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

None: The element contrast is not visible or perceived.
Weak: The element contrast can be seen but does not attract attention.
Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong: The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for proposed landscape activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed project/development. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the Proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003)*(Sheppard, S.R.J., 2005)*.This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information

- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity and Interest

The Code of Ethical Conduct states that the presenter should:
- Demonstrate an appropriate level of qualification and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for, or used in, the visualisation process.
- Conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and timeframes appropriate to the area being visualised.
- Estimate and disclose the expected degree of uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use, or the appearance of, 'sales' techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and how key decisions were taken *(Sheppard, S.R.J., 2005)*.

11.2 Questionnaires

Scenic Quality Rating Questionnaire

KEY FACTORS	**RATING CRITERIA AND SCORE**		
SCORE	**5**	**3**	**1**
Land Form	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations or detail features that are dominating and exceptionally striking and intriguing.	Steep-sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting, though not dominant or exceptional.	Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures and patterns.	Some variety of vegetation, but only one or two major types.	Little or no variety or contrast in vegetation.
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	Flowing, or still, but not dominant in the landscape.	Absent, or present but not noticeable.
Colour	Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water.	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	Subtle colour variations contrast or interest: generally mute tones.
Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	Adjacent scenery moderately enhances overall visual quality.	Adjacent scenery has little or no influence on overall visual quality.

Scarcity	One of a kind: unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly common within the region.
SCORE	**2**	**0**	**-4**
Cultural Modification	Modifications add favourably to visual variety, while promoting visual harmony.	Modifications add little or no visual variety to the area, and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

Sensitivity Level Rating Questionnaire

FACTORS	**QUESTIONS**	
Type of Users	**Maintenance of visual quality is:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Amount of use	**Maintenance of visual quality becomes more important as the level of use increases:**	
	A high level of use	High
	Moderately level of use	Moderate
	Low level of use	Low
Public interest	**Maintenance of visual quality:**	
	A major concern for most users	High
	A moderate concern for most users	Moderate
	A low concern for most users	Low
Adjacent land Users	**Maintenance of visual quality to sustain adjacent land use objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low
Special Areas	**Maintenance of visual quality to sustain Special Area management objectives is:**	
	Very important	High
	Moderately important	Moderate
	Slightly important	Low

11.3 VRM Terminology

FORM	LINE	COLOUR	TEXTURE
Simple Weak Strong Dominant Flat Rolling Undulating Complex Plateau Ridge	Horizontal Vertical Geometric Angular Acute Parallel Curved Wavy Strong Weak	Dark Light Mottled	Smooth Rough Fine Coarse Patchy Even Uneven Complex Simple Stark

Valley Plain Steep Shallow Organic Structured	Crisp Feathered Indistinct Clean Prominent Solid		Clustered Diffuse Dense Scattered Sporadic Consistent

Simple	Basic, composed of few elements	Organic	Derived from nature; occurring or developing gradually and naturally
Complex	Complicated; made up of many interrelated parts	Structure	Organised; planned and controlled; with definite shape, form, or pattern
Weak	Lacking strength of character	Regular	Repeatedly occurring in an ordered fashion
Strong	Bold, definite, having prominence	Horizontal	Parallel to the horizon
Dominant	Controlling, influencing the surrounding environment	Vertical	Perpendicular to the horizon; upright
Flat	Level and horizontal without any slope; even and smooth without any bumps or hollows	Geometric	Consisting of straight lines and simple shapes
Rolling	Progressive and consistent in form, usually rounded	Angular	Sharply defined; used to describe an object identified by angles
Undulating	Moving sinuously like waves; wavy in appearance	Acute	Less than 90°; used to describe a sharp angle
Plateau	Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes	Parallel	Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet
Ridge	A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills	Curved	Rounded or bending in shape
Valley	Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground	Wavy	Repeatedly curving forming a series of smooth curves that go in one direction and then another
Plain	A flat expanse of land; fairly flat dry land, usually with few trees	Feathered	Layered; consisting of many fine parallel strands
Steep	Sloping sharply often to the extent of being almost vertical	Indistinct	Vague; lacking clarity or form
Prominent	Noticeable; distinguished, eminent, or well-known	**Patchy**	Irregular and inconsistent;
Solid	Unadulterated or unmixed; made of the same material throughout; uninterrupted	**Even**	Consistent and equal; lacking slope, roughness, and irregularity
Broken	Lacking continuity; having an uneven surface	**Uneven**	Inconsistent and unequal in measurement irregular
Smooth	Consistent in line and form; even textured	**Stark**	Bare and plain; lacking ornament or relieving features
Rough	Bumpy; knobbly; or uneven, coarse in texture	**Clustered**	Densely grouped
Fine	Intricate and refined in nature	**Diffuse**	Spread through; scattered over an area
Coarse	Harsh or rough to the touch; lacking detail	**Diffuse**	To make something less bright or intense

12 ANNEXURE 3: GENERAL LIGHTS AT NIGHT GUIDELINES

The International Dark-sky Association (IDA) recommend lighting with lower color temperatures has less blue in its spectrum and is referred to as being "warm." "Higher color temperature sources of light are rich in blue light. (International Dark-sky Association)

IDA recommends that only warm light sources be used for outdoor lighting. This includes LPS, HPS and low-color-temperature LEDs. In some areas, the white light of even a low-color-temperature LED can be a threat to the local nighttime environment. In those cases, LPS or narrow-spectrum LEDs are preferred choices". The following recommendations are presented by the New England Light Pollution Advisory Group (NELPAG)

What is good lighting? Good outdoor lights improve visibility, safety, and a sense of security, while minimizing energy use, operating costs, and ugly, dazzling glare.

Why should we be concerned? Many outdoor lights are poorly designed or improperly aimed. Such lights are costly, wasteful, and distractingly glary. They harm the night-time environment and neighbours' property values. Light directed uselessly above the horizon creates murky skyglow — the "light pollution" that washes out our view of the stars.

Glare Here's the basic rule of thumb: If you can see the bright bulb from a distance, it's a bad light. With a good light, you see lit ground instead of the dazzling bulb. "Glare" is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

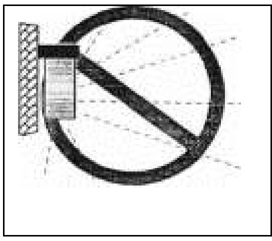
Light Trespass Poor outdoor lighting shines onto neighbours' properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

Excess Lighting Some homes and businesses are flooded with much stronger light than is necessary for safety or security.

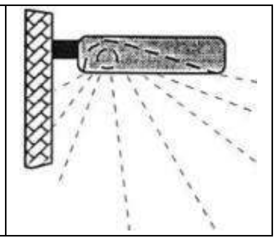
Good and Bad Light Fixtures

Typical "Wall Pack"



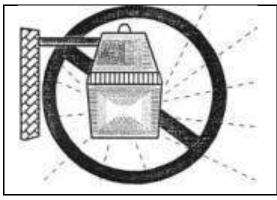
BAD
Waste light goes up
and sideways

Typical "Shoe Box" (forward throw)



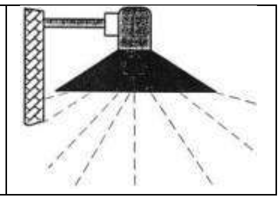
GOOD
Directs all light down

Typical "Yard Light"



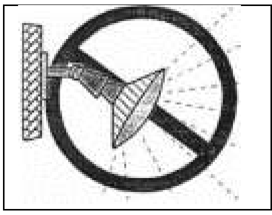
BAD
Waste light goes up
and sideways

Opaque Reflector (lamp inside)



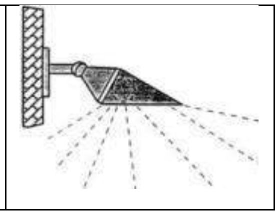
GOOD
Directs all light down

Area Flood Light



BAD
Waste light goes up
and sideways

Area Flood Light with Hood



GOOD
Directs all light down

How do I switch to good lighting?
Provide only enough light for the task at hand; don't over-light, and don't spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the full Moon! More importantly, by choosing properly shielded lights, you can meet your needs without bothering neighbours or polluting the sky. (NELPAG)

1. Aim lights down. Choose "full-cutoff shielded" fixtures that keep light from going uselessly up or sideways. Full-cutoff fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.

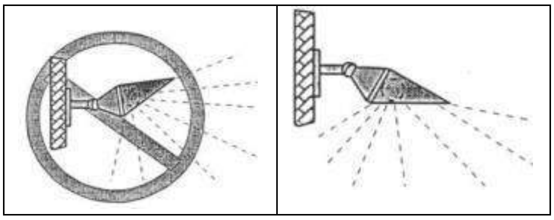
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as well as a wasteful light does with a high-wattage bulb.

If colour discrimination is not important, choose energy- efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If "white" light is needed, fixtures using compact fluorescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour bulbs.

3. Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put home security lights on a motion-detector switch, which turns them on only when someone enters the area; this provides a great deterrent effect!

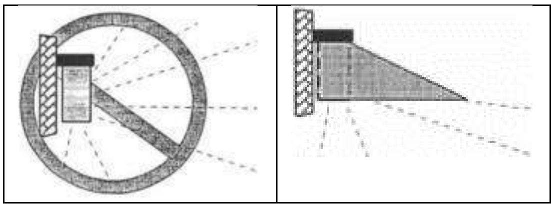
What You Can Do To Modify Existing Fixtures

Change this . . . to this ***(aim downward)***



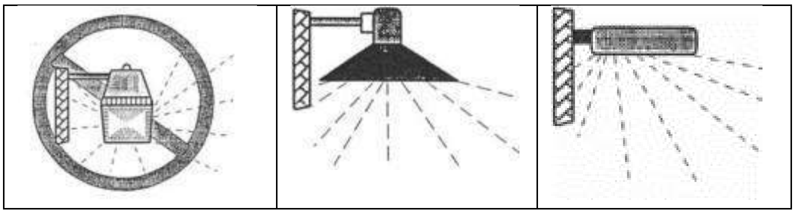
Floodlight:

Change this . . . to this ***(aim downward)***



Wall Pack

Change this . . . to this or this



Yard Light Opaque Reflecter Show Box

Replace bad lights with good lights.
You'll save energy and money. You'll be a good neighbour. And you'll help preserve our view of the stars.

APPENDIX E:

Public Participation

APPENDIX E.1:

DEA Pre-application meeting minutes

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Meeting Record

Project number	**112667**	Meeting date	**12 July 2016**
Project name	**Hotazel Solar Park**	Recorded by	**Patrick Killick**
Meeting/subject	**Hotazel Solar Park Pre-application Meeting**	Total pages	**6**

1 Attendance

Present	Copy	Name	Organisation	Contact details
☒	☒	Coenrad Agenbach	Department of Environmental Affairs	Cagenbach@environment.gov.za
☒	☒	Mahlatse Shubane	Department of Environmental Affairs	MShubane@environment.gov.za
☒	☒	Nazley Towfie	Juwi Renewable Energies (Pty) Ltd	nazley.towfie@juwi.co.za
☒	☒	Patrick Killick	Aurecon South Africa (Pty) Ltd	Patrick.Killick@aurecongroup.com

Item	Agenda item	Discussions	Consensus / Action / residual issues
1	Welcome and introductions	The meeting was held at 10h00 on the 12th July 2016 at the DEA's Environment House in Tshwane.	
2	Brief introduction and contextualisation of the project to DEA.	Project entails a 200MW two phase (100MW each) solar PV farm and two transmission lines connecting to the existing Eskom Hotazel and Umtu substations, near Hotazel, Northern Cape. A provisional map showing the general layout, transmission line and alternative routes were provided to provide context. It was explained that the area is congested with mining related infrastructure and electrical supply infrastructure and that this had large influence the layout and transmission line and alternative routes. It was also discussed that whilst each solar phase being applied for has its own supporting infrastructures, if both phase are authorised and both are awarded through the REIPPPP process, then the two phases would likely share supporting infrastructure, such as main substation, offices, access roads, and possibly even transmission lines. This would reduce the combined footprint of these associated infrastructures.	
3	Specific matters	What follows is a set of queries or matters that the EAP and applicant wanted clarity on.	

Item	Agenda item	Discussions	Consensus / Action / residual issues
3.1	~~Is the DEA is satisfied with the approach of one EIA application resulting in 4 EAs (as opposed to four separated applications)~~	~~We would like to run the project as a single application, as provided for under Section 11 of the EIA regulations, but have four EAs issued, one for each solar phase (Hotazel Solar Farm 1 (Pty) Ltd and Hotazel Solar Farm 2 (Pty) Ltd) and one for each transmission line (both in the name of juwi Renewable Energies (Pty) Ltd, as provided for under Section 25(2).~~ ~~Previously, during a similar project, separate applications resulted in issues and some confusion arising from their being handled as separate applications. Also the stakeholders become confused and frustrated by the number of seemingly identical reports.~~ ~~In this regard a draft letter was prepared and presented to DEA at the meeting to confirm their satisfaction in principle with the approach and apply for permission as is required~~	~~The DEA agree in principle that the separate components can be applied for as a combined application and result in four EAs and received the formal request letter and would provide a formal response in due course.~~ ~~DEA indicated that they would investigate and confirm that the separate EAs could be issued for the transmission lines where the listed activities only necessitated a basic assessment but where a Scoping and EIR process was followed. This would be confirmed with the legal department and included as required in the formal response.~~ ~~This agreement was conditional to the submission of 4 separate EIAR/EMPr and layouts, as described in further detail under the following point.~~ Addendum: The DEA refused to give permission to undertake a combined application (Letter dated 30 August 2016) as provided for in Section 11 of the NEMA EIA regulations and have instructed the Applicant to undertake the project as four discreet applications. Where relevant, above and below, notes have been struck through, where this change in approach renders those points of discussion redundant.

Item	Agenda item	Discussions	Consensus / Action / residual issues
3.2	~~How should the reporting should be set up to allow DEA to issue separate EAs~~	~~Whilst DEA agrees in principle to a single application (as discussed above and to be officially confirmed) to allow for the issuing of separate EAs, the project will need to be split into four separate EIA reports. The scoping report can be dealt with as a single report and the specialists can write a single report covering all four EA domains, but impacts and mitigation measures must be clearly ring-fenced within these reports. Specialists should also make sure that the consider the listed activities that have been triggered and make explicit where certain impacts relate to specific listed activities, so that in the final report it is clear where specific listed activities were assessed.~~	~~The combined application will thus involve the following:~~ ~~1. Scoping Report: A single report, covering all four EA subcomponents. Specialist inputs, assessing the alternative and providing motivations to arrive at a single preferred alternative, for each EA subcomponent to be carried forward to the EIA phase.~~ 2. Scoping phase specialists inputs: specialists are to provide a short report assessing the alternatives holistically against one another and providing an assessment of which alternative is preferred and why, plus an indication of mitigation levels attainable. This is not a detailed list of individual impacts per field but rather overview by each field of study. ~~3. EIR: four separate EIA reports, one per EA subcomponent. Four separate project layout maps within the EIR.~~ ~~4. EMPr: Four spate EMP reports~~ 5. EIA phase Specialist reports: a single report per specialist in the EIR phase but with clear separation of the impacts according to the four subcomponents. This subdivision should also extend to the baseline description where required.
3.3	Clarity regarding the contents of scoping report with regard to that requested under R982 Appendix 2, where items 2(h)(v), (vii),(viii), (ix) & (xi) can be interpreted to mean that impact assessment must be completed in the scoping phase?	These regulations appear to require impact assessment type content that belongs in the impact assessment phase, not the scoping report? Aurecon requested confirmation on its interpretation of these regulations to mean that the scoping phase the EAP & specialists should methodically screen project alternatives (sites and routings) and motivate a preferred option (Which the DEA must then approve as part of the FSR?), then in the EIA phase only assesses the approved alternative against the no go alternative. And that the scoping report should not specifically provide a detailed impact assessment as is implied in Appendix 2 (h)(v) or a detailed set of mitigation measures as required by Section (h)(vii)	The DEA confirmed this interpretation, indicating that the specialists should input into the screening of the project alternatives and that a single project (no alternatives) is taken forward and assessed in the impact assessment phase against the no go. The DEA added that one and only one project, made up of the preferred alternatives, can be assessed and applied for in the EIA phase. Thus the comparative assessment of alternatives in the impact assessment phase is no longer undertaken and the applicant is beholden to commit to a single configuration.

Item	Agenda item	Discussions	Consensus / Action / residual issues
3.4	Alternatives ○ Site / routes: No site alternatives for the PV phases will be considered. Each transmission line will consider possible corridor routing alternatives. ○ Technology: Solar panel mounting fixed axis vs single ○ Storage: With / without storage.	A brief discussion was held around the alternatives and the motivations for them and DEA were content with these at this time. DEA impressed upon us that by the end of the scoping phase, with the assistance of specialists, the scoping report should put forward and single preferred alternative that will be assessed in the impact assessment phase. The applicant must therefore commit to a preferred alternative before embarking on the EIA phase and this must be supported by the specialist findings.	
3.5	Does the DEA agree with the list of specialist studies to be undertaken? • Agricultural assessment; • Aquatic assessment; • Avifauna assessment; • Botanical assessment; • Heritage assessment (including archaeology); • Palaeontology assessment; • Socio-economic assessment; • Storm water (hydrology); • Desktop traffic assessment; • Visual assessment.	Yes, the DEA agrees with the proposed list of studies. A discussion was held with regard to the proposed battery storage facility and it was proposed that the facility be subjected to a risk assessment. The DEA was in agreement with this approach and agreed that it would likely provide the type of information needed to make an informed decision.	A risk assessment will be undertaken for the operation of battery storage facility if it is taken forward as a preferred alternative into the impact assessment phase. Other specialists will pick up the impacts associated with the physical aspects, such as visual, regarding the structure and botanical assessing the clearing of vegetation.
3.6	Stakeholder groups to be consulted: Local • Affected landowners • Immediate neighbours and properties with 100m • The Hotazel Manganese Mine (Samancore) Authorities • DAFF • DENC • District Municipality • DMR • DOE • DWS • Eskom • Local Municipality • Provincial roads • SAHRA (plus northern cape Heritage) • Department of Rural Development and Land Reform NGOs ○ BirdlifeSA	DEA were satisfied with the list of stakeholders to be included. Aurecon brought to their attention the presence of an airfield and DEA agreed that the Civil Aviation Authority should be added to the stakeholders list. DEA went on to also say that even through the project occurred outside the Square Kilometre Array exclusion area, it would still be cautious to include them as a stakeholder as the project was in the Norther Cape	The Civil Aviation Authority and the Square Kilometre Array will be added as stakeholders and provided opportunity to comment.
4	Other guidance / requests from the DEA	DEA was asked if they had any specific requests or guidance that they would like to raise that may have relevance to the project. These follow:	

Item	Agenda item	Discussions	Consensus / Action / residual issues
4.1	Camelthorn and Witgat Trees	Camelthorn and Witgat trees are a significant issue in the region. Botanical specialist must be sure to get an address these as a special area of concern in the assessment, getting an accurate sense of numbers of trees that may be affected and We must ensure that DENC is included and comment on any findings in this regard.	Comment is to be sought from DAFF and DENC during the project comment periods.
4.2	Assessing listed activities	Assessment of listed activities: DEA requires that the EIA report can clearly show where the respective listed activities have been considered and assessed. If this is not clear, the DEA cannot give authorisation for a specific listed activity.	In the EIA report Aurecon will provide a table referencing where in the documents the respective listed activities have been considered, discussed and assessed. Aurecon will also make this understanding clear to all specialists, that impacts that link up with the listed activities need to be linked with one another explicitly and vice versa that care needs to be taken that the assessment specifically looks at the impacts associated with the listed activities. It is noted that some identified impacts may not link with any specific listed activity.
4.3	Cumulative impact assessment	The DEA have indicated a growing impetus on cumulative impact assessment and need for EAP and specialists' to give due diligence to this. All specialist assessments should consider all Solar PV project within a 30km radius of the project and use this to inform their cumulative assessments. Aurecon indicated that getting this information was sometimes difficult as renewable energy projects tried to keep their interests and projects secret until they were fully committed and had secured the agreements that would allow the projects to proceed. DEA said that we should submit a formal request to DEA to disclose all renewables projects within a 30km radius that have been approved or are currently undergoing application.	Aurecon to send a formal request to DEA's Muhammed Essop (CC Coenrad Agenbach) to disclose all renewables projects within a 30km of the site radius be disclosed to us for cumulative assessment purposes.
4.4	Comments and responses reports	The DEA have indicated that the response "noted" would no longer be accepted in comments and responses report and weren't considered sufficient. The EAP is required to provide enough of a response	Aurecon to ensure that all response fit with and close the loop on all comments made by stakeholders, provide the DEA with confidence that the matters have been addressed, even where I&AP's were making a statement, rather than a query or comment.

Name	Organisation	Date	Signed
Coenrad Agenbach	Department of Environmental Affairs		
Mahlatse Shubane	Department of Environmental Affairs		
Nazley Towfie	Juwi Renewable Energies (Pty) Ltd		
Patrick Killick	Aurecon South Africa (Pty) Ltd		

DRAFT

APPENDIX E.2:

I&AP Register

HOTAZEL SOLAR PARK AND TRANSMISSION LINES I&AP REGISTER

Org	Erf	Name / Position
Aero Club of South Africa		Kevin Storie
AfriBits		Tumisang Tagane
AMP Property Management & Land Acquisition		Anne-Marie Botha
Assmang Ltd		Andre Venter
Birdlife South Africa		Mark Anderson
Birdlife South Africa		Samantha Ralston-Paton
Civil Aviation Authorities		Koos Pretorius
Civil Aviation Authorities: Obstacle Specialist		Lizelle Stroh
DAFF: AgriLand Liaison Office		Thoko Buthelezi
DAFF: Deputy Director		Mashudu Marubini
DAFF: Land Use & Soil Management		Jacoline Mans
DAFF: Land Use & Soil Management		Mashubu Marbubini
Department of Agriculture		Ntombi Yende
Department of Agriculture		Obed Mvula
Department of Agriculture (Northern Cape)		Lucia Manong / Dr Kegaliwe
Department of Agriculture, Forestry and Fisheries		Hettie Buys
Department of Agriculture, Forestry and Fisheries		Jacoline Mans
Department of Agriculture, Land Reform & Rural Development		Lucia Manong
Department of Agriculture, Land Reform & Rural Development		WVD Mothibi
Department of Agriculture, Land Reform & Rural Development (HOD)		WVD Mothibi
Department of Agriculture, Land Reform & Rural Development, Northern Cape		Leon Terblanche
Department of Energy		The Director: Northern Cape
Department of Environment and Nature Conservation (DENC)		L. Tools-Bernado
Department of Environment and Nature Conservation (DENC)		Thulani Mthombeni
Department of Environmental Affairs		Collen Phalatsi / Case officer on HSP
Department of Environmental Affairs		Lunga Dlova
Department of Environmental Affairs		Mahlatse Shubane
Department of Environmental Affairs		Takalani Maswime
Department of Environmental Affairs - Biodiversity		Shonisani Munzhedzi / Deputy Director-General Biodiversity and Conservation
Department of Environmental Affairs – Waste application official		Herbert Kutama
Department of Mineral Resources (DMR)		Jasper Nieuwoudt
Department of Mineral Resources (DMR) Northern Cape		Dorathy Goliath
Department of Mineral Resources (DMR) Northern Cape		Ephesia Semenya
Department of Public Works, Roads and Transport - Northern Cape		Itumeleng Bulane
Department of Rural Development and Land Reform		Ryan Oliver
Department of Science and Technology		Tshepo Seekoe
Department of Transport		RC Barlow
Department of Transport		RC Barlow
Department of Water Affairs (DWA): Deputy Director Lower Orange WMA		Shaun Cloete / Christine White (seketaresse) vir aandag: Ernest Kubayi
Department of Water and Sanitation (DWS)		Lebogang Swaratlhe
Department of Water and Sanitation (DWS)		Sibongile Manamathela
DMB Minerals cc		Doctor Bvuma
DWS: Deputy Director Lower Orange WMA		Shaun Cloete
Electricity commission		Rene De Briun
ESKOM		Andrea van Gensen
ESKOM		Benito Williams
ESKOM		Gerrie Van Schalkwyk
Eskom		John Geeringh
ESKOM		Lindiwe Mbhele
ESKOM		Stephen Nakanyane
EWT-Wildlife Energy Interaction Group (WEIG)		Luke Strugnell / Andrew Pearson
Heritage Northern Cape		Andrew Timothy
Hotazel Library		Vinene Wessels
Hotazel Manganese Mines		Koos Janse van Vuuren
Hotazel Manganese Mines (Pty) Ltd	331/1	Dineo Peta
Hotazel Manganese Mines (Pty) Ltd	331/2	Dineo Peta
Hotazel Manganese Mines (Pty) Ltd	700/3	Dineo Peta
Hotazel Manganese Mines (Pty) Ltd	280/0	Emsley Manne Dipico
Hotazel Manganese Mines (Pty) Ltd	331/3	Rudzani Mudau
Hotazel Manganese Mines (Pty) Ltd	332/4	Rudzani Mudau
Hotazel Manganese Mines (Pty) Ltd	329/5	Rudzani Mudau
Hotazel Manganese Mines (Pty) Ltd	700/3	Rudzani Mudau
Joe Morolong Local Municipality		Magdalene Schuping / Ward 4 Councillor

HOTAZEL SOLAR PARK AND TRANSMISSION LINES I&AP REGISTER

Org	Erf	Name / Position
Joe Morolong Local Municipality		Matshidiso Thebeyagoe / Major's seceratary
Joe Morolong Local Municipality		Moses Mbolekwa / Major
Joe Morolong Local Municipality		Seneo Seleka / Environmental Manager
Joe Morolong Local Municipality		Tshepho Bloom / Municipal Manager
John Taolo Gaetsewe District		M Bokgwathile
John Taolo Gaetsewe District Municipality		Gerrie van der Westhuizen
John Taolo Gaetsewe District Municipality – Acting Director Economic Development		Klaas Teise
Kalagadi Manganese Pty Ltd	282/0	Neels Cockeran
Kudumane Manganese Resources	278/0	Neels Cockeran
Kudumane Manganese Resources Pty Ltd	277/0	Simisani Khupe
Kudumane Manganese Resources Pty Ltd	279/11	Simisani Khupe
Kudumane Manganese Resources)		Conri Moolman / Neels Cockeran
Mamatwan 331 - T594/ 1987 Remaining extent	331/0	Andries Mathys Van Den Berg
Mdux-ICS (Pty) Ltd		Noa Modukanene / Chief Executive Officer
National Department of Agriculture, Forestry and Fisheries: Directorate: Land Use and Soil Management		Mrs Anneliza Collet
NERSA (National Energy Regulator of South Africa)		Phindile Baleni
Northern Cape (Department of Environmental Affairs and Nature Conservation) DENC		Thato Molese
Northern Cape Department of Environmental Affairs and Nature Conservation		Brian Fisher
Northern Cape Department of Environmental Affairs and Nature Conservation		Dineo Moleko
Northern Cape Department of Environmental Affairs and Nature Conservation		Ms Lucille Karsten
Northern Cape Occupational Health		Dr Tidu vd Merwe
Northern Cape Provincial Heritage (Boswa ya Kapa Bokone)		Andrew Timothy
Northern Cape Tourism Authority		Peter Mckuchsne
Northern Cape Transport, Roads & Public Works		Mr Nogwili
Northern Cape Transport, Roads and Public Works		K Nogwili
Northern Cape Transport, Roads and Public Works		Tembelani Mfecane
Ntsimbintle Mining Pty Ltd	331/16	Jeff Leader
Ntsimbintle Mining Pty Ltd	331/17	Jeff Leader
Ntsimbintle Mining Pty Ltd	331/18	Jeff Leader
Private	278/0	Dawie Fourie
Private	276/0	Eben Antonissen
Private	279/0	Jacobus Petrus Jansen
Private		Justin Pitt
Private	700/0	Machiel Andries Kruger
Private	367/1	Nick Fourie
SAHRA Northern Cape		The Provincial Manager
Saltrim Ranches (Pty) Ltd	332/0	H P Venter
Samancor		Oscar Van Antwerpen
SANRAL		Ms René de Kock / The Regional Manager
Sentech		Alishea Pretorius
Sentech		Johan Koegelenberg
SKA		Adrian Tiplady
South African Civilian Aviation Authority		Lizell Stroh
South African Heritage Resource Agency (SAHRA)		Katie Smuts
South African Heritage Resources Agency		Catherine Motsisi
Southern Ambitions 1549 CC		
Terra Nominees (Samancor Manganese	748	Dineo Peta
Terra Nominees (Samancor Manganese)	330/1	Dineo Peta
Transet Freight	277/1	Andre Bodenstein
Transnet	328/3	Sam Fiff
Transnet	328/7	Sam Fiff
Transnet	367/3	Sam Fiff
Transnet	700/1	Sam Fiff
Transnet Freight Rail	276/1	André Bodenstein
Transnet Freight Rail		André Bodenstein
Ukoyisa Corporation and Khonziwe Investment Holdings Joint venture		Sehunelo Phemelo
United Manganese of Kalahari manganese mine		Protea Leserwane
WeatherSA		Zamikhaya Magogotya / Morgan Griffiths / Andries Kruger
WESSA NC		Suzanne Erasmus
WWF		Natasha Wilson / Samantha Sithole

APPENDIX E.3:

Site notices

Hotazel Solar Park: Site Notice Locations

APPENDIX E.4:

Newspaper advertisement

PUBLIC COMMENT PERIOD AND I&AP REGISTRATION FOR A PROPOSED 132 KV OVERHEAD TRANSMISSION LINE FOR THE HOTAZEL SOLAR PARK NEAR HOTAZEL, NORTHERN CAPE

Reference #:	-27.240419° / 22.956514°
Location:	Hotazel, Joe Morolong Local Municipality, Northern Cape
Properties:	278/0 (Annex Langdon), 280/0 (Hotazel); 277/0 (Devon), 277/1 (Devon) (Railway servitude); 279/11 (York A), 282/0 (Olive Pan).
NEMA Activity:	GN R 983: Activity 11(i) "The development of facilities or infrastructure for the transmission and distribution of Electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."
NEMA Process:	Basic Assessment

Background: juwi Renewable Energies (Pty) Ltd (juwi) wishes to construct a transmission line associated with the proposed Hotazel Solar Park to connect the facility to the national grid. This triggers Activity 11(i) of Government Notice Regulation 983 in terms of National Environment Management Act (NEMA) No. 107 of 1998 (as amended). Authorisation is required the Department of Environmental Affairs (DEA), via the Basic Assessment process (as provided for GN No. R982 of 4 December 2014). Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the application and submit all requirements to the DEA.

Description: Three transmission corridor alternatives are being considered to evacuate power from the Hotazel solar facility to the national grid. These have been comparatively assessed against a "no-go" alternative and the results provided in a draft Basic Assessment Report (BAR). Two of the transmission line alternatives connect directly to existing Eskom substations, namely the Hotazel and Umtu substations and the third Alternative is a shorter Loop-in Loop-Out (LILO) connection option connecting with an Eskom transmission line near the Hotazel Solar Farm. If constructed, the transmission line would form part of the national grid and therefore fall under the ownership and operation of Eskom.

Participation: You are hereby notified of the availably of the Draft Basic assessment Report for review and comment. The report can be found at the Hotazel Library, Art & Cultural Centre or downloaded from www.aurecongroup.com/en/public-participation.aspx. The comment period closes on 11 May 2017 and comments must be submitted in writing via the contact details provided below. If you do not wish to submit comment but wish to be kept informed throughout the process please register as an Interested and Affected Party (I&AP) by contacting with your contact details Aurecon as follows.

Project contact person:
Patrick Killick; T: 044 805 5432;
Written comments or I&AP registrations to Fax: 044 805 5454;
Email: patrick.killick@aurecongroup.com;
Post: PO Box 509, George, 6530

HOTAZEL SOLAR PARK (DEA Ref:14/12/16/3/3/2/987): Please note that the Draft Environmental Impact Assessment report (EIAr) for the proposed Hotazel Solar Park, will also be available at the same locations and for the same period indicated above. People affected by the project may still register as I&APs and submit written comments on the draft EIAr by **11 May 2017.**

If you know of anyone who may be affected by these projects, kindly draw their attention to this notice.

TYDPERK VIR OPENBARE KOMMENTAAR EN B&GP REGISTRASIE VIR DIE VOORGESTELDE 132 KV OORHOOFSE KRAGLYN VIR DIE HOTAZEL SONKRAGAANLEG NABY HOTAZEL, NOORD-KAAP

Verwysings #:	-27.240419° / 22.956514°
Ligging:	Hotazel, Joe Morolong Plaaslike Munisipaliteit, Noord-Kaap
Eiendom:	278/0 (Anneks Langdon), 280/0 (Hotazel); 277/0 (Devon), 277/1 (Devon) (Spoorweg serwituut); 279/11 (York A), 282/0 (Olive Pan).
NEMA Aktiwiteit:	GN R 983: Aktiwiteit 11(i) "Die ontwikkeling van fasiliteite of infrastruktuur vir die oordrag en verspreiding van Elektrisiteit (i) buite stedelike gebiede of nywerheidskomplekse met 'n kapasiteit van meer as 33 maar minder as 275 kilovolt."
NEMA Proses:	Basiese Beoordeling

Agtergrond: juwi Hernubare Energie (Edms) Bpk (juwi) wil graag 'n oorhoofse kraglyne bou wat verband hou met die voorgestelde Hotazel Sonkragaanleg om die fasiliteit te verbind met die nasionale netwerk. Die beplande oorhoofse kraglyn het die volgende Gelyste bedrywighede to gevolg: 11(i) van Goewermentskennisgewing Regulasie 983 in terme van Wet op Nasionale Omgewingsbestuur (WNOB) Nr. 107 van 1998 (soos gewysig). Magtiging word vereis deur die Department van Omgewingsake (DOS), via die Basiese Beoordeling proses (soos bepaal GK Nr. R982 van 4 Desember 2014). Aurecon Suid-Afrika (Edms) Bpk (Aurecon) is aangestel om die aansoek te onderneem en al die vereistes by die DOS in te dien.

Beskrywing: Drie kraglyn korridor alternatiewe word oorweeg om elektrisiteit te ontruim vanaf die Hotazel sonkragaanleg na die nasionale netwerk. Hierdie alternatiewe was relatief beoordeel teenoor 'n "geen-ontwikkeling" alternatief en die resultate omvat in 'n Konsep Basiese Beoordelingverslag (BEV). Twee van die oorhoofse kraglyne alternatiewe verbind direk aan bestaande Eskom substasies, naamlik die Hotazel en Umtu substasies. Die derde alternatief is 'n korter Lus-In Lus-Uit (LILU) verbinding opsie wat verbind met 'n Eskom kraglyn naby die Hotazel Sonkragaanleg. Indien die oorhoofse kraglyn gebou word sal dit deel van die nasionale netwerk uitmaak en dus onder die eienaarskap en bestuur van Eskom val.

Deelname: U word hiermee in kennis gestel van die beskikbaarheid van die Konsep Basiese Beoordelingverslag vir oorsig en kommentaar. Die verslag kan besigtig word by die Hotazel Biblioteek, Kuns & Kultuur Sentrum of afgelaai word vanaf www.aurecongroup.com/en/public-participation.aspx. Die tydperk vir kommentaar sluit op **11 Mei 2017** en kommentaar moet skriftelik via die onderstaande kontak besonderhede ingedien word. Indien u nie wil kommentaar lewer nie, maar ingelig wil bly deur die hele proses moet u asseblief registreer as 'n Belanhebbende en Geaffekteerde Pary (B&GP) deur Aurecon te kontak.

Projek kontak persoon: Patrick Killick; T: 044 805 5432;
Skriftelike kommentaar of B&GP registrasies na Faks: 044 805 5454;
Epos: patrick.killick@aurecongroup.com;
Pos: Posbus 509, George, 6530

HOTAZEL SONKRAGAANLEG (DOS Verw:14/12/16/3/3/2/987): Let asseblief daarop dat die Konsep Omgewings Invloedbepalingsverslag (OIBV) vir die voorgestelde Hotazel Sonkrag Aanleg ook beskikbaar sal wees op dieselfde plekke en vir dieselfde tydperk hierbo aangedui. Mense wat geraak word deur die projek kan nog registreer as B&GP's en geskrewe kommentaar indien op konsep OIBV teen **11 May 2017.**

Indien u van enige iemand weet wat deur die projekte geraak mag word verwys hulle asseblief na hierdie kennisgewing.

APPENDIX F:

Impact Assessment

APPENDIX F.1:

Assessment methodology

1.1 METHODOLOGY FOR RANKING OF IMPACTS

The assessment of the predicted significance of impacts for a proposed development is by its nature, inherently uncertain – environmental assessment is thus an imprecise science. To deal with such uncertainty in a comparable manner Aurecon ranks impacts using a standardised and internationally recognised methodology adhering to ISO 14001 and World Bank/IFC requirements.

For each predicted impact, criteria are applied to establish the **significance** ranking of the impact based on likelihood and consequence, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

The criteria establish the **consequence** of the impact by estimating the expected **intensity**, which also includes the **type** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale). The sensitivity of the receiving environment and/or sensitive receptors is incorporated into the consideration of consequence by appropriately adjusting the thresholds or scales of the intensity, duration and extent criteria, based on expert knowledge and best practice. For each predicted impact, the specialist applies professional judgement in ascribing a numerical rating for each of these criteria respectively as per the examples provided in Table 1, Table 2 and Table 3 below. The consequence is then established using the formula:

Consequence = type x (intensity + duration + extent).

Depending on the numerical result, the impact's consequence would be defined as either extremely, highly, moderately or slightly detrimental; or neutral; or slightly, moderately, highly or extremely beneficial. These categories are provided in Table 5.

To determine the significance of an impact, the **probability** (or likelihood) of that impact occurring is also taken into account. In assigning a probability factor the specialist takes into account the likelihood of occurrence but also takes cognisance of uncertainty and detectability of the impact. The most suitable numerical rating for probability is selected from Table 4 below and applied with the consequence as per the equation:

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as either, negligible, minor, moderate or major, and the type would be either positive or negative. Examples of these categories are provided in Table 6.

Once the significance of an impact occurring without mitigation has been established, the specialist will apply their professional judgement to assign ratings for the same impact after the proposed mitigation has been implemented.

The tables on the following pages show the scales used to classify the above variables, and define each of the rating categories.

Table 1 | Definition of Intensity ratings

Rating	Criteria	
	Negative impacts (Type of impact = -1)	**Positive impacts** (Type of impact = +1)
7	Irreparable damage to natural systems and human health. Irreplaceable loss of species.	Noticeable, on-going benefits to which have improved the quality and extent of natural systems, including formal protection.
6	Irreparable damage to natural systems and the contravention of legislated standards.	Great improvement to ecosystem processes and services.
5	Very serious impacts and irreparable damage to components of natural systems.	On-going and widespread positive benefits to natural systems.
4	On-going damage to natural system components and species.	Average to intense positive benefits for natural systems.
3	Damage to natural system components and species.	Average, on-going positive benefits for natural systems.
2	Minor damage to natural system components and species. Likely to recover over time. Ecosystem processes not affected.	Low positive impacts on natural systems.
1	Negligible damage to individual components of natural systems.	Some low-level benefits to degraded natural systems.

*NOTE: Where applicable, the intensity of the impact is related to a relevant standard or threshold, or is based on specialist knowledge and understanding of that particular field.

Table 2 | Definition of Duration ratings

Rating	Criteria
7	**Permanent:** The impact will remain long after the life of the project
6	**Beyond project life**: The impact will remain for some time after the life of the project
5	**Project Life:** The impact will cease after the operational life span of the project
4	**Long term**: 6-15 years
3	**Medium term:** 2-5 years
2	**Short term:** 2 years
1	**Immediate**: Less than 1 month

Table 3 | Definition of Extent ratings

Rating	Criteria
7	**International:** The effect will occur across international borders
6	**National:** Will affect the entire country
5	**Province/ Region:** Will affect the entire province or region
4	**Municipal Area:** Will affect the whole municipal area
3	**Local:** Extending across the site and to nearby settlements
2	**Limited:** Limited to the site and its immediate surroundings
1	**Very limited:** Limited to specific isolated parts of the site

Table 4 | Definition of Probability ratings

Rating	Criteria
7	**Certain/ Definite:** There are sound scientific reasons to expect that the impact will definitely occur
6	**Almost certain/Highly probable:** It is most likely that the impact will occur
5	**Likely:** The impact may occur
4	**Probable:** Has occurred here or elsewhere and could therefore occur
3	**Unlikely:** Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
2	**Rare/ improbable:** Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact manifesting is very low as a result of design, historic experience or implementation of adequate mitigation measures
1	**Highly unlikely/None:** Expected never to happen.

Table 5 | Application of Consequence ratings

Range		Significance rating
-21	-18	Extremely detrimental
-17	-14	Highly detrimental
-13	-10	Moderately detrimental
-9	-6	Slightly detrimental
-5	5	Negligible
6	9	Slightly beneficial
10	13	Moderately beneficial
14	17	Highly beneficial
18	21	Extremely beneficial

Table 6 | Application of significance ratings

Range		Significance rating
-147	-109	Major - negative
-108	-73	Moderate - negative
-72	-36	Minor - negative
-35	-1	Negligible - negative
0	0	Neutral
1	35	Negligible - positive
36	72	Minor - positive
73	108	Moderate - positive
109	147	Major - positive

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, environmental assessment processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of that impact.

Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, environmental assessments must endeavour to come to terms with the significance of the potential environmental impacts associated with particular development activities. Recognising this, Aurecon has attempted to address potential subjectivity in the current EIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail. Having an explicit methodology not only forces the specialist to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader with a clear summary of how the specialist derived the assigned significance;
- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties; and
- Utilising a team approach and internal review of the assessment to facilitate a more rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

The specialists appointed to contribute to this Impact Assessment have empirical knowledge of their respective fields and are thus able to comment on the confidence they have in their findings based on the availability of data and the certainty of their findings (Example provided in Table 7).

Table 7 | Definition of Confidence ratings

Rating	Criteria
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

1.2 METHODOLOGY FOR RANKING OF CUMULATIVE IMPACTS

To address these potential system wide consequences resulting from the combination of individual effects of multiple actions over time, the IFC has published a guideline to advise on the assessment and management of cumulative impacts, the *Good Practice Handbook Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets* (IFC, 2013). The IFC Good Practice Handbook proposes as a useful preliminary to conduct a rapid cumulative impact assessment (RCIA).

A table format has been used to identify the Valued Environmental and Social Component (VEC); namely the project activity causing the impacts; the impacts to the VEC; and the subsequent effect on the receptor. The future baseline with respect to that VEC is then also described, taking taken into account the future development scenario. This is undertaken as a qualitative exercise and has been based on the specialist studies undertaken as part of this EIA as well as other available information. Lastly, a significance rating has been applied based on the Design Manual for Roads and Bridges (DMRB) methodology (Highways Agency, 2008).

The IFC Handbook (2013) states that in order to assess the significance of a cumulative impact on a VEC, it is necessary to establish whether the cumulative impact on VEC condition will approach, be near to, or exceed a threshold. The guidance notes that the analysis may reveal that significant cumulative impacts will exist without the project.

The DMRB developed by the Highways Agency sets out significance criteria for cumulative environmental effects, whereby five categories are proposed as a framework for determining significance of cumulative effects. This has been ascribed to the cumulative impact on each VEC. Refer to

Table 8 below.

Table 8: Framework for assessing significance of cumulative effects

Significance	Effect
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects which are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

The IFC Handbook (2013) requires that the methodology should include the identification, where necessary, of additional project mitigation (beyond that identified in the project EIA) to reduce an estimated unacceptable cumulative impact on a VEC to an acceptable level. For example, the study could identify the potential for other regional strategies that could maintain VECs at acceptable conditions.

APPENDIX F.2:

Environmental Impact Statement

Construction Phase: Impact Assessment for the 3 Alternative Transmission Lines and No go

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[1] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
Impacts on Botany	***Direct impacts:*** Impacts occurring directly on the vegetation of the transmission corridors.	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** Neutral	- The corridors should be kept clear of woody vegetation and only a cover of grass would be permitted. This would be required for the safe operation of the transmission lines. (The vegetation would not revert to its natural state after construction since it would be kept in check by systematic and regular clearing). - Care must be taken to not spread alien invasive plant species, particularly *Prosopis glandulosa var. torreyana* (honey mesquite) during construction. Careful monitoring for the occurrence of this species must be implemented and this must be written into the EMPr. Where this species occurs it should be eradicated.	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** Neutral
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	- None	None identified
	Cumulative impacts: Impacts caused by several similar projects, related strategic actions and existing trends.	**Alternative 1-3** Low Negative (-) **No-Go** N/A	- The only mitigation possible would be revegetation at places where there is significant disturbance from construction.	**Alternative 1-3** Low Negative (-) **No-Go** N/A
Impacts on Avifauna	***Direct impacts:*** Displacement due to disturbance and habitat transformation associated with the construction of the transmission lines.	**Alternatives 1-3** Low (-) **No-Go** N/A	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. - Measures to control noise and dust should be applied according to current best practice in the industry. - Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. - The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. - Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of priority species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise. - Bird Flight Diverters must be installed where found to be required in order to limit the potential collision mortality - There is a potential collision risk associated with the ephemeral Ga-Mogara River where it is expected that waterbirds could commute up and down the drainage line when it is flowing or when it contains large pools of standing water, and raptors and vulture could descend to pools in the river to drink and bath. This risk is specifically associated with the Umtu TX corridor which crosses the river near the Umtu Substation.	**Alternatives 1-3** Low (-) **No-Go** N/A

[1] *"The Loop In Loop Out connection depends on technical capacity of the Eskom line before being deemed a feasible alternative. This is considered the least, technically, viable alternative at this stage, though this might change in future"*

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[1] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Cumulative avifauna impacts are discussed in the operational phase.	**Alternatives 1-3** Low (-) **No-Go** N/A	▪ The extensive powerline and road network within the 30km radius around Hotazel has led to extensive fragmentation of the natural habitat. The fragmentation of the habitat has an impact that exceeds the mere physical footprint of the infrastructure. However, the short length of the proposed powerline should limit the cumulative impact of displacement due to disturbance and habitat destruction.	**Alternatives 1-3** Low Negative (-) **No-Go** N/A
Impacts on Freshwater	***Direct impacts:*** Aquatic habitat modification	**Hotazel Alternative 1** **Very Low (-)** **Umtu Alternative 2** Low (-) **LILO Alternative 3** **Very Low (-)** / Neutral **No-Go Alternative 4** **Very Low (-)** / Neutral	▪ The pylons for the transmission line should be placed outside of the recommended buffer of 100 m from the top of bank on either site of the river. With regards to any access roads to the transmission line for construction and maintenance, existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. If an access road need to be constructed it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.	**Hotazel Alternative 1** **Very Low (-)** / Neutral **Umtu Alternative 2** **Very Low (-)** **LILO Alternative 3** **Very Low (-)** / Neutral **No-Go Alternative 4** **Very Low (-)** / Neutral
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	None	None identified
	Cumulative impacts: Aquatic habitat modification	**Alternatives 1-3** Low Negative (-) **No-Go Alternative 4** N/A	▪ Surrounding land use currently consists of manganese mining activities with some agriculture. Current land/water use impacts on the Ga-Mogara River area are moderate. The proposed renewable energy projects are near the Ga-Mogara River System. ▪ The pylons for the transmission line should be placed outside of the recommended buffer of 100 m from the centreline of the river. The renewable energy projects with mitigation have minimal impact on the surface water. (The largest potential impact of these projects is as a result of the associated infrastructure. These potential impacts can be mitigated such that their impacts on the aquatic ecosystems are of a low significance)	**Alternatives 1-3** Low Negative (-) **No-Go Alternative 4** N/A
Impacts on Agricultural Potential	***Direct impacts:*** Loss of agricultural production and potential.	**Alternatives 1-3** **Very Low (-)** **No-Go Alternative 4** Neutral	▪ If an activity will mechanically disturb below-surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. ▪ Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. ▪ Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land. ▪ During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. ▪ Erosion must be controlled where necessary on top soiled areas.	**Alternatives 1-3** **Very Low (-)** **No-Go Alternative 4** Neutral

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation **Umtu Alternative 2: ≤14km** transmission line corridor from solar park to Umtu substation **LILO[1] Alternative 3:** Loop-in Loop-out with transmission line of **≤5.5km** **No-Go Alternative 4:** *Status quo* remains				
Activity	**Impact summary**	**Pre – mitigation Significance**	**Proposed mitigation**	**Post mitigation - Significance**
			■ Implement effective spillage and waste management system.	
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	■ None	None identified
	Cumulative impacts: Loss of agricultural production and potential.	**Alternative 1-3** Low (-) **No-Go Alternative 4** Neutral	■ None	**Alternative 1-3** Low (-) **No-Go Alternative 4** Neutral
Impacts on Heritage and Palaeontological resources	***Direct impacts:*** Clearing of the surface and construction of the power lines and service road: impacts to archaeology. Clearing of the surface and construction of the power lines and service road: impacts to palaeontology. Clearing of the surface and construction of the power lines and service road: impacts to the landscape.	**Alternatives 1-3** **Heritage and Palaeo:** **Very Low (-)** **No-Go Alternative 4** **Heritage and Palaeo:** Zero	■ It is recommended that the ECO examine all excavations greater than 1 m depth to check for palaeontological material. ■ Although the chance of finding buried archaeological resources, fossil resources or possibly graves is very low, should any such material be found it should be reported to the project environmental control officer (ECO) who should then report to an archaeologist or palaeontologist as appropriate for assessment and advice on how to proceed. The ECO or heritage practitioner should also report the find to SAHRA. ■ If any archaeological material, palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	**Alternatives 1-3** **Heritage and Palaeo:** **Very Low (-)** **No-Go Alternative 4** **Heritage and Palaeo:** N/A
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	■ None	None identified
	Cumulative impacts: ■ Clearing of the surface and construction of the power lines and service road: cumulative impacts to archaeology. ■ Clearing of the surface and construction of the power lines and service road: cumulative impacts to the landscape.	**Alternatives 1-3** **Heritage and Palaeo:** **Very Low (-)** **<u>No-Go Alternative 4</u>** **<u>Heritage and Palaeo:</u>** Zero	None	**Alternatives 1-3** **Heritage and Palaeo:** **Very Low (-)** **<u>No-Go Alternative 4</u>** **<u>Heritage and Palaeo:</u>** N/A
Visual Impacts	***Direct impacts:*** Visual impact	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** **Very Low (-)** **No-Go Alternative 4** Neutral	■ Lights at night have the potential to significantly extend the project zone of visual influence. As such, light spillage reduction should be planned at the Pre-construction phase in accordance with the recommendations contained in the annexure to restrict the light spillage to within the local level (2km), ensuring that the current dark sky setting of the surrounding rural agricultural sense of place is retained. ■ Topsoil excavated from the road footprints should be stockpiled and utilised for rehabilitation of the laydown site. ■ Windblown dust during construction should be monitored by the ECO. Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** **Very Low (-)** **No-Go Alternative 4** Neutral

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ≤14km transmission line corridor from solar park to Umtu substation
LILO[1] Alternative 3: Loop-in Loop-out with transmission line of **≤5.5km**
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
			should be implemented under authorisation of the ECO. ▪ Signage on the R31 should be moderated and natural colours used in the signage as much as possible. ▪ Soil erosion measures need to be adequately implemented and routinely monitored by the ECO.	
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Massing effects from numerous power lines.	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** **Very Low (-)** **No-Go Alternative 4** Neutral	▪ The route with the least potential to result in Cumulative Effects is the LILO alternative due to the short length, and not treavering any sensitive areas. (Route mitigation is the best way to influence the potential impacts associated with loss of vegetation or soil erosion from the maintenance track).	**Hotazel Alternative 1** Low (-) **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** **Very Low (-)** **No-Go Alternative 4** Neutral
Socio-economic impacts	***Direct impacts:*** ▪ Increase in production and GDP-R of the national and local economies due to project capital expenditure	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** N/A	▪ Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for ▪ Establish a local skills desk to determine the potential skills that could be sourced in the area. ▪ Recruit local labour as far as feasible. ▪ Employ labour-intensive methods in construction where feasible. ▪ Sub-contract to local construction companies where possible. ▪ Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering and other services to the construction crew. Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock. ▪ Ensure that maintenance construction workers do not damage property or inflict other losses to the land owners and households residing on the farms. ▪ Negotiate terms and conditions that would guide construction activities/maintenance activities on the properties, as well as behaviour and conduct of the construction/maintenance crew. ▪ A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all construction/maintenance vehicles and construction/maintenance crew; the chosen route should follow the existing roads as far as feasible. ▪ Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property. ▪ Construction vehicles are to follow a safe speed and should mind animals inhibiting the farms. ▪ Construction activity should be undertaken only during working hours.	**Hotazel Alternative 1** **Medium (-)** **Umtu Alternative 2** **Medium (-)** **LILO Alternative 3** Low (-) **No-Go Alternative 4** N/A
	▪ Creation of temporary employment in the local communities and elsewhere in the country ▪ Affected Land Owners and Households	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A		**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts: Impacts that are not a direct result of the proposed	None identified	▪ None	None identified

Hotazel Alternative 1: ≤11km transmission line corridor from solar park to Hotazel substation **Umtu Alternative 2: ≤14km** transmission line corridor from solar park to Umtu substation **LILO[1] Alternative 3:** Loop-in Loop-out with transmission line of **≤5.5km** **No-Go Alternative 4:** *Status quo* remains				
Activity	**Impact summary**	**Pre – mitigation Significance**	**Proposed mitigation**	**Post mitigation - Significance**
	activity, but occur away from the original source of impact.			
	Cumulative impacts:	None identified	▪ None	None identified
Impacts on Hydrology	***Direct impacts:*** Erosion caused by construction of transmission line pylons	**Alternatives 1-3** **Medium (-)** **No-Go Alternative 4** N/A	▪ Place pylons outside of the flood plain of the Ga-Morgara River ▪ Place pylons outside of buffer zones identified by the aquatic ecologist (Around the Ga-Morgara River) ▪ Installation of pylons should not mobilise sediment	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts: Erosion	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A	▪ Cumulative impact of pylons from the transmission line would be low if they are kept out of the watercourse floodplain and out of any buffer identified by the aquatic ecologist.	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
Traffic impact	***Direct impacts***	**Alternatives 1-3** Low (-) **No-Go Alternative 4** Low (-)	▪ Manage traffic volumes by means of the management of delivery volumes and times. ▪ Implement dust control measures during construction as speed limits and regular watering. ▪ Ensure delivery drivers are licensed and competent, and vehicles are in good road worthy condition.	**Alternatives 1-3** Low (-) **No-Go Alternative 4** Low (-)
	Indirect impacts: Impacts that are not a direct result of the proposed activity, but occur away from the original source of impact.	None identified	▪ None	None identified
	Cumulative impacts:	Negligible	▪ None	Negligible

Operational Phase

Hotazel Alternative 1: ~12 km transmission line corridor from solar park to Hotazel substation
Umtu Alternative 2: ~17 km transmission line corridor from solar park to Umtu substation
LILO Alternative 3: Loop-in Loop-out with transmission line of < 300 m
No-Go Alternative 4: *Status quo* remains

Activity	Impact summary	Pre – mitigation Significance	Proposed mitigation	Post mitigation - Significance
Impacts on Botany	***Direct impacts:*** None were identified.	None identified	▪ None	None identified
	Indirect impacts: No indirect impacts were identified.	None identified	▪ None	None identified
	Cumulative impacts: No cumulative impacts were identified.	None identified	▪ None	None identified
Impacts on Avifauna	***Direct impacts:*** • Electrocution of priority species on the proposed 132kV powerline	**Alternatives 1-3** High Negative (-) **No-Go Alternative 4** N/A	▪ An Eskom approved bird friendly pole design will be used (APPENDIX 3). In addition, if a monopole structure is used, as this report has assumed, a Bird Perch must be installed on top of all poles, to provide safe perching substrate for birds well above the dangerous hardware. ▪ Bird flight diverters (BFDs) are to be maintained throughout the operational life. The Avifauna specialist may recommend additional BFDs if the need arises and is supported by monitoring. ▪ Install bird flight diverters as per the instructions of the specialist following the site walkthrough. ▪ The operational monitoring programme must include regular monitoring of the grid connection power line for collision mortalities.	**Alternatives 1-3** High Negative (-) **No-Go Alternative 4** N/A
	• Collisions of priority species with the earthwire of the proposed line	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A	▪ The current HV powerline network is extensive with several hundred kilometres of HV line present within the 30km radius around Hotazel, mostly linked to mining activity. The level of collision mortality on these lines is unknown, but it can be assumed that it is a regular occurrence. However, the short length of the proposed 132kV line should limit the potential for collision mortality, especially if properly mitigated with Bird Flight Diverters.	**Alternatives 1-3** Low (-) **No-Go Alternative 4** N/A
	Indirect impacts: No indirect impacts were identified.	None identified	▪ None	None identified
	Cumulative impacts: The cumulative impact of a number of renewable projects in the larger region may result in: Greater chance of collision and electrocution.	**High Negative (-)**	▪ There are hundreds of kilometres of 11kV and 22kV MV lines in the 30km radius around Hotazel. It is not known how bird-friendly these lines are, but it can be assumed that there are bird unfriendly lines which are electrocuting birds, especially large raptors and vultures. However, the proposed 132kV line will not pose an electrocution risk to vultures if fitted with a bird perch as recommended. The cumulative impact of the powerline in terms of potential collision mortality of priority species is therefore rated to be Low.	**Low negative (-)**
Impacts on Freshwater	***Direct impacts:*** No impacts were identified during operation phase.	None identified	▪ None	None identified
	Indirect impacts: No indirect impacts were identified.	None identified	▪ None	None identified
	Cumulative impacts: No impacts were identified during operation phase.	None identified	▪ None	None identified
Impacts on Agricultural Potential	***Direct impacts:*** The agricultural impacts of a transmission line in this environment, which has low agricultural potential and no cultivation, is negligible.	None identified	▪ The only viable agricultural land use in the study area, grazing, can continue entirely unaffected below transmission lines.	None identified
	Indirect impacts: No indirect impacts were identified.	None identified	▪ None	None identified
	Cumulative impacts: No cumulative impacts were identified.	None identified	▪ None	None identified
Impacts on Visual	***Direct impacts:*** Visual (Sense of place)	**Hotazel Alternative 1** Low (-) **Umtu**	▪ The laydown areas, or any areas disturbed during constructions, should be ripped, if needed, to de-compacted top-soil, and then rehabilitated to natural bush-veld vegetation with endemic grass species.	**Hotazel Alternative 1** Low (-) **Umtu**

Hotazel Alternative 1: ~12 km transmission line corridor from solar park to Hotazel substation **Umtu Alternative 2:** ~17 km transmission line corridor from solar park to Umtu substation **LILO Alternative 3:** Loop-in Loop-out with transmission line of < 300 m **No-Go Alternative 4:** *Status quo* remains				
Activity	**Impact summary**	**Pre – mitigation Significance**	**Proposed mitigation**	**Post mitigation - Significance**
		Alternative 2 **Medium (-)**	▪ The natural areas along the R31 should be monitored by the ECO on a bi-annual basis to ensure that the area does not become a fire risk. Appropriate measures to reduce deadwood from the area should be implemented ▪ Ongoing erosion control monitoring by the ECO.	**Alternative 2** **Medium (-)**
		LILO Alternative 3 **Very Low (-)**		**LILO Alternative 3** **Very Low (-)**
		No-Go Alternative 4 Neutral		**No-Go Alternative 4** Neutral
	Indirect impacts: No Indirect impacts were identified	None identified	▪ None	None identified
	Cumulative impacts: Visual (Sense of place)	**Moderate** Negative (-)	▪ Integration planning with Eskom to assess the possibility of shared power line resources. Though the final determination will rest with Eskom.	**Minor positive (+)**
Impacts on Socio-economic	***Direct impacts:*** Affected landowners and Households – supply of electricity	**Alternatives 1-3** High Positive (+)	▪ Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock. ▪ Ensure that maintenance workers do not damage property or inflict other losses to the land owners and households residing on the farms. ▪ Negotiate terms and conditions that would guide maintenance activities on the properties, as well as behaviour and conduct of the maintenance crew. ▪ A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all maintenance vehicles and maintenance crew; the chosen route should follow the existing roads as far as feasible. ▪ Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property. ▪ Maintenance vehicles are to follow a safe speed and should mind animals inhibiting the farms. ▪ Maintenance activity should be undertaken only during working hours.	**Alternatives 1-3** High Positive (+)
		No-Go Alternative 4 N/A		**No-Go Alternative 4** N/A
	Affected landowners and Households	**Alternatives 1-3** Low (-)		**Alternatives 1-3** Low (-)
		No-Go Alternative 4 N/A		**No-Go Alternative 4** N/A
	Indirect impacts: No Indirect impacts were identified	None identified	▪ None	None identified
	Cumulative impacts: None foreseen at this stage	None identified	▪ None	None identified

Please note: Decommissioning of the Transmission lines will have similar impacts as those encountered in the construction phase. The majority of materials are recyclable and will not go to waste. The transmission lines are expected to have an operational lifespan of 20 to 30 years during which they will likely become part of the grid network, through possible expansion of the grid. Decommissioning is therefore deemed unlikely and determining the nature and extent of the impacts associated with the decommissioning of the lines in such a distant future is deemed imprudent. Lastly, the decommissioning of the transmission line is a listed activity in terms of GN R. 983 31(i) and would require assessment and authorisation prior to decommissioning thus the impacts associated with the decommissioning of the transmission lines has not been reported here.

APPENDIX G:

Environmental Management Programme (EMPr)

ENVIRONMENTAL BASIC ASSESSMENT PROCESS: PROPOSED 132 kV OVERHEAD TRANSMISSION LINE FOR THE HOTAZEL SOLAR FARM NEAR HOTAZEL, NORTHERN CAPE

DEA REF NO.: TO BE ISSUED

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

(PREFERRED ALTERNATIVE : HOTAZEL SUBSTATION)

March 2017

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Document Control Record

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1977/003711/07

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Document control							aurecon
Report Title		Proposed 132 kV Overhead Transmission Line (Hotazel) for the Hotazel Solar Park near Hotazel, Northern Cape					
Document ID			Project Number		111285		
File Path		N:\Data\PROJECT\ENVIRO\PROJECTS\112667~Hotazel solar park\3 Project delivery\2 Deliverables\6 dBAR\BAR Annexures\Appendix G EMPr\Hotazel_EMPr.doc					
Owner		Prepared for Juwi	Owner Contact		Nazley Towfie		
Rev	Date	Revision Details/Status	Prepared by	Author	Verifier	Approver	
0	xx	1st Draft	Corlie Steyn	Corlie Steyn	Patrick Killick	Diane Erasmus	
Current Revision		**0**					
Approval							
Author Signature			Approver Signature				
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ABBREVIATIONS

BA Basic assessment
DEA Department of Environmental Affairs
DEA&DP Department of Environmental Affairs and Development Planning
DWA Department of Water Affairs
EA Environmental Authorisation
EAP Environmental Assessment Practitioner
ECO Environmental Control Officer
EMPr Environmental Management Programme
NEMA National Environmental Management Act (No. 107 of 1998)
OHS Occupational Health and Safety Act (No. 85 of 1998)
SDEMA Specification Data Environmental Management
SPEC EMA Specification Environmental Management

1 OVERVIEW

This document represents the Environmental Management Programme (EMPr) for the proposed 132 kV Overhead Transmission Line for the Hotazel Solar Farm near Hotazel in the Northern Cape.

1.1 PURPOSE OF THE EMPR

The EMPr provides a link between the impacts identified in the process and the environmental management on the ground during project implementation and operation. The objective is to ensure for environmental management interventions identified by the specialists during the impact assessment are implemented throughout the project lifecycle which include the following stages of the proposed development:

- Pre-construction;
- Construction;
- Operation; and
- Decommissioning.

The EMPr will be amended to include all relevant conditions contained in the Environmental Authorisation (EA) that holder or their subsidiaries need to observe, thereby ensuring that identified environmental considerations are efficiently and adequately taken into account during all stages of development.

Note that this EMPr should be regarded as a 'living' document and should allow for amendments throughout the lifecycle of the project, allowing for adjustments as new information is made available and new mitigations where unforeseen environmental impacts arise.

1.2 LEGAL REQUIREMENTS OF ENVIRONMENTAL MANAGEMENT PROGRAMMES

1.2.1 The National Environmental Management Act, 1998 (Act No. 107 of 1998)

In terms of the Environmental Impact Assessment (EIA) Regulations (Regulation R.543 of 18 June 2010) enacted in terms of the National Environmental Management Act (Act No. 107 of 1998, as amended) (NEMA), the proposed project triggers Activities 10, 11 and 18 of Regulation R.544 (18 June 2010), and Activity 14 of Regulation R.546 (18 June 2010). As the proposed project triggers listed activities in terms of Regulations R.544 and R.546, it is necessary to submit a BAR for Environmental Authorisation (EA) to the Department of Environmental Affairs (DEA). Section 22 (l) of the EIA Regulations requires that a draft Environmental Management Programme (EMPr) is submitted in support of the BAR.

The contents of the EMPr must meet the requirements outlined in Section 24N (2) and (3) of NEMA (as amended) and Section 33 of the EIA Regulations. The EMPr must address the potential environmental impacts of the proposed activity on the environment throughout the project life-cycle including an assessment of the effectiveness of monitoring and management arrangements after implementation. The Department requires that the EMPr be submitted together with the BAR so that it can be considered simultaneously. Table 1 lists the requirements of an EMPr as stipulated by Section 33 of the EIA Regulations R543. Table 2 lists the requirements of an EMPr as stipulated by Section 24N (2) and (3) of the NEMA.

Table 1: Section 33 of EIA Regulation R543 listing the requirements of an EMPr

33. A draft environmental management programme must comply with section 24N of the Act and include –

(a) details of –
(i) the person who prepared the environmental management programme; and
(ii) the expertise of that person to prepare an environmental management programme;

(b) information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of—

(i) planning and design;

(ii) pre-construction and construction activities;

(iii) operation or undertaking of the activity;

(iv) rehabilitation of the environment; and

(v) closure, where relevant.

(c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;

(d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);

(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

(f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;
(g) a description of the manner in which it intends to—
(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
(ii) remedy the cause of pollution or degradation and migration of pollutants;
(iii) comply with any prescribed environmental management standards or practices;
(iv) comply with any applicable provisions of the Act regarding closure, where applicable;
(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;
(h) time periods within which the measures contemplated in the environmental management programme must be implemented;
(i) the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;
(j) an environmental awareness plan describing the manner in which—
(i) the Owner intends to inform his or her Employees of any environmental risk which may result from their work; and
(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;

(k) where appropriate, closure plans, including closure objectives.

The legislation hereby aims to ensure that effective environmental management is implemented throughout the life of the project via the translation of management actions identified in the Basic Assessment into the EMPr.

The Department of Environmental Affairs & Development Planning (DEA&DP)'s[1] *Guideline for Environmental Management Plans* (2005) aims to inform and guide the preparation and implementation of EMPR's. The guideline defines EMPR's as:

> *"an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented; and that the positive benefits of the project are enhanced".*

[1] Please note that DEA&DP's guideline is used even though the proposed project is based in the Northern Cape, as DEA has not compiled a guideline on EMPRs.

Section 24N (2) and (3) of the NEMA listing the requirements of an EMPR are given in **Table 2**.

Table 2: Section 24N (2) and (3) of the NEMA listing the requirements of an EMPr

24N.(2) the environmental management programme must contain- *(a) information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of –* *(i) planning and design;* *(ii) pre-construction and construction activities;* *(iii) the operation or undertaking of the activity in question;* *(vi) the rehabilitation of the environment; and* *(vii) closure, where relevant.* *(b) details of –* *(i) the person who prepared the environmental management programme; and* *(ii) the expertise of that person to prepare an environmental management programme* *(c) a detailed description of the aspects of the activity that are covered by the draft environmental management plan;* *(d) information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);* *(e) information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance.* *(f) as far as is reasonable practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and* *(g) a description of the manner in which it intends to-* *(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;* *(ii) remedy the cause of pollution or degradation and mitigation of pollutants; and* *1. (iii) comply with any prescribed environmental management standards or practices.* *2. (3) the environmental management programme must , where appropriate-* *3. (a) set out time periods within which the measures contemplated in the environmental management programme must be implemented;* *4. (b) contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of prospecting or mining operations or related mining activities which may occur inside and outside the boundaries of the prospecting area or mining area in question; and* *5. (c) develop an environmental awareness plan describing the manner in which-* *6. (i) the Owner intends to inform his or her Employees of any environmental risk which may result from their work; and* *7. (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.*

This EMPr aims to meet the EMPr requirements as legislated by the NEMA Regulations as well as complying with the DEA&DP guideline document for an Environmental Management Plan[2]. It should however be noted that no guideline or guidance exists in terms of best practice approach to EMPR's. This document should thus be seen in an iterative context allowing for amendments throughout the life-cycle of the project, allowing for adjustments as new information is made available.

[2] Lochner, P. 2005. *Guideline for Environmental Management Plans*. CSIR Report No ENV-S-C 2005-053 H. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

1.3 STRUCTURE OF THE EMPR

As discussed above, the EMPr aims to address environmental management throughout the project life-cycle, from planning and design, through construction, to operation and potential decommissioning. The EMPr has been structured to include the following sections:

- Chapter 1: Overview
- Chapter 2: Project description
- Chapter 3: Pre-construction phase
- Chapter 4: Construction phase
- Chapter 5: Operational phase
- Chapter 6: Decommissioning phase
- Chapter 7: Conclusion

Table 3: NEMA requirements for EMPR's and location in this EMPr

Appendix 4 of EIA Regulation R982 and Section 24 (5) and (44) of the NEMA listing		Chapter or section
(a)	Details of: (i) the person who prepared the environmental management programme; and (ii) the expertise of that person to prepare an environmental management programme;	Annexure A
(b)	a detailed description of the aspects of the activity that are covered by the draft environmental management programme;	Section 3.1- 6.1
(c)	a map at an appropriate scale which superimposes the proposed activity, its associated structures and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas should be avoided, including buffers	Section 3.1- 6.1
(d)	A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities.	Section 3.1- 6.1
(e)	A description and identification of impact management outcomes requires for aspects contemplates in paragraph (d)	Section 3.1- 6.1
(f)	A description of proposed impact management actions, identifying the manner in which the impact management objective and outcomes contemplated in paragraphs (d) and € will be achieved , and must, where applicable, include actions to - (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; (iii) comply with any prescribed environmental management standards or practices; (iv) comply with any applicable provisions of the Act regarding closure, where applicable; (v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	Section 3-6
(g)	the method of monitoring the implementation of the impact management actions contemplates in paragraph (f)	Section 3-6
(h)	the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f)	Section 3-6
(i)	An indication of the persons who will be responsible for the implementation of the impact management actions	Section 3-6
(j)	the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 3-6

Appendix 4 of EIA Regulation R982 and Section 24 (5) and (44) of the NEMA listing		Chapter or section
(k)	the mechanism for monitoring the compliance with the impact management actions contemplated in paragraph (f)	Section 3-6
(l)	a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations	Section 4.2
(m)	an environmental awareness plan describing the manner in which— (i) the Owner intends to inform his or her Employees of any environmental risk which may result from their work; and risks must be dealt with in order to avoid pollution or the degradation of the environment;	See Section 2.2.1 and 2.2.2 of the General Specification
(n)	Any specific information that may be requires by the competent authority	None at the moment

1.4 EXPERTISE OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS

Section 33 of EIA Regulations and Section 24N (2) and (3) of the NEMA requires that an EMPr must include the details of the person(s) who prepared the EMPR, and the expertise of that person to prepare an EMPr. In this regard, the *Curriculum Vitae* of the Environmental Assessment Practitioners who compiled the EMPr are included in Appendix A.

2 PROJECT DESCRIPTION

2.1 PROJECT DESCRIPTION

Three transmission corridor alternatives to evacuate power from the solar facility to the national grid are being considered by connecting the Solar Facility to the existing Eskom substations, namely the Hotazel and Umtu substations and a shorter Loop-in Loop-Out (LILO)[3] connection option. The technical feasibility of the LILO connection depends on upgrades to the Ferrum/Umtu 132kV powerline which may be constrained at this stage. This alternative was assessed in the Basic Assessment in case the option does become available in future. In the event that the line is upgraded the applicant can revert to this line option through an EA amendment process. This option would be the most environmentally feasible option, but cannot be put forward as the preferred option due to the technical uncertainty. These transmission lines would form part of the national grid and therefore fall under the ownership and operation of Eskom. Ownership of this infrastructure to be ceded to Eskom once constructed and must therefore have separate environmental authorisation to allow for the transference of ownership.

The aspects of the three alternatives are:

Transmission line C1: **Hotazel Substation** (**Alternative 1**: Preferred Alternative)

- A 200m wide corridor ≤11km, of a double circuit 132kV power lines will be constructed
- Servitude width 35m
- ≤110monopole pylons
- ≤12km long and 4m wide service track

Transmission line C2: **Umtu substation** (**Alternative 2**)

- A 200m wide corridor ≤14km double circuit 132kV power lines will be constructed
- Servitude width 35m
- ≤140 monopole pylons

[3] [3] "The Loop In Loop Out connection depends on technical capacity of the Eskom line before being deemed a feasible alternative. This is considered the least, technically, viable alternative at this stage, though this might change in future"

- ≤15km long and 4m service track

Transmission Line C3: **LILO connection** (**Alternative 3**)

- A 200m wide corridor in which two rows of parallel pylons ≤5.5km long, of a double circuit 132kV power lines will be constructed (not less than 21m or greater than 42m apart). The lines will tie into the existing 132kV Eskom line located to the west of the site.
- Servitude width 35m per line.
- ≤60 monopole pylons (i.e. ≤120 pylons in total)
- ≤6km long and 4m service track per line

No-Go Alternative C4

- No transmission lines would be constructed. Assuming the Hotazel solar plant is authorised, 200MWac power generated by the facility would not be available to the national grid. No environmental or social impacts, positive or negative, would arise.

Refer to Figure 1 for the locality of the proposed project and Figure 2 for the identified sensitive areas.

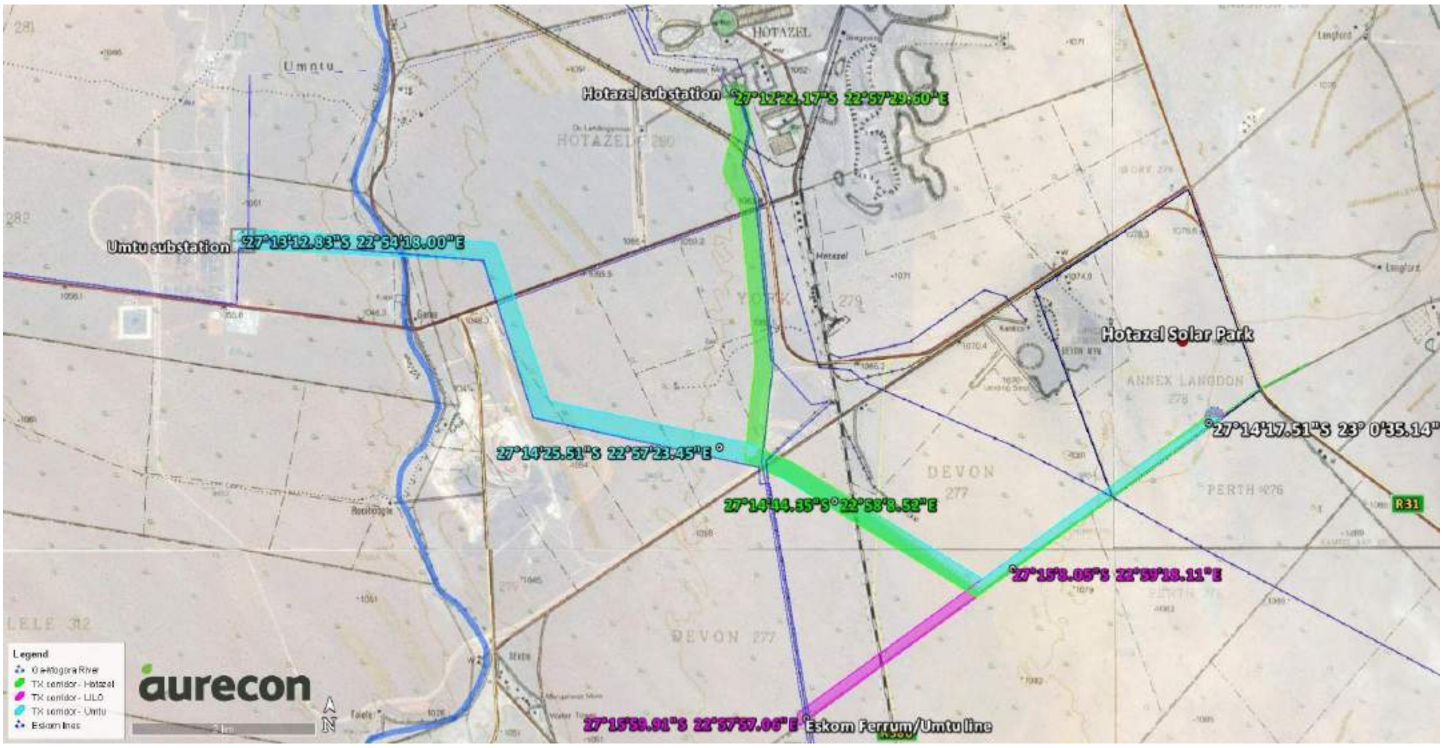

Figure 1: Locality map of the proposed 132 kV Transmission Line (Hotazel)

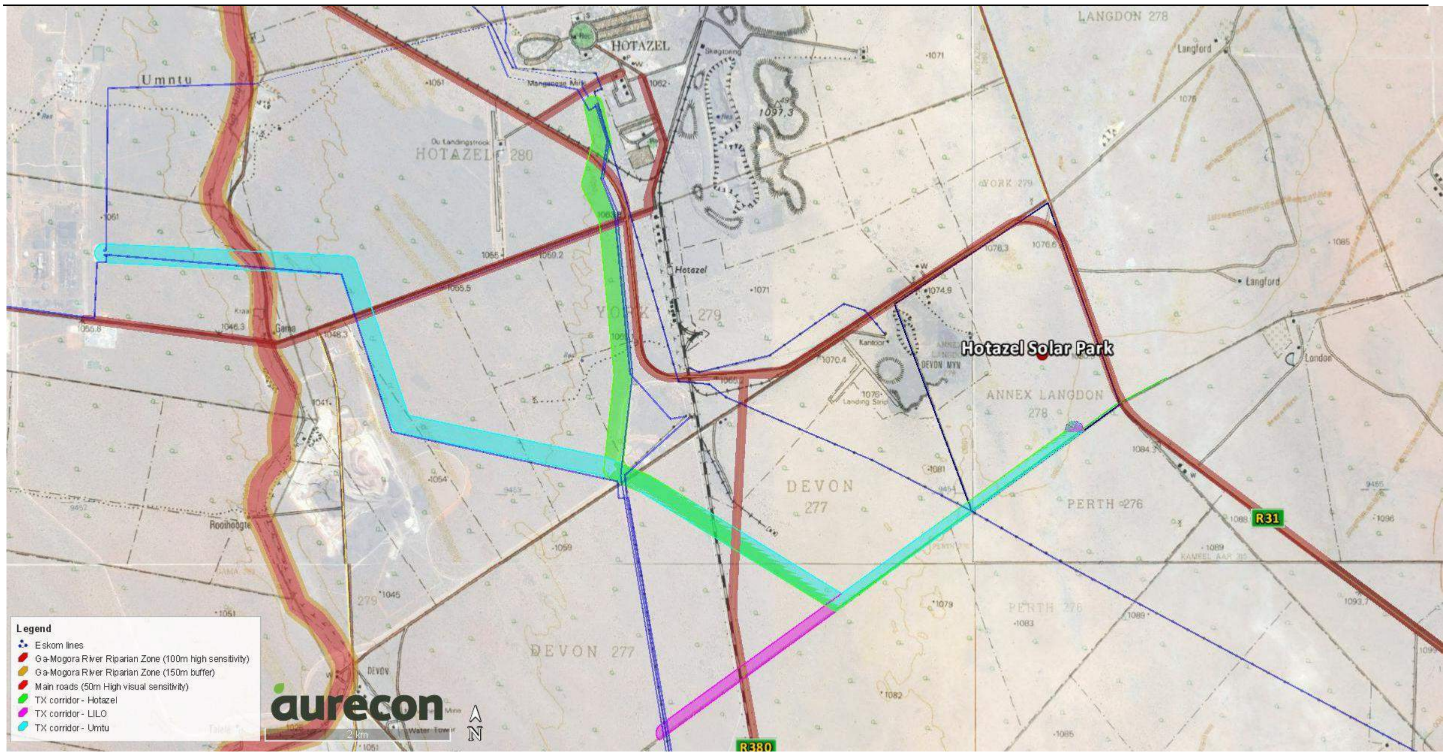

Figure 2: Sensitive areas - 132 kV Transmission Line (Hotazel)

3 PRE-CONSTRUCTION PHASE

This section of the EMPr has been divided into subsections which outline how environmental considerations have informed and been incorporated into the planning and design phase of the proposed transmission line. Detailed design is usually undertaken as part of the pre-construction phase as it is a costly undertaking which is generally only costed for once all required authorisations have been obtained. Thus, the planning and design phases discussed are limited to those associated with the pre-authorisation phases. Mitigation measures have been recommended for the pre-construction phase. The r~~R~~oles and responsibilities should be applied during the pre-construction, construction, operational and decommissioning phases.

3.1 ROLES AND RESPONSIBILITIES

3.1.1 The Owner

The holder of the EA or Owner shall assume overall responsibility for the administration and implementation of the EMPr. Whilst responsibilities for the implementation of the EMPr may be delegated to a Project Manager, Engineer or Contractor, the ultimate responsibility and liability remains with the Permit Holder. This Permit Holder has the following responsibilities during the pre-construction phase:

- Ensure all authorisations, permits, consents are in place and any other legal requirements are settled before construction commences.
- Appoint or engage a suitably qualified Project Manager or Engineer.
- Appoint a suitably qualified bird, bat and botanical specialist to undertake preconstruction walkthrough and infrastructure micro siting, where required.
- Appoint or engage a suitably qualified independent ECO to monitor compliance with the EMPr.
- All documentation e.g. permits, audit/monitoring/compliance reports and notifications, required to be submitted to the Department in terms of the authorisation, must be submitted to the Director: Compliance Monitoring at the Department.
- If required, obtain a Water Use Licence from the Department of Water and Sanitation (DWS) prior to the commencement of the project should the holder impact on any wetland or water resource. A copy of the license must be kept on site and provided to the ECO.
- Notify the affected landowners at least 30 days prior to the mobilisation of the Contractor or any construction activity.

- Fourteen (14) days written notice must be given to the Department that the activity commence. Commencement for the purposes of this condition includes site preparation, the notice must include a date on which it is anticipated that the activity will commence. This notification period may coincide with the Notice of Intent to Appeal period, within which construction may not commence.
- A copy of this authorisation and the approved EMPr must be kept at the property where the activity will be undertaken. The EAs and approved EMPr must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the property.
- Must notify both the Director: Integrated Environment Authorisations and the Director: Compliance Monitoring at the Department, in writing and within 48 (forty eight) hours, if any condition of this authorisation cannot be or is not adhered to any notification in terms of this condition must be accompanied by reasons for the non-compliance.

3.2 PROJECT MITIGATIONS MEASURES

In addition to any conditions of approval, the following key and project specific mitigation measures should be considered during the pre-construction phase.

3.2.1 Botanical

- The corridors should be kept clear of woody vegetation and only a cover of grass would be permitted. This would be required for the safe operation of the transmission lines. (The vegetation would not revert to its natural state after construction since it would be kept in check by systematic and regular clearing).

Limit vegetation clearance to taller woody vegetation that would impact safety, but retain shorter woody species and herbaceous vegetation as far as possible.

No herbicides, except stump treatments on coppicing species.

3.2.2 Avifauna

- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- The recommendations of the botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of priority species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.
- An avifaunal specialist must conduct a site walk through of final pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required.
- Install bird flight diverters as per the instructions of the specialist following the site walkthrough and micro-siting.
- Bird Flight Diverters must be installed in order to limit the potential collision mortality where crossing the ephemeral Ga-Mogara River where it is expected that water birds could commute up and down the drainage line when it is flowing or when it contains large pools of standing water, and raptors and vulture could descend to pools in the river to drink and bath. This risk is particularly important for the Umtu TX corridor which crosses the river near the Umtu Substation.
- An Eskom approved bird friendly pole design will be used (APPENDIX 3). In addition, if a monopole structure is used, as this report has assumed, a Bird Perch must be installed on top of all poles, to provide safe perching substrate for birds well above the dangerous hardware.

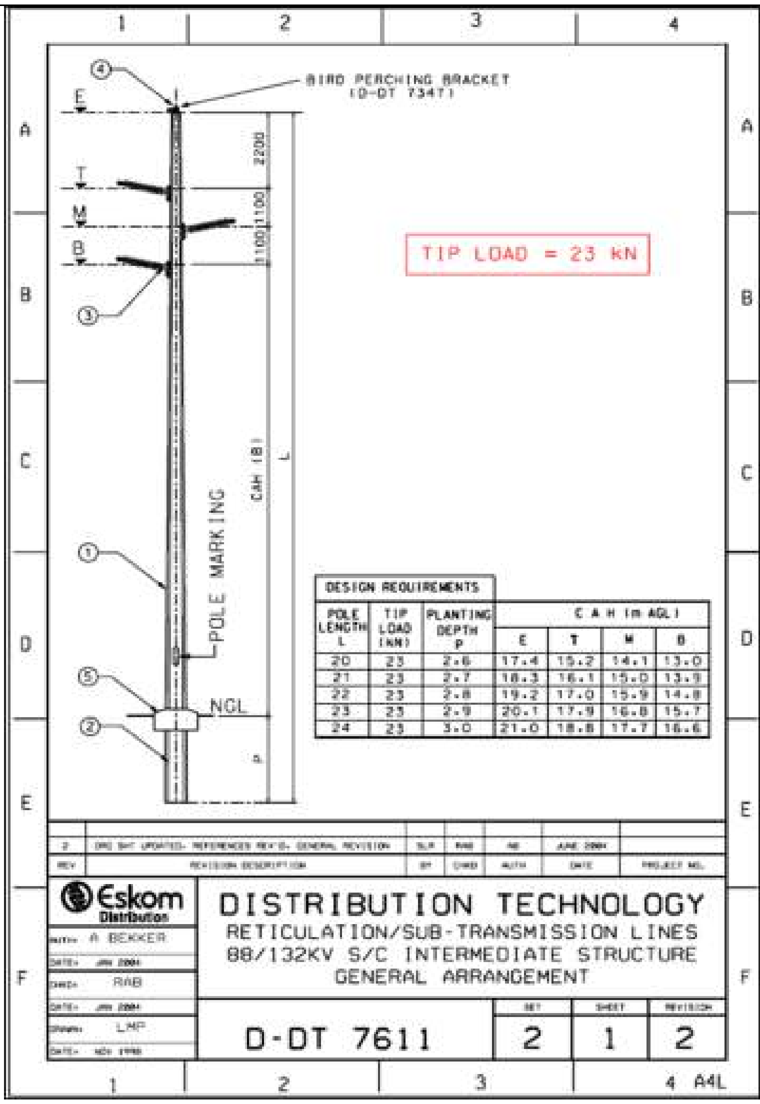

Figure 3: Powerline design (Avifauna Assessment Report, 2016)

3.2.3 Fresh Water

- The pylons for the transmission line should be placed outside of the recommended buffer of 100 m from the top of bank on either site of the river. As indicated in the sensitivity map which indicates a 100m from river centreline plus 50m buffer where added caution should be observed (i.e. limited vegetation clearance, restricted use of hydrocarbons, portable toilets, earth moving equipment, etc.).
- With regards to any access roads to the transmission line for construction and maintenance, existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed project. If an access road need to be constructed it should preferably be placed outside of the recommended buffer. Any disturbed areas within the river corridor and recommended buffer that are associated with the project activities should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

3.2.4 Agricultural

- Erosion must be controlled where necessary on topsoiled areas.
- Implement effective spillage and waste management system.

3.2.5 Heritage and Palaeontological resources

- It is recommended that the ECO examine all excavations greater than 1 m depth to check for palaeontological material and report this via a standard chance finds procedure to the relevant authority.

3.2.6 Visual

- Lights at night have the potential to significantly extend the project zone of visual influence. As such, light spillage reduction should be planned at the Pre-construction phase in accordance with the

recommendations contained in the annexure to restrict the light spillage to within the local level (2km), ensuring that the current dark sky setting of the surrounding rural agricultural sense of place is retained.
- Placement of pylons, vegetation clearance and other visual disturbances during construction should be minimised where the transmission lines cross the roads to minimise the visual intrusion of the transmission lines as far as possible at these points.

3.2.7 Socioeconomic
- Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for
- Establish a local skills desk to determine the potential skills that could be sourced in the area.
- Recruit local labour as far as feasible.
- Employ labour-intensive methods in construction where feasible.
- Sub-contract to local construction companies where possible.
- Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering and other services to the construction crew. Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock.
- Ensure that maintenance construction workers do not damage property or inflict other losses to the land owners and households residing on the farms.
- Negotiate terms and conditions that would guide construction activities/maintenance activities on the properties, as well as behaviour and conduct of the construction/maintenance crew.
- A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all construction/maintenance vehicles and construction/maintenance crew; the chosen route should follow the existing roads as far as feasible.
- Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property.
- Construction vehicles are to follow a safe speed and should mind animals inhibiting the farms.
- Construction activity should be undertaken only during working hours.

3.2.8 Hydrology
- Place pylons outside of the flood plain of the Ga-Morgara River.
- Place pylons outside of buffer zones identified by the aquatic ecologist. This has been set as 100m from the centreline of the river as a minimum and must be on the upper banks.

3.2.9 Traffic
- Ensure delivery drivers are licensed and competent, and vehicles are in good road worthy condition.

4 CONSTRUCTION PHASE

The section aims to address mitigation measures pertaining to the construction phase as identified during the course of the BA. This section includes both General Specifications as well as Draft Specification Data, addressing general construction issues and issues that are not addressed by the General Specifications, respectively.

4.1 CONSTRUCTION EMPR GENERAL SPECIFICATIONS

The complete General Specifications have been included in **Appendix C** and include the following sections:

- Scope
- Normative References
  - Supporting Specifications
- Definitions
- Requirements
  - Earthworks
  - Pumping
  - Bitumen
  - Fire control
  - Emergency procedures

  - Material
  - Material handling, use and storage
  - Hazardous substances
  - Shutter oil and curing compound
  - Bitumen
  - Plant
  - Ablution facilities
  - Solid waste management
  - Contaminated water
  - Site structures
  - Noise control
  - Lights
  - Fuel (petrol and diesel) and oil
  - Workshop, equipment maintenance and storage
  - Dust
  - Methods and procedures
  - Environmental awareness training
  - Construction personnel information posters
  - Site clearance
  - Site division
  - Site demarcation
  - "No go" areas
  - Protection of natural features
  - Protection of flora and fauna
  - Protection of archaeological and paleontological remains
  - Access routes/ haul roads
  - Cement and concrete batching
  - Community relations
  - Erosion and sedimentation control
  - Aesthetics
  - Recreation
  - Access to site
  - Crane operations
  - Trenching
  - Demolition
  - Drilling and jack hammering
  - Stockpiling
  - Site closure and rehabilitation
  - Temporary re-vegetation of the areas disturbed by construction
  - Temporary site closure
- Compliance with requirements and penalties
  - Compliance
  - Penalties
  - Removal from site and suspension of Works
- Measurement and Payment
  - Basic principles
    - General
    - All requirements of the environmental management specification
    - Work "required by the Specification Data"
  - Billed items
    - Method Statements: Additional work
    - All requirements of the environmental management specification

4.2 ROLES AND RESPONSIBILITIES

In addition to the roles and responsibilities stipulated in Section 3.1 the following will apply during the construction phase:

4.2.1 The Owner

- Assume overall responsibility for the administration and implementation of the EMPr through an identified Project Manager or Engineer;
- Appoint or engage a suitably qualified independent ECO to monitor compliance with the EMPr. and undertake monthly and close out audits of compliance with the requirements of the EMPr and provide a copy of the audit reports to DEA and the Contractor.
  - An ECO must be appointed before commencement of any authorised activity.
  - An ECO must remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is ready for operation.
  - Once appointed the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring of the Department.
- Keep all records relating to monitoring and auditing on file and make it available for inspection to any relevant and competent authority in respect of the development.
- If required, Submit an environmental audit report to the Department within 30 days of completion of the construction phase (i.e. within 30 days of site handover) and within 30 days of completion of rehabilitation activities.

- The environmental audit report must:
  - Be compiled by an independent environmental auditor;
  - Indicate the date of the audit, the name of the auditor and the outcome of the audit,
  - Evaluate compliance with the requirements of the approved EMPr and the environmental authorisation;
  - Include copies of any approvals granted by other authorities relevant to the development for the reporting period;
  - Highlight any outstanding environmental issues that must be addressed, along with recommendations for ensuring these issues are appropriately addressed;
    - Include a copy of this authorisation and the approved EMPr;
    - Include all documentation such as waste disposal certificates, hazardous waste landfill site licences etc. pertaining to this authorisation; and
    - Include evidence of adherence to the conditions of the environmental authorisation and the EMPr where relevant such as training records and attendance records.
- Appoint or engage a suitably qualified Project Manager or Engineer; and
- Appoint or engage a suitably qualified independent ECO to:
  - monitor compliance with the EMPr;
  - undertake monthly, and close out, audits of compliance with the requirements of the EMPr; and
  - provide a copy of the audit reports to DEA and the Contractor.

4.2.2 Project Manager

The Project Manager or Engineer shall:

- Has the authority to stop works and issue fines, as necessary, and in accordance with the Contract;
- Receive reports from the ECO and report to the Owner; and
- Support the ECO in his/her roles and responsibilities, including notifying the ECO of any non-compliances or incidents.

4.2.3 The Contractor

The Contractor shall be responsible for ensuring that his activities are compliant with the EMPr and shall make the required financial and physical resource provisions needed to ensure compliance. The Contractor shall appoint, in writing, a member of his staff to the role of Environmental Officer (EO) for the duration of his contract. The EO shall have the following duties:

- Undertake routine environmental awareness training with staff;
- Schedule, plan and oversee all environmental aspects of the project;
- Prepare method statements for consideration and acceptance by the Project Management and ECO;
- Undertake daily inspection of the works to ensure the requirements of the EMPr are being fulfilled;
- Liaise with the Developer, Project Manager, and ECO on matters relating to environmental management;
- Oversee corrective actions associated with non-compliance observations noted by the ECO;
- Collect data required by the ECO and submit these as part of monthly returns;
- Report any incidents to the ECO and follow-up with a written report within 24hrs indicating causation, containment or remediation actions taken.

4.2.4 The ECO

The role of the ECO will be to monitor compliance and implementation of the construction phase EMPr and Operational Phase EMPr, which includes compliance with the relevant conditions contained in the EA. This includes the following responsibilities:

- Liaison with the Owner, Project Manager or Engineer and DEA;
- Monitoring of all of the Contractor's activities for compliance with the various environmental requirements contained in the construction specification;
- Monitoring of compliance with the EA related to the construction phase as issued by DEA as well as other relevant environmental legislation;

- Reviewing of the Contractor's environmental Method Statements;
- Discuss the conditions of the EA and the content of the EMPr with the contractors prior to any site clearing occurring and ensure that all protection measures are in place to protect sensitive and no go areas;
- Ensuring that the requisite remedial action is implemented in the event of non-compliance;
- Ensuring the proactive and effective implementation and management of environmental protection measures;
- Ensuring that a register of public complaints is maintained by the Contractor and that any and all public comments or issues are appropriately reported and addressed;
- Recording and reporting of environmental incidents.
- Routine recording and reporting of environmental activities on a monthly basis;
    - Keep record of all activities on site, problems identified, transgressions noted and a schedule of tasks undertaken by the ECO
    - Keep and maintain a detailed incident (including spillage of fuels, chemicals or any other material) and complaint register on site indicating how these issues were addressed, what rehabilitation measures were taken and what preventative measures were implemented to avoid re-occurrence of incidents/complaints.
    - Keep copies of all reports submitted to the Department.
    - Keep and maintain a schedule of current site activities including the monitoring of site activities.
    - Obtain and keep record of all documentation, permits, licences and authorisations such as waste disposal certificates, hazardous waste landfill site licences etc. required by this facility.
    - Compile a monthly monitoring report.

4.3 PROJECT MITIGATION MEASURES

In addition to the standard environmental management practices detailed in Appendix B, and in line with the roles and responsibilities described under the forgoing heading, the following mitigation measures shall be implemented during the construction phase.

4.3.1 Botanical

- The corridors should be kept clear of woody vegetation and only a cover of grass and herbaceous shrubs would be permitted. This would be required for the safe operation of the transmission lines. (The vegetation would not revert to its natural state after construction since it would be kept in check by systematic and regular clearing).
- Care must be taken to not spread alien invasive plant species, particularly *Prosopis glandulosa var. torreyana* (honey mesquite) during construction. Careful monitoring for the occurrence of this species must be implemented and this must be written into the EMPr. Where this species occurs it should be eradicated.

4.3.2 Avifauna

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of priority species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close

proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.
- Bird Flight Diverters must be installed in order to limit the potential collision mortality where crossing the ephemeral Ga-Mogara River where it is expected that water birds could commute up and down the drainage line when it is flowing or when it contains large pools of standing water, and raptors and vulture could descend to pools in the river to drink and bath. This risk is particularly important for the Umtu TX corridor which crosses the river near the Umtu Substation. The Avifuana speciliest may also prescribe addiontal BFD's during the preconstruction walkthrough and micrositiing.

4.3.3 Agricultural

- If an activity will mechanically disturb below-surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation.
- Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.
- Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.
- During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
- Erosion must be controlled where necessary on topsoiled areas.
- Implement effective spillage and waste management system.

4.3.4 Heritage and Palaeontological resources

- It is recommended that the ECO examine all excavations greater than 1 m depth to check for palaeontological material.
- Although the chance of finding buried archaeological resources, fossil resources or possibly graves is very low, should any such material be found it should be reported to the project environmental control officer (ECO) who should then report to an archaeologist or palaeontologist as appropriate for assessment and advice on how to proceed. The ECO or heritage practitioner should also report the find to SAHRA.
- If any archaeological material, palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

4.3.5 Visual

- Windblown dust during construction should be monitored by the ECO. Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the ECO.
- Soil erosion measures need to be adequately implemented and routinely monitored by the ECO.

4.3.6 Socio-Economic

- Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for
- Establish a local skills desk to determine the potential skills that could be sourced in the area.
- Recruit local labour as far as feasible.
- Employ labour-intensive methods in construction where feasible.
- Sub-contract to local construction companies where possible.
- Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering and other services to the construction crew. Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock.

- Ensure that maintenance construction workers do not damage property or inflict other losses to the land owners and households residing on the farms.
- Negotiate terms and conditions that would guide construction activities/maintenance activities on the properties, as well as behaviour and conduct of the construction/maintenance crew.
- A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all construction/maintenance vehicles and construction/maintenance crew; the chosen route should follow the existing roads as far as feasible.
- Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property.
- Construction vehicles are to follow a safe speed and should mind animals inhibiting the farms.
- Construction activity should be undertaken only during working hours.

4.3.7 Hydrology

- Place pylons outside of the flood plain of the Ga-Morgara River.
- Place pylons outside of buffer zones identified by the aquatic ecologist.
- Installation of pylons should not mobilise sediment.

4.3.8 Traffic

- Manage traffic volumes by means of the management of delivery volumes and times.
- Implement dust control measures during construction as speed limits and regular watering.
- Ensure delivery drivers are licensed and competent, and vehicles are in good road worthy condition.

5 OPERATIONAL PHASE

The section aims to address mitigation measures pertaining to the operation phase as identified during the course of the BA.

5.1 ROLES AND RESPONSIBILITIES

In addition to the roles and responsibilities stipulated in Section 3.1 the following will apply during the operational phase:

5.1.1 The Owner

The transmission line and the EA will be ceded to Eskom. The holder of the EA shall assume overall responsibility for the administration and implementation of the EMPr in the operational phase. Whilst responsibilities for the implementation of the EMPr may be delegated to service providers or Operation and Maintenance (O&M) Contractor, the ultimate responsibility and liability remains with the EA Holder. The EA Holder carries the following responsibilities during the operational phase:

- Assign responsibilities for environmental supervision to a suitable member of staff who shall monitor compliance with the EMPr and undertake routine audits of compliance.
    - Keep all records relating to monitoring and auditing on file and make it available for inspection to any relevant and competent authority in respect of the development.
    - Identify and correct any project induced issues that may have environmental implications.
    - Supervise maintenance teams to ensure work is carried out in an environmentally responsible fashion and consistent with Eskom's environmental policies and standard operating procedures.
    - All documentation e.g. permits, audit/monitoring/compliance reports and notifications, required to be submitted to the Department in terms of this authorisation, must be submitted to the Director: Compliance Monitoring at the Department (DEA, 2014).
    - A copy of this authorisation and the approved EMPr must be kept at the property where the activity will be undertaken. The EAs and approved EMPr must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the property.

- Must notify both the Director: Integrated Environment Authorisations and the Director: Compliance Monitoring at the Department, in writing and within 48 (forty eight) hours, if any condition of this authorisation cannot be or is not adhered to any notification in terms of this condition must be accompanied by reasons for the non-compliance.
- Develop a Maintenance Management Plan (MMP), or update an existing Eskom MMP to include this line, for submission and approval by the DEA and to allow routine vegetation clearance on the transmission line servitude without having to apply for authorisation as a result of GN R 985 Activity 12.

5.2 PROJECT MITIGATION MEASURES

In addition to any conditions of Authorisation, or those set out in Eskom policies and procedures, and in line with the roles and responsibilities described under the forgoing heading, the following mitigation measures shall be implemented during the operational phase.

5.2.1 Avifauna

- Formal operational phase monitoring should be implemented for one year with monthly carcass searches to search the ground below the Transmission line. This should be carried out in conju7ction with the Solar Park Avifauna monitoring campaign.
- Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant more than anticipated. What is considered to be significant will have to be established on a species-specific basis by the avifaunal specialist, in consultation with BirdLife South Africa.
- The exact protocol to be followed for the carcass searches and operational phase monitoring must be compiled by the avifaunal specialist in consultation with the plant operator before the commencement of operations.

5.2.2 Agricultural

- Agricultural land use may continue unaffected by the transmission lines provided the safety specifications, including clearance, is observed.
- The holder of the EA shall provide landowners with contact information where landowners may report issues or liaise regarding activities and safety issues/pre-cautions associated with activities in proximity to the lines.
- The Holder of the EA shall communicate any and all safety risks and protocols associated with the transmission lines at the start of the operations phase. This may be done via workshop or via brochure.

5.2.3 Visual

- Lights at night have the potential to significantly extend the project zone of visual influence. With the exception of aircraft safety and navigation hazard warning lights, if needed, pylons must not be lit at night.

5.2.4 Socioeconomic

- Land owners should be adequately compensated for any unforeseen damage to property or loss of assets such as livestock.
- Ensure that maintenance workers do not damage property or inflict other losses to the land owners and households residing on the farms.
- Negotiate terms and conditions that would guide maintenance activities on the properties, as well as behaviour and conduct of the maintenance crew, or as provided for by Eskom’s policies and procedures.
- A pre-defined access route to the servitude should be chosen in consultation with the land owner and should be strictly adhered to by all maintenance vehicles and maintenance crew; the chosen route should follow the existing roads as far as feasible.
- Site clearance activities should be limited to the minimum required area to minimise potential damages to the environment and property.

- Maintenance vehicles are to follow a safe speed and should mind animals inhibiting the farms.
- Maintenance activity should be undertaken only during working hours.

6 DECOMMISSIONING PHASE

The section aims to address mitigation measures pertaining to the decommisioning phase as identified during the course of the BA. The transmission infrastructure which would be utilised for the proposed project is expected to have a lifespan of approximately 20-25 years. Decommissioning of the Transmission lines will have similar set of impacts as those encountered in the construction phase. The majority of materials are recyclable and will not go to waste. The transmission lines likely become part of the grid network, through possible expansion of the grid during the operational life. Decommissioning is therefore deemed unlikely, even if the Solar Park is decommissioned. The decommissioning of the transmission line is a listed activity in terms of GN R. 983 31(i) and would require assessment and authorisation prior to decommissioning thus the impacts associated with the decommissioning would be assessed and management measures proposed at that time to manage and mitigate impacts..

6.1 ROLES AND RESPONSIBILITIES

In addition to the roles and responsibilities stipulated in Section 3.1 the following will apply during the decommissioning phase:

6.1.1 Owner

- Should the activity ever cease or become redundant, the Owner shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered by any relevant and competent authority at that time (DEA, 2014). Not that decommissioning is currently a listed activity in terms of NEMA and requires Environmental Aut5horisation.

6.2 PROJECT MITIGATION MEASURES

In addition to the standard environmental management practices detailed in Appendix B, any conditions of Authorisation, the prevailing legislation at the time of decommissioning and in line with the roles and responsibilities described under the forgoing heading, the following mitigation measures shall be implemented during the decommissioning phase.

6.2.1 Visual

- Removal of all structures and recycling of the structure and cables.
- Removal of any foundations and filling of holes created.
- Shape footprint area to reflect natural landscape.
- Rehabilitation and restoration of the footprint and track with native grass species.

6.2.2 Socio-Economic

- Preference should be given to local communities for employment opportunities during the decommissioning stage of the transmission line.

6.2.3 Fresh Water

- Activities should as far as possible be limited to the delineated site for the proposed development. All disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.
- All disturbed areas should be seeded with native grass species on completion to establish cover and avoid wind or water erosion.
- All debris and waste must be removed from the site and safely disposed of.

6.2.4 General

- After disassembling, the pylon components would be reused, recycled or disposed of in accordance with regulatory requirements.

7 CONCLUSION

It should be noted that the EMPr should be regarded as a living document and changes should be made to the EMPr as required by project evolution, while retaining the underlying principles and objectives on which the document is based.

The compilation of the EMPr has incorporated impacts and mitigation measures from the BA as well as incorporating principles of best practice in terms of environmental management. By identifying the potential impacts, mitigation measures, responsibilities, available resources, potential schedule and verification responsibility. The EMPr has ensured that all the individual mitigation measures based on the project in its entirety has been incorporated into this document.

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Appendix A Curriculum Vitae of Environmental Assessment Practitioners (See BA Annexure H)

Appendix B Construction EMPR General Specifications (Comprehensive)

GENERAL ENVIRONMENTAL SPECIFICATION FOR CONSTRUCTION

CONTENTS

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1 GENERAL

1.1 SCOPE

This Specification covers the standard requirements for controlling the impact of construction activities on the environment. It contains clauses that are generally applicable to the undertaking of civil engineering works to impose pro-active controls on the extent to which the construction activities impact on the environment. This Specification contains only generic specification clauses which may be augmented or superseded by project specific specifications contained in an Environmental Management Plan or Environmental Authorisation.

The Specifications contained herein shall apply to contractors undertaking work as part of the project. The Principle Contractor shall be responsible for the implementation of these Specifications.

Interpretations and variations of this Specification are set out in the Specification Data.

1.2 DEFINITIONS

For the purposes of this Specification the definitions and abbreviations given in the applicable specifications listed in 1.4and the following definitions shall apply:

Environment: The surroundings within which humans exist and that are made up of:

i) the land, water and atmosphere of the earth;
ii) micro-organisms, plant and animal life;
iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Potentially hazardous Substance: A substance that, in the reasonable opinion of the Engineer, can have a deleterious effect on the environment. Any substance or mixture containing such substances as listed in the OHSA General Machinery Regulation 8: Schedule A.

Method Statement: A written submission by the Contractor to the Engineer in response to the Specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting the Method Statement, in such detail that the Engineer is enabled to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.

The Method Statement shall cover applicable details with regard to: construction procedures, materials and equipment to be used, transportation of equipment/materials to and from site, movement of equipment/material on site, storage of materials on site, containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur, timing and location of activities, areas of non-compliance with the Specifications, and any other information deemed necessary by the Engineer.

Reasonable: Unless the context indicates otherwise, reasonable in the opinion of the Engineer after he has consulted with a suitably experienced person, not an employee of the Employer, in "environmental implementation plans" and "environmental management plans" (both as defined in Act No 107,1998).

Solid waste: All solid waste, including construction debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Contaminated water: Water contaminated by the Contractor's activities, e.g. concrete water and runoff from plant/ personnel wash areas.

Top material: The top 150 mm of soil (topsoil) and root material of cleared vegetation.

1.3 NORMATIVE REFERENCES

1.4 Supporting specifications and legal framework

The following specifications shall, *inter alia*, form part of the Contract Document.

a) An approved Environmental Management Plan;
b) The conditions associated with any relevant Environmental Authorisation or Permit;
c) SANS 1200 Series of Standardized Specifications;
d) SANS 1200 A or SANS 1200 AA, as applicable;
e) Occupation Health and Safety Act (OHSA): Specification AO,
f) Construction Regulations, 2003, and
g) Standards listed in Appendix A.

1.5 Management and administration

This Specification and any supporting document containing project specific specifications shall be provided to a perspective Contractor's at the tender / quoting stage. The implementation of this General Specification (or subsequent agreements as the case may be) is non-negotiable and every perspective contractor shall cost for and make the necessary provisions available to ensure implementation of these General Environmental Specifications and any associated documents (i.e. Environmental Management Plan and or Environmental Authorisation). The Contractor may defer responsibility for implementation and oversight of environmental requirements onto a third party, but may not defer liability and will held accountable for any non-compliances and associated damages.

The Contractor shall construct and/or implement all the necessary environmental protection measures in each area before any construction work may proceed under the direction of the Engineer or delegated official. The Engineer may suspend the Works at any time should the Contractor, in the Engineer or delegated official's opinion, fail to implement, operate or maintain any of the environmental protection measures adequately. The costs of such suspension shall be to the Contractor's account.

1.5.1 Environmental Site Officer (ESO)[1]

The Contractor shall, at commencement, appoint, in writing, a suitably qualified or otherwise senior member of his permanent site staff to perform the role of the ESO. The Contractor shall ensure that this appointee is provided adequate time to fulfil the requirements of the role, which will be proportional to the project scale and extent. Should the Engineer find that the ESO does not adequately fulfil the role and duties of the ESO then the Contractor maybe directed to recruit a suitably qualified, dedicated ESO for the duration of the construction period. The ESO will be required to develop a detailed understanding of the Specifications and ensure that the Contractor's fulfils the requirements of the specifications and remains compliant throughout the project term, including any defects liability period. The ESO will be required to report of compliance issues during monthly progress meetings and to co-operate with the any official representative from the Government, Client and Engineer on environmental management matters. The key responsibilities of the ESO include the following:

- Develop a detailed understanding of the requirements of this specification;
- Obtain confirmation in writing from the Client that all regulatory processes, authorisation and permit requirements have been fulfilled. Copies of the permits and authorisations shall be obtained, and retained onsite, and studied by the EO prior to the commencement of site establishment and site works. Any conditions contained in a permit or authorisation shall be deemed to form part of this Specification. Special attention must be given to any areas identified as No Go areas during an EIA study.
- Undertake routine inspections of all areas and activities under the Contractor's control, identify environmental non-conformances and incidents and initiate measures to remedy such issues.
- Ensuring that the Contractor's staff abide by the Specification and initiate disciplinary actions where required.
- Report on environmental incidents and compliance matters at monthly progress meetings.
- Liaise and co-operate with any official environmental representative from the Government, Client

[1] This role is the same as an Environmental Officer (EO)

and Engineer regarding environmental matters associated with the project.

- Ensure that any environmental monitoring requirements are met and undertaken with precision, according to best practice sampling and monitoring methodologies.

2 CONTRACTOR MOBILISATION AND GENERAL PROVISIONS

2.1 Baseline photography

Following official handover of the site to the Contractor and prior to the commencement of mobilisation activities, the Contractor shall take photographs of all areas that will be impacted by construction activity and their immediate surrounds. Photographs shall include, *inter alia*, all works areas, site establishment and laydown areas, access roads, gates, no go and natural areas, debris, boundary fences, existing structures and infrastructure on the site and any defects or issues to any of the foregoing. These photographs shall be provided to the Engineer for reference purposes.

2.2 Method statements

Method statements shall be produced and submitted for approval by the Engineer at least five working days prior to the commencement of the activities. The Contractor shall not commence the activity until the Method Statement has been approved. Approval of method statements shall not unreasonably be withheld. The Engineer may approve, reject or approve with conditions any method statement.

The Engineer may request, on an *ad hoc* and reasonable basis, that a method statement be produced for any activity or component of the works which carries significant risk. All method statements must comply with the provisions of this Specification, unless, if there is a need to deviate from the provisions of the specification such deviation must be clearly articulated in the method statement or letter, a motivation provided for the need for such deviation and proposed mitigation measures that will be implemented to ensure that such deviation will not pose a undue risk to the environment. The Engineer shall, without risk of prejudice, retain the right to reject any proposed deviation and is under obligation to consult with and confirm the acceptability of such deviation with an Environmental Specialist or Government Official. A method statement containing a proposed deviation must also be approved in writing by the Client. Method statements containing proposed deviations shall be submitted at least 15 working days prior to the commencement of the activity.

The following is a provisional list of required method statements:

1) Mobilisation Plan, with consideration to the following:
   a. A plan indicating the layout of the site establishment area, laydown and staging areas, workshops, fuel storage and dispensing areas, stores (including explosives), offices, ablutions, recess areas, roads and sidings, fences and gates, signboards, central waste storage area and any other temporary structure or use area that will be directly affected by site establishment or routine project administration.
   b. Provisions to address and maintain housekeeping throughout the site.
   c. A detailed plan and design for the fuel storage site, including the type and volume of storage container and the design and capacity of the bund. The plan shall include procedures and measures to prevent spills and leaks of fuels and oils during transference.
   d. A provisional list of major vehicles, plant and equipment that will be permanently based on site and where plant, equipment and vehicles will be parked when not in use.
   e. A list of the bulk construction materials and a description of how they will be transported to site and where they will be staged prior to use.
   f. A description of a temporary storm water control measures to be installed around yards and site establishment areas.
   g. A description of the proposed security and access control measures.
   h. A description and plan of roads to be used during construction and the proposed traffic safety measures.
   i. A provision list of potentially hazardous materials that will be used during construction phase and a description of how and where these will be stored.
   j. A detailed description of a waste management plan giving consideration to:
      i. Measures relating to recycling, reducing and reusing any waste.
      ii. A description of the type and the proposed number and location of rubbish bins.

iii. The location and design of the central waste storage area including hazardous wastes.
iv. A plan for dealing with inert waste including building rubble and spoil.

k. Provisional Construction Programme.
l. Outline of the Contractor's staff recruitment policy.
m. Description of the construction staff accommodation provisions and policy.
n. Any special arrangements or agreements made between the Contractor, the landowner, municipality, local businesses/ service providers and or neighbouring land owners.

2) Emergency preparedness and response plan, detailing the following:
   a. A telephone contact list of personal responsible for emergency prevention and response, including the relevant Client and Engineer representatives and local emergency services.
   b. A list and description of the types of emergencies that may arise on site.
   c. Site evacuation procedures and emergency assembly point.
   d. Procedures to be followed in the event of a fire.
   e. Safeguard measures to prevent fire, with special reference to hazardous materials, fuels and lubricants and explosives stores.
   f. A plan showing the following:
      i. The location and type of firefighting equipment.
      ii. Emergency assembly point
      iii. Evacuation routes.
   g. Measures for the handling use and storage aimed at preventing spills and leaks of hydrocarbons and other hazardous substances.
   h. Procedures to be followed after spill or leak of hydrocarbon or other hazardous substances including.
      i. Training of plant and equipment operators in the procedures.
      ii. A description and location of spill containment, clean up materials, personal protective equipment and specialist handling equipment of site or in plant and equipment.
      iii. Procedure for reporting a spill, containment, clean up, remediation and disposal.

3) Earthworks plan, detailing the following:
   a. A layout drawing indicating the following
      i. Location and extent of all areas to be cleared.
      ii. Location of topsoil stockpiles.
      iii. Location of temporary and final spoil areas
   b. A description of how cleared vegetation and other debris will be dealt with.
   c. A description of how dust will be controlled.
   d. A description of and plans for dealing with water:
      i. Preventing ingress of water into excavations.
      ii. Approach to dewatering.
      iii. Storm water and erosion control measures.
      iv. Pollution and sediment control and treatment measures and disposal of contaminated water.

4) Concrete works plan, detailing the following:
   a. How concrete will be produced on site (Batched on site or ready-mix). If batched on site then detailed procedures and plans must be produced as to how much, where and how this will be undertaken.
   b. Measures to avoid the contamination of water and measures to treat contaminated water, including storm water control interventions and cleaning of tools and equipment, including drum wash, that used in the concrete operations;
   c. Measures to prevent and clean up spillage of concrete spills and over pours.
   d. Measures for dealing with concrete admixtures, shutter oil and any other chemical substances that may be employed in the concrete works.
   e. Any other measure employed during the batching, transport or pouring of concrete to avoid pollution of contamination of the environment.

2.2.1 Environmental awareness training

Within seven days of the Commencement Date, the Contractor's site staff including foremen and site management staff shall attend an environmental awareness training course. The Contractor shall liaise with the Engineer prior to the Commencement Date to fix a date and venue for the course. The environmental awareness training course shall be held in the morning during normal working hours. The Contractor shall provide a suitable venue and ensure that the specified employees attend the course. The Contractor shall keep a register of attendance and attendees must sign that they were in attendance and shall provide the Engineer with a copy of the attendance register the day after each course as part of their monthly submissions. The Environmental awareness course will be included in the general orientation of any new employees, who must also sign acknowledgement of receiving the course and any associated materials.

Subject to the implementation of a written warning system and any appropriate disciplinary interventions, repetitive failure to observe the requirements set out in this specification by any one member of staff should be treated as a dismissible offence. Should recurring non-compliances occur as a result of the actions or omissions of one individual, the Engineer may instruct the Contractor to remove such person from site.

2.2.2 Toolbox talks

Relevant environmental site matters, incidents and issues shall form part of the Contractor’s tool box talks. The Contractor shall make a note of what environmental subjects were discussed

2.2.3 Construction personnel information posters

The Contractor shall erect and maintain information posters for the information of his employees depicting actions to be taken to ensure compliance with aspects of the Specifications. Such posters will be supplied by the Engineer and shall be erected at a location specified by the Engineer.

2.3 Surveying and setting out

2.3.1 Site establishment

The Engineer shall be advised of the area that the Contractor intends using for his site establishment by way of the Mobilisation plan discussed under item 1) of Clause 2.2. The Contractor’s camp shall occupy as small an area as possible, and no site establishment shall be allowed within 50 m of any watercourse unless otherwise approved by the Engineer.

The Contractor shall inform the Engineer of the intended actions and programme for site establishment. The site layout shall be planned to facilitate ready access for deliveries, facilitate future works and to curtail any disturbance or security implications for neighbours.

2.3.2 Site fencing and demarcations

As may be required, the Contractor shall erect and maintain permanent and/or temporary fences of the type and in the locations directed by the Engineer. Such fences shall, if so specified, be erected before undertaking designated activities. The Contractor shall not damage or remove any boundary fences without the agreement of the adjoining landowner. Where property fences are replaced these shall, at the minimum, meet specification of the fencing it replaces, in terms of top height, sturdiness and rigidity (pole foundations and supports and strength and wire gauge), security (barbed or razor wire) and size of the largest openings (i.e. distances between horizontal wires or mesh dimensions.

2.3.3 No Go Areas

If required, certain areas shall be considered "no go" areas and these may be detailed in the Environmental Management Plan or as conditions attached to an Environmental Authorisation. The Contractor shall ensure that, insofar as he has the authority, no unauthorised entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the demarcated “no go” areas. “No go” area demarcation fencing shall be established prior to the commencement of construction in the vicinity.

“No go” areas shall be demarcated with fencing consisting of wooden or metal posts at 3 m centres with 1 plain wire strand tensioned horizontally at 900 mm from ground level. Commercially available danger tape shall be wrapped around the wire strand. The Contractor shall maintain the fence for the duration of construction and ensure that the danger tape does not become dislodged.

2.4 Overarching environmental requirements

The following provisions relate to all areas of construction.

2.4.1 Protection of natural features

The Contractor shall not deface, paint, damage or mark any natural features (e.g. rock formations) situated in or around the Site for survey or other purposes unless agreed beforehand with the Engineer. Any features affected by the Contractor in contravention of this clause shall be restored/ rehabilitated to the satisfaction of the Engineer.

The Contractor shall ensure that plant, equipment, materials and staff are not permitted to enter any designated “no go” area.

The Contractor shall not permit his employees to make use of any natural water sources (e.g. springs, streams, and open water bodies) for the purposes of swimming, personal washing and the washing of machinery or clothes.

2.4.2 Protection of fauna and flora

Except to the extent necessary for the carrying out of the Works (as per an approved method statement), flora shall not be removed, damaged or disturbed nor shall any vegetation be planted without the Engineer’s approval. Firewood may not be collected from the site unless written approval is provided by the Engineer.

Trapping, poisoning and/ or shooting of animals is strictly forbidden. No domestic pets or livestock are permitted on Site.

The use of biocides is subject to the approval of the Engineer unless provided for in the project specification. Where the use of biocides and other poisonous substances has been specified, they shall be stored, handled and applied with due regard to their potential harmful effects. Persons using any biocide or poisonous substances shall have received training in the appropriate handling, use and storage of such materials. Care will be taken to ensure no movement or drift occurs into non-target areas. Dyes shall be mixed into sprayed biocide so that the treatment areas may be inspected and the risk of over spray / re-spraying is avoided.

2.4.3 Protection of archaeological and palaeontological remains

The Contractor shall take reasonable precautions to prevent any person from removing or damaging any fossils, coins, articles of value or antiquity and structures and other remains of archaeological interest discovered on the Site, immediately upon discovery thereof and before removal. The Contractor shall inform the Engineer immediately of such a discovery and carry out the Engineers instructions for dealing therewith. All construction within the vicinity of the discovery shall cease immediately and the area shall be cordoned off until such time as the Engineer authorises resumption of construction in writing.

The Engineer will contact and follow due process as required by the relevant authority.

All buildings older than 60 years require a permit from South African Heritage Resources Agency in terms of the National Heritage Resources Act (no. 25 of 1999). A demolition permit is also required from the local authority in terms of the National Building Regulations.

2.4.4 Noise control

The applicable regulations framed under the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), and the provisions of SANS 1200 A Subclause 4.1 regarding "built-up areas" shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas.

Appropriate directional and intensity settings are to be maintained on all hooters and sirens, and the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant such that the noise level in inhabited areas and dwellings adjacent to the work areas will not increase by more than 7 dB(A)Leq 60 above residual background sound levels. Similarly in habituated areas adjacent to access roads maximum noise levels shall not exceed 60 dB(A)Leq 60 and maximum sound pressure level of 70 dB(A).

Where excess noise generation is unavoidable, the Contractor shall, by means of barriers, isolate the source of any such noise in order to comply with the said regulations. The Contractor shall restrict any of his operations that may result in excessive noise disturbance to those communities and dwellings abutting the Site to the hours of 08:00 to 17:00 on weekdays and Saturdays. No work will be permitted on Sundays unless otherwise agreed to with the Engineer.

Where loud construction operations or plant are required, that cannot be practically barricaded (i.e. Pile driving, hydraulic breakers or rock crushing), nearby residents that may be disturbed by the operation will be notified and provided with a program for the works prior to commencement. The Contractor shall be reasonable in accommodating the needs of neighbours and take reasonable measures to minimise the impact of noise on neighbouring communities.

With the exception of warning and emergency sirens and public address systems used during an emergency, no sound is to be broadcast across the site with approval from the Engineer.

2.4.5 Lighting

The Contractor shall ensure that any lighting installed on the site for his activities does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding community or other users of the area. Subject to meeting the minimum requirements of the OHSA and general security, lighting shall be kept to the minimum. Care will be taken to ensure lighting is task specific and does not spill into the surrounding environment through appropriate placement and shielding. Floodlighting of expansive work areas or up- or down lighting of vertical structures or natural features shall only be permitted if approved by Engineer.

2.4.6 Fuel (petrol and diesel) and oil

Unless otherwise specified, fuel may be stored on site in an area approved by the Engineer. The Contractor shall ensure that all liquid fuels (petrol and diesel) are stored in tanks with lids, which are kept firmly shut or in bowsers. The tanks/bowsers shall be situated on a smooth impermeable surface (concrete or 250 µm plastic) with an earth bund (plastic must have a 5 cm layer of sand on top to prevent damage and perishing). The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be 130% of the total capacity of all the storage tanks/ bowsers. The bunded area shall be covered to protect it from rain. Provision shall be made for refuelling at the fuel storage area, by protecting the soil with 250 µm plastic covered with a minimum of a 5 cm layer of sand.

If fuel is dispensed from 200 litre drums, only empty externally clean drums may be stored on the bare ground. All empty externally dirty drums shall be stored on an area where the ground has been protected. The proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage drum shall be stored in a waterproof container when not in use.

The Contractor shall prevent unauthorised access into the fuel storage area. No smoking shall be allowed within the vicinity of the fuel storage area. The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.

Where reasonably practical, plant shall be refuelled at the fuel storage area or at the workshop as applicable. If it is not reasonably practical then the surface under the refuelling area shall be protected against pollution to the reasonable satisfaction of the Engineer prior to any refuelling activities. The Contractor shall employ the use of appropriate non-spill dispensing equipment and drip trays to prevent spills during refuelling. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill. The Contractor shall ensure that staff responsible for refuelling of plant is trained to clean up any fuel of oil spills as they occur. The Contractor shall obtain the Engineer's prior approval for any refuelling or maintenance activities. The fuel bowsers and stores must be inspected daily by the Contractor and any contaminated soil shall be collected and disposed of via the hazardous waste system. Care will be taken to ensure that oil contaminated soil, rags or other materials are not disposed of as part of domestic waste system due to the fire risk.

2.4.7 Contaminated water

The Contractor shall take reasonable measure to prevent the contamination of water and where this is not possible will set up a contaminated water management system, which shall include collection facilities to be used to prevent pollution, as well as suitable methods of disposal of contaminated water. The Contractor shall prevent the discharge of water contaminated with any pollutants, such as soaps, detergent, cements, concrete, lime, chemicals, glues, solvents, paints and fuels, into the environment.

The Contractor shall notify the Engineer immediately of any pollution incidents on Site. The Engineer's approval is required prior to the discharge of contaminated water to the Municipal sewer system.

2.4.8 Stormwater and drainage

The Contractor shall ensure that storm water is managed in such a way that prevents erosion. The Contractor shall install temporary stormwater control measures which may include cut off drains, berms, side drains, retention ponds or similar needed to divert stormwater away from earthworks areas, or as directed by the Engineer.

2.4.9 Solid waste management

The Contractor shall provide sufficient bins with lids on Site to store the produced on a daily basis. Solid, non-hazardous waste shall be disposed of in the bins provided and no on-site burying, dumping or burning of any waste materials, vegetation, litter or refuse shall occur. Bins shall not be allowed to become overfull and shall be emptied a minimum of once daily. The waste may be temporarily stored on Site in a central waste area that is weatherproof and scavenger-proof, and which the Engineer has approved.

All solid waste shall be disposed of offsite at an approved landfill site. The Contractor shall supply the Engineer with a certificate of disposal.

2.4.9.1 Shutter oil and curing compound

Shutter oil and curing compound pose a risk of causing water and soil contamination and accordingly are regarded as potential hazardous substances. The Contractor shall ensure that shutter oil and curing compound containers in use are stored within the fuel bund. The remaining containers shall be inspected regularly to ensure that no leakage occurs. When shutter oil or curing compound is dispensed, the proper dispensing equipment shall be used, and the storage container shall not be tipped in order to dispense the oil/compound. The dispensing mechanism of the shutter oil/curing compound storage container shall be stored in a waterproof container when not in use.

Shutter oil and curing shall be used in moderation and shall be applied under controlled conditions using appropriate equipment. The Contractor shall take all reasonable precautions to prevent accidental and incidental spillage during the application of these compounds.

In the event of a shutter oil or curing compound spill, the source of the spillage shall be isolated, and the spillage contained. The Contractor shall clean up the spill, either by removing the contaminated soil or by the application of absorbent material in the event of a larger spill. Treatment and remediation of the spill area shall be undertaken to the reasonable satisfaction of the Engineer.

2.4.9.2 Bitumen

The Engineer shall be advised of the area that the Contractor intends using for the storage of bitumen drums/ products. The storage area shall have a smooth impermeable (concrete or 250 µm plastic covered in sand) floor. The floor shall be bunded and sloped towards a sump to contain any spillages of substances. The bund shall be inspected and emptied daily, and serviced when necessary. The bund shall be closely monitored during rain events to ensure that it does not overflow.

2.4.9.3 Hazardous substances

Procedures detailed in the Material Safety Data Sheets (MSDSs) shall be followed in the event of an emergency situation.

Petroleum, chemicals, harmful and hazardous waste shall be stored in an enclosed and bunded area. This area shall be subject to the approval of the Engineer. The waste shall be disposed of at a hazardous waste disposal site as approved by the Engineer.

2.4.10 Workshop, equipment maintenance and storage

The Contractor shall ensure that all items of plant and equipment are inspected daily prior to commencement. Any maintenance requirements shall be seen to before start-up. Inspection checklists shall be retained and submitted to the Engineer on request.

Leaking equipment shall be repaired immediately or removed from the Site. Where practical, all maintenance of equipment and vehicles on Site shall be performed off Site or in the workshop. If it is necessary to do maintenance outside of the workshop area, the Contractor shall obtain the approval of the Engineer prior to commencing activities. The Contractor shall ensure that in his workshop and other plant maintenance facilities, including those areas where, after obtaining the Engineer's approval, the Contractor carries out emergency plant maintenance, there is no contamination of the soil or vegetation. The workshop shall have a smooth impermeable (concrete or 250 µm plastic covered with sand) floor. The floor shall be bunded and sloped towards an oil trap or sump to contain any spillages of substances (e.g. oil).

When servicing equipment on site, drip trays shall be used to collect the waste oil and other lubricants. Drip trays shall also be provided in construction areas for stationary plant (such as generators, pumps and compressors) and for Transport and Earthmoving Equipment (such as scrapers, diggers, loaders, trucks, cranes, etc.). Drip trays shall be inspected and emptied daily. Drip trays shall be closely monitored during rain events to ensure that they do not overflow. Where practical, the Contractor shall ensure that equipment is covered so that rainwater is excluded from the drip trays.

The washing of equipment shall be restricted to urgent or preventative maintenance requirements only. All washing shall be undertaken off Site or in the workshop. The use of detergents for washing shall be restricted to low phosphate and nitrate containing, low sudsing-type detergents.

2.4.11 Materials handling, use and storage

The Contractor shall ensure that any delivery drivers are informed of all procedures and restrictions (including "no go" areas) required to comply with the Specifications. The Contractor shall ensure that these delivery drivers are supervised during off loading, by someone with an adequate understanding of the requirements of the Specifications.

Materials shall be appropriately secured to ensure safe passage between destinations. Loads including, but not limited to sand, stone chips, fine vegetation, refuse, paper and cement, shall have appropriate cover to prevent them spilling from the vehicle during transit. The Contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.

2.4.12 Dust

The Contractor shall take reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Engineer. The Contractor’s dust management planning shall, as a minimum, take cognisance of the following:

- Schedule of spraying water on unpaved roads paying due attention to control of runoff.
- Speed limits for vehicles on unpaved roads and minimisation of haul distances.
- Measures to ensure that material loads are properly covered during transportation.
- Schedule for wheel cleaning and measures to clean up public roads that may be soiled by construction vehicles.
- Minimisation of the areas disturbed at any one time and protection of exposed soil against wind erosion, e.g. by dampening with water or covering with straw
- Location and treatment of material stockpiles taking into consideration prevailing wind directions and location of sensitive receptors.
- Controlled blasting techniques to minimise dust and fly rock during blasting.
- Adherence to the dust loads and protective gear stipulated in the Occupational Health and Safety Act.
- Reporting mechanism and action plan in case of excessive wind and dust conditions.

During dry and, or windy periods, a water tanker shall be available for the control of dust, and the Contractor shall ensure that the sprays do not generate excess run off.

During high wind conditions, the Contractor shall comply with the Engineer's instructions regarding dust-damping measures. The Engineer may request the temporary cessation of all construction activities where wind speeds are unacceptably high, and until such time as dust levels return to acceptable levels.

As required by the National Dust Control Regulations, promulgated in terms of section 53(o) of National Environmental Air Quality Act (Act 39 of 2004) the Contractor shall establish of a network of dust monitoring points using method ASTM D1739: 1970[2] (or equivalent), sufficient in number to establish the contribution of the person to dustfall in residential and non-residential areas in the vicinity of the premises, to monitor identified or likely sensitive receptor locations, and to establish the baseline dustfall for the district.. The following standards will apply:

- For residential areas the dust fallout may not exceed 600mg/m^2/day (on a 30 day average) more than two times a year and not on sequential months.
- For non-residential areas the dust fallout may not exceed 1200mg/m^2/day (on a 30 day average) more than two times a year and not on sequential months.

All items of plant capable of generating significant volumes of dust (i.e. crusher plants, concrete batching plants) shall be equipped with necessary equipment (Bag filters in cement silos, sprayers and conveyor transfer and fall points and hoppers) to ensure that fugitive dust is minimised.

2.4.13 Aesthetics

All site establishment components (as well as equipment) shall be positioned to limit visual intrusion on neighbours and the size of area disturbed. The type and colour of roofing and cladding materials to the Contractor's temporary structures shall be selected to reduce reflection.

The Contractor shall take reasonable measures to ensure that construction activities do not have an unreasonable impact on the aesthetics of the area. Measures will be taken to obscure construction yards and associated plant and equipment from onlookers as far as is reasonable. Refer also to 2.4.4 regarding requirements for lighting.

2.4.14 Disruption to existing and neighbouring land use activities

The Contractor shall take measures to limit the disruption of any existing land use activities occurring on the site or neighbouring sites as far as reasonable. Where construction may impact on access routes, safe alternative access shall be provided to the satisfaction of the Engineer. Refer also to clauses 2.4.4, 2.4.5, 2.4.11 and 2.4.13 regarding dust, noise, lighting and aesthetics. Where construction will result in disruptions to activities, the Contractor shall notify the affected landowner and inform him of the construction activity, the program and what mitigations measures will be implement to minimise the disruptions. The Client, Contractor and Engineer shall make compensations and or accommodate landowner's requests and to maintain the *status quo,* as far as is reasonable.

2.4.15 Temporary site closure

If the site is closed for a period exceeding one week, the Contractor, in consultation with the Engineer shall carry out the following checklist procedure.

Hazardous materials stores:

- Outlet secure / locked.
- Bund empty (where applicable).
- Fire extinguishers serviced and accessible.
- Secure area from accidental damage e.g. vehicle collision.
- Emergency and contact details displayed.
- Adequate ventilation.

Safety:

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[2] American Standard for Testing and Materials method D1739

- All trenches and manholes secured.
- Fencing and barriers in place as per the Occupational Health and Safety Act (No 85 of 1193).
- Emergency and management contact details for at least two standby staff displayed.
- Pipe stockpile wedged/ secured.
- Emergency equipment, including firefighting and spill response materials and equipment remain readily accessible to standby staff.
- Site security measures in place.
- All plant and equipment have their keys removed or are disabled to prevent unauthorised start-up / theft.

Erosion:

- Wind and dust mitigation in place.
- Slopes and stockpiles at stable angle.
- Revegetated areas watering schedules and supply secured.

Water contamination and pollution:

- Cement and materials stores secured.
- Toilets empty and secured.
- Refuse bins empty and secured.
- Drip trays empty and secure (where possible).
- Structures vulnerable to high winds secure.
- All plant and equipment not in use are withdrawn from areas prone to flooding.

2.4.16 Public roads

The Contractor shall control the movement of all vehicles and plant including that of his suppliers so that they remain on designated routes, are distributed so as not to cause an undue concentration of traffic and that all relevant laws are complied with. . In addition such vehicles and plant shall be so routed and operated as to minimise disruption to regular users of the routes not on the Site. Where road safety may be impacted on the Contractor shall notify the relevant roads authority and arrange for the necessary road warning signage and appoint trained points men to control traffic around any hazards. Any damage caused to the public road system as a result of construction or as a direct result of construction vehicles and equipment shall be repaired to the satisfaction of the Engineer.

On gravel or earth roads on Site and within 500 m of the Site, the vehicles of the Contractor and his suppliers shall not exceed a speed of 20 km/h. Mud and sand deposited onto public roads by construction activities shall be cleared on a daily basis.

2.4.17 Security and access control

The Contractor shall ensure that access to the Site and associated infrastructure and equipment is off-limits to the public at all times during construction. If so required, as directed by the Engineer, the Contractor shall fence the site to ensure effective control of access to the site. This fence shall be a diamond mesh fence or similar with a minimum height of 1.8 m, and it shall be erected around the site and shall be maintained for the duration of construction.

All authorised personal and visitors shall be issued with an identification card (or similar) to ensure that the security personnel may identify authorised persons.

2.4.18 Access routes / haul roads

Access to the Construction camp and working areas shall utilise existing roads or tracks as far as possible. Entry/exit points onto public roads shall take cognisance of traffic safety. Traffic safety measures shall include appropriate signage and signalmen where relevant.

Where temporary roads are required for construction the route, design and layout shall be subject to the approval of the Engineer. Roads shall be routed to limit environmental impact by avoiding sensitive environmental features including rivers, wetlands, areas of botanical significance or any other areas as identified through environmental planning processes. Roads shall follow routes that minimise stormwater related risks (i.e. steep gradients, cuts and fills, drainage lines, marshy areas). Where temporary roads cross drainage lines (which must be an approved, see Activity 18 of R 544 of NEMA) the reasonable provision shall be made to accommodate flooding without structural damages to the road crossing, approaches or to the river banks, the design of crossings shall be subject to approval by the Engineer. Subject to the preceding requirements, roads shall be designed to have the least possible footprint needed to meet project objectives. All temporary roads shall undergo full rehabilitation at project completion and the expense of such shall be to the Contractor's account. Unless inside the urban edge or part of an environmental authorisation in terms of NEMA R544 Activity No. 22.(II) no new construction road shall exceed 8m or where such road already exists be widened by more than 6m or lengthened by more than 1000m.

2.4.19 Housekeeping

The Contractor shall make available the time and resources need to undertake routine housekeeping of the works areas and site establishment areas at a minimum of a weekly interval. Housekeeping shall include maintenance of barriers, structures, signage, material stockpiles to ensure that they are safe and aesthetically acceptable and to the satisfaction of the Engineer. Construction materials shall be stacked in a safe, neat and orderly fashion and shall comply with the requirements of the OHSA. Windblown litter, construction debris and spoil shall be collected and removed for disposal.

2.4.20 Ablution facilities

The Contractor shall deploy an adequate number (As per the requirements of the OHSA) of portable toilets at the various works areas and site establishment area, including provision for security and access control personal. Toilets should not be located further than 100m from the place of work. Toilets should be placed in shaded areas wherever possible. The Contractor shall make provision to have the toilets cleaned and maintained in a hygienic fashion and shall supply toilet paper. Toilets shall be secured to the ground to ensure they are not blown over during high winds or bumped over by some other means. The Contractor shall also make available a hand washing facility. Where portable toilets are located within view of the public or neighbouring residences or places of business, efforts should be taken to screen such facilities from view and provide privacy to users.

The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are properly stored and removed from Site. Discharge of waste from toilets into the environment and burial of waste is strictly prohibited and must be treated at a registered waste water treatment works. The Contractor shall keep record, and provided such records upon request, of the location and volumes of waste disposed. The use of pit latrines and soak-a-ways is prohibited unless approved by the Engineer.

Washing, whether of the person or of personal effects and acts of excretion and urination are strictly prohibited other than at the facilities provided. The Contractor shall take disciplinary action against any staff member found in contravention of this requirement.

2.4.21 Recess areas and canteens

The Contractor shall provide covered recess areas at the site establishment area and at various working areas, which are situated too far from the site establishment area to allow staff to return for recesses. The recess area should be located in an area that provides natural shade but should not be located within 32m of a drainage lines or wetland, in or adjacent a "no go" area, in dense combustible vegetation or near any neighbour or activity to which they may cause disturbance. The recess areas should also be located away from construction noise, dust, waste storage areas, hazardous materials stores, fuel storage and dispensing areas and any other activity that may contaminate food or impair comfort. The recess areas shall provide adequate seating to accommodate the staff stationed at that area of the works. Recess areas shall be located near, but not next to, ablution and hand washing facilities. Recess areas should also have an adequate supply of cool potable water, as determined by the number of staff working in that area. An adequate number of rubbish bins shall be provided to contain the waste generate by this facility in a day. The recess areas shall make provision for a smoking area, including seating and a fire proof sand filled container for extinguishing cigarettes. Smoking shall otherwise be prohibited across the site and in the works areas. The recess areas shall be equipped with an appropriate sized fire extinguisher to deal with a fire at this location. Subject to implementation of reasonable fire protection measures and the presence of fight fighting equipment, the Contractor may establish a purpose built warming or cooking fire in an area cleared of all combustible material near the recess area (Note in terms of Clause 2.4.2 however that firewood may not be collected for the surrounding area). Staff shall not be permitted to eat or rest during recess times in any other areas other than the designated recess or canteen area.

The following specifications will apply to a site canteen. The Canteen will be situated according to the principles for recess areas, as provided above. The Canteen will shall be designed to ensure the hygienic preparation of food and cleaning of cooking utensils cutlery and crockery. Water decanted from cooking processes or that from the washing shall not be disposed of into the environment but rather via a storage tank and then the sewage disposal system. The Canteen shall be equipped with the appropriate size and type of fire extinguished needed to deal with type and nature of fire that may arise. The Canteen shall have an adequate number of scavenger and weather proof rubbish bins needed to deal with the days' waste. Rubbish bins shall be cleared daily to the central waste storage area. The Contractor shall take measure to ensure that housekeeping and maintenance of hygienic conditions are strictly observed..

2.4.22 Site clinic or first aid station

Should the scale of construction warrant the need for a first aid station (clinic, sick bay, medical bay) the following requirements shall apply. The design and maintenance of the first aid station shall be such that the hygienic safety of the patients can be assured. The first aid station shall be operated by a certified first aider or paramedic. All waste arising from the first aid station or site ambulance shall be treated as hazardous waste and shall not be disposed of via the domestic waste system. . A safe potable water supply shall be provided. Effluents from washing shall be direct to a tank, collected and disposed via the sewage disposal system.

2.5 Emergency procedures

In addition to the emergency procedures set out in the Contractor method statement titled Emergency preparedness and response plan as dealt with under Item 2) of Clause 2.2, the Contractor's procedures for the following emergencies shall include:

2.5.1.1 Fire

No fires may be lit on site. Any fires that occur shall be reported to the Engineer immediately. Smoking shall not be permitted in those areas where it is a fire hazard. Such areas shall include the workshop and fuel storage areas and any areas where the vegetation or other material is such as to make liable the rapid spread of an initial flame. In terms of the Atmospheric Pollution Prevention Act (No. 45 of 1965), burning is not permitted as a disposal method.

The Contractor shall ensure that there is basic fire-fighting equipment available on Site at all times. This shall include at least rubber beaters when working in urban open spaces and fynbos areas, and at least one fire extinguisher of the appropriate type when welding or other "hot" activities are undertaken.

The Contractor shall advise the relevant authority of a fire as soon as one starts and shall not wait until he can no longer control it. The Contractor shall ensure that his employees are aware of the procedure to be followed in the event of a fire. The Contractor shall provide adequate fire protection measures at each work area and the site establishment area to deal with the type and nature of fire that may arise. On large construction site located in a wilderness area or adjoin commercial forestry of agricultural land use that may be prone to and susceptible to veld fires the Engineer may specify that the Contractor install fire breaks along boundary fences together with any other fire protection measure deemed necessary to protect property and lives of site staff and neighbours.

2.5.1.2 Accidental leaks and spillages

The Contractor shall ensure that his employees are aware of the emergency procedure(s) to be followed for dealing with spills and leaks, which shall include notifying the Engineer and the relevant authorities. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks is available on Site at all times. Treatment and remediation of the spill areas shall be undertaken to the reasonable satisfaction of the Engineer.

In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill.

2.6 Community relations

The Contractor shall erect and maintain information boards in the position, quantity, design and dimensions specified. Such boards shall include contact details for complaints by members of the public in accordance with details provided by the Engineer.

The Contractor shall keep a "Complaints Register" on Site. The Register shall contain all contact details of the person who made the complaint, and information regarding the complaint itself and any measures or agreements made in resolution to such complaint.

The Contractor shall develop an employment policy and shall disseminate this to interested communities, informing them of how many opportunities are available and the skills required for such opportunities. Depending on the scale of the project and the proximity and populace of nearby communities, the Contractor shall consider appointing a community liaison officer and an employment desk in the interested communities to manage the recruitment of staff. Local South Africans should be given first priority with regard to any employment opportunities and the Contractor's recruitment policy and nature and number of job opportunities should be communicated timeously and clearly to manage expectations and avoid conflict.

2.7 Construction Methods and procedures

2.7.1 Site clearance

The Contractor shall ensure that the clearance of vegetation is restricted to that required to facilitate the execution of the Works. Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be to the Engineer's approval. All cleared vegetation shall either be mulched and mixed into the topsoil stockpiles or disposed of at an approved disposal site. The disposal of vegetation by burying or burning is prohibited without the requisite permit from the local authority.

The Contractor shall strip the Topmaterial within the working areas. The Topmaterial shall be stockpiled separately from subsoil and used for subsequent rehabilitation and revegetation. Topmaterial stockpiles shall not be compacted.

Should fauna be encountered during site clearance, earthworks shall cease until fauna have been safely relocated.

2.7.2 Demolition

Hazardous and non-hazardous materials shall be separated at site and disposed of in a manner approved by the Engineer.

All buildings older than 60 years require a permit from South African Heritage Resources Agency in terms of the National Heritage Resources Act (no. 25 of 1999). A demolition permit is also required from the local authority in terms of the National Building Regulations.

2.7.3 Cement and concrete batching

Where applicable, the location of the batching plant (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the Engineer. The concrete/cement batching plant shall be kept neat and clean at all times.

No batching activities shall occur directly on unprotected ground. The batching plant shall be located on a smooth impermeable surface (concrete or 250 µm plastic covered with 5 cm of sand). The area shall be bunded and sloped towards a sump to contain spillages of substances. All wastewater resulting from batching of concrete shall be disposed of via the contaminated water management system and shall not be discharged into the environment. Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented

Empty cement bags shall be stored in weatherproof containers to prevent wind blown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives. The Contractor shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.

The Contractor shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

Where "readymix" concrete is used, the Contractor shall ensure that the delivery vehicles do not wash their chutes directly onto the ground. Any spillage resulting from the "readymix" delivery shall be immediately cleared and disposed of via the solid waste management system. Readymix trucks shall not be permitted to dump drum wash on site unless into contaminated water pond which must be fully rehabilitated at completion and the sediment collected for disposal.

2.7.4 Earthworks

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the Engineer.

2.7.5 Dewatering

Pumps shall be placed over a drip tray in order to contain fuel spills and leaks. Pumps shall be located sufficiently above the water line to ensure that that it does not become inundated if pumping is discontinued. The Contractor shall take all reasonable precautions to prevent spillage during the refuelling of these pumps.

The Contractor shall ensure that, unless of similar to the upstream water quality, none of the water pumped during any dewatering activities, including well points, is released into the environment without the Engineer's approval. The Engineer's approval is required prior to the discharge of this water into the Municipal sewer system.

2.7.6 Bitumen

Over spray of bitumen products outside of the road surface and onto roadside vegetation or the surrounding environment shall be prevented using a method approved by the Engineer.

When heating bitumen products, the Contractor shall take cognisance of appropriate fire risk controls. Heating of bitumen products shall only be undertaken using LPG or similar zero emission fuels and appropriate fire fighting equipment shall be readily available.

Stone chip/gravel excess shall not be left on road / paved area verges. This shall be swept / raked into piles and removed to an area approved by the Engineer.

Water quality from runoff from new/ fresh bitumen surfaces will be monitored visually by the Engineer and remedial actions taken where necessary by the Contractor.

2.7.7 Erosion and sedimentation control

The Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities. Where erosion and/or sedimentation, whether on or off the Site, occurs despite the Contractor complying with the foregoing, rectification shall be carried out in accordance with details specified by the Engineer. Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the Engineer.

Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. Consideration and provision shall be made for various methods, namely, brushcut packing, mulch or chip cover, straw stabilising (at a rate of one bale/ 20 m^2 and rotovated into the top 100 mm of the completed earthworks), watering, soil binders and anti-erosion compounds, mechanical cover or packing structures (e.g. Hessian cover).

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised area shall be repaired and maintained to the satisfaction of the Engineer.

2.7.8 Crane operations

Drive plants shall be well maintained and drip trays shall be positioned at potential leak areas. Over-greasing of crane cables shall be avoided.

Movement and lifting of hazardous materials shall be undertaken such that they do not cause a pollution, spillage or safety risk (in particular were concrete buckets are in use).

2.7.9 Trenching

Trenching for services shall be undertaken in accordance with the engineering specifications with the following environmental amplifications, where applicable:

- Topsoil shall be removed and stockpiled separately from and not mixed with the subsoil. Preferably topsoil should be placed on the upslope side of the trench which subsoil is placed on the downslope side of the trench, levelled and used for construction access. The areas used for topsoil and subsoil stockpiling should not be cleared of shorter herbaceous vegetation and must not be grubbed. Only once the trench is backfilled and shaped will the topsoil be spread across the trench area,
- Soil shall be excavated and used for refilling trenches i.e. soil from the first trench shall be excavated and stockpiled, thereafter soil from the second excavated trench length shall be used to backfill the trench behind it once the services have been laid. The last trench shall be filled using the soil stockpiled from the first trench.
- Trench lengths shall be kept as short as practically possible before backfilling and compacting.
- Trenches shall be re-filled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion.
- Stormwater control measures shall be used to reduce the ingress of stormwater into the trench. Where needed the Contractor shall provide temporary stormwater pipes to allow stormwater to cross the open trench.

2.7.10 Drilling and jack hammering

The Contractor shall take all reasonable measures to limit dust generation and noise as a result of drilling operations. The Contractor shall ensure that no pollution results from drilling operations, either as a result of oil and fuel drips, or from drilling fluid.

Any areas or structures damaged by the drilling and associated activities shall be rehabilitated by the Contractor to the satisfaction of the Engineer.

2.7.11 Stockpiling

The Engineer will identify suitable sites for stockpiling. Stockpiles shall be convex in shape and shall be limited in height so that it does not result in undue visual impacts or significant dust, as approved by the Eengineer. Stockpiles shall be so placed to occupy minimum width compatible with the natural angle of repose of material, and measures shall be taken to prevent the material from being spread over too wide a surface. Unless otherwise stipulated, areas for temporary stockpiling will not be cleared of shorter herbaceous vegetation as this compacted vegetation layer will serve protect the topsoil and serve as a marker during stockpile reclamation. Where required, appropriate precautions shall be taken to prevent the erosion and limit the compaction of the stockpiles. The Contractor shall ensure that all stockpiles do not result in the damming of water or run off, or is itself washed away.

Top material stockpiles shall not be covered with any material (e.g. plastic) that may kill seeds or cause it to compost. If the stockpiles start to erode significantly or cause dust problems, they shall be covered with hessian. Where practical, Topmaterial shall not be left for longer than six to eight months before being used for rehabilitation. If stored for longer than six months, the Topmaterial shall be analysed and, if necessary, ameliorated before use in rehabilitation works.

2.7.12 Site closure and rehabilitation

Any areas that the Engineer believes may have been impacted upon or disturbed, shall be rehabilitated to the satisfaction of the Engineer, which includes all areas where Topmaterial has been stripped or compacted. Once construction is complete the Contractor shall clear all construction debris and materials from the Site not forming part of the Permanent Works. The area to be rehabilitated shall first be landscaped to match the topography of the surrounding area as it was prior to construction. The composition of vegetation to be used for any rehabilitation shall be specified.

The Contractor may not use herbicides, pesticides, fertilisers or other poisonous substances for the rehabilitation process unless otherwise agreed with the Engineer.

All rehabilitated areas shall be considered “no go” areas and the Contractor shall ensure that none of his staff or equipment enters these areas. The Contractor shall undertake irrigation of rehabilitated areas for a minimum period of six to eight weeks to encourage germination. They may elect to extend the irrigation programme or the Engineer may specify ongoing irrigation programme if required. However any irrigation programme must taper off over a period of four to eight weeks before complete cessation as an abrupt cessation is likely to result in high seeding mortality rates (depending on local soil and climatological factors).

The Contractor shall undertake to remove all alien vegetation re-establishing on the area and shall implement the necessary temporary or permanent measures to combat soil erosion.

2.7.13 Temporary revegetation of the areas disturbed by construction

Where there is likely to be a delay of greater than two weeks in the landscaping and revegetation of a disturbed area or where that site is likely to be the subject of further construction activities at a later stage, the Contractor shall ensure that the area is temporarily revegetated to combat dust generation and prevent erosion. This revegetation shall occur incrementally immediately upon completion of the construction activities at the subject location.

Prior to revegetation structures and material not forming part of the Permanent Works, including remnants of building materials, concrete foundations, timber and foreign debris, shall be removed and disposed of via the solid waste management system. The area shall be revegetated as follows:

a) Compacted areas, such as roads, stockpile areas and construction platforms shall be ripped or scarified to depth of 300mm.

b) The surface shall be levelled by hand or machine as far as practically possible.

c) Alien vegetation shall be cleared by cutting the plants off at ground level, and painting the stump with 0.5% Garlon in diesel.

d) For areas with a slope of greater than 1:3, straw shall be utilised as a binding material to stabilise the soil during revegetation and rehabilitation of the site. Straw shall consist of natural, dried fibres of hay or chaff of various lengths between 50mm and 400mm, delivered to Site in bales and shall be applied evenly by hand or machine at a rate of 1 bale per $20m^2$ over the area to be revegetated. It shall then immediately be rotovated into the upper 100 mm layer of soil.

e) The prepared area shall be hydro- or hand-seeded at a rate of 40 kg/ha using a suitable indigenous grass species or Rye grass (*Lolium multiflorum*). In the event of hand-seeding, the seed mixture as specified shall be mixed with two parts per volume of clean dry plaster sand, then divided in half and applied evenly in two successive applications, one after the other, by means of an approved hand seeding machine (known colloquially as a “tefsaaier”). On completion of the seeding the surface shall be lightly raked to cover the seed with no more than 5 mm of soil.

f) Water used for the irrigation of vegetated areas shall be free of pollutants that will have a detrimental effect on the plants. The vegetated area shall only be watered once, immediately following seeding. Watering should be carried out from a tanker, using a fine nozzle spray to avoid erosion and disturbance of the vegetation. Water for irrigation purposes may must be from an approved source.

No construction equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been vegetated. Only persons or equipment required for the preparation of areas, application of fertiliser and maintenance of revegetated area shall be allowed to operate on these areas.

3 COMPLIANCE WITH REQUIREMENTS AND PENALTIES

3.1 Compliance

Environmental management is concerned not only with the final results of the Contractor's operations to carry out the Works but also with the control of how those operations are carried out. Tolerance with respect to environmental matters applies not only to the finished product but also to the standard of the day-to-day operations required to complete the Works.

It is thus required that the Contractor shall comply with the environmental requirements on an ongoing basis and any failure on his part to do so will entitle the Engineer to certify the imposition of a penalty as detailed below.

3.2 Penalties

Penalties will be issued for certain transgressions. Penalties may be issued per incident at the discretion of the Engineer. Such penalties will be issued in addition to any remedial costs incurred as a result of non-compliance with this Specification. The Engineer will inform the Contractor of the contravention and the amount of the penalty, and shall be entitled to deduct the amount from monies due under the Contract.

3.3 Removal from site and suspension of Works

The Engineer may instruct the Contractor to remove from Site any person(s) who in their opinion is guilty of misconduct, or is incompetent, negligent or constitutes an undesirable presence on Site. Subclause 2.4.10 of this Specification requires that all Plant be in good working order, and accordingly the Engineer may order that any Plant not complying with the Specifications be removed from Site. Where the Engineer deems the Contractor to be in breach of any of the requirements of this Specification, he may order the Contractor to suspend the progress of the Works or any part thereof.

4 MEASUREMENT AND PAYMENT

4.1 Basic principles

4.1.1 General

Except as specified below, or in the Specification Data or as billed, no separate measurement and payment will be made to cover the costs of complying with the provisions of this Specification and such costs shall be deemed to be covered by the rates tendered for the items in the Bill of Quantities completed by the Contractor when submitting his tender.

4.1.2 All requirements of the environmental management specification

All work not measured elsewhere, associated with complying with any requirement of this Environmental Management specification will be measured and paid as a sum.

The tendered sum shall cover the cost of with complying with the environmental management specification and shall include for all materials, labour and plant required to execute and complete the Works as specified, described in the Bill of Quantities or shown on the Drawing(s).

4.1.3 Work "required by the Engineer"

Where a clause in this Specification includes a requirement as "required by the Engineer", measurement and payment for compliance with that requirement shall be in accordance with the relevant measurement and payment clause of the Project Specifications.

4.2 Billed items

4.2.1 Method Statements: Additional work

No separate measurement and payment will be made for the provision of Method Statements but, where the Engineer requires a change on the basis of his opinion that the proposal may result in, or carries a greater than warranted risk of damage to the environment in excess of that warranted by the Specifications, then any additional work required, provided it could not reasonably have been foreseen by an experienced contractor, shall be valued in accordance with the Clause in the General Conditions of Contract dealing with Provisional Sums.

A stated sum is provided in the Bill of Quantities to cover payment for such additional work.

4.2.2 All requirements of the environmental management specification

Unit: Sum

All other work not measured elsewhere, associated with complying with any requirement of the environmental management specification shall be measured as a sum.

The tendered rate shall cover any cost associated with complying with the environmental management specification and shall include for all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

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APPENDIX H:

Details and expertise of EAP

APPENDIX H.1:

Patrick Killick

Patrick Killick

Environmental Practitioner

Patrick is based in Aurecon's Cape Town office as a senior environmental practitioner and project leader with significant onsite experience in the supervision, hands-on management and monitoring of construction related environmental impacts and occupational health and safety associated with the construction of dams, roads, pipelines, underground works, weirs, and residential villages whilst employed on the Berg Water Project.

Patrick moved into an environmental consulting role where he has gained seven years of experience in the impact assessment field whilst undertaking a number of environmental impact studies and other regulatory and planning processes for various developments within South Africa, Tanzania, Mozambique and Namibia. Project experience is primarily focused on the areas of municipal bulk water supply, (including seawater desalination) and wastewater treatment infrastructure, bulk thermal power generation (including renewable energy in the form of wind and solar photovoltaic (PV) farms) and open cast mining and associated mining infrastructures. With a keen interest in the technical aspects of his projects, Patrick's core competency is seated around the compilation and implementation of construction and operational phase environmental management plans (EMP's). Patrick also devotes a portion of his time to business management and development of proposals for various prospects pursued by the Aurecon Environmental Units throughout Africa.

He obtained a master's degree for environmental management in 2005 from the University of the Free State (UFS) and is a member of the International Association for Impact Assessment South African Affiliate (IAIAsa).

Qualifications

MPhil (Environmental Management)

NDip (Forestry)

BTech (Forestry)

Member, International Association for Impact Assessment South African Affiliate (IAIAsa)

Specialisation

Project Leader/Senior Environmental Practitioner

Years in industry

12.16

Experience

Rössing Desalination Plant, Erongo region, Namibia, Rio Tinto Rössing Uranium Limited, 08/2014 - Date, Project Leader

This project consisted of a 10,000 m3/d seawater desalination plant, north of Swakopmund to supply the water needs of Rössing Uranium Mine.

Wolf Wind Farm, Eastern Cape Province, South Africa, Juwi Renewable Energies (Pty) Ltd, 11/2013 - Date, Project Leader

This project involved a proposed wind energy facility (WEF) and associated infrastructure, with a generation capacity of 80MW on farms near Wolwefontein in the Eastern Cape with 132 kV or 220 kV overhead transmission lines for transmission and distribution. Responsible for conducting an environmental impact assessment (EIA).

Outeniqua Wind Farm, Western Cape Province, South Africa, Juwi Renewable Energies (Pty) Ltd, 03/2013 - Date, Project Leader

The project involves conducting an environmental impact assessment process in terms of the National Environmental Management Act for a 39 MW wind energy facility (WEF).

Construction of a bulk water supply scheme to the town of Aussenkehr, Karas Region, Namibia, Namibian Water Corporation, 05/2012 - 06/2012, Consulting Team Member

The project comprised the compilation of a life-cycle environmental management plan for the bulk water supply scheme for the town of Aussenkehr.

Environmental and socio-eonomic impact assessment (ESIA) for a coal-fired power station, Erongo Region, Namibia, NamPower, 04/2012 - 05/2012, Consulting Team Member

The project comprised the compilation of an EIA and EMP for a 150 MW, 300 MW or 800 MW coal fired power station located in the Erongo Region of Namibia. The preferred site located at the town of Arandis.

Mineral exploration environmental management plan (EMP) for License Areas No 3450L and 3451L, Tete Province, Mozambique, Coal India Africana Limitada, 02/2012 - 05/2012, Consulting Team Member

The project entailed the compilation of an environmental management plan (EMP) for mineral exploration drilling (diamond core and percussion drilling) in Licence Area no's 3450L and 3451L of the Moatize coal fields.

450 MW Khanyisa coal fired power station, Mpumalanga Province, South Africa, AngloGold, 08/2011 - 09/2011, Consulting Team Member

Compilation of construction and operations phase environmental management programmes (MP's) for a 450 MW coal-fired power station and associated infrastructure, including ash disposal dumps.

15 Ml/d Emergency desalination plant in Mossel Bay, Western Cape Province, South Africa, Mossel Bay Municipality, 05/2010, Project Manager, Lead Consultant and Environmental Control Officer (ECO)

Compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 15 Ml/d seawater reverse osmosis plant as a result of more than 1:150 year drought situation in the Southern Cape, inclusive of a construction phase environmental management plan (EMP) and environmental control officer (ECO) services.

New sulphuric acid storage tank at the Rössing Uranium Mine, Arandis, Erongo, Namibia, Rio Tinto Rössing Uranium Mine Limited, 02/2010 - 06/2010, Consulting Team Member

Commissioned by Rössing Uranium to compile of a social and environmental management plan (SEMP) for the proposed new 15 Kt sulphuric acid storage tank located within the mine precinct.

2 Ml/d Emergency desalination plant in Plettenberg Bay, Western Cape Province, South Africa, Bitou Municipality, 12/2009, Lead Consultant and Environmental Control Officer (ECO)

Compilation of a Section 24G application in terms of the National Environmental Management Act for an emergency 2 Ml/d seawater reverse osmosis plant as a result of more than 1:150 year drought situation in the Southern Cape, inclusive of a construction phase environmental management plan and environmental control officer services.

Upgrading the Keurbooms pump station, abstraction works and rising main, Western Cape Province, South Africa, Bitou Municipality, 11/2009 - 12/2011, Environmental Control Officer (ECO)

Appointed by the Bitou Municipality to compile an environmental management plan (EMP) associated with the proposed urgent upgrading of the Keurbooms Pumpstation, abstraction works and a 650 m length of 500 mm diameter steel rising raw water main. Responsible for compiling an EMP associated with the proposed urgent upgrading of the Keurbooms Pumpstation, abstraction works and a 650 m length of 500 mm diameter steel rising raw water.

Emergency upgrading of Keurbooms rising main and pumps, Plettenberg Bay, Western Cape Province, South Afri, Bitou Municipality, 10/2009 - 11/2009, Lead Consultant

Appointed by the Bitou Municipality to undertake an Emergency application for the upgrading of a 295 m section of perished pipeline, with 500 mm diameter steel pipe and the upgrading of pump impellors to increase abstractions from 100 l/s to 120 l/s out of the Keurbooms River. Responsible to compile an EMP and to function as the ECO for the Emergency application and subsequent upgrading of a 295 m section of perished pipeline, with 500 mm diameter steel pipe and the upgrading of pump impellors to achieve a greater abstraction rate.

Decommissioning of the Sonae Novobord fibreboard factory, Western Cape Province, South Africa, Sonae Novobord (Pty) Ltd, 06/2009 - 06/2011, Consulting Team Member

Appointed by the Sonae Novobord to compile an environmental management plan (EMP) and act as the environmental control officer (ECO) for the decommissioning of their factory in George Industria, with a focus on the recovery and handling of salvageable materials and the lawfull recovery and disposal of hazardous wastes and contaminated soil.

Upgrading of the Merweville wastewater treatment works (WWTW), Western Cape Province, South Africa, Beaufort West Municipality, 05/2009 - 10/2009, Project Manager and Lead Consultant

Appointed by the Beaufort West Municipality to undertake waste license application involving the compilation of a basic assessment report and a construction, operation and decommissioning phase environmental management plan (EMP) for the upgrading of the Merweville wastewater treatment works (WWTW).

Pipeline for reclamation of water from wastewater treatment works (WWTW), Western Cape Province, South Africa, Water and Waste Water Engineering, 02/2009 - 05/2009, Consulting Team Member

Appointed by Water and Wastewater Engineering to facilitate the requisite environmental process, including environmental management plan (EMP) for the implementation of a Waste Water Reclamation Plant for Beaufort West Municipality.

Social and environmental management for mineral exploration drilling plan, Arandis, Erongo, Namibia, Rio Tinto Rössing Uranium Mine Limited, 11/2008 - 04/2010, Consulting Team Member

Commissioned by Rössing Uranium Limited to compile a social and environmental management plan (SEMP) for the proposed exploration drilling activities within the Namib-Naukluft Park and mine licence area.

Social and environmental management plan for a bulk sulphur handling facility, Erongo, Namibia, Rio Tinto Rössing Uranium Mine Limited, 04/2008 - 12/2009, Consulting Team Member

Commissioned by Rössing Uranium to compile of a social and environmental management plan (SEMP) for the proposed bulk sulphur importation, stockpiling and handling facility in the port of Walvis Bay.

Environmental and socio-economic impact assessment (ESEIA) for a proposed NamPower coal-fired power station at Walvis Bay, Erongo, Namibia, NamPower, 04/2008 - 08/2009, Consulting Team Member

Responsible for acting as Lead Consultant on the ESEIA for the proposed NamPower coal-fired power station at Walvis Bay. This included a site screening and selection process, a scoping study, and an ESEIA, all supported by an environmental management plan (EMP).

40 Ml off-channel reservoir in Karatara, Western Cape Province, South Africa, Knysna Municipality, 04/2008 - 07/2009, Principle Environmental Consultant/Environmental Control Officer

The project entailed the compilation of the construction phase environmental management plan (EMP) for a 40 000 m^2 off-channel reservoir, in-channel abstraction works, and associated pipe work. Responsible for acting as environmental control officer (ECO) to supervise the implementation of the environmental management plan (EMP), and undertake compliance monitoring and reporting.

Paratus emergency generation facility in Walvis Bay, Erongo, Namibia, NamPower, 04/2008 - 08/2008, Consulting Team Member

Responsible for assisting with the environmental process management and compiling documentation in relation to a proposed 50 MW heavy fuel oil emergency generation facility located in the industrial port area.

Timber treatment facility, Albertinia, South Africa, Outeniqua Pale (Pty) Ltd, 2008, Consulting Team Member

The project was concerned with the compilation of a construction, operation and decommission phase environmental management plan (EMP) for a Creosote and CCA pole treatment facility in conjunction with a basic assessment report.

Review of the biodiversity components of municipal spatial development frameworks in the Cape domain, Western Cape Province, South Africa, South African National Biodiversity Institute (SANBI), 09/2007 - 06/2008, Consulting Team Member

Aurecon was appointed to provide an overview of the requirements for biodiversity in SDF's, and an assessment of the current status of biodiversity in these SDF's. as well as to undertake the review as Phase I of a process to improve the input of biodiversity priorities in spatial planning documents and processes. Responsible for reviewing the first phase of a process to improve the input of biodiversity priorities in spatial planning documents and processes.

Relocation of Sedgefield's water treatment and supply infrastructure, Western Cape Province, South Africa, Knysna Municipality, 08/2007 - 12/2007, Consulting Team Member

The project consisted of a basic assessment report for the construction of a 4,5 Ml water treatment works; a 1,8 km, 300 mm rising raw water pipeline; and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station. Conduct a Basic Assessment process for the construction or a 4.5Ml water treatment works, a 1,8 km, 300 mm rising raw water pipeline and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station. Compilation of the construction, operational and decommissioning phase EMP's for the construction or a 4,5 Ml water treatment works, a 1,8 km, 300 mm rising raw water pipeline and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station.

Chemical storage and distribution facility in George, Western Cape Province, South Africa, Metsi Chem Ikapa (Pty) Ltd, 06/2007 - 11/2007, Consulting Team Member

The project involved Section 24G retrospective applications for the authorisation of illegal activities relating to the storage of various hazardous chemicals used in the water purification industry, and the development of an associated operational phase environmental management plan (EMP) for incorporation into an ISO14001 environmental management system (EMS).

Creosote and CCA timber pole treatment facility, Groot Brak and Albertinia, South Africa, Outeniqua Pale (Pty) Ltd, 06/2007 - 03/2010, Consulting Team Member

Responsible for assisting with an environmental impact assessment (EIA) for the decommissioning of an Outeniqua Pale Creosote and CCA pole treatment facility in Groot Brak and re-establishing it on a new site in Albertinia. Appointed by Outeniqua Pale (Pty) Ltd to compile of a construction, operation and decommission phase environmental management plan (EMP) for a Creosote and CCA pole treatment facility in conjunction with a basic assessment report (BAR).

Mine life extension for Rössing Uranium Mine, Arandis, Namibia, Rio Tinto Rössing Uranium Mine Limited, 06/2007 - 12/2011, Consulting Team Member

The project comprised the compilation of a social and environmental management plan (SEMP) for various activities associated with the life extension of Rössing Uranium Mine. This included the extension of the open pit operations, acid manufacturing plant, ore sorting plant, extended waste rock disposal areas, and tailings facilities, as well as a bulk sulphur handling facility in the port at Walvis Bay.

Overhead power lines between Ha Lejone and the Liqhobong and Kao Diamond Mines, Lesotho, Liqhobong Mining Development Company and Kao Diamond Mine/Plantech Associates, 03/2007 - 02/2008, Consulting Team Member

Responsible for assisting with the compilation of an environmental impact assessment (EIA) for a 38 km, 132 kV overhead power line and associated step-up and step-down substations.

Independent review of environmental impact assessment (EIA) applications, Eastern Cape Province, South Africa, Department of Environmental Affairs and Tourism (DEAT), 01/2007 - 02/2009, Consulting Team Member

Responsible for assisting with the review of various Section 22 EIA applications in terms of the Environmental Conservation Act (Act 73 of 1989) for the Department of Economic Affairs, Environment and Tourism (DEAET).

Mine life extension for Rössing Uranium Mine, Arandis, Namibia, 2007, Consulting Team Member

Responsible for assisting with the compilation of a social and environmental impact assessment (SEIA) for various activities associated with the life extension of Rössing Uranium Mine, including the extension of the open pit operations, the acid manufacturing plant, the ore sorting plant, extended waste rock disposal areas, and tailings facilities.

Chemical storage facility, George, South Africa, Metsi Chem Ikapa (Pty) Ltd, 2007, Consulting Team Member

This project involved Section 24G retrospective applications for the authorisation of illegal activities relating to the storage of various hazardous chemicals used in the water purification industry, and the development of an associated operational phase environmental management plan (EMP) for incorporation into an ISO14001 environmental management system (EMS).

Keurbooms River raw water pipeline, Plettenberg Bay, South Africa, Bitou Municipality, 2007, Environmental Control Officer

The project consisted of the provision of ad hoc environmental planning, routine audits, and compliance monitoring of the implementation of the environmental management plan (EMP) and ROD conditions of approval for the installation of a 9 km raw water pipeline and the rehabilitation of the construction servitude on completion.

Relocation of Sedgefield's water treatment and supply infrastructure, Sedgefield, South Africa, Knysna Municipality, 2007, Consulting Team Member

The project included the development of the construction, operational and decommissioning phase environmental management plans (EMP's) for the construction of a 4,5 Ml water treatment works; a 1,8 km, 300 mm rising raw water pipeline; and the decommissioning and upgrading of the Ruigtevlei water treatment works into a pump station.

Alien vegetation eradication and rehabilitation, Fancourt Estate, George, Western Cape, South Africa, Fancourt Golf and Country Estate, 05/2006 - 06/2007, Consulting Team Member

Responsible for formulating an alien vegetation eradication and rehabilitation plan for Afromontane Forest for the estate's landholding on Malgas River.

Berg water project, Franschhoek, Western Cape Province, South Africa, Trans-Caledon Tunnel Authority (TCTA), 03/2004 - 03/2007, Environmental Monitor

The project entailed the construction of bulk water supply infrastructure to service the greater Cape Town metropolitan area which is comprised of the Berg River Dam, large diameter water transfer pipelines, two heavy duty pump stations, a scheme control centre, a balancing dam, several gauging weirs, a diversion weir, an asphalt access road, and an 80-unit residential village with associated bulk services. Responsible for construction supervision, environmental monitoring and reporting, review and assistance with construction method statements, monitoring health and safety aspects and legal compliance, as well as investigating and advising on internal and external entities with regard to environmental issues.

APPENDIX H.2:

Corlie Steyn

Curriculum vitae: Mrs CJ STEYN

Name	:	**STEYN, CORNELIA JOHANNA**
Date of Birth	:	22 August 1974
Profession/Specialisation	:	Environmental management
Years with Firm	:	3
Nationality	:	South African
Years of experience	:	15

Key qualifications

Corlie is an environmental practitioner with a focus on environmental management, and is also a part-time lecturer at the Nelson Mandela Metropolitan University's (NMMU's) Department of Nature Conservation.

She has extensive experience in environmental management and research projects related to climate change. She also has experience in the evaluation and review of environmental impact assessments (EIA's); advising on law enforcement and environmental matters; managing public participation processes, including in-depth interviews with stakeholders; chairing workshops; and presenting final reports to government departments and civil society stakeholders.

Corlie is a registered member of the International Association for Impact Assessment South Africa (IAIAsa). She holds an MPhil degree in Environmental Management at the University of Stellenbosch, South Africa. She also holds an Honours Degree in Geography, a BA Degree and a Higher Education Diploma, all obtained from the University of Pretoria in South Africa.

Employment record

2011 - Date	Aurecon, Senior Environmental Practitioner
2008 - 2010	Wildlife and Environment Society of South Africa (WESSA), Environmental Practitioner
2008 - 2010	Provincial Department of Environmental Affairs & Development Planning, Principal Environmental Officer
2007 - Date	Nelson Mandela Metropolitan University (NMMU), Lecturer
2007	Aurecon, Environmental Practitioner
2003 - 2006	Department of Environmental Affairs and Development Planning, Environmental Officer
2000 - 2003	High School Pro-Arte Alphen Park, High School Teacher in Geography and French
1999	East Brook and Forest Gate, London, UK, High School Teacher in Geography and French
1998	Macrocon Civil Engineers, Assistant

Management experience

2007 - Date	Managing coastal management students, field trips and practical tests as a lecturer at the Nelson Mandela Metropolitan University (NMMU).

Experience record

***Cost estimate for solid waste sites in the George and Uniondale Municipal areas* (Western Cape Province, South Africa) 06/2014 - Date.** *Environmental Practitioner.* This project entailed the compilation and public private partnership (PPP) involved with the updated cost estimate for the solid waste sites in George and Uniondale. Involved for 3 person-months. (Mubesko Africa).

***Second bridge on the River Niger* (Delta State, Nigeria) 05/2014 - Date.** *Environmental Practitioner.* The Federal Government of Nigeria, through the Federal Ministry of Works, is proposing to construct a second bridge across the River Niger between Onitsha and Asaba. Aurecon was appointed to undertake an environmental and social impact assessment (ESIA) required in terms of the Environmental Decree No 86 of 1992, in accordance with the International Finance Corporation (IFC) guidelines which included a resettlement action plan (RAP). This study is undertaken to ensure regulatory compliance with the Nigerian environmental legislation and to achieve the highest possible compliance with Equator Principles. The bridge and access road will be constructed under a design, build, finance and operate concession agreement. Responsible for the compilation of the environmental management plan (EMP) for the proposed bridge. Involved for 1 person-month. (Nigeria Sovereign Investment Authority (NSIA)).

Revision of the solid waste cost estimate report for George Municipality **(Western Cape Province, South Africa) 06/2013 - 07/2014.** *Environmental Practitioner.* The project entailed the revision and compilation of the solid waste cost estimate report for George Municipality done during 2012. Involved for 3 person-months. (George Municipality).

Working for Wetlands Plan **(Western Cape Province, South Africa) 06/2013 - Date.** *Environmental Practitioner.* Aurecon was appointed for a three year project cycle to undertake the planning, design, environmental, project and risk management of the South African government's Working for Wetlands Programme. Responsible for the compilation of a basic assessment report (BAR), public-private partnership PPP and application form. Involved for 12 person-months. (South African National Biodiversity Institute (SANBI)).

Mulilo photovoltaic (PV) expansion **(Northern Cape Province, South Africa) 03/2013 - 10/2014.** *Environmental Practitioner.* The project involved an environmental impact assessment (EIA) for the expansion of approved solar energy facilities located near Prieska and De Aar. The expansion of Hoekplaas farm in Prieska includes ten additional 75 MW photovoltaic (PV) facilities and six additional PV units at Klipgats Pan farm; and the expansion of Badenhorst Dam farm includes four additional 75 MW PV facilities and three additional PV units at Du Plessis Dam farm. Responsible for the compilation of the environmental management plan (EMP). Involved for 1 person-month. (Mulilo Renewable Energy (MRE)).

Outeniqua Wind Farm **(Western Cape Province, South Africa) 03/2013 - Date.** *Environmental Practitioner.* Aurecon was appointed to undertake an environmental impact assessment (EIA) process for a proposed wind energy facility (WEF) and all associated infrastructure near Uniondale in the Western Cape. The proposed WEF would comprise 13 to 15 turbines of 2 MW to 3 MW each, with a combined total capacity of 39 MW. Responsible for the compilation of the environmental management plan (EMP). Involved for 1 person-month. (Juwi Renewable Energies).

Solid waste cost estimate reports **(Northern and Western Cape Provinces, South Africa) 06/2012 - 07/2014.** *Environmental Practitioner.* The project entailed the compilation of a solid waste cost estimate report for George Municipality as well as Hantam Municipality and six sites within the district. Responsibilities included site visits, public participation and compilation of the reports. Involved for 6 person-months. (Various).

Solid waste cost estimate report for George Municipality **(Western Cape Province, South Africa) 06/2012 - 07/2014.** *Environmental Practitioner.* The project entailed the compilation of a solid waste cost estimate report for George Municipality, including the Uniondale site. Responsibilities included site visits, public participation and compilation of the report. Involved for 3 person-months. (George Municipality).

Proposed wind and solar (Photovoltaic) energy facility near Springbok **(Northern Cape Province, South Africa) 03/2012 - Date.** *Environmental Practitioner.* The project involved environmental impact assessments (EIA) for a 750 MW wind energy facility and a 250 MW solar photovoltaic energy facility on farms near Springbok in the Northern Cape. Responsibilities included report compilation, corresponding with key stakeholders and specialists and undertaking the public participation process. Involved for 12 person-months. (South Africa Mainstream Renewable Power Developments).

Proposed photovoltaic (PV) facilities near De Aar **(Northern Cape Province, South Africa) 09/2011 - 03/2013.** *Environmental Practitioner.* The project entailed an environmental impact assessment (EIA) for three photovoltaic (PV) power facilities near De Aar in the Northern Cape. PV2 is located on Paarde Valley Farm (portion 2 of farm number 145), generating between 75 and 150 MW, and covering an area of 225 to 450 ha. PV3 is located on the Badenhorst Dam Farm (portion 1 of farm number 180), generating between 100 and 135 MW, and covering an area of 300 to 405 ha. PV4 is on the Du Plessis Dam Farm (farm number 179 remainder), generating 19 MW, and covering an area of 1 060 ha. The associated infrastructure required for the PV facility include 132 kV overhead transmission lines; the upgrading of access roads and water supply infrastructure linking the site to the municipal network. Responsible for the compilation of an environmental report and a screening report as per criteria of the independent power producer (IPP) programme) as well as an environmental management plan (EMP) for the proposed solar energy facility on Annex Du Plessis Dam Farm. Involved for 1 person-month. (Mulilo Renewable Energy).

***Langezandt Quays* (Western Cape Province, South Africa) 06/2011 - 09/2014.** *Environmental Practitioner.* This project entailed an environmental impact assessment (EIA) for the proposed development of Langezandt Quays in Struisbaai. Responsible for the compilation of the environmental management plan (EMP). Involved for 1 person-month. (Golden Falls Trading).

***Unifying and standardising of highway engineering practices* (Abu Dhabi, United Arab Emirates) 01/2009 - 01/2010.** *Environmental Practitioner.* The project included an environmental impact assessment (EIA) for the Abu Dhabi transport system, relating to the unifying and standardising of highway engineering practices. Responsible for reviewing the manual, complete comment sheets and write the environmental chapter.
Involved for 2 person-months. (Department of Transport (DoT)).

***Western Cape Provincial road materials supply strategy* (Western Cape Province, South Africa) 06/2008 - Date.** *Environmental Practitioner.* The project involved the drafting of an environmental management programme (EMPr) for the exploitation of borrow pits for supply of material for the re-graveling and maintenance of sections of Divisional Roads DR01587, DR01607, DR01630, MR0336 and OP0484 for Mossel Bay local municipality and in the Eden District Municipality. Responsibilities included report compilation, corresponding with key stakeholders and specialists and undertaking the public participation process. Involved for 24 person-months. (Western Cape Provincial Government Department of Transport and Public Works).

***Review of impact assessments and appeals* (Western Cape Province, South Africa) 05/2008 - 04/2010.** *Principal Environmental Officer.* The project entailed the review of impact assessments and appeals in terms of the Environment Conservation Act (ECA). Responsible for site visits and consulting on land development processes. Involved for 15 person-months. (Western Cape Department of Environmental Affairs and Development Planning).

***Scenario planning to assess the implications of climate change on land and water use within the agricultural sector of the Garden Route* (Western Cape Province, South Africa) 01/2008 - 12/2010.** *Environmental Practitioner.* The project comprised a study for the completion of a publication relating to climate change. The study entailed examining how farmers' perceptions of weather conditions correspond with the climatic data recorded at various meteorological stations by conducting in-depth interviews; and studying analysed farmers' adaptive responses and perceptions of climate change. The project implemented a scenario-planning exercise to determine adaptation trends in the observed and projected climate for the Garden Route, with the aim of providing possible solutions for wiser agricultural practices. Responsible for completing two reports; public participation; literature reviews of the existing data relating to the implications of changes in temperature and rainfall patterns on agricultural practices; and the collation of climatic data; the completion of an assessment of current agricultural practices, including an assessment of the farmers' attitudes towards changing rainfall patterns and other climatic variables. The results were incorporated into a scenario-planning exercise to determine trends in the observed and projected climate for the project area. Final results were reviewed by a panel of experts, comprising an agricultural economist, a climatologist, a biologist, and a sociologist, during a workshop where the panel suggested recommendations to the farmers, agricultural unions, relevant government departments and politicians, based on the outcomes projected by the models. These reports were then disseminated to government departments and civil society stakeholders. Involved for 24 person-months. (Wildlife and Environment Society South Africa (WESSA)).

***Review of the biodiversity components of municipal spatial development frameworks* (Western Cape Province, South Africa) 01/2008 - 04/2008.** *Environmental Practitioner.* Aurecon was appointed to provide an overview of the requirements for biodiversity in spatial development frameworks (SDF's) and an assessment of the current status of biodiversity in these SDFs in the Western Cape. This formed part of the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) funded Cape Action for People and the Environment (CAPE). Involved for 4 person-months. (South African National Biodiversity Institute (SANBI)).

***Independent review of environmental impact assessment (EIA) applications* (Eastern Cape Province, South Africa) 02/2007 - 04/2008.** *Specialist Independent Reviewer.* The project entailed the review of environmental impact assessment (EIA) applications to assist the Eastern Cape Province with the processing of the backlog of applications in terms of the Environment Conservation Act (ECA). Involved for 3 person-months. (Department of Economic Development, Environment and Tourism).

***Review of impact assessments and appeals* (Western Cape Province, South Africa) 03/2003 - 12/2006.** *Environmental Officer.* The project involved the review of applications in terms of the National Environmental Management Act (NEMA). Responsible for liaising, with relevant authorities with regard to applications, conducting site visits, consulting on land development processes, environmental management program reports, liaising with stakeholders on the implementation of the relevant environmental legislation and checking legal non-compliance. Responsibilities also included liaising with municipalities and mentoring junior environmental officers. Involved for 46 person-months. (Western Cape Department of Environmental Affairs and Development Planning).

Academic experience

Nelson Mandela Metropolitan University (NMMU)

- 2007 - Date; Appointed to lecture fourth year students in Coastal Management including the legislative background, detailed case studies, and biophysical, social and economic factors related to coastal and marine management.

Research supervision

Prof Johan Hattingh from the University of Stellenbosch

Education

2013	:	Mphil Environmental Management, University of Stellenbosch, South Africa
1997	:	BA (Hons) Geography, University of Pretoria (UP), South Africa
1995	:	HED, University of Pretoria (UP), South Africa

Career enhancing courses

2006	:	Sustainable Development Implementation Plan, Department of Environmental Affairs and Development Planning
2005	:	Sustainable Livelihoods, The IDL Group
2005	:	Environmental Law for Environmental Managers, North-West University (NWU), South Africa
2004	:	Environmental Impact Assessment (EIA) Process, Department of Environmental Affairs and Development Planning

Professional affiliations

Member, International Association for Impact Assessment South Africa (IAIAsa)

Languages

	Reading	**Writing**	**Speaking**
English	Excellent	Excellent	Excellent
Afrikaans	Excellent	Excellent	Excellent
French	Fair	Fair	Fair

Research projects

Steyn, CJ. December 2010. "A literature review of existing data, relating to the implications of change in temperature and rainfall patterns on agricultural practices, both nationally and internationally". Included the collation of climatic data for the Garden Route obtained from the CSIR, an assessment of current agricultural practices in the Garden Route and a study of farmers' attitudes towards changing rainfall patterns and other climatic variables.

Honours and awards

Cum Laude for Honours degree

Publications

Steyn CJ, 2010. "Scenario Planning to Assess the Implications of Climate Change on Land and Water Use within the Agricultural Sector of the Garden Route". Presented at the Garden Route and Gouritz Initiatives in 2010 and 2011 respectively.

Referees

Company	Contact Person	Telephone nr.
Department of Environmental Affairs and Development Planning	Yakeen Atwaru/Danie Swanepoel	+27 44 805 8600
Nelson Mandela Metropolitan University (NMMU)	Mike Cameron/Anton Schmidt	+27 44 801 5111

By my signature below I certify the correctness of the information above and my availability to undertake this assignment.

Signature of Staff Member   Date

APPENDIX H.3:

Diane Erasmus

Diane Erasmus

Environmental Specialist

Diane currently manages the George office of Aurecon's environmental team where she has been active in the field of environmental management with more than two decades of experience. She has also been assisting with management of the environmental team in the Cape Town team and so has managerial responsibility for a team of 21 people. She obtained experience as a specialist consultant in undertaking environmental impact assessments for both small and medium to large-scale developments. This includes a wide range of projects, from communication structures, housing and resort applications to pipelines, bridges and industrial developments. She has also undertaken environmental processes in a number of African countries, including South Africa, Nigeria, Namibia, Uganda Botswana and Malawi.

Diane has experience in writing and implementing environmental management plans (EMP's) for the construction and operational phases of developments. She has also been responsible for undertaking studies that address strategic environmental input into the early stages of project planning, including environmental management frameworks (EMF's) and feasibility/planning projects. She has undertaken a number of projects where international best practice was a pre-requisite, this has entailed ensuring compliance with amongst others, World Bank and International Finance Corporation standards.

Diane's responsibilities on projects have included drawing up proposals, project and financial management of projects, management of specialist teams, integration of specialist findings and compilation of reports. Furthermore, she has been responsible for undertaking environmental impact assessments (EIA's) and has acquired a number of skills, including the ability to analyse the environment in a holistic manner, while evaluating options and trade-offs. She has also been involved in undertaking scoping and stakeholder participation; assessment of impacts and evaluation of their potential significance; as well as recommending mitigation measures, management and monitoring of impacts; and managing, coordinating and integrating the findings of an interdisciplinary team.

She is a certified environmental practitioner at the Environmental Assessment Practitioners Association of South Africa (EAPASA) and has been active at the International Association for Impact Assessment: South Africa (IAIAsa), acting as Western Cape Chair (2006); Southern Cape Chair (2007) and National President (2008).

Qualifications

MSc Nature Conservation

BSc (Hons) Nature Conservation

BSc Botany and Zoology

Environmental Practitioner, Environmental Assessment Practitioners Association of South Africa (EAPASA)

Member, International Association of Impact Assessment (IAIA)

Specialisation

Environmental Practitioner

Years in industry

27.33

Experience

Implementation service provider (ISP) for flood risk management (FRM) at the Shire River Basin, Southern Region, Malawi, BRL Ingénierie, 07/206 - 08/2016, Environmental Specialist

The Shire River Basin Management Programme (Phase 1) Project (SRBMP-1) aims to transform the largely sectoral planning approaches in the Shire River Basin into inclusive stakeholder-based development planning and management of the basin's water and related natural resources to generate sustainable social, economic and environmental benefits. Aurecon was appointed as the implementation service provider (ISP) for flood risk management. Responsible for the safeguards report which details the environmental and social aspects related to the engineering designs for the first batch of civil works (seven interventions) for proposed flood mitigation civil works in the lower Shire River Basin (includes riverbank stabilisation structures, dykes and culverts) as part of the Shire River Basin Management Programme.

Amendment of an environmental and socio-economic impact assessment (ESEIA) from coal-fired to concentrated solar power (CSP) technology for power generation near Arandis town, Erongo Region, NamPower, 03/2016 - 08/2016, Reviewer

An environmental certificate was issued in 2012 to the Namibia Power Corporation (Pty) Ltd (NamPower) to build a thermal coal-fired power station near Arandis in the Erongo Region. This project was put on hold and NamPower now proposes to develop a concentrated solar power (CSP) facility on the same site. Aurecon was appointed to undertake an assessment of the CSP technologies proposed on the same site, as required in terms of the Environmental Management Act (Act No. 7 of 2007).

Transaction advisory services for the Botswana-South Africa (BOSA) Transmission Interconnection Project, South Africa and Botswana, Southern African Power Pool (SAPP), 04/2016 - 07/2016, Environmental Specialist

Aurecon was appointed to provide consultancy services comprising a scoping study, feasibility study up to the project implementation phase which included procurement of an engineering, procurement and construction (EPC) firm and project financial close. Responsible for acting as an environmental specialist as part of the transaction advisor team with responsibility for environmental and social input into the preliminary design and the subsequent environmental and social impacts assessment (ESIA) for the 400 kV transmission lines from the Isang substation in Botswana to the Watershed B substation in South Africa.

Pre-feasibility study for a 500 MW gas fired power plant in Abia State, Nigeria, Abia State, Nigeria, Orascom Construction, 12/2015 - 03/2016, Environmental Specialist

Orascom Construction (Egypt) and Geometric Power (Nigeria) are jointly developing a nominal 500 MW gas fired power plant in Abia State Nigeria. The client engaged Aurecon to carry out the pre-feasibility study for the project. This aspect included an overview of the environmental and social aspects of the project.

Preparation of national integrated catchment management and rural infrastructure development guidelines, Malawi, Ministry of Agriculture, Irrigation and Water Development (MoAIWD), 02/2014 - 11/2015, Environmental Specialist

The aim of this project is to address the interlinked challenges of poverty and a deteriorating natural resource base not only in the Shire Basin but in Malawi as a whole, to reduce the process of environmental degradation and improve the productive potential of natural resources. Responsible for assisting with compiling a consolidated network of catchment management guidelines that address best practice for land and natural resources management for the Malawi government. Oversight of production of a series of videos targeted at village-level audience.

Western Cape Provincial road materials supply strategy, Western Cape Province, South Africa, Provincial Government of the Western Cape (PGWC): Department of Transport and Public Works, 02/2008 - 11/2015, Environmental Specialist

Aurecon was appointed for prospecting suitable road making materials, sampling, testing and identifying technically suitable sources to be used for both identified projects and as strategic pits as well as for getting all the required approvals. Responsibilities included environmental screenings of two potential borrow pits as required under the National Environmental Management Act (NEMA) (No 107 of 1998).

Diane Erasmus Environmental Specialist

High level environmental and social pre-feasibility assessment of proposed coal mine and power station near Mbeya, south of Rukwa Lake, Tanzania, Rukwa Development Company, 11/2014 - 09/2015, Environmental Specialist

Aurecon was appointed to undertake pre-feasibility studies of the mine and power station, respectively, and this aspect included an overview of the environmental and social aspects of the project.

Proposed construction of a second bridge across the River Niger between Onitsha and Asaba, Delta State, Nigeria, Nigeria Sovereign Investment Authority (NSIA), 05/2014 - 09/2015, Project Manager

Aurecon was appointed to provide the lead consultancy services for the environmental and social impact assessment (ESIA) for the proposed bridge over the Niger River, including the identification of environmental risks for the proposal, a scoping and EIA study as well as the development of an environmental management plan (EMP). Responsible for the environmental process, including the financial management of the budget, project coordination and the management of a team of 19 sub-consultants.

Sustainability training course, KwaZulu-Natal Province, South Africa, Pragma, 2015, Environmental Specialist

Aurecon was appointed to compile and present a one day training course on sustainable development for Pragma. Responsible for compilation of the course and for presenting twice to asset managers at the eThekwini Metropolitan Municipality.

Three photovoltaic power plants and associated infrastructure, Namibia, NamPower, 2014 - 2015, Environmental Specialist

Aurecon was appointed to undertake the environmental processes for three PV plants in Namibia in accordance with Namibian environmental legislation. Responsible for advice throughout the project and review of all documentation.

Morupule B Phase II, 300 MW Brownfield Coal IPP, Central District, Botswana, Ministry of Minerals, Energy and Water Resources (MMEWR), Botswana, 06/2014 - 12/2014, Environmental Specialist

Aurecon was appointed as the technical advisor to the government of Botswana for the development of 2 new X 150 MW coal fired power units at next to the existing units. Responsible for overseeing the environmental aspects of the appointment, including drawing up terms of reference for the environmental process to be undertaken.

Proposed hydropower station and associated infrastructure at Boegoeberg dam on the Orange River, near Groblershoop, Northern Cape Province, South Africa, Boegoeberg Hydro Electric Power (Pty) Ltd, 06/2013 - 04/2014, Project Manager

Aurecon was appointed to provide the lead consultancy services for the environmental impact assessment (EIA) for the proposed 15 MW hydro power station at Boegoeberg, including the identification of environmental risks for the proposal, a scoping and EIA study and the development of an environmental management plan (EMP). Responsible for the environmental process, including the financial management of the budget, project coordination and the management of a team of 5 sub-consultants.

Update to rapid strategic environmental assessment (SSEA): Development of a pilot catchment management plan, Uganda, Ministry of Water and Environment (Uganda), 08/2013 - 09/2013, Environmental Coordinator

Appointed to prepare a pilot catchment management plan for the Awoja Catchment. Major social and environmental issues within the catchment area were identified early in the process as critical informants to catchment management planning so these can be integrated into the planning process at an early stage. The SSEA has focussed on identifying the issues and conditions in the catchment related to water and natural resources that are likely to be a major influence, and that might represent important risks, as linked to potential water resource development options. Coordinated the environmental in-out into the catchment management plan (i.e. the SSEA).

Pre-feasibility study and screening for fatal flaws for the increase in capacity for the Kouga Dam, Eastern Cape Province, South Africa, Department of Water Affairs (DWA), 10/2012 - 03/2013, Environmental Coordinator

A pre-feasibility study was undertaken to investigate potential raising of the Kouga Dam in the Baviaanskloof World Heritage Site. The feasibility study has identified potential environmental and social risks associated with the various options considered. Responsible for coordination of environmental input into the overall study.

Social and environmental impact assessments (SEIA) process for the proposed mining of the Z20 uranium deposit, Namibia, Rössing Uranium, 2012, Reviewer

Aurecon and SLR Environmental Consulting were appointed to manage the social and environmental impact assessments (SEIA) process for the proposed mining of the Z20 uranium deposit. This entailed undertaking a baseline description and assessment of impacts and the development of an environmental management plan (EMP), as well as public participation. Responsible for the internal review of the scoping report.

Environmental and socio-economic impact assessment (ESEIA) for a fuel storage facility in the Etosha National Park, Namibia, Millennium Challenge Account (MCA), 2011 - 2012, Project Manager

The project involved an environmental and socio-economic impact assessment (ESEIA) to assess the impact of a fuel storage facility at Okaukuejo in the Etosha National Park. This included a baseline description and environmental impact assessment study and the development of an environmental management plan (EMP), as well as public participation. Responsible for the management of the environmental process; financial management of the budget; client interaction; and writing of reports.

Environmental and socio-economic impact assessment (ESEIA) for the proposed coal-fired power station at Arandis, Namibia, Namibian Power Corporation (NamPower), 2011 - 2012, Project Manager

The project entailed an environmental and socio-economic impact assessment (ESEIA) for a proposed coal-fired power station at Arandis. The ESEIA included a site screening and selection process, a scoping and environmental impact assessment study and the development of an environmental management plan (EMP). Responsible for the management of the environmental process; financial management of the budget; project co-ordination; and management of a team of 11 sub-consultants.

Environmental and socio-economic impact assessment (ESEIA) for the infrastructure upgrading in Etosha National Park, Etosha, Namibia, Millennium Challenge Account (MCA), 2010 - 2011, Project Manager

Aurecon was appointed to provide the lead consultancy services for the environmental and socio-economic impact assessment (ESEIA) for proposed upgrading of infrastructure within two zones of the Etosha National Park. This included the identification of the preferred sites for development, a socio-economic census of the park residents, using a multi-criteria decision analysis (MCDA) model, a baseline description and environmental impact assessment (EIA) study and the development of an environmental management plan (EMP), as well as public participation. Responsible for the environmental process, including the financial management of the budget, project coordination and the management of a team of 6 sub-consultants.

Health, safety, environment and quality (HSEQ) brochure for Rössing Uranium's expansion project, Namibia, Rössing Uranium, 2010 - 2011, Team Member

The project involved the compilation of a succinct report describing the Rössing Uranium health, safety, environmental and quality (HSEQ) management system (HSEQ brochure). The report will serve as an annexure to various environmental and social impact assessments (ESIA's), and environmental and social management plans (ESMP's) currently underway. The aim is to provide the authorities and other readers with an adequate understanding of the system and the various management policies, programmes and procedures already in use at the mine. Responsible for providing technical input and assisting with the compilation of the HSEQ brochure.

North Corridor Development project: railway line in Malawi, Malawi, Vale, 12/2010, Package Manager

The project involved the management of the public participation aspect of the environmental impact assessment (EIA) to investigate the development of railway infrastructure to transport coal from the Moatize mine in Mozambique to the Port of Nacala in Mozambique, through Southern Malawi. The public participation process (PPP) for this project involved a thorough approach, including a number of public and stakeholder meetings at national, district and local level to ensure the engagement of the affected parties in the process. Responsible for managing the environmental process; management of specialists; client interaction regarding technical aspects; public participation; and writing of the reports.

Technical feasibility study to investigate future expansion of the Lüderitz Port, Namibia, The Namibian Ports Company (Pty) Ltd (Namport), 2010, Environmental coordinator

A technical feasibility study was undertaken to investigate future expansion of the Lüderitz Port as a key step to the expansion of Namport's national operations. The feasibility study has identified a possible development scenario for the port. Responsible for coordination of environmental input into the overall study, including management of marine and social specialists.

Environmental and socio-economic impact assessment (ESEIA) for the proposed coal-fired power station at Walvis Bay, Namibia, Namibian Power Corporation (NamPower), 2008 - 2009, Project Manager

Aurecon was appointed by the Namibian Power Corporation (NamPower) to provide the lead consultancy services for the environmental and socio-economic impact assessment (ESEIA) for the proposed coal-fired power station at Walvis Bay, including the identification of environmental boundaries for the proposal, a site screening and selection process, a scoping and environmental impact assessment (EIA) study and the development of an environmental management plan (EMP). Responsible for the environmental process, including the financial management of the budget, project coordination and the management of a team of 12 sub-consultants.

Assessment of alternative alignments for the railway line in Malawi, Malawi, Vale, 2008, Team Member

The project involved the assessment of the environmental aspects of four alternative alignments for railway infrastructure to transport coal from the Moatize Mine in Mozambique to the Port of Nacala, through Southern Malawi. A multi-criteria decision analysis (MCDA) was undertaken of the four alternatives to consider the best solution from a variety of perspectives. Responsible for technical input; managing the input from the environmental team; and writing of reports.

Paratus emergency generation facility in Walvis Bay, Walvis Bay, Namibia, Namibian Power Corporation (NamPower), 2008, Lead Consultant

The project entailed managing the environmental process in relation to a proposed 50 MW heavy fuel oil emergency electricity generation facility located in the industrial port area. Responsible for the environmental process, including the financial management of the budget, project coordination, and the management of a team of sub-consultants.

Floating liquefied natural gas (LNG) facility in the Mossel Bay area, Western Cape Province, South Africa, PetroSA, 2008, Public Participation Process (PPP) Manager

The project involved the management of the public participation aspect of the environmental impact assessment (EIA), as appointed by PetroSA to investigate the development of infrastructure for the importation of liquefied natural gas (LNG) in Vleesbaai, west of Mossel Bay, in order to augment the supply of gas to its existing gas-to-liquid (GTL) facility located in the vicinity of Mossel Bay. Responsible for managing the public consultation process related to the EIA.

Garden Route environmental management framework (EMF), Western Cape Province, South Africa, Earth Inc./Department of Environmental Affairs and Tourism (DEAT), 2008, Environmental Engineer

Aurecon was appointed to contribute to the hydrology and infrastructure information layers and provision of local liaison support for the development of the Garden Route environmental management framework (EMF), focusing on the Kaaimans River to Noetzie study area on the Garden Route in the Southern Cape. Responsible for providing input into the process.

Upgrading of the Knysna wastewater treatment works (WWTW), Western Cape Province, South Africa, Knysna Local Municipality, 2007, Project Manager

The project entailed undertaking a scoping and an environmental impact assessment (EIA) process in terms of National Environmental Management Act (NEMA). Responsible for management of the environmental process; project coordination; management of a team of six sub-consultants; client interaction; financial management of the project; and writing of reports.

Coal-fired power station and associated infrastructure in the Witbank area, Mpumalanga Province, South Africa, Eskom, 2007, Team Member

The project entailed assisting in dealing with the appeal process on the positive authorisation for the 5 400 MW base-load power plant and associated infrastructure. Responsible for assisting with the environmental impact assessment (EIA) appeal process.

Review of the biodiversity components of municipal spatial development frameworks (SDFs) in the Cape Action for People and the Environment (C.A.P.E.) domain, Western Cape Province, South Africa, South African National Biodiversity Institute (SANBI), 2007, Project Manager

The project involved the provision of an overview of the requirements for biodiversity in spatial development frameworks (SDF's), and an assessment of the current status of biodiversity in these SDF's. Responsible for undertaking the review of numerous SDF's, and the compilation of a feedback report.

Review of applications to develop under the Environmental Conservation Act (Act 73 of 1989) (ECA), Eastern Cape Province, South Africa, Eastern Cape Provincial Government, 2007, Team Member

The project involved the provision of an independent review of a range of development applications. Responsible for acting as independent reviewer.

Residential development, Romansbaai Beach and Country Estate, Gansbaai, Western Cape Province, South Africa, Pinnacle Point Developments, 2006, Project Manager

The project entailed undertaking an environmental impact assessment (EIA) for this residential development in a sensitive environment. The EIA involved the identification of development opportunities and constraints, management of a large team of specialists and extensive public participation. Responsible for managing the EIA process; managing a team of sub-consultants; interaction with clients; financial management of the project; and writing of reports.

Mixed use development, Klapmuts, Western Cape Province, South Africa, Simondium Development Trust, 2006, Project Manager

The project involved undertaking the scoping stage of the environmental impact assessment (EIA) process for a mixed density township development, Klapmuts Housing Estate, in the Western Cape. Responsible for management of the EIA process; management of a team of sub-consultants; client interaction; financial management; and writing of reports.

Cape Point Wine Estate, Noordhoek, Western Cape Province, South Africa, Private developer, 2006, Project Manager

The project undertook an environmental impact assessment (EIA) for the development of a restaurant and hotel development, with a housing component for a property in the heart of Noordhoek. Responsible for management of the EIA process; management of a team of sub-consultants; client interaction; financial management of the project; and writing of reports.

Residential development, Montagu Country Estate, Montagu, Western Cape Province, South Africa, Private developer, 2006

The project undertook an environmental impact assessment (EIA) for the residential development around an existing golf course. Responsible for the management of the environmental process; project coordination; management of a team of sub-consultants; client interaction; financial management of the project; and writing of reports.

Proposed communications mast, Newlands, Cape Town, Western Cape Province, South Africa, City of Cape Town, 2006, Project Manager

The project involved the compilation of a scoping checklist for the proposed mast for upgraded communications for the electrical supply system for the City of Cape Town. Responsible for management of the EIA process; client interaction; financial management; and writing of reports.

Environmental management plan (EMP): Sunnydale housing development, Sunnydale, South Peninsula, Western Cape Province, South Africa, Private developer, 2006, Project Manager

The project entailed the compilation the environmental management plan (EMP) for the construction phase for this housing development. Responsible for managing the EMP process and providing training for the construction staff.

Environmental management plan (EMP) for the Glen Housing development, Camps Bay, Cape Town, Western Cape Province, South Africa, Private developer, 2006, Project Manager

The project involved the compilation of the environmental management plan (EMP) for the construction phase for this housing development. Responsible for managing the EMP process; and training for construction staff.

Environmental management plan (EMP) for the Heritage Park development, Somerset West, Western Cape Province, South Africa, Private developer, 2005, Project Manager

The project involved the compilation of the environmental management plan (EMP) for the construction phase for this housing development. Responsible for managing the EMP process and providing training for the construction staff.

Redevelopment of the Heartlands site for AECI Limited, Somerset West, Western Cape Province, South Africa, Melanie Attwell Heritage Consultants, 2005, Public Participation Process (PPP) Manager

The project involved undertaking the public participation process (PPP) for the heritage impact assessment (HIA) process for the project. Responsible for managing the PPP.

Change in land use for housing, Mfuleni, Western Cape Province, South Africa, City of Cape Town, 2005, Project Manager

The project involved the compilation of a scoping checklist for the proposed development of low cost housing in Cape Town. Responsible for managing the environmental management plan (EMP) process; client interaction and writing of reports.

Cellular communication structures for MTN, Western Cape Province, South Africa, MTN, 1998 - 2005

The project involved undertaking the environmental process for 65 cellular communications base stations throughout the Western Cape. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Environmental management plan (EMP) for Heron Banks Golf Course development, Sasolberg, Free State Province, South Africa, Private developer, 2005, Project Manager

The project involved the compilation of the environmental management plan (EMP) for the operational phase of this golf course and housing development on the banks of the Vaal River. Responsible for managing the EMP process.

Skuifraam repeater station, Franchhoek, Western Cape Province, South Africa, Telkom, 2004, Project Manager

The project involved the compilation of a scoping checklist for a repeater site to allow for enhanced radio communications during the construction phase of the Berg River Dam. Responsible for managing the environmental impact assessment (EIA) process; client interaction and writing of reports.

Township development, Heritage Park, Somerset West, Western Cape Province, South Africa, Somerset Trust Business Park, 2004, Project Manager

The project involved undertaking an environmental impact assessment (EIA) process for the development of this residential and commercial township development. Responsible for managing the EIA process; client interaction and writing of reports.

Upgrading of the Excelsior Hotel, Swiss Farm, Franschhoek, Western Cape Province, South Africa, Private developer, 2004, Project Manager

The project entailed the compilation of a scoping checklist for upgrade to the existing facilities of the hotel. Responsible for managing the environmental impact assessment (EIA) process; client interaction and writing of reports.

Change in land use, Kommetjie, Western Cape Province, South Africa, Private landowner, 2004, Project Manager

The project entailed the compilation a scoping checklist for the change in land use to a small piece of land on the urban edge. Responsible for managing the environmental impact assessment (EIA) process; including client interaction and writing of reports.

Residential development, Onrus, Western Cape Province, South Africa, Private landowner, 2004, Project Manager

The project involved the compilation of a scoping checklist for the change in land use to a small piece of land on the urban edge. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Residential development, Parow, Cape Town, Western Cape Province, South Africa, Private landowner, 2004, Project Manager

The project involved the compilation of a scoping checklist for the change in land use of a small piece of open space in the centre of an existing residential area. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Radio network for the train system in the Karoo, Western Cape Province, South Africa, Transtel, 2002 - 2004, Project Manager

The project involved the undertaking of the screening process and scoping checklists for 15 sites throughout the Karoo, as part of the upgrade to the radio network system for trains. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Environmental management plan (EMP) for Abelone Farm, Hawston, Western Cape Province, South Africa, Private developer, 2004, Project Manager

The project entailed the compilation of the environmental management plan (EMP) for the construction phase for this development. Responsible for managing the EMP process.

Upgrade to the City of Cape Radio Trunking Network for Emergency Services, Cape Town, Western Cape Province, South Africa, City of Cape Town, 2003 - 2004, Project Manager

The project involved undertaking the scoping process for 13 sites as part of the upgrade to the City of Cape radio trunking network for emergency services. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Upgrade to Village Drums and Pails facility in Phillipi, Western Cape Province, South Africa, Village Drums and Pails, 2003, Project Manager

The project involved undertaking the scoping process upgrade to facilities for drum reconditioning. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Environmental management plan (EMP) for Hillside Farm, Kommetjie, Western Cape Province, South Africa, DC & Associates, 2003, Project Manager

The project involved the compilation of the environmental management plan (EMP). Responsible for managing the EMP process and providing training for the construction staff.

Environmental management plan (EMP) for Farm Groot Paternoster No. 1014, Groot Paternoster Punt, Western Cape Province, South Africa, Private developer, 2003, Project Manager

The project involved the compilation and overseeing of the implementation of the environmental management plan (EMP) for the construction phase for this development. Responsible for managing the EMP process and training of construction staff.

Development of a cellular communications network for Cell C, Cape Town, Western Cape Province, South Africa, Siemens, 2002 - 2003, Project Manager

The project undertook the screening process and scoping checklists for 31 cellular communications base stations. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Residential development, Sunnydale, Cape Town, Western Cape Province, South Africa, DC & Associates, 2002, Project Manager

The project involved the compilation of a scoping checklist for the change in land use of an agricultural area for residential development. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Radio trunking sites for Telkom communications system, Sutherland, Western Cape Province, South Africa, Telkom, 2002, Project Manager

The project entailed undertaking the screening process and scoping reports for 27 sites for an upgraded communications system in this isolated area. This project was selected by Telkom as part of the best practice document (BPD) presented at the World Summit for Sustainable Development (WSSD) in Johannesburg in 2002. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Change in land use for the establishment of a church: remainder of Farm 766, Phillipi, Western Cape Province, South Africa, Ebenezer Baptist Church, 2002, Project Manager

The project involved undertaking the screening report and scoping checklist for the change in land use for the establishment of a church. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Change in land use, Panache Country Lodge, Erf 7754, Hout Bay, Western Cape Province, South Africa, Private landowner, 2002, Project Manager

The project involved the compilation of a screening report and a scoping checklist for the change in land use to allow for resort facilities. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Environmental management plan (EMP): water supply pipeline, Moorreesberg, Western Cape Province, South Africa, MVD, 2002, Project Manager

The project involved the compilation and overseeing of the implementation of the environmental management plan (EMP) for the construction phase for this development. Responsible for managing the EMP process, including construction staff training.

Environmental management plan (EMP) for Celestewood development in Sunnydale, South Peninsula, Western Cape Province, South Africa, Private developer, 2002, Project Manager

The project involved the compilation and overseeing of the implementation of the environmental management plan (EMP) for the construction phase for this housing development. Responsible for managing the EMP process, including construction staff training.

Change in land use, Portion 3 of Pardekloof Farm No 475, Caledon, Western Cape Province, South Africa, Private landowner, 2002, Project Manager

The project entailed the compilation of a screening report and scoping checklist for a change in land use of sensitive mountain fynbos for resort development. Responsible for managing the environmental impact assessment (EIA) process, including client interaction and writing of reports.

Environmental management plan (EMP) for farm dams, De Dam, Oudtshoorn, Western Cape Province, South Africa, Private landowner, 2002, Project Manager

The project involved the compilation of the environmental management plan (EMP) for the construction phase for the dam construction. Responsible for managing the EMP process.

Environmental management plan (EMP) for the City of Cape Town Radio Trunking System, Western Cape Province, South Africa, City of Cape Town, 2001, Project Manager

The project involved the compilation and overseeing of the implementation of the environmental management plan (EMP) for the construction phase for the construction phase of 14 sites. Responsible for managing the EMP process and training the construction staff.

Upgrade to the Stony Point area, Betty's Bay, Western Cape Province, South Africa, Hangklip-Kleinmond Municipality, 2001, Project Manager

The project entailed undertaking a scoping exercise for the upgrade to the area. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Water supply pipeline, Moorreesberg, Western Cape Province, South Africa, MVD, 2001, Project Manager

The project involved undertaking the scoping process for the water supply system to the agricultural area. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Construction and upgrade of farm dams, De Dam Farm, Oudtshoorn, Western Cape Province, South Africa, Private landowner, 2001, Project Manager

The project entailed undertaking the screening process and scoping checklist for the construction of one farm dam and the upgrading of another. Responsible for managing the environmental impact assessment (EIA) process; including client interaction and writing of reports.

Residential development, Portion 12 of Farm 214, Brackenfell, Western Cape Province, South Africa, Terraplan Associates, 2001, Project Manager

The project undertook a scoping exercise for the residential development proposed for the area. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Residential development, Portion 25 of Cape Farm 951, Sunnydale, Cape Town, Western Cape Province, South Africa, DC & Associates, 2001, Project Manager

The project entailed the compilation of a scoping checklist for the change in land use of an agricultural area for residential development. Responsible for managing the environmental impact assessment (EIA) process; client interaction; and report writing.

Development of a cellular communications network for Motorola, Cape Town, Western Cape Province, South Africa, Motorola, 2000 - 2001, Project Manager

This project, as part of the bid to become the third cellular network provider in South Africa, involved the undertaking of the screening process for blanket exemptions for 135 cellular communications base stations sites throughout Cape Town. Responsible for the environmental impact assessment (EIA) process, client interaction and report writing.

MTN cellular communication structures: application for exemption, Cape Town, Western Cape Province, South Africa, MTN, 2000, Project Manager

The project involved undertaking the screening process for blanket exemptions for 12 sites for MTN. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Development of a cellular communications network for Lucent Technologies, Cape Town, Western Cape Province, South Africa, Lucent Technologies, 2000, Project Manager

This project, as part of the bid to become the third cellular network provider in South Africa, involved the undertaking of the screening process for blanket exemptions for 45 cellular communications base stations sites throughout Cape Town. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Review of applications to develop under the Environmental Conservation Act (Act 73 of 1989), Western Cape Province, South Africa, Provincial Government of the Western Cape (PGWC), 1998 - 2000, Reviewer

The project involved the provision of an independent review of a range of development applications. Responsible for the review applications.

Environmental management plan (EMP) for the Sixteen Mile Beach housing development, Yzerfontein, Western Cape Province, South Africa, Private developer, 1999, Project Manager

The project involved the compilation of the environmental management plan (EMP) for the operational phase of this housing development. Responsible for managing the EMP process.

MTN cellular communications base stations: Environmental management system (EMS), South Africa, MTN, 1999, Project Manager

The project was concerned with controls for the construction periods - guidelines for MTN. Responsible for managing the environmental impact assessment (EIA) process.

Crematorium, Somerset West, Western Cape Province, South Africa, Excem, 1999, Project Manager

The project entailed undertaking the environmental evaluation and application report for a crematorium in Helderberg. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Industrial development, Klipheuwel, Western Cape Province, South Africa, Private developer, 1999, Project Manager

The project involved undertaking an environmental evaluation and report for exemption for an industrial development. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Low cost housing development, Saron, Western Cape Province, South Africa, Rumboll & Verster, 1999, Project Manager

The project entailed undertaking the environmental evaluation and report for exemption for the low cost housing development. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Residential development, Jantjiesfontein, Berg River, Western Cape Province, South Africa, Rumboll & Verster, 1999, Project Manager

The project involved undertaking the environmental evaluation and report for exemption for the housing development. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Faunal assessment for the development at Silverstroom, Atlantis, Western Cape Province, South Africa, Knight Hall & Hendry, 1999, Project Manager

The project entailed undertaking a specialist faunal study as part of the environmental impact assessment (EIA) process. Responsible for providing specialist input.

Faunal assessment for a housing development on Pappegaaiberg, Stellenbosch, Western Cape Province, South Africa, SRK Consulting, 1998, Project Manager

The project entailed undertaking the specialist faunal study as part of the environmental impact assessment (EIA) process. Responsible for giving specialist input.

Faunal assessment for the housing development at Uitkamp, Durbanville, Western Cape Province, South Africa, Doug Jeffery Environmental Consultants, 1998, Specialist

The project involved undertaking a specialist faunal study as part of the environmental impact assessment (EIA) process. Responsible for giving specialist input.

Environmental management plan (EMP) for Jacobuskraal housing development, Yzerfontein, Western Cape Province, South Africa, Private developer, 1998, Project Manager

The project entailed the compilation of the environmental management plan (EMP) for the operational phase of this housing development. Responsible for managing the EMP process.

Residential development, Muizenberg East, Cape Town, Western Cape Province, South Africa, Ogden Entertainment, 1997, Project Manager

The project involved undertaking the environmental evaluation for a housing development. Responsible for managing the environmental impact assessment (EIA) process, client interaction and report writing.

Faunal assessment for the Paradyskloof Golf Estate, Stellenbosch, Western Cape Province, South Africa, SRK Consulting, 1997, Specialist

The project entailed undertaking specialist faunal study as part of the environmental impact assessment (EIA) process. Responsible for giving specialist input.

Assessment of the preservation of biotic diversity in forestry plantations, South Africa, Timber Growers Association, 1997, Project Manager

The project entailed the assessment of the contribution of the forestry industry to the preservation of biodiversity in South Africa. Responsible for managing the environmental input.

Faunal assessment for the Sparrebos development, Knysna, Western Cape Province, South Africa, SRK Consulting, 1996, Specialist

The project involved undertaking a specialist faunal study as part of the environmental impact assessment (EIA) process. Responsible for giving specialist input.

APPENDIX I:
Declarations of interest

Original signed decelerations from specialists to be provided in the final Basic Assessment. Some decelerations have been provided in the various specialists reports

APPENDIX 8
DECLARATION OF THE APPLICANT

I, Nazley Towfie ________________ are that I -

- am, or represent[2], the applicant in this application;
- have appointed / will appoint (delete that which is not applicable) an environmental assessment practitioner to act as the independent environmental assessment practitioner for this application / will obtain exemption from the requirement to obtain an environmental assessment practitioner[3];
- will provide the environmental assessment practitioner and the competent authority with access to all information at my disposal that is relevant to the application;
- will be responsible for the costs incurred in complying with the Regulations, including but not limited to –
  - costs incurred in connection with the appointment of the environmental assessment practitioner or any person contracted by the environmental assessment practitioner;
  - costs incurred in respect of the undertaking of any process required in terms of the Regulations;
  - costs in respect of any fee prescribed by the Minister or MEC in respect of the Regulations;
  - costs in respect of specialist reviews, if the competent authority decides to recover costs; and
  - the provision of security to ensure compliance with conditions attached to an environmental authorisation, should it be required by the competent authority;
- will ensure that the environmental assessment practitioner is competent to comply with the requirements of the Regulations and will take reasonable steps to verify that the EAP
  - know the Act and the regulations, and how they apply to the proposed development
  - know any applicable guidelines
  - perform the work objectively, even if the findings do not favour the applicant
  - disclose all information which is important to the application and the proposed development
  - have expertise in conducting environmental impact assessments
  - complies with the Regulations
- will inform all registered interested and affected parties of any suspension of the application as well as of any decisions taken by the competent authority in this regard;
- am responsible for complying with the conditions of any environmental authorisation issued by the competent authority;
- hereby indemnify the Government of the Republic, the competent authority and all its officers, agents and employees, from any liability arising out of the content of any report, any procedure or any action which the applicant or environmental assessment practitioner is responsible for in terms of these Regulations;
- will not hold the competent authority responsible for any costs that may be incurred by the applicant in proceeding with an activity prior to obtaining an environmental authorisation or prior to an appeal being decided in terms of these Regulations;
- will perform all other obligations as expected from an applicant in terms of the Regulations;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

____
Signature[4] of the applicant[5]/ Signature on behalf of the applicant:

juwi Renewable Energies Pty Ltd
____
Name of company (if applicable):

23 March 2017
____
Date:

---

[2] If this is signed on behalf of the applicant, proof of such authority from the applicant must be attached.
[3] If exemption is obtained from appointing an EAP, the responsibilities of an EAP will automatically apply to the person conducting the environmental impact assessment in terms of the Regulations.
[4] Only original signatures will be accepted. No scanned, copied or faxed signatures will be accepted.
[5] If the applicant is a juristic person, a signature on behalf of the applicant is required as well as proof of such authority. An EAP may not sign on behalf of an applicant.

APPENDIX 9

DECLARATION OF THE EAP

I, **Patrick James Killick** ıre that –

General declaration:

- I act as the independent environmental practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the Regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence in terms of regulation 48 of the Regulations and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

Signature of the environmental assessment practitioner:

Aurecon South Africa (Pty) Ltd

Name of company:

4 April 2017

Date:

APPENDIX J:
Additional Information

APPENDIX J.1:

Hydrology peer review

HYDROLOGIC CONSULTING (PTY) LTD

CONSULTING HYDROLOGISTS

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15 March 2017

HOTAZEL SOLAR PARK – SURFACE WATER SPECIALIST REPORT REVIEW

In reviewing the report, comments have been made in the original word document provided. In a few instances, I have amended some of the grammar/punctuation errors picked up, however, I have tried to avoid recommending alterations based on writing style.

The overall comment is that a surface water assessment of the proposed Hotazel Solar Park likely doesn't need more than a high-level review (as provided) along with generic erosion control measures due to slight increases in hardstanding and exposure of soils due to clearing. A simple calculation to determine expected runoff rates/volumes could help to establish this unless the author in using Cook and McCuen (2013) wants to establish a clear precedent for not considering any formal drainage on a site such as this. In this case, more detail from the aforementioned reference is needed. While improvements to the report have been recommended, I found the scope, methodology, and findings relating to the impacts and mitigations (as supported by the Aurecon EMPr and appended general specifications) to be generally adequate for the intended purpose.

In broad terms – my professional opinion is that the proposed development is not likely to have a significant impact on the surface water environment (pre or post mitigation). This makes the following review comments less significant (in comparison to a more hydrologically sensitive site).

The main findings of the review are as follows:

- Solar Park
  - The structure of the report is in need of attention. There is an issue with the heading of the Solar Park impacts section. The Transmission Lines section suddenly appears, having not been referred to in the project description – although this appears due to the Transmission Lines being tacked on as an 'extra' for the Basic Assessment process. A read through to improve the flow of the report would be beneficial.
  - Some of the data is disaggregated between sections. i.e. independent soils data is mentioned after the section on soils and land use. This could just be my personal reservation though.
  - A structured CV is missing although a section on specialist details is included (which may be adequate)
  - An overview of the hydrology of the surrounding area would have helped in understanding the hydrological setting and the proximity of watercourses – one was provided for the transmission lines but not the solar park (which only included a site layout).
  - The 6-hour storm was used to broadly assess runoff potential based on infiltration rates and the depth of rainfall. Why 6 hours has been used is unknown as other durations may have had more value.
  - A simple Rational Method calculation would establish likely runoff volumes/rates and may provide a justification towards the stormwater management approach which would be more robust than pointing out rainfall depths and infiltration rates.
  - A study by Cook and McCuen (2013) forms the foundation for the assessment of stormwater management on site. Additional detail would be useful given the weight of this reference.
  - The addition of gravel under panels is indicated as requiring stormwater management, whereas if natural vegetation is kept – no stormwater management is needed. It is my opinion that gravel would have a marginal impact on the generation of stormwater on site. Compaction of surface would lead to increased runoff, whereas gravel would serve to slow down runoff and enhance infiltration, much like natural vegetation. The use of gravel in locations where below solar panels (where kinetic energy of water is expected to be higher) seems to be a sensible recommendation.
  - The consideration of cumulative impacts in the vicinity of the site appears to only account for other solar farms and not all activities.

  - The impacts section needs to have an introduction to help the reader understand what is being assessed.
  - Only two parts of the solar parks infrastructure have been assessed and impacts relating to service roads, collector substation, O&M area, temporary and other infrastructure are absent. Assessment of the cumulative impact of the site infrastructure is also unclear as this could be referred to the cumulative impact of other solar parks/activities in the vicinity.
  - A generic comment on the storage of fuels and lubricants is also missing.
  - As a hydrologist, I am unable to establish the significance of an impact in relation to other specialisms (the work of the environmental practitioner collating the reports). I have consequently not considered the identified magnitudes (high/low etc.) in much detail.
- Transmission Lines
  - A reference to topography in the transmission lines section needs to be expanded on as to whether it excludes the floodplain – since topography and flooding are linked.
  - I made a personal (potentially valid) comment on the reference to a freshwater specialist versus a surface water specialist (hydrologist)
  - Only the Umtu line crosses a river yet each transmission line is indicated as possibility restricting flow

Table 1 presents the DEA specific terms of reference, while Table 2 presents comments as per the requirements of Appendix Six from NEMA (2014). These comments are not complete as some information is missing.

TABLE 1: DEA SPECIFIC TERMS OF REFERENCE

A CV clearly showing expertise of the peer reviewer:	*Included.*
Acceptability of the terms of reference;	*Acceptable, although Cook and McCuen (2013) is a foundational reference requiring more detail.* *See primary write-up for more detail*
Is the methodology clearly explained and acceptable;	*A high-level assessment is undertaken which means that a detailed methodology is not included.* *See primary write-up for more detail*
Evaluate the validity of the findings (review data evidence);	*Baseline data used to inform the assessment appears accurate.*
Discuss the suitability of the mitigation measures and recommendations;	*Proposed mitigation measures are adequate, although erosion protection below solar panels should be included due to increase kinetic energy (e.g. gravel strips)* *See primary write-up for more detail*
Identify any shortcomings and mitigation measures to address the short comings;	*The primary shortcoming is that the site as a whole isn't assessed – or at least it is not clear that it is assessed. Mitigation measures are nevertheless likely adequate.* *See primary write-up for more detail*
Evaluate the appropriateness of the reference literature;	*References included are appropriate.*
Indicate whether a site-inspection was carried out as part of the peer review (site visit not mandatory); and	*No site-inspection was carried out as part of the peer review.*
Indicate whether the article is well-written and easy to understand.	*The report was well written but could benefit from structural changes and a read through to improve the flow.*

TABLE 2: APPENDIX SIX (NEMA, 2014) - SPECIALIST REPORTS

1	A specialist report prepared in terms of Regulation GNR 982 Appendix 6, must contain-	
(a)	details of-	
(i)	*the specialist who prepared the report; and*	*Indicated on document control record*
(ii)	*the expertise of that specialist to compile a specialist report including a curriculum vitae*	*Indicated in Section 1.2.5* *Structured CV is missing*
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority	*Not provided*
(c)	an indication of the scope of, and the purpose for which, the report was prepared	*Outlined in Section 1.2 and 1.1*
(d)	the date and season of the site investigation and the relevance of the season to the outcome of the assessment	*Specified in Section 1.2.2*

1	A specialist report prepared in terms of Regulation GNR 982 Appendix 6, must contain-	
		Season is not included – although outcome of investigation is independent to season.
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process	*Section 1.2.3 and 1.2.4*
(f)	the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	*Section on 'Impact Tables' although section heading is missing.* *Not all activities accounted for*
(g)	an identification of any areas to be avoided, including buffers	*Applicable to transmission lines only due to absence of rivers on solar farm site. 100m recommended as buffer distance.*
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	*Figure 2 presents site layout* *100m buffer not included in Figure 11 – Transmission lines route*
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge	*None included*
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment	*Section on 'Impact Tables' although section heading is missing.* *Section 5.1 – Impact Assessment – Transmission Lines*
(k)	any mitigation measures for inclusion in the EMPr	*Included in both impacts sections*
(l)	any conditions for inclusion in the environmental authorisation	*None*
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*None*
(n)	a reasoned opinion-	
(i)	*as to whether the proposed activity or portions thereof should be authorised*	*Section 6 - Summary*
(ii)	*if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan*	*Mitigation measures included in Section 4.1, 4.2, 5.1 and in the two solar park and transmission lines impact sections. These are supported by generic mitigation measures contained in the EMPr and associated "general specifications", and collectively these are deemed adequate.*
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report	*Unknown*
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto	*Unknown*
(q)	any other information requested by the competent authority	*Unknown*

M Bollaert

PrSciNat, CSci, CEnv, C.WEM

(Reviewer)

Mark Bollaert
Hydrologist Hydrologic Consulting *Curriculum Vitae*

Mark Bollaert ***Curriculum Vitae***

Hydrologist

Hydrologic Consulting

Qualifications

Pr.Sci.Nat	2012	Professional Natural Scientist - Water Resources (Reg. 400115/12)
C.WEM	2011	Chartered Water and Environmental Manager (Reg. 36849)
CEnv	2011	Chartered Environmentalist (Reg.6623)
CSci	2011	Chartered Scientist (Reg. WEM/105/000508)
MSc	2007	Hydrology, University of KwaZulu Natal
BSc (Hons)	2003	Hydrology, University of KwaZulu Natal
BSc	2002	Hydrology and Geography, University of Natal

Key Areas of Expertise

Key areas of Mark's expertise are summarised below.

Stormwater Management	Stormwater management plans designed as per requirements of GN 704 and IFC guidance (where applicable)
Water Sensitive Urban Design	Conceptual design and layout of sustainable drainage systems in order to enable a low impact development, mimicking the natural hydrological regime.
Flood Hydrology	Catchment delineation, flood peak and hydrograph estimates, using a variety of techniques
Hydraulic Modelling	Development and review of 1D, 2D and 1D/2D hydraulic models for fluvial, tidal and stormwater investigations, including flood-line delineation
Catchment Modelling	Modelling of hydrological catchments for the purposes of defining average and low-flow conditions, as well as the impact of land use change
Surface Water Impact Assessments	Reporting on surface water impacts, constraints and opportunities as part of Environmental Impact Assessments (EIAs)
Water Quality Monitoring	Surface and groundwater monitoring as per authorised or investigative monitoring programs including sampling, analysis and interpretation
Water Licencing	Integrated water use license applications (WULAs) according to DWS standards
Mine Wide Water Balances	Development and evaluation of dynamic and static mine wide water balances
GIS	Application of project-oriented GIS for the purposes of mapping and modelling as well as provision of technical GIS support
Project Management	Project management skill developed to handle projects from proposal to report completion, including client, relevant authority and multidisciplinary team coordination

Summary of Experience

Mark has over 10 years of experience working as a hydrologist in both the United Kingdom and South Africa during which time he has worked on various hydrological studies for residential, industrial, commercial, mining, power, transport and government sectors. Mark began his professional career in London, following the completion of a Mater of Science in degree in hydrology at the University of KwaZulu-Natal. During his three years in London, he primarily worked on flood risk assessments, stormwater management plans and sustainable drainage systems associated with industrial, commercial and residential developments. At the end of his stay in the United Kingdom, Mark was applied for and was subsequent awarded professional qualifications as a chartered scientists, charted environmentalist and chartered water and environmental manager. Upon his return to South Africa, Mark joined the environmental consulting company Metago (now SLR) for over two years where he continued in his professional development with a focus on the mining sector, during which time he qualified as a professional natural scientist in water recources . From July 2012, Mark started his own company, Hydrologic Consulting where he continues in his role as a hydrologist. During his time with Hydrologic Consulting, Mark has worked in various sectors with the majority of his work involving stormwater management, flooding and surface water impact assessments.

Recent Project Experience

Some of Mark's more recent project experience is summarised below and includes a combination of roles as presented in the key areas of expertise.

Client	Project	Country	Year
Water Research Commission	Regional Water Sensitive Urban Design Scenario Planning for Cape Town	South Africa	2016
Gestamp Wind	Copperton Wind Farm Hydrological Assessment and Flood Study	South Africa	2016
Circum Minerals	Sustainable Water Resource Options for the Danakil Project	Ethiopia	2016
Auroch Minerals NL	Update to the Manica Gold Stormwater and Flood Study	Mozambique	2016
Tati Nickel Mining Company	Hydrological Assessment for Selkirk Mine	Botswana	2016
DRDGold	Withok Tailings Complex Attenuation Dam Study	South Africa	2016
Commissiekraal	Hydrological Assessment of the Proposed Coal Mine	South Africa	2016
Morobe Mining	Wafi Golpu Feasibility Study	Papua New Guinea	2015
Lonmin	Lonmin Stormwater Management Plans Phase 2	South Africa	2015
Impala Platinum	Shaft 18 Stormwater Management Plan	South Africa	2014
TSB Sugar	Massingir Sugarcane Plantation Assessment	Mozambique	2014
Portucel Pulp and Paper	Manica and Zambezia Afforestation Assessment	Mozambique	2014
Impala Platinum	Impala Stormwater Management Plans	South Africa	2013
Transnet	Mposa River Crossing Assessment	South Africa	2013
ENI Oil and Gas	Hydrological Baseline Assessment of the Proposed LNG Sites	Mozambique	2012
Lonmin	Lonmin Stormwater Management Plans Phase 1	South Africa	2012

APPENDIX J.2:

Traffic peer review

deca
CONSULTING ENGINEERS

Contact Person: *Liezl du Plooy*
Your Ref: *112667*
Our Ref: *D198*
Date: *16 March 2017*

Aurecon South Africa (Pty) Ltd
Aurecon Centre
1 Century Drive
Waterford Precinct
Century City
7441

For attention: Mr. Patrick Killick

Sir

PEER REVIEW OF THE TRANSPORT IMPACT ASSESSMENT FOR THE PROPOSED HOTAZEL SOLAR PARK

1. INTRODUCTION

Deca Consulting Engineers were approached by Aurecon to review the Traffic and Transport Impact Assessment (TIA) conducted by Aurecon's traffic engineering branch for the above mentioned project. The review was undertaken by Ms. Liezl du Plooy, a registered professional engineer with a Masters Degree in Transport Studies. A curriculum vitae is attached to this letter.

The Terms of Reference set by Aurecon for the traffic impact investigation were sufficient and acceptable.

2. COMPLIANCE WITH ADMINISTRATIVE REQUIREMENTS

The copy of the document supplied to Deca did not include a CV of the report's author as stipulated in Appendix 6 of the NEMA Requirements for Specialist Reports. The qualifications of the author and supervisor were indicated on the report's cover page and are sufficient. The supervisor is known to Ms. Du Plooy and has years of expertise in the field of transportation.

A declaration indicating the independence of the author was not attached.

The purpose and scope of the report, as well as assumptions made were set out clearly. A list of acronyms and abbreviations would have been helpful for readers unfamiliar with electrical engineering terms. The date of the report is March 2017. The roads and traffic operations in the area where the project is located are not subject to seasonal change and therefore the season in which the investigation was done is irrelevant. Although not specifically stated in the report's introductory chapters, the methodology followed by the report's author was sound and sufficiently covered all aspects relating to traffic and transport.

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MEMBERS: L. DU PLOOY PR. ENG | P. ENGELBRECHT PR. TECH ENG • REG NO: 98/10478/23
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Drawings showing the location of the project site, the roads surrounding the site and routes from ports to the site are provided in the report, but more detail such as route numbers and distances between sites would have illustrated the text more clearly.

3. ASSESSMENT OF TECHNICAL ASPECTS

The scope of work is set out clearly and covers all aspects relating to the transport impact of the project. The reviewer is of the opinion that the assumptions made to determine trip generation figures, existing traffic conditions, freight transport requirements and mitigation measures are of an acceptable technical standard. The assumption regarding foundations on page 9 is not entirely clear.

The traffic study did not include a site visit or traffic counts on the roads that will be affected by the project. The background traffic volumes (available and estimated) are very low, which allows for a large margin of error in the assumptions regarding volumes. The expected traffic operations during the various phases of the project are set out logically. Deca is in agreement with the findings of the traffic study and the contents of the traffic impact rating table.

More detail could have been provided on the traffic impact of the transmission lines' construction. Again, the generated traffic as well as background traffic volumes are so low that Deca agrees that the impact will be negligible.

No written description of the site was provided in the "Site Description" section and the sketch provided is not clear. Detail of the site was, however, provided in Table 1.

The section on the preferred routes from ports to the site is clear and contains sufficient detail. The description of the access road is sufficient and proposals made for the construction of this road are good.

4. CONCLUSIONS

The contents of the report and the technical aspects are up to standard. Deca agrees with the conclusions drawn from and recommendations made in the study. Some sections were not entirely clear upon first glance and required interpretation by the reader. Some references to Figures were incorrect and some Figures require more detail. Little can be done to mitigate the traffic impact, but the measures that were proposed are logical and can be practically implemented.

In conclusion it can be stated that the Aurecon report gives a good reflection of the impact that the Hotazel Solar Park will have on traffic and transport on roads affected by the project.

We trust that you will find this peer review in order. Kindly contact Liezl du Plooy at telephone number 082 338 6466 should you have any questions.

LduPlooy

Liezl du Plooy M. Eng Pr. Eng
Deca

ABBREVIATED CURRICULUM VITAE

LIEZL DU PLOOY

Liezl du Plooy is a professional engineer and director at Deca Consulting Engineers. She received her Civil Engineering degree from the University of Stellenbosch in 1998, and started her career as a civil engineering contractor the following year. Liezl was subsequently employed as transport engineer at Helderberg Municipality until she joined ICE Boland as a consulting engineer in 2002, where she became co-owner and manager in 2008. She was registered as a professional engineer in 2008 and completed her master's degree in Transport Studies at the University of Cape Town in 2011. Liezl became a Director at DECA consulting engineers with the re-branding of ICE Boland as DECA Consulting Engineers in 2014. Liezl has done work in the fields of public transport operations, infrastructure and planning, non-motorised transport planning and infrastructure, transport impact assessments, transport planning, infrastructure design and feasibility studies. She has a special interest in the compilation of transport plans and traffic management plans, as well as transport information systems.

Qualifications

- Baccalaureus in Civil Engineering, University of Stellenbosch, 1998
- Masters in Civil Engineering (Transport Studies), University of Cape Town, 2011

Professional Affiliations

- Professional Engineer, Engineering Council of South Africa, 2008
- Corporate Member of the SA Institute of Civil Engineers, 2016

Employment history

- 1999: Site engineer and site agent at LTA Limited
- 1999 - 2002: Traffic Engineer at Helderberg Municipality
- 2002 – 2008: Civil engineer and manager at ICE Boland consulting engineers
- 2008 – 2014: Co-owner, manager and engineer at ICE Boland consulting engineers
- 2014 - 2016: Director at Deca Consulting Engineers

SELECTED PROJECTS REFLECTING LIEZL DU PLOOY'S EXPERIENCE

Transport impact assessments for public housing developments

- Citrusdal low cost housing TIA for ASLA, 710 erven, 2011
- McGregor low cost housing TIA for ASLA, 522 erven, 2013
- Tulbagh low cost housing TIA for ASLA, 2000+ units, 2006
- Vredebes, Ceres, low cost housing TIA, 2000+ units, 2014
- Bella Vista, Ceres, low cost housing TIA, 300 units, 2014
- Idasvallei low cost & gap housing TIA, 290 units, 2015
- Goodwood Station social housing TIA, 360 units, 2015
- Heideveld Station social housing TIA, 182 units, 2015
- Retreat station social housing TIA, 168 units, 2015
- Phola Park low cost housing TIA, 226 erven, 2015

Non-motorised transport

- Ceres cycle paths (Witzenberg Municipality)
- Stellenbosch non-motorised transport infrastructure provision (Stellenbosch Municipality)
- George Blake Street non-motorised transport route, Stellenbosch (Stellenbosch Municipality)
- Sidewalk, Slanghoek Primary School, Slanghoek (Cape Winelands District Municipality)
- Sidewalk and footpaths, Bella Vista Primary School, Bella Vista (Witzenberg Municipality)
- Sidewalk and public transport facility, Kliprug Primary School, Prince Alfred's Hamlet (Witzenberg Municipality)
- Sidewalks and bus embayments, Bon Esperance School, De Doorns (Breede Valley Municipality);
- Footpath, Skurweberg Secondary School, Op-die-Berg (Witzenberg Municipality)

Roads and Traffic Engineering

- Durbanville Town Centre transport impact assessment
- Vredebes Housing Development transport impact assessment
- Phola Park transport impact assessment
- Shell Masterplan, City of Cape Town northern and eastern growth districts
- Traffic impact assessments for Asla housing developments in Citrusdal, McGregor, Prince Alfred's Hamlet and Bella Vista
- Onverwacht Village / Summer Club traffic impact assessment

Planning, design, contract administration and construction supervision of traffic engineering projects

- Design, project management and construction supervision of a number of local improvements to the Stellenbosch cycle route and pedestrian route networks, including ramps, new sidewalks and dropped kerbs and medians to ensure universal accessibility. Project value: R1,2 million, construction completed;
- Vos Street / Voortrekker Street traffic signals, Ceres, construction completed;
- Nduli taxi rank, construction completed;
- Design of intersections, access, sidewalks and parking garage layout for Centre Point shopping centre, Milnerton.

Transport planning

- Hermanus CBD revitalisation
- Kleinbaai and De Kelders nodal development studies
- Overberg District Municipality CPTR, OLS, PTP and ITP
- Franschhoek Transport Master Plan
- Faure Marine Drive, Gordon's Bay, Traffic Management Plan
- Beach Road, Strand, Traffic Management Plan

Public transport projects

- Grabouw taxi rank
- Strand taxi rank
- Shoprite Worcester taxi rank
- Voortrekker Street and Vos Street Ceres taxi embayments

Traffic signals

Traffic signal staging plans are calculated by using traffic counts and the SIDRA intersection analysis software, with fine tuning on site to allow for holiday peaks, off-peaks, driver characteristics. Some projects include:

- Planning and implementation of new traffic signals at La Belle Road / Winelands Close intersection, Bellville
- New staging plans for Voortrekker Street / Vos Street and Voortrekker Street / Owen Street intersections in Ceres;
- Implementation of new traffic signals at R102 / Kramat Road intersection in Croydon, George Street / Broadway Boulevard and Victoria Street / Broadway Boulevard intersections in Strand.

Feasibility studies

- Feasibility study for the implementation of traffic signals at the R102 / Kramat Road intersection in Croydon, measuring the economic cost of safety (damage to vehicles, injuries, lives lost) and the economic cost of delay (time lost in traffic) versus financial cost of implementation;
- West Coast Engen filling station, Vredenburg: feasibility study in terms of financial viability, traffic impact and social impact (job creation, economic stimulation);
- Langverwacht Engen filling station, Kuilsrivier: feasibility study
- Zevenwacht Shell filling station, Kuilsrivier: feasibility study
- Borcherd's Quarry Road filling station, Airport Industria: feasibility study

Information Systems

- Transport database for Franschhoek on IMQS
- Assistance with the costing of traffic-related infrastructure and hardware for municipal asset registers;
- Population and maintenance of Signview database of traffic and information signs and road markings for Helderberg Municipality (now incorporated into the City of Cape Town).

Investigations and options analyses

- Development of a development contribution policy for Overstrand Municipality;
- Investigation into the impact of a regional landfill site for Eden District Municipality on road condition and traffic on the N2 and various rural roads including the analyses of three site and a number of route options in terms of traffic impact, environmental impact and cost;
- Beach Road, Strand, Traffic Management Plan, including the investigation of various intersection control and road environment (four-lane road, two-lane road, one-way system, pedestrianised beachfront) alternatives, public participation process, options analyses and implementation.

Funding applications

- Application for funding from the Western Cape Government Department of Transport and Public Works for the upgrading of intersections and road sections on Trunk Road 22/2, Ceres;
- Application for funding from the Western Cape Government Department of Transport and Public Works for Phase 2 of the Grabouw Taxi Rank, including lighting, paving, road marking and signage;
- Application for Western Cape Provincial Government public transport funds for the provision of a taxi rank in De Doorns and bus embayments with related pedestrian safety measures at Bon Esperance school, including the drafting of business plans, meetings with authorities, managing of funds and monthly reporting during the construction period.

Licence applications

- Drafting of an Operating Licence Strategy for minibus taxis in the Overberg District, including the Theewaterskloof area.

APPENDIX J.3:

250m interval route coordinates for all alternatives

	Latitude (S):	Longitude (E):	Latitude (S):	Longitude (E):	Latitude (S):	Longitude (E):	
Chainage	Alternative 1 (Hotazel)		Alternative 2 (Umtu)		Alternative 3 (LILO)		
0.00 km	27°14'17.54"S	23° 0'35.19"E	27°14'17.54"S	23° 0'35.19"E	27°14'17.54"S	23° 0'35.19"E	All three follow same route
0.25 km	27°14'18.23"S	23° 0'35.80"E	27°14'18.23"S	23° 0'35.80"E	27°14'18.23"S	23° 0'35.80"E	
0.50 km	27°14'22.95"S	23° 0'28.40"E	27°14'22.95"S	23° 0'28.40"E	27°14'22.95"S	23° 0'28.40"E	
0.75 km	27°14'27.68"S	23° 0'21.00"E	27°14'27.68"S	23° 0'21.00"E	27°14'27.68"S	23° 0'21.00"E	
1.00 km	27°14'32.48"S	23° 0'13.62"E	27°14'32.48"S	23° 0'13.62"E	27°14'32.48"S	23° 0'13.62"E	
1.25 km	27°14'37.24"S	23° 0'6.16"E	27°14'37.24"S	23° 0'6.16"E	27°14'37.24"S	23° 0'6.16"E	
1.50 km	27°14'41.97"S	22°59'58.75"E	27°14'41.97"S	22°59'58.75"E	27°14'41.97"S	22°59'58.75"E	
1.75 km	27°14'46.78"S	22°59'51.33"E	27°14'46.78"S	22°59'51.33"E	27°14'46.78"S	22°59'51.33"E	
2.00 km	27°14'51.49"S	22°59'43.87"E	27°14'51.49"S	22°59'43.87"E	27°14'51.49"S	22°59'43.87"E	
2.25 km	27°14'56.20"S	22°59'36.47"E	27°14'56.20"S	22°59'36.47"E	27°14'56.20"S	22°59'36.47"E	
2.50 km	27°15'0.99"S	22°59'29.07"E	27°15'0.99"S	22°59'29.07"E	27°15'0.99"S	22°59'29.07"E	
2.75 km	27°15'5.73"S	22°59'21.68"E	27°15'5.73"S	22°59'21.68"E	27°15'5.73"S	22°59'21.68"E	
3.00 km	27°15'10.53"S	22°59'14.24"E	27°15'10.53"S	22°59'14.24"E	27°15'10.53"S	22°59'14.24"E	
3.25 km	27°15'15.64"S	22°59'6.21"E	27°15'15.64"S	22°59'6.21"E	27°15'15.64"S	22°59'6.21"E	
3.50 km	27°15'11.47"S	22°58'58.46"E	27°15'11.47"S	22°58'58.46"E	27°15'20.39"S	22°58'58.87"E	Umtu and Hotrazel follow same route
3.75 km	27°15'7.18"S	22°58'50.70"E	27°15'7.18"S	22°58'50.70"E	27°15'25.11"S	22°58'51.43"E	
4.00 km	27°15'2.90"S	22°58'42.98"E	27°15'2.90"S	22°58'42.98"E	27°15'29.80"S	22°58'44.06"E	
4.25 km	27°14'58.65"S	22°58'35.23"E	27°14'58.65"S	22°58'35.23"E	27°15'34.60"S	22°58'36.61"E	
4.50 km	27°14'54.42"S	22°58'27.52"E	27°14'54.42"S	22°58'27.52"E	27°15'39.36"S	22°58'29.16"E	
4.75 km	27°14'50.12"S	22°58'19.77"E	27°14'50.12"S	22°58'19.77"E	27°15'44.11"S	22°58'21.76"E	
5.00 km	27°14'45.89"S	22°58'11.98"E	27°14'45.89"S	22°58'11.98"E	27°15'48.88"S	22°58'14.40"E	
5.25 km	27°14'41.61"S	22°58'4.22"E	27°14'41.61"S	22°58'4.22"E	27°15'53.60"S	22°58'6.89"E	
5.50 km	27°14'37.39"S	22°57'56.52"E	27°14'37.39"S	22°57'56.52"E	27°15'59.75"S	22°57'57.34"E	
5.75 km	27°14'33.60"S	22°57'49.69"E	27°14'33.60"S	22°57'49.69"E			
6.00 km	27°14'30.47"S	22°57'41.33"E	27°14'30.47"S	22°57'41.33"E			
6.25 km	27°14'28.88"S	22°57'36.80"E	27°14'27.30"S	22°57'32.73"E			
6.50 km	27°14'20.76"S	22°57'37.88"E	27°14'25.57"S	22°57'23.81"E			
6.75 km	27°14'12.65"S	22°57'38.85"E	27°14'23.88"S	22°57'14.91"E			
7.00 km	27°14'4.67"S	22°57'39.79"E	27°14'22.15"S	22°57'6.05"E			
7.25 km	27°13'55.63"S	22°57'40.96"E	27°14'20.52"S	22°56'57.14"E			
7.50 km	27°13'47.58"S	22°57'40.11"E	27°14'18.76"S	22°56'48.32"E			
7.75 km	27°13'39.51"S	22°57'39.24"E	27°14'17.15"S	22°56'39.36"E			
8.00 km	27°13'31.42"S	22°57'38.42"E	27°14'15.38"S	22°56'30.52"E			
8.25 km	27°13'23.35"S	22°57'37.60"E	27°14'13.70"S	22°56'21.67"E			
8.50 km	27°13'15.22"S	22°57'36.71"E	27°14'12.24"S	22°56'14.15"E			
8.75 km	27°13'7.15"S	22°57'35.86"E	27°14'4.59"S	22°56'11.18"E			
9.00 km	27°13'1.69"S	22°57'35.32"E	27°13'56.89"S	22°56'8.28"E			
9.25 km	27°12'54.44"S	22°57'31.19"E	27°13'49.21"S	22°56'5.31"E			
9.50 km	27°12'49.56"S	22°57'28.51"E	27°13'41.51"S	22°56'2.37"E			
9.75 km	27°12'41.62"S	22°57'30.82"E	27°13'33.83"S	22°55'59.43"E			
10.00 km	27°12'35.02"S	22°57'32.89"E	27°13'26.15"S	22°55'56.49"E			
10.25 km	27°12'27.14"S	22°57'30.89"E	27°13'17.34"S	22°55'53.14"E			
10.50 km	27°12'22.14"S	22°57'29.58"E	27°13'16.93"S	22°55'44.02"E			
10.75 km			27°13'16.43"S	22°55'34.93"E			
11.00 km			27°13'16.10"S	22°55'25.89"E			
11.25 km			27°13'15.61"S	22°55'16.80"E			
11.50 km			27°13'15.12"S	22°55'7.76"E			
11.75 km			27°13'14.74"S	22°54'58.67"E			
12.00 km			27°13'14.31"S	22°54'49.57"E			
12.25 km			27°13'13.88"S	22°54'40.43"E			
12.50 km			27°13'13.45"S	22°54'31.37"E			
12.75 km			27°13'12.84"S	22°54'18.33"E			