SOUTH AFRICA MAINSTREAM RENEWABLE POWER DEVELOPMENTS (PTY) LTD

Proposed Construction of the !Xha Boom On-site Eskom Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province

Draft Basic Assessment Report

DEA Reference:	**To be Announced**
Issue Date:	14 December 2017
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Document Title:	Proposed Construction of the !Xha Boom On-site Eskom Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province: Draft Basic Assessment Report.
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Version Number:	1
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Signature:	
For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Portion 1 of the Farm Graskoppies No. 176	C01500000000017600001
Portion 2 of the Farm Graskoppies No. 176	C01500000000017600002
Portion 7 of the Farm Konnes No. 183	C01500000000018300007
The Farm Buchufontein No. 184	C01500000000018400000
Portion 2 of the Farm Aan De Karree Doorn Pan No. 213	C01500000000021300002
Remainder of the Farm Aan De Karree Doorn Pan No. 213	C01500000000021300000
Portion 1 of the Farm Karree Doorn Pan No. 214	C01500000000021400001
Portion 2 of the Farm Karree Doorn Pan No. 214	C01500000000021400002
Remainder of the Farm Springbok Tand No. 215	C01500000000021500000
Portion 1 of the Farm Hartebeest Leegte No. 216	C01500000000021600001
Portion 2 of the Farm Georg's Vley No. 217	C01500000000021700002
Portion 1 of the Farm Sous No. 226	C01500000000022600001
Portion 3 of the Farm Sous No. 226	C01500000000022600003
Remainder of the Farm Sous No. 226	C01500000000022600000
Remainder of the Farm Klein Rooiberg No. 227	C01500000000022700000
The Farm Leeubergrivier No. 1163	C01500000000116300000
The Farm Springbok Pan No. 1164	C01500000000116400000

The proposed !Xha Boom On-site Eskom Substation will be located on Portion 2 of the Farm Georg's Vley No. 217, while the proposed Linking Substation will be located on Portion 1 of the Farm Hartebeest Leegte No 216. It should be noted that a preferred power line corridor alternative has not yet been determined and therefore it is unclear at this stage which farms / properties will be traversed and/or affected by the proposed 132kV power line. As such, the table above includes details of all of the farms / properties which are traversed and/or affected by the current proposed power line corridor alternatives. Details of the farms / properties which will be traversed and/or affected by the selected preferred power line corridor will be provided in the FBAR once a preferred power line corridor alternative has been selected.

!XHA BOOM ON-SITE ESKOM SUBSTATION SITE ALTERNATIVES			
ALTERNATIVE	AREA (HECTARES)	CENTRE POINT COORDINATES	
		SOUTH	EAST
Option 1	2	S30° 17' 41.614"	E19° 16' 50.509"
Option 2	2	S30° 17' 13.641"	E19° 15' 55.620"

It should be noted that for the purpose of this BA, Mainstream are assessing an area of approximately 15 hectares (ha) with regards to the On-site Substation site. However, only an area of approximately 2ha will be used for the construction of the proposed On-site substation.

LINKING SUBSTATION SITE ALTERNATIVES			
ALTERNATIVE	**AREA (HECTARES)**	**CENTRE POINT COORDINATES**	
		SOUTH	**EAST**
Option 1	5	S30° 19' 23.315"	E19° 20' 4.455"
Option 2	5	S30° 18' 46.373"	E19° 18' 45.622"

It should be noted that for the purpose of this BA, Mainstream are assessing an area of approximately 36 hectares (ha) with regards to the proposed Linking Substation site. However, only an area of approximately 5ha will be used for the construction of the proposed linking substation.

!XHA BOOM 132kV POWER LINE CORRIDOR ALTERNATIVES				
CENTRE LINE COORDINATES (DD MM SS.sss)				
CORRIDOR ALTERNATIVE	**START POINT**	**MIDDLE POINT**	**END POINT (MOOKODI SUBSTATION)**	**APPROX LENGTH (KM)**
Option 1	S30° 17' 8.659"	S30° 20' 6.409"	S30° 29' 58.002"	52.20
	E19° 15' 47.319"	E19° 27' 39.274"	E19° 33' 37.699"	
Option 2	S30° 17' 8.659"	S30° 20' 25.669"	S30° 29' 58.002"	52.80
	E19° 15' 47.319"	E19° 27' 34.292"	E19° 33' 37.699"	
Option 3	S30° 17' 8.659"	S30° 24' 23.227"	S30° 29' 58.002"	47.00
	E19° 15' 47.319"	E19° 24' 44.885"	E19° 33' 37.699"	
Option 4	S30° 17' 8.659"	S30° 19' 3.132"	S30° 29' 58.002"	53.40
	E19° 15' 47.319"	E19° 29' 30.547"	E19° 33' 37.699"	

Refer to **Appendix 9A** for the full list of coordinates.

TITLE DEEDS / WINDEEDS: Mainstream were unable to obtain the actual title deeds for the affected farms / properties. As such, Mainstream obtained WinDeed information for the affected farms / properties. These are incuded in **Appendix 9B**.

PHOTOGRAPHS OF SITE:

It should be noted that the substation in the photograph above is the exisiting Eskom Helios Main Transmission Substation (MTS) which is located adjacent to the district road that connects the town of Loeriesfontein with Granaatboskolk to the north. This substation is not located on the site proposed for the !Xha Boom Wind Farm (Part of a separate on-going EIA process)

It should be noted that the substation in the photograph above is Mainstream's On-site Khobab IPP substation which has recently been constructed on a different property as part of the Khobab Wind Farm.This substation is not located on the site proposed for the !Xha Boom Wind Farm (Part of a separate on-going EIA process)

General Characteristics of the study area

STRUCTURE HEIGHT: The type of towers being considered for the proposed power line at this stage include self-supporting suspension monopole structures (**Figure i**) for relatively straight sections of the power line and angle strain towers where the route alignment bends to a significant degree. The steel monopole tower type is between 18m and 25m in height, depending on the terrain, but will be high enough to ensure minimum overhead line clearances from buildings and surrounding infrastructure. The exact height of the towers will be determined during the final design stages of the power line. In addition, the heights of the proposed On-site Eskom and Linking Substations are not known at this stage and will be determined during the design stages of the respective substations. It should however be noted that the highest component of the proposed development would be the lightning masts which have a height of up to 23m.The rest of the components (i.e. busbars etc.) would have a height of between 4m and 10m).

Figure i: Example of the proposed Tower Type

SURFACE AREA TO BE COVERED: It should be noted that for the purpose of this BA, Mainstream are assessing areas of approximately 15ha and 36ha for the proposed !Xha Boom On-site Eskom Substation and Linking Substation sites respectively. However, only areas of approximately 2ha and 5ha will be used for the construction of the proposed On-site Eskom and linking substations respectively. In addition, the surface area which is to be covered by the proposed power line towers has not been determined yet. The final design details are yet to be confirmed and will become available during the detailed design phase of the project. At this stage it can however be confirmed that the servitude width for the proposed 132kV power line will be up to 31m.

SUBSTATION AND POWER LINE DESIGN: The proposed !Xha Boom On-site Eskom Substation and Linking Substation will be on-site substations with voltages of up to 132kV respectively. The !Xha Boom On-site Eskom Substation and Linking Substation will be shared substations connecting the proposed !Xha Boom Wind Farm project (part of a separate on-going EIA process) to the existing Eskom Helios Main Transmission Substation (MTS). As previously mentioned, for the purpose of this BA, Mainstream are assessing areas of approximately 15ha and 36ha for the proposed !Xha Boom On-site Eskom Substation and Linking Substation sites respectively. However, only areas of approximately 2ha and 5ha will be used for the construction of the above-mentioned substations respectively. A power line of up to 132kV is proposed and will run from the proposed !Xha Boom On-site Eskom Substation to the existing Helios MTS. The 132kV power line will consist of a series of towers located approximately 170m to 250m apart, depending on the terrain, and will have a servitude width of 31m. It should be noted that the exact location of the towers will be determined during the final design stages of the power line. At this stage, the typical structures being considered include self-supporting suspension monopole structures (**Figure i**) for relatively straight sections of the power line and angle strain towers where the route alignment bends to a significant degree. The steel monopole tower type is between 18m and 25m in height, depending on the terrain, but will be high enough to ensure minimum overhead line clearances from buildings and surrounding infrastructure. Access roads to the !Xha Boom On-site Eskom Substation and Linking Substation will form part of the associated infrastructure.

SUBSTATION AND POWER LINE CAPACITY: The proposed !Xha Boom On-site Eskom Substation, Linking Substation and associated power line will have voltages of up to 132kV respectively.

A3 Maps of all smaller maps included in the report are included in **Appendix 5**.

SOUTH AFRICA MAINSTREAM RENEWABLE POWER DEVELOPMENTS (PTY) LTD

PROPOSED CONSTRUCTION OF THE !XHA BOOM ON-SITE ESKOM SUBSTATION, LINKING SUBSTATION AND ASSOCIATED 132KV POWER LINE NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE

DRAFT BASIC ASSESSMENT REPORT

Executive Summary

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as “Mainstream”) are proposing to construct a 33kV/132kV On-site Eskom Substation (namely the !Xha Boom Substation), a 132kV Linking Substation and an associated 132kV power line near Loeriesfontein in the Northern Cape Province (hereafter referred to as the “proposed development”). SiVEST Environmental Division (hereafter referred to as “SiVEST”) has subsequently been appointed as Independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment (BA) process for the proposed development. The overall objective of the proposed development is to feed the electricity generated by Mainstream’s proposed !Xha Boom Wind Farm (part of a separate on-going EIA process) into the national grid by constructing the proposed !Xha Boom On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line.

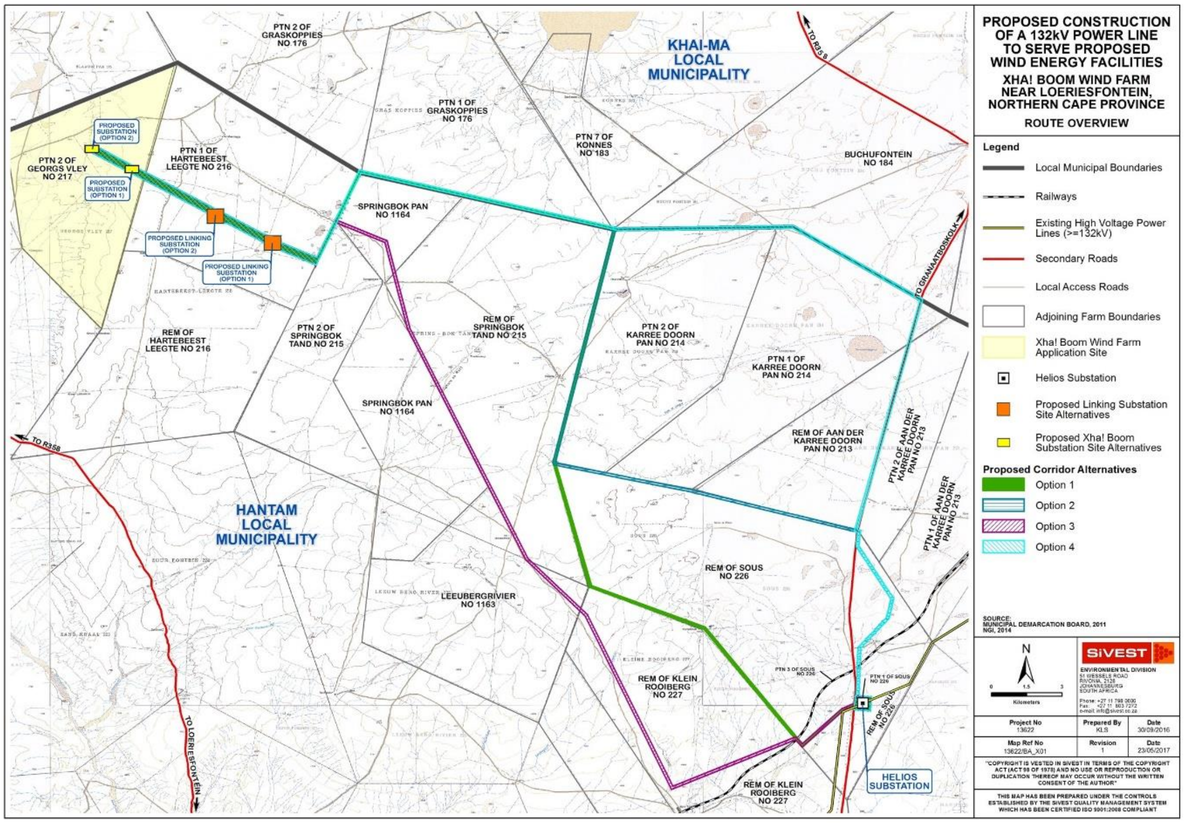

Figure ii: Route overview for the proposed !Xha Boom On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line

The proposed !Xha Boom On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line will connect the proposed !Xha Boom Wind Farm to the existing Eskom Helios Main Transmission Substation (MTS) (**Figure ii**). The !Xha Boom Wind Farm is currently subject to a separate on-going Environmental Impact Assessment (EIA) process. This proposed wind farm forms one (1) of four (4) wind farms with a 235MW export capacity that Mainstream are proposing to develop near the town of Loeriesfontein within the Northern Cape Province. The Department of Environmental Affairs (DEA) reference number allocated for the proposed !Xha Boom Wind Farm is **14/12/16/3/3/2/1018**. Additionally, BA processes are being conducted for the proposed Graskoppies, Hartebeest Leegte and Ithemba On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line. The DEA reference numbers for these projects have however not been allocated yet and will be provided in the Final Basic Assessment Report (FBAR). Although the four (4) proposed Mainstream Wind Farm projects (i.e. Graskoppies, Hartebeest Leegte, Ithemba and !Xha Boom Wind Farms) and the four (4) proposed Mainstream electricity generation projects (Graskoppies, Hartebeest Leegte, Ithemba and !Xha Boom On-site Eskom Substations, 132kV Linking Substations and associated 132kV power lines) will be assessed separately, a single public participation process is being undertaken to consider all eight (8) proposed developments.

Figure iii below indicates all of the wind farm and electricity generation (On-site Eskom Substation, Linking Substation and 132kV Power Line) projects being proposed near Loeriesfontein by Mainstream as part of recent applications.

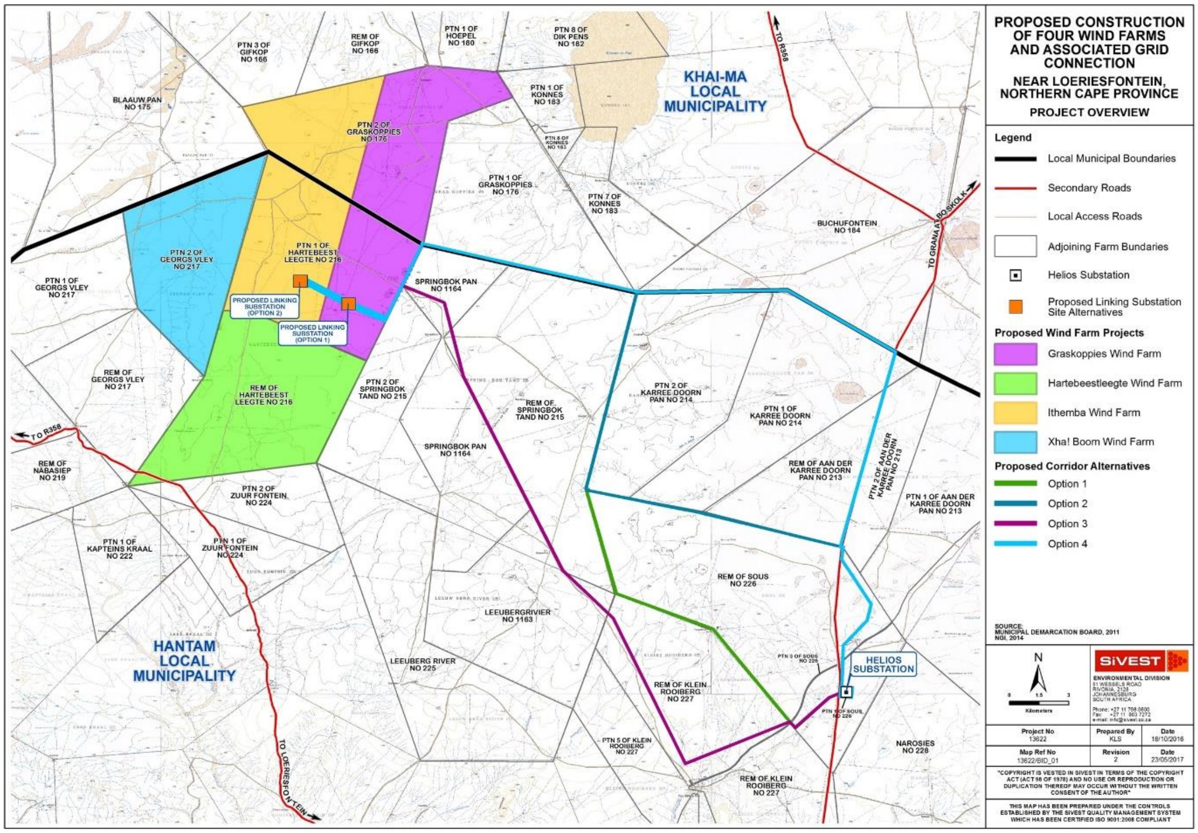

Figure iii: Site locality map showing all Mainstream Wind Farm and Electricity Generation (On-site Eskom Substation, Linking Substation and 132kV Power Line) projects being proposed near Loeriesfontein in the Northern Cape Province as part of recent applications

!XHA BOOM ON-SITE ESKOM SUBSTATION SITE ALTERNATIVES			
ALTERNATIVE	**AREA (HECTARES)**	**CENTRE POINT COORDINATES**	
		SOUTH	**EAST**
Option 1	2	S30° 17' 41.614"	E19° 16' 50.509"
Option 2	2	S30° 17' 13.641"	E19° 15' 55.620"

It should be noted that for the purpose of this BA, Mainstream are assessing an area of approximately 15ha with regards to the On-site Eskom Substation site. However, only an area of approximately 2ha will be used for the construction of the proposed On-site Eskom substation.

LINKING SUBSTATION SITE ALTERNATIVES			
ALTERNATIVE	AREA (HECTARES)	CENTRE POINT COORDINATES	
		SOUTH	EAST
Option 1	5	S30° 19' 23.315"	E19° 20' 4.455"
Option 2	5	S30° 18' 46.373"	E19° 18' 45.622"

It should be noted that for the purpose of this BA, Mainstream are assessing an area of approximately 36ha with regards to the proposed Linking Substation site. However, only an area of approximately 5ha will be used for the construction of the proposed linking substation.

!XHA BOOM 132kV POWER LINE CORRIDOR ALTERNATIVES				
CENTRE LINE COORDINATES (DD MM SS.sss)				
CORRIDOR ALTERNATIVE	START POINT	MIDDLE POINT	END POINT (MOOKODI SUBSTATION)	APPROX LENGTH (KM)
Option 1	S30° 17' 8.659"	S30° 20' 6.409"	S30° 29' 58.002"	52.20
	E19° 15' 47.319"	E19° 27' 39.274"	E19° 33' 37.699"	
Option 2	S30° 17' 8.659"	S30° 20' 25.669"	S30° 29' 58.002"	52.80
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	E19° 15' 47.319"	E19° 29' 30.547"	E19° 33' 37.699"	

Refer to **Appendix 9A** for the full project coordinates.

For the purpose of this BA, Mainstream are assessing areas of approximately 15ha and 36ha for the proposed !Xha Boom On-site Eskom Substation and Linking Substation sites respectively. However, only areas of approximately 2ha and 5ha will be used for the construction of the above-mentioned proposed substations respectively. As previously mentioned, the surface area which is to be covered by the proposed power line towers has not been determined yet. The final design details are yet to be confirmed and will become available during the detailed design phase of the project. At this stage it can however be confirmed that the proposed 132kV power line will have a servitude width of 31m. In addition, the lengths of proposed power line corridor alternatives (i.e. Option 1, Option 2, Option 3 and Option 4) are approximately 52.2km, 52.8km, 47km and 53.4km respectively.

The proposed development requires Environmental Authorisation (EA) from the DEA. However, the provincial authority will also be consulted (i.e. Northern Cape Department of Environment and Nature Conservation (NC DENC)). The EIA for the proposed development will be conducted in terms of the EIA Regulations promulgated in terms of Chapter 5 of the National Environmental Management Act (NEMA), which came into effect on 8 December 2014, and as amended on 7 April 2017. In terms of these regulations, a Basic Assessment (BA) process is required for the proposed development. All relevant legislations and guidelines (including Equator Principles) will be consulted during the BA process and will be complied with at all times.

As previously mentioned, the proposed development involves the construction of an On-site Eskom substation (namely the !Xha Boom Substation) and linking substation with voltage capacities up to 132kV respectively, as well as an associated 132kV power line, which will connect the proposed !Xha Boom Substation to the existing Eskom Helios MTS. It should be noted that corridors between 100m and 300m wide were assessed for the proposed power line, however the final servitude width will only be 31m. In addition, two (2) alternative sites for the proposed On-site Eskom Substation and Linking Substation are being assessed respectively.

The proposed development will be located approximately 68km north of the town of Loeriesfontein in the Northern Cape Province, within the Hantam Local Municipality. The proposed !Xha Boom 33/132kV On-site Eskom Substation will be located on Portion 2 of the Farm Georg's Vley No. 217, while the proposed Linking Substation will be located on Portion 1 of the Farm Hartebeest Leegte No 216. It should be noted that a preferred power line corridor alternative has not yet been determined and therefore it is unclear at this stage which farms / properties will be traversed by the proposed 132kV power line. As such, the farms / properties which will be traversed by the selected preferred power line corridor will be provided in the FBAR. The proposed development can be accessed easily via the N7 towards Kliprand via the R358 regional road or via the N1 to Loeriesfontein. Additionally the proposed development can also be accessed via the district road that connects the town of Loeriesfontein with Granaatboskolk to the north.

According to the National Geo-spatial Information (NGI) (2014) and the South African National Biodiversity Institute (SANBI) (2012), the dominant vegetation class across the study area is Bushmanland Basin Shrubland which is characterised by dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs. The aridity of the area has restricted the vegetation to low shrubs around 30-40 cm in height, distributed uniformly across the landscape, except in areas of disturbance where patches of bare earth occur (Mucina & Rutherford, 2006). Western Bushmanland Klipveld occurs on the north-western boundary of the study area, while Bokkeveld Sandstone Fynbos is present on the south-western boundary. Bushmanland Vloere occurs in and around the salt pans scattered across the eastern half of the study area, and is largely characterized by dwarf shrubs with some loose thicket evident is some areas. Some tree species (some relatively large and some low) can however also be found within certain parts of the study area. In certain areas, man has had an impact on the natural vegetation, especially around some farmsteads, where over many years' tall exotic trees and other typical garden plants have been established.

Several specialist studies were conducted during the BA process to identify issues or legislative implications associated with the proposed development. These include:

- Biodiversity Assessment (fauna and flora);
- Avifauna Assessment;
- Surface Water Assessment;
- Soils and Agricultural Potential Assessment;
- Heritage Assessment;
- Palaeontology Assessment (Desktop);
- Visual Assessment; and
- Socio-Economic Assessment.

Based on the various specialist studies which were conducted, a few potentially sensitive sites have been identified within the study area. These have informed the preliminary assessment of layout alternatives which are included in **Section 11** and will be further assessed. The table below summarises the specialist findings for the entire project.

Table i: Summary of findings

Environmental Parameter	Summary of major findings	Recommendations / Conclusions
Biodiversity	The on-site substation Option1 as well as both the Linking Substation alternatives are located within the Bushmanland Arid Grassland habitat type. The on-site Substation Option 2 is located within the Western Bushmanland Klipveld. These are extensive vegetation units with low diversity and low abundance of species of conservation concern. Consequently, nearly all of the substation alternatives are considered acceptable and would generate low impact. Only on-site Substation Option 2 is considered unfavourable as there a numerous small drainage lines in the affected area. On-site Substation Option 1 was identified as the preferred on-site substation alternatives and while differences are small, Linking Substation Option 1 was identified as the preferred linking substation alternative. In terms of the grid corridors, there was also not a lot of difference between the alternatives and preferences were based on relatively small differences in potential impact as no alternatives were considered fatally-flawed. Grid Corridor Option 2 was identified as the preferred route as there are no highly sensitive features along the route and the last third of the line towards Helios substation is located along existing roads and disturbed areas. The overall impact of this option would be the lowest of the options considered. Grid Corridor Option 4 is considered the next most favourable option as the route is adjacent to existing access routes or power lines	The report concludes that with the application of relatively simple mitigation and avoidance measures, the impact of the !Xha Boom Wind Farm’s grid connection can be reduced to a low overall level. There are no specific long-term impacts likely to be associated with the grid connection that cannot be reduced to an acceptable level through mitigation and avoidance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. All recommended mitigation measures should be implemented and adhered to.

	for large sections of the route with the result that construction-phase disturbance is likely to be relatively low. Although the current assessment is only for the grid connection and substations, the grid connection is contingent on a wind energy facility being built and as such, the development of the power line and the wind farm are not independent of one another. Consequently, cumulative impacts for the power line have been considered in context of the wind farm as a whole, including the grid connection. An analysis of potential cumulative impacts in the area indicates that a node of renewable energy facilities is developing round the Helios Substation. The total potential extent of direct habitat loss from all proposed developments if they were all to be built would amount to about 3000ha. This represents about 1% of the local area and less than 0.1% of the Bushmanland Basin Shrubland or Bushmanland Arid Grassland vegetation type. This indicates that the current developments at the site do not pose a risk of significantly impacting the national availability of the affected units or elevate them to a higher threat status. The development of the !Xha Boom Wind Farm with associated grid connection would generate about 100ha of direct habitat loss which is not considered highly significant and the potential for habitat fragmentation from the development would also be low. The broader study area has low ecological sensitivity and the concentration of development within this low sensitivity area is seen as having significantly less ecological impact compared to a more dispersed development pattern over a wider area. Based on these	

	results, total cumulative impacts and the contribution of the !Xha Boom Wind Farm and associated grid connection to cumulative impacts in the region are seen as being acceptable and would remain of low overall significance.	
Avifauna	The proposed !Xha Boom grid connection and associated substations will have potential impacts on Red Data avifauna. The impacts are the following: ▪ Displacement due to disturbance during construction; ▪ Displacement due to habitat change and loss; and ▪ Collisions with the earthwire of the 132kV grid connection **<u>Displacement due to habitat destruction and disturbance</u>** 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. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through transformation of habitat, which could result in temporary or permanent displacement.	**<u>Displacement due to disturbance during construction</u>** While the habituation is a factor to be considered, it would still be preferable to have an alignment as far as possible from the nest as a pre-cautionary measure to limit the potential for displacement during construction of the grid connection. The proposed !Xha Boom grid connection will have potential impacts on avifauna, ranging from high to low, prior to the implementation of mitigation. With the implementation of mitigation measures, the high impacts could be reduced to medium, while the low impacts can be further reduced. All four the proposed alignments are situated in the same habitat and are of comparable length. The associated impacts are therefore expected to be very similar in nature and extent. However, when looking very carefully at the four respective alignments, Options 1 and 3 are less favourable due to their proximity to the active Martial Eagle nest near Helios Substation. Option 4 emerges as most preferred: ▪ It follows the main Loeriesfontein access road and existing HV lines for about a third of the way, thereby reducing the impact of habitat fragmentation, and reducing the risk of collisions;

	<u>Displacement due to disturbance during construction</u> Construction and maintenance activities could potentially displace Red Data species through disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities could be a source of disturbance and could lead to temporary or even permanent abandonment of nests. The most obvious potential issue that need to be addressed in this instance is the active Martial Eagle nest on the Aries - Helios 400kV line near the Helios substation. The nest was active in June 2017, which indicates that the birds have become habituated to the constant traffic on the dirt road that runs 450m from the nest. This is the main access road to Helios Substation, and is also constantly used by construction vehicles active at the Loeriesfontein 2 and Khobab WEFs. While the habituation is a factor to be considered, it would still be preferable to have an alignment as far as possible from the nest as a pre-cautionary measure to limit the potential for displacement during construction of the grid connection. Options 1 and 3 are approximately 1.2km from the nest at their closest point, while Options 2 and 4 are 2km from the nest at their closest point. The pre-mitigation risk of displacement due to disturbance during the construction phase is rated as low, but could be further reduced through appropriate mitigation. **<u>Displacement through habitat destruction during the construction phases</u>**	▪ About 50% of the alignment is oriented in an east-west direction, which is parallel to the main migration movement of Ludwig's Bustard, therefore reducing the risk of collisions for the species; and ▪ It never comes closer than 2km from the active Martial Eagle nest on the Aries – Helios 400kV line, which reduces the risk of disturbance to the birds.

	In the present instance, the risk of displacement of Red Data species due to habitat destruction is likely to be fairly limited given the nature of the vegetation. Very little if any vegetation clearing will have to be done in the power line servitude itself. The habitat at the proposed !Xha Boom substation sites is common in the greater study area and the transformation of a few hectare of habitat should not impact any of the Red Data species significantly. The risk of displacement through habitat destruction during construction is rated as low, which could be reduced through appropriate mitigation. **Collisions of Red Data species with the earthwire of the 132kV grid connection** The most likely Red Data candidates for collision mortality on the proposed 132kV grid connection are Ludwig's Bustard, Karoo Korhaan, both whom have high reporting rates in the study area. Kori Bustard and Secretary Bird may also be at risk, although they occur at much lower densities than the previous two species. The risk of collision mortality through collisions with the earthwire of the 132kV grid connection is rated as high which can be reduced to medium through appropriate mitigation. **Concluding Statement** Overall, the combined cumulative impacts of the proposed !Xha Boom grid connection and the existing and proposed HV networks on Red Data species, assuming	

	implementation of appropriate mitigation measures, are expected to be moderate to minor within the 40km development node around Helios Substation. The overall cumulative assessment has been produced with a moderate level of certainty.	
Surface Water	Findings from the fieldwork undertaken show that the following surface water resources were identified on the study site: ▪ Five (5) Depression Wetlands; ▪ Twenty six (26) Major Drainage Lines including Klein-Rooiberg, Leeuberg and Hartbeeslaagte (drainage line with a channel width >5m); ▪ One hundred and eighty (180) Minor Drainage Lines (drainage lines with a channel width <5m). An ecological buffer zone of 100m for the major drainage lines and a buffer of 50m for minor drainage lines and the natural depression wetlands have been applied in consideration of the potential direct and indirect impacts which may occur, so as to limit these impacts on the surface water resources as far as practically possible. A comparative assessment was undertaken to determine the environmentally preferred options include the following: ▪ On-site Substation Option 1 ▪ Linking Substation Option 2 ▪ Grid Line Option 3 The above preferred options were chosen given the fewer amount of surface water resources to be directly and	Once a final layout (including a road plan and grid line, showing tower positions) is available, it is recommended that an assessment using the risk assessment protocol in terms of Government Notice 509 of 2016 (No. 40229) is undertaken to potentially determine whether a General Authorisation (GA) can be issued in this regard for water uses (c) and (i) instead of undertaking a full water use license application. Should it be identified that the proposed development falls within the Low risk category, a GA registration process may be applicable as opposed to a full water use license application. Specialist recommendations include the following: ▪ All surface water resources and buffer zones must be avoided as far as practically possible in the final layouts (including access / service roads and power lines, including tower positions) to be designed in order to minimise and potentially avoid potential impacts as far as possible. ▪ Where it is not possible to avoid impacts to surface water resources as a result of roads and power lines, the necessary water use license / general authorisation and environmental authorisations as relevant will be required prior to construction.

	indirectly affected as well as to ability of the grid line to avoid / span potentially affected surface water resources. It was identified that several potential impacts may affect the surface water resources within the proposed development area during the construction, operation and decommissioning phases as alluded to above. **<u>Construction Phase:</u>** ▪ Loss of Wetland and Riparian Habitat; ▪ Impacts to the Geomorphology of Surface Water Resources; ▪ Impacts to Soil and Water in Surface Water Resources; and ▪ Impacts to the Fauna associated with Surface Water Resources. **<u>Operation Phase:</u>** ▪ Impacts to the Geomorphology of Surface Water Resources. From a direct cumulative potential impact perspective, where there is no direct impact to surface water resources on the proposed project site, there will be no direct cumulative impact to surface water resources from a project site specific level. The nearest surrounding development that could potentially be impacted as a result of the proposed development from an indirect perspective is the Kokerboom 2 Wind Farm. This wind farm is located approximately 9km from the proposed development site. Therefore, there is a	▪ All stipulated mitigation measures are to be adhered to in order to minimise potential impacts to surface water resources. ▪ With the implementation of mitigation measures, it is the opinion of this specialist that the proposed development components as per the layout are acceptable (notwithstanding final access / service road layouts, final grid line routes and tower positions) and therefore, may by environmentally authorised.

	fair distance between the proposed development and the nearest surrounding development. The two sites are also separated by a watershed and occupy separate local catchments. Drainage from the proposed development is in a northern direction, whilst drainage for the Kokerboom 2 Wind Farm is in a south eastern direction. As a result, it is therefore highly unlikely that the proposed development will affect the Kokerboom 2 Wind Farm should this development proceed to construction. Indirect impacts such as increased run-off, consequent sedimentation and erosion are highly unlikely. Over and above the negligible potential cumulative impact to Kokerboom 2 Wind Farm, the potential cumulative impact on the remaining surrounding renewable energy developments is negligible for the same reasons, as stated above. The negligible cumulative impact is compounded by the fact that there is an increased distance to the remaining surrounding proposed renewable energy developments. In terms of NEMA (1998) and the EIA Regulations (2017), based on the current layout, it has been identified that Activities 12 and 19 of Government Notice 327 Listing Notice 1 may be triggered due to potential direct impacts due to access / service roads and power lines, thereby requiring Environmental Authorization. In terms of the NWA (1998), it has been identified that based on the current layout, there are a number of surface water resources which may be affected by access / service roads and power lines. Water uses (c) and (i) will therefore be applicable. However, once a final layout (including a road plan and grid line, showing tower positions) is available, it is recommended that an	

	assessment using the risk assessment protocol in terms of Government Notice 509 of 2016 (No. 40229) is undertaken to potentially determine whether a General Authorisation (GA) can be issued in this regard for water uses (c) and (i) instead of undertaking a full water use license application. Should it be identified that the proposed development falls within the Low risk category, a GA registration process may be applicable as opposed to a full water use license application.	
Soils and Agricultural Potential	The proposed development is on land zoned and used for agriculture (grazing). 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 development is on land which is of extremely low agricultural potential, and which is only suitable as grazing land. The key findings of the Soils and Agricultural Potential study include the following: ▪ Soils across the study area are predominantly shallow, sandy soils on underlying rock or hard-pan carbonate, of the Coega, Mispah, Glenrosa and Askham soil forms. ▪ The major limitations to agriculture are the extremely limited climatic moisture availability and the poor soils. ▪ As a result of these limitations, the study area is unsuitable for cultivation and agricultural land use is limited to low intensity grazing.	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. The following mitigation measures were recommended: ▪ Implement an effective system of storm water run-off control; ▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas; ▪ Control dust through appropriate dust suppression methods; ▪ Strip and stockpile topsoil before disturbance and re-spread it on the surface as soon as possible after disturbance; ▪ Manage any sub-surface spoils from excavations in such a manner that they will not bury the topsoil of agricultural land; ▪ Minimise road footprint and control vehicle access on designated roads only; and

	▪ The land capability is classified as Class 7 - non-arable, low potential grazing land. The study area has a very low grazing capacity of 45 hectares per large stock unit. ▪ There are no agriculturally sensitive areas and no parts of the study area need to be avoided by the development. ▪ The significance of all agricultural impacts is kept low by two important factors. The first is that the actual footprint of disturbance of the development is very small in relation to the available grazing land. The second is the fact that the proposed study area is on land of extremely limited agricultural potential that is only viable for low intensity grazing. ▪ Six 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 development's footprint of disturbance. ○ Soil Erosion caused by alteration of the surface characteristics. ○ Generation of dust caused by alteration of the surface characteristics. ○ Loss of topsoil in disturbed areas, causing a decline in soil fertility. ○ Degradation of surrounding grazing land due to vehicle trampling. ○ Soil contamination from hydrocarbon spills during construction. ▪ All impacts were assessed as having low significance.	▪ Implement effective spillage and waste management system. No additional investigation of agricultural issues is required for the Environmental Impact Assessment of the proposed development.

	▪ 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. ▪ Cumulative impact is also assessed as low. Furthermore 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. ▪ There are no conditions resulting from this assessment that need to be included in the environmental authorisation. ▪ There is no difference and therefore no preference between the proposed alternatives, in terms of agricultural impacts.	
Heritage	The background research completed in October 2016 has shown that the proposed !Xha Boom WEF grid connection and substation to be developed as a WEF may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites. The subsequent field work completed for October 2016 and June 2017, has confirmed the presence of 1 heritage resource (XHA003) as well as several areas with existing infrastructure such as fenced off camps, windmills and reservoirs. **Impact and Cumulative Impact:**	The design process and methodology followed by the developer for this project will enabled the heritage assessment to provide input into the proposed layouts. This resulted in cognisance being taken of the positions of the heritage resources and thus the reduction of impacts at an early design phase The mitigation measures proposed is as follows: ▪ **Pre-Construction:** 1. A walk down of the final layout to determine if any significant sites will be affected. 2. Monitor find spot areas, by a qualified archaeologist, if construction is going to take place through them.

	Only one (1) low significance identified heritage resources is affected by the proposed grid connection and substation layout. The impact by the proposed development on heritage resources will be low to negligible. It is the specialist's considered opinion that this additional load on the overall impact on heritage resources will have a low to negligible cumulative impact. None of the alternatives are deemed to be unfavourable and all can be utilised from a heritage point of view. **Palaeontology** In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.	3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by a qualified archaeologist during the construction phase. 4. Avoid the historical farmstead at BHL001. ▪ **Palaeontology** In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary. However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

Palaeontology (Desktop)	The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal mudrocks of the lower part of the Ecca Group (Karoo Supergroup). This include the Prince Albert, Whitehill and Tierberg Formations (in order of decreasing age). Permian and Jurassic bedrocks are mantled with a range of superficial deposits, mostly Late Caenozoic (Quaternary to Recent) in age. The intrusive Karoo dolerites are of no palaeontological significance and the Late Caenozoic superficial deposits are generally of low palaeontological sensitivity. Fossil material of aquatic vertebrates (fish, mesosaurid reptiles,) invertebrates (*e.g.* crustaceans) and petrified wood is known from the Whitehill Formation. These fossils are more scarce in the Prince Albert and Tierberg Formations. However, fossils other than trace assemblages are generally scarce and most of the Ecca sediments are of low overall palaeontological sensitivity. The proposed Leeuwberg wind farm development is thus unlikely to pose a substantial threat to local fossil heritage. In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.	Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional paleontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA. Recommended mitigation of the inevitable damage and destruction of fossil within the proposed development area would involve the following: ▪ Surveying, recording, description and collecting of fossils within the development footprint by a professional palaeontologist. This work should take place after initial vegetation clearance has taken place but before the ground is levelled for construction ▪ Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. ▪ The possibility of a negative impact on the palaeontological heritage of the area can be reduced

		by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category.
Visual	It is SiVEST's opinion that the visual impacts are not significant enough to prevent the project from proceeding and that an EA should be granted. It should be noted that no visually sensitive receptors with tourism significance have been identified within the study area. A total number of nineteen (19) potentially sensitive visual receptors were however identified. These included scattered farmsteads / homesteads which house the local farmers as well as their farm workers. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. From a visual impact perspective, only three (3) of the potentially sensitive visual receptors (namely VR 27, VR 32 and VR 34) are expected to experience a high degree of visual impact from the proposed development. In addition, the proposed development is expected to alter the largely natural / scenic character of the study area and contrast significantly with the typical land use and/or pattern and form of human elements present as the study area is largely natural / scenic and untransformed. The existing anthropogenic elements already present in the study area have however already altered the natural character of the surrounding environment to a degree and are expected to lower the visual contrast of the proposed development with the surrounding area. SiVEST is therefore of the opinion that the visual impact associated with the	It is recommended that all mitigation measures should be implemented.

	construction and operation phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.	
Socio-economic	The relevant national, provincial, and local government policies reveal that the development of RE technologies is strongly supported by government. It is seen as the means to diversify the energy mix in the country, achieve climate change commitments, and stimulate economic development in the country while creating new employment opportunities. As such, the assessment of the proposed project revealed that the stimulation of the economy, job creation and improved service infrastructure are among the positive impacts that can ensue from the proposed project during both construction and operational phase. According to the Hantam IDP, the economy of the Hantam LM is characterised by heavy dependence on the primary sector, low education and skill levels. Therefore, the introduction of the proposed development is expected to benefit the local municipality specifically due to its small economic base and large unemployment rate. The following positive and negative impacts are anticipated during the construction and operation phases: ▪ Stimulation of the economy and creation of temporary employment during construction; ▪ Increased risk of threat to personal safety and livestock theft during construction; ▪ Impact on the sense of place; and ▪ Impact on service infrastructure.	Mitigation measures include the following: ▪ To increase the profitability of the project and ensure the trickling down effect to the local economy, the project proponent must source the materials and equipment in South Africa. ▪ Where feasible (i.e. in cases where the appointed individuals match the skills required), the proponent is to ensure the employment of local labour. ▪ Ensure effective lines of communication and disseminate as much information to local communities regarding the project and employment opportunities for contracting small businesses. ▪ Minimise the possibility of attracting a number of people in search for employment in the vicinity of the farms by ensuring clear communication regarding the project. ▪ Engage with property owners prior to the developing of the substations and erection of the power line to ensure that the expectations (rules) of the farmers regarding access to farms are understood and effectively adhered to. ▪ Construction workers must be thoroughly informed of the rules made by farmers and be made to understand the accompanying consequences. ▪ Implement controlled access to farm properties where the power line and substations will be built and will

	Based on the results of the comparative review of the proposed alternatives and options for the power line route and substations, the following can be recommended: ▪ **<u>Substation route alternative</u>:** In all instances (impacts) related to the substation alternatives (both on-site and linking substations), no preferences were identified for any of the alternatives. ▪ **<u>Power line route option</u>:** Considering the identified potential negative and positive impacts, corridor option 3 (pink) appears to be slightly more preferred among the four alternatives. Although it will result in the lowest economic benefits to the national and local economy, such benefits would be temporary and would not be significant regardless of the route option chosen. Importantly, Option 3 affects the least farms and is associated with the shortest power line length. Option 1 and 2 are considered favourable and are slightly more preferred than Option 4 from the reviewed socio-economic impacts perspective. However, considering that the owner of the Portion 2 of Farm Karree Doorn Pan no. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to section 5.3), it would be advisable to consider Option 1 and Option 4 before selecting Option 2.	ensure that the construction workers are on site during reasonable working hours. ▪ Implement mitigation measures recommended by the relevant specialist (i.e. visual). ▪ Deconstruct the power line and substations once the wind facility is decommissioned.

These specialist studies were conducted to address the potential impacts relating to the proposed development that were identified. An impact assessment was conducted to ascertain the level of each identified impact, as well as mitigation measures which may be required. The potential positive and negative impacts associated within these studies have been evaluated and rated accordingly. The results of the specialist studies have indicated that no fatal flaws exist as a result of the proposed project. Additionally, the specialists comparatively assessed the alternatives as provided in **Figure i**. As previously mentioned, a few potentially sensitive sites have been identified within the study area based on the various specialist studies which were conducted. These have informed the preliminary assessment of layout alternatives. The results of the comparative assessment of alternatives are summarised in **Table i** below.

Table i: Summary of comparative assessment of EIA Phase layout alternatives

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	FATAL FLAWS
!XHA BOOM 132kV ON-SITE ESKOM SUBSTATION ALTERNATIVES			
Option 1	Biodiversity	PREFERRED	No Fatal Flaws
	Avifauna	NO PREFERENCE	No Fatal Flaws
	Surface Water	PREFERRED	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No Fatal Flaws
	Visual	FAVOURABLE	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No Fatal Flaws
Option 2	Biodiversity	NOT PREFERRED	No Fatal Flaws
	Avifauna	NO PREFERENCE	No Fatal Flaws
	Surface Water	NOT PREFERRED	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No Fatal Flaws
	Visual	FAVOURABLE	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No Fatal Flaws
132kV LINKING SUBSTATION ALTERNATIVES			
Option 1	Biodiversity	PREFERRED	No Fatal Flaws
	Avifauna	NO PREFERENCE	No Fatal Flaws
	Surface Water	FAVOURABLE	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No Fatal Flaws
	Visual	FAVOURABLE	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No Fatal Flaws
Option 2	Biodiversity	FAVOURABLE	No Fatal Flaws
	Avifauna	NO PREFERENCE	No Fatal Flaws
	Surface Water	PREFERRED	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	FATAL FLAWS
	Visual	FAVOURABLE	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No Fatal Flaws
132kV !XHA BOOM POWER LINE CORRIDOR ALTERNATIVES			
Option 1	Biodiversity	(LESS) FAVOURABLE	No Fatal Flaws
	Avifauna	NOT PREFERRED	No Fatal Flaws
	Surface Water	FAVOURABLE	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No Fatal Flaws
	Visual	FAVOURABLE	No Fatal Flaws
	Socio-economic	FAVOURABLE	No Fatal Flaws
Option 2	Biodiversity	PREFERRED	No Fatal Flaws
	Avifauna	FAVOURABLE	No Fatal Flaws
	Surface Water	FAVOURABLE	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No Fatal Flaws
	Visual	PREFERRED	No Fatal Flaws
	Socio-economic	FAVOURABLE	No Fatal Flaws
Option 3	Biodiversity	NOT PREFERRED	No Fatal Flaws
	Avifauna	NOT PREFERRED	No Fatal Flaws
	Surface Water	PREFERRED	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No Fatal Flaws
	Visual	NOT PREFERRED	No Fatal Flaws
	Socio-economic	PREFERRED	No Fatal Flaws
Option 4	Biodiversity	(MORE) FAVOURABLE	No Fatal Flaws
	Avifauna	PREFERRED	No Fatal Flaws
	Surface Water	FAVOURABLE	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No Fatal Flaws
	Visual	FAVOURABLE	No Fatal Flaws
	Socio-economic	FAVOURABLE	No Fatal Flaws

!XHA BOOM 132kV ON-SITE ESKOM SUBSTATION ALTERNATIVES

Based on the findings of the specialist studies, the two (2) 132kV On-site Eskom Substation site alternatives are relatively similar in terms of which is the environmentally preferred alternative. Almost all of the specialists found there to be no preference between the two (2) alternatives, with the only exceptions being the biodiversity, surface water and visual specialists. The biodiversity and surface water specialists found Option 1 to be preferred. In addition, the visual specialist found both Option 1 and Option 2 to be favourable. However, Option 2 was found to be not preferred from biodiversity and surface water perspectives respectively. In light of this, **132kV On-site Eskom Substation Option 1** is deemed to be the preferred alternative from an environmental perspective. It should be noted that Mainstream are considering Option 1 as their preferred On-site Eskom substation site alternative. This is deemed to be acceptable as Option 1 was found to be the preferred alternative from an environmental perspective and would not result in any significant environmental impacts. In addition, the extent of the preferred On-site Eskom substation site has been reduced in order to avoid the identified environmentally sensitive areas. As such, in combination with the shorter distance to the connecting linking substation, this On-site Eskom substation site alternative is considered to be preferred. From a technical perspective, the shorter distance between the On-site Eskom substation and the linking substations reduces the amount of electrical losses experienced, which is also preferred.

132kV LINKING SUBSTATION ALTERNATIVES

Based on the findings of the specialist studies, the two (2) Linking Substation site alternatives are relatively similar in terms of which is the environmentally preferred alternative. Almost all of the specialists found there to be no preference between the two (2) alternatives, with the only exceptions being the biodiversity, surface water and visual specialists. The biodiversity specialist found Option 1 to be preferred, while Option 2 was found to be preferred from a surface water perspective. Option 2 was however still found to be favourable from a biodiversity perspective, while the surface water specialist found Option 1 to be favourable. In addition, the visual specialist found both Option 1 and Option 2 to be favourable. In light of this, Linking Substation Option 1 and Option 2 are deemed to be equally preferred from an environmental perspective and thus both options are deemed to be acceptable. It should be noted that Mainstream are considering Option 1 as their preferred linking substation site alternative. This is deemed to be acceptable as both options were found to be equally preferred from an environmental perspective and would not result in any significant environmental impacts. In addition, Option 1 would reduce the length of the overhead power line which will connect to the Helios MTS by approximately 3km and will also reduce the length of the required access roads to the On-site Eskom substation site. Therefore, from environmental and technical perspectives, **Linking Substation Option 1** is deemed to be acceptable and is thus the preferred alternative.

132kV !XHA BOOM POWER LINE CORRIDOR ALTERNATIVES

Based on the findings of the specialist studies, Option 1 was found to be not preferred from an avifauna perspective and thus this option is not preferred from an environmental perspective. The same can be said for Option 3, as this option was found to be not preferred from biodiversity, avifauna and visual perspectives respectively, despite being preferred from a socio-economic perspective. The biodiversity and visual specialists found Option 2 to be preferred, while this option was found to be favourable from avifauna, surface water, socio-economic and heritage and palaeontology perspectives respectively. In addition, Option 4 was found to be preferred from an avifauna perspective, while the biodiversity, surface water, socio-economic and heritage and palaeontology and visual specialists found this option to be favourable. In light of this, **132kV Power Line Corridor Option 2** and **132kV Power Line Corridor Option 4** were both found to be favourable alternatives from an environmental perspective due to the preference from biodiversity, avifauna and visual perspectives respectively. It is thus recommended that both **132kV Power Line Corridor Option 2** and **132kV Power Line Corridor Option 4** be considered as favourable options for the construction of the proposed power line. However, during the socio-economic specialist's interviews with the I&APs, the owner of Portion 2 of the Farm Karree Doorn Pan No. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to Section 5.3 of the Socio-economic Report). As such, **132kV Power Line Corridor Option 4** is considered to be a slightly more favourable alternative from an environmental perspective. A preferred power line corridor alternative will however be selected and will be presented in the FBAR once comments on the DBAR have been received and all objections have been considered.

It should be noted that no fatal flaws were identified and therefore all the alternatives mentioned above are considered to be environmentally acceptable.

As such, the preferred substation site and favourable power line corridor layout alternatives are indicated in **Figure iv** below. The final selected preferred layout in relation to environmentally sensitive and no-go areas identified by some of the specialists will be presented in the FBAR.

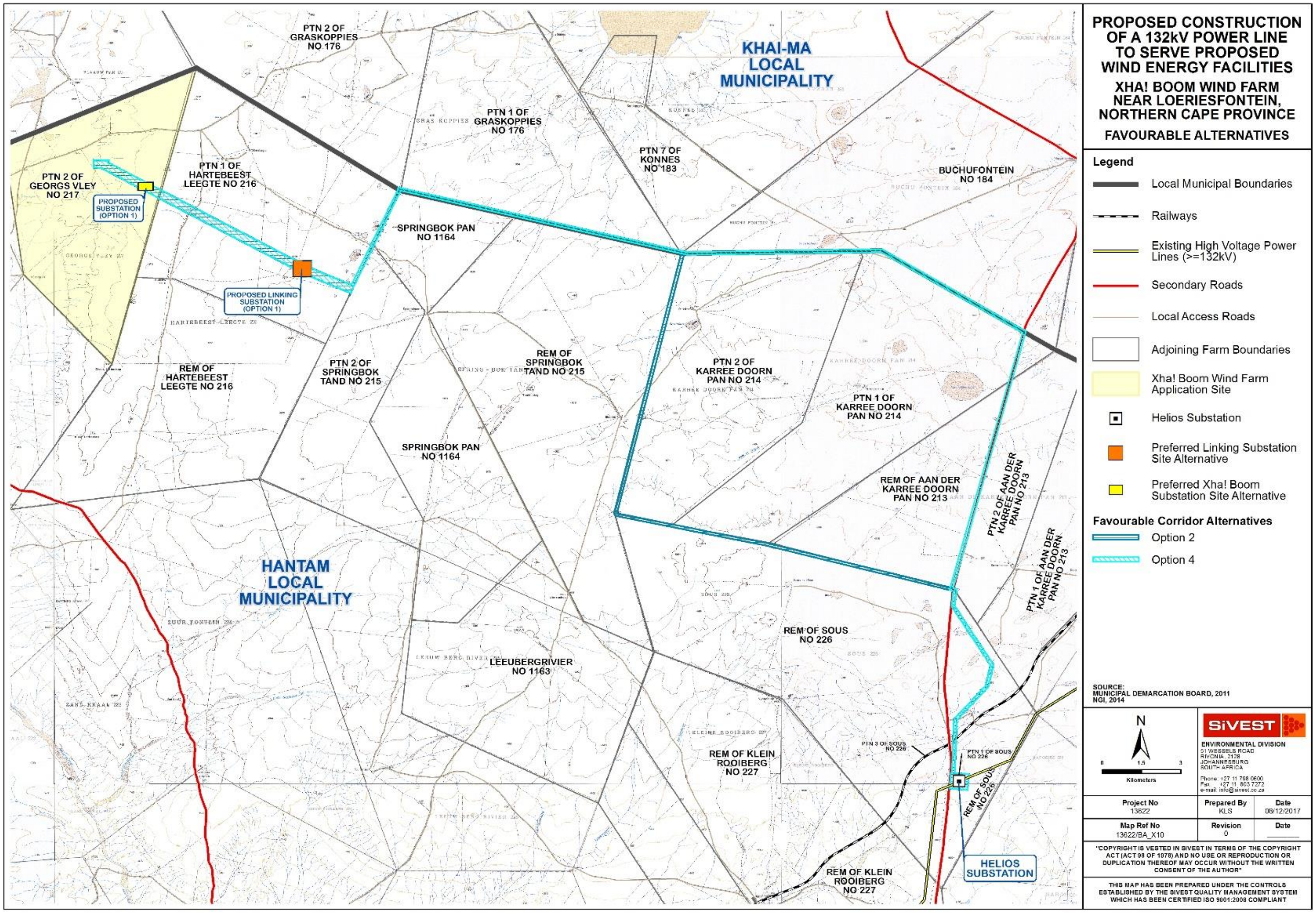

Figure iv: Preferred !Xha Boom On-site Eskom Substation, Linking Substation and Favourable Power Line Corridor Alternatives

It should be noted that micrositing may be required within the authorised power line corridor during the detailed design phase. In addition, the alignment of the power line within the authorised power line corridor will be determined during the detailed design phase. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction. In addition, the specialist sensitivities and no-go areas will be incorporated into the layout design when completing the final layout.

It is the opinion of the EAP that the information and data provided in this Draft Basic Assessment Report (DBAR) is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Furthermore, it is the opinion of the EAP, that based on the findings of the BA that the proposed development should be granted an EA and allowed to proceed provided the following conditions are adhered to:

- The proposed 132kV On-site Eskom Substation should be constructed within the preferred substation site for Option 1. This is also the option which Mainstream are considering as their preferred alternative. This is deemed to be acceptable as Option 1 was found to be the preferred alternative from an environmental perspective and would not result in any significant environmental impacts. In addition, the extent of the preferred On-site Eskom substation site has been reduced in order to avoid the identified environmentally sensitive areas. As such, in combination with the shorter distance to the connecting linking substation, this alternative is considered to be preferred. From a technical perspective, the shorter distance between the On-site Eskom substation and the linking substations reduces the amount of electrical losses experienced, which is also preferred.
- The proposed 132kV Linking Substation could be constructed within either Option 1 or Option 2 as both alternatives were deemed to be equally preferred from an environmental perspective. Both options are thus deemed to be acceptable. It should however be noted that Mainstream are considering Option 1 as their preferred linking substation site alternative. This is deemed to be acceptable as both options were found to be equally preferred from an environmental perspective and would not result in any significant environmental impacts. In addition, Option 1 would reduce the length of the overhead power line which will connect to the Helios MTS by approximately 3km and will also reduce the length of the required access roads to the On-site Eskom substation site. Therefore, from environmental and technical perspectives, Option 1 is deemed to be acceptable and is thus the preferred alternative.
- The proposed 132kV power line should be constructed within either Power Line Corridor Option 2 or Power Line Corridor Option 4 as these alternatives were found to be preferred from avifuana, biodiversity, visual and socio-economic perspectives. Power Line Corridor Option 2 and Option 4 are thus both considered to be favourable from an environmental perspective. It should however be noted that Power Line Corridor Option 4 is considered to be a slightly more favourable alternative. A preferred power line corridor alternative will however be selected once comments on the DBAR have been received and all objections have been considered and will be presented in the FBAR.
- Final routing of the proposed power line within the corridor should avoid tower placement within 32m of any identified surface water resources (such as the drainage lines and wetlands), and associated environmentally sensitive areas located within the power line corridor and no construction activities should take place within these areas.

- All feasible and practical mitigation measures recommended by the various specialists must be implemented, where applicable to the authorised substation site and power line corridor.
- Final EMPr should be approved by DEA prior to construction.
- The final power line and access road alignment should be submitted to the DEA for approval prior to commencing with the activity.

SiVEST, as the EAP, is therefore of the view that:

- Preferred On-site Eskom and Linking Substation sites have been identified which are less environmentally sensitive compared to the other sites considered.
- Favourable power line corridors have been identified which are environmentally acceptable and will not result in significant impacts, provided that the recommended mitigation measures are implemented and the routing of the power line within the corridor avoids tower placement within environmentally sensitive areas. As previously mentioned, a preferred power line corridor alternative will only be selected once comments on the DBAR have been received and all objections have been considered and will be presented in the FBAR.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the 132kV On-site Eskom Substation, Linking Substation and associated 132kV power line can be mitigated to acceptable levels.

The date on which the activity will commence cannot be determined at this stage as they are based on the timeframes dictated by the Renewable Energy Independent Power Producer Procurement Programme (REIPPP) bid windows. The date of the next round of bid submissions has not yet been announced. The construction of the !Xha Boom On-site Eskom Substation, Linking Substation and associated 132kV Power Line is dependent on being selected as a preferred bidder. The project will therefore require an environmental authorisation of at least 5 years.

It is trusted that the DBAR provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

SOUTH AFRICA MAINSTREAM RENEWABLE POWER DEVELOPMENTS (PTY) LTD

PROPOSED CONSTRUCTION OF THE !XHA BOOM ON-SITE ESKOM SUBSTATION, LINKING SUBSTATION AND ASSOCIATED 132KV POWER LINE NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE

DRAFT BASIC ASSESSMENT REPORT

Contents

List of Tables

List of Figures

List of Appendices

Glossary of Terms

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural Significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Cumulative Impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Equator Principles: A financial industry benchmark for determining, assessing and managing social and environmental risk in project financing.

Environmental Impact Assessment: In relation to an application, to which Scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application.

Environmental Impact Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

Heritage Significance Grades:
a) Grade I: Heritage resources with qualities so exceptional that they are of special national significance;
(b) Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
(c) Grade III: Other heritage resources worthy of conservation.

Heritage Resources: This means any place or object of cultural significance. See also archaeological resources above.

Iron Age: Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and

they herded cattle as well as sheep and goats. These people, according to archaeological evidence, spoke early variations of the Bantu Language. Because they produced their own iron tools, archaeologists call this the Iron Age.
Early Iron Age AD 200 - AD 900
Middle Iron Age AD 900 - AD 1300
Late Iron Age AD 1300 - AD 1830

Kilovolt (kV): a unit of electric potential equal to a thousand volts (a volt being the standard unit of electric potential. It is defined as the amount of electrical potential between two points on a conductor carrying a current of one ampere while one watt of power is dissipated between the two points).

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red Data Species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping Report: An “issues-based” report which forms the first phase of an Environmental Impact Assessment process.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.
Early Stone Age 2 000 000 - 150 000 Before Present
Middle Stone Age 150 000 - 30 000 BP
Late Stone Age 30 000 - until c. AD 200

List of Abbreviations

AP	- Action Plan
ATNS	- Air Traffic and Navigation Services Company Limited
AIA	- Archaeological Impact Assessment
ADT	- Average Daily Traffic
ADTT	- Average Daily Truck Traffic
BA	- Basic Assessment
BAR	- Basic Assessment Report
BID	- Background Information Document
CARA	- Conservation of Agricultural Resources Act
CBA	- Critical Biodiversity Area
CSW	- Continuous Surface Wave
DBAR	- Draft Basic Assessment Report
DEA	- Department of Environmental Affairs
DDD	- Data Deficient
DDT	- Taxonomically uncertain
DM	- District Municipality
DEIAr	- Draft Environmental Impact Assessment Report
DSR	- Draft Scoping Report
DoE	- Department of Energy
DM	- District Municipality
DWS	- Department of Water and Sanitation
EAP	- Environmental Assessment Practitioner
ECA	- Environmental Conservation Act No 73 of 1989
ECO	- Environmental Control Officer
ED	- Economic Development
EHS	- Environmental, Health, and Safety
EIA	- Environmental Impact Assessment
EIR	- Environmental Impact Report
EMPr	- Environmental Management Programme
EP	- Equator Principles
EPFI	- Equator Principles Financial Institutions
ERA	- The Electricity Regulation Act No. 4 of 2006
ESA	- Ecological Support Area
EAS	- Early Stone Ages
ESMP	- Environmental and Social Management Plan
ESMS	- Environmental and Social Management System
FBAR	- Final Basic Assessment Report
FEIAr	- Final Environmental Impact Assessment Report
EHS	- Environmental, Health, and Safety
FGM	- Focus Group Meeting

FSR	- Final Scoping Report
GDP	- Gross Domestic Product
GHG	- Green House Gases
GIIP	- Good International Industry Practice
GIS	- Geographic Information System
GW	- Gigawatts
HIA	- Heritage Impact Assessment
HSR	- Heritage Scoping Report
I&AP(s)	- Interested and Affected Parties
IBA(s)	- Important Bird Area(s)
IDP	- Integrated Development Plan
IEP	- Integrated Energy Plan
IFC	- International Finance Corporation
IPP(s)	- Independent Power Producers
IRP	- Integrated Resource Plan
IUCN	- International Union for the Conservation of Nature and Natural Resources
KSW	- Key Stakeholder Workshop
kV	- Kilo Volt
LM	- Local Municipality
LED	- Local Economic Development
LSA	- Late Stone Age
LWEF	- Leeuwberg Wind Energy Facility
MSA	- Middle Stone Age
MTS	- Main Transmission Substation
MLL	- Minimum Living Level
MW	- Megawatt
NC DENC	- Northern Cape Department of Environment and Nature Conservation
NC PGDS	- Northern Cape Provincial Growth and Development Strategy
NEA	- The National Energy Act No. 34 of 2008
NEMA	- National Environmental Management Act No. 107 of 1998
NEMBA	- National Environmental Management: Biodiversity Act No. 10 of 2004
NFA	- The National Forest Act No. 84 of 1998
NHRA	- National Heritage Resources Act No. 25 of 1999
NSBA	- National Spatial Biodiversity Assessment
NWA	- National Water Act No. 36 of 1998
NEMAA	- National Environmental Management: Air Quality Act of 2004
NPAES	- National Parks Area Expansion Strategy
NRTA	- The National Road Traffic Act No. 93 of 1996
OHL	- Overhead Line
OHSA	- Occupational Health and Safety Act No. 85 of 1993
PoS	- Plan of Study
PM	- Public Meeting

PPA	- Power Purchase Agreement
PPP	- Public Participation Process
PV	- Photovoltaic
RBS	- Revised Balanced Scenario
REIPPP	- Renewable Energy Independent Power Producer Procurement Programme
RE	- Renewable Energy
RFP	- Request for Proposals
RFQ	- Request for Qualifications
SA	- South Africa
SAHRA	- South African Heritage Resources Agency
SANBI	- South African National Biodiversity Institute
SDF	- Spatial Development Framework
SKA	- Square Kilometre Array
SPVs	- Special Purpose Vehicles
TL	- Terrain Loss
WEF	- Wind Energy Facility
WETFEPA	- Wetland Freshwater Ecosystem Priority Areas
WF	- Wind Farm
WMA	- Water Management Area
WTG	- Wind Turbine Generator
WUL	- Water Use License
WULA	- Water Use License Application

SOUTH AFRICA MAINSTREAM RENEWABLE POWER DEVELOPMENTS (PTY) LTD

PROPOSED CONSTRUCTION OF THE !XHA BOOM ON-SITE ESKOM SUBSTATION, LINKING SUBSTATION AND ASSOCIATED 132KV POWER LINE NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE

DRAFT BASIC ASSESSMENT REPORT

1 INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as "Mainstream") are proposing to construct a 33kV/132kV On-site Eskom Substation (namely the !Xha Boom Substation), a 132kV Linking Substation and an associated 132kV power line near Loeriesfontein in the Northern Cape Province (hereafter referred to as the "proposed development") (**Figure 1**). SiVEST Environmental Division (hereafter referred to as "SiVEST") has subsequently been appointed as Independent Environmental Assessment Practitioner (EAP) to undertake the Basic Assessment (BA) process for the proposed development. The overall objective of the proposed development is to feed the electricity generated by Mainstream's proposed !Xha Boom Wind Farm (part of a separate on-going EIA process) into the national grid by constructing the proposed !Xha Boom On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line.

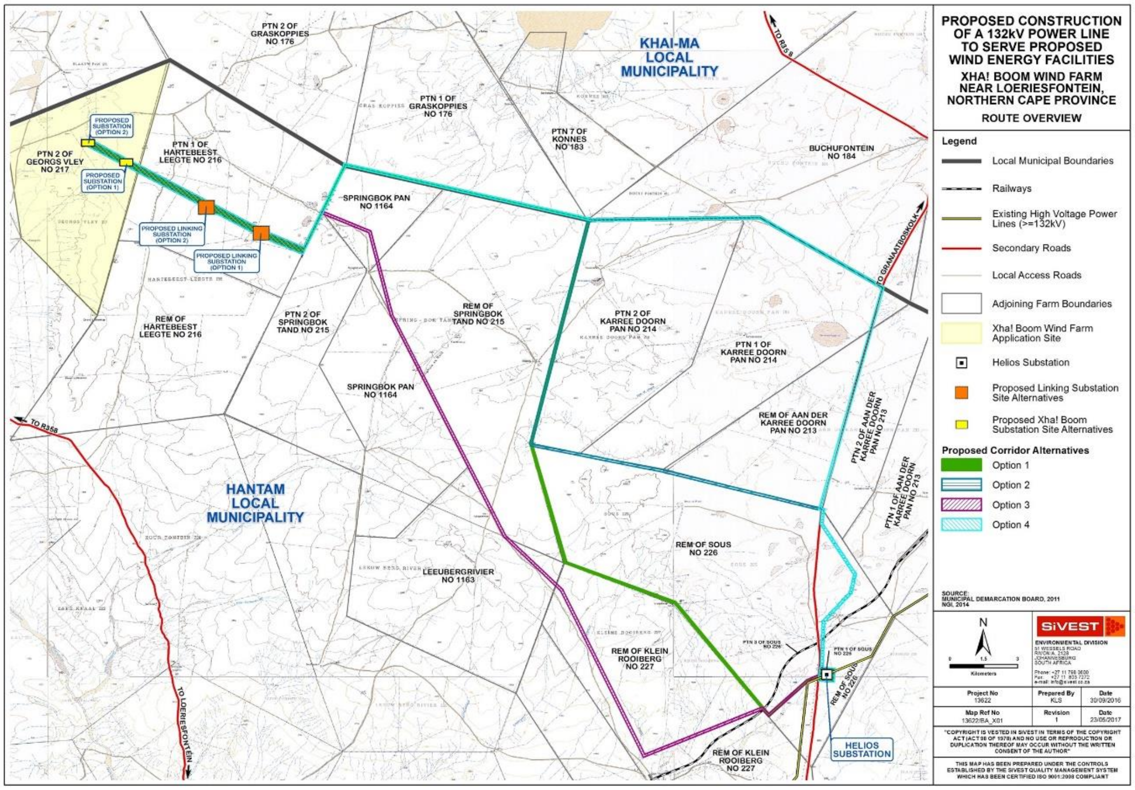

Figure 1: Route overview for the proposed !Xha Boom On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line

The proposed !Xha Boom On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line will connect the proposed !Xha Boom Wind Farm to the existing Eskom Helios Main Transmission Substation (MTS). The !Xha Boom Wind Farm is currently subject to a separate on-going Environmental Impact Assessment (EIA) process. This proposed wind farm forms one (1) of four (4) wind farms with a 235MW export capacity that Mainstream are proposing to develop near the town of Loeriesfontein within the Northern Cape Province. The Department of Environmental Affairs (DEA) reference number allocated for the proposed !Xha Boom Wind Farm is **14/12/16/3/3/2/1018**. Additionally, BA processes are being conducted for the proposed Graskoppies, Hartebeest Leegte and Ithemba On-site Eskom Substation, 132kV Linking Substation and associated 132kV power line. The DEA reference numbers for these projects have however not been allocated yet and will be provided in the Final Basic Assessment Report (FBAR). Although the four (4) proposed Mainstream Wind Farm projects (i.e. Graskoppies, Hartebeest Leegte, Ithemba and !Xha Boom Wind Farms) and the four (4) proposed Mainstream electricity generation projects (Graskoppies, Hartebeest Leegte, Ithemba and !Xha Boom On-site Eskom Substations, 132kV Linking Substations and associated 132kV power lines) will be assessed separately, a single public participation process is being undertaken to consider all eight (8) proposed developments.

Figure 2 below indicates all of the wind farm and electricity generation (On-site Eskom Substation, Linking Substation and 132kV Power Line) projects being proposed near Loeriesfontein by Mainstream as part of recent applications.

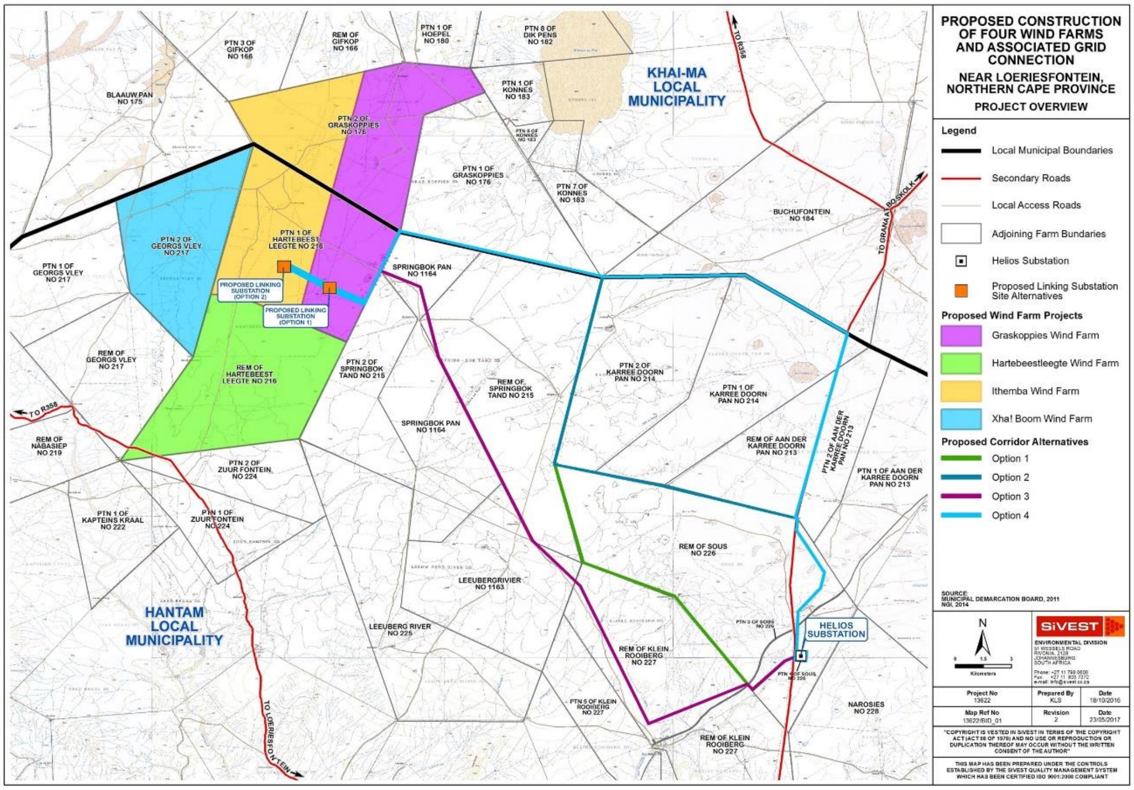

Figure 2: Combined layout map showing all Mainstream Wind Farm and Electricity Generation (On-site Eskom Substation, Linking Substation and 132kV Power Line) projects being proposed near Loeriesfontein in the Northern Cape Province as part of recent applications

The proposed development requires Environmental Authorisation (EA) from the DEA. However, the provincial authority will also be consulted (i.e. Northern Cape Department of Environment and Nature Conservation (NC DENC)). The EIA for the proposed development will be conducted in terms of the EIA Regulations promulgated in terms of Chapter 5 of the National Environmental Management Act (NEMA), which came into effect on 8 December 2014, and as amended on 7 April 2017. In terms of these regulations, a Basic Assessment (BA) process is required for the proposed development. All relevant legislations and guidelines (including Equator Principles) will be consulted during the BA process and will be complied with at all times.

This report has been compiled in accordance with World Bank standards and the Equator Principles (EP). The EP is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing (Equator Principles, 2013). This development is considered a Category B project. Category B Projects are those with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures (Equator Principles, 2013). The project will also comply with the International Finance Corporation's (IFC) Social and Environmental Performance Standards (2012) and General Environmental Health and Safety (EHS) Guidelines (2007).

1.1 Structure of this Report

This DBAR is structured as follows:

- **Section 1** introduces the project and discusses the experience of the Environmental Assessment Practitioners (EAP), including specialists, who have contributed to the report. It expands on the relevant legal ramifications applicable to the project and describes the Equator Principles, IFC Performance Standards and the relevant development strategies and guidelines.
- **Section 2** elaborates on the assumptions and limitations pertaining to the BA process for the proposed development.
- **Section 3** provides explanation to the need and desirability of the proposed development by highlighting issues such as security of power supply; the appropriateness of the selected site; local employment as well as the regional and local income profile.
- **Section 4** gives detailed technical descriptions of the proposed development as well as the alternatives involved.
- **Section 5** provides a description of the region in which the proposed development is intended to be located. Although the section provides a broad overview of the region, it is also specific to the application. It contains descriptions of the site and the specialist studies conducted during the BA process are also summarised.
- **Section 6** describes the Public Participation Process (PPP) undertaken during the BA process and tables issues and concerns raised by Interested and Affected Parties (I&APs).
- **Section 7** documents the findings of the specialist studies and associated potential impacts of the proposed development.
- **Section 8** presents a rating of each environmental issue before and after mitigation measures.
- **Section 9** identifies recommendations from the specialists that have a bearing on the layout alternatives as well as proposed mitigation measures.
- **Section 10** identifies potential cumulative impacts per environmental issue (specialist study).
- **Section 11** gives a comparative assessment of all identified alternatives based on the various environmental issues (specialist studies).
- **Section 12** provides a description of the environmental monitoring and auditing process to be undertaken for the proposed wind farm.
- **Section 13** presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.

- **Section 14** summarises the findings and recommendations per specialist study and provides the overall conclusion.
- **Section 15** lists references indicated in the Draft Basic Assessment Report (DBAR).

The content requirements of a Basic Assessment Report (BAR) as detailed in Appendix 1 of the EIA Regulations, 2014, as well as details of the section within this report that fulfils these requirements, are shown in **Table 1** below.

Table 1: Content requirements for a BAR

Content Requirements	Applicable Section
(a) details of- (i) the EAP who prepared the report; and	Details of the EAP are included in **Section 1.2**.
(ii) the expertise of the EAP, including a curriculum vitae;	Details of the EAP and full project team are included in **Section 1.2, Table 3**. The expertise (including curriculum vitae) of the EAP and full project team are include in **Appendix 2**.
(b) the location of the activity, including- (i) the 21 digit Surveyor General code of each cadastral land parcel;	The location (including 21 digit Surveyor General codes) of the activity is detailed on **page iv – v** of the report, as well as in **Section 5.1** and **Section 5.2**.
(ii) where available, the physical address and farm name;	The farm names have been included on **page iv – v** of the report, as well as in **Section 5.2**.
(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. Coordinates of the proposed substation site (on-site Eskom substation and linking substation) and power line corridor alternatives are however shown on ***page iii*** of the report, as well as in **Section 5.2**. Additionally, all coordinates are included in **Appendix 9A**.
(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is-	Maps of the regional locality and route overview for the proposed power line are shown in **Section 5.1** and **5.2** respectively. Additionally, all project maps are included in **Appendix 5**.

(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	Coordinates of the proposed power line corridor alternatives are shown on **page *iii*** of the report, as well as in **Section 5.2**. Additionally, all coordinates are included in **Appendix 9A**.
(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	N/A. Coordinates of the proposed substation site (on-site Eskom substation and linking substation) and power line corridor alternatives are however shown on ***page iii*** of the report, as well as in **Section 5.2**. Additionally, all coordinates are included in **Appendix 9A**.
(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and applied for; and	The listed and specified activities triggered as per NEMA are detailed in **Section 1.3.2**.
(ii) a description of the activities to be undertaken, including associated structures and infrastructure;	The technical project description is included in **Section 5**. This includes a description of activities to be undertaken, including associated structures and infrastructure.
(e) a description of the policy and legislative context within which the development is proposed including- (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;	A description of all key legal and administrative requirements is provided in **Section 1.3**, this includes an explanation of how the proposed development complies with the requirements. Key development strategies and guidelines and their applicability to the proposed project are detailed in **Section 1.4**.
(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;	The need and desirability of the proposed project is discussed in **Section 4**, including the need and desirability of the activity at the location as proposed.
(g) a motivation for the preferred site, activity and technology alternative;	The site specific suitability is discussed in **Section 3.4**.

(h) a full description of the process followed to reach the proposed preferred alternative within the site, including:	A description of the alternatives considered in terms of the Regulations is included in **Section 4.2** and a full description and comparative assessment of the alternatives considered is included in **Section 11**.
(i) details of all the alternatives considered;	A description of the alternatives considered in terms of the Regulations is included in **Section 4.2** and a full description and comparative assessment of the alternatives considered is included in **Section 11**.
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	The public participation process followed is detailed in **Section 6**. Additionally, all public participation documents are included in **Appendix 7**. This includes a summary of issues raised by I&APs, and the responses to their comments.
(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;	All public participation documents are included in **Appendix 7**. This includes a summary of issues raised by I&APs, and the responses to their comments.
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	A description of the alternatives considered in terms of the Regulations is included in **Section 4.2** and a full description and comparative assessment of the alternatives considered is included in **Section 11,** including a full description of the environmental attributes associated with the alternatives.
(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;	The impacts and risks associated with each alternative are assessed in **Section 8.2**. Potential mitigation measures are included in **Section 9**.

(bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	
(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;	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 is included in **Section 8.1**.
(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;	The positive and negative impacts that the proposed activity and alternatives will have on the environment are discussed in **Section 8.2**.
(viii) the possible mitigation measures that could be applied and level of residual risk;	Possible mitigation measures that could be applied and level of residual risk are included in **Section 9**.
(ix) the outcome of the site selection matrix;	The outcome of the site selection matrix is included in **Section** 11.
(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.	A concluding statement indicating the preferred alternatives is contained in **Section 11**.
(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- (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;	The process undertaken to assess the impacts as well as the assessment of impacts by each specialist are shown in **Section 8**. Each environmental issue and risk is tabulated in **Section 8.2** and an assessment of the significance of each issue before and after mitigation measures is included.
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts;	The impact rating system contained in **Section 8.1.2** details the methodology for determining

(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;	the significance of an impact. This includes the points (j) (i to vii). The assessment of each risk identified by the specialists is contained in **Section 8.2**.
(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;	All relevant specialist findings are included in **Section 7**, with all recommended mitigation measures detailed in the respective impact tables in **Section 8.2**, as well as in **Section 9**. The mitigation measures have been incorporated into the EMPr which is contained in **Appendix 8**. The tabulated summary of key specialist findings and recommendations is included in **Section 14.1** and in the executive summary.
(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment;	**Section 14** contains a tabulated summary of the key findings in each specialist assessment and the positive and negative impacts associated with the activity, which were identified by each specialist, are also summarised in table form in the section.
(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	**Section 0** also contains a map showing the final preferred layout superimposed with sensitive and no-go areas and buffers where required.
(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	**Section 15** contains a tabulated summary of the key findings in each specialist assessment and the positive and negative impacts

	associated with the activity, which were identified by each specialist, are also summarised in table form in the section.
(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;	The recommended mitigation measures associated with each impact are included in **Section 8.2**, and overall specialist recommendations and mitigation measures are included in **Section 9**. These measures are contained in the EMPr which can be found in **Appendix 8**.
(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Any aspects identified by specialists or the EAP that should be included as conditions of the authorisation are identified in **Section 14** and in the executive summary.
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	All assumptions and limitations are highlighted in **Section 2**.
(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;	A reasoned opinion as to whether or not the proposed activity should be authorised, including conditions if required, is included in **Section 14** and in the executive summary.
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	The period required for the environmental authorisation, as well as the date on which the activity and post construction monitoring will be concluded is discussed in **Section 14** and the executive summary.
(r) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs;	The EAP affirmation is included in **Appendix 3**.

(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties.	
(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	If applicable, details of any financial provisions for the management of negative environmental impacts are included in **Section 9**, **Section 14** and the executive summary.
(t) any specific information that may be required by the competent authority; and	No specific information has been required by the competent authority to date. Should any specific information be required by the competent authority, this will be included in the FBAR.
(u) any other matters required in terms of section 24(4)(a) and (b) of the Act.	All requirements in terms of section 24(4)(a) and (b) of the Act have been met in this report.

1.2 Expertise of Environmental Assessment Practitioner

SiVEST has considerable experience in the undertaking of BAs. Staff and specialists who have worked on this project and contributed to the compilation of this DBAR are detailed in **Table** 2 below.

Table 2: Project Team

Name and Organisation	Role
Andrea Gibb – SiVEST	Project Leader, EAP and Visual
Stephan Jacobs – SiVEST	Environmental Consultant, Visual and Public Participation Practitioner
Shaun Taylor – SiVEST	Environmental Consultant, Surface Water Specialist
Simon Todd – Simon Todd Consulting	Biodiversity (fauna and flora)
Chris van Rooyen – Chris van Rooyen Consulting	Avifauna
Johann Lanz	Agricultural Potential
Wouter Fourie – PGS	Heritage

Name and Organisation	Role
Elena Broughton – Urban-Econ Development Economists	Socio-economic
Zimkita Nkata – Urban-Econ Development Economists	Socio-economic
Nicolene Venter – Imaginative Africa	Senior Public Participation Practitioner
Kerry Schwartz – SiVEST	GIS, Mapping and Visual

As per the requirements of the EIA Regulations (2014), as amended, the details and level of expertise of the persons who prepared the DBAR are provided in **Table 3** below.

Table 3: Expertise of the EAP

Environmental Practitioner	SiVEST South Africa (Pty) Ltd – Andrea Gibb
Contact Details	andreag@sivest.co.za
Qualifications	BSc Landscape Architecture and BSc (Hons) Environmental Management
Expertise to carry out the EMPr	Andrea has 8.5 years' work experience and specialises in undertaking and managing Environmental Impact Assessments (EIAs) and Basic Assessment (BAs), primarily related to energy generation and electrical distribution projects. She also specialises in undertaking visual impact and landscape assessments, by making use of ArcGIS technology and field surveys. She has extensive experience in overseeing public participation and stakeholder engagement processes and has been involved in environmental baseline assessments, fatal flaw / feasibility assessments and environmental negative mapping / sensitivity analyses. From a business and administrative side, Andrea is actively involved in maintaining good client relationships, mentoring junior staff and maintaining financial performance of the projects she leads.
Environmental Consultant	SiVEST South Africa (Pty) Ltd – Stephan Jacobs
Contact Details	stephanj@sivest.co.za
Qualifications	BSc Environmental Sciences and BSc (Hons) Environmental Management and Analysis
Expertise to carry out the EMPr	Stephan joined SiVEST in May 2015 and holds the position of Graduate Environmental Consultant in the Johannesburg office. Stephan specialises in the field of Environmental Management and has been involved in the compilation of Environmental Impact Assessments (EIAs) and Basic Assessments (BAs). Stephan has also assisted extensively in the undertaking of field work and the compilation of reports for specialist studies such as surface water and visual impact assessments. Stephan also has experience in Environmental Compliance and Auditing and has acted as an Environmental Control Officer (ECO) for several infrastructure

	projects.
Environmental Consultant	SiVEST South Africa (Pty) Ltd – Shaun Taylor
Contact Details	shaunt@sivest.co.za
Qualifications	BA Geography and Environmental Science, BSc (Hons) Geography and Environmental Studies, MSc Aquatic Health
Expertise to carry out the EMPr	Shaun joined SiVEST in October 2010 and is based in the Johannesburg office in the capacity of an Environmental Scientist. Shaun has eight and a half (8.5) years of experience in the environmental industry. More specifically, Shaun has a passion for working in the environmental and water (wetlands) field. From an environmental management perspective, Shaun has completed a number of environmental impact assessments, basic assessments, strategic environmental assessments, environmental management programmes/plans, various exemption and amendment applications, and conducted environmental auditing. Within the water field, Shaun has undertaken water use licensing (WUL) and WUL compliance monitoring for various developments. In terms of specialist work, Shaun has completed numerous surface water (including wetlands and riparian) assessments for renewable energy projects, linear projects as well as site specific projects.

Please refer to attached CV's for more information in **Appendix 2**. Declarations of Independence of each specialist are contained in **Appendix 3**.

1.3 Key Legal and Administrative Requirements Relating to the Proposed Development

1.3.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) – NEMA EIA Requirements

The National Environmental Management Act, 1998 (Act No. 107 of 1998) was promulgated in 1998. This Act replaces parts of the Environment Conservation Act (Act No 73 of 1989) with exception to certain parts pertaining to Integrated Environmental Management. The act intends to provide for:

- co-operative environmental governance by establishing principles for decision-making on matters affecting the environment;
- institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state;
- to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment; and

- to provide for matters connected therewith.

NEMA now governs the BA process with the recent promulgation of the new EIA regulations in April 2017 (Government Gazette No. 40772 of the 7th of April 2017), as amended.

In terms of the NEMA read with the EIA Regulations (2014), activities that may significantly affect the environment must be considered, investigated and assessed prior to implementation.

Therefore, in terms of the EIA Regulations (2014) promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), which came into effect on 8 December 2014, as amended, a BA is required for the proposed project.

1.3.2 NEMA and EIA Requirements

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an environmental authorisation. As mentioned earlier, the result being that NEMA governs the BA process with the said promulgation of EIA Regulations in December 2014 (Government Gazette No. 38282 of 04 December 2014), as amended. This BA has therefore been undertaken in accordance with the NEMA and EIA 2014 Regulations which are contained in four (4) Government Notices (GN R 982, 983, 984, and 985) which came into effect on the 4th of December 2014, as amended.

In terms of these Regulations, a BA process is required for the proposed project based on triggered activities.

The following Schedules of the Government Notice No. R. 983 – 985 of 4 December 2014, as amended, are of relevance to the project in question. All of the Listed Activities identified in terms of Sections 24(2) and 24D include:

Table 4: Listed activities in terms of the NEMA Regulations

Activity number of the relevant notice:	**Listed activity as described in GNR 983, 984 and 985**	**Description of Listed Activity**
GN R. 983 Item 11	*The development of facilities or infrastructure for the transmission and distribution of electricity-*	**The proposed development will include the construction of on on-site Eskom substation, a linking substation and an associated power line. The proposed on-site Eskom substation, linking substation and**

	(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	**associated power line will be located outside an urban area and will have capacities of 132kV respectively.**
GN R. 983 Item 12	*The development of:* *ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(a) within a watercourse;* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*	**The proposed development will entail the construction of buildings and other infrastructure exceeding 100 square metres in size.** **The Surface Water Specialist Assessment identified five (5) depression wetlands, twenty six (26) Major Drainage Lines (drainage line with channel width >5m) and one hundred and eighty (180) Minor Drainage Lines (drainage lines with channel width <5m).** **As a result, components of the proposed development might fall within 32m of surface water features. This activity will not be triggered by the on-site Eskom and linking substations since neither of the proposed alternatives are planned to be directly within or within close proximity (within 32m) to the identified surface water resources. However, a number of surface water features which can be found within the proposed power line corridor alternatives were identified. Depending on the location of the power line towers within the chosen power line corridor, it is possible that the power line might affect these identified surface water features.**
GN R. 983 Item 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	**The Surface Water Specialist Assessment revealed that there are surface water features located within the study area which might be impacted by the proposed development.**

	But excluding where such infilling, depositing, dredging, excavation, removal or moving- *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	**The Surface Water Specialist Assessment identified five (5) depression wetlands, twenty six (26) Major Drainage Lines (drainage line with channel width >5m) and one hundred and eighty (180) Minor Drainage Lines (drainage lines with channel width <5m).** **This activity will not be triggered by the on-site Eskom and linking substations since neither of the proposed alternatives are planned to be directly within or within close proximity (within 32m) to the identified surface water resources. However, a number of surface water features which can be found within the proposed power line corridor alternatives were identified. Depending on the location of the power line towers within the chosen power line corridor, it is possible that the power line might affect these identified surface water features. Should construction activities take place within a watercourse, soil will need to be removed.** **Roads providing access to the substations and the power line servitude will need to be constructed through a number of watercourses and this will involve the removal and infill of material from the respective affected watercourses that may amount to more than 10m³.**
GN R. 983 Item 27	*The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where*	**The proposed development will include the construction of an on-site Eskom substation and a linking substation. For the purpose of this BA,**

	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.*	**Mainstream are assessing areas of approximately 15ha and 36ha with regards to the on-site Eskom and Linking Substation sites respectively. However, only areas of approximately 2ha and 5ha will be used for the construction of the proposed on-site Eskom and Linking substations, respectively.** **All vegetation on these sites would therefore need to be cleared for the construction of the substations and associated infrastructure and this will amount to an area greater than 1 hectare, but less than 20 hectares.** **The dominant vegetation class across the study area is Bushmanland Basin Shrubland. Western Bushmanland Klipveld occurs on the north-western boundary of the study area, while Bokkeveld Sandstone Fynbos is present on the south-western boundary. Bushmanland Vloere occurs in and around the salt pans scattered across the eastern half of the study area.**
GN R. 983 Item 28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 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;* *excluding where such land has already been developed for residential, mixed,*	**The proposed project site is currently used for agricultural purposes, specifically commercial sheep farming, and the proposed project will result in an area greater than 1 hectare being transformed into an industrial land use.**

	retail, commercial, industrial or institutional purposes.	

1.3.3 Environmental Impact Assessment Guideline for Renewable Energy Projects, DEA Notice 989 of 2015

The purpose of this document is primarily to provide guidance on the environmental management legal framework applicable to renewable energy operations and all the role players in the sector. The guideline is principally intended for use by the following stakeholder groups:

- Public Sector Authorities (as regulator and/or competent authority);
- Joint public sector authorities and project funders, e.g., Eskom, IDC, etc.
- Private Sector Entities (as project funder/developer/consultant); and
- Other interested and affected parties (as determined by the project location and/or scope).

This guideline seeks to identify activities requiring authorisation prior to commencement of that activity, and provide an interface between national EIA regulations and other legislative requirements of various authorities.

The guidelines are applicable for the construction, installation and/or development of the following renewable energy projects:

  - Concentrating Solar Power Energy facility;
  - Wind Farm;
  - Hydropower Station; and
  - Photovoltaic Power Facility.

As the proposed development is for electricity distribution infrastructure which will form part of a wind farm, it is subject to the recommendations proposed in the guidelines.

1.3.4 National Energy Act No. 34 of 2008

The National Energy Act (Act no, 34 of 2008), promulgated in 2008, has, as one (1) of its key objectives, the promotion of diversity of supply of energy and its sources. From this standpoint, the Act directly references the importance of the renewable energy (RE) sector, with a mention of the wind energy sector included. The aim is to ensure that the South African economy is able to grow and develop, fast tracking poverty alleviation, through the availability of a sustainable, diverse energy mix. Moreover, the goal is to provide for the increased generation and consumption of RE (Republic of South Africa, 2008).

1.3.5 National Heritage Resources Act No. 25 of 1999

This Act requires all developers to undertake archaeological impact studies whenever any type of development activity is undertaken. Preliminary archaeological impact studies will consequently become a common procedure for all development activities, even if such development may be exempted in terms of the National Environmental Management Act (Act No 107 of 1998).

The law ensures community participation in the protection of national heritage resources and will involve all three (3) levels of government in the management of the country's national heritage. The South African Heritage Resources Agency (SAHRA) will establish and maintain a national policy, strategy plans and standards for heritage resources management and will monitor the system as a whole.

Heritage authorities will assist and co-operate with individuals and organisations concerned with the study, the conservation, promotion and utilisation of national heritage resources. A newly established National Heritage Resources Fund will provide financial assistance for heritage projects.

A heritage assessment has been conducted to explore how the proposed development may impact on heritage resources as protected by the Act.

1.3.6 National Water Act No. 36 of 1998, as amended

The National Water Act (NWA) No 36 of 1998 was promulgated on the 20th of August 1998. This Act is important in that it provides a framework to protect water resources against over exploitation and to ensure that there is water for socio-economic and economic development, human needs and to meet the needs of the aquatic environment. The Act also recognises that water belongs to the whole nation for the benefit of all people.

It is important to note that water resources are protected under the Act. Under the act, water resources as defined include a watercourse, surface water, estuary or aquifer. A watercourse is defined as a river or spring, a natural channel in which water flows regularly or intermittently, or a wetland, lake or dam into which, or from which water flows.

One (1) of the main aims of the Act is the protection of water resources. 'Protection' in relation to a water resource entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource; and

- The rehabilitation of the water resource.

In the context of the proposed development and any potential impact on water resources, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (*inter alia*):

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

This definition of pollution is quite wide ranging, and it applies to all types of water resource. Activities which cause alteration of the biological properties of a watercourse (i.e. the fauna and flora contained within that watercourse are also considered pollution).

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include (inter alia):

- measures to cease, modify, or control any act or process causing the pollution;
- comply with any prescribed waste standard or management practice;
- contain or prevent the movement of pollutants;
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse.

A surface water assessment has been conducted to explore how the proposed development may impact on water resources as protected by the Act.

1.3.7 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004 as amended)

The overarching aim of the National Environmental Management: Biodiversity Act (NEMBA) No. 10 of 2004, within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

The South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.

NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake a Faunal and Botanical Impact Assessment where proposed developments, in an area that is considered ecologically sensitive, require an environmental authorisation in terms of NEMA, with such Assessment taking place during the basic assessment or EIA. These two (2) studies will be undertaken during the project.

The NEMBA is relevant to the proposed project as the construction of the electricity distribution infrastructure may impact negatively on biodiversity. The project proponent is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required and to also invite SANBI to provide commentary on any documentation resulting from the proposed development.

1.3.8 National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003 as amended)

The overarching aim of the National Environmental Management: Protected Areas Act (NEMPAA) No. 57 of 2003, within the framework of NEMA, is to provide for:

- provide for the declaration and management of protected areas;
- provide for co-operative governance in the declaration and management of protected areas;
- effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity;
- provide for a representative network of protected areas on state land, private land and communal land;
- promote sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas;
- promote participation of local communities in the management of protected areas, where appropriate; and
- provide for the continued existence of South African National Parks.

1.3.9 National Forests Act, 1998 (Act No. 84 of 1998)

The National Forest Act (NFA) was enacted to:

- Provide for the protection, management and utilisation of forests;
- The protection of certain plant and animal life;
- The regulation of trade in forest produce;
- The control and management of a national hiking way system and National Botanic Gardens.

The NFA enforces the necessity for a license to be obtained prior to destroying any indigenous tree in a natural forest and, subject to certain exemptions, cutting, disturbing, damaging, destroying or removing any protected tree. The list of protected trees is currently contained in GN 908 of 21 November 2014. Licenses are issued by the Minister and are subject to periods and conditions as may be stipulated.

The NFA is relevant to the proposed project as the removal and/or disturbance and/or clearance of indigenous vegetation may be required and a license in terms of the NFA may be required for this to be done.

1.3.10 Conservation of Agricultural Resources Act No. 43 of 1983

The Conservation of Agricultural Resources Act (CARA) No. 43 of 1983 controls the utilisation of natural agricultural resources in South Africa. The Act promotes the conservation of soil, water sources and vegetation as well as the combating weeds and invader plants. The Act has been amended in part by the Abolition of Racially Based Land Measures Act, No. 108 of 1991.

The primary objective of the Act is to conserve natural agricultural resources by:

- maintaining the production potential of land;
- combating and preventing erosion and weakening or destruction of the water resources;
- protecting vegetation; and
- combating weeds and invaders plants.

The CARA is relevant to the proposed projects as the construction of the substations and power line may impact on agricultural resources and vegetation on the site. The Act prohibits the spreading of weeds and prescribes control measures that need to be complied with in order to achieve this. As such, measures will need to be taken to protect agricultural resources and prevent weeds and exotic plants from invading the site as a result of the proposed development.

An agricultural potential assessment has been conducted to explore how the proposed development may impact on the agricultural production potential of the proposed site.

1.3.11 Subdivision of Agricultural Land Act No. 70 of 1970, as amended

The Subdivision of Agricultural Land Act No. 70 of 1970 controls the subdivision of all agricultural land in South Africa; prohibiting certain actions pertaining to agricultural land. Under the Act the owner of agricultural land is required to obtain consent from the Minister of Agriculture in order to subdivide agricultural land.

The purpose of the Act is to prevent uneconomic farming units from being created and degradation of prime agricultural land. To achieve this purpose the act also regulates leasing and selling of agricultural land as well as registration of servitudes.

The Act is of relevance to the proposed development as any land within the study area that is zoned for agricultural purposes will be regulated by this Act.

Although the whole of this Act has been repealed by section 1 of the Subdivision of Agricultural Land Act Repeal Act 64 of 1998, this Repeal Act has not been implemented and no date of coming into operation has been proclaimed.

It is important to note that the implementation of this act is problematic as the Act defines 'Agricultural Land' as being any land, except land situated in the area of jurisdiction of a municipality or town council, and subsequent to the promulgation of this Act uninterrupted Municipalities have been established throughout South Africa.

1.3.12 National Road Traffic Act No. 93 of 1996, as amended

The National Road Traffic Act (NRTA) No. 93 of 1996 provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed project.

1.3.13 Civil Aviation Act No. 13 of 2009

The Civil Aviation Act No. 13 of 2009 controls and regulates aviation within South Africa. It provides for the establishment of a South African Civil Aviation Authority (CAA) and independent Aviation Safety Investigation Board in compliance with Annexure 13 of the Chicago Convention. It gives effect to various conventions related to aircraft offences, civil aviation safety and security, and provides for additional measures directed at more effective control of the safety and security of aircrafts, airports and matters connected thereto.

Although the Act is not directly relevant to the proposed development, it should be considered as the establishment of electricity distribution infrastructure (such as substations and power lines) may impact on aviation and air traffic safety if located directly within aircraft flight paths.

Air Traffic and Navigation Services Company Limited (ATNS) and the CAA will be consulted and the required approvals will be obtained prior to construction.

1.3.14 Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)

These are developed to protect both animal and plant species within the various provinces of the country which warrant protection. These may be species which are under threat or which are already considered to be endangered. The provincial environmental authorities are responsible for the issuing of permits in terms of this legislation. The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) and the Nature and Environmental Conservation Ordinance 19 of 1974 are of relevance to the Northern Cape Province.

A biodiversity assessment has been conducted to explore how the proposed development may impact on biodiversity as protected by the Act.

1.3.15 Astronomy Geographic Advantage Act No. 21 of 2007

The Astronomy Geographic Advantage Act No. 21 of 2007 provides for:

- The preservation and protection of areas that are uniquely suited for optical and radio astronomy; and
- Intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas and matters connected therewith.

In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. As such, all land within a 3 Kilometre radius of the centre of the Southern African large Telescope (SALT) dome located in the Northern Cape Province, falls under the Sutherland Core Astronomy Advantage

Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope.

Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation; of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavours.

1.3.16 Additional Relevant Legislation

- Occupational Health and Safety Act (Act No. 85 of 1993)
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008 as amended)
- Development Facilitation (Act No. 67 of 1995)
- The Hazardous Substances Act (Act No. 15 of 1973)
- Water Services Act (Act No. 108 of 1998)
- Electricity Regulation Act (Act No. 4 of 2006 as amended)
- Municipal Systems Act (Act No. 32 of 2000)
- Mineral and Petroleum Resource Development Act (Act No. 28 of 2002 as amended)
- Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998)

1.4 Key Development Strategies and Guidelines

1.4.1 Integrated Development Plans

An Integrated Development Plan (IDP) is defined in the Local Government: Municipal Systems Act No. 32 of 2000), as an inclusive and strategic plan that:

- Links, integrates and co-ordinates plans and takes into account proposals for the development of the municipality;
- Aligns the resources and capacity of the municipality with the implementation of the plan
- Forms the policy framework on which annual budgets must be based; and
- Is compatible with national and provincial development plans and planning requirements binding on the municipality in terms of legislation.

The main purpose of the IDP is considered the enhancement of service delivery and fighting poverty through an integrated and aligned approach between different role-players and stakeholders.

Each municipality is required to produce an IDP which would address pertinent issues relevant to their municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development.

The proposed development is situated within the Hantam Local Municipality (LM), which is located within the greater Namakwa District Municipality (DM). The Namakwa Integrated Development Plan (IDP) sets out to utilise natural resources in the Province by optimally utilising and managing resources in each sector; this includes the growing realisation of investing in more renewable energy based development. The Namakwa DM has a competitive advantage in the energy sector as wind, solar, wave, nuclear and natural gas energy plants have all been identified as suitable investments in the area. Amongst other sectors such as agriculture and tourism, renewable energy is thus prioritised. Several large-scale renewable energy projects have already been included in the IDP of the district. The district also recognises the importance of the agriculture and tourism industries in the area and promotes their development and transformation, especially eco-heritage (Namakwa DM, 2014).

Despite the fact that the proposed development is situated within the Hantam LM only, the Khai-Ma LM is also located within close proximity to the project site and is thus also expected to be impacted to a degree. As such, the IDPs for both the Hantam and Khai-Ma LMs have been assessed and included in this section. According to the Hantam LM and Khai-Ma LM Integrated Development Plans (IDPs), considering the location of the site relative to the Hantam and Khai-Ma LMs, the review of the strategic policies highlights the importance of improving the living standards of the citizens of the municipalities as being amongst the top priorities of local government. Stimulating and strengthening the economy through various sector development interventions is envisioned to be one (1) of the means to achieve this. Based on the composition and natural resource endowment of these municipalities, particular developmental priority is given to the agriculture and tourism sectors. Although flower tourism is seasonal in the Hantam LM, eco-tourism has been recently seen as the main growth stimulant for the regional economy. At the same time, the agricultural sector provides the most employment opportunities in the municipal area; thus, making it the backbone of the Hantam LM (Hantam IDP, 2015). The above suggests that the tourism and agricultural sectors should be preserved and all effort needs to be made in order to ensure that no new development results in the loss of these activities.

In considering the spatial development pattern of the Khai-Ma LM, strengthening local economic growth is one (1) of the focal aspects of the Khai-Ma LM Rural Spatial Development Framework (SDF). In terms of their contribution to GDP, the agriculture and tourism sector are the main contributors to the economic sector of the Khai-Ma LM as the municipality has a unique environment that needs to be exploited in a sustainable manner (Umsebe Development Planners, 2010). The Hantam LM SDF also further highlights that economic sector interventions in the area has led the municipality to seek complementary development opportunities in sectors such as agriculture, mining, tourism and renewable energy (Umsebe Development Planners, 2010; Hantam LM Spatial Development Framework (SDF)).

Upon reviewing the spatial planning component, the Namakwa DM as well as the Hantam and Khai-Ma LMs' spatial development frameworks do not suggest any potential conflicts between the planned spatial development visions and the proposed development. In addition, the site where the proposed project will be developed is not located near any settlement or tourism attraction or agricultural land that might be sensitive to the environmental effects of the proposed project. After considering the reviewed documentation, the proposed development is in alignment with national, provincial and local objectives, plans and strategies relating to socio-economic development of the areas under analysis. There were no fatal flaws or contraventions identified as all spheres of government prioritise the development of renewable energy projects. The proposed project fits well with the plans to diversify the provincial, district and local economies through investment in renewable energy projects.

It can be suggested that the proposed project does not only conflict with any of the identified developmental priorities of the local governments in question but is also in alignment with the identified means to stimulate the local economy. The Hantam IDP, 2015, notes that Climate change will impact on biodiversity and with this the ability of biodiversity and ecosystems to provide ecosystem services that support human society. This is particularly important in rural areas such as the Namakwa District (ND), where the link between people and the environments that support them (and place them at risk in terms of droughts and other extreme weather events) is far more direct than in more urbanized environments (Hantam IDP, 2015). Some features in the landscape are more likely to support resilience of biodiversity to climate change than others. Such features include: riparian corridors and buffers; coastal corridors; areas with temperature, rainfall and altitudinal gradients; areas of high diversity; areas of high plant endemism; refuge sites including south-facing slopes and kloofs; and priority large unfragmented landscapes. Keeping these areas in a natural or near-natural state will help ecosystems and species to adapt naturally to climate change, thus supporting healthy landscapes and the ability of ecosystems to continue to provide ecosystem services to communities (Hantam IDP, 2015). Policy decisions taken in the next decade will largely determine the dimension of the impact of climate change. Eco-systems-based adaptation approaches, using nature and biodiversity to help people cope with, and respond to the negative impacts of climate change, will have an important role to play in Hantam. Local government is in the front line of implementation and service delivery, and thus needs to pursue adequate mitigation and adaptation strategies which should include participation from the public sector, the private sector and NGOs (Hantam IDP, 2015). Therefore, it is evident that the proposed development is aligned with the goals of the municipal IDPs in the study area.

1.4.2 Draft Integrated Energy Plan for the Republic of South Africa, 2013

The Draft Integrated Energy Plan (IEP), developed by the DoE, are anchored in the National Energy Act, 2008 (Act No. 34 of 2008). The IEP was undertaken to determine the best way to meet current and future energy service needs in the most efficient and socially beneficial manner, while:

- Maintaining control over economic costs;
- Serving national imperatives such as job creation and poverty alleviation; and
- Minimising the adverse impacts of the energy sector on the environment.

The IEP takes into consideration the crucial role that energy plays in the entire economy and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple objectives, some of which include:

- To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector;
- To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power facilities and refineries to be built and the prices that should be charged for fuels);
- To guide investment in and the development of energy infrastructure in South Africa; and
- To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

The IEP considers the national supply and demand balance and proposes alternative capacity expansion plans based on varying sets of assumptions and constraints. While infrastructural matters are briefly discussed, the IEP does not explicitly consider supply and demand at specific geographical locations within the country, nor does it take into account infrastructure bottlenecks at specific locations. These are, or will be, covered in detail as follows:

- Electricity infrastructure (transmission and distribution) is dealt with in other plans and the Integrated Resource Plan (IRP) should assess these in detail, taking into consideration the grid planning currently conducted by Eskom;
- Electricity supply is dealt with in the IRP;
- Liquid fuels will be dealt with in the 20-Year Liquid Fuel Infrastructure Roadmap which will cover logistical matters relating to pipelines and storage facilities for petroleum products; and
- The Gas Utilisation Master Plan (GUMP) will take into consideration the bottlenecks and capacity constraints of the current natural gas infrastructure. All the above will inform the integrated energy planning process and will enable overall enhancement through ongoing periodic iterations to ensure alignment.

1.4.3 Integrated Resource Plan, 2010 and updated 2016

The Integrated Resource Plan (IRP) was created in order to plan for projected national electricity demand. The IRP 2010-30 was promulgated in March 2011, and was planned to be a “living plan”, as it needs to take into account changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst other factors. Since the promulgation of the (IRP) 2010-30 there have been a number of developments in the energy sector in South and Southern Africa. In addition the electricity demand outlook has changed from that expected in 2010. As a result the DoE is in the processing of updating the IDP and has recently published Assumptions and Base Cases in November 2016.

- While the IRP 2010-30 remains the official government plan for new generation capacity until it is replaced by an updated plan, there are a number of assumptions that have changed and these include: The changed landscape over the past years, in particular in electricity demand and the underlying relationship with economic growth;
- New developments in technology and fuel options (locally and globally);
- Scenarios for carbon mitigation strategies and the impact on electricity supply up to 2050; and
- The affordability of electricity and its impact on demand and supply.

The IRP 2010-30 assumed the existing Eskom fleet to have an average availability of 86%, however actual performance has in the recent past declined to less than 70% availability.

The learning rates adopted in IRP 2010-30 are maintained in the 2016 update with PV and Wind learning rates adjusted to reflect the quick fall in prices experienced in South Africa and are reflected in the table below.

Technology	**2015 (R/kW)**	**2050 (R/kW)**
PV (fixed tilt)	16860.6	13425.03408
PV (tracking)	17860.6	14221.26959
Wind	19208.1	17287.405
Nuclear	55260	53768.80047

The new generation capacities called for in the Ministerial Determinations that are not yet committed (no procurement has started) are allowed to lapse. This means that only procurement up to bid window 4.5 for renewables (expedited including smalls) and coal 900MW are considered committed. The Base Case maintains a number of policy positions imposed in the IRP 2010-30 in particular an annual build limit of new capacity for wind (1600 MW) and photovoltaic (1000 MW).

- Based on least cost and moderate emissions reduction trajectory, the model results indicates, 18GW of PV, 37GW of Wind, 20GW of Nuclear, 34GW of Gas, 2500 of Hydro, 15GW of Coal by end of the study horizon (year 2050);
- Looking at same study period used in the promulgated IRP 2010-30, the model results indicate 4.7GW of PV ,6.4GW of Wind, 12.7GW of Gas and 5.3GW of Coal by year 2030;

- The first unit of Nuclear appears around year 2037, but this is sensitive to other technology primary fuel costs and their associated emission assumptions. These will be tested as a scenario as indicated in the next section. The 2030 figures in the Base Case are different from those in the IRP 2010-30 because they exclude the capacity already procured/under procurement (6.2GW of renewable energy as well as 900MW of coal). The figures are also different because adjustment based on scenario analysis and policy has not been done.

1.4.4 Department of Energy White Paper on Renewable Energy, 2003

The Department of Energy (DoE) gazetted its White Paper on Renewable Energy in 2003, and introduced it as a "policy that envisages a range of measures to bring about integration of renewable energies into the mainstream energy economy." At that time the national target was fixed at 10 000GWh (0.8Mtoe) renewable energy contribution to final energy consumption by 2013. The White Paper proposed that this would be produced mainly from biomass, wind, solar and small-scale hydropower. It went on to recommend that this renewable energy should to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. Since the White Paper was gazetted, South Africa's primary and secondary energy requirements have remained heavily fossil-fuel dependant, in terms of both indigenous coal production and use, as well as the use of imported oil resources. Alongside this, the projected electricity demand of the country has led the National utility Eskom, to embark upon an intensive build programme to secure South Africa's longer-term energy needs, together with an adequate reserve margin.

1.4.5 Renewable Energy Independent Power Producer Procurement Program (REIPPPP)

(The following information was extracted from the Eskom website: **Guide to Independent Power Producer (IPP) processes in South Africa and Eskom, June 2010** http://www.eskom.co.za/live/content.php?Item_ID=14324)

The objective of this section is to provide an overview of the processes in the country and within Eskom relating to Independent Power Producers (IPPs). It is important that certain enabling policies, rules and regulations are in place to provide certainty and transparency in the introduction of IPPs.

- **Country Process**

South Africa has two (2) acts that direct the planning and development of the country's electricity sector:

i. The National Energy Act of 2008 (No. 34 of 2008); and
ii. The Electricity Regulation Act (ERA) of 2006 (No. 4 of 2006).

In August 2009, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- Formal Programmes

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) developed by the DoE sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP. The table below highlights the energy plan that has been proposed until 2030.

Table 5: Government Energy Plans up until 2030 in terms of the IRP

New Build Options									
	PV	**Wind**	**Landfill Gas**	**DR**	**Nuclear**	**OCGT**	**CCGT**	**Coal PF wFGD**	**Inga**
2016									
2017									
2018									
2019									
2020									
2021	160								
2022	160								
2023	370	200							
2024	440	500		1000		396			
2025	650	1000	15	1000		2376	732		
2026	580	1000	5	1000		264	1464		
2027	580	1000	230	1000		264	2196		
2028	580	1000		500		396	1464	1500	
2029	580	1100		1000			1464	1500	
2030	580	1200		1000		1716		2250	1000
2031	580	1200		1000		1584		750	
2032	580	1200		500			732	1500	1000
2033	580	100					1464	750	500
2034	580	1200		1000		1452			
2035	580	1600		500			1464	1500	
2036	580	1600		1000				1500	
2037	580	1400		500	1359		732	2250	
2038	580	1600				1848	1464	750	
2039	650	1500			1359		2928		
2040	650	1600		1000		1056	732		
2041	650	1600		1000	4077	792		750	

2042	650	1600		500			2196		
2043	650	1600		500					
2044	650	1800		500	1359				
2045	770	1600			2718		2196		
2046	790	1600		500	1359	924			
2047	720	1800		1000	1359		732		
2048	720	1600		500	2718	264			
2049	660	1500		500	1359				
2050	720	1400		500	2718				
Total (MW)	17600	37400	250	500	20385	13332	21960	15000	2500

A decision that additional capacity be provided by an IPP must be made with the concurrence of the Minister of Finance. Once such a decision is made, a procurement process needs to be embarked upon to procure that capacity in a fair, equitable and transparent process.

The New Generation Regulations set out the procurement process. The stages within a bid programme are prescribed as follows:

i. Request for Qualifications (RFQ);
ii. Request for Proposals (RFP); and
iii. Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to approval by the Regulator.

1.4.6 The Northern Cape Provincial Growth and Development Strategy (NC PGDS)

The importance of developing the renewable energy sector in the Northern Cape was first acknowledged in the Northern Cape Provincial Growth and Development Strategy (NC PGDS). The NC PGDS refers to the need to ensure availability of affordable energy. It notes, “in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured.” At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province’s natural resource endowments must be encouraged. In this regard the NC PGDS notes that, “development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which economic opportunity and activity is generated in the Northern Cape”. The NC PGDS also notes that “sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation”. In this regard, care needs to be taken to ensure that renewable energy facilities and their associated infrastructure do not impact negatively on the region's natural environment.

1.4.7 The Northern Cape Provincial Spatial Development Framework (SDF)

In the Northern Cape Provincial Spatial Development Framework (SDF) of 2011, the Northern Cape provincial government acknowledges that the major energy challenge faced by the province is finding a balance between ensuring electricity security and addressing issues around climate change. The Northern Cape Provincial SDF (2011) states that the energy sector could benefit the economy significantly through created economic spin-offs or multiplier effects. This will, however, require innovative planning to provide the necessary infrastructure and associated amenities to accommodate the industry in an efficient manner (Dennis Moss Partnership, 2012).

2 ASSUMPTIONS AND LIMITATIONS

The following general assumptions, uncertainties ans gaps in knowledge were encountered by the EAP / Environmental Team when preparing the DBAR:

- It is assumed that all information provided by the Applicant to the Environmental Team was correct and valid at the time it was provided.
- It is not always possible to involve all Interested and/or Affected Parties (I&APs) individually, however, every effort has/is been made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations / parties.
- It is assumed that the information provided by the various specialists is unbiased and accurate.

The following assumptions, uncertainties and gaps in knowledge were encountered by the various specialists:

- **<u>Biodiversity:</u>**
  - The current study is based on a number of site visits as well as an associated desktop study.
  - Although it was not very wet at the time of the site visits, conditions were nevertheless suitable for the assessment and there no significant limitations associated with the timing of the field assessment.
  - The presence of some fauna is difficult to verify in the field as these may be shy or rare and their potential presence at the site must be evaluated based on the literature and available databases. In many cases, these databases are not intended for fine-scale

use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past.

- Many remote areas have not been well sampled with the result that the species lists derived for the area do not always adequately reflect the actual fauna and flora present at the site. This is acknowledged as a limitation of the study, however it is substantially reduced by the fact that the consultant has sampled the adjacent properties on multiple occasions across different seasons. In order to further reduce this limitation, and ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site.

- **Avifauna:**
  - A total of 63 full protocol lists has been completed to date for the 16 pentads where the powerline study area is located (i.e. listing surveys lasting a minimum of two hours each). This is a fairly comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed powerline study area. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, SABAP1 records (Harrison et al. 1997), the results of the 12-months pre-construction monitoring and observations during a follow-up site visit.
  - Conclusions in this study are based on experience of these and similar species in different parts of South Africa. However, bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
  - Specific emphasis was placed on the potential impact on Red Data species.

Cumulative Impacts:

- The information on proposed WEFs and grid connections in the study area was received from SiVEST and from various websites. The assessment was made on this basis, but it cannot be guaranteed that these are the only proposed developments.

- **Surface Water:**
  - This short term once-off surface water assessment has only focused on the identification and delineation of surface water resources within the proposed development area. Identification and delineation of surface water resources in the wider area outside of the proposed development area have not been undertaken.
  - Given the timing and short term once-off nature of the assessment, the assessment should not be undertaken to be a fully comprehensive study on wetland and riparian vegetation species occurrence within the surface water resources.
  - Use of database information for the desktop assessment included the National Freshwater Ecosystem Priority Areas (NFEPA, 2011) database. This database is a national level database and some smaller surface water resources may not be identified if the database. Additionally, mainly wetlands with permanent inundation are included in the database. Therefore, wetlands with seasonal and temporary saturation

cycles may not be included. The fieldwork component was included in the assessment to verify the desktop database information in order to address these shortcomings.

  - Surface water resources were initially identified and delineated at a desktop level. These were then groundtruthed and verified in the field work phase. The initial delineations undertaken at a desktop level were refined following findings made in the field work phase.
  - A Global Positioning System (GPS) device was used to groundtruth surface water resources as well as for delineation purposes. The GPS is expected to be accurate from 5m up to 15m depending on meteorological conditions.
  - Aquatic studies of fish, invertebrates, amphibians etc. have not been included in this report. Nor have water quality, hydrological or groundwater studies been included.
  - Wetland or river health, present ecological status (PES), ecosystem services and the ecological importance (EI)/ecological sensitivity (ES) categories have not been assessed for identified surface water resources. Only desktop information in terms of PES/EI/ES (where available) from the databases were provided as per the scoping assessment information.
  - Application of the DWAF (2005 and 2008) delineation guidelines are limited for the delineation of drainage lines and pan wetlands in arid and semi-arid regions due to the intermittent nature of flow which is poorly accommodated in the methodology, and application thereof.
  - Avifauna in general are known to frequent surface water resources regularly, or in some cases can live in these habitats on a longer more permanent basis. Impacts to avifauna therefore may fall within the scope of a surface water assessment from an ecological perspective. However, as a separate independent avifaunal assessment has been undertaken for the proposed development, the assessment of potential impacts as related to avifauna have not been included in this assessment. It is therefore assumed that all avifaunal impacts (including that related to waterfowl associated with wetlands and other surface water resources) will have been adequately covered in the avifaunal impact assessment.

- **Soils and Agricultural Potential:**
  - The field investigation for this assessment is considered more than adequate for the purposes of this study (see section 3.1 of the Soils and Agricultural Potential Report) and is therefore not seen as a limitation.
  - 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 study area. 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.

- **Heritage:**
  - Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the development area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

- **Palaeontology:**
  - The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:
    - Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist
    - The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
    - Impact studies and other reports (e.g. of commercial mining companies) - is not readily available for desktop studies.
  - Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies of this nature therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a Palaeontological Impact Assessment may be significantly improved through field-survey by a professional palaeontologist.

- **Visual:**
  - The identification of visual receptors has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Thereafter a site visit was undertaken from the 05th to the 09th of December 2016 in order to verify the sensitive visual receptors within the study area and assess the visual impact of the development

from these receptor locations where possible. Due to the extensive area covered by the study area, a number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic locations within natural settings. The presence of a receptor in an area potentially affected by the proposed development does not therefore necessarily mean that a visual impact will be experienced.

- On-site substations and power lines are very large structures by nature and could impact on receptors that are located relatively far away, particularly in areas with very flat terrain. Given the nature of the receiving environment and the height of the proposed development, the study area or visual assessment zone is assumed to encompass a zone of 5km from the proposed development– i.e. all areas within a 5km radius of the power line corridor and/or substation site alternatives. This 5km limit on the visual assessment zone was applied because distance is a critical factor when assessing visual impacts and although the proposed power line may still be visible beyond 5km, the degree of visual impact would diminish considerably. As such the need to assess the impact on potential receptors beyond this distance would not be warranted.
- Due to the varying scales and sources of information as well as the fact that only 20m contours were available to establish the Digital Terrain Model (DTM); maps and terrain models may have minor inaccuracies. As such, only large scale topographical variations have been taken into account and minor topographical features or small undulations in the landscape may not be depicted on the DTM.
- During the site visit, it was observed that a few of the farmsteads / residential dwellings identified via desktop means (i.e. Google Earth) have been abandoned and no one is currently residing within them. As such no further assessment was undertaken from these locations and they were eliminated from the list of potentially sensitive receptor locations for the purpose of this study.
- Due the extensive area covered by the study area, the extensive number of farmsteads and residential dwellings located within the study area and access limitations during the site visit access, the impact rating assessment of the proposed development on the potentially sensitive visual receptor locations was undertaken primarily via desktop means. Although the use of these farmsteads / residential dwellings could not be established during the field investigation, they were still regarded as being potentially sensitive to the visual impacts associated with the proposed substations and power line and were assessed as part of the VIA.
- No viewsheds were generated during this visual study, as the topography within the study area is relatively flat and no detailed contours were available. Within this context,

minor topographical features, vegetative screening, or man-made structures would be important factors which influence the degree of visibility, but would not be reflected in the viewsheds.

- A matrix has been developed to assist in the assessment of the potential visual impact at each receptor location. The limitations of quantitatively assessing a largely subjective or qualitative type of impact should be noted. The matrix is relatively simplistic in considering three main parameters relating to visual impact, but provides a reasonably accurate indicative assessment of the degree of visual impact likely to be exerted on each receptor location by the proposed substations and power line. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location.
- The assessment of receptor-based impacts has been based on the power line corridor and substation site alternatives provided by the proponent. It is recognised however that the exact route of the power line within the corridor has not been determined, and as such the final routing of the proposed power line may result in greater or lesser visual impacts on receptor locations.
- Visualisation modelling has not been undertaken for the proposed development as the power line route alignment within the corridor and tower locations have not been established.
- No feedback related to the visual environment has been received during the BA phase public participation processes. Should any feedback be received, this report will be updated accordingly.
- Operational and security lighting will be required for the substations proposed within the development footprint. At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed at a detailed level. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.
- Most rainfall within the area occurs from November to March, during the late summer months. It should be noted that the fieldwork was undertaken at the beginning of December 2016, during early summer. During winter months up until early summer, the visual impact of the proposed development may be greater, particularly from farmhouses surrounded by tall deciduous trees. As such, the surrounding vegetation is expected to provide less potential screening than in the late summer months.
- The weather conditions in the study area also have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. As mentioned above, the fieldwork was undertaken during the early summer months which are characterised by clear weather conditions. In these clear weather conditions the contrast of the power line towers with the surrounding environment would be greater than the contrast on a cloudy day. As such, the weather conditions during the time of the study area were taken into consideration when undertaking the impact

rating for each identified sensitive and potentially sensitive receptor locations (section 4.2 of the Visual Impact Assessment Report).

- **<u>Socio-Economic:</u>**
  - The secondary data sources used to compile the socio-economic baseline (demographics, dynamics of the economy), although not exhaustive, can be viewed as being indicative of broad trends within the study area.
  - The study was done with the information available to the specialist within the timeframes and specified budget.
  - Project-related information supplied by the environmental practitioner and the client for the purpose of this analysis is assumed to be reasonably true.
  - It is assumed that the project description and infrastructure components as discussed above are reasonable accurate. These details were used to assess the potential impacts.
  - Possible impacts, as well as stakeholder responses to these impacts, cannot be predicted with complete accuracy, even when circumstances are similar and these predictions are based on research and years of experience, taking the specific set of circumstance into account.
  - Regarding the interviews undertaken, the following assumptions were made:
    - Questions asked during the interviews were answered accurately.
    - The degree of the perceived possible significance of concerns raised by the respondents were rated by them truthfully.
    - The attitudes of the respondents towards the project will remain reasonably stable over the short to medium terms.
  - The focus on the primary data collection was on those parties that were perceived to be the most sensitive to the proposed project. As such, it is believed that the study was able to identify the most significant impacts and assess the most pertinent issues.

3 PROJECT NEED AND DESIRABILITY

3.1 National Renewable Energy Requirement

In 2010 South Africa (SA) had 44,157MW of power generation capacity installed. Current forecasts indicate that by 2025, the expected growth in demand will require the current installed power generation capacity to be almost doubled to approximately 74,000MW (SAWEA: 2010).

This growing demand, fuelled by increasing economic growth and social development within Southern Africa, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmental impact, climate change and the need for sustainable development. Despite the worldwide concern regarding GHG emissions and climate change, South Africa continues to rely heavily on coal as its primary source of energy, while most of the countries renewable energy resources remain largely untapped (DME, 2003). There is therefore an increasing need to establish a new source of generating power in SA within the next decade.

The use of renewable energy technologies, as one of a mix of technologies needed to meet future energy consumption requirements is being investigated as part of Eskom's long-term strategic planning and research process. It must be remembered that wind energy is plentiful, renewable, widely distributed, clean and reduces greenhouse gas emissions when it displaces fossil-fuel derived from electricity. In this light, renewable wind energy can be seen as desirable.

The REIPPP programme and the competitiveness nature of the bidding process has resulted in significant lowering of solar and wind tariff prices since 2011. Solar PV, for example, was bid with tariffs of R2.80/kWh at the inception of the REIPPPP in 2011, to 60c/kWh at present. Further projects will increase the competitive nature of the REIPPP program and further result in cost savings to South African consumers.

3.2 National Renewable Energy Commitment

In support of the need to find solutions for the current electricity shortages, the increasing demand for energy, as well as the need to find more sustainable and environmentally friendly energy resources, South Africa has embarked on an infrastructure growth programme supported by various government initiatives. These include the National Development Plan (NDP), the Presidential Infrastructure Coordinating Commission (PICC), the Department of Energy's Integrated Resource Plan, the National Strategy for Sustainable Development, the National Climate Change Response White Paper, the Presidency of the Republic of South Africa's Medium-Term Framework, and the National Treasury's Carbon Tax Policy Paper.

The Government's commitment to growing the renewable energy industry in South Africa is also supported by the *White Paper on Renewable Energy* (2003) which sets out the Government's principals, goals and objectives for promoting and implementing renewable energy in South Africa. In order to achieve the long term goal of achieving a sustainable renewable energy industry, the Department of Energy has set a target of contributing 17,8*GW* of renewable energy to the final energy consumption by 2030. This target is to be produced mainly through, wind and solar; but also through biomass and small scale hydro (DME, 2003; IRP, 2010). Further renewable energy targets have been proposed within the latest IRP, which is scheduled to be released for Gazetting in the first quarter of 2018.

3.3 Wind Power Potential in South Africa and Internationally

Onshore wind energy technology is the most commonly used and commercially developed renewable energy technology in South Africa, wind is abundant and inexhaustible (DEA Guideline for Renewable Energy, 2015). Wind energy is one of the lowest-priced renewable energy sources and is economically competitive (www.wasaproject.info).

3.4 Site Specific Suitability

The selection of a potential wind farm project site included several key aspects including wind resource, grid connection suitability as well as environmental, competition, topography and access.

Wind resource is one (1) of the main drivers of project viability across South Africa. This specific project site has been identified by Mainstream through a pre-feasibility desktop analysis based on the estimation of the wind energy resource. This region of the Northern Cape Province in South Africa has above average wind resource potentials. Following 12 months of wind resources measuring, initial results confirmed average wind speeds between 6 and 8m/s, which is considered highly suitable for a wind farm development. This high resource ensures the best value for money is gained for the economy of South Africa. The general area would experience a similar resource, but as resource is only one driver of site selection, the other aspects should be considered when holistically evaluating a project. Although wind resource information is considered to be confidential (by the developer) because of its commercial sensitivity, the following on-site wind parameter measurement related information can be provided:

- The project site was chosen based on an in-house study on the wind resource in the broader area;
- The findings of this study were supported by historic data from a local weather station, as well as from the Loeriesfontein and Khobab Met Masts, which have been measuring since 2012;
- Together this research provided a comprehensive macro wind model of the area, which clearly illustrated the preferred site as an optimal site for a wind farm;
- A met mast which was subsequently installed on site has confirmed the expected wind resource to be between 6 and 8m/s; and
- In addition to the wind resource, other key factors which indicated that the site is potentially suitable for a wind farm included but were not limited to proximity to and availability of Eskom grid, site access and constructability, and potential environmental and social sensitivities.

Grid connection suitability is the next element which drives the project location. Long connection lines have increased environmental impacts as well as add increased costs to the project development. The !Xha Boom project site has good grid connection potential as the project is likely to connect to the existing regional Helios MTS. The !Xha Boom facility is located approximately 32km from the substation, thereby minimising the need for an extensive grid network upgrade or long power line.

Environmental is a key aspect that Mainstream considers when evaluating a wind energy project. The project should be developed in a sustainable and ecologically friendly manner ensuring its development has the least possible impact on the land on which it will be built. The regional farms have been evaluated before the selection of these specific farms and it was concluded that the development on these farms would result in the least impact of regional fauna and flora. Certain farms in the region, which are located in the lower areas have increased biodiversity which are deemed sensitive and other farms show increased biodiversity.

The site is not located within any Critical Biodiversity Area (CBA), Protected Area, Important Bird Area (IBA) or Nature Reserve. There are however surface water resources (drainage lines and wetlands) located within the project site. It should be noted that buffers have been applied to these areas so that they will be avoided as far as practically possible.

Other key criteria which refines the site selection on a micro level include competition, topography and access. The project site has a flat arid topography which is suitable for the development of a wind project. The region does have several ongoing EIA developments, with two (2) 140MW projects currently under construction. The project site can be accessed easily via the N7 towards Kliprand via the R358 regional road or via the N1 to Loeriesfontein. Upgrade of the district gravel road will be done by the current preferred bidder projects to allow for direct access to site.

The proposed !Xha Boom 33/132kV On-site Eskom Substation will be located on Portion 2 of the Farm Georg's Vley No. 217, while the proposed Linking Substation will be located on Portion 1 of the Farm Hartebeest Leegte No 216. It should be noted that a preferred power line corridor alternative has not yet been determined and therefore it is unclear at this stage which farms / properties will be traversed by the proposed 132kV power line. As such, the farms / properties which will be traversed by the selected preferred power line corridor will be provided in the FBAR.

The farms are currently used for agricultural purposes, specifically commercial sheep farming. The proposed development is not envisioned to impact farming activities after the construction phase has been completed. With regards to competing land uses in the area, it was found that while sheep farming is the dominant activity grazing can still continue within the development area. The arid nature of the climate has restricted stocking densities which has resulted in relatively large farms across the area which are ideal for wind farm developments (including associated infrastructure such as substations and power lines). The wider area is therefore sparsely populated, and human-related infrastructure is largely restricted to isolated farmsteads and gravel access roads. The area is regarded as largely uninhabited and the closest built up area is the small town of Loeriesfontein approximately 68km to the south of the proposed development. It should also be noted that quarrying activities are present in the wider area, on the eastern edge of Konnes se Pan which is located to the north of the proposed development. These quarrying activities are however isolated to this part of the area and fall outside of the visual assessment zone. Despite this, these activities have reduced the natural/scenic character of the wider area to some degree. Due to the extreme aridity constraints as well as the poor soils, agricultural land use in the area is restricted to low intensity grazing only. As such, the area is not valued for its agricultural potential and the proposed development will only impact agricultural land which is of extremely low agricultural potential and is unsuitable for cultivation. In addition, several renewable energy developments (both wind and solar) are being proposed and/or constructed in the area. Such developments could cumulatively have positive or negative impacts which needs to be taken into consideration when determining the desirability of the project at the current location. The construction of these renewable energy developments is expected to result in the loss of agricultural land. The impact is however low because of the extremely limited agricultural potential of all land in the area, predominantly as a result of climatic limitations, and the fact that there is no particular scarcity of such land in South Africa. Furthermore it is preferable to incur a cumulative 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. In light of the above, it can be concluded that the land use in the area appears to be shifting more towards the use of renewable energy developments and the proposed site is therefore considered to be suitable from a land use perspective.

Additionally, cumulative impact assessments of similar developments in the area were undertaken by the specialists for this proposed development. The cumulative impact assessments rated the significance of the cumulative impacts using the significance rating methodology. Based on the findings of the cumulative impact assessments which were undertaken by the specialists, the cumulative impacts associated with the proposed development were found to range from medium to low. In addition, the cumulative impact of the proposed development on priority avifauna within a 40km radius around the Helios MTS, are expected to range from minor to insignificant, if appropriate mitigation is implemented. From a surface water perspective, the potential cumulative impact on the surrounding renewable energy developments is considered to be negligible. Despite the fact that there are a number of few similar projects in the area, the medium to low cumulative impacts associated with the proposed development will result in the site location being considered ideal for the proposed development of an On-site Eskom substation, linking substation and associated power line.

It should be noted that it is possible for the On-site Eskom substation, linking substation and power line to be decommissioned and/or potentially upgraded after the associated !Xha Boom Wind Farm (part of a separate on-going EIA process) has reached its lifespan. The initial lifespan of the associated !Xha Boom Wind Farm is proposed to be approximately 20 years, based primarily on the DoE PPA terms. Technically, however, through suitable maintenance and upgrade activities, the proposed wind farm could run for another 10 to 20 years, should Eskom or the DoE see a need for the continued need for the electricity being generated. The proposed project could also be paired with energy storage systems and potentially contribute to baseload capacity in the country. Should the proposed development be decommissioned (along with the associated wind farm), the sites / properties would be restored to their original state, and as detailed by the EMPr, whereafter they could be returned to use as agricultural land. Given the limited on-ground footprint of the infrastructure, the proposed development sites / properties could essentially be re-used in various forms, be it upgrading the installed technology or reverting to a new land use.

3.5 Local Need

The Northern Cape Province faces numerous socio-economic and developmental challenges, which are not unique to the Province and are observed throughout the country. Reducing poverty through social development and achieving a sustainable economic growth in the Province through diversification and transformation of its economy are at the forefront of the provincial government's developmental objectives (Northern Cape Government, 2008; Office of the Premier of the Northern Cape, 2012).

The Northern Cape Province is endowed with biological diversity, mineral resources, and renewable energy sources such as solar and wind. Therefore, the achievement of its developmental objectives is envisaged to be done by capitalising on the local resources and specifically, the development of the agriculture and agro-processing, mineral extraction and mineral beneficiation, fishing and aquaculture, manufacturing, and tourism industries (Northern Cape Government, 2008; Office of the Premier of the Northern Cape, 2012).

Ensuring availability of inexpensive energy is seen to be fundamental to growing competitive industries in the Province (Northern Cape Government, 2008). However, provincial government advocates the development of the energy sector in the Province through "the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments" (Northern Cape Government, 2008). This implies the use of renewable energy sources and natural gas fields that the Province enjoys (Northern Cape Government, 2008). Provincial strategic documents specifically promote the development of large-scale renewable energy projects, similar to the one (1) under analysis, which among others, would contribute to renewable energy targets set by national government and allow to secure supply, tackle climate change and address the needs of the Province (Office of the Premier of the Northern Cape, 2012).

Harnessing renewables is also seen to contribute towards alleviation and reduction of poverty in the Province. One (1) of the interventions that underpins the provincial approach to poverty eradication is "utilisation of natural resources in a sustainable manner", which in turn implies the transition to greater exploitation of renewables, including wind (Northern Cape Government, 2008).

Considering the above, it can be concluded that the development of the proposed project follows the provincial priorities and developmental objectives. From a spatial perspective, the project also does not appear to raise any red flags.

Similar to the Province, the district and local municipalities where the proposed project is to be established, also face challenges of poverty, unemployment, and income inequality. Therefore, the municipalities' developmental priorities largely coincide. Although much of the focus within district and local municipalities relates to the development and delivery of basic services, infrastructure, agriculture and tourism, the development of a green economy remains to be seen as an additional fundamental pillar of growth. Thus, in like any manner with the national and provincial policies, the district and local municipalities have placed considerable emphasis on the prioritisation and promotion of renewable energy resources within their boundaries. As previously mentioned, the Namakwa DM has a competitive advantage in the energy sector as wind, solar, wave, nuclear and natural gas energy plants have all been identified as suitable investments in the area. Amongst other sectors such as agriculture and tourism, renewable energy is thus prioritised. Several large-scale renewable energy projects have already been included in the IDP of the district. The district also recognises the importance of the agriculture and tourism industries in the area and promotes their development and transformation, especially eco-heritage (Namakwa DM, 2014). This is explained in more detail below.

3.5.1 Namakwa District Municipality views in Renewable Energy

Renewable Energy projects have been prioritised in strategies at various municipal scales in the area. The Northern Cape Province aims to provide a "home" for Renewable Energy. The Namakwa DM aims to "enable development around the construction of the 100MW wind farm16". This would suggest that the site for the proposed development would be supported by the DM. In the 2016-2017 IDP, renewable energy is identified as a focus area within their programme of action, specifically in relation to economic development and the "optimal utilisation of natural resources in a sectoral manner".

The Namakwa SDF identifies a number of major infrastructure projects, which includes "the promotion of domestic and large scale solar energy usage and projects such as wind and solar farms subject to appropriate guidelines and siting principles". The plan specifically lists wind and solar farm siting principles based on slope, geology, soils, surface hydrology, ground water and vegetation.

3.5.2 Hantam Local Municipality

The Hantam LM has identified the need to speed up economic growth and transform the economy in a sustainable manner and to provide a programme to build economic and social infrastructure. In the next five years (2015-2020) the LM aims to raise public awareness on green energy and energy saving.

The Loeriesfontein ward region is a very arid region of the Northern Cape where agricultural potential is very low. Sheep farming forms the predominant land use and large expanses of land are required for grazing. Large farms (exemplified by those on which this project is proposed) hold little to no economic opportunity for the farmers with little access to water. During an interview with one (1) of the affected landowners, the socio-economic specialist identified that many of the farmers are unable to employ farm workers permanently, and generally only employ seasonal workers for sheep shearing.

The proposed development would therefore directly benefit the local community. Firstly, it would be a source of income to the landowner and would improve the economic viability of the landowner's current farming operations. Secondly, it would also create direct and indirect job opportunities for the local community, with associated skills development.

Secondary economic benefits may include an increase in service amenities through an increase in contractors and associated demand for accommodation and other services.

It should be noted that a percentage of the operational revenue of the proposed !Xha Boom Wind Farm (forms part of the proposed development and is being undertaken as part of a separate on-going EIA process) will be utilised to support local economic development initiatives, via the community trust to be created for the wind farm. The local municipality will play a strong role in guiding how the funds in the community trust are utilised, thus ensuring that relevant and pressing needs in the community will be addressed.

3.5.3 Loeriesfontein

The Khobab and Loeriesfontein Wind Farms are nearing end of construction on neighbouring farms. The services provided and development of unskilled labour for these construction phases will be complementary to the proposed !Xha Boom Wind Farm (part of a separate on-going EIA process), as well as the proposed On-site Eskom substation, linking substation and associated power line. The area is currently being designed to be an area of excellence for renewable energy (provided the projects are implemented). This is well suited given the need for clean energy in South Africa, and the low agricultural potential of the land on which this project is proposed.

The land proposed is currently zoned as agricultural land. The respective landowners have signed an option for a long-term lease agreement with the Proponent. The leased land has very low agricultural potential and grazing could continue below the turbines and as such it would not negatively affect the economic viability of the farm. Participating landowners would receive a percentage of the revenue from the !Xha Boom Wind Farm (forms part of the proposed development and is being undertaken as part of a separate on-going EIA process) and this additional income would safeguard the economic sustainability of the farms.

3.5.4 Suitability of Services

The services required for the proposed development would include appropriate road access to the site; an appropriate connection to the national grid; access to water and disposal of different waste streams for the construction period; as well as associated services supplied from the local towns (accommodation, etc.).

The construction of the Loeriesfontein and Khobab Wind Farms has led to the upgrade of the roads in the area to facilitate the movement of abnormal loads. These construction periods will have also increased the demand from secondary services from the local towns.

The capacity of the municipal water and waste streams will need to be determined prior to construction. It is unfeasible to consider this during the BA process as construction of this project may only begin in more than two (2) years, if the project is granted all authorisations and the associated wind farm (i.e. !Xha Boom Wind Farm – part of a separate on-going EIA process) is selected as a preferred bidder in terms of REIPPPP. Appropriate waste disposal site/s with sufficient capacity to accept the project's waste will be identified closer to the time of construction. The applicant (or their appointed construction contractor) will be responsible for securing the necessary service agreements with the Municipality or private service providers prior to construction.

Based on the above reviewed IDPs, SDF's and other site specific information, it is evident that the site is suitable for the development of infrastructure associated with a renewable energy facility (such as substations and power lines) and that the proposed project fits well with the plans to diversify the provincial, district and local economies through investment in renewable energy projects.

4 TECHNICAL PROJECT DESCRIPTION

4.1 Project Description

The proposed development will encompass the construction of an On-site Eskom substation (namely the !Xha Boom Substation), linking substation and associated power line in order to feed electricity generated by the proposed !Xha Boom Wind Farm (part of a separate on-going EIA process) into the Eskom grid. The proposed !Xha Boom Substation, linking substation and associated power line will have voltage capacities of up to 132kV respectively. The proposed power line will run from the !Xha Boom Substation to the existing Helios MTS and will have a servitude width of approximately 31m. The proposed power line will consist of a series of towers located approximately 170m to 250m apart, depending on the terrain. At this stage, the typical structures being considered include self-supporting suspension monopole structures (**Figure 3**) for relatively straight sections of the power line and angle strain towers where the route alignment bends to a significant degree. The steel monopole tower type is between 18m and 25m in height, depending on the terrain, but will be high enough to ensure minimum overhead line clearances from buildings and surrounding infrastructure. It should be noted that the exact location of the towers will be determined during the final design stages of the power line. Access roads to the !Xha Boom Substation and linking substation will form part of the associated components / infrastructure. It should be noted that for the purpose of this BA, Mainstream are assessing areas of approximately 15ha and 36ha for the proposed !Xha Boom On-site Eskom Substation and Linking Substation sites respectively. However, only areas of approximately 2ha and 5ha will be used for the construction of the proposed substations respectively. The surface area which is to be covered by the proposed power line towers has not been determined yet. The final design details are yet to be confirmed and will become available during the detailed design phase of the project. In addition, the lengths of proposed power line corridor alternatives (i.e. Option 1, Option 2, Option 3 and Option 4) are approximately 52.2km, 52.8km, 47km and 53.4km respectively.

Figure 3: Example of the proposed Tower Type

4.1.1 Substation and Power Line Project Components

Mainstream is proposing the establishment of the !Xha Boom On-site Eskom substation, a linking substation and associated power line on the development site near Loeriesfontein in the Northern Cape Province (**Figure 4**). As mentioned, the objective of the proposed development is to feed electricity generated by the proposed !Xha Boom Wind Farm (part of a separate on-going EIA process) into the Eskom grid at the Helios MTS. The proposed !Xha Boom On-site Eskom substation, linking substation and associated power line will have voltage capacities of up to 132kV respectively.

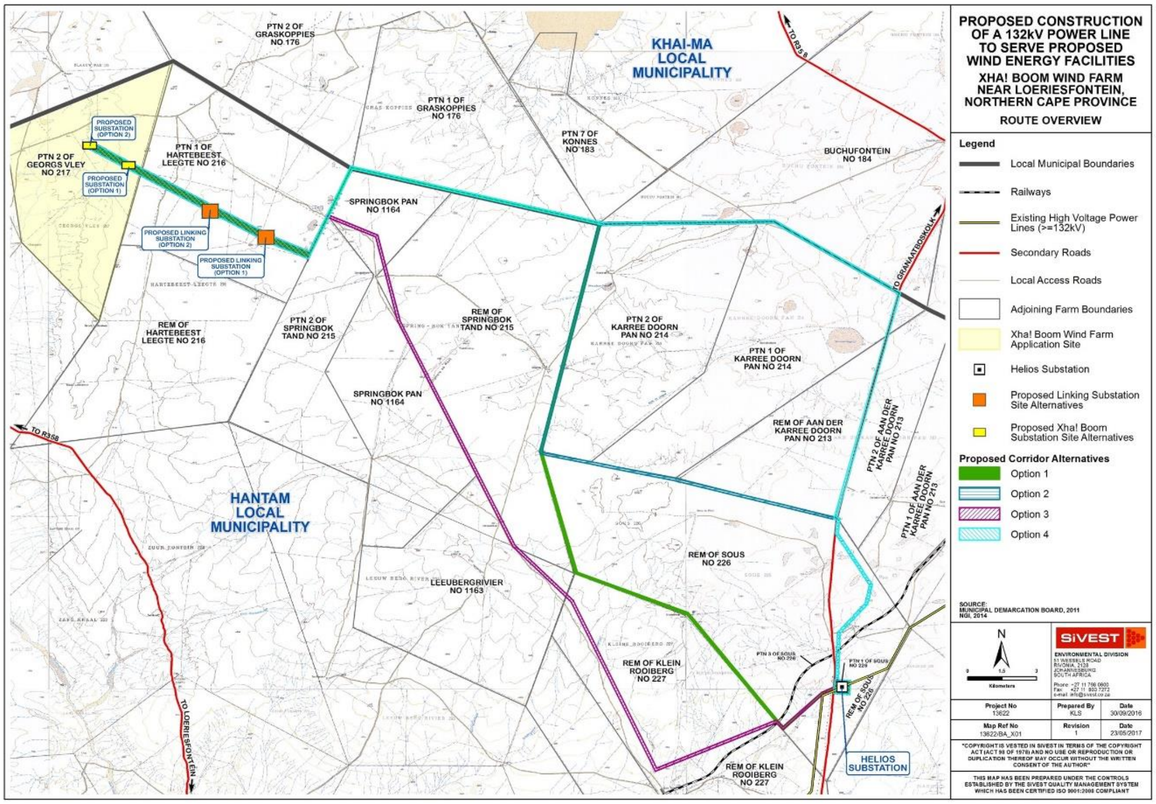

Figure 4: Route overview for the proposed !Xha Boom On-site Eskom Substation, Linking Substation and associated Power Line

The key technical details and infrastructure required is presented in the table below (**Table 6**).

Table 6: !Xha Boom Wind Farm technical summary

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for the proposed project
!Xha Boom On-site Eskom Substation,	To be announced	**<u>On-site Eskom Substation:</u>**	▪ **Grid connection** for the !Xha Boom Wind Farm (part of a separate on-going EIA process) will be to the

Linking Substation and Power Line		▪ Portion 2 of the Farm Georg's Vley No.217. **<u>Linking Substation:</u>** ▪ Portion 1 of the Farm Hartebeest Leegte No. 216. **<u>Power Line:</u>** A preferred power line corridor alternative has not yet been determined and therefore it is unclear at this stage which farms / properties will be traversed by the proposed power line. These will be provided in the FBAR.	proposed On-site IPP Substation (namely the !Xha Boom Substation); ▪ The **voltage capacities** of the proposed On-site Eskom substation and linking substation are anticipated to be up to **132kV** respectively; ▪ The On-site Eskom substation and linking substation will be **common substations** connecting the !Xha Boom Wind Farm projects (part of a separate on-going EIA process) to the Helios Main Transmission Substation (MTS); ▪ For the purpose of this BA, Mainstream are assessing an area of approximately 15ha for the On-site Eskom substation site. The proposed On-site Eskom substation will however only occupy a maximum **footprint area of approximately 2ha**; ▪ For the purpose of this BA, Mainstream are assessing an area of approximately 36ha for the linking substation site. The proposed linking substation will however only occupy a maximum **footprint area of approximately 5ha**; ▪ **A power line associated with the !Xha Boom On-site Eskom Substation and linking substation of up to 132kV** is also proposed and will run from the proposed On-site Eskom substation and linking substation to the existing Helios MTS; ▪ The proposed power line will have a **servitude width of up to 31m**; ▪ The typical structure to be used would predominantly be the **self-supporting suspension monopole structure** for relatively straight sections of the power line and **angle strain towers** where the route alignment bends to a

			significant degree. The towers will be between 18m and 25m in height, depending on the terrain, but will be high enough to ensure minimum overhead line clearances from buildings and surrounding infrastructure. The exact height of the towers will be determined during the final design stages of the power line. ▪ The **power line towers** are expected to be placed approximately 170m to 250m apart, depending on the terrain; ▪ A **laydown area** will be required for the temporary storage of materials during the construction activities. This will fall within the area assessed for the proposed On-site Eskom substation; and ▪ Internal **access roads** are proposed to be up to 20m wide. This would however only be for the construction phase after which the width of the internal access roads will be reduced to 6 - 8m during the operational phase.

As previously mentioned, the proposed On-site Eskom substation and linking substation will be shared substations connecting the !Xha Boom Wind Farm (part of a separate on-going EIA process) to Eskom's existing Helios MTS. The above-mentioned wind farm will however require a separate Environmental Authorisation (EA) and therefore the EIA for this is being conducted separately. Although the wind farm and the electrical infrastructure (i.e. On-site Eskom substation, linking substation and power line) will be assessed separately, a single public participation process is being undertaken to consider both of the proposed developments. The potential environmental impacts associated with both developments will be assessed as part of the cumulative impact assessment. The DEA reference number allocated for the proposed !Xha Boom Wind Farm is **14/12/16/3/3/2/1018**.

4.1.2 Other Associated Infrastructure

Other associated infrastructure includes the following:

- Internal access roads to the substation and power line corridor. Internal access roads with a maximum width of 20m are initially being proposed for the construction phase. This is however only temporary as the width of proposed internal access roads will be reduced to approximately 6 - 8m for maintenance purposes during the operational phase. The proposed internal access roads will include the net load carrying surface excluding any V drains that might be required.

4.2 Alternatives

As per Chapter 1 of the EIA regulations (2014), as amended, feasible and reasonable alternatives are required to be considered during the BA process. Alternatives are defined at “different means of meeting the general purpose and requirements of the activity” These alternatives may include:

(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.

Each of these alternatives are discussed in relation to the proposed project in the sections below.

4.2.1 The property on which or location where it is proposed to undertake the activity

No site alternatives are being considered for this project because the placement of the proposed On-site Eskom substation, linking substation and associated power line are dependent on the location of the proposed !Xha Boom Wind Farm (part of a separate on-going EIA process). The selection of a potential wind project site includes several key aspects including wind resource, environmental, grid connection suitability as well as competition, topography and access. The project site was selected by Mainstream based on the above criteria ahead of other regional farms due to the cumulative assessment of all criteria. This internal process takes several weeks to complete and ensures that the least environmentally sensitive farm is selected in the specific region of development.

The placement of wind energy installations is dependent on the factors discussed above, all of which are favourable at the proposed site location. The project site has access to the national grid via the existing Helios MTS. The project site has a relatively flat topography which is suitable for the development of substations and power lines. The project site is easily accessible via the N7 towards Kliprand via R358 or the N1 to Loeriesfontein. The site is therefore considered highly suitable for the proposed development and no other locations are being considered.

4.2.2 The type of activity to be undertaken

No other activity alternatives are being considered. The proposed project is required to connect the !Xha Boom Wind Farm (part of a separate on-going EIA process) to Eskom's grid and therefore no other type of activity could be considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development point of view.

4.2.3 The design or layout of the activity

Design or layout alternatives are being considered in the BA process. Various environmental specialists assessed the sites during their respective field investigations. The specialist assessments included the identification of sensitive areas (**Figure 5** - **Figure 7**). These sensitive areas were used to perform a preliminary comparison of layout alternatives (**Section 11**). These layout alternatives were also extensively investigated. Four (4) corridor alternatives were assessed for the proposed power line route, as well as two (2) alternative site locations for the proposed On-site Eskom substation (namely the !Xha Boom Substation) and linking substation respectively.

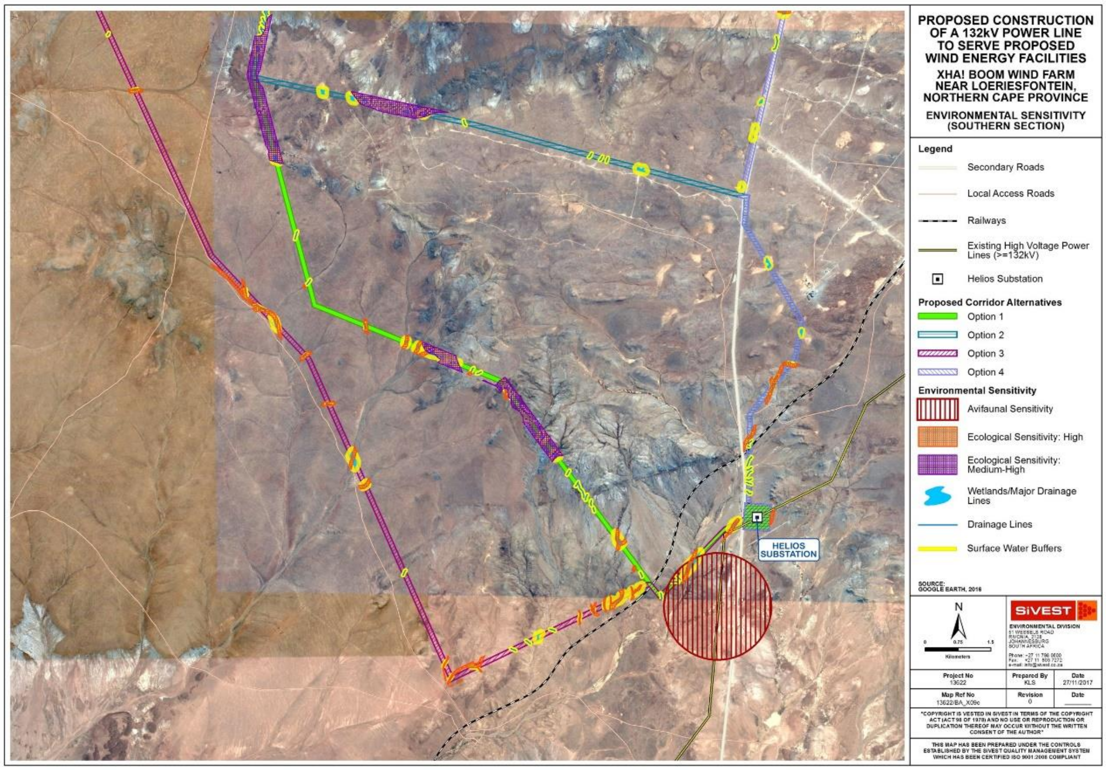

Figure 5: Southern Section of the Proposed Layout Alternatives in relation to Environmentally Sensitive Areas

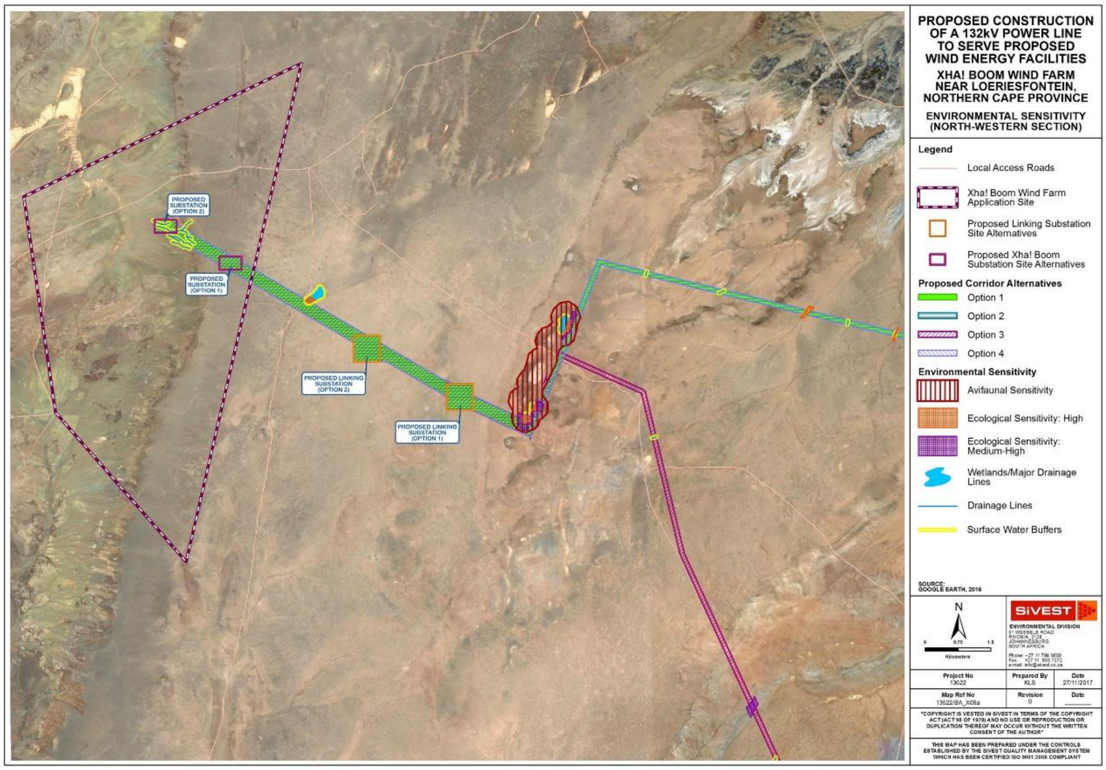

Figure 6: North-Western Section of the Proposed Layout Alternatives in relation to Environmentally Sensitive Areas

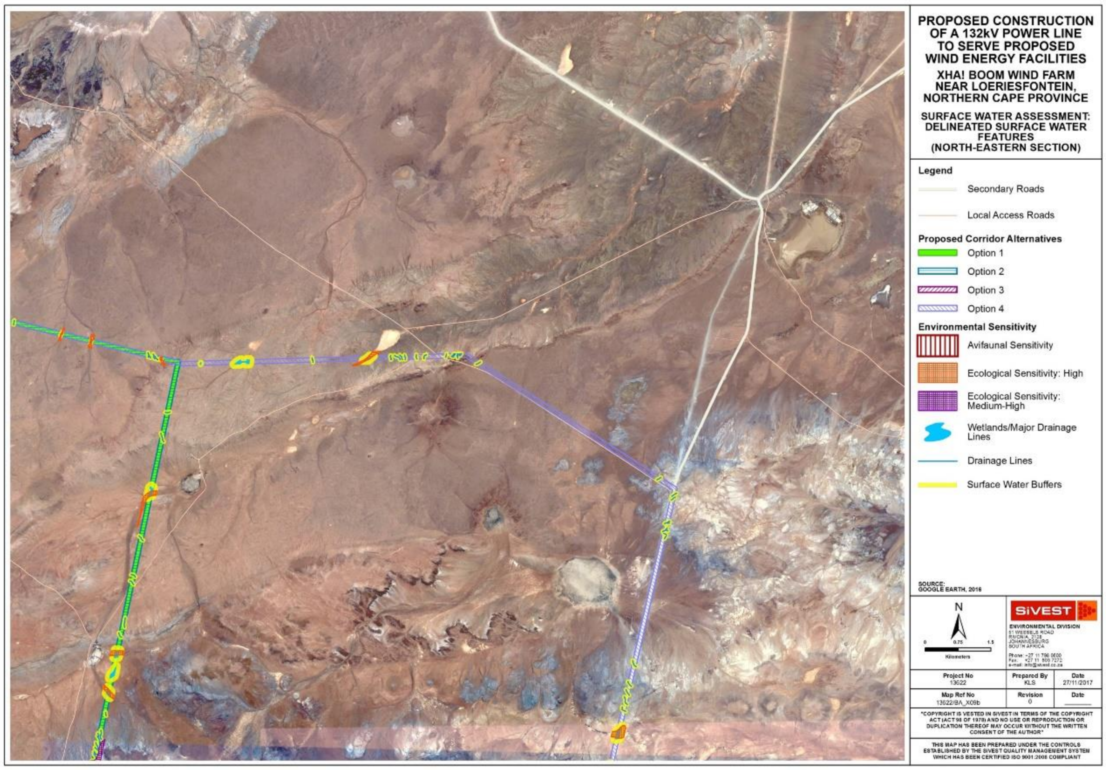

Figure 7: North-Eastern Section of the Proposed Layout Alternatives in relation to Environmentally Sensitive Areas

Based on the findings of the comparative assessment of alternatives undertaken by the various specialists, preferred substation sites (On-site Eskom and linking substations) and favourable power line corridor alternatives were selected. The preferred substation site and favourable power line corridor alternatives, including maps, are presented in **Section 11**. As previously mentioned however, a preferred power line corridor alternative will only be selected once comments on the DBAR have been received and and all objections have been considered and will be presented in the FBAR. The selected preferred alternatives will be based on both environmental constraints and design factors. It should be noted that the findings of the specialist studies and sensitivity mapping will be used to inform the layout of the proposed development within the preferred sites.

The preferred site layout in relation to environmentally sensitive and no-go areas identified by the specialists will be presented in the FBAR.

4.2.4 The technology to be used in the activity

No technology alternatives will be considered for the proposed substations and power line. The type of technology to be used for the substations and power line will largely depend on the terrain and other technological and economic factors. At this stage, it is proposed that self-supporting suspension monopole structures predominantly be used for relatively straight sections of the power line and angle strain towers be used where the route alignment bends to a significant degree. The steel monopole tower type will be between 18m and 25m in height, depending on the terrain, but will be high enough to ensure minimum overhead line clearances from buildings and surrounding infrastructure. In addition, the proposed tower will have a servitude width of up to 31m. It should be noted that the exact location of the towers will be determined during the final design stages of the power line. The impacts on the environment of the different types of substation technology and tower types would be very similar during construction, operation and decommissioning. Therefore no technology alternatives will be considered during the BA. The choice of technology used will ultimately be determined by Eskom.

4.2.5 The operational aspects of the activity

No operational alternatives were assessed in the BA as none are available for substations and power lines.

4.2.6 The option of not implementing the activity

The option of not implementing the activity, or the **'no-go'** alternative, is considered in the BA. The proposed substations and power line are intrinsically linked to the proposed !Xha Boom Wind Farm project (part of a separate on–going EIA process) and will allow for the export of the generated renewable energy to the Eskom grid at the existing Helios MTS. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although wind energy is not the only solution to solving the energy crisis in South Africa, not establishing the proposed wind farm would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project could contribute to addressing the problem. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

A general description of the study area is outlined in the section below. The receiving environment in relation to each specialist study is also provided.

5.1 Regional Locality

The proposed development will be located approximately 68km north of the town of Loeriesfontein in the Northern Cape Province, within the Hantam Local Municipality (**Figure 8**). The proposed development can be accessed via the N7 towards Kliprand via the R358 regional road or via the N1 to Loeriesfontein. Additionally the proposed development can also be accessed via the district road that connects the town of Loeriesfontein with Granaatboskolk to the north. The centre point co-ordinates for the substation site alternatives (On-site Eskom substation and linking substation), as well as the start, middle and end point co-ordinates for the power line alternatives are included in **Table 7, Table 8** and **Table 9** respectively.

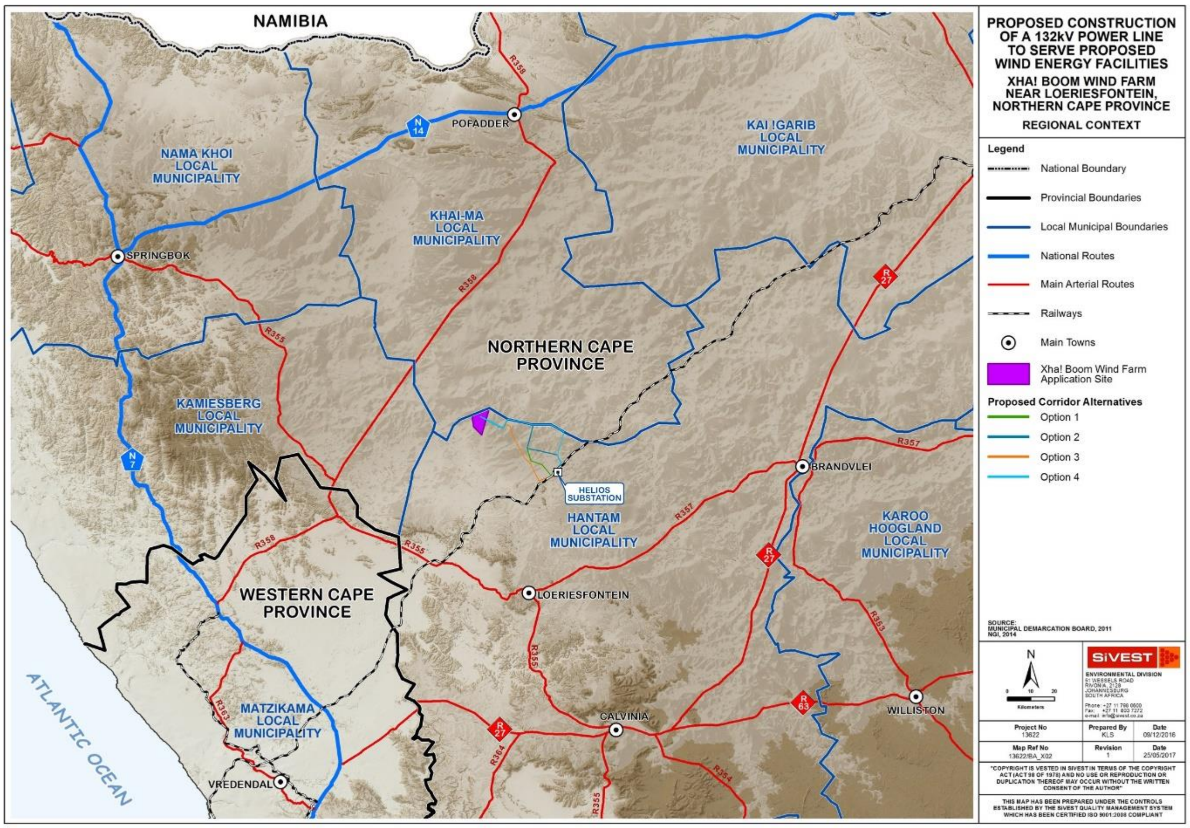

Figure 8: Regional Study Area.

5.2 Study Site Description

The proposed !Xha Boom On-site Eskom substation will be located on Portion 2 of the Farm Georg's Vley No. 217, while the proposed linking substation will be located on Portion 1 of the Farm Hartebeest Leegte No. 216. As previously mentioned, a preferred power line corridor alternative has not yet been determined and therefore it is unclear at this stage which farms / properties will be traversed by the proposed 132kV power line. The farms / properties which will be traversed by the proposed power line will be provided in the FBAR. However, at this stage, the following farms/properties are affected by the proposed power line corridor alternatives:

- Portion 1 of the Farm Graskoppies No. 176;
- Portion 2 of the Farm Graskoppies No. 176;
- Portion 7 of the Farm Konnes No. 183;
- The Farm Buchufontein No. 184;
- Portion 2 of the Farm Aan De Karree Doorn Pan No. 213;
- Remainder of the Farm Aan De Karree Doorn Pan No. 213;
- Portion 1 of the Farm Karree Doorn Pan No. 214;
- Portion 2 of the Farm Karree Doorn Pan No. 214;
- Remainder of the Farm Springbok Tand No. 215;
- Portion 1 of the Farm Hartebeest Leegte No. 216;
- Portion 2 of the Farm Georg's Vley No. 217;
- Portion 1 of the Farm Sous No. 226;
- Portion 3 of the Farm Sous No. 226;
- Remainder of the Farm Sous No. 226;
- Remainder of the Farm Klein Rooiberg No. 227;
- The Farm Leeubergrivier No. 1163; and
- The Farm Springbok Pan No. 1164.

Table 7: On-site Eskom Substation Site Location

!XHA BOOM ON-SITE ESKOM SUBSTATION SITE ALTERNATIVES			
ALTERNATIVE	**AREA (HECTARES)**	**CENTRE POINT COORDINATES**	
		SOUTH	**EAST**
Option 1	2	S30° 17' 41.614"	E19° 16' 50.509"
Option 2	2	S30° 17' 13.641"	E19° 15' 55.620"

It should be noted that for the purpose of this BA, Mainstream are assessing an area of approximately 15ha with regards to the On-site Eskom Substation site. However, only an area of approximately 2ha will be used for the construction of the proposed On-site Eskom substation.

Table 8: Linking Substation Site Location

LINKING SUBSTATION SITE ALTERNATIVES			
ALTERNATIVE	**AREA (HECTARES)**	**CENTRE POINT COORDINATES**	
		SOUTH	**EAST**
Option 1	5	S30° 19' 23.315"	E19° 20' 4.455"
Option 2	5	S30° 18' 46.373"	E19° 18' 45.622"

It should be noted that for the purpose of this BA, Mainstream are assessing an area of approximately 36ha with regards to the proposed Linking Substation site. However, only an area of approximately 5ha will be used for the construction of the proposed linking substation only.

Table 9: Power Line Corridor Alternative Locations

!XHA BOOM 132kV POWER LINE CORRIDOR ALTERNATIVES				
CENTRE LINE COORDINATES (DD MM SS.sss)				
CORRIDOR ALTERNATIVE	**START POINT**	**MIDDLE POINT**	**END POINT (MOOKODI SUBSTATION)**	**APPROX LENGTH (KM)**
Option 1	S30° 17' 8.659"	S30° 20' 6.409"	S30° 29' 58.002"	52.20
	E19° 15' 47.319"	E19° 27' 39.274"	E19° 33' 37.699"	
Option 2	S30° 17' 8.659"	S30° 20' 25.669"	S30° 29' 58.002"	52.80
	E19° 15' 47.319"	E19° 27' 34.292"	E19° 33' 37.699"	
Option 3	S30° 17' 8.659"	S30° 24' 23.227"	S30° 29' 58.002"	47.00
	E19° 15' 47.319"	E19° 24' 44.885"	E19° 33' 37.699"	
Option 4	S30° 17' 8.659"	S30° 19' 3.132"	S30° 29' 58.002"	53.40
	E19° 15' 47.319"	E19° 29' 30.547"	E19° 33' 37.699"	

The sites for the proposed On-site Eskom and linking substations as shown on the route overview map below comprise of Portion 2 of the Farm Georg's Vley No. 217 and Portion 1 of the Farm Hartebeest Leegte No. 216 respectively (**Figure 9**). The proposed On-site Eskom and linking substation layouts will require approximately 2ha and 5ha respectively. Portion 2 of the Farm Georg's Vley No. 217 and Portion 1 of the Farm Hartebeest Leegte No. 216 are currently used for agricultural purposes, specifically commercial sheep farming. There are no farmsteads / homesteads which can be found within Portion 2 of the Farm Georg's Vley No. 217, within the site proposed for the On-site Eskom substation alternatives. In addition, no farmsteads / homesteads can be found within Portion 1 of the Farm Hartebeest Leegte No. 216, within the site proposed for the linking substation alternatives. There is however one (1) other building which can be found within Portion 1 of the Farm Hartebeest Leegte No. 216, within the site proposed for the linking substation alternatives. This building was confirmed to be a house which is being used on a temporary basis by the landowner's shepherds during sheering time (De Jager, 2017). A 1km buffer was however applied to this building in order to ensure that this area is avoided as far as is practically possible.

As previously mentioned, a preferred power line corridor alternative has not yet been determined and therefore it is unclear at this stage which farms / properties will be traversed by the proposed 132kV power line. As such, details pertaining to the farms / properties which will be traversed by the proposed power line will be provided in the FBAR.

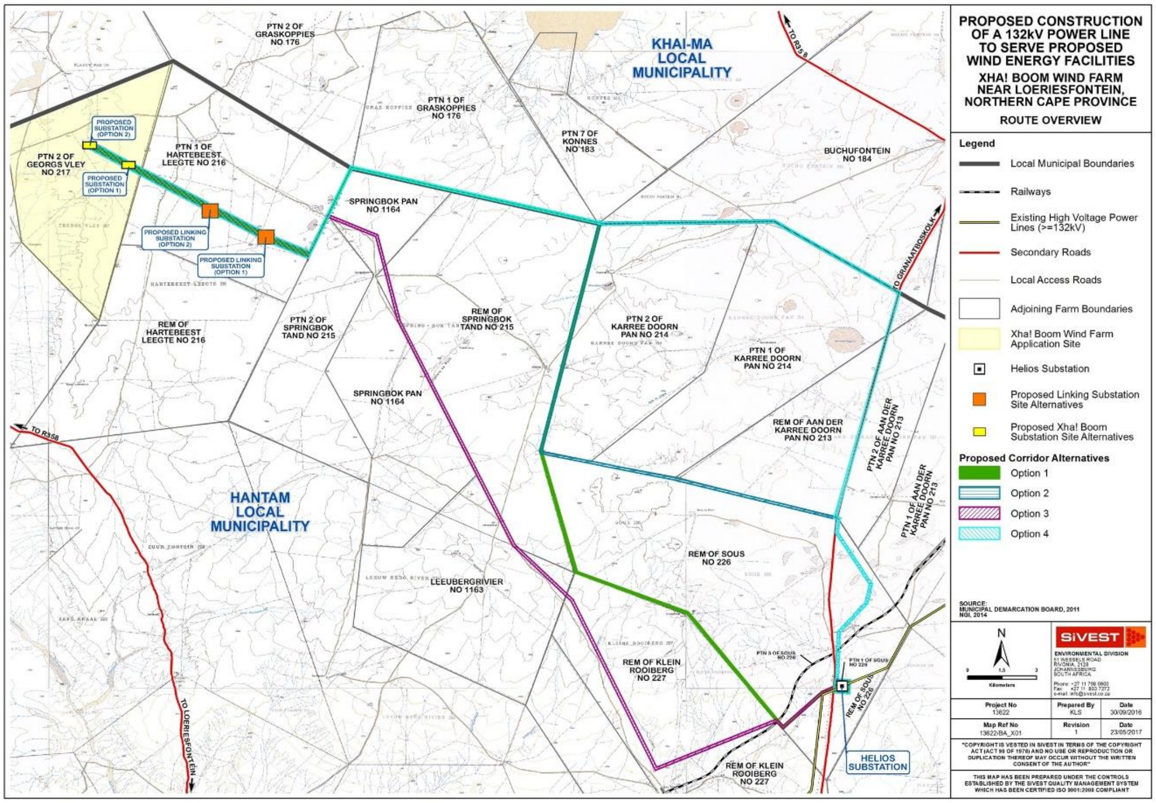

Figure 9: Power Line Route Overview, including all alternatives

Please note that all maps within the report are included in **Appendix 5** and are in A3 format.

5.3 Land Use

According to the South African National Land Cover (2013-2014) from Geoterraimage (2014), much of the land cover in the wider study area is classified as bare (non-vegetated) with some isolated patches of grassland, low shrubland, thicket and woodland in evidence mainly in the south-western sector of the study area (**Figure 10**).

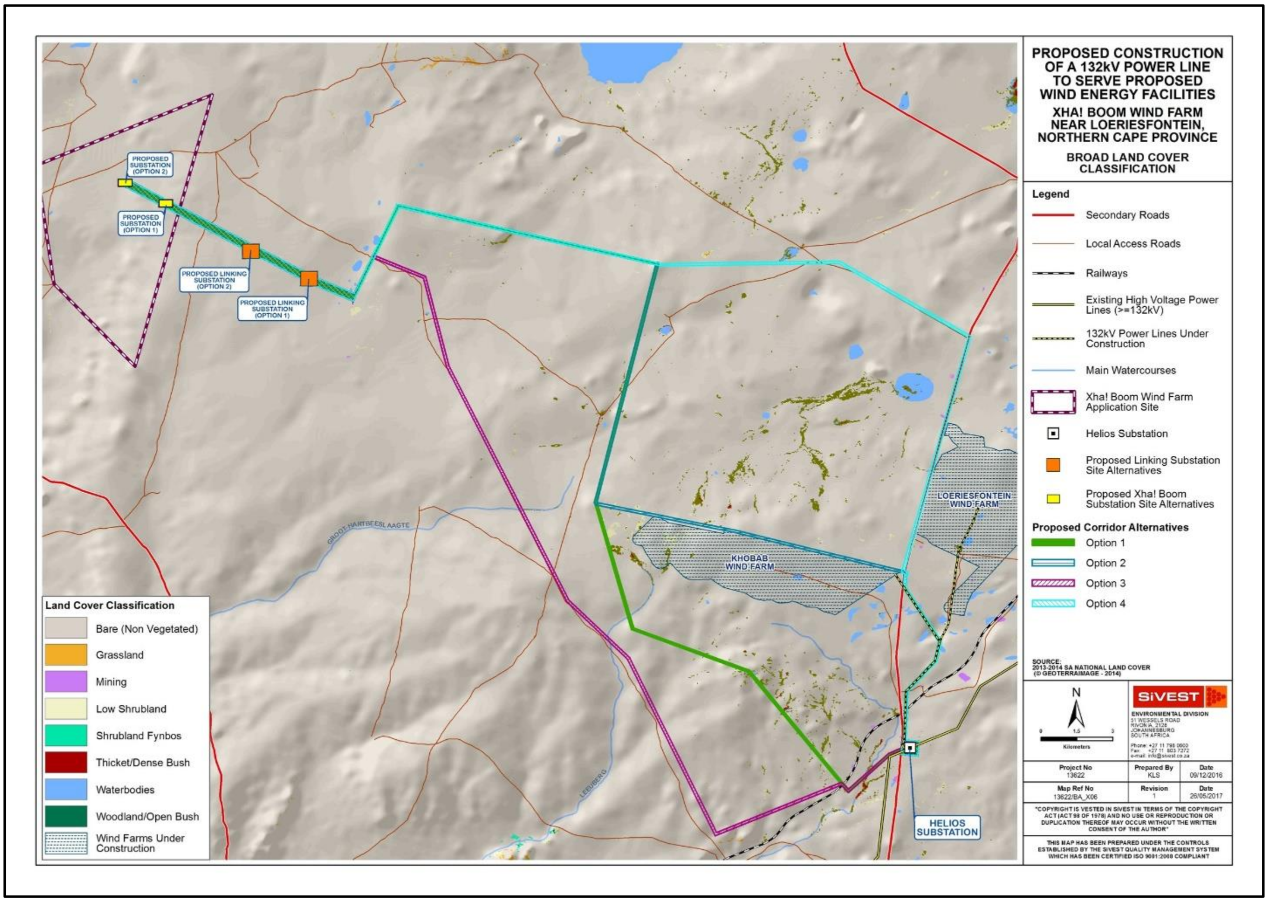

Figure 10: Map showing the land cover classification within the study area

Sheep farming (**Figure 11**) is the dominant activity in the study area although the arid nature of the climate restricts stocking densities. As a result, farms in the area are relatively large and isolated farmsteads are scattered across the area resulting in a very low density of rural settlement. The area is therefore regarded as largely uninhabited and the natural vegetation has been retained across most of the study area.

Figure 11: Typical view of sheep farming activities in the study area

Built form in much of the of the study area is limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines and boundary fences and the closest built up area is the small town of Loeriesfontein approximately 68km south of the site. It should be noted that the study area is also characterised by the presence of certain pastoral elements (**Figure 12**). These elements can be found throughout the study area and are typically present in areas where sheep farming is taking place. The study area is however traversed by a secondary road, known locally as the Granaatboskolk Road, which links Loeriesfontein with Granaatboskolk some 38km north-east of the study area. In addition, a railway line crosses the southern section of the study area, running in a south-west to north-east direction (**Figure 13**).

Figure 12: Example of typical pastoral elements which can be found within parts of the study area, especially in areas where sheep farming is taking place

Figure 13: View of railway line which traverses the study area

Limited human influence on the landscape is evident in the eastern section of the study area where small-scale mining/quarrying activities occur, mostly scattered along the Granaatboskolk Road and the railway line.

Built form and human influence on the landscape become more evident in the southern sector of the study area where several high voltage power lines feed into the Helios 400kV Main Transmission Substation (MTS) (**Figure 14**). The tall steel structures of the Substation, as well as the high voltage power line towers are highly visible from various parts of the study area (**Figure 15**).

Figure 14: View of the Helios MTS

Figure 15: High voltage power lines feeding into Helios MTS

Also present in this area are the the Khobab and Loeriesfontein Wind Farms (**Figure 16**) which are presently under construction, as well as the on-site Khobab IPP substation which had already been constructed during the time of the in-field investigation (**Figure 17**). In addition, the construction camp area for the Khobab Wind Farm is situated within this part of the study area, within close proximity to the Helios MTS (**Figure 18**). It must be noted that during the time of the in-field investigation it was noted that the Khobab Wind Farm was still in the early stages of construction and no turbines had been erected (**Figure 19**). Each of these developments includes some 61 wind turbines with associated infrastructure as well as 132kV grid connections to the Helios MTS. All of this development in combination is resulting in a significant level of transformation of the natural environment in this part of the study area.

Figure 16: Wind turbines at the Loeriesfontein Wind Farm.

Figure 17: View of the on-site Khobab IPP Substation which had already been constructed during the time of the in-field investigation

Figure 18: View of the Khobab Wind Farm construction camp area which is situated within the study area, within close proximity to the Helios MTS

Figure 19: View of the construction activities associated with the proposed Khobab Wind Farm.

5.4 Topography and Slope

The topography across much of the study area is characterised by a flat to gently undulating landscape with gentle slopes, typical of much of the Karoo (**Figure 20**). There are however areas of localised hilly topography characterised by the presence of small hills / ridges / koppies (**Figure 21**). In the wider area, the Klein and Groot Rooiberg and Leeuwberg koppies are significant features of the landscape, forming an areas of localised hilly topography to the south and south-west of the proposed development. It should however be noted that only the Klein Rooiberg koppie is located inside the visual assessment zone.

In the eastern sector of the study area, the presence of a number of pans signals that the topography is very flat and poorly drained.

Figure 20: View from the proposed development site showing typically flat to gently undulating terrain found within the study area

Figure 21: View of localised hills / ridges/ koppies found in the wider visual assessment zone.

Maps showing the topography and slope characteristics in the study area are provided in **Figure 22** and **Figure 23** below.

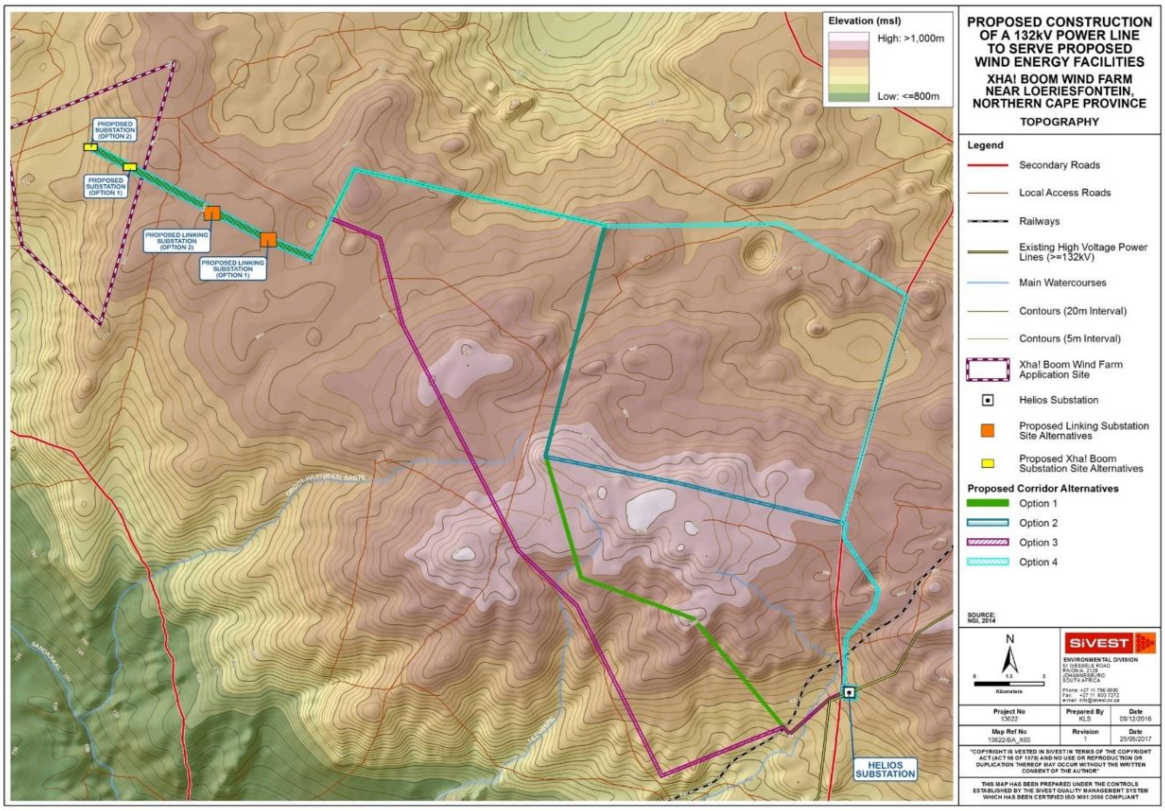

Figure 22: Topography of the study area.

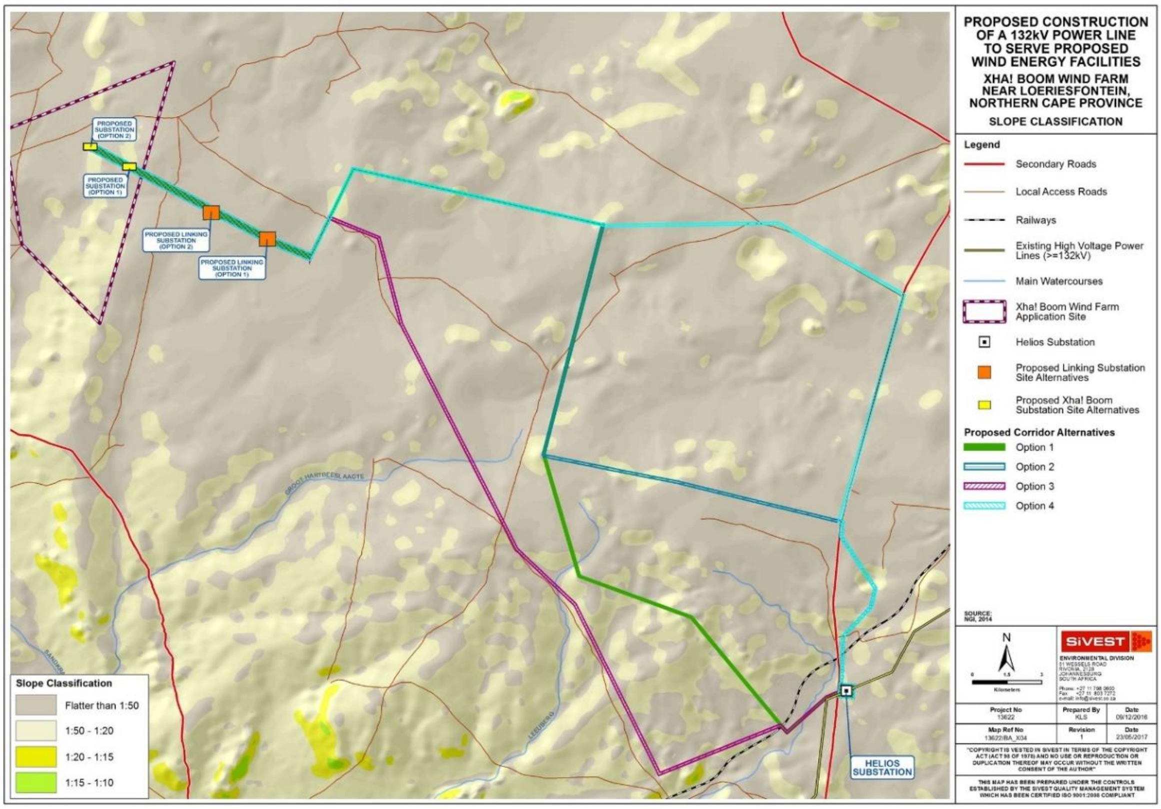

Figure 23: Degree of slope within the study area.

5.5 Climate

Rainfall for the study area is given as a very low 130 mm per annum (The World Bank Climate Change Knowledge Portal, undated). The average monthly distribution of rainfall is shown in **Figure 24**. One (1) of the most important climate parameters for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. This parameter largely controls what rain fed agriculture (including grazing) is possible within a given environment. Moisture availability is classified into 6 categories across the country (see **Table 10**). The study area falls into the driest 6th category, which is labelled as a very severe limitation to agriculture.

There are wind pumps with stock watering points in several places across the study area. Water for irrigation is not available across the study area. 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.

Table 10: 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

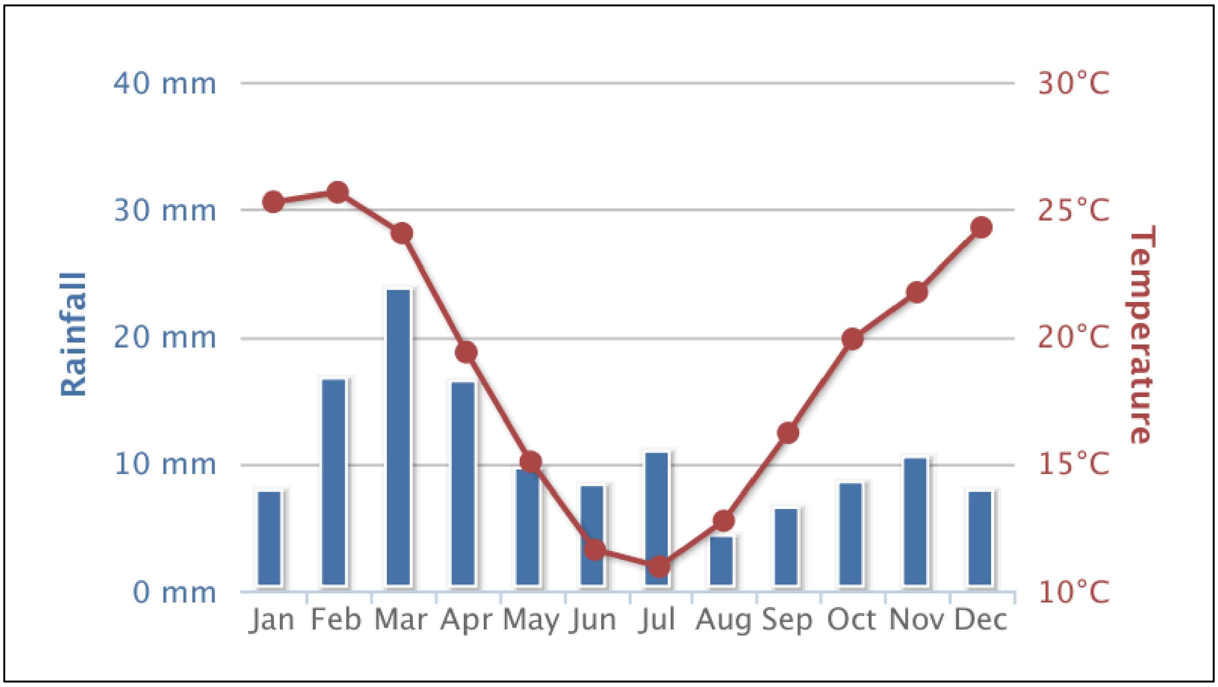

Figure 24: Average monthly temperature and rainfall for the study area (The World Bank Climate Change Knowledge Portal, undated).

5.6 Geology

The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal rocks of the lower part of the Ecca Group (Karoo Supergroup). They are assigned to the Prince Albert Formation, Whitehill Formation and Tierberg Formation in order of decreasing age. The Ecca Group were laid down within the marine to freshwater Ecca Sea.

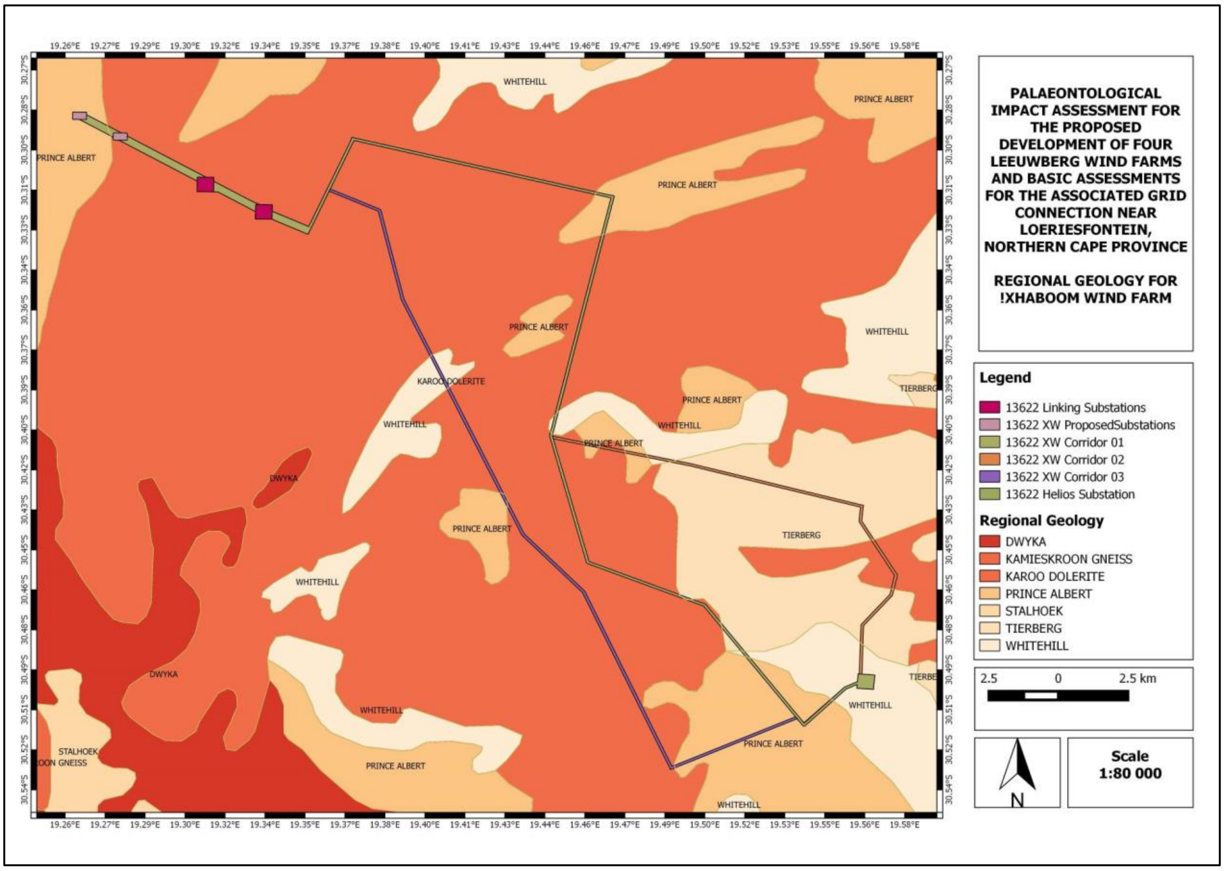

Figure 25: The surface geology of the proposed !Xha Boom grid connection project (On-site Eskom substation, linking substation and power line) near Loeriesfontein in the Northern Cape Province. The development footprint is underlain by Karoo Dolerite as well as the Prince Albert, Whitehill and Tierberg Formations of the Ecca Group.

5.7 Biodiversity (Flora and Fauna)

The Biodiversity Assessment was conducted by Simon Todd and is included as **Appendix 6A**. The environmental baseline from a biodiversity perspective is presented below. The purpose of the Terrestrial Biodiversity Basic Assessment Report is to describe and detail the ecological features of the proposed site; provide an assessment of the ecological sensitivity of the site and identify and assess the impacts associated with the development of the grid connection infrastructure.

5.7.1 Broad-Scale Vegetation Patterns

The national vegetation map (Mucina & Rutherford 2006, 2012) for the study area is depicted below in **Figure 26**. The majority of the !Xha Boom grid connection site is mapped as falling within the Western Bushmanland Klipveld vegetation type, with a small proportion of Bushmanland Basin Shrubland along the eastern margin of the site. The site visit however revealed that the areas mapped as Bushmanland Basin Shrubland consist of a mosaic of Bushmanland Basin Shrubland and Bushmanland Arid Grassland. The On-site Substation Option 2 falls within the Western Bushmanland Klipveld vegetation type, while all the rest of the substation options and the majority of the power line corridors are mapped as falling within the Bushmanland Basin Shrubland vegetation type. Although the dominant and characteristic species associated with each of these vegetation types is described in Mucina & Rutherford, these lists are not repeated here as the actual vegetation as observed at the site is described in the next section.

With an extent of 34 690 km^2 Bushmanland Basin Shrubland is one (1) of the most extensive vegetation types in South Africa. Bushmanland Basin Shrubland occurs on the extensive basin cantered on Brandvlei and Van Wyksvlei, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to around Williston in the south. The area is characterised by slightly irregular plains dominated by a dwarf shrubland, with succulent shrubs or perennial grasses in places. The geology consists largely of mudstones and shales of the Ecca group and Dwyka tillites with occasional dolerite intrusions. Soils are largely shallow to non-existent, with calcrete present in most areas. Rainfall ranges from 100-200 mm and falls mostly during the summer months as thunder storms. As a result of the arid nature of the area, very little of this vegetation type has been affected by intensive agriculture and it is classified as Least Threatened. There are few endemic and biogeographically important species present at the site and only *Tridentea dwequensis* is listed by Mucina and Rutherford as biogeographically important while *Cromidon minimum*, *Ornithogalum bicornutum* and *O.ovatum* subsp *oliverorum* are listed as being endemic to the vegetation type.

Bushmanland Arid Grassland is an extensive vegetation type and is the second most extensive vegetation type in South Africa and occupies an area of 45 478 km^2. It extends from around Aggeneys in the east to Prieska in the west. It is associated largely with red-yellow apedal (without structure), freely drained soils, with a high base status and mostly less than 300mm deep. Due the arid nature of the unit which receives between 70 and 200 mm annual rainfall, it has not been significantly impacted by intensive agriculture and more than 99% of the original extent of the vegetation type is still intact. Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is a relatively low number given the extensive nature of the vegetation type.

The western two thirds of the !Xha Boom site consists of Western Bushmanland Klipveld, which forms part of the Succulent Karoo Biome and occurs on the northwestern plains of Bushmanland east of the Namaqualand Klipkoppe, north and south of Kliprand and west of Stofvlei. It consists of sparse plains of desertic character supporting dwarf succulent shrubs and drought-tolerant grasses. This vegetation type has an extent of 2297km2, of which 99% is still intact, with no major transformation, although erosion is extensive with as much as 70% considered to be suffering from significant erosion. Eight endemic species are reported for this vegetation type by Mucina & Rutherford, which is significant given the low extent of this vegetation type.

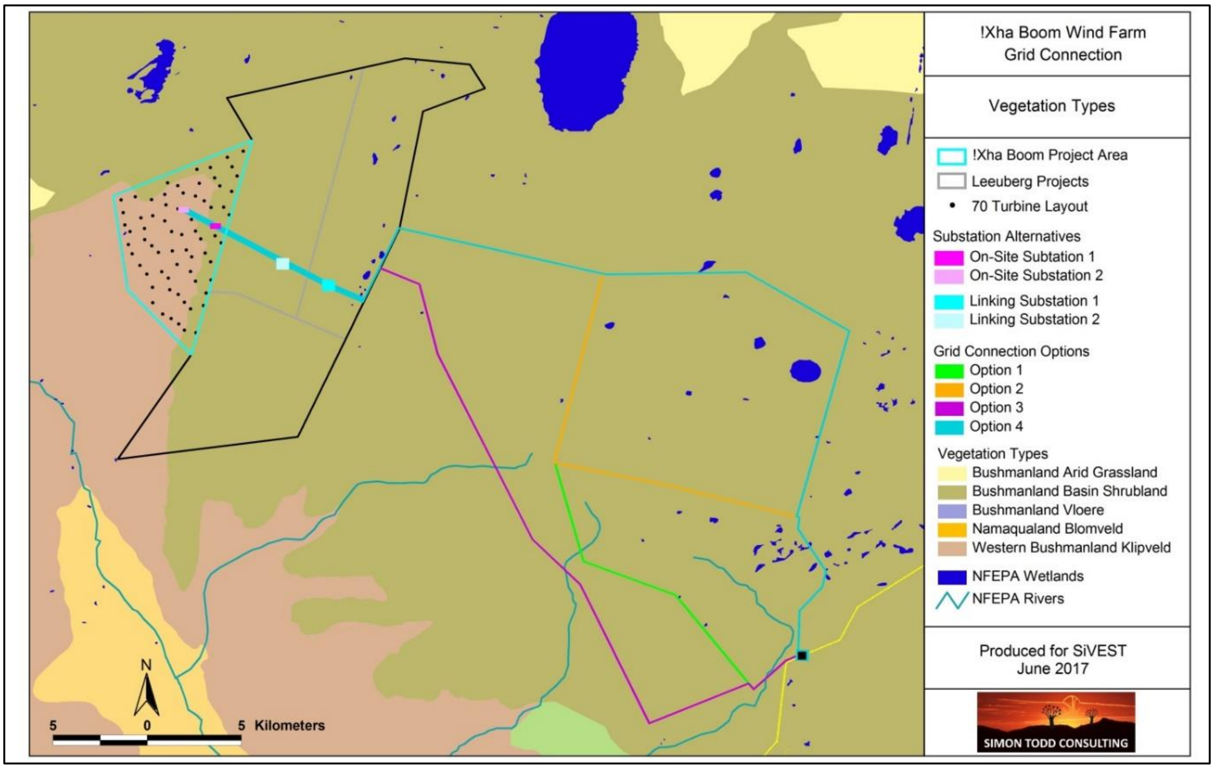

Figure 26: The national vegetation map (Mucina & Rutherford 2006/2012) for the study area. Rivers and wetlands (pans) delineated by the National Freshwater Ecosystem Priority Areas Assessment (Nel et al. 2011) are also depicted.

As can be seen from the figure above, Power Line Corridor Option 1 and Option 3 appear to traverse NFEPA rivers. It should be noted that the presence of these NFEPA rivers are expected to negatively affect the preference of the above-mentioned power line corridor alternatives (i.e. Option 1 and Option 3) from a biodiversity perspective. The preferences which have been assigned to each of the respective proposed power line corridor alternatives by the various specialists is discussed in **Section 11**.

5.7.2 Fine-Scale Vegetation Patterns

The different habitats and landscape units associated with the various power line options and substation alternatives are described in detail below. Each unit is described and then the prevalence of this unit along the various power line routes and substation alternatives is discussed.

- **<u>Bushmanland Arid Grassland</u>**

The site visit revealed that the eastern margin of the !Xha Boom as well as the majority of the rest of the greater Leeuwberg site consists of open plains dominated by so-called “white grasses” and is clearly representative of the Bushmanland Arid Grassland vegetation type (**Figure 27**). This discrepancy with the vegetation map can be ascribed to the coarse nature of the national vegetation map and associated uncertainty along the boundaries of the vegetation units. In addition, boundaries between units have been mapped largely from aerial or satellite imagery and these boundaries are not always clearly visible. The main driver of vegetation pattern in the area is substrate. On gravels and stony soils, the vegetation consists of open shrub-dominated vegetation typical of Bushmanland Basin Shrubland, while on sandy soils the vegetation is typically dominated by various *Stipagrostis* species and is typical of Bushmanland Arid Grassland. There are also many areas on shallow soils, which consist of grassy shrublands and are clearly transitional areas between the two typical forms.

Figure 27: Looking west towards the boundary of the !Xha Boom site, showing the Bushmanland Arid Grassland habitat type that characterises this area. On-site Substation Option 1 is located within this habitat type

The areas of Bushmanland Arid Grassland are associated with extensive flat to gently sloping open plains characterised by shallow red sands, sometimes with exposed calcrete as well. This habitat tends to be very homogenous with low local and overall species richness and low species turnover. This unit is usually dominated by *Stipagrostis ciliata*, *S.brevifolia* and *s.obtusa* with low shrubs such as *Lebeckia spinescens*, *Monechma incanum*, *Asparagus capensis*, *Asparagus retrofractus*, *Eriocephalus microphyllus var. pubescens*, *Zygophyllum retrofactum* with occasional larger *Lycium pumilum* shrubs or small *Parkinsonia africana* trees. Protected or listed species are rare in this habitat and only an occasional *Hoodia gordonii* was observed within this vegetation type.

This habitat unit is present at On-site Substation Option 1 as well as the two (2) Linking Substation options on Ithemba and Graskoppies Wind Farms to the east of the !Xha Boom site. Large sections of the power line options are also within this unit, especially the northern sections of alternatives, Option 1, Option 2 and Option 4 (**Figure 28**) as well as the majority of the central section of Option 3. This is not a sensitive habitat type as it is homogenous and has low diversity and abundance of SCC.

Figure 28: Bushmanland Arid Grassland along Power Line Option 4, looking east towards the R355

- **Bushmanland Basin Shrubland**

Shallow, stony soils dominate large parts of the site and these areas are usually dominated by a sparse cover of low woody shrubs (**Figure 29**). This unit is representative of Bushmanland Basin Shrubland and are usually dominated by species such as *Pentzia incana, Zygophyllum lichtensteinianum, Eriocephalus spinescens, Aptosimum spinescens, Tripteris sinuata, Tetragonia fruticosa, Hermannia spinosa, Felicia clavipilosa, Osteospermum armatum, Pegolettia retrofracta, Pteronia glomerata, Pteronia sordida, Thesium hystrix, Euphorbia decussata* and *Salsola tuberculata*; as well as forbs such as *Aptosimum indivisum, Hypertelis salsoloides, Gazania lichtensteinii* and *Fockea sinuata*; succulent shrubs include *Aridaria noctiflora, Ruschia intricata* and *Sarcocaulon patersonii*; taller shrubs are usually restricted to run-on environments and consist of species such as *Lycium pilifolium* and *Rhigozum trichotomum*. There are occasional rocky outcrops present at the site of limited extent, which can also be attributed to this vegetation type; typical species include E*nneapogon scaber, Jamesbrittenia atropurpurea subsp. atropurpurea, Aloe falcata, Lycium oxycarpum, Dyerophytum africanum* and *Asparagus capensis*. The only species of significance observed on the plains was *Hoodia gordonii*, while *Aloe falcata* which is provincially protected is common on the rocky hills.

Figure 29: Bushmanland Basin Shrubland shrubland along Power Line Option 2, which exposed calcrete in the foreground, showing the low vegetation cover and lack of soil characteristic of this habitat type

The Bushmanland Basin Shrubland habitat is not considered highly sensitive as it has low diversity and few species of concern present. This is a dominant habitat type along large sections of all the power line corridors, once they leave the greater Leeuwberg Wind Farm site (**Figure 30**). Along with the Grassland habitat type, these two (2) units occupy the majority of the affected area.

Figure 30: Bushmanland Basin shrubland along the central section of Corridor Option 3, after it has left the greater Leeuwberg study area, showing the exposed calcrete and low vegetation cover which characterises this habitat unit

- **Western Bushmanland Klipveld**

The majority of the !Xha Boom site as well as a small portion of the Hartebeest Leegte Wind Farm site consists of Western Bushmanland Klipveld (**Figure 31**). These areas are dominated by shrub species such as *Pentzia incana, Zygophyllum lichtensteinianum, Zygophyllum retrofractum, Zygophyllum flexuosum, Eriocephalus spinescens, Aptosimum spinescens, Tripteris sinuata, Hermannia spinosa, Felicia clavipilosa, Osteospermum armatum, Pegolettia retrofracta, Pteronia glomerata, Pteronia sordida, Thesium hystrix, Euphorbia decussata* and *Salsola tuberculata*; succulent shrubs including *Aridaria noctiflora, Ruschia intricate, Prenia tetragonia* and *Sarcocaulon patersonii*; annual grasses such as *Aristida congesta, Stipagrostis anomala* and *Enneapogon desvauxii*. Taller shrubs are usually restricted to run-on environments and consist of species such as *Lycium pilifolium* and *Rhigozum trichotomum*. There are also a number of forbs and annuals present including *Sesamum capense, Galenia sarcophylla, Gazania lichtensteinii, Leysera tenella, Osteospermum pinnatum* and *Tribulis terrestris*. Cover across most of this area is very low and while this can be partly attributed to the aridity of the area, livestock grazing also appears to have played a significant role in leading to the degradation of the area and further loss in the plant cover.

Overall, this is not considered a highly sensitive habitat as no species of conservation concern were observed in this habitat during the site visit. In addition, the affected area appears to have been negatively affected by livestock grazing which has had a negative effect on the diversity of this habitat. On the on-site substation Option 2 and the immediate adjacent section of power line are within this habitat.

Figure 31: Western Bushmanland Klipveld near to On-site Substation Option 2, showing the stony soils and very low vegetation cover which characterises this area

- **Succulent Shrubland**

Some of the low-lying areas in the south of the grid connection corridors consist of fine-textured soils overlying calcrete and are characterised by a higher proportion of succulent shrubs compared to the other shrub-dominated habitats. Typical and dominant species include *Brownanthus ciliatus, Euphorbia decussata, Ruschia robusta, Cephalophyllum rigidum, Aridaria noctiflora, Phyllobolus nitidus, Drosanthemum lique, Exomis microphylla, Octompoma quadrisepalum, Ruschia abbreviata, Galenia fruticosa, Sceletium tortuosum, Tetragonia fruticosa, Prenia tetragonia, Tripteris sinuata, Zygophyllum retrofractum, Lycium pumilum*. Although these areas are considered somewhat more sensitive than the other plains habitats, diversity remains relatively low and the abundance of species of concern is low. As a result, these areas have been classified as higher sensitivity than the Arid Grassland and Shrubland habitats, but are not considered high sensitivity to the extent that they need to be avoided.

The Succulent Shrubland habitat is conspicuous only in the south of the study area and is prevalent only along sections of Power Line Option 1 and 3 (**Figure 32**). As discussed above, it is not considered highly sensitive but has a higher abundance of provincially protected species and somewhat higher diversity than the other habitats.

Figure 32: Succulent Shrubland habitat near the point where Power Line Corridor 1 and Power Line Corridor 3 merge, about 2.5km from the Helios MTS

- **<u>Drainage Lines</u>**

The drainage lines of the site are not very well developed and do not have a tall woody component (**Figure 33**). Typical and dominant species include *Stipagrostis namaquensis, Stipagrostis obtusa, Osteospermum armatum, Arctotis fastuosa, Deverra denudata, Melianthus comosus, Salvia disermas, Lycium pumilum, Lycium oxycarpum, Galenia sarcophylla, Salsola aphylla* and *Sesamum capense*. Although the drainage lines are not well developed, which can be ascribed to aridity of the area, they are ecologically important because the higher cover and productivity of these areas is important for fauna forage and habitat availability and they also play an important hydrological role and regulate flow following occasional strong rainfall events. As such disturbance to these areas should be minimised as far as possible.

Figure 33: The drainage lines of the site such as this one along Power Line Option 3, are typically broad and not well-defined. Typical and dominant species includes *Lycium pumilum* as seen above, as well as grasses such as *Stipagrostis spp*. and *Aristida congesta*

- **Pans**

There are a number of small pans in the vicinity of the development footprint, the most conspicuous of which are those to the west of the power line corridors on the Graskoppies Wind Farm. The pans of the area are quite diverse and can be divided into at least three (3) different types; non-saline pans with a bare centre and fringed by taller woody vegetation; non-saline pans vegetated by *Athanasia minuta* and saline pans that are not vegetated. In the north of the site, the pans are not saline and are bare or vegetated in their centre by *Athanasia minuta* with species such as *Lycium pumilum, Salsola glabrescens, Salsola aphylla, Rhigozum trichotomum, Parkinsonia africana, Psilocaulon coriarium* and *Osteospermum armatum* around the fringes. The saline pans are not vegetated on account of the salt present, but are nevertheless ecologically important as they support a variety of temporary water organisms when they contain water.

As already mentioned, the pans on the adjacent Graskoppies project area are the most significant and well-developed in the study area (**Figure 34**). There are however one (1) or two (2) smaller pans present near to power line Alternative 4. These are considered sensitive features and while a direct impact on these features is not likely as they are outside of the development footprint, the low slope around some of these features makes them vulnerable to activities which can change the overland flow pattern of water, such as road construction.

Figure 34: One (1) of the larger pans on the Graskoppies site north east of the Linking Substation Option 1. The power line, which includes all options at this point, runs across the face of the ridge on the other side of the pan, about 200m from the pan

5.7.3 Listed Plant Species

The study area has been very poorly sampled in the past and many of the quarter degree squares in the area have no data available. Listed and protected species observed in the area include the provincially protected species Aloe falcata, A.claviflora and Hoodia gordonii and Aloinopsis luckhoffii and Euphorbia multiceps. Hoodia gordonii is protected under NEMA and is listed as DDD (Data Deficient – insufficient information) while Aloinopsis luckhoffii is provincially protected is listed as taxonomically uncertain (DDT).

5.7.4 Faunal communities

- **Mammals**

The site falls within the distribution range of 40 terrestrial mammals suggesting that potential mammalian diversity at the site is quite low. Species observed in the area include Steenbok *Raphicerus campestris*, Cape Porcupine *Hystrix africaeaustralis*, Aardvark *Orycteropus afer*, Yellow Mongoose *Cynictis penicillata*, Cape Hare *Lepus capensis,* Cape Fox *Vulpes chama*, Bat-eared Fox *Otocyon megalotis* and Round-eared Elephant Shrew *Macroscelides proboscideus*. In terms of specific habitats which are likely to be of above average significance, the low ridges and drainage lines are likely to contain the highest fauna abundance and diversity.

The only mammal species of conservation concern which may occur at the site is the Black-footed cat *Felis nigripes* (Vulnerable). As this species has a broad distribution across South Africa, the relatively limited footprint of the development is not likely to compromise the local or regional populations of this species. In addition, the majority of the site would still be accessible to such fauna and it is likely that most predators will continue to use the site. In terms of the power line, there is little scope for interaction between mammals and the power line in the operational phase and long-term impacts would be low. The substations would be fenced and although some smaller fauna would use this area if there is any natural vegetation within the site, in general mammals would avoid this area and given the large amount of intact available habitat in the area, a significant disruption of landscape connectivity for fauna is highly unlikely.

- **Reptiles**

The site lies in or near the distribution range of at least 40 reptile species (Appendix 3 of the Biodiversity Specialist Report), comprising 5 tortoises, 12 snakes, 15 lizards and skinks, 8 geckos and 1 chameleon. This is a comparatively low total, suggesting that reptile diversity at the site is likely to be low. There are no listed species which are likely to occur at the site. Species which were observed in the area include the Karoo Girdled Lizard *Karusasaurus polyzonus*, Namaqua Sand Lizard *Pedioplanis namaquensis*, Spotted Desert Lizard *Meroles suborbitalis*, Western Sandveld Lizard *Nucras tessellata*, Southern Rock Agama *Agama atra*, Ground Agama *Agama aculeata* subsp. *aculeata* and Bushmanland Tent Tortoise *Psammobates tentorius verroxii*. There are no specific areas of high reptile importance at the site as it is homogenous with no rocky outcrops or other major features of high significance.

In terms of the likely impacts of the development on reptiles, habitat loss is not likely to be highly significant as the direct footprint of the development is not likely to exceed a hundred hectares and this would not be significant in context of the relatively homogenous and intact surrounding landscape. In some situations, the loss of vegetation cover associated with roads and other cleared areas can generate significant impact on reptiles as they may be vulnerable to predation while crossing such cleared areas, but as the site is arid, plant cover is already low and the reptile species present are mostly well-adapted to low-cover environments.

- **Amphibians**

Given the aridity of the site and lack of surface water in the area, it is not surprising that only six (6) frog species may occur in the area. Of these only those which are relatively independent of water such as the Karoo Toad *Vandijkophrynus gariepensis* are likely to occur within the site itself. Impacts on amphibians are likely to be low given the limited extent of the development as well as low likely density of amphibians in the area. Although there are some pans present in the area, these are not necessarily available to amphibians as many of the pans are saline and not suitable for amphibians.

5.7.5 Critical Biodiversity Areas and Broad-Scale Processes

The recently completed Northern Cape Critical Biodiversity Areas (CBAs) map (Oosthuysen & Holness 2016) is depicted below for the study area (**Figure 35**). This biodiversity assessment identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. There are no CBAs within

!Xha Boom or the other properties which make up the greater Leeuwberg Wind Farm. However, there are some short sections of CBA 1 and CBA 2 along all of the grid connection options. These are associated with drainage lines and aimed at protecting these features. The power line would however not generate significant impact on these features and the associated CBAs with the appropriate mitigation. The site does not lie within a National Protected Area Expansion Strategy (NPAES) focus area and has therefore not been identified as an important area for future conservation area expansion.

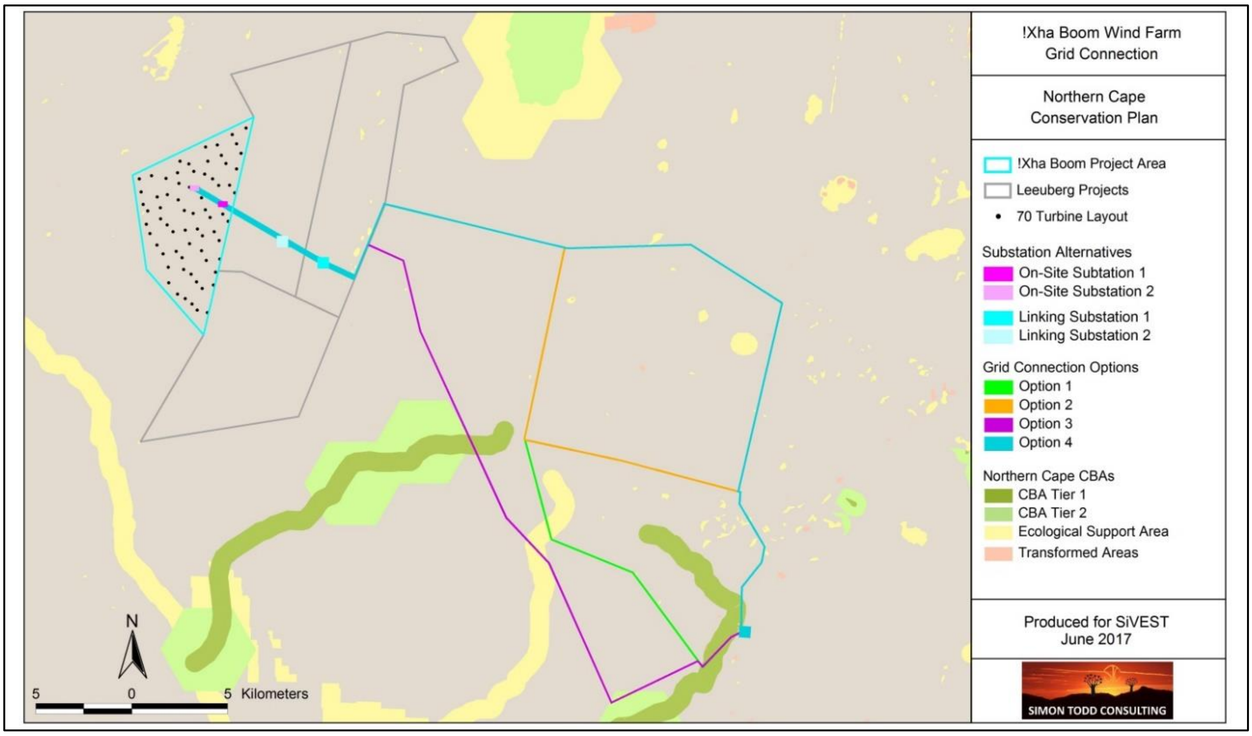

Figure 35: Extract of the Northern Cape Conservation Plan for the study area, showing that there are no CBAs within the !Xha Boom site.

As can be seen from the figure above, Power Line Corridor Option 1 appears to traverse a Tier 1 CBA as well as an Ecological Support Area (ESA). In addition, Power Line Corridor Option 3 appears to traverse Tier 1 and Tier 2 CBAs as well as an ESA. It should be noted that the presence of these CBAs and ESA are expected to negatively affect the preference of the above-mentioned power line corridor alternatives (i.e. Option 1 and Option 3) from a biodiversity perspective. The preferences which have been assigned to each of the respective proposed power line corridor alternatives by the various specialists is discussed in **Section 11**.

5.8 Avifauna

The Avifauna Assessment was conducted by Chris van Rooyen and is included as **Appendix 6B**. The environmental baseline from an avifaunal perspective is presented below.

5.8.1 Description of the Affected Environment

5.8.1.1 Natural Environment

The powerline study area is located on a vast, arid, topographically uniform plain. The habitat is very uniform, and consists of Bushmanland Basin Shrubland. Bushmanland Basin Shrubland consists of dwarf shrubland dominated by a mixture of low, sturdy and spiny (and sometimes also succulent) shrubs (*Rhigozum, Salsola, Pentzia, Eriocephalus*), 'white' grasses (*Stipagrostis*) and in years of high rainfall also abundant annual flowering plants such as species of *Gazania* and *Leysera* (Mucina & Rutherford 2006). A number of ephemeral drainage lines flow through the powerline study area, but they only hold water for brief periods after exceptional rainfall events, which are rare events. The greater study area is extremely arid with a mean annual rainfall of 170.5mm, with peak rainfall between March and July. The temperatures are highest on average in January, at around 22.8 °C. The lowest average temperatures in the year occur in July, when it is around 9.9 °C. The powerline study area is situated in an ecological transitional zone between the Nama Karoo and Succulent Karoo biomes (Harrison *et al.* 1997). In comparison with Succulent Karoo, the Nama Karoo has higher proportions of grass and tree cover. The ecotonal nature of the greater study area is apparent from the presence of typical avifauna of both Succulent and Nama Karoo e.g. Karoo Eremomela *Eremomela gregalis* (Succulent Karoo) and Red Lark *Calendulauda burra* (Nama Karoo). The two Karoo vegetation types support a particularly high diversity of bird species endemic to Southern Africa, particularly in the family *Alaudidae* (Larks). Its avifauna typically comprises ground-dwelling species of open habitats (Harrison *et al* 1997). Because rainfall in the Nama Karoo falls mainly in summer, while peak rainfall in the Succulent Karoo occurs mainly in winter, it provides opportunities for birds to migrate between the Succulent and Nama Karoo, to exploit the enhanced conditions associated with rainfall. Many typical karroid species are nomads, able to use resources that are patchy in time and space (Barnes 1998).

A feature of the greater study area where the proposed site is located is the presence of pans. Pans are endorheic wetlands having closed drainage systems; water usually flows in from small catchments but with no outflow from the pan basins themselves. They are typical of poorly drained, relatively flat and dry regions. Water loss is mainly through evaporation, sometimes resulting in saline conditions, especially in the most arid regions. Water depth is shallow (<3m), and flooding characteristically ephemeral (Harrison *et al.* 1997). The proposed powerline study area itself contains a number of small pans (e.g. Kareedoringpan), and there are several larger pans situated north and east of the powerline study area (e.g. Konnes se Pan, Dwaggasoutpan, Boegoefonteinpan and Bitterputspan). The pans are normally dry and covered by a distinctive vegetation type known as Bushmanland Vloere, a form of inland saline scrub vegetation. When these pans hold water (which is only likely after exceptional rainfall events), waterbird movement to and from these pans is possible, including Greater Flamingo *Phoenicopterus roseus* and Lesser Flamingo *Phoenicopterus minor*. It is possible that nocturnal flamingo movement might take place over the powerline study area between coast and the abovementioned pans, although this should be sporadic rather than regularly.

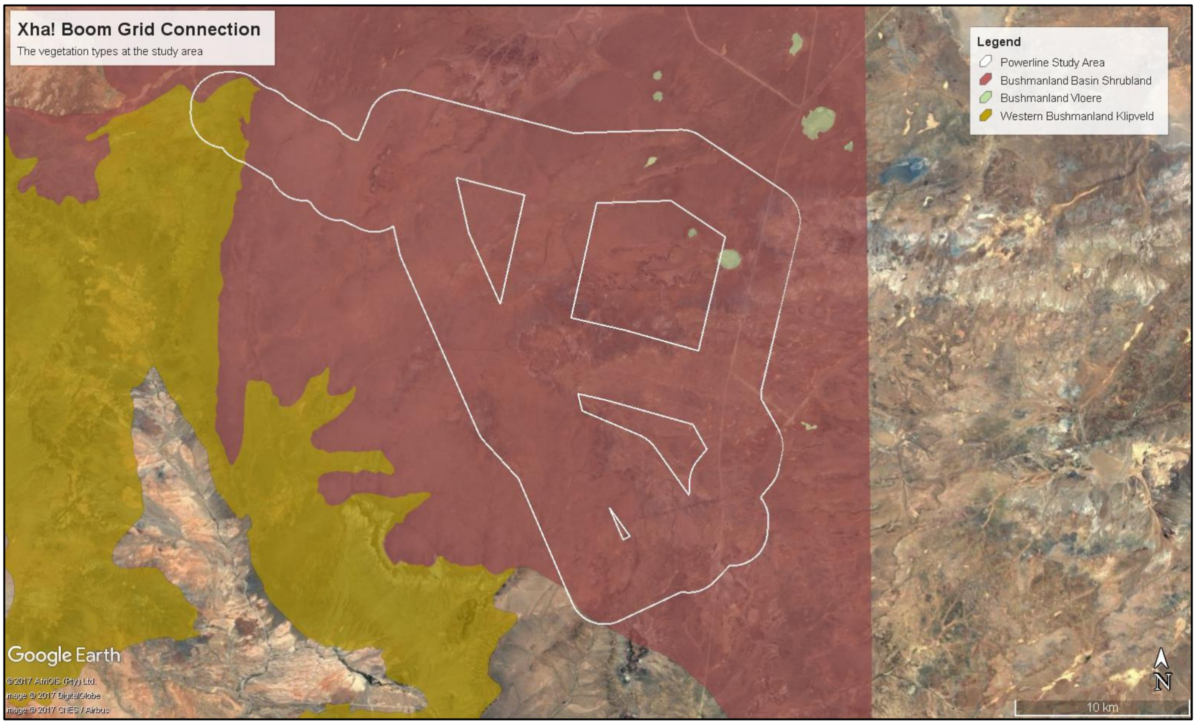

Figure 36: Vegetation types, indicating the homogenous character of the habitat at the powerline study area (Mucina & Rutherford 2006). The powerline study area is indicated by the white polygon.

5.8.1.2 Modified Environment

Whilst the distribution and abundance of the bird species in the greater study area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine the few external modifications to the environment that may influence the distribution and abundance of avifauna in the powerline study area.

The following avifaunal-relevant anthropogenic habitat modifications were recorded within the powerline study area:

- **Water points:** The land use in the powerline study area is mostly small stock farming. The entire powerline study area is divided into grazing camps, with several boreholes with associated water reservoirs and drinking troughs. In this arid environment, open water is a big draw card for several bird species, including Red Data species such as Martial Eagle and Sclater's Lark that use the open water troughs to bath and drink.
- **Transmission lines:** The Aries - Helios 400kV transmission line runs to the east of the powerline study area, with only small section falling within it. The transmission towers are used by raptors for perching and roosting, and also for breeding. Three (3) Martial Eagle nests were recorded on the Aries - Helios 400kV transmission line, one (1) of which falls within the powerline study area (**Figure 37**).

Appendix B of the Avifauna Impact Assessment Report provides a photographic record of the habitat at the powerline study area and the greater study area. A map of the powerline study area, indicating the location of water points and the Martial Eagle nests is shown in **Figure 37**.

Figure 37: Location of water points and Martial Eagle nests in the powerline study area.

5.9 Surface Water

The Surface Water Assessment was conducted by Shaun Taylor of SiVEST (**Appendix 6C**) and the environmental findings from a Surface Water perspective are presented below.

5.9.1 Surface Water Database Information

In terms of the National ENPAT (2002) database, the proposed development study site is completely within the Berg Olifants Water Management Area (WMA) (**Figure 38**). Moreover, the proposed development is therefore also within the Olifants – Cape Primary Catchment. At a finer level of detail, the !Xha Boom Wind Farm site traverses two (2) quaternary catchments including E31A and E31C.

In terms of the NFEPA (2011) database, there are six (6) natural depression wetlands, one (1) natural seep wetland and one (1) natural flat wetland. Therefore, eight (8) wetlands in total were identified. None of the identified wetlands are considered to be a Wetland Freshwater Ecosystem Priority Area (WETFEPA). A WETFEPA is a wetland that is earmarked to stay in good condition in order to conserve freshwater ecosystems and protect water resources for human use. These are classified according to a number of criteria some of which include existing protected areas and focus areas for protected area expansion identified in the National Protected Expansion Strategy.

Three (3) episodic rivers / streams were identified in both the Northern Cape ENPAT (2000) and NFEPA (2011) databases. These include the Hartebeeslaagte, Leeuwberg and Klein-Rooiberg. All are classified as Class B: Largely Natural systems in terms of the Present Ecological Status (PES) according to the NFEPA (2011) database. However, the more recent DWA (2014) database provides more detail for each system as follows:

- Hartbeeslaagte – PES B; Ecological Importance (EI) Moderate; Ecological Sensitivity (ES) Moderate;
- Leeuberg – PES B; EI Moderate; ES Moderate;
- Klein-Rooiberg – PES B; EI Moderate; ES High.

The Northern Cape ENPAT (2000) database also however identifies an additional tributary to the Leeuwberg episodic stream. Furthermore, additional drainage lines were also identified on the 1:50 000 topographical maps.

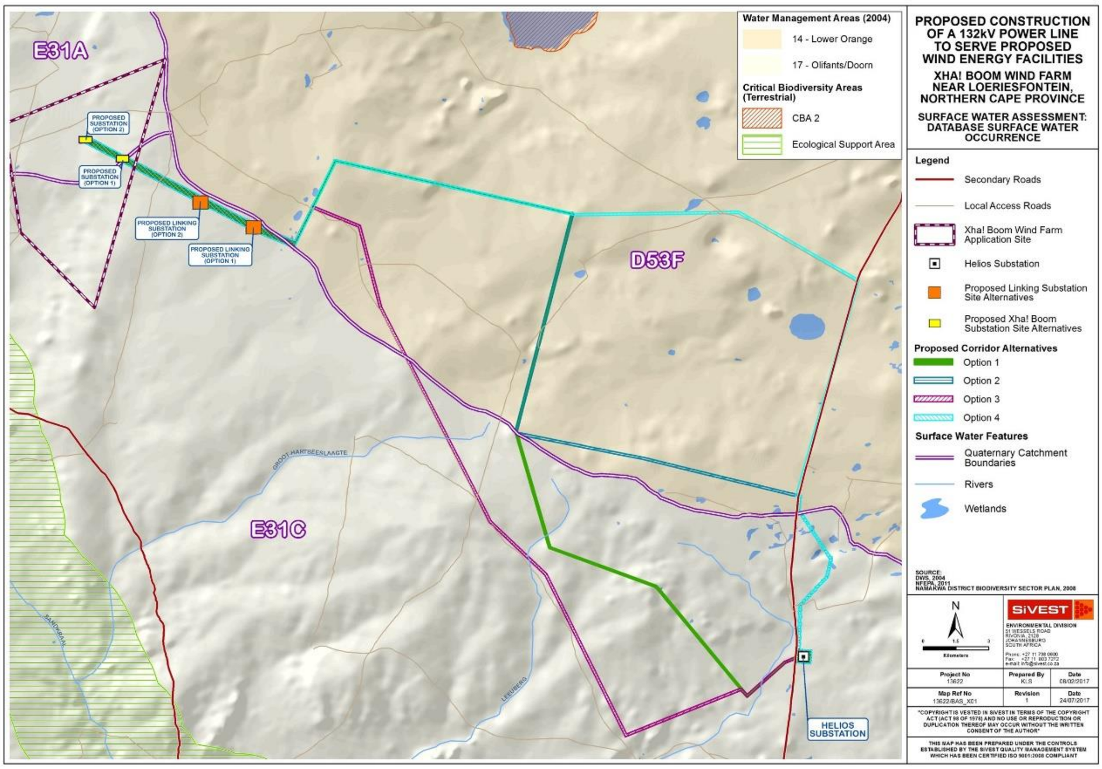

Figure 38: Database Surface Water Occurrence Map

5.10 Soils and Agricultural Potential

The Soils and Agricultural Potential Assessment was conducted by Johann Lanz. The full report is included in **Appendix 6D**. The environmental baseline from a soils and agricultural perspective is presented below.

5.10.1 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. There are six (6) land types across the study area (**Figure 39**). Soils on these land types are similar and are predominantly shallow, sandy soils on underlying rock or hard-pan carbonate. The soils would fall into the Lithic and Calcic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land types is provided in the Appendix of the Soils and Agricultural Potential Impact Assessment Report in Table A1. The field investigation confirmed the occurrence of shallow, sandy soils on underlying rock or hard-pan carbonate across the entire study area. The predominant soil forms are Coega, Mispah, Glenrosa and Askham.

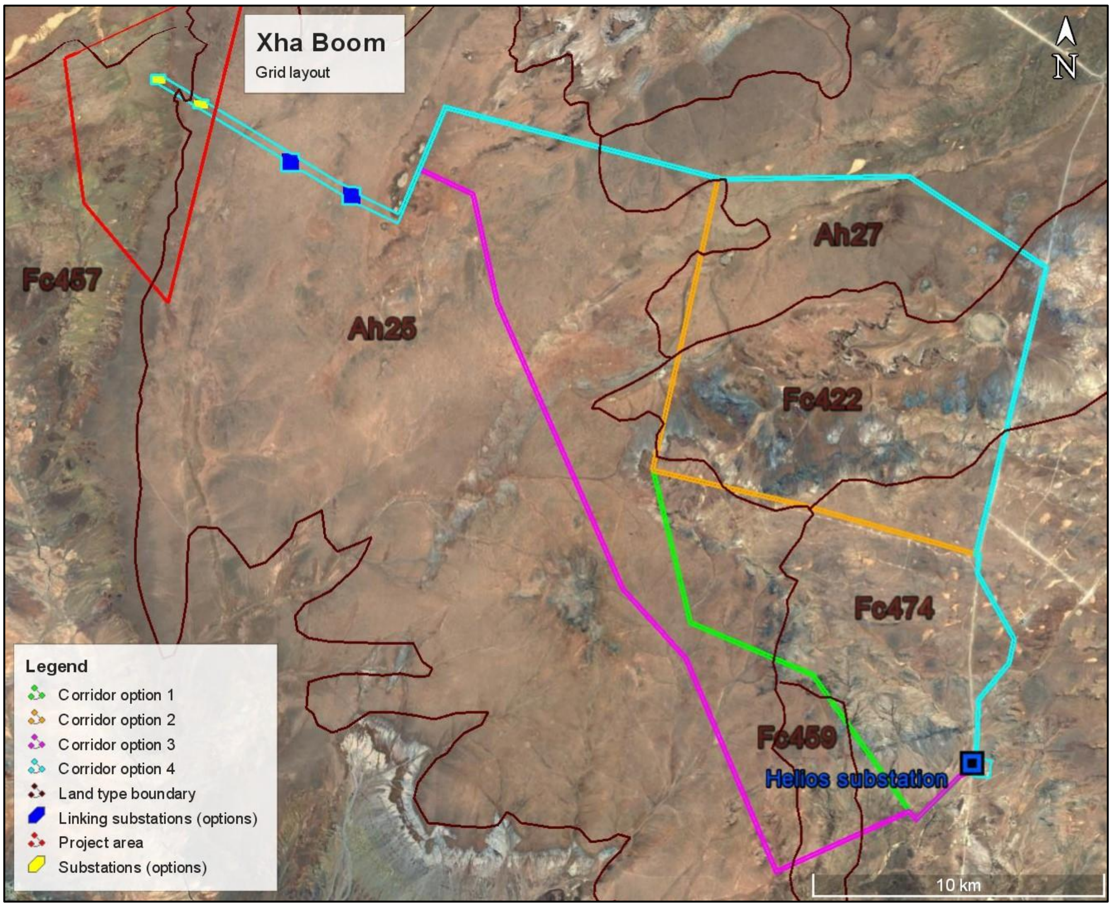

Figure 39: A satellite image of the study area showing the layout alternatives overlaid on land types


Figure 40: Photograph showing typical landscape and veld conditions on the site


Figure 41: Photograph showing typical landscape and veld conditions on the site

Figure 42: Photograph showing site conditions with example of dolerite outcrops that occur on study area

5.11 Heritage and Palaeontology

The Heritage Impact Assessment was conducted by Wouter Fourie of PGS Heritage. The full report is included in **Appendix 6E**. In addition, a desktop Palaeontological Impact Assessment was undertaken by Elize Butler of Banzai Environmental. The full desktop Palaeontological Impact Assessment Report is included as an appendix of the Heritage Impact Assessment Report (Appendix D of the Heritage Impact Assessment Report). The environmental baseline from a heritage and palaeontological perspective is presented below.

5.11.1 Background Research

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore, an Internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

5.11.1.1 Previous Studies

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. Previous studies listed for the area in the APM Report Mapping Project included a number of surveys within the area listed in chronological order below:

- MORRIS, DAVID. 2007. Archaeological Specialist input with respect to the upgrading railway infrastructure on the Sishen-Saldanha ore line in the vicinity of Loop 7a near Loeriesfontein. McGregor Museum.
- FOURIE, WOUTER. 2011. Heritage Impact Assessment for the proposed Solar Project on the farm Kaalspruit, Loeriesfontein. PGS Heritage and Grave Relocation Consultants.
- ALMOND, J.E. 2011. Palaeontological Desktop Study for the Proposed Mainstream Wind Farm Near Loeriesfontein, Namaqua District Municipality, Northern Cape Province.
- VAN SCHALKWYK, J. 2011. Heritage Impact Assessment for the proposed establishment of a wind farm and PV facility by Mainstream Renewable Power in the Loeriesfontein Region, Northern Cape Province.
- VAN De WALT, JACO. 2012. Archaeological Impact Assessment for the proposed Hantam PV Solar Energy Facility on the farm Narosies 228, Loeriesfontein, Northern Cape Province.
- WEBLEY, L & HALKETT, D. 2012. Heritage Impact Assessment: Proposed Loeriesfontein Photo-Voltaic Solar Power Plant On Portion 5 of the Farm Klein Rooiberg 227, Northern Cape Province.
- MORRIS, DAVID. 2013. Specialist Input for the Environmental Basic Assessment and Environmental Management Program for the Khobab Wind Energy Facility: Power Line Route Options, Access Road And Substation Positions.
- ORTON, JAYSON. 2014. Heritage Impact Assessment for the proposed re-alignment of the authorized 132kV Power Line for the Loeriesfontein 2 WEF, Calvinia Magisterial District, Northern Cape.

5.11.1.1 Findings from the studies

- **<u>Palaeontology</u>**

The following section has been compiled by Elize Butler for PGS Heritage. The full report can be viewed in Appendix D of the Heritage Impact Assessment Report.

The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal rocks of the lower part of the Ecca Group (Karoo Supergroup). They are assigned to the Prince Albert Formation, Whitehill Formation and Tierberg Formation in order of decreasing age. The Ecca Group were laid down within the marine to freshwater Ecca Sea.

These mudrocks are generally weathered, and creates landscapes of low relief. The Ecca Group sediments, particularly the Whitehill Formation, are intruded by Early Jurassic (183 ± 2 Million years old) igneous intrusions of the Karoo Dolerite Suite (Duncan & Marsh 2006). The basic sills thermally metamorphosed or baked the adjacent Ecca country rocks. In many areas the Permian and Jurassic bedrocks are mantled with a variety of superficial deposits, most of which is probably of Late Caenozoic (Quaternary to Recent) age. This include doleritic surface rubble, gravelly to silty river alluvium and pan sediments and small patches of aeolian (i.e. wind-blown) sands. The intrusive Karoo dolerites are of no direct palaeontological significance and the Late Caenozoic superficial deposits are generally of very low palaeontological sensitivity.

A figure indicating the surface geology of the proposed grid connection of the !Xha Boom Wind Farm is provided in **Figure 25**.

- **Archaeology**

Although a study conducted by Morris (2007) have indicated minimal finds of archaeological sites in the vicinity of the upgrade of Loop 7A of the Sishen-Saldanha ore line to the north of the study area, discussions with local framers have indicated the occurrence of some archaeological sites.

Morris (2010) notes that previous studies have indicated that substantial MSA scatters is fairly uncommon in the Bushmanland/Namaqualand areas. While herder sites where more limited to sheltered and dune areas close to water sources such as pans and rivers.

The HIA's (Fourie, 2011; Van Schalkwyk, 2011; Webley & Halkett, 2012 and Orton, 2014) and the AIA's (Morris, 2007; Van De Walt, 2012 and Morris, 2013), have added to the body of work conducted in the area since the observations of Beaumont et al. (1995), that "thousands of square kilometres of Bushmanland area covered by a low density lithic scatter".

Orton (2014) notes that previous studies in the vicinity of the current study area, have found and assessed archaeological material dating to the early (ESA), Middel (MSA) and Later (LSA) Stone Ages.

5.11.1.2 Heritage sensitivities

The evaluation of the possible heritage resource finds and their heritage significance linked to mitigation requirements was linked to types of landscape. The heritage sensitivity rating does not indicate no-go areas but the possibility of finding heritage significant site that could require mitigation work.

5.11.1.3 Possible finds

Evaluation of aerial photography has indicated that certain areas may be sensitive from an archaeological perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in **Table 11.**

Table 11: Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

5.12 Visual

The Visual Assessment was conducted by Stephan Jacobs and Andrea Gibb of SiVEST. The full report is included in **Appendix 6F**. The environmental baseline from a visual perspective is presented below.

The physical and land use related characteristics are outlined below as they are important factors affecting the visibility of a development and contributing to the visual character of the study area. Defining the visual character is an important part of assessing visual impacts as it establishes the visual baseline or existing visual environment in which the development would be constructed. The visual impact of a development is measured against this visual baseline by establishing the degree to which the development would contrast with or conform to the visual character of the surrounding area. The inherent sensitivity of the area to visual impacts or visual sensitivity is thereafter determined, based on the visual character, economic importance of the scenic quality of the area, inherent cultural value of the area and presence of visual receptors.

5.12.1 Topography

The flat terrain that occurs across most of the study area results in generally wide-ranging vistas throughout the study area (**Figure 43**), and the horizon is usually visible across an entire 360^{o} arc of the viewer. The only exception to this flat topography is the presence of the localised hills / ridges / koppies in parts of the wider visual assessment zone as well as the range of hills located some distance to the south and south-west of the proposed development which are expected to shield views of the proposed development to a degree.

Figure 43: Generally wide-ranging vistas found throughout the study area

5.12.2 Vegetation

The natural short vegetation cover will offer no visual screening. Parts of the visual assessment zone are however characterised by the presence of some tree species which occur naturally in some areas and are expected to contribute to the overall natural character of the study area as well as provide some form of screening from the proposed development. In addition, tall exotic trees may effectively screen the proposed development from farmhouses, where these trees occur in close proximity to the farmhouse and are located directly in the way of views to the proposed development.

5.12.3 Land Use

The general lack of human habitation and associated human infrastructure across much of the study area has a distinct impact on the sense of place, giving the area a largely natural, rural feel (**Figure 44**). The pastoral elements which are present in parts of the study area, especially where sheep farming occurs, are however expected to give the surrounding area a more pastoral feel.

Figure 44: Typical natural or scenic visual character found across much of the study area

High levels of human transformation are however evident in the south-eastern sector of the study area in the form of Helios Substation and associated high voltage power lines as well as the Khobab and Loeriesfontein Wind Farms which are presently under construction. As previously mentioned, the on-site Khobab IPP substation and the construction camp area for the Khobab Wind Farm can also be found within this part of the study area, within close proximity to the Helios Substation.

The influence of the level of human transformation on the visual character of the area is described in more detail below.

5.12.4 Visual Character

The physical and land cover related characteristics of the study area contribute to its overall visual character. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as electrical infrastructure.

The majority of the study area is considered to have a natural (almost vacant) visual character and there is minimal human habitation and associated infrastructure. In addition, the predominant land use (sheep farming) has not transformed the natural landscape and the area has thus largely retained its natural rural character. It should however be noted that there are some pastoral elements in the area which are expected to give the surrounding area a more pastoral feel. As mentioned above, built infrastructure across much of the study area is limited to isolated farmhouses, gravel farm access roads and farm boundary fences, although there is some quarrying activity in the north-eastern portion of the study area.

The relatively low density of human transformation throughout much of the area is an important component contributing to the largely natural visual character of the study area. This is important in the context of potential visual impacts associated with the proposed development of substations and power lines as introducing this type of development could be considered to be a degrading factor in this context particularly if no existing electrical infrastructure is located nearby.

There are however significant anthropogenic elements in the study area including the Granaatboskolk Road, the railway line, high voltage power lines and Helios Substation. In addition, there are two (2) wind farms presently under construction in the study area, namely Khobab and Loeriesfontein 2. The on-site Khobab IPP substation and the construction camp area for the Khobab Wind Farm can also be found within the study area, within close proximity to the Helios Substation. These facilities and their associated infrastructure consist of very large structures which are highly visible, significantly altering the visual character and baseline in the study area and resulting in a more industrial-type visual character in this part of the study area.

It is important to note that several renewable energy developments (solar and wind) are being proposed in the surrounding area. These facilities and their associated infrastructure typically consist of very large structures which are highly visible. The presence of these renewable energy developments (if constructed) will thus further transform the current visual character and lessen the degree to which the proposed development would contrast with the elements and form in the surrounding environment.

5.12.5 Cultural, Historical and Scenic Value

Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world. The concept of 'cultural landscape' is a way of looking at a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). The cultural landscape concept is relatively new in the heritage conservation movement across the world. In 1992 the World Heritage Committee adopted the following definition for cultural landscapes:

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

According to the Committee's Operational Guidelines Cultural Landscapes can fall into three (3) categories

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

The greater area surrounding the proposed development site is also an important component when assessing visual character. The area can be considered to be typical of a Karoo or "platteland" landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa's dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Traditionally the Karoo has been seen by many as a dull, lifeless part of the country that was to be crossed as quickly as possible on route from between the major inland centres and the Cape coast, or between the Cape and Namibia. However, in the last couple of decades this perception has been changing, with the launching of tourism routes within the Karoo, and the promotion of tourism in this little visited, but extensive part of South Africa. In a context of increasing urbanisation in South Africa's major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published "Getaway Guide to Karoo, Namaqualand and Kalahari" (Moseley and Naude-Moseley, 2008). The exposure of the Karoo in the national press during 2011, as part of the debate around the potential for fracking (hydraulic fracturing) mining activities, has brought the natural resources, land use and lifestyle of the Karoo into sharp focus. Many potential objectors stress the need to preserve the environment of the Karoo, as well as preserve the 'Karoo Way of Life', i.e. the stock farming practices which are highly dependent on the use of abstracted ground water (e.g. refer to the Treasure Karoo Action Group website http://treasurethekaroo.co.za/). Although the small town of Loeriesfontein may be used by tourists as a stop-over destination, the proposed development is located approximately 68km to the north of the town and would therefore not influence these visitors. None of the roads passing near the proposed development are considered to be tourism routes.

The typical Karoo landscape can also be considered a valuable 'cultural landscape' in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small Karoo towns such as Loeriesfontein, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, "continuing" landscape.

The study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the proposed development of a power line and substation. Introducing this type of development is not considered to be a significant degrading factor in the context of the natural Karoo character of the study area, as electrical infrastructure forms part of the typical form present within the Karoo landscape (**Figure 45**).

Figure 45: View of a typical Karoo landscape, which includes electrical infrastructure (Kay, 2014)

5.12.6 Visual Sensitivity

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer, 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be 'key issues' (Oberholzer, 2005).

Based on the criteria in the matrix (**Table 12**), the visual sensitivity of the area is broken up into a number of categories, as described below:

i) **High -** The introduction of a new development such as the erection of an on-site substation or power line would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors

ii) **Moderate -** Presence of receptors, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

iii) **Low -** The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 12: Environmental factors used to define visual sensitivity of the study area

FACTORS	**RATING**									
	1	2	3	4	5	6	7	8	9	10
Pristine / natural character of the environment										
Presence of sensitive visual receptors										
Aesthetic sense of place / scenic visual character										
Value to individuals / society										
Irreplaceability / uniqueness / scarcity value										
Cultural or symbolic meaning										
Scenic resources present in the study area										
Protected / conservation areas in the study area										
Sites of special interest present in the study area										
Economic dependency on scenic quality										
Local jobs created by scenic quality of the area										
International status of the environment										
Provincial / regional status of the environment										
Local status of the environment										
**Scenic quality under threat / at risk of change										

**A rating above ‘5’ for this factor will trigger the need to undertake an assessment of cumulative visual impacts.

Low							Moderate							High
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**

Based on the above factors, the study area is rated as having a moderately-low visual sensitivity. This is mainly due to the relatively uninhabited character of the area. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. As described below, very few potentially sensitive receptors are present in the study area. Although no formal protected areas or leisure / nature-based tourism activities exist within the study area, the area would still be valued as a typical Karoo cultural landscape.

As previously mentioned, there are two (2) wind farms under construction in the study area, and several other renewable energy facilities (solar and wind) are proposed in the study area. As such, an assessment of the cumulative impact is discussed in Section 4.3 of the Visual Impact Assessment Report.

Although the area is associated with a moderately low visual sensitivity, it should be stressed that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of the likelihood that the area would be sensitive to the visual impacts. This is based on the physical characteristics of the study area, economic activities within the study area and land use that predominates. This does not mean that high visual impacts could not potentially be experienced in areas of low visual sensitivity. The potential presence and perception of sensitive receptors as discussed below must also be taken into account.

5.12.7 Sensitive and Potentially Sensitive Visual Receptor Locations

A sensitive receptor location is defined as a location from where receptors would potentially be adversely impacted by a proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. As described above, the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the proposed substations and 132kV power line into a ‘view’, which may affect the ‘sense of place’. The identification of sensitive receptors is typically undertaken based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas with a natural visual character;
- the presence of leisure-based (esp. nature-based) tourism or sites with historical and cultural value in an area;
- the presence of sites / routes that are valued for their scenic quality and sense of place;
- the presence of homesteads / farmsteads in largely natural settings where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the BA study.

A distinction must be made between a receptor location and a sensitive receptor location. Receptor locations are sites from where the proposed on-site substations and 132kV power line may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities, scenic sites and residential dwellings in natural settings.

Generally, the visibility of the development would diminish exponentially over distance. As such, the proposed development would be more visible to receptors located within a short distance and these receptors would experience a higher adverse visual impact than those located at a moderate or long distance from the proposed development. The distance of a sensitive receptor location from the proposed development site was taken into account when rating the visual impact of the proposed development on these potential receptors.

In order to account for this, distance bands were used to assign zones of visual impact from the proposed development site. Based on the height and scale of the project, as well as the investigations undertaken during the fieldwork, the radii chosen to assign these zones of visual impact are as follows:

- 0 < 500m (high impact zone);
- 500m < 2km (moderate impact zone);
- 2km < 5km (low impact zone); and
- >5km (Negligibly low impact zone)

A total number of nineteen (19) scattered farmsteads / homesteads which house the local farmers as well as their farm workers were identified within the study area. These dwellings are regarded as <u>potentially</u> sensitive visual receptors as they are located in a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. The degree of visual impact experienced will vary from one inhabitant to another, as it is largely based on the viewer’s perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer’s sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).
- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

As far as possible, each potentially sensitive visual receptor that was identified via desktop means was visited to determine the current use of the facility and assist with rating the impact of the proposed development from the location. However, due to the extensive area covered by the study area and access limitations during the site visit, it was not possible to verify the status of all the identified potentially sensitive receptor locations. As such, the impact rating assessment of the proposed development on the potentially sensitive visual receptor locations was undertaken primarily via desktop means. Although the use of these farmsteads / residential dwellings could not be established during the field investigation, they were still regarded as being potentially sensitive to the visual impacts associated with the proposed development and were assessed as part of the VIA. As mentioned above, nineteen (19) potentially sensitive visual receptors were identified within the study area. No sensitive visual receptor locations with tourism significance were identified within the study area. This is mainly due to low levels of leisure-based or nature based tourism activities in the assessment area.

Table 13 below provides details of the potentially sensitive places that have cultural and symbolic importance that were identified within the study area.

It should be noted that a few of the farmsteads / homesteads which were identified via desktop means were excluded as potentially sensitive receptor locations for the purposes of this visual study as it was discovered during the time of the site visit that these were uninhabited and/or abandoned. No further assessment was undertaken from these abandoned farmsteads / homesteads as it was assumed that no individuals currently live in these farmsteads / homesteads and therefore no visual impact will be experienced from these locations.

Table 13: Visual receptor locations identified within the study area.

Name		**Proximity to proposed Substation Site or Power Line Corridor**	**Visual Impact Zone**
*VR13	Farmstead/Homestead	Approx. 2.6km from Power Line Corridor 1, 2, 3 and 4	Low
**VR18	Farmstead/Homestead	Approx. 3.0km from Power Line Corridor 1, 2, 3 and 4	Low
VR25	Farmstead/Homestead	Approx. 200m from Power Line Corridor Option 1	High
VR27	Farmstead/Homestead	Approx. 1.6km from Power Line Corridor Option 3	Moderate
VR28	Farmstead/Homestead	Approx. 2.2km from Power Line Corridor Option 3	Low
VR29	Farmstead/Homestead	Approx. 2.2km from Power Line Corridor Option 3	Low
VR30	Farmstead/Homestead	Approx. 2.2km from Power Line Corridor Option 3	Low
VR31	Farmstead/Homestead	Approx. 2.2km from Power Line Corridor Option 3	Low
VR32	Farmstead/Homestead	Approx. 800m from Power Line Corridor Option 1 and 2	Moderate
VR33	Farmstead/Homestead	Approx. 700m from Power Line Corridor Option 4	Moderate
VR34	Farmstead/Homestead	Approx. 180m from Power Line Corridor Option 2 and 4	High
VR35	Farmstead/Homestead	Approx. 1.2km from Power Line Corridor Option 3	Moderate

Name		Proximity to proposed Substation Site or Power Line Corridor	Visual Impact Zone
VR36	Farmstead/Homestead	Approx. 1.2km from Power Line Corridor Option 3	Moderate
VR37	Farmstead/Homestead	Approx. 1.6km from Power Line Corridor Option 3	Moderate
VR38	Farmstead/Homestead	Approx. 1.5km from Power Line Corridor Option 3	Moderate
VR39	Farmstead/Homestead	Approx. 4.2km from Power Line Corridor Option 4	Low
VR40	Farmstead/Homestead	Approx. 4.5km from Power Line Corridor Option 4	Low
VR41	Farmstead/Homestead	Approx. 4km from Power Line Corridor Option 4	Low
VR43	Farmstead/Homestead	Approx. 4.6km from Power Line Corridor Option 4	Low

**According to the Noise Specialist (with the Public Participation Practitioner's advice), this receptor was confirmed as a house which is used very temporary (one night) on occasion. There is also single room present for a shepherd (De Jager, 2017).*

***According to the Noise Specialist (with the Public Participation Practitioner's advice), this receptor was confirmed as a farmstead / homestead which is owned by a Mr Kallie van Zyl (De Jager, 2017). No further information was however provided with regards to this receptor.*

It should be noted that, as mentioned above, it was not possible to verify the status of all the identified potentially sensitive receptor locations. As such it is possible that some of the structures identified by desktop means may not, in reality, be potentially sensitive receptors. Although the use of these receptors could not be established during the field investigation, they were still regarded as being potentially sensitive to the visual impacts associated with the proposed development and were assessed as part of the VIA. In light of the above, the impact rating assessment of the proposed development on the potentially sensitive visual receptor locations was undertaken primarily via desktop means.

In many cases, roads along which people travel are considered to be sensitive receptor locations. Road infrastructure in the study area largely comprises gravel access roads used primarily by local farmers. The southern sector of the study area is however traversed by the Granaatboskolk Road, a secondary road which connects the town of Loeriesfontein with Granaatboskolk to the north. This road is not part of any scenic tourist route and is not specifically valued or utilised for its scenic or tourism potential. As such, there are no visually sensitive roads within the study area.

The visually sensitive and potentially sensitive receptor locations in relation to the zones of visual impact are indicated in **Figure 46** below.

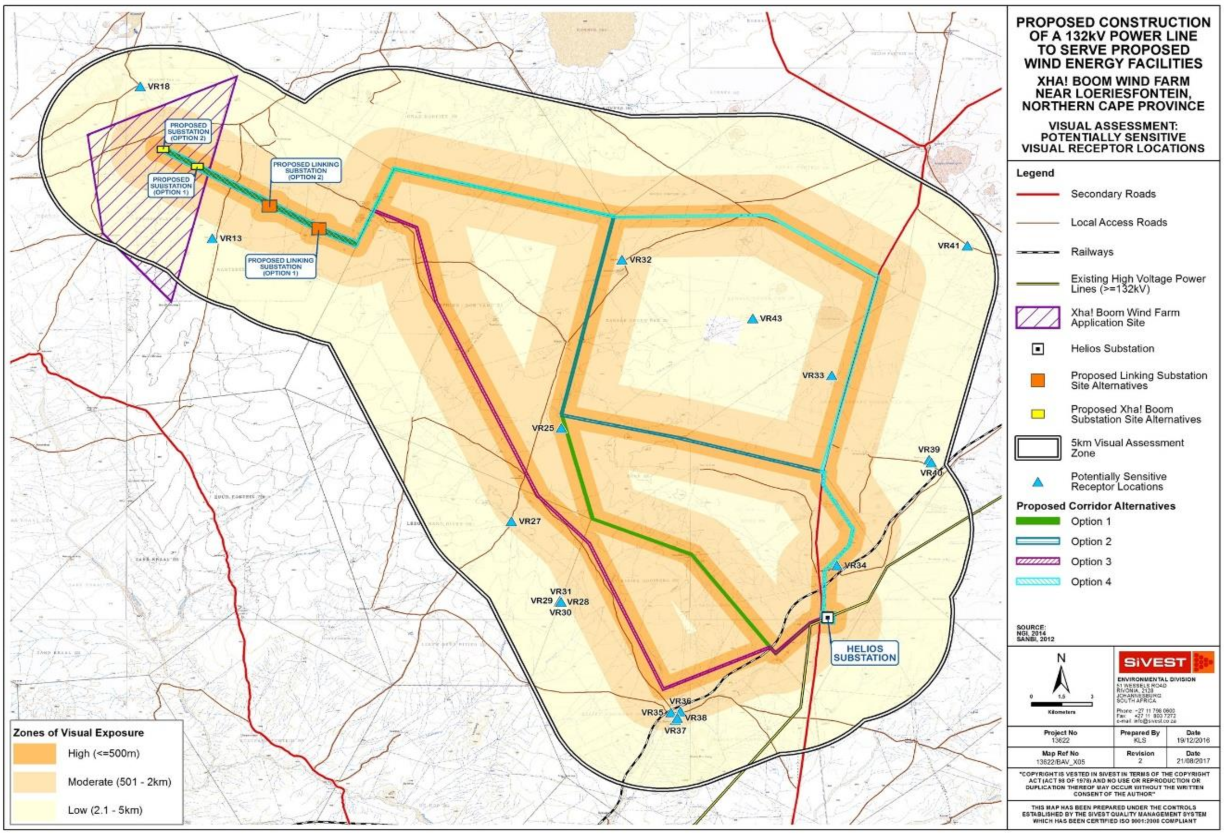

Figure 46: Potentially Sensitive Visual Receptors within the study area

5.13 Socio-economic Environment

The Socio-economic Assessment was conducted by Zimkita Nkata and Elena Broughton of Urban-Econ Development Economists. The full report is included in **Appendix 6G**. The environmental baseline from a socio-economic perspective is presented below.

5.13.1 Baseline Information

This chapter examines key socio-economic characteristics of the study area, as per the delineation provided. This is essential as it provides both qualitative and quantitative data related to the communities and economies under observation, creating a baseline against which the impacts can be assessed. As previously mentioned, the proposed development is located within the Hantam LM, which falls under the Namakwa DM.

- **Spatial Context and Regional Linkages**

Geographically, the **Northern Cape** is the largest province located within South Africa with an area of 372 889km^2 equating to approximately 30.6% of South Africa's spatial composition. Despite having the largest surface area, the Northern Cape is the least populated province in South Africa with a population of 1.1 million people equating to 2.2% of the national population (Stats SA, 2011). This province is a dry and hot region classified as a semi-desert as it also experiences scarce rainfall patterns. The Northern Cape Province consists of five districts, namely Frances Baard, Pixley ka Seme, Namakwa, ZF Mgcawu (previously known as Siyanda) and John Taolo Gaetsewe.

The proposed substations and power lines fall within the **Namakwa DM** which is situated on the western part of the Northern Cape Province and is the largest municipality of the five (5) main municipal districts of the Province covering an area of 126 900km^2 (34%) of the total provincial landmass. Although it is the largest district geographically, the Namakwa DM is sparsely populated with a population of 115 842 people, which comprise 10.11% of the total province population (Stats SA, 2011).

In the Namakwa DM, the project lies within the borders of the Hantam LM and the Khai-Ma LM. The **Hantam LM** is an inland municipality which lies on the west of the Namakwa DM and is located 140km from Springbok. The Hantam LM covers an area of 36 128km^2 and has a population of 21 581 people (Stats SA, 2011). The municipality is known for its wide open space, striking mountain ranges and nature reserves filled with a vast array of indigenous plants and bulbs (Hantam IDP, 2015). The main attractions of the area are therefore, the floral displays, hiking and the natural environment. Hantam municipality is also furnished with four conservation areas, namely Oorlogskloof Nature Reserve, Hantam National Botanical Gardens, Tankwa Karoo National Park and the Akkerdam Nature Reserve (Umsebe Development Planners, 2010).

With a total surface area of 16 627km^2, the **Khai-Ma LM** is situated along the north-western part of the Namakwa DM and is a sparsely populated region with 12 466 people. The Khai-Ma LM is bordered by Namibia on the north, the ZF Mgcawu LM on the east and, the Nama-Khoi LM on the west. Urban nodes surrounding the local municipality include Pofadder town, as the main centre; Aggeneys; Pella; Witbank and Onseepkans. Although the surrounding area of the region has a low grazing potential, a vast amount of extensive land in Khai-Ma is predominantly used for livestock farming (Umsebe Development Planners, 2010).

5.13.2 Sense of Place, History and Cultural Aspects

The closest town to the proposed 132kV substations and 132kV powerline is Loeriesfontein. This is a small rural service centre town that lies within a basin surrounded by mountains and is situated to the north-west of the town of Calvinia. Loeriesfontein was built around a general store in the year 1894 by a British bible salesman, Frederick Turner (Hantam IDP, 2015). The town has a population of 2 746 people, which has grown by 12.4% since the year 2001. Loeriesfontein town covers a total surface area of 34.45km^2 and has a population density of 80 people/km^2 (Stats SA, 2011).

The south-western part of Loeriesfontein forms part of Namaqualand, which is a region popular for its spring flowers and its wide variety of diverse vegetation (Hantam IDP, 2015). Loeriesfontein town also houses the Gannabos (Quiver) Forest, which is home to the world’s largest colony of the *Aloe Dichotoma* species (Umsebe Development Planners, 2010). During spring, the town is flooded with tourists attracted by the spring flowers. The town also boasts its Windmill museum, which is one of only two (2) in the world. Sheep farming and salt mining are the predominant activities within and around Loeriesfontein town (Umsebe Development Planners, 2010).

5.13.3 Demographic Profile

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills and determines the demand for the production output. Examining population dynamics is essential in gaining an accurate perspective of those who are likely to be affected by any prospective development or project.

- **Population demographics**

As previously noted, the **Hantam LM** has a population of 21 581 individuals accounting for 18.6% of the total population of the Namakwa DM. In comparison to the year 2001, the population of the Hantam LM has increased by 6.6%. Within the local municipality, 80% of the people reside in urban areas whilst the rest occupy farms. In total, the Hantam LM has 6 341 households with a household density of 0.14km^2 (Stats SA, 2011). The majority of the people in the Hantam LM reside in the city centre, which is Calvinia town; thus, only a small percentage of people reside in other smaller surrounding towns such as Loeriesfontein (13%) (Stats SA, 2011). Over 90% of the residents in the municipality, as well as the nearby towns (Loeriesfontein and Brandvlei), speak Afrikaans as a first language, with the dominant race being coloured people (82%) and white people lagging behind at 11%. The Hantam LM's population consists of 50.1% males and 49.9% females. The largest group of people falls under those aged between 35 and 64 years of age. In this LM, the youth (15-34 years) encompass about 29.1% of the total population. Only 28% of Hantam residents are married, whilst 54% have never been married (Stats SA, 2011).

Loeriesfontein, being the closest town to the Graskoppies Substation project site, only has 806 households in total resulting in a household density of 23.3 km^2. The majority (94.3%) of people have access to formal housing whilst the rest either live in houses or flats in a backyard (0.87%) or in informal dwellings (4.12%). A huge portion of people living in Loeriesfontein are coloured (86%), followed by white people at 11.54% whilst black people equate to 1.9% of the total population. Afrikaans is the main language spoken as more than 90% of the people cited it as their first language; only 0.4% residents speak English whilst 0.5% speak Setswana (Stats SA, 2011). Only 26.5% residents are married, whilst 56.9% have never married.

Although Loeriesfontein is a relatively small town, residents and farm owners stated that since the introduction of renewable energy projects in the area, namely Khobab and Loeriesfontein 2 wind farms, the town has experienced an influx of people either in an attempt to find employment or to seize economic opportunities brought by the wind farms.

The **Khai-Ma LM**, on the other hand, has a smaller population of 12 466 people; this accounts for 10.7% of the total population of the Namakwa DM. Although the population has increased by 6.2% from 11 692 people in 2001, it is still only almost two-thirds of the Hantam population (Stats SA, 2011). Most residents within the Khai-Ma LM reside in the urban areas (81%) whilst some reside on farms (17%). The total number of households in the Khai-Ma LM is 3 796, resulting in a household density of 0.22km^2. Just over 80% of the residents speak Afrikaans in the municipality (Stats SA, 2011). Coloured people equate to three-quarters of the total population with black people (18%) being the second dominant race. Only 24% of the Khai-Ma LM residents are married whilst 64% have never been married. In like manner with the Hantam LM, the Khai-Ma LM has more males (52.6%) than females (47.4%) with the largest population also falling within 35 and 64 years of age. Although this is the case, this local municipality, however, has a youth population (15-34 years) that is just over a third (36.8%) of the total population (Stats SA, 2011).

- **Health Demographics**

The process of assessing and monitoring the level of health in a particular area is beneficial as it provides useful information on the development as well as human welfare of an area. Over the last 15 years, in comparison to the rest of South Africa and the Northern Cape Province, the effect of HIV has been less severe on the DM and LM's. AIDS related deaths have also been following a similar pattern.

In the year 2015, the **Hantam LM** reported a total of 956 people to be living with HIV, which equates to 4.5% of the total LM population. Although the number of HIV-positive people for the Namakwa DM (4.9%) is close to that of the LM (4.5%), national and provincial HIV infected percentage levels are much higher, as they are at 11.4% and 7.3%, respectively.

Table 14: Population, HIV positive, AIDS and other deaths (2015)

Indicator	South Africa	Northern Cape	Namakwa DM	Hantam LM	Khai-Ma LM
Population	54 956 509	1 175 780	116 834	21 371	11 805
HIV positive	6 248 908	86 146	5 702	956	673
AIDS deaths	206 761	2 360	113	20	7
Other deaths	444 866	9 729	1 159	213	98

The **Khai-Ma LM** had a slightly higher percentage of people living with HIV (5.7%). AIDS related deaths at the national, provincial, regional and local context are relatively low as they range from a range of 0.1%-0.4%. In a period of 15 years (2000-2015), people living with the HIV illness in the Hantam LM had increased by 695 people whilst residents living in the Khai-Ma LM with the same illness increased by 463 within the same period.

Although the prevalence of HIV/Aids in **Loeriesfontein town** is not clear, during the site visit and interviews conducted with various stakeholders it was revealed that construction workers employed to develop wind farms in the area, namely Khobab and Loeriesfontein 2, mingle with young females and this has since resulted in a sharp increase in the rate of teenage pregnancies. The presence of construction workers in the area has also increased a number of social ills such as the use of alcohol and drug abuse. Although many of the residents agree that this has always been a norm in the town, many alluded to the fact that the social ills have exacerbated in the last few years correlating with the period of establishment of the two wind farms. One such example is the increase in the number of liquor licenses applied for, as well as an increase in the number of young school girls who interact with construction workers resulting in unwanted pregnancies.

- **Crime Demographics**

In the **Hantam LM**, 816 serious crimes were reported; of these, a total amount of 760 were community reported crimes whilst 56 of them were detected by the police. Common assault was the most frequently reported crime with 207 cases, followed by property-related crime with 154 cases and assault with the intention to harm with 125 cases. The total number of serious crimes equate to 17% of the district reported crimes and 1.41% of the provincial reported crime cases. Although the use the alcohol and drugs have increased in Loeriesfontein town, crime levels have been stable and have not resulted in any criminal activities that can be directly linked to the heavy influx of people.

In 2015, the **Khai-Ma** LM had less crime-related occurrences, as only a total of 285 serious crimes were reported. The most commonly reported crimes are similar to trends noted in the Hantam LM but are at less severe rates with common assault reported to have had 69 cases, property related crime with 52 cases and assault with the intent to harm with 46 cases. Crimes reported in Khai-Ma LM equate to 6% of the cases reported at the district level and only 0.5% of the provincial reported crimes.

Table 15: Crimes reported by crime type (2015)

Types of crime	South Africa	Northern Cape	Namakwa DM	Hantam LM	Khai-Ma LM
Serious crimes	2 209 068	57 817	4 782	816	285
➢ Community reported crimes	2 068 261	54 724	4 212	760	255
➢ Crimes dependent on police action for detection	140 807	3 093	570	56	30

5.13.4 Economy

The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector is also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors.

The **Hantam LM** is a relatively small economy that is valued at R1 184 million in current prices. In total, the economy of the Hantam LM equates to 11.1% of the Namakwa Districts Gross Domestic Product per Region (GDP-R) which was valued at R10 696 million in current prices (Quantec, 2016). The contribution of the LM to the Province as a whole is significantly low as it only accounts for 1.64% of the Northern Cape Province. The Hantam LM economy has been manifesting a fluctuating growth rate revealing its sensitivity to external shocks related to national and global changes. For instance, the Hantam economy was adversely affected by the 2008 global recession (Quantec, 2016). Although this was the case, the economy began slowly recovering between the 2010-2011 period. Overall, between the 1995-2011 period, the Hantam LM economy grew at a Compounded Annual Growth Rate (CAGR) of 3.19%.

The economy of the **Khai-Ma LM** lags behind the Hantam economy with a total size of R939 million in current prices (Quantec, 2016). This contribution accounts for 8.8% of the districts economy and 1.3% of the Province economy. The Khai-Ma LM experienced similar growth patterns with Hantam, as it experienced stagnation in the year 2009 after the global recession and began recovering shortly after. At current prices, the 20-year period (1995-2011) CAGR for Khai-Ma LM equates to 2.44%.

According to the Hantam LED Framework (2011), economic development ought to be sustainable. Ensuring that it is sustainable entails strengthening and diversifying the economy through a range of sectors such as the primary, secondary and tertiary sector which should cater for all consumer and business needs. Due to the fact that 72% of the GDP-R of the **Hantam LM** is generated by the tertiary sector, this LM is a service economy with prominent sub-sectors such as general government (13%), transport and communication (16%) as well as wholesale, retail and trade (25%). A contributing factor to this is mostly likely the numerous government departments that are situated in Calvinia town as it serves as the main seat and administrative town of the Hantam LM (Hantam IDP, 2015). On the other end of the spectrum, within the primary sector, agriculture is the main contributor to GDP-R as it equates to 18% of the Hantam economy.

Although the mining industry currently has a very low contribution to the economy, 80% of the worlds' gypsum reserves lie just outside Loeriesfontein town; thus, an opportunity exists for salt and gypsum mining in the region as salt pans at Dwaggas Pit also employ 30 permanent workers (Umsebe Development Planners, 2010).

Since the start of the construction of Khobab and Loeriesfontein 2 wind farms, the informal hospitality industry in the town of Loeriesfontein has boomed as construction workers have been in need for accommodation in town thus majority of town. In order to meet the increased demand in accommodation, the majority of the town residents have transformed their backyards and availed their garages for rent purposes. In conjunction with the 20-year old wind museum in the town, the recently established wind farms have also added value to the tourism component of the area. Due to the influx of people in the town, the economic impact has been positive for the town as a result of this; food and fuel sales have spiraled increasing businesses' gross revenues and profits in an unprecedented manner. Further positive investments are expected to trickle down to the Loeriesfontein community when the surrounding wind farms break even (after 9 years) and 5% of the generated profits will be invested in the community.

In the **Khai-Ma LM,** the primary sector contributes the highest percentage (67%) to the municipal GDP-R. Within the primary sector, mining and quarrying is the prominent industry with a contribution of 51%, whilst the agriculture industry contributes 15% to the overall economy. The high percentage contribution of the mining industry is most likely due to the presence of various minerals within the municipal area such as zinc, copper, lead, granite and quartz (Umsebe Development Planners, 2010). Mining activity is thus exacerbated by the existence of the Black Mountain mine in Aggeneys town as well as the gypsum mine in Pofadder town. The second contributor to the GDP-R of the Khai-Ma LM is the tertiary sector with a contribution of 28%. Within the tertiary sector, the most imminent industries are general government (10%), transport and communication (6%) as well as wholesale and retail trade, catering and accommodation (6%).

5.13.5 Labour Force and Employment Structure

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being. The following paragraphs examine the study area's labour profile.

- **Labour force composition**

During the year 2011, the total working population of the **Hantam LM** consisted of 13 680 people, within this figure, the total labour force only equated to 7 004 people. As outlined in **Table 16** below, a percentage of 3.4% of people are described as discouraged job seekers, which typically refers to a group of people who are capable of searching for employment but have become discouraged and are no longer looking for employment. The difference between the number of people employed (6 122) and unemployed (882) in the region results in an unemployment rate of 12.6%, which is relatively low in comparison to the national and provincial unemployment rates (29.7% and 27.4%), respectively. Within the Hantam region, Loeriesfontein town has a slightly higher unemployment rate of 14.7% (Stats SA, 2011).

Although only 100-150 local residents are currently employed by the nearby wind farms, the impact of increased employment levels in **Loeriesfontein** has been significant; this is so because in the past the town was heavily reliant on income from extensive farming. However, in the event that agricultural farms undergo expansion, employment levels usually remain the same as farming in the area largely comprises of livestock farming, which is not very labour-intensive. However, with that being said, the prevalence of drug abuse has restricted the number of locals that can be employed as the impact of the drugs is said to result in a lack of personal motivation.

In the **Khai-Ma LM**, the total working population consisted of 8 541 people with a labour force equating to 5 889 people. In 2011, about 4% of people were recorded as discouraged jobseekers. The Khai-Ma LM has a relatively higher unemployment rate of 20.9% (Stats SA, 2011).

Table 16: National, Provincial & Regional Labour Force Profile

Town / settlement	**Working age**	**Labour force**			**Discouraged job seekers**	**Unemployment rate**
		Employed	Unemployed	Total		
South Africa	33928806	13254829	5586624	18841453	1848720	29,7%
Northern Cape	736205	284202	107379	391581	40170	27,4%
Namakwa DM	76579	33713	8455	42168	4258	20,1%
Hantam LM	13860	6122	882	7004	475	12,6%
Loeriesfontein	1767	680	117	797	33	14,7%
Khai-Ma LM	8541	4660	1229	5889	327	20,9%

- **Employment structure**

Within the working age population (15-64 years) of the **Hantam LM**, about 60% of the individuals are employed in the formal sector whilst 21% are employed in the informal sector (Stats SA, 2011). Employment opportunities provided by private households equate to approximately 17% of the Hantam working population. Within the Hantam LM, Loeriesfontein town employed the least people in the formal sector resulting in it being the dominant job creator in the informal sector. In the **Khai-Ma LM**, more employment is offered in the formal sector whilst only a minority of people work in the informal sector.

Similar patterns can be observed for the provision of employment by private households within the LM as well as the towns.

Within the formal sector, only 14% of people of the Hantam LM's working population are considered to be skilled, whilst majority (30%) of the people either occupy jobs that require semi-skilled or low-skilled individuals. The rest of the working population (27%) are employed in the informal sector. In the Khai-Ma LM, very few individuals (10%) within the working population are considered skilled. Instead, similar to the Hantam LM, majority of people are semi-skilled and lowly-skilled (Quantec, 2016). Twenty percent (20%) of the people within the LM are occupied in the informal sector. As it can be noted in **Table 17** below, employment percentages by skill level for the Local Municipalities (Hantam and Khai-Ma) are relatively similar to the districts skill level percentages.

Table 17: Employment sector and compensation by skill level (2015)

Skills	**Employment sector and compensation by skill level**					
	Namakwa DM		**Hantam LM**		**Khai-Ma LM**	
	Employment	%	Employment	%	Employment	%
Formal: skilled	5092	14%	987	14%	446	10%
Formal: Semi-skilled	11151	32%	2004	29%	1613	36%
Formal: Low-skilled	9917	28%	2077	30%	1536	34%
Informal	8962	26%	1849	27%	879	20%

(Quantec, 2016)

In the Hantam LM, the tertiary sector is the largest contributor to formal and informal employment with 60% share of all employment provided in the municipality. As depicted in **Table 18** below, such employment consists of opportunities working in wholesale and trade (18%), finance and business services (7%), general government (17%) as well as community, social and personal services with 15%. Although the Hantam LM is dominated by the services sector, within the primary sector, agriculture employs the largest number of people (29%). The secondary sector makes very little contribution to employment services as it only accounts for 10% of the Hantam working population.

In contrast, the Khai-Ma LM is dominated by the primary sector, equating to 54% of municipal working age population. Within this sector, half of the total employment within the municipality is provided by the agriculture industry. The tertiary sector is the second largest contributor to job creation in the Khai-Ma LM; within this sector, prominent industries include general government (12%) and wholesale and retail trade (12%). The secondary sector lags with a contribution of 10% to the working population.

Table 18: Employment by economic services (2015)

Economic sector	**Employment by area**					
	Namakwa DM		**Hantam LM**		**Khai-Ma LM**	
	Employment	**%**	**Employment**	**%**	**Employment**	**%**
Agriculture, Forestry and Fishing	7948	23%	1972	29%	2220	50%

Mining and Quarrying	783	2%	2	0%	175	4%
Manufacturing	1384	4%	140	2%	335	7%
Electricity, gas and water	152	0%	20	0%	4	0%
Construction	2760	8%	564	8%	114	3%
Wholesale and retail trade, catering and accommodation	7016	20%	1253	18%	517	12%
Transport, storage and communication	1138	3%	218	3%	64	1%
Finance, insurance, real estate and business services	2689	8%	493	7%	178	4%
General government	6269	18%	1200	17%	557	12%
Community, social and personal services	4983	14%	1055	15%	310	7%
Industry employment total	**35122**	**100%**	**6917**	**100%**	**4474**	**100%**

5.13.6 Income

In order to improve the living standards of residents in terms of to the Minimum Living Level (MLL), which broadly refers to the minimum monthly income needed to sustain a household, the Khai-Ma SDF stipulates that a greater disposable income per household is required. Linked to this point, economic development is thus seen as an essential pathway to raising the living standards and general wellbeing of residents (Umsebe Development Planners, 2010).

The average household annual income in the **Hantam LM** is R116 276 in 2016 prices; this implies an average household monthly income of R9 690. The monthly income for Loeriesfontein is R10 620; these figures are relatively higher than the provincial average income, which is R8 521 per month. As highlighted in **Table 19** below, 9% of households do not have a regular amount of income in both the Hantam LM and Loeriesfontein town which in on par with the national and provincial levels, where the proportion of people who do not receive any form of income equated to 9% and 7% respectively. In the Hantam LM, 54% of people fell within the poverty line as they earned less than R3 200 per month.

The main source of income in the municipality is the agricultural sector; predominantly sheep farming and rooibos tea. The second largest income contributor is the community employment sector; particularly the social and personal services industry.

Subsequent to the establishment of wind farms in the area, new economic opportunities in **Loeriesfontein** town have emerged. Public transport has benefitted as a result of the increased demand for the transportation of workers to and from construction sites. Cleaning services have also provided work opportunities for unemployed individuals whilst informal trading amongst residents has also increased and has stimulated further income and job creation in the town. Wind farm construction companies either pay their workers once a month or every fortnight; this has resulted in more money in circulation as the purchasing power of local residents also increased. This is important as it may assist in reducing the number of people living below the poverty line. Upon consultation, one farmer went to the extent of sharing that poverty levels have been slightly alleviated in the Loeriesfontein town.

The average household annual income in the **Khai-Ma LM** was R99 144 in 2016 prices; this equated to an average household monthly income of R8 262. The main source of income in Khai-Ma is the Black Mountain Mine situated in Aggeneys town, as well as several government departments. Commercial farmers depend on incomes generated from their farms. The rest of the residents are either dependent on the government grant or they earn a living by providing housekeeping and gardening services (Umsebe Development Planners, 2010).

Table 19: Household per monthly income groups (2011)

Indicator	Namakwa DM	Hantam LM	Loeriesfontein	Khai-Ma LM
No income	8%	9%	9%	5%
R1 – R3 200	54%	57%	61%	62%
R3 201 – R6 400	14%	12%	12%	10%
R6 401– R12 800	12%	11%	10%	13%
R12 801– R25 600	7%	6%	4%	6%
R25 601– R51 200	2%	2%	2%	1%
>R51 200	4%	3%	3%	2%

(Stats SA 2011)

5.13.7 Access to Services and State of Local Built Environment

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure is another indicator to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities further indicates the nature of the study area, which is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against, which the potential impacts of the proposed project can be assessed.

- **<u>Settlement profile</u>**

In comparison to the national population density (42 people/km^2), the Hantam LM is characterised by a low density of people per square km. It is also relatively lower than the district (0.91 people/ km^2) and provincial (3.07 people/ km^2) density. Although population densities for the LM are significantly low (0.59 people/ km^2), as outlined in **Table 20** below, Loeriesfontein town has a higher population density of 79.69 people/km^2 making it the most densely populated area between the three areas under analysis.

Table 20: Population density of Hantam and Khai Ma LM (2011)

Indicator	Towns in the Hantam and Khai-Ma LM's		
	Hantam LM	Loeriesfontein	Khai-Ma LM

Population total	21581	2746	12466
Area (Sq. Km)	36128.07	34.45	16627.9
Population density	0.59	79.69	0.74

The Khai-Ma LM also has a relatively low population density with only 0.74 people/km^2, making it a sparsely populated region. Most people in the Khai-Ma LM are situated in the urban areas or in agricultural clusters along the Orange River, which also provides opportunities for water sport and recreation as well as resort development (Umsebe Development Planners, 2010).

- **<u>Access to Housing and Basic Services</u>**

With respect to basic service provision and housing, the Namakwa DM is responsible for assisting and ensuring that local municipalities provide adequate housing to inhabitants in their jurisdiction such. The current level of access to various basic services in the municipality are as follows:

- **Housing:** During the year 2011, housing shortages in the **Hantam LM** were an acute problem. In Hantam LM, 94% of houses had access to formal housing (i.e., a house made of brick or a concrete structure on a separate yard). Towns of the Hantam LM followed a similar path with Loeriesfontein having 94% access to formal housing (Stats SA, 2011). Amongst other pressing developments of the municipality, new housing unit developments have been identified by the Hantam SDF (Umsebe Development Planners, 2010). In comparison to the Hantam LM, the **Khai-Ma LM** residents had less access to formal housing as only 74% of inhabitants resided in formal housing structures (Stats SA, 2011).
- **Access to water**: In the **Hantam LM,** more than 90% of the households have access to piped water either inside their dwellings or yards. This includes residents living in Loeriesfontein town. More than 95% of water for the Hantam LM as well as for nearby towns is supplied by a regional or local water scheme operated by the municipality. In the **Khai-Ma LM**, more than 90% of households have access to piped water either in their dwellings or yards. A very low percentage of people do not have any type of access to piped water in the Khai-Ma LM.
- **Access to sanitation**: Although the Spatial Development Framework suggests that almost all households in the **Hantam LM** had access to flush toilets in 2011 (Umsebe Development Planners, 2010), statistics show that just over three quarters (76%) of households in Hantam LM have access to flush toilets either connected to the sewerage or to a septic tank. Whilst the Hantam LM believes to have eradicated the bucket system (Umsebe Development Planners, 2010), 3.1% of residents rely on the bucket latrine system whilst 0.9% do not have any form of access to any form of sanitation (Stats SA, 2011). Just over half of Loeriesfontein residents utilise flush toilets. The **Khai-Ma LM** has the same proportion of people who have access to flush toilets as the Hantam LM, with 6% of people who have no access to any type of sanitation.
- **Access to electricity:** In the **Hantam LM**, only urban areas are provided with electricity whilst the rural areas depend on other sources (Umsebe Development Planners, 2010). Slightly more than three quarters (77%) of households in the municipality have access to electricity for lighting whilst only 15% and 7% of people use candles and solar for lighting, respectively (Stats SA, 2011). Similar trends can be noted when assessing the towns of the municipality as more than 90% of

Loeriesfontein town residents have access to electricity. One of the objectives of the municipality is to improve the living standards of its residents by implementing opportunities for bulk infrastructure development (Urban-Econ Development Economists, 2011). Although the SDF highlights electricity as one of the sectors experiencing backlogs in the **Khai-Ma LM**, 90% of households in the municipality use electricity for lighting whilst the rest use 7% candles and 2% use solar. Development objectives premised on the optimisation of resources relating to bulk infrastructure such as electricity remains a goal for the municipality (Umsebe Development Planners, 2010).

- **Transport Infrastructure**

The transport sector plays a vital role in meeting the objectives of economic development, access to employment opportunities and social infrastructure (Dennis Moss Partnership, 2012). As a result of this, industrial development ought to take the mode of transport utilised by the labour force of a particular region into consideration. This means that new economic developments should not be situated far from the pick-up or drop-off points of various means of transport (Urban-Econ Development Economists, 2011). In 2001, just over a third 36.8% of people in the Hantam LM travelled to work or school by foot. The rest of the people used public transport (4.92%) whilst others made use of bicycles (1.39%) and their own transport facilities (5.12%) (Stats SA, 2001). Using the R55 gravel road, the distance between Calvinia and Loeriesfontein is 86km, whilst travelling from Calvinia to Brandvlei requires the utilisation of the R27 tar surface road for approximately 2 hours and 30 minutes.

The **Hantam LM** is traversed by a number of regional roads and encompasses two (2) transport corridors (Umsebe Development Planners, 2010):

- Nieuwoudtville – Calvinia - Williston corridor consisting of the R63 tar road and railway link among Calvinia, Williston and Carnarvon, which links Gauteng and the Western Cape
- Nieuwoudtville – Calvinia – Brandvlei -Kenhardt corridor consisting of the R27 tar road leading from Cape Town to Upington, which provides a shortcut alternative to the route via Springbok and is often used by trucks particularly during the grape season. Considering that this is the main route in the region, it is essential that this road is maintained as it is of economic importance to the area.

The **Khai-Ma** IDP places emphasis on the need for local communities to have adequate accessibility to services through the provision of sufficient transport infrastructure. Although the Khai-Ma LM recognises the need for sufficient transport facilities, about 30% of people walked home and either to and from work or school. The second most-utilised mode of transport is public transport in the form of buses, trains and taxis (Umsebe Development Planners, 2010).

As derived from the above, there is currently no national road that passes through the Hantam municipal area. Due to the influx of people and heavy load traffic in the Hantam LM as well as nearby towns, the main route (R27) in the area, which is also the only tarred road connecting Nieuwoudtville and Brandvlei via Loeriesfontein, has been rapidly deteriorating and needs to be frequently maintained.

With respect to water availability in the area, consultations with farm owners revealed that the affected farm portions do not have any direct access to water as it is a scarce resource in the area. To prevent water shortage impacts, some farmers in the area have reservoirs within their property or use water tanks to store water

- **Social and Recreational Infrastructure**

More often than not, residents require access to social services and shared community experiences in order to create a sense of belonging to an area. Access to sufficient social infrastructure such as schools, universities, medical facilities also plays a significantly important role in maintaining the social contact within communities. Whereas, a lack of social infrastructure results in a number of inconveniences and triggers long-term community dissatisfaction. Throughout the country, district, and local municipal level, government therefore has the mandate and responsibility to provide and build adequate facilities such as schools, hospitals, police stations, post offices safety as well as recreational amenities.

The **Hantam LM** has the following social and recreational infrastructure available:

- Fifteen (15) schools (primary and secondary);
- Three (3) hospitals and four (4) clinics;
- Six (6) police stations; and
- Sixteen (16) sport and recreational facilities.

The **Khai-Ma LM** has the following social and recreational infrastructure available:

- Eleven (11) schools (primary and secondary);
- One (1) hospital and four (4) clinics;
- Five (5) police stations; and
- Six (6) sport and recreational facilities.

5.13.8 Profile of the Zone of Influence

There are approximately fifteen (15) farm portions located in the zone of influence of the power line alternatives and on-site and linking substations site options. The following table indicates the farm options that may be affected by these alternatives.

Table 21: Zone of influence of power line and substation alternatives (portion and farm name)

Farm Portion	Power Lines				On-site Substation		Linking Substation	
	O1	O2	O3	O4	Alt 1	Alt 2	Alt 1	Alt 2
Portion 2 of Georges Vley Farm No.217								
Portion 1 of Hartebeestleegte Farm No.216								
Portion 1 of Graskoppies Farm No.176								

Portion 1 of Konnes Farm No.183								
Portion 0 of Buchufontein Farm No.184								
Portion 0 of Springbok Pan Farm No.1164								
Portion 2 of Springbok Tand Farm No.215								
Rem of Springbok Tand Farm No.215								
Portion 2 of Karree Doorn Pan Farm No.214								
Portion 1 of Karree Doorn Pan Farm No.214								
Rem of Aan De Karree Doorn Pan Farm No.213								
Portion 2 of Aan De Karree Doorn Pan Farm No.213								
Portion 0 of Leeubergrivier Farm No.1163								
Rem of Klein Rooiberg Farm No.227								
Rem of Sous Farm No.226								

Given the information gathered through the telephonic interviews with the I&APs, the following can be summarised with respect to the zone of influence applicable to each alternative and substation site options:

Table 22: Zone of influence of power line alternatives and substations alternatives

Alternative		**Brief Overview**
Power Line Option	Option 1 (Green)	• Mat affect up to nine (9) farm portions but does not cut across any farm portions • Cuts across the Sishen-Saldanha Railway line • Follows the farm portion boundary of the currently under construction Khobab wind farm for 16km
	Option 2 (Blue)	• May affect up to eleven (11) farm portions • Cuts across the Sishen-Saldanha Railway line
	Option 3 (Pink)	• May affect up to seven (7) farm portions • The shortest route in terms of kilometres • Directly cuts across four (4) of the affected farm portions • Cuts across the Sishen-Saldanha Railway line

	Option 4 (Light blue)	• May affect up to thirteen (13) farm portions • The longest route in terms of kilometres • Follows the R358 route for about 10km • Cuts across the Sishen-Saldanha Railway line • Will follow the border of the currently under construction Loeriesfontein 2 wind farm for about 8km • Cuts across the currently under construction Khobab wind farm for about 8km • Directly cuts across one (1) farm portion
On-site Substation Alternative	Alternative 1	• Will affect one (1) farm portion • Will be located on farm used for commercial sheep farming • Will be located on same farm as the proposed !Xha Boom wind facility
	Alternative 2	• Will affect one (1) farm portion • Will be located on farm used for commercial sheep farming • Will be located on same farm as the proposed !Xha Boom wind facility
Linking Substation Alternative	Alternative 1	• Will affect one (1) farm portion • Will be located on farm used for commercial sheep farming
	Alternative 2	• Will affect one (1) farm portion • Will be located on farm used for commercial sheep farming

The engagement with the I&APs suggested that majority of the local land owners did not have any objections to the proposed substations and powerline. Most of the property owners highlighted their understanding of the importance of renewable energy projects in the context of South Africa. With this being said, there were some concerns expressed regarding the uncertainty of the path that would be followed by the power line. Such concerns were linked to the need to understand whether the proposed power line would affect the fencing on the farms. In addition, the presence of similar renewable energy developments that currently traverse the surrounding farm portions can also be used as an indication to further deduce that the landowners do not have any major concerns related to the establishment of the project.

6 PUBLIC PARTICIPATION PROCESS

Public participation is the cornerstone of any BA. The principles of NEMA as well as the EIA Regulations govern the BA process, including public participation. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment, and ensuring the participation of previously disadvantaged people, women and the youth.

The public participation process is primarily based on two (2) factors; firstly, ongoing interaction with the environmental specialists and the technical teams in order to achieve integration of technical assessment and public participation throughout. Secondly, to obtain the bulk of the issues to be addressed early on in the process, with the latter half of the process designed to provide environmental and technical evaluation of these issues. These findings are presented to stakeholders for verification that their issues have been captured and for further comment.

Input into the public participation process by members of the public and stakeholders can be given at various stages of the BA process. Registration on the project can take place at any time during the BA process up until the final BA report is submitted to DEA. There are however set periods in which comments are required from Interested and / or Affected Parties (I&APs) in order to ensure that these are captured in time for the submission of the various reports. The comment periods were implemented according to NEMA EIA Regulations. The comment periods (as set out by EIA Regulations 2014) are as follows:

- Background Information Document (BID): 4 Calendar weeks, but also as and when an I&AP registers.
- Comment period for the Draft Basic Assessment Report (DBAR): 4 Calendar weeks (30 days).
- Any public participation process must be conducted for a period of at least 30 days.

The EIA regulations emphasise the importance of public participation. In terms of the EIA regulations, registered interested and/or affected parties –

- may participate in the application process;
- may comment on any written communication submitted to the competent authority by the applicant or environmental consultant;
- must comment within the timeframes as stipulated by the EIA Regulations;
- must send a copy of any comments to the applicant or Environmental Assessment Practitioner (EAP) if the comments were submitted directly to the competent authority; and
- must disclose any direct business, financial, personal or other interests that the person has in the application being granted or refused.

Further, in terms of the EIA regulations, the EAP:

- manages the application process;
- must be independent;
- must undertake the work objectively – even if this results in views and findings that are not favourable to the applicant;
- must disclose material information that may influence the decision; and
- must conduct a public participation process.

The following actions were / will be taken upon receiving comments/queries/issues:

- The contact details provided were entered into the project database for use in future notifications.
- Confirmation of receipt of comments.
- Addressed comments in the Comments and Response Report (C&RR).

6.1 Objectives of the Public Participation

An understanding of what the public participation is, and is what it is not, needs to be explored and must be clarified.

- Public Participation is:
  - A communication mechanism to inform I&APs regarding a proposed project.
  - A communication mechanism to record comments and/or concerns raised during the relevant phase of the EIA by I&APs regarding a proposed project.

- What Public Participation is not:
  - A marketing exercise.
  - A process to address grievances but rather to record comments raised.
  - One-on-one consultation with each I&AP during the BA process (not relevant to possibly affected landowners identified).

The primary aims of the PPP are:

- To inform interested and affected parties (I&APs) and key stakeholders of the proposed development.
- To initiate meaningful and timeous participation of I&APs.
- To identify issues and concerns of key stakeholders and I&APs with regards to the proposed development
- To promote transparency and an understanding of the proposed project and its potential environmental impacts.
- To provide information used for decision-making.
- To provide a structure for liaison and communication with I&APs and key stakeholders.
- To assist in identifying potential environmental impacts associated with the proposed development.
- To ensure inclusivity (the views, needs, interests and values of I&APs must be considered in the decision-making process).
- To focus on issues relevant to the project and issues considered important by I&APs and key stakeholders.
- To provide responses to I&AP queries.
- To encourage co-regulation, shared responsibility and a sense of ownership.

In addition to the guidance of the PPP in the EIA Regulations, every effort was also made to conform to the requirements of the Promotion of Administrative Justice Act 2000 (Act 3 of 2000).

6.2 Overview of the Public Participation Process to date

The public participation process for the BA was initiated in October 2016 with the issuing of the BID and initial landowner consultation. Site notices (as per regulations) were placed near the study area during a site visit between Wednesday 26 October 2016 and Friday 28 October 2016. Additional site notices were also erected near the study area during a site visit on Wednesday 1 November 2017. Proof of the site notices which were erected near the study area are provided in **Appendix 7A**.

Two (2) Focus Group Meetings (FGMs) were held on 31 October 2017 and 1 November 2017 respectively. The FGMs included an Authority FGM, which was undertaken with members of the local and district municipalities, as well as a Landowner FGM which was undertaken with affected landowners. In addition, a Public "Open Day" was also held on 1 of November. This was a poster display session which was held in order to provide I&APs and members of the local community with information regarding the proposed development, present the environmental findings and invite I&APs and members of the local community to raise any further comments and/or concerns that they may have. Invitation letters were sent out via post and e-mail to all registered I&APs on the project's database. Proof of the invitations that were sent out to all registered I&APs is provided in **Appendix 7B**. The minutes of the Authority FGM will be provided in **the FBAR**. It should be noted that no questions and/or comments were raised during the Authority FGM or the Public "Open Day" and thus no minutes will be prepared for these meetings.

It should be noted that the DBAR will be released for public review and comment on 15 December 2017.

On-going consultation with key stakeholders (e.g. provincial, district and local authorities, relevant government departments, local business, affected and adjacent landowners etc.) and identified I&APs will ensure that I&APs are kept informed regarding the BA process (the full stakeholder database list is included in **Appendix 7F**). Networking with I&APs will effectively continue throughout the project until the FBAR has been submitted to the DEA. Where required, stakeholders and I&APs were engaged on an individual basis.

During the environmental studies, consultations were held with individuals, businesses, institutions and organisations, and the following sectors of society have been identified and were afforded the opportunity to comment (the full stakeholder database list is included in **Appendix 7F**):

- National Authorities;
- Provincial Authorities;
- Namakwa District Municipality
- Hantam Local Municipality
- Khai-Ma Local Municipality
- Government Structures such as SAHRA, SANRAL, Eskom Telkom, etc.;
- Agriculture Associations;
- Regional and local media (advertisements and public documents e.g. BID);
- Business and commerce;
- Environmental bodies / NGOs;
- Department of Environmental Affairs: Biodiversity Section;
- Department of Water and Sanitation;
- Community representatives, CBOs, development bodies;
- Landowners;
- Square Kilometre Array (SKA);
- Civil Aviation Authority (CAA); and
- Air Traffic and Navigation Services (ATNS).

The stages that typically form part of the public participation process during the BA process are reflected in **Figure 47** below.

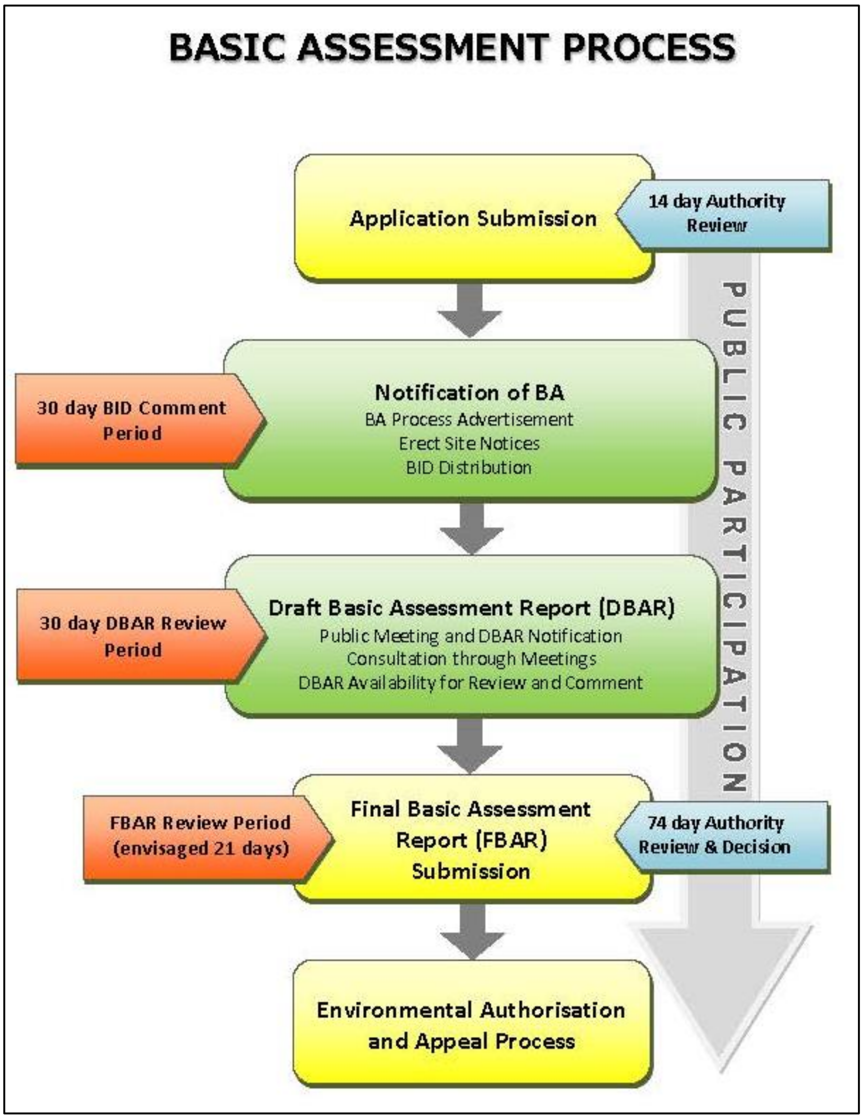

Figure 47: BA and Public Participation Process

6.3 Consultation and Public Involvement

Through the consultation process, issues for inclusion within the DBAR were identified and confirmed. Telephonic discussions and one-on-one consultation were undertaken where relevant. Meetings with landowners took place prior to the release of the DBAR in order to identify key issues, needs and priorities for input into the proposed project. Special attention was paid to the consultation with possibly affected landowners and communities within the study area to try and address their main concerns.

It should be noted that Municipal / Authority and Landowner Focus Group Meetings (FGMs) were held on Tuesday 31 October 2017 and Wednesday 1 November 2017 respectively. The Authority FGM was undertaken with members of the local and district municipalities, while the Landowner FGM was undertaken with affected landowners. In addition, a Public “Open-Day” was also held on the Wednesday 1 November 2017 in order to provide members of the local community with information about the proposed development and to provide them with an opportunity to register as an I&AP. It should be noted that the Public Open Day was undertaken as a poster display session. Invitation letters for the above-mentioned meetings were sent out via post and e-mail to all registered I&APs on the project’s database. Proof of the invitations that were sent out to all registered I&APs is provided in **Appendix 7B**. Minutes of the above-mentioned meetings will be provided in the FBAR. As previously mentioned, no questions and/or comments were raised during the Authority FGM or the Public “Open Day” and thus no minutes will be prepared for these meetings.

Notifications will be sent via email, sms, fax and post to inform I&APs of the availability of the DBAR.

6.4 Comments Received

All comments and recommendations made by stakeholders and I&APs have been taken into consideration when preparing the DBAR.

All comments received up until this stage are addressed and included in the C&RR (**Appendix 7E)**.

6.5 Proof of Notification

Appendix 7 includes all proof of notification to I&APs which includes;

- Proof of process advertisements in the newspapers (**Appendix 7C**)
- EIA Newsletter (**Appendix 7B**)
- Correspondence to registered I&APs and key stakeholders (**Appendix 7B** and **7D**)

6.6 Notification of the Potential Interested and Affected Parties

Communication with I&APs were conducted by means of telephone, faxes and email in order to obtain the necessary background information to compile this report. The advertising process was followed in terms of regulation 41 of the EIA Regulations published in R982 in Government Gazette No. 38282 of 4 December 2015, as amended.

An advertisement was placed in “Die Noordwester” newspaper on 16 June 2017. Proof of the advertisement that was placed is provided in **Appendix 7C**.

In addition, many site notices (as per regulations) were placed near the study area during a site visit in October 2016. Additional site notices were also erected near the study area during a site visit on

Wednesday 1 November 2017. Proof of the site notices which were erected near the study area are provided in **Appendix 7A**.

As stakeholders respond to these advertisements, they will be registered on the project database and sent letters of invitation to participate as well as the BID.

6.7 Focus Group Meetings

Focus Group Meetings (FGMs) are smaller meetings with specific groups or organisations who have similar interests in or concerns about the project.

Two (2) FGMs took place prior to the release of the DBAR. This included an Authority FGM, which was undertaken with members of the local and district municipalities, as well as a Landowner FGM which was undertaken with affected landowners. The meetings were held early in the BA process in order to give I&APs greater influence in the project process, and if necessary to allow changes to be make without affecting the legislated time frames. The Authority FGM took place on the 31st of October 2017, while the Landowner FGM took place on the 1st of November 2017. As previously mentioned, affected landowners and authorities were invited to the respective FGMs via post and e-mail. Proof of the invitations that were sent out to the affected landowners and authorities is provided in **Appendix 7B**.

Table 23: Focus Group Meetings

Meeting Type	Venue	**Interested Parties**	**Date**	**Time**
Authority FGM	Board Room, Hantam Local Municipal Offices Hope Street, Calvinia	Councillors and Officials from the local and district municipalities	Tuesday, 31 October 2017	14h30
Landowner FGM	NG Church Hall, Church Street, Loeriesfontein	Affected landowners	Wednesday, 1 November 2017	09h00

Minutes of the FGMs were compiled and forwarded to all attendees for their review and comment. The primary aim of the meetings was to:

- Disseminate information regarding the proposed development to I&APs.
- Provide I&APs with an opportunity to interact with the BA team and the Mainstream representatives present.
- Supply more information regarding the BA process.
- Answer questions regarding the project and the BA process.
- Receive input regarding the public participation process and the proposed development.
- Present I&APs with an overview of the specialist findings.

Minutes of the meetings will be included in the FBAR. No questions and/or comments were however raised during the Authority FGM or the Public "Open Day" and thus no minutes will be prepared for these meetings.

6.8 Public Meeting / Open Day

A Public “Open Day” was held prior to the review of the DBAR. The Public Open Day took place on 1 November 2017 and was undertaken as a poster display session which was held early in the BA process in order to give I&APs and members of the local community greater influence in the project process, and if necessary to allow changes to be make without affecting the legislated time frames.

Invitation letters were sent out via post and e-mail to all registered I&APs on the project’s database. Proof of the invitations that were sent out to the affected landowners and authorities is provided in **Appendix 7B**. In addition, loud-hailing was done in the local community on the day of the Public Open Day in order to inform as many individuals of the local community as possible.

Table 24: Public Open Day

Venue	Interested Parties	Date	Time
Loeriesfontein Community Hall	I&APs and members of the local community	Wednesday, 1 November 2017	13h30

As mentioned, the Public “Open Day” was a poster display session which was held in order to provide I&APs and members of the local community with information regarding the proposed development, present the environmental findings and invite I&APs and members of the local community to raise any further comments and/or concerns that they may have.

Proof that the above-mentioned Public “Open Day” was undertaken will be included in the FBAR.

6.9 Public Review of Draft Basic Assessment Report

The DBAR will be made available for review from **14 December 2017 to 05 February 2018** at the following venue for a period of 30 calendar days, excluding public holidays and the December closure period:

Table 25: Venues where the DBAR will be publicly available

VENUE	STREET ADDRESS	HOURS	CONTACT NO
Loeriesfontein Library	Main Street, Loeriesfontein	Mondays – Fridays 14h00 – 17h00	027 662 8607

All comments received on this report will be incorporated into the Comments and Response Report (C&RR), which will be attached to the FBAR as **Appendix 7E**.

6.10 Comments and Response Report (C&RR)

Issues, comments and concerns raised during the public participation process to date are captured in the Comments and Response Report (C&RR) – **Appendix 7E**. The C&RR provides a summary of the issues raised, as well as responses provided to I&APs. This information will be used to feed into the evaluation of environmental and social impacts. All comments received to date have been included in the C&RR.

7 SPECIALIST STUDIES

The following specialist studies were undertaken as part of the BA process:

- Biodiversity (flora and fauna);
- Avifauna;
- Surface Water;
- Soils and Agricultural Potential;
- Heritage;
- Palaeontology (Desktop);
- Visual; and
- Socio-economic.

Each specialist assessed the impact of the proposed !Xha Boom On-site Eskom substation, linking substation and associated power line that Mainstream are proposing to develop near Loeriesfontein and the results are presented below.

7.1 Biodiversity

7.1.1 !Xha Boom Grid Connection Sensitivity Assessment

The sensitivity map for the study area is depicted below in **Figure 48**. The majority of the site consists of arid grasslands or low open shrublands on open plains that are not considered highly sensitive. The substation alternatives are all located within the Western Bushmanland Klipveld or Arid Grassland habitat types which is are low sensitivity with few species of concern present. There are few significant features present along the power line corridors and the only sensitive features present are the occasional drainage lines. As the drainage lines are not very large, they would easily be spanned by the power line and a significant impact on these features can easily be avoided. The overall impact of the development would be local in nature and there are no highly significant impacts that cannot be reduced to a low level.

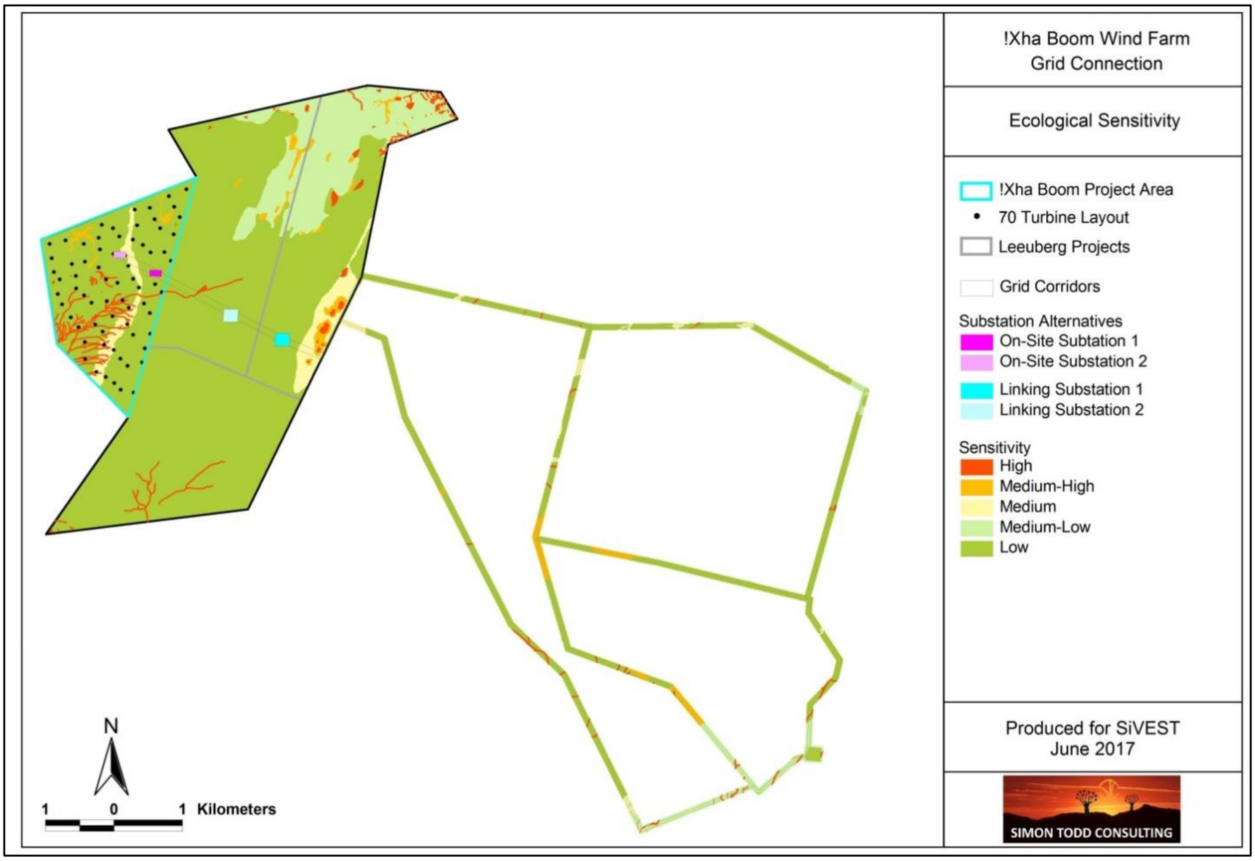

Figure 48: Ecological sensitivity map for the !Xha Boom study area. The majority of the site is arid grassland or low open shrublands of low sensitivity.

7.1.2 Impacts and Issues Identification

The development of the !Xha Boom grid connection, is likely to result in a variety of impacts, associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as substations, access roads and power lines, etc. The following impacts are identified as the major impacts that are likely to be associated with the development and which are assessed for the !Xha Boom grid connection, for the pre-construction, construction, operational and decommissioning phases of the development.

The likely impacts on the terrestrial ecology of the site resulting from the development of the !Xha Boom grid connection are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarised below before the impacts are assessed.

- **<u>Impact 1. Impacts on vegetation and listed or protected plant species</u>**

The development would require vegetation clearing for the substations, access roads and pylon foundations. Apart from the direct loss of vegetation within the development footprint, listed and protected species would potentially be impacted. These impacts are likely to occur during the construction phase of the development, with additional vegetation impacts during operation likely to be relatively low. This impact is therefore assessed for the development, for the construction phase only.

- **Impact 2. Direct Faunal Impacts**

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity was high. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. During the operational phase, impacts associated with the power line and substation would be low and are not considered significant. Faunal impacts will therefore be assessed only during the construction and decommissioning phases of the development.

- **Impact 3. Increased Erosion Risk**

Disturbance created during construction would leave the site vulnerable to wind and water erosion. Soil disturbance associated with the development will render the impacted areas vulnerable to erosion and measures to limit erosion will need to be implemented. This impact is likely to manifest during construction and would persist into the operational phase and is therefore be assessed for both phases.

- **Impact 4. Alien Plant Invasion**

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some woody aliens are already present and additional alien plant invasion is inevitable and regular alien plant clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, roadsides are likely to remain foci of alien plant invasion for years. This impact would manifest during the operational phase, although some of the required measures to reduce this impact are required during construction.

- **Impact 5. Cumulative Impact 1 - Impacts on broad-scale ecological processes and cumulative habitat loss**

The development will contribute to cumulative impacts on habitat loss in the area and potentially the ability to meet future conservation targets. The main source of impact in this regard would come from the substations as well as access and service roads associated with the power line. This impact is however assessed for the project as a whole and not just the power line as this would not be built without the establishment of the wind farm. This impact would persist for the life of the development and is thus assessed for the operational phase of the grid connection.

7.2 Avifauna

Table 26 lists Red Data species that could potentially occur in the proposed powerline study area. The list is based on a combination of the pre-construction monitoring that was conducted in the WEF study area, supplemented with other data sources e.g. SABAP1, SABAP2, environmental impact assessments conducted for other wind farms in the same habitat, and a site visit in June 2017. *It is important to note that* *while some of the monitoring was not conducted strictly within the powerline study area, or across the whole of the powerline study area, the uniformity of the habitat makes the data gathered during surveys in the greater study area equally relevant for the powerline study area.*

Table 27 lists all species that were recorded through pre-construction monitoring in the WEF study area. Data was collected by means of drive transect counts, walk transect counts, vantage point (VP) watches and incidental sightings.

Appendix C of the Avifauna Impact Assessment Report lists all the species that were recorded by SABAP2 surveys in the period between January 2009 and January 2017.

The following abbreviations and acronyms are used:

VU Vulnerable
NT Near threatened
EN Endangered
SAE Southern African endemic or near endemic
Dd Displacement through disturbance
Dh Displacement through habitat transformation
C Collisions with grid connection

Table 26: Red Data species potentially occurring in the powerline study area. Species recorded during pre-construction monitoring in the WEF study area are shaded

Name	Scientific name	SABAP2 reporting rate % (63 cards)	Regional threatened status (Taylor et al. 2015)	Global threatened status (IUCN 2016)	Likelihood of occurrence	Potential impact
Martial Eagle	*Polemaetus bellicosus*	18.75	EN	NT	**Confirmed**. One incidental sighting of a flying bird in the broader area, and recorded briefly flying high over the greater study area. Could sporadically be attracted to water troughs. The nest near Helios MTS which falls within the powerline study area was active in June 2017.	Dd
Ludwig's Bustard	*Neotis ludwigii*	31.25	SAE, EN	EN	**Confirmed**. Occurrence likely to be linked to habitat conditions. The species is nomadic and a partial migrant and may occur sporadically.	C, Dd,
Secretarybird	*Sagittarius serpentarius*	0	VU	VU	**Low**. May occur sporadically	C, Dd,

Kori Bustard	*Ardeotis kori*	1.25	NT	Least concern	**Low**. May occur sporadically. Lack of dry watercourses with trees may be an inhibiting factor.	C, Dd,
Lanner Falcon	*Falco biarmicus*	10%	VU	Least concern	**Confirmed**. Breeding resident. Most likely to perch on fence lines and powerlines running through the powerline study area, but may also be attracted to the water points where it hunts small birds.	-
Name	**Scientific name**	**SABAP2 reporting rate % (63 cards)**	**Regional threatened status (Taylor et al. 2015)**	**Global threatened status (IUCN 2016)**	**Likelihood of occurrence**	**Potential impact**
Sclater's Lark	*Spizocorys sclateri*	11.25	SAE, NT	NT	**Confirmed**. The species is nomadic and may occur sporadically.	Dd
Red Lark	*Calendulauda burra*	57.7	SAE, VU	NT	**Confirmed.** The species were recorded regularly all over the site but in relatively low densities.	Dd
Verreaux's Eagle	*Aquila verreauxi*	1.25	VU	Least concern	**Confirmed**. Solitary single birds were recorded sporadically. Could sporadically be attracted to water troughs, one individual was recorded drinking at a water trough.	-
Karoo Korhaan	*Eupodotis vigorsii*	70%	SAE, NT	Least concern	**Confirmed**. One of the most commonly recorded terrestrial species. Occurs all over the greater study area.	Dd, C
Burchell's Courser	*Cursorius rufus*	5%	SAE, VU	Least concern	**Confirmed**. Mostly recorded in the west of the greater study area.	C
Greater Flamingo	*Phoenicopterus roseus*	0	NT	LC	**Low**. Might be attracted to large pans outside the study area, but occurrence is linked to standing water. This will only happen after exceptional rain events, perhaps once a decade	C

					during which the pans will contain standing water for a short period.	
Lesser Flamingo	*Phoeniconaias minor*	0	NT	NT	**Low**. Might be attracted to large pans outside the study area, but occurrence is linked to standing water. This will only happen after exceptional rain events, perhaps once a decade during which the pans will contain standing water for a short period.	C

Table 27: List of all species recorded during pre-construction surveys and incidental counts in the WEF study area

Common name	**Taxonomic Name**
Black-Chested Snake-Eagle	*Circaetus pectoralis*
Booted Eagle	*Aquila pennatus*
Burchell's Courser	*Cursorius rufus*
Double-banded Courser	*Rhinoptilus africanus*
Greater Kestrel	*Falco rupicoloides*
Jackal Buzzard	*Buteo rufofuscus*
Karoo Korhaan	*Eupodotis vigorsii*
Lanner Falcon	*Falco biarmicus*
Ludwig's Bustard	*Neotis ludwigii*
Martial Eagle	*Polemaetus bellicosus*
Northern Black Korhaan	*Afrotis afraoides*
Red Lark	*Calendulauda burra*
Sclater's Lark	*Spizocorys sclateri*
Southern Pale Chanting Goshawk	*Melierax canorus*
Verreaux's Eagle	*Aquila verreauxii*
Yellow-Billed Kite	*Milvus aegyptius*
Acacia Pied Barbet	*Tricholaema leucomelas*
African Pipit	*Anthus cinnamomeus*
Anteating Chat	*Myrmecocichla formicivora*
Barn Swallow	*Hirundo rustica*
Black-Eared Sparrowlark	*Eremopterix australis*
Bokmakierie	*Telophorus zeylonus*
Cape Bunting	*Emberiza capensis*
Cape Crow	*Corvus capensis*
Cape Penduline-Tit	*Anthoscopus minutus*
Cape Sparrow	*Passer melanurus*

Cape Turtle-dove	*Streptopelia capicola*
Capped Wheatear	*Oenanthe pileata*
Chat Flycatcher	*Bradornis infuscatus*
Common Fiscal	*Lanius collaris*
Common Quail	*Coturnix coturnix*
Eastern Clapper Lark	*Mirafra [apiata] fasciolata*
Egyptian Goose	*Alopochen aegyptiaca*
European Bee-eater	*Merops apiaster*
Familiar Chat	*Cercomela familiaris*
Greater Striped Swallow	*Hirundo cucullata*
Grey Tit	*Parus afer*
Grey-backed Cisticola	*Cisticola subruficapilla*
Grey-backed Sparrowlark	*Eremopterix verticalis*
Karoo Chat	*Cercomela schlegelii*
Karoo Eremomela	*Eremomela gregalis*
Karoo Long-Billed Lark	*Certhilauda subcoronata*
Karoo Prinia	*Prinia maculosa*
Karoo Scrub-Robin	*Cercotrichas coryphoeus*
Large-Billed Lark	*Galerida magnirostris*
Lark-Like Bunting	*Emberiza impetuani*
Laughing Dove	*Streptopelia senegalensis*
Little Swift	*Apus affinis*
Long-billed Crombec	*Sylvietta rufescens*
Mountain Wheatear	*Oenanthe monticola*
Namaqua Dove	*Oena capensis*
Namaqua Sandgrouse	*Pterocles namaqua*
Pied Crow	*Corvus albus*
Red-Billed Teal	*Anas erythrorhyncha*
Red-Capped Lark	*Calandrella cinerea*
Red-Headed Finch	*Amadina erythrocephala*
Rock Kestrel	*Falco rupicolus*
Rock Martin	*Hirundo fuligula*
Rufous-Eared Warbler	*Malcorus pectoralis*
Sabota Lark	*Calendulauda sabota*
South African Shelduck	*Tadorna cana*
Southern Masked-weaver	*Ploceus velatus*
Southern Pale Chanting Goshawk	*Melierax canorus*
Speckled Pigeon	*Columba guinea*
Spike-Heeled Lark	*Chersomanes albofasciata*
Spotted Thick-Knee	*Burhinus capensis*

Spur-Winged Goose	*Plectropterus gambensis*
Stark's Lark	*Spizocorys starki*
Tractrac Chat	*Cercomela tractrac*
White-rumped Swift	*Apus caffer*
White-throated Canary	*Crithagra albogularis*
Yellow Canary	*Crithagra flaviventris*
Yellow-bellied Eremomela	*Eremomela icteropygialis*

7.2.1 Potential Impacts on Avifauna

Because of their size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two (2) common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines. (Ledger and Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs and Ledger 1986b; Ledger, Hobbs and Smith, 1992; Verdoorn 1996; Kruger and Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Anderson 2001; Shaw 2013). Other problems include electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure (Van Rooyen *et al.* 2002), and displacement through disturbance and habitat destruction during construction and maintenance activities.

- **Electrocution of Red Data species on the HV power lines and in the substations**

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 pole/tower design largely determines the electrocution risk. The tower design that has been proposed for this project is the steel monopole (**Figure 3**).

Clearance between phases on the same side of the 132kV steel monopole structure is approximately 2.2m, and the clearance on strain structures is 1.8m. This clearance should be sufficient to reduce the risk of phase – phase electrocutions of birds on the towers to negligible. The length of the stand-off insulators is approximately 1.6m. If a very large species attempts 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 is an unlikely occurrence, except occasionally with vultures. Vultures are unlikely to occur within the study area; therefore, it can be concluded that the risk of electrocutions on the proposed 132kV power lines is practically non-existent.

Electrocutions within the proposed !Xha Boom substations are possible, but should not affect the more sensitive Red Data bird species as these species are unlikely to use the infrastructure within the substation yards for perching or roosting.

Given the low risk of electrocutions for Red Data species, this potential impact need not be further assessed in the report.

- **<u>Collisions of Red Data species with the earth wire of the 132kV grid connection</u>**

Collisions are unquestionably the biggest 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 maneuverability, 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 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 maneuverability 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)."*

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 (2) 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 maneuverability of the bird, topography, weather conditions, power line configuration and powerline size. The large transmission lines kill more birds than the smaller distribution lines, especially as far as Ludwig's Bustards are concerned. (Shaw 2013). 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.

A potential impact of the proposed 132kV grid connection power line is collisions with the earth wire. Quantifying this impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth.

However, from incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are likely to be impacted upon (see Figure 10 below - Jenkins *et al.* 2010). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

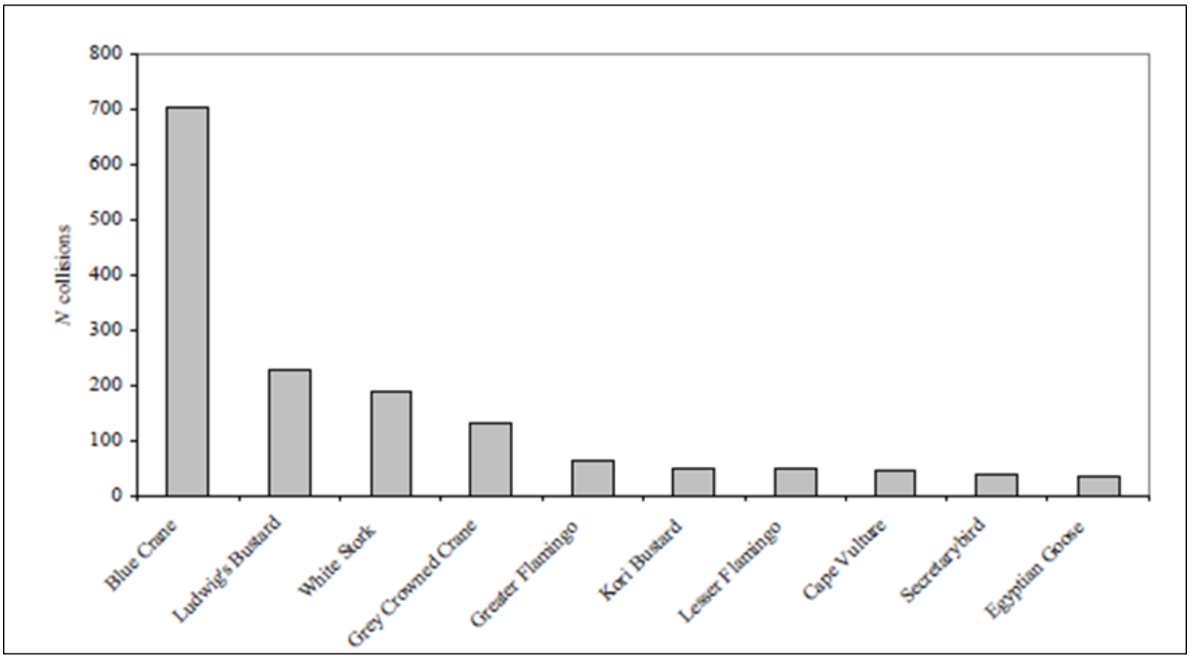

Figure 49: The top ten (10) collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom-EWT Strategic Partnership central incident register 1996 - 2008 (Jenkins *et al.* 2010)

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), although it is less effective 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 up to 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).

<u>!Xha Boom Grid Connection</u>

The most likely Red Data candidates for collision mortality on the proposed 132kV grid connection are the Ludwig's Bustard and the Karoo Korhaan, both whom have high reporting rates in the study area. Kori

Bustard and Secretarybird may also be at risk, although they occur at much lower densities than the previous two (2) species.

- **Displacement due to habitat destruction and disturbance**

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. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through transformation of habitat, which could result in temporary or permanent displacement.

!Xha Boom Grid Connection
In the present instance, the risk of displacement of Red Data species due to **habitat destruction** is likely to be fairly limited given the nature of the vegetation. Very little if any vegetation clearing will have to be done in the powerline servitude itself. The habitat at both the proposed !Xha Boom and Linking substation sites is common in the greater study area and the transformation of a few hectares of habitat should not impact any of the Red Data species significantly.

Apart from direct habitat destruction, the above-mentioned construction and maintenance activities could also potentially displace Red Data species through **disturbance**; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities could be a source of disturbance and could lead to temporary or even permanent abandonment of nests. The most obvious potential issue that need to be addressed in this instance is the active Martial Eagle nest on the Aries - Helios 400kV line near the Helios substation. The nest was active in July 2017, which indicates that the birds have become habituated to the constant traffic on the dirt road that runs 450m from the nest. This is the main access road to Helios Substation, and is also constantly used by construction vehicles active at the Loeriesfontein 2 and Khobab WEFs. While the habituation is a factor to be considered, it would still be preferable to have an alignment as far as possible from the nest as a pre-cautionary measure to limit the potential for displacement during construction of the grid connection. The closest potential corridors (Corridor12 and Corridor 3) are approximately 1.2km from the nest at their closest points, which means that while the potential for disturbance is likely to be low, but cannot be ruled out. This would especially be the case if the construction activities, e.g., the construction of new access roads, is required closer than 1.2km from the nest.

7.3 Surface Water

7.3.1 Findings of the Assessment

7.3.1.1 Surface Water Infield Delineation Information

The in-field wetland delineation assessment took place from the 6th to the 8th of December 2016 as well as the 8th to the 9th June 2017. The fieldwork verification, ground-truthing and delineation assessment was undertaken to scrutinise the results of the desktop identified features as well as to identify any potentially overlooked wetlands or other surface water resources in the field for the proposed development area. The refined results for the proposed development are as follows:

- Five (5) Depression Wetlands;
- Twenty six (26) Major Drainage Lines including Klein-Rooiberg, Leeuberg and Hartbeeslaagte (drainage line with a channel width >5m);
- One hundred and eighty (180) Minor Drainage Lines (drainage lines with a channel width <5m).

The refinement of the surface water resources as stated above are presented in **Figure 50** to **Figure 52** below. A more detailed description of the environmental attributes (indicators) of the surface water resources characteristics is provided in the sub-sections below.

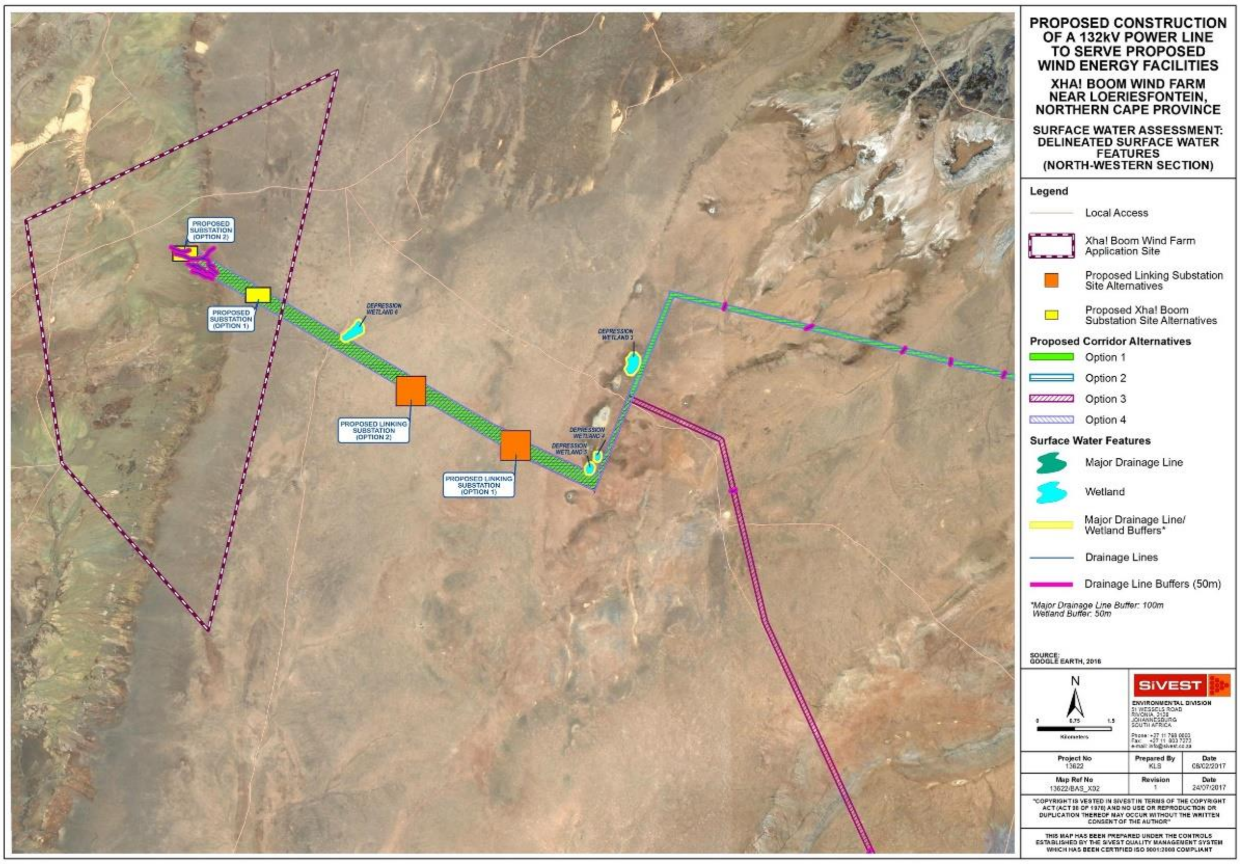

Figure 50: Surface Water Delineation Map (North-western Section)

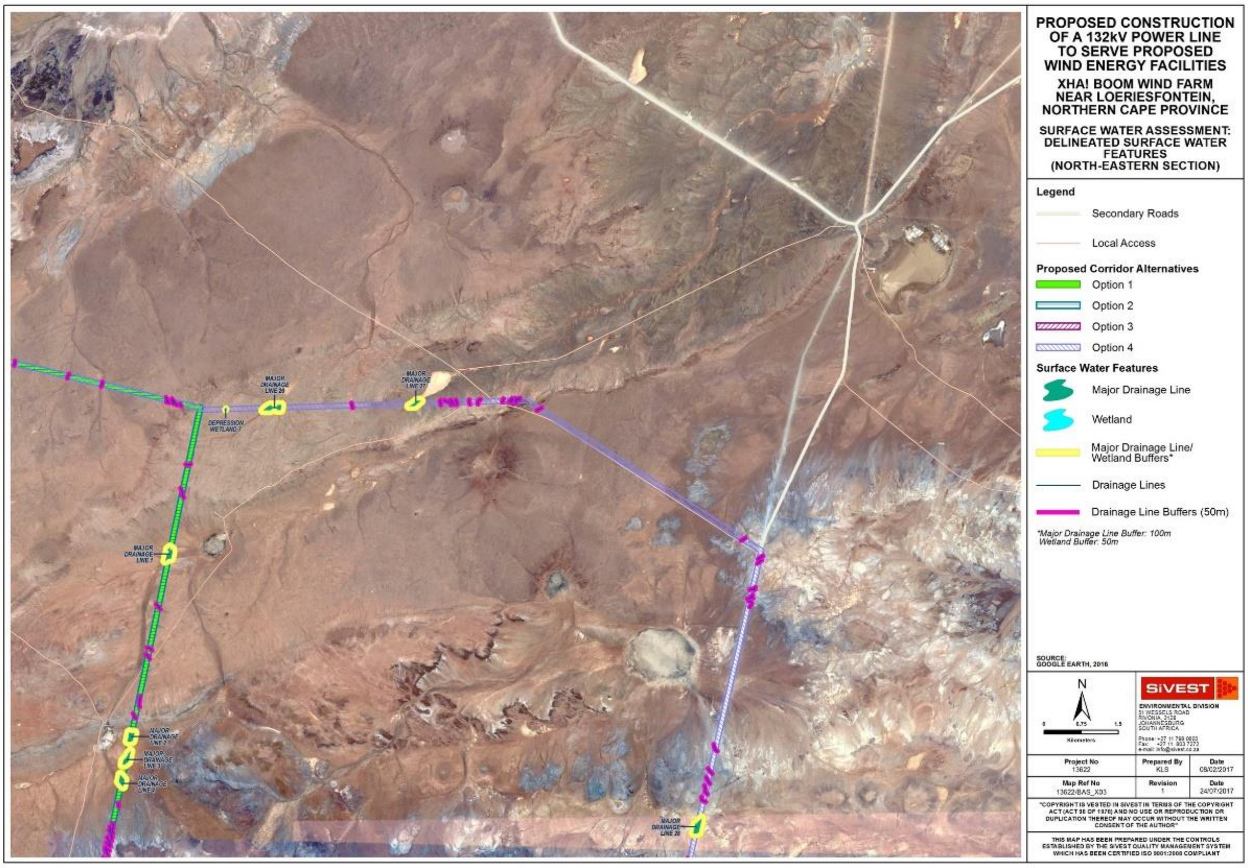

Figure 51: Surface Water Delineation Map (North-eastern Section)

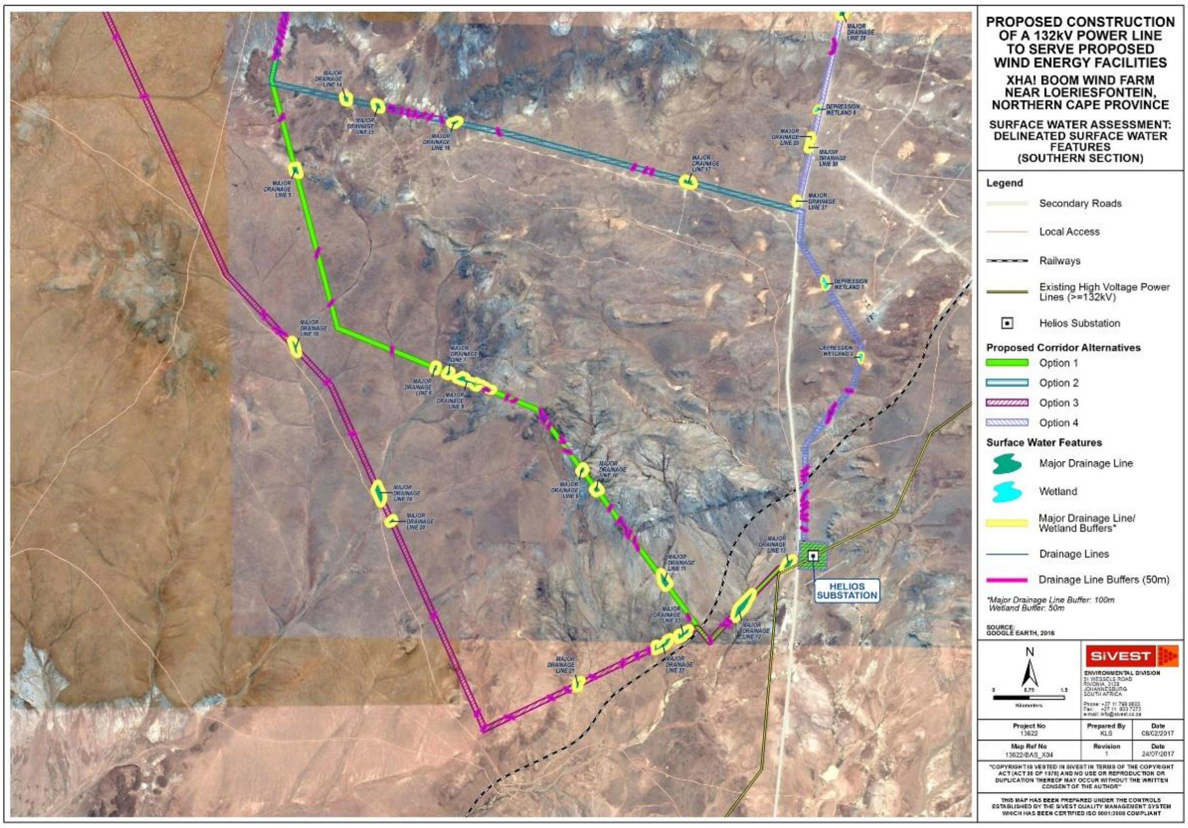

Figure 52: Surface Water Delineation Map (Southern Section)

7.3.1.1.1 Channels (Minor Drainage Lines)

The study region is characterized by varied topography. Linking Station 2 located on a ridgeline which runs from south to north and bisects the initial sections on the grid option alternatives. Other areas beyond this point in the north-west, are relatively flat (**Figure 53**) to gently undulating. Low ridges and undulating terrain become more characteristic in the eastern and south eastern areas. The direction of drainage is dependent on the local topography and can flow in any direction. Drainage mainly begins as first order streams that either lead to central relatively large depression wetlands, or eventually flow and link to larger river systems downstream (i.e. Klein Rooiberg, Leeuberg and Hartbeeslaagte). The minor drainage lines therefore serve as tributaries of which many are first and second order streams or A-section reaches. The minor drainage lines are considered A-section reaches due to the lack of a saturation zone. The drainage lines are presumed to mainly flow episodically during and briefly after rainfall events. Hence, all minor drainage lines were identified as ephemeral watercourses. The minor drainage line channels have variable lengths, but are no more than 5m wide. The channels are weakly defined in the upper reaches but become more incised downstream.

Figure 53: Relatively Flat Terrain in the North Western Area of the Study Region where Minor Drainage Lines were identified.

According to **Lanz (2017)**, soils across the study area are predominantly shallow, sandy soils on underlying rock or hard-pan carbonate. As the depth of soils on the proposed development area are relatively shallow, flow is predominantly via surface run-off. Therefore, limited sub-surface flow takes place, with the exception only where the composition and depth of the soil profile permits infiltration in thicker permeable soil profiles (i.e. valley bottom areas). Soil erosion potential is therefore also limited due to shallow soil depth (**Figure 54**). Overall however, erosion was very limited. Relatively good growth of a mixture of both herbaceous and graminoid species keep soils intact. Minor erosion is restricted to the channels of the drainage lines, mainly in the south eastern areas of the study area.

Figure 54: Example of a Minor Drainage Line with Limited Channel Incision

- **Alluvial Soils and Deposited Materials**

Generally, fine to sandy particles are found within the minor drainage lines. However, the grain size of sediments can increase to gravel sized sediments (**Figure 55**) which presumably are transported from the surrounding landscape via overland flow into the drainage lines. Following flows, driven by rainfall events, sediments are deposited along the length within the drainage lines. Deposited sediments were therefore evident at the time of the assessment. All drainage lines were however dry during the site investigation, indicating the ephemeral nature of the drainage lines.

Figure 55: Example of Gravel Sized Alluvial Sediments within a Minor Drainage Line

- **Vegetation**

According to Todd (2017), the main driver of vegetation pattern in the study area is the substrate. Todd (2017) elaborates that on the gravel and stony soils, the vegetation consists of open shrub-dominated vegetation typical of Bushmanland Basin Shrubland, while on sandy soils the vegetation is typically dominated by *Stipagrostis* species characteristic of Bushmanland Arid Grassland. As such, large parts of the site including the Ithemba study area is dominated by so called "white grasses" and is clearly representative of the Bushmanland Arid Grassland vegetation type. However, the Bushmanland Basin Shrubland is considered the dominant habitat type along large sections of the grid line corridors. In consideration of the above, the drainage lines in the northern areas of the study site were found to be dominated by shrubland vegetation species including a mixture of low sturdy and spiny (and sometimes also succulent) shrubs. Todd (2017) states that taller shrubs are usually restricted to run-on environments and consist of species such as *Lycium pilifolium* and *Rhigozum trichotomum*. Graminoid species were also present directly within and along the banks of the drainage lines. The most notable grasses found in the northern drainage lines were that of the *Stipagrostis* family. Conclusively, Todd (2017) states that, although the drainage lines are not well developed (which can be ascribed to aridity of the area), they are ecologically important because the higher cover and productivity of these areas is important for fauna forage and habitat availability and they also play an important hydrological role and regulate flow following occasional strong rainfall events.

Figure 56: Example of Low and Sturdy Spinescent Vegetation Species typical of the Bushmanland Basin Shrubland Vegetation Type inhabiting a Minor Drainage Line

- **Comment on Ecological Condition of the Minor Drainage Lines**

Overall, the drainage lines appeared to be in a largely natural condition. Existing impacts affecting the drainage lines are mainly due to grazing and anthropogenic (dirt road and fencing) impacts. Minor signs of erosion were evident. Drainage lines were also generally well vegetated along the channel banks as well as instream in some instances.

7.3.1.1.2 Channel (Major Drainage Lines)

- **Topography Associated with the Watercourse**

The major drainage lines were found toward the mid-way to end sections of the grid line corridors. As such, the topography associated with the major drainage lines are generally characterised by low ridges and undulating terrain in the eastern and south eastern areas. Again, the direction of drainage is dependent on the local topography and can flow in any direction. The major drainage lines were found to be more well-developed reaches (particularly the Klein Rooiberg, Leeuberg and Hartbeeslaagte) downstream of numerous first order streams found higher in the drainage network. The major drainage lines were not in flow during both assessment periods and are therefore also considered to be ephemeral, only flowing temporarily during and briefly after heavy rainfall events. The major drainage lines are relatively broad in extent, reaching a channel width of typically 100-200m. The widest drainage line crossing a grid line corridor however reached approximately 450m. Some major drainage lines are characterized by broad valley bottoms which open up into bare and exposed plains where overland flows wash through into more densely vegetated areas further downstream. The major drainage lines with open wash areas tend to however lack clearly defined channels. As such, the reaches of the delineated major drainage lines are considered an A-section reach due to the lack of a distinct channel and visible saturation zone (**Figure 57**). However, despite the more defined channels associated with incised macro channel banks, these systems are located relatively high up in the respective catchments and also lack a visible saturation zone. Therefore, the Klein Rooiberg, Leeuberg and Hartbeeslaagte as well as all other identified major drainage lines are also a representative of A-section reaches.

Figure 57: Image of the Major Drainage Line with Poorly Developed Channel

- **Alluvial Soils and Deposited Materials**

The alluvial soils and deposited materials are highly similar to the sediments found in the minor drainage lines consisting of a mixture of fine-sandy-gravel sized grains that are deposited following flows driven by rainfall events.

- **Vegetation**

The vegetation in the major drainage lines were found to be highly similar to that found in the minor drainage lines. As previously mentioned, the drainage lines in the northern areas of the study site were found to be dominated by shrubland vegetation species including a mixture of low sturdy and spiny (and sometimes also succulent) shrubs. As such, the vegetation consisted of a mixture of taller spinescent shrubs (*Lycium pilifolium* and *Rhigozum trichotomum*) and *Stipagrotis* (particularly *Stipagrostis namaquensis*) species. Once again, the importance of the drainage lines are reiterated in terms of the higher cover and productivity of these areas which are important for fauna forage and habitat availability, as well as performing an important hydrological role through regulating flow following occasional strong rainfall events **(Todd, 2017)**.

- **Comment on Ecological Condition of the Major Drainage Line**

Overall, the major drainage lines appeared to be in a largely natural condition. Similar existing impacts affecting the minor drainage lines were found to also affect the major drainage line. The existing impacts included mainly grazing impacts and anthropogenic impacts (dirt roads and fences). The major drainage lines were also generally well vegetated along the channel banks as well as instream in some instances.

7.3.1.1.3 Depression (Pan) Wetlands

- **Terrain and Wetland Soil Characteristics**

The depression wetlands identified can be divided into two sub-groups, namely saline and non-saline depression wetlands. The first sub-group includes a cluster of depression wetlands which can be found within 2km of Linking Substation Option 1. Only one (1) of the depression wetlands belonging to the cluster of wetlands is in the common grid line corridor shared by all alternative options. This depression wetland was found to be linked geologically to a ridgeline west of the wetlands. The wetlands are therefore wedged on the eastern side of the ridgeline (**Figure 58**).

Figure 58: Saline Depression Wetland Wedged alongside a Ridgeline

The second sub-group of wetlands includes the non-saline depression wetlands. A total of four (4) non-saline depression wetlands were identified mainly on relatively flat to gently undulating terrain. Two wetlands (2) are located in grid line option 2 which is also common to grid line option 4, whilst the remaining two (2) depression wetlands can be found within grid corridor option 4. In general, climate and landscape characteristics create favorable drainage conditions resulting in depression formations. The depression wetlands did not appear to be saline as no salt precipitation was evident at the surface (**Figure 59**).

Figure 59: Non-saline Depression Wetland

Aside from salt precipitation at the surface, soil samples drawn from the saline depression wetland revealed that the topsoil could be attributed to an Orthic A horizon. Meanwhile, the sub-soil showed typical mottling signatures in the form of red iron oxide mottling. The presence of this sub-soil may be said to be representative of a Soft Plinthic B horizon. Black mottling signatures were also evident indicating a degree of manganese concentration in the sub-soils (**Figure 60**). It must also be stated that these soils appeared to exhibit a higher clay content. The Westleigh Soil Form could therefore be attributed to these wetlands. Soil sampling was limited by rock depth (approximately 60-80cm).

Figure 60: Salt Precipitation at the Surface (left) and Red Iron and Black Manganese Accumulations observed in the Sub-soils of a Saline Wetland

In terms of the non-saline wetlands, soil samples drawn revealed fine-grained to sandy particles within a light brown matrix. Soils were relatively shallow (>0.5m). No distinct signs of wetness could however be observed (**Figure 61**). It was therefore considered that the chemical constituency of these particular soils are not considered conducive to the formation of typical wetland hydrogeomorphic (reduction and mottling) characteristics found in the saline wetlands. It may well be that the geochemical constituency of the sediment particles, coupled with high pH and the physico-chemical characteristics of the soils may mask the formation of the typical mottling characteristics observed in wetlands in other parts of the country. This is a limitation not expressed in the DWAF (2005 & 2008) guideline for delineation of wetlands.

Figure 61: Sub-soils from a Soil Sample Drawn from a Non-saline Depression Wetland

Overall, the prevailing climate acts as a constraint to the time that water is available or the duration of saturation (hydroperiod) for the both the saline and non-saline wetlands. The wetlands are therefore rainfall driven and consequently temporary in nature. High temperatures, low rainfall and high evaporation rates in the region contribute to limited hydroperiod of the wetlands. For the saline depression wetland near the Option 1 Linking Substation, these factors also play a role in combination to the geology and soil composition of the area contributing to the salinity status of the wetlands. Given the prevailing climate and characteristics of the soils, the wetlands were deemed to be temporary in nature.

- **Wetland Vegetation**

Vegetation within the wetlands varied from no vegetation in the core areas of the saline wetland, to relatively dense coverage of the non-saline wetlands consisting of mainly shrubland vegetation. It was identified that salinity could be linked to the degree of vegetation occurrence. Todd (2017) identifies three wetland habitat types for the depression wetlands in the region including non-saline pans with a bare center and fringed by taller woody vegetation; non-saline pans vegetated by *Athanasia minuta* (**Figure 62**) and saline pans that are not vegetated. Of these wetland vegetation types, the wetlands within the grid line corridors include two types. These being the non-saline pans vegetated by *Athanasia minuta* and saline pans that are not vegetated. Todd (2017) further states that the depression wetlands which are not saline and are vegetated in the centre by *Athanasia minuta* additionally may include species such as *Lycium pumilum*, *Salsola glabrescens*, *Salsola aphylla*, *Rhigozum trichotomum*, *Parkinsonia africana*, *Psilocaulon coriarium* and *Osteospermum armatum* around the fringes. He furthermore states that, the saline pans are not vegetated on account of the salt present, but are nevertheless ecologically important as they support a variety of temporary water organisms when they contain water (Todd, 2017).

In this respect, the depression wetlands are important for the maintenance of biodiversity. Given that the depression wetlands are temporary in nature, these system are therefore highly variable ecosystems which undergo changes in physical and chemical characteristics regularly. As such, variations are brought about in changes in substrate, inundation cycles, local climate and physical dimension of the wetland(s). Consequently, the invertebrate fauna that inhabit these environments have various physiological, behavioural and structural adaptations, enabling their survival in a constantly changing environment. Important organisms of concern that may potentially occur in these wetlands, is that of the class *Branchiopoda* (and the order *Anostraca*). These species survive desiccation through production of an egg bank which is resistant to desiccation, hatching after lying dormant during the dry phase under favorable conditions when inundation takes place. With this in mind, impacts such as sedimentation could result in preventing hatching after rainfall.

Figure 62: Depression Wetland colonised by *Athanasia minuta*

- **<u>Comment on the Ecological Condition of the Depression Wetlands</u>**

The pan wetlands were observed to be in a largely natural condition. Prevailing impacts that were found to affect the wetlands include mainly grazing impacts. Depression wetlands near to Helios Substation were found to be additionally affected by anthropogenic (dirt roads, grid lines and fences) impacts.

7.3.2 Surface Water Buffer Zones

When determining the buffer zones for drainage lines and wetlands, critical factors that need to be considered as a result of the proposed development include the ecological drivers of these hydrological features.

The primary threats related to the proposed substation, grid lines and service / access roads are mainly during the construction phase. Particularly, the potential impacts include increased run-off, erosion and sediment inputs. Additional potential threats include geomorphological impacts due to compaction as a result of direct physical degradation from vehicular activity, soil contamination from vehicles and machinery, as well as related water quality impacts from oil and fuel spills and / or leakages from vehicles and machinery. Given this, increased run-off will have impacts on the hydrology of the surface water resources in terms of alteration of flood peaks. Clearing of vegetation can also affect the surface roughness of the catchment thereby also contributing to accelerated surface run-off, consequent sedimentation and erosion of surface water resources. Sedimentations and erosion impacts can affect the geomorphological integrity of the surface water resources. In terms of contamination impacts, leakages and spill of hazardous substances such as fuels and oils can affect the water quality and contaminate soils of the surface water resources following transportation of these substances and liquids in surface run-off following rainfall events. Potential negative impacts to the biota and vegetation inhabiting the surface water resources may result in affecting the biodiversity and overall ecological functioning of the surface water resources.

For the operation phase, degradation impacts as a result of vehicle movement is a concern. Compaction impacts and degradation of vegetation associated with the surface water resources is the main concern for this impact from a surface water perspective. Compaction impacts negatively impacts on the geomorphological integrity of the surface water resources potentially causing alteration of the physical conditions of the soil as well as making surface water resources vulnerable to erosion. Additionally, storm water run-off impacts can be anticipated due to the increased hard and impermeable surfaces to be constructed. As such, accelerated run-off can impact on the hydrology of the surface water resources. Moreover, erosion and sedimentation risks can also be associated with increased run-off and need to be taken into consideration.

Given the above, a buffer zone of 100m for the major drainage line and a buffer of 50m for minor drainage lines and the natural depression wetlands have been applied in consideration of the factors above so as to limit potential direct and indirect impacts on the surface water resources as far as practically possible.

7.3.3 Nature of the Potential Impacts Associated with the Proposed Development

This section will identify and contextualise each of the potential impacts on the identified surface water resources within the context of the proposed development. This section will rate these potential impacts according to an impact rating system (see Appendix B of the Surface Water Impact Assessment Report for a full methodology and description of the impact rating system), determine the effect of the environmental impact and provide recommendations towards mitigating the anticipated impact. The identification and rating of impacts will be undertaken for the construction, operation and de-commissioning phase of the proposed development.

7.3.3.1 Construction Phase Potential Impacts

- **Loss of Wetland and Riparian Habitat**

There are a number of direct impacts during the construction phase that can potentially have an adverse effect on the identified and delineated surface water resources habitat. These include construction of the substation, lay-down area and grid line pylons directly or in close proximity to surface water resources and the associated buffer zones (<50m of wetland and drainage lines buffer zones and within 100m of major drainage lines), clearing of drainage line or wetland vegetation, human degradation to surface water resources habitat during construction activities, and vehicle degradation by compaction during movement.

Firstly, placement of the construction lay-down area as well as grid line pylons directly within or within close proximity to surface water resources habitat can have impacts in terms of removal of vegetation and / or indirect edge impacts. Removal of vegetation will degrade the condition of the wetlands and expose the soil leaving the wetlands vulnerable to erosion. Additionally, disturbance due to construction activities may provide opportunities for pioneer and / or alien species to colonise the wetlands.

The substation and construction lay-down area particularly will need to be cleared of all vegetation and ideally flattened to establish the electrical infrastructure, temporary site offices, and storage areas for waste (temporary), vehicles, materials and machinery, respectively. Here removal of vegetation and edge impacts will degrade the state of vegetation associated with the surface water resources. With regards to clearing vegetation in general for the grid line pylons and access / future service roads, the areas where the pylons will need to be placed will need to be cleared of vegetation in order for the foundations to be established. Additionally, vegetation clearing will need to take place where roads are to be established for transport of workers and materials and may potentially be used as future service roads for maintenance in the future.

Ultimately, removal of vegetation associated with surface water resources in these areas will result in loss of habitat. Moreover, degradation caused by movement of vehicles within the drainage line(s) and wetland habitat will likely result in degradation of habitat due to compaction when vehicles move through surface water resources. Lastly, human degradation specifically can take the form of physical direct degradation such as lighting fires in or near the drainage lines and / or wetlands, as well as directly damaging or removing wetland vegetation. Disturbance and potential removal of drainage line and / or wetland vegetation may therefore occur.

- **Impacts to the Geomorphology of Surface Water Resources**

Vegetation clearing will need to take place for the construction process. Excessive or complete vegetation clearance in the surface water resources and the nearby surrounding areas is likely to result in exposing the soil, leaving the ground susceptible to wind and water erosion particularly during and after rainfall events. Due to the climate of the study area (generally arid with sudden sporadic rainfall) soil erosion, as a consequence of the proposed development, is a possibility. A further impact due to erosion and potential storm water run-off impacts is increased run-off and sedimentation to surface water resources. Increased run-off can erode channels more easily, whilst an increased load of deposited sediments can smother vegetation and change flow paths / dynamics making affected areas susceptible to alien plant invasion leading to further degradation.

Soil compaction due to vehicle and worker movement within the internal access road areas within the surface water resources is another distinct possibility. This is likely to take place during the construction phase of the proposed development. Vehicles (heavy and light) will require access to the designated construction areas.

- **Impacts to Soil and Water in Surface Water Resources**

With the movement of vehicles and personnel potentially in surface water resources, there is the possibility of soil and water contamination. Soil contamination may take place as a result of oil, fuel leakages and / or cement spills from the vehicles passing in close proximity or directly within surface water resources.

Similarly, where and when surface water is present, water contamination from the same source may result. In addition, other amenities and / or storage of substances may also lead to both soil and water contamination either directly or indirectly. Where temporary toilets for workers are placed within the buffer zones, indirect contamination may result where leakages from temporary toilet units drain into surface water resources. Moreover, direct soil and water contamination can take place where temporary toilets are placed directly in surface water resources and where leakage takes place.

In terms of other substances, fuel, paints and oil in storage areas may similarly spill, leak and drain directly within surface water resources where these substance and liquids are stored and or used directly in surface water resources. Indirectly, soil and water contamination may equally take place where storage areas are situated within buffer zones and spills of leaks take place. Furthermore, run-off from storage areas can also accumulate such hazardous liquids and drain into surface water resources. Lastly, from a construction point of view specifically, mixing cement and cleaning construction tools in the wetland can affect the water quality of the wetland.

Altering the chemical composition of the soil and water disrupts the natural baseline condition to which organisms and vegetation have adapted to in order to survive. Contamination of water and soil may affect the functionality of organisms and vegetation, even potentially leading to death. Importantly, altering the chemical composition of water is considered pollution and must be prevented in terms of the NWA.

- **Impacts to Fauna associated with Surface Water Resources**

The possibility of impacts to fauna associated with surface water resources may occur during the construction phase. Fauna are often hunted, trapped, killed or eaten by workers for various reasons.

7.3.3.2 Operation Phase Potential Impacts

- **Impacts to the Geomorphology and Hydrology of Surface Water Resources**

Vehicle access to the substation/linking station sites and infrastructure (such as roads, cables and grid lines etc.) in and / or through and / or over (grid lines spanning) surface water resources. It is therefore important that access routes / future service roads are not planned and constructed within surface water resources as far as practically possible. However, where this is required and the relevant environmental authorization and water use license is obtained, access routes and service roads for vehicles in or through surface water resources may be susceptible to soil compaction and consequent erosion impacts. Regular vehicle movement in surface water resources can compact the soil affecting the hydrology of the surface water resources. Similarly, regular movement from vehicles can flatten the ground surface making it a preferential flow path for storm water and thereby becoming susceptible to accelerated run-off which may result in progressive erosion. Compaction from vehicles can also create incisions which may induce donga erosion over time.

With the above in mind, stormwater and erosion control management will be important so that where impacts to surface water resources are permitted, stormwater and erosion is controlled so as not to drastically alter the hydrology and structural integrity and sediment regime of the potentially affected surface water resources. Altering the hydrology of the surface water resources can disrupt the drainage dynamics of the landscape. Likewise, long term erosion of surface water resources compromises the structural integrity of the surface water resources and can lead to long term degradation and possibly failure.

7.3.3.3 Decommissioning Impacts

Should the proposed development need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Similar impacts are therefore expected to occur and the stipulated mitigation measures where relevant and appropriate must be employed as appropriate to minimise impacts.

7.3.4 Legislative Implications

7.3.4.1 National Environmental Management Act, 1998 (Act No. 108 of 1998) and Environmental Impact Assessment Regulations (2017)

In the context of NEMA (1998) and the EIA Regulations (2017), based on the current layout, it is identified that Activities 12 and 19 of Government Notice 327 Listing Notice 1 will be triggered due to access / service roads and power lines through surface water resources, thereby requiring Environmental Authorization. The aforementioned potentially applicable activities are elaborated on in more detail below.

- **Environmental Impact Assessment Regulations 2017, Listing Notice 1, GN. 327, Activity 12:**

The development of-
(x) buildings exceeding 100 m² in size;
(xii) infrastructure or structures with a physical footprint of 100 m² or more;

where such development occurs-

a) within a watercourse (wetland);
b) if no development setback exists, within 32 m of a watercourse, measured from the edge of a watercourse (wetland); -

Where access / service roads will route directly through of within 32m of any of the identified surface water resources, this activity will be triggered.

- **Environmental Impact Assessment Regulations 2017, Listing Notice 1, GN. 327, Activity 19:**

The infilling or depositing of any material of more than 10 m³ into, or the dredging, excavation, removal or moving of soil, sand, pebbles or rock of more than 10 m³ from-

(I) a watercourse;

Where access / service roads will route directly through any of the identified surface water resources and will be associated with the infilling or depositing of any material of more than 10 m³ into, or the dredging, excavation, removal or moving of soil, sand, pebbles or rock of more than 10 m^3 from surface water resources, this activity will be triggered.

7.3.4.2 National Water Act, 1998 (Act No. 36 of 1998)

In the context of the NWA (1998) and the proposed development, a "water use" is required to be registered where construction activities will impact directly or indirectly (within the regulated area as per Government Notice 509 of 2016 (No. 40229)) on a water resource. The regulated area as per Government Notice 509 of 2016 (No. 40229) is defined as follows:

- Activities within 500 meter radius of a wetland or pan;
- Activities within the outer edge of the 1:100 year flood line or riparian habitat (whichever is greatest);
- Activities within 100m from the edge of a watercourse (annual bank fill flood bench) in absence of the 1:100 year flood line or riparian habitat.

In this light, "water use" is defined *inter alia* as follows:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in stream flow reduction activity contemplated in Section 36 of the NWA;
e) Engaging in a controlled activity identified as such in Section 37 (1) or declared under Section 38 (1) of the NWA;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing of waste in a manner of water which contains waste from, or which has been heated in any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

In this context, a water use license will be required where any of the above water uses are required for a development. As such, for the proposed development, it has been identified based on the current layout that surface water resources will be affected by construction of access / service roads and power lines. Therefore, water uses (c) and (i) are applicable.

However, once a final layout (including a road plan and grid line, showing tower positions) is available, it is recommended that an assessment using the risk assessment protocol in terms of Government Notice 509 of 2016 (No. 40229) is undertaken to potentially determine whether a General Authorisation (GA) can be issued in this regard for water uses (c) and (i) instead of undertaking a full water use license application. Should it be identified that the proposed development falls within the Low risk category, a GA registration process may be applicable as opposed to a full water use license application.

7.4 Soils and Agricultural Potential

7.4.1 Agricultural Capability

Land capability is defined as the combination of soil suitability and climate factors. The area has a land capability classification, according to the eight (8) category scale of Class 7 which is non-arable, low potential grazing land. The limitations to agriculture are the extreme aridity and lack of access to water as well as the predominantly shallow, rocky soils. Due to these constraints, agricultural land use is restricted to low intensity grazing only. The natural grazing capacity is given on AGIS as very low, at 45 hectares per animal unit. This is amongst the lowest grazing capacity areas in the country.

7.4.2 Land use and development on and surrounding the site

The study area is located in a sheep farming agricultural region, and grazing (sheep and some cattle) is the only agricultural land use on the study area and surrounds. There is no agricultural infrastructure in the study area, apart from fencing into camps and wind pumps with stock watering points.

7.4.3 Status of the land

The vegetation classification for the study area is Western Bushmanland Klipveld and Bushmanland Basin Shrubland. The vegetation is grazed and very sparse due to a number of years of low rainfall. Natural surface erosion, typical of sparsely vegetated, arid environments, is active but there is no evidence of excessive, accelerated erosion, or other land degradation. The land is classified as having a low to moderate water erosion hazard (class 5), and it is classified as susceptible to wind erosion (class 2b) because sands, as a soil textural class, are dominant.

7.4.4 Possible land use options for the study area

Due to the extreme aridity constraints as well as the poor soils, agricultural land use is restricted to low intensity grazing only.

7.4.5 Agricultural sensitivity

Agricultural potential and conditions are very uniform across the study area and the choice of placement of facility infrastructure, including access roads, and transmission lines therefore has minimal influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the study area. From an agricultural point of view, no parts of the study area need to be avoided by the development and there are no required buffers.

7.4.6 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; and
- Construction activities that disturb the soil profile and vegetation, for example for excavations.

The significance of all agricultural impacts is kept low by two (2) important factors. The first is that the actual footprint of disturbance of the electricity grid infrastructure is very small in relation to the available grazing land on the effected farm portions, and all agricultural activities in the study area can continue unaffected under power lines. The second is the fact that the proposed site is on land of extremely limited agricultural potential that is only viable for low intensity grazing. These factors also mean that cumulative regional effects as a result of other surrounding developments, also have low significance.

From an agricultural impact perspective, land on this study area is ideally suited to renewable energy development because of its very limited production potential. It is agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to such land.

7.5 Heritage and Palaeontology

7.5.1 Field Work Findings

7.5.1.1 Methodology

A survey of the study area was conducted from 24-30 October 2016 and June 2017. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, two (2) archaeologists of PGS conducted a vehicle and foot-survey that covered the study area. The fieldwork was logged with a GPS to provide a background of the areas covered (**Figure 65**).

The proposed study area is situated approximately 75km north of Loeriesfontein off the R355 in the Northern Cape.

The proposed site is characterised by a flat arid landscape. The vegetation is typical Karoo. The area is being utilized for game (mostly springbok) and sheep.

Figure 63: View of the western side of the study area.

Figure 64: View of the southern side of the study area from the ridge

7.5.1.2 Findings

The fieldwork identified one (1) heritage resource (GK004) as well as several areas with existing infrastructure such as fenced off camps, windmills and reservoirs.

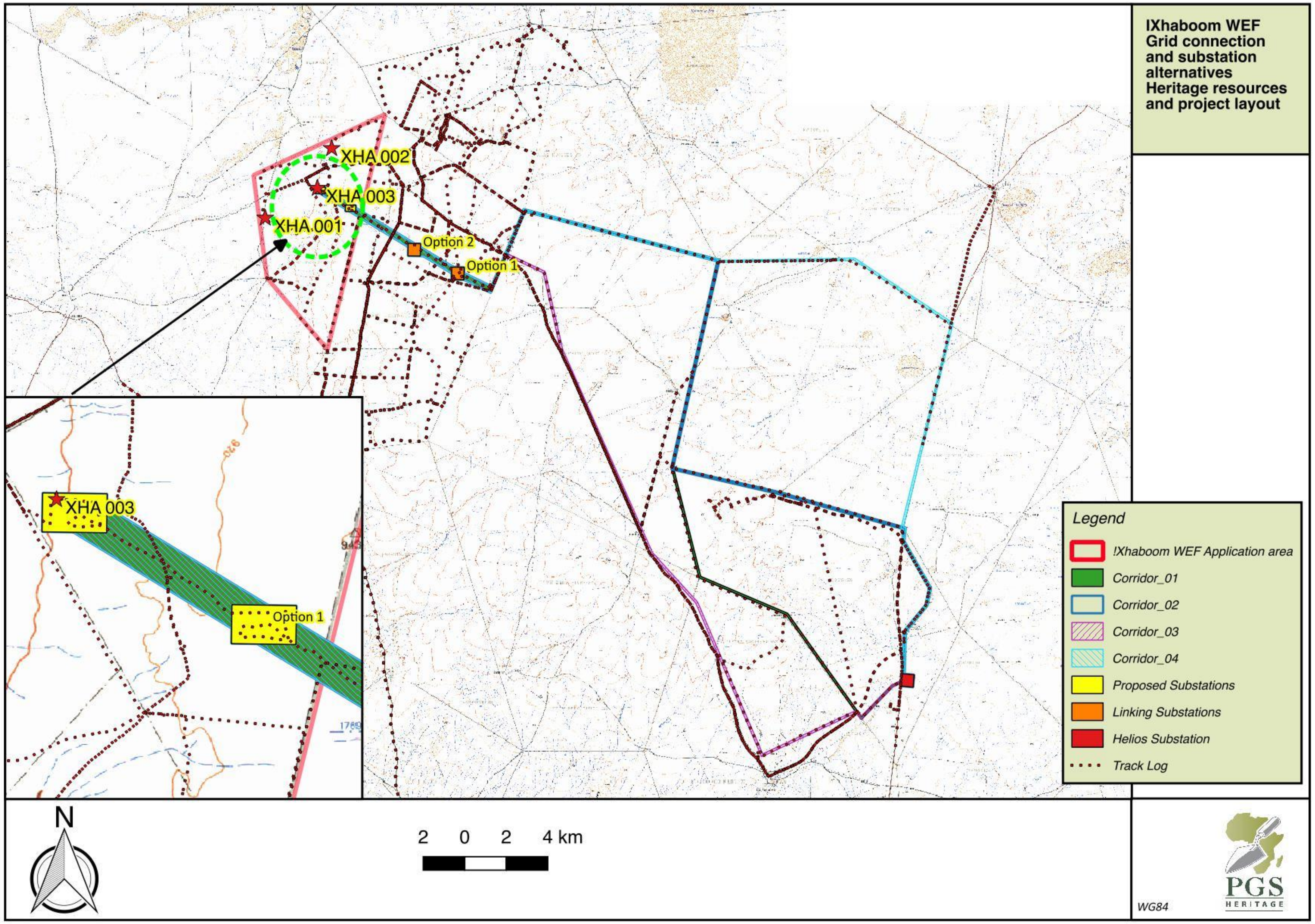

Figure 65: Heritage resources with tracklog

Table 28: Heritage resources found						
Site Number	**Lat**	**Lon**	**Type Find**	**Description**	**Significance**	**Heritage Rating**
XHA 003	S30.286190°	E19.263994°	Find spot	A low density scatter of lithic tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated within a pan amongst the grassy plains of the study area. The artefacts were exposed in some deflated areas due to some measure of sheet erosion. The lithic tools are mainly from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, hornfels and CCS and they were found scattered over an area which measured approximately 60m in diameter. The site is of low significance and no further mitigation is necessary.	Low	GP.C

Figure 66: General view of XHA 003

Figure 67: View of landscape showing lithic distribution

Figure 68: Artefacts identified at XHA 003

7.5.2 *Palaeontology (Desktop Assessment)*

- **Dwyka Group**

Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Formation. Other trace fossils include coprolites (fossilized faeces) of chondrichthyians (sharks, skates and rays). Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living Nautilus), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp*., Phestia* sp*., Aphanaia haibensis, Eurydesma mytiloides*), brachiopods (Attenuatella sp.) and palaeoniscoid fish such as Namaichthys schroederi and Watsonichthys lotzi. Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005).

- **Ecca Group**

The fossil assemblage of the Prince Albert Formation is basically trace fossils. Trace fossils have been described from the deep water deposits of this Group in various places in the Karoo Basin, whereas plant fossils are abundantly present in the sandstone rich units in the northern parts of the Basin. This trace fossil assemblage of the non-marine *Mermia* Ichnofacies, is dominated by the ichnogenera *Umfolozia* (arthropod trackways) and *Undichna* (fish swimming trails), are generally found in basinal mudrock facies of the Prince Albert Formation.

Fossil Heritage of the Whitehill Formation includes mesosaurid reptiles, palaeoniscoid fish, small eocarid crustaceans, insects, trace fossils (king crab track ways. shark coprolites), palynomorphs (organic-walled spores and pollens), petrified wood (mainly of primitive gymnosperms, silicified or calcified) and sparse vascular plant remains (Glossopteris leaves, lycopods etc.).

The fossil assemblage of the Tierberg Formation comprise of disarticulated micro vertebrate remains (e.g. fish teeth, scales) sponge spinucles, scarce vascular plants (leaves and petrified wood) and a moderate diversity if trace fossil assemblages.

- **Karoo Dolerite Suite**

The Karoo Dolerite Suite consists of igneous rocks and are unfossiliferous.

- **Late Caenozoic superficial deposits**

The central Karoo drift deposits have been relatively neglected in palaeontological terms. They may occasionally contain important fossil biotas, e.g. bones, teeth and horn cores of mammals as well as remains of reptiles like tortoises. Non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites), and plant remains such as peats or palynomorphs (pollens, spores) in organic-rich alluvial horizons and siliceous diatoms in pan sediments have also been found.

7.5.2.1 Impact Assessments

An assessment of the impact significance of the proposed construction of the four (4) Leeuwberg Wind Farms and the four (4) grid connections near Loeriesfontein in the Northern Cape Province and associated infrastructure on local fossil heritage is presented here:

- **Nature of the impact**

The excavations and site clearance will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. According to the Geology of the development site there is a possibility of finding fossils in the Dwyka and Ecca Groups but the palaeontological sensitivity is low (see description).

- **Geographical extent of impact**

The impact on fossil materials and thus palaeontological heritage will be limited to the construction phase when new excavations into fresh potentially fossiliferous bedrock take place. The extent of the area of potential impact is thus restricted to the project site and therefore categorised as local.

- **Duration of the impact**

The expected duration of the impact is assessed as potentially permanent to long term.

- **Potential significance of the impact**

The Permo-Carboniferous Dwyka Group and Early to Middle Permian lower part of the Ecca Group are known to be of low significance in Palaeontological terms.

- **Severity / benefit scale**

The proposed project is potentially beneficial on not only a local level, but regional and national levels as well. The wind farm will provide a long term benefit to the community in terms of the provision of electricity from a renewable energy resource to a progressively stressed national electricity grid

- **Intensity**

The intensity of the impact on fossil heritage is rated as low.

- **Probability of the impact occurring**

The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal mudrocks of the lower part of the Ecca Group (Karoo Supergroup). These assemblage zones are known to be fossiliferous, but due to poor preservation and weathering the impact on fossil heritage is rated as low. The intrusive Karoo dolerites are of no palaeontological significance and the Late Caenozoic superficial deposits are generally of very low palaeontological sensitivity.

7.5.2.2 Damage Mitigation, Reversal and Potential Irreversible Loss

- **Mitigation**

Fossil heritage is present in the development footprint, but due to the preservation and scarcity of fossil heritage no mitigation measures are recommended.

- **Degree of irreversible loss**

The Permo-Carboniferous Dwyka Group and Early to Middle Permian rocks of the lower part of the Ecca Group are known to be fossiliferous but due to preservation and weathering the irreplaceable loss of resources is rated as low.

- **Degree to which the impact may cause irreplaceable loss of resources**

The Permo-Carboniferous Dwyka Group and Early to Middle Permian rocks of the lower part of the Ecca Group are known to be fossiliferous, but due to preservation and weathering the irreplaceable loss irreplaceable loss of resources is rated as insignificant.

7.6 Visual

7.6.1 Impact Assessment

7.6.1.1 Visual Compatibility / Contrast

The visual compatibility of the proposed development refers to the degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would be in conformity with the land use, settlement density, structural scale, form and pattern of elements that define the structure of the surrounding landscape. Visual compatibility is an important factor to be considered when assessing the impact of the development within a specific context. A development that is incongruent with the surrounding area may change the character of the landscape and could have a significant visual impact on key scenic views within the study area. Where a development corresponds with the surrounding environment the development would be easily absorbed by the surrounding environment and would result in little or no change in the visual character of the area.

As previously mentioned, the proposed development includes the construction of a 132kV On-site Eskom substation (namely the !Xha Boom Substation), a 132kV Linking Substation and a 132kV power line and associated infrastructure which required to feed electricity generated by the proposed !Xha Boom Wind Farm (part of separate on-going EIA process) into the national grid. In general, the proposed development would not be consistent with the prevailing pastoral land use within the surrounding area. However, the existing anthropogenic elements in parts of the study area are expected to lessen the degree to which the proposed development would be considered incongruent with the surrounding landscape. As mentioned above, the presence of other built-form such as roads, railways, high voltage power lines and substations would influence the degree to which a new power line and substation would visually contrast with the elements already present within the landscape. Where existing electrical infrastructure is present the visual environment would already be visually 'degraded' and thus the introduction of a new power line or substation in this setting would result in less visual contrast than if no existing built infrastructure were visible.

The existing electrical infrastructure and industrial form within the study area, includes several high voltage power lines, the Helios MTS, road and rail infrastructure as well as some scattered small-scale quarrying activities. In addition, the Khobab and Loeriesfontein Wind Farms are presently under construction in this area, each these facilities comprising some 61 wind turbines with associated substations, ancillary buildings and internal roads. It should also be noted that the on-site Khobab IPP substation has already been constructed in this area, while the construction camp area for the Khobab Wind Farm is also situated within this area, within close proximity to the Helios MTS. These elements have already degraded the natural environment to some extent and will significantly reduce the visual impact as the proposed development would be in conformity with these elements. It is also important to note that the substations and power line are being proposed to serve the proposed !Xha Boom Wind Farm and as such the substation and power line would only be constructed if this Wind Farm is developed. The proposed development would therefore be dwarfed by the large number of wind turbines, thus significantly reducing the likely visual contrast of the proposed substations and power line.

Several other renewable energy facilities are proposed to be constructed within close proximity to the proposed development and could significantly alter the visual baseline within the study area, further reducing the visual contrast of the proposed power line and substations, if constructed.

7.6.1.2 Receptor Impact Rating

In order to assess the impact of the proposed development on the sensitive / potentially sensitive receptor locations, a matrix that takes into account a number of factors has been developed (**Table 29**), and is applied to each receptor location.

The matrix has been based on a number of factors as listed below:

- Distance of receptor location away from the proposed development (zones of visual impact);
- Presence of potential screening factors (topography, vegetation etc.); and
- Visual contrast of the development with the landscape pattern and form.

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a sensitive / potentially sensitive receptor location in this context. It should be noted that this rating matrix is a relatively simplified way to assign a likely representative visual impact, which allows a number of factors to be considered. Experiencing of visual impacts is however a complex and qualitative phenomenon, and thus difficult to quantify accurately. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

Table 29: Visual assessment matrix used to rate the impact of the proposed development on sensitive / potentially sensitive visual receptors

	VISUAL IMPACT RATING			
VISUAL FACTOR	**HIGH**	**MODERATE**	**LOW**	**OVERRIDING FACTOR: NIL**
Distance of receptor away from proposed development	0 < 500m **Score: 3**	500m < 2km **Score: 2**	2km < 5km **Score: 1**	5km <
Presence of screening factors	Limited or no screening factors – development highly visible **Score: 3**	Screening factors likely to partially obscure the development **Score: 2**	Screening factors likely to obscure most of the development **Score: 1**	Screening factors completely block any views towards the development, i.e. the development is not within the viewshed
Zone of Visual Contrast	**High:** The development would contrast highly with the typical land use and/or pattern and form of human elements (infrastructural form). Typically a natural / pastoral environment with low-density rural infrastructure present (low voltage power lines and farm boundary fences). **Score: 3**	**Moderate:** The development would contrast moderately with the typical land use and/or pattern and form of human elements (infrastructural form) and existing level of visual transformation. Typically areas within close proximity to other prominent infrastructure (high voltage power lines and railway lines) and within intensive agricultural lands / cultivated fields. **Score: 2**	**Low:** The development would correspond with the typical land use and/or pattern and form of human elements (infrastructural form) and existing level of visual transformation. Presence of urban form and industrial-type infrastructure. The area is not highly valued or sensitive to change (e.g. the outskirts of urban and built-up areas). **Score: 1**	

- **Distance**

As described above, distance of the viewer / receptor location away from the development is an important factor in the context of experiencing of visual impacts. A higher impact rating has thus been assigned to receptor locations that are located closer to proposed development. Beyond 5km, the visual impact would be virtually nil, as the development would appear to merge with the elements on the horizon.

The radii chosen to assign the zones of visual impact are as follows:

- 0 < 500m (high impact zone);
- 500m < 2km (moderate impact zone);
- 2km < 5km (low impact zone); and
- >5km (Negligibly low impact zone)

- **Screening factors**

The presence of screening factors is as important in this context as the distance away from the development. Screening factors can be vegetation, buildings and topography. For example, a grove of trees located between a receptor location and an object could completely shield the object from the receptor location. Topography (relative elevation and aspect) plays a similar role as a receptor location in a deep or incised valley will have a very limited viewshed and may not be able to view an object that is in close proximity, but not in its viewshed. As such, the complete screening of the development has also been assigned an overriding nil impact rating, as the development would not impose any impact on the receptor.

- **Zones of visual contrast**

The degree to which the proposed development would appear to contrast with the surrounding land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape is also considered in the matrix. Visual contrast is an important factor to be considered when assessing the impact of the proposed development from a specific location, as a development that appears to contrast with the visual backdrop may change the visual character of that landscape. This could have a significant visual impact on potentially sensitive visual receptors within the study area.

Land use and visual character in the surrounding landscape was assessed to determine the level of transformation and the degree to which the proposed development would appear to be visually compatible with the surrounding environment when viewed from a particular location. In the context of this proposed development, the presence or absence of existing electrical infrastructure, dense settlement or other urban built-up form were important factors influencing the level of visual contrast. For example, if the development was located adjacent to an existing substation or power line it would result in significantly less visual contrast. The development site was therefore classified into the following zones of visual contrast:

- **High –** undeveloped / natural / rural areas;
- **Moderate –**
    - within 500m of existing power lines and Helios Substation;

    - within 500m of rail infrastructure, and
    - between 1.5 - 3km from existing windfarms;
- **Low –** within 1.5km of Khobab and Loeriesfontein Wind Farms.

The outcome of the visual contrast classification in relation to the sensitive / potentially sensitive visual receptor locations is provided in **Figure 69** below.

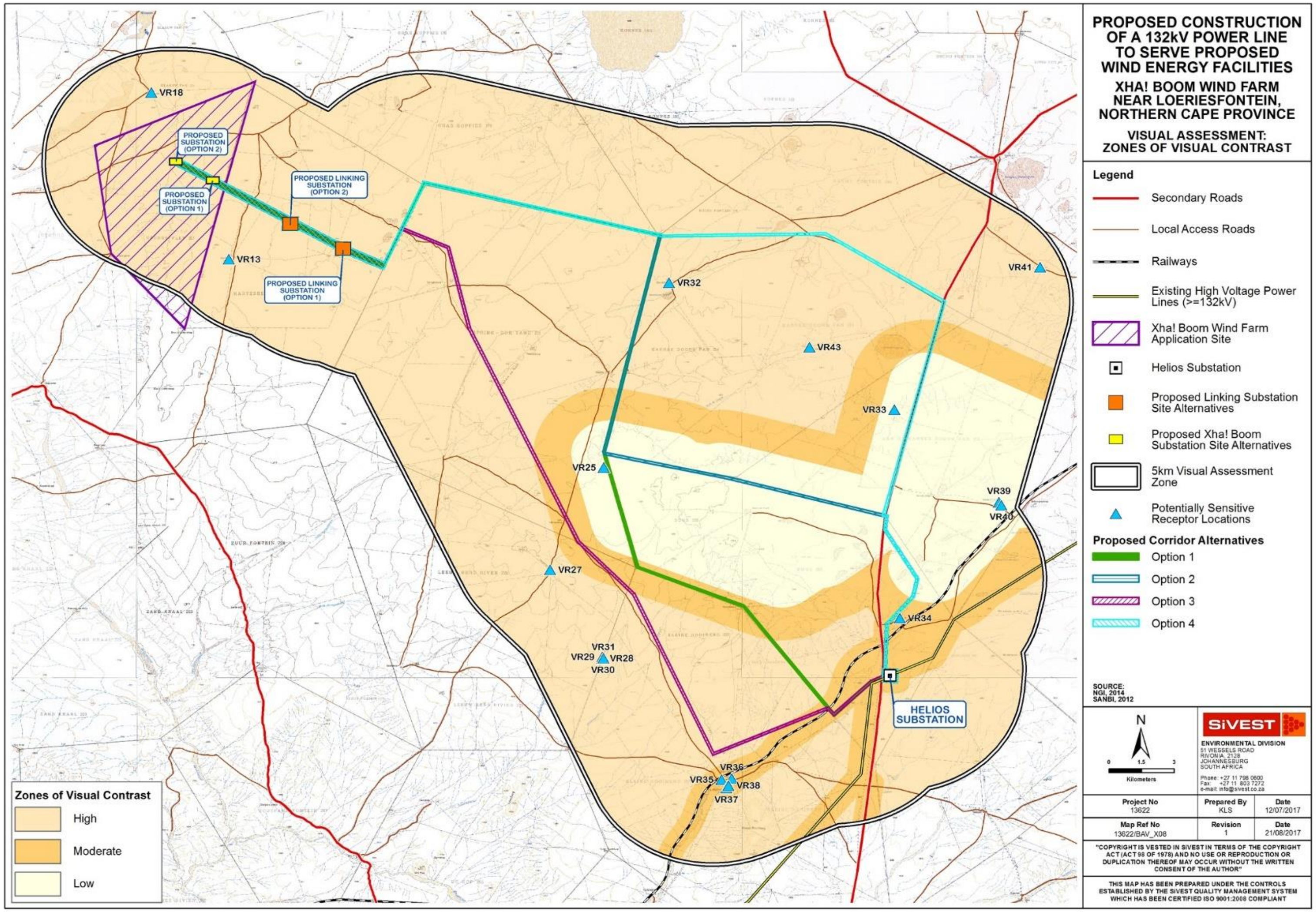

Figure 69: Zones of Visual Contrast

Table 30 below presents the results of the visual impact matrix.

Categories of impact:

Rating	Overall Score
High Visual Impact	8-9
Moderate Visual Impact	5-7
Low Visual Impact	3-4
Negligible Visual Impact	(overriding factor)

Table 30: Visual impact of the proposed development on sensitive / potentially sensitive visual receptors within the study area

Receptor Location	Distance	Screening	Contrast	OVERALL IMPACT RATING
VR13	Low (1)	High (3)	High (3)	**MODERATE**
VR18	Low (1)	High (3)	High (3)	**MODERATE**
VR25	High (3)	High (3)	Low (1)	**MODERATE**
VR27	Moderate (2)	High (3)	High (3)	**HIGH**
VR28	Low (1)	High (3)	High (3)	**MODERATE**
VR29	Low (1)	High (3)	High (3)	**MODERATE**
VR30	Low (1)	High (3)	High (3)	**MODERATE**
VR31	Low (1)	High (3)	High (3)	**MODERATE**
VR32	Moderate (2)	High (3)	High (3)	**HIGH**
VR33	Moderate (2)	High (3)	Low (1)	**MODERATE**
VR34	High (3)	High (3)	Moderate (2)	**HIGH**
VR35	Moderate (2)	Moderate (2)	Moderate (2)	**MODERATE**
VR36	Moderate (2)	Moderate (2)	Moderate (2)	**MODERATE**
VR37	Moderate (2)	Moderate (2)	Moderate (2)	**MODERATE**
VR38	Moderate (2)	Moderate (2)	Moderate (2)	**MODERATE**
VR39	Low (1)	Moderate (2)	Low (1)	**LOW**
VR40	Low (1)	Moderate (2)	Low (1)	**LOW**
VR41	Low (1)	Moderate (2)	High (3)	**MODERATE**
VR43	Low (1)	High (3)	High (3)	**MODERATE**

As previously mentioned, a few of the farmsteads / homesteads identified via desktop means were excluded as potentially sensitive receptor locations for the purposes of this study as during the time of the site visit it appeared as if these were uninhabited and/or abandoned. No further assessment was undertaken from these farmsteads / homesteads as it was assumed that no individuals currently live in these farmsteads / homesteads and therefore no visual impact will be experienced from these locations. In addition, it was not possible to verify the status of all the identified potentially sensitive receptor locations. As such it is possible that some of the structures identified by desktop means may not, in reality, be potentially sensitive receptors. Although the use of these farmsteads / residential dwellings could not be established during the field investigation, they were still regarded as being potentially sensitive to the visual impacts associated with the proposed development and were assessed as part of the VIA. In light of the above, the impact rating assessment of the proposed development on the potentially sensitive visual receptor locations was undertaken primarily via desktop means.

As indicated above, the proposed development would result in a moderate visual impact on all but five (5) of the potentially sensitive visual receptor locations within the study area (14 in total). It is important to note that the proposed development would result in a high visual impact on three (3) of the potentially sensitive receptor locations identified within the study area, namely VR 27, VR 32 and VR 34. In addition, the proposed development would result in a low visual impact on two (2) of the potentially sensitive receptor locations identified within the study area, namely VR 39 and VR 40.

7.6.7 Night-time Impacts

The visual impact of lighting on the nightscape is largely dependent on the amount of existing light present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely have a significant impact on the nightscape. In contrast, introducing light sources into a relatively dark night sky will impact on the visual quality of the area at night. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed development.

Much of the study area is uninhabited and as a result, relatively few light sources are present. At night, the study area is characterised by a picturesque dark starry sky and the visual character of the night environment is considered to be mostly ‘unpolluted’ and pristine. The town of Loeriesfontein is also too far away to have an impact on the night scene. It must however be noted that security lighting at the Helios MTS and at the site offices for the Khobab and Loeriesfontein Wind Farms are prominent light sources in the study area. Additional impacts on the night scene are expected to emanate from the substations and ancillary buildings at these wind farms once constructed as they will also require lighting for security and operational reasons. Other prominent light sources within the study area at night are largely restricted to isolated lighting from the surrounding farmsteads and residential dwellings, as well as transient light from passing cars travelling along the Granaatboskolk Road.

Operational and security lighting at night will be required for the proposed on-site !Xha Boom Substation as well the proposed Linking Substation. The type and intensity of lighting required was unknown at the time of writing this report and therefore this assessment of the potential night-time impact of the development is based on the general effect that additional light sources will have on the ambient nightscape.

Although the area is not generally renowned as a tourist destination, the natural dark character of the nightscape will be sensitive to the impact of additional lighting at night, particularly from nearby farmhouses. The operational and security lighting required for the proposed development is likely to intrude on the nightscape and create glare, which will contrast with the extremely dark backdrop of the surrounding area. Existing night time views from sensitive / potentially sensitive receptors are characteristic of a relatively dark night scene with some visible light sources, these including Helios MTS and security lighting associated with Khobab and Loeriesfontein Wind Farms.

As a result, lighting impacts from the proposed on-site !Xha Boom Substation and the proposed Linking Substation will marginally increase the existing light pollution in the surrounding area. It should also be noted that the substation and power line will only be constructed if the proposed !Xha Boom Wind Farm (part of a separate on-going EIA process) is developed as well. Operational and security lighting at night will be required for the wind farm in addition to permanent aviation lights or red aircraft warning lights on the top of each wind turbine, creating a network of red lights in the dark night-time sky. The lighting impacts from the proposed on-site !Xha Boom Substation and the proposed Linking Substation would therefore be dwarfed by the glare and contrast of the lights associated with the wind farm. As such, the substations are not expected to result in significant lighting impacts.

7.6.8 Visual Impact Summary

- **Access Roads**

As previously mentioned, there are no main or arterial roads in close proximity to the proposed development. The study area is however traversed by a secondary road, known locally as the Granaatboskolk Road, which links the town of Loeriesfontein with Granaatboskolk some 38km north-east of the study area.

A network of gravel roads will be constructed to provide access to the proposed power line for maintenance work. Roads are typically only associated with significant visual impact if they traverse sloping ground on an aspect that is visible to the surrounding area. Considering the flat nature of the terrain on the site, it is likely that the visual impact associated with these roads would be limited to the impact of clearing the vegetation. However, if these roads are not maintained correctly during the construction phase, construction vehicles travelling along the gravel access roads could expose surrounding farmstead to dust plumes.

- **Power lines**

Power lines consist of a series of tall towers which make them highly visible. Power lines are not features of the natural environment, but are representative of anthropogenic transformation. Thus when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. Conversely, the presence of other anthropogenic elements associated with the built environment, especially other power lines, may result in the visual environment being considered to be ‘degraded’ and thus the introduction of a new power line into this setting may be less of a visual impact than if there was no existing built infrastructure visible.

Power lines are anthropogenic elements that are not uncommon in the landscape, in both built-up and natural rural settings. The visual impact of a power line would largely be related to the physical characteristics of the area, land use and the spatial distribution of potential receptors. When combining this with the likely value judgements of visual receptors, the visual impact of the proposed power line can be determined. In areas, where the power line would contrast with the surrounding area it may change the visual character of the landscape and be perceived negatively by visual receptors.

As previously mentioned, four (4) power line corridor alternatives are being assessed, linking the proposed on-site !Xha Boom Substation, via the proposed Linking Substation, with Helios Substation approximately 33km to the south-east. All of the proposed power line corridor alternatives traverse parts of the study area which have remained largely natural. The south-eastern sector of the study area however has been degraded / transformed to some degree by the presence of existing electrical infrastructure and industrial form, including high voltage power lines, Helios MTS and the Khobab and Loeriesfontein Wind Farms presently under construction.

A summary of the visual impact of the proposed power line corridor alternatives, in relation to the physical characteristics, land use, visual character, presence of visual receptors and existing power lines or other infrastructure in the surrounding landscape, is discussed in **Table 31** below. These factors have been investigated in order to determine the degree to which the proposed power line corridor would be visually compatible with the surrounding environment and to determine its overall visual impact.

Table 31: Visual impact summary of the proposed power line corridor alternatives in relation to surrounding environment

Physical and Land Use Characteristics	Visual Character	Visual Contrast	Presence of Visual Receptors	Overall Visual Impact
Topography: The proposed power line is expected to be visible from much of the study area due to the largely flat terrain and wide-ranging vistas in the study area. The localised hills / koppies in parts of the study area would offer some localized visual screening, however the topographical undulations would offer minimal visual screening. **Vegetation:** The natural short shrub-like vegetation cover which dominates most of the study area results in wide-ranging vistas across most of the study area. Parts of the study area are however characterised by tree species (both naturally occurring and artificial) which are expected provide localised screening from the proposed development.	Most of the study area is considered to have a natural (almost vacant) visual character resulting from minimal human habitation and associated infrastructure. The predominant land use (sheep farming) has not transformed the natural landscape and thus the natural rural character has been retained across much of the study area. There are however some pastoral elements in the area which are expected to give the surrounding area a more pastoral feel. Typical anthropogenic elements and built infrastructure in the rural parts of the study area include isolated farmhouses, gravel access roads, boundary fences and telephone poles. The visual	The area is largely natural or rural / pastoral in character and the prevailing land use (i.e. sheep farming) has retained the natural vegetation across much of the study area. As such the development would not be consistent with the prevailing pastoral land use within the surrounding area. However, the existing anthropogenic elements in parts of the study area are expected to lessen the degree to which the proposed development would be considered incongruent with the surrounding landscape. The presence of road and rail infrastructure in the south-eastern parts of the study area introduces distinct linear elements into the landscape. In this setting,	Approximately nineteen (19) potentially sensitive visual receptors were identified within viewing distance (5km) of the power line corridor. All of these are believed to be scattered farmsteads / homesteads / residential dwellings. It must be noted that only two (2) of the potentially sensitive visual receptors identified are located within the 'High' Visual Exposure zone (i.e. within 500m of the nearest proposed power line corridor alternative). Seven (7) potentially sensitive receptors are located in the 'Moderate' Visual Exposure zone (i.e. between 500m and 2km of the nearest power line corridor alternative) while the remaining ten (10) receptors are located more than 2km	Due to the fact that most of the visual receptors identified are located in either Moderate or Low zones of visual exposure, distance from the proposed power line corridors, and the presence of existing anthropogenic elements (such as the road and rail infrastructure, Helios Substation and associated high voltage power lines and Khobab and Loeriesfontein Wind Farms), the visual impact resulting from the proposed power line is rated as moderate. Refer to **Section 8.2.6** for the overall visual impact rating.

Land use: Much of the assessment area is characterised by natural unimproved vegetation with sheep farming being the dominant activity. A major portion of the study area is very sparsely populated, with relatively little human-related infrastructure in evidence. The southern sections of the study area are however characterised by greater human influence in the form of rail and electrical infrastructure as well as the Khobab and Loeriesfontein Wind Farms presently under construction. These anthropogenic elements are expected to alter the visual character of the study area and as such the visual contrast of the proposed power line would be reduced in these degraded areas.	character is more transformed in the southern and south-eastern parts of the study area due to the presence of the Granaatboskolk Road, rail infrastructure, Helios Substation and associated high voltage power lines. In addition, significant transformation is occurring in the south-eastern section of the study area with the construction of the Khobab and Loeriesfontein Wind Farms.	the development of a new power line would contrast only moderately with the surrounding environment. It is also important to note that the south-eastern sections of the study area are characterised by greater human influence in the form of Helios Substation with associated high voltage power lines and the Khobab and Loeriesfontein Wind Farms presently under construction. These anthropogenic elements are expected to alter the visual character of the study area thus reducing the visual contrast of the proposed development.	from the nearest corridor alternative.	

▪ **On-Site Substations**

Two (2) new substations are proposed in conjunction with the 132kV power line development, namely the 33/132kV On-site Eskom substation (!Xha Boom Substation) and a Linking Substation. The proposed !Xha Boom substation, located at the western-most end of the power line corridor, will serve to transform or 'step-up' the voltage of electricity generated by the proposed !Xha Boom Wind Farm to feed into the National Grid. The proposed Linking Substation will be located south-east of the proposed !Xha Boom Substation within the power line assessment corridor.

In isolation, the proposed substations may be considered to be visually intrusive, but as these substations are intended to serve the proposed !Xha Boom Wind Farm (part of a separate on-going EIA process), they would only be constructed in conjunction with the proposed wind farm development. When viewed from the surrounding area, the substations would likely form part of the wind farm complex and would therefore be dwarfed by the large number of wind turbines comprising the wind farm. As such, the substations are not expected to be associated with a significant visual impact, or even a measurable cumulative impact.

7.7 Socio-Economic

7.7.1 Socio-Economic Impact Evaluation

The following sections discuss the socio-economic impacts that the proposed power line and substations are envisaged to create, considering the knowledge of the potentially affected socio-economic environment related to each alternative and option. Based on feedback collected during the interviews with I&APs as well as the information about the proposed activities. The following potential impacts were identified and will be analysed further in the section

- Impact 1: Stimulation of the economy and employment during the construction;
- Impact 2: Increased risk of threat to personal safety and livestock theft during the construction phase;
- Impact 3: Impact on sense of place; and
- Impact 4: Impact on service infrastructure.

▪ **Impact 1: Stimulation of the economy and employment during the construction**

The process of constructing power lines and developing substations is often associated with the need to acquire various goods such as steel products, electrical components, cables, bricks, cement, etc. In the event that the required material is purchased locally, i.e. within South Africa, the production of the respective businesses supplying the goods will increase. In addition to this, the erection of the power lines and substation development will require the project proponent to source construction supporting activities/businesses who will facilitate the whole process. The outcome of the spending that will occur as a result of the procurement of the mentioned material and the hiring of construction services will result in the stimulation of the national economy as well as the local district (where inputs or services are procured).

The costs associated with the construction of the on-site substation and linking substation will be the same regardless the power line route chosen. With respect to the construction of the power line, though, the opposite is true. This is so because although the cost per kilometre of the power line is the same (i.e. estimated at R3mil/km), the power line route alternatives considered for the project are of different length and will therefore result in a differing capital expenditures. Therefore, the longer the route, the greater the expense of the power line erection, which ultimately results in a greater capital injection in national and local economies. Considering the length of different routes mentioned earlier in the report, Option 1, 2 and 4 appear to be the preferred options from an economic perspective. Option 3 is also an acceptable option, but since its length is significantly shorter than the other route alternatives, it is a favourable option from the perspective of economic stimulus and job creation.

- **Impact 2: Increased risk of threat to personal safety and livestock theft during construction phase**

The erection of power lines and substations' development is expected to increase the movement and presence of people in and around the farms. Based on the information given by the project proponent, ±70% of the jobs will be allocated to local community members. As a result of this, the increased presence of people around the farms will not only increase the threat to the personal safety of landowners, but it will also result in the increased risk of livestock theft due to high exposure to people during construction. Linked to this, one of the interviewed I&APs (landowner of Portion 2 of Farm Graskoppies no.176) expressed that although he has no concerns with the erection of the power lines and development of substations, he was concerned about the possibility of the power lines affecting his fencing which he uses to control the sheep from wandering about, thus increasing the risk of losing the stock and their exposure to theft. To alleviate this impact, farms that will be affected by the construction of the power line must practice strict access control, and rules made by the farmers regarding access to their properties must also be adhered to.

Regarding the power line alternatives, the most preferred alternative would be the option that affects the least farm portions and is also the shortest, as this reduces the level of risk and exposure (in terms of time) of farmers to crime-related activities such as burglaries and livestock theft, whilst the least preferred option would be the alternative that affects the most farms. In the case of the proposed facility, the route that affects the least farm portions and by coincidence is also the shortest route is corridor option 3. However, although option 3 affects the least farms and is also the shortest route, it also directly cuts across four farms, which is in this case used as a proxy to determine the extent of the landowners' exposure to life-threatening occurrences. Due to this, option 3 will most probably result in a low-medium impact to landowners and will therefore be listed as the preferred option (which highlights that the alternative will result in a low impact).

With respect to the on-site and linking substation alternatives, no differentiation can be made as the impact will remain the same despite the alternative chosen.

- **Impact 3: Impact on the sense of place**

According to the plans of the project proponent regarding the development of the substations as well as the erection of the power lines, the connection of the wind turbines will require the use of buried medium voltage cables except where a technical assessment of the proposed design suggests overhead lines as the more appropriate option. Overhead lines often make more sense over rivers and gullies. As such, where overhead lines are required, the use of H-pole tower types will be used.

In light of the above, the proposed power lines and substations can be expected to result in a change in the sense of place in the area. This is mostly because the infrastructural components mentioned above, as well as the construction of internal access roads, temporary construction laydown areas, administration and maintenance buildings, will all be built in an area that is relatively undeveloped and will further increase the development footprint of the project. Although this is the case, the establishment of other proposed renewable energy facilities in the vicinity makes it reasonable to assume the future presence of similar power lines. Currently, two (2) wind farms and one (1) solar PV plant have been approved under the RE IPPPP whilst four (4) other projects (three wind farms and one solar PV plant) have received environmental authorisation whilst an additional six (6) projects (all wind farms) are currently at the environmental impact assessment (EIA) stage (including the !Xha Boom wind farm energy facility). Therefore, considering the presence of other proposed facilities, regardless of their current status of development, the landscape of the area is most likely to change significantly. However, in view of the nature of the proposed developments, none of them will alter the landscape to such an extent of completely affecting the current land-use of the area, which is predominantly commercial sheep farming, or alter the rural nature of the locality.

During the interviews with the I&APs, only one farm owner (Portion 2 of Farm Karree Doorn Pan no. 214) expressed a preference that the chosen power line alternative rather follow his farm boundary on the northerly side (power line corridor option 4) as opposed to the farm boundary along the west (power line corridor option 2). The reason for the preference toward option 4 is because the farm boundary on the west (which is corridor option 2) has a bushveld which is of notable importance to the farmer. This farmer's particular concern also stemmed from the fact that Eskom already has a servitude running across his farm.

In light of the envisaged changes to the landscape as well as the concerns raised, the impact of the proposed 132 kV power line and 132 kV substations is expected to be negligible.

From the outlook of the erection of the power line route options, only route options 1 and 2 are equally acceptable. This is so because although option 3 affects the least farms, it directly cuts across four (4) of the farm properties. While option 4 affects the most properties, it is also the only option that follows the route of a regional road for about 10km whilst also cutting across the farm portion with the currently under construction Khobab wind farm. Based on this information, there is no differentiation between options 3 and 4 as they are both associated with a higher impact on the sense of place.

- **Impact 4: Impact on service infrastructure**

Considering that the whole aim of the proposed substations and power line erection is to feed electricity generated at the wind farm into the national electricity grid, the establishment of these facilities will assist in increasing the capacity of the national grid. Accompanying benefits of the connection of the proposed facility to the national grid also includes the simultaneous greening of the economy (through the reduction of the use of coal for electricity production) whilst strengthening the national supply of electricity.

The impact will be the same regardless of the power line route chosen and substation alternatives; thus, no preference between these alternatives can be determined.

8 ENVIRONMENTAL IMPACT ASSESSMENT

8.1 Methodology for Impact Assessment

The BA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

8.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 33**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

8.1.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

- **Rating System Used To Classify Impacts**

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 32: Description

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.

3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects

2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY/ MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.

6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 33: Rating of impacts

IMPACT TABLE FORMAT	
Environmental Parameter	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water
Issue/Impact/Environmental Effect/Nature	A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota. The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water
Extent	A brief description indicating the chances of the impact occurring
Probability	A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity
Reversibility	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost
Duration	A brief description of the amount of time the proposed activity is likely to take to its completion
Cumulative effect	A brief description of whether the impact will be exacerbated as a result of the proposed activity
Intensity/magnitude	A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily

IMPACT TABLE FORMAT		
Significance Rating	A brief description of the importance of an impact which in turn dictates the level of mitigation required	
	Pre-mitigation impact rating	**Post mitigation impact rating**
	Pre-mitigation impact rating	
Extent	1	4
Probability	1	4
Reversibility	1	4
Irreplaceable loss	1	4
Duration	1	4
Cumulative effect	1	4
Intensity/magnitude	2	2
Significance rating	-12 (low negative)	-48 (medium negative)
Mitigation measures	*Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analysing the significance. These measures will be detailed in the EMPr.*	

The 2014 EIA regulations also specify that alternatives must be compared in terms of impact assessment.

8.2 Environmental Impact Assessment

8.2.1 Biodiversity

- Planning

No impacts are expected during planning.

- Construction

Table 34: Impacts on vegetation and protected plant species

Impact 1. Impacts on vegetation and protected plant species	
Environmental Parameter	Vegetation and protected plant species
Issue/Impact/Environmental Effect/Nature	Vegetation clearing for powerline, access roads and substations will impact on vegetation and protected plant species.
Extent	The extent of the impact will be restricted to the grid connection footprint and as such would be local in nature.

Impact 1. Impacts on vegetation and protected plant species		
Probability	This impact will definitely occur as vegetation clearing will be required for the construction and establishment of the project.	
Reversibility	This impact is not highly reversible as it would take a long time for any cleared areas to return to their former state and rehabilitation of arid environments is very difficult.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources.	
Duration	The construction phase itself will be of short duration, but the resulting impact would persist for a long time.	
Cumulative effect	The clearing would contribute to vegetation impacts in the area, the contribution of the grid connection development itself would be low, but as there are several facilities in the area, the cumulative impact would be moderate at the local level, but low at a broader scale.	
Intensity/magnitude	The intensity of the impact would be low as the extent of the footprint to be cleared is limited and localised.	
Significance Rating	Without mitigation, this impact would be of low significance, but with avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-28 (low negative)	-13 (very low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Placement of pylons and other infrastructure within the High Sensitivity areas and drainage lines should be avoided. 2) Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are avoided where possible. 3) Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible. 4) Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.	

Impact 1. Impacts on vegetation and protected plant species	
	5) Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. 6) Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However caution should be exercised to avoid using material that might entangle fauna.

Table 35: Impacts on fauna due to construction phase activities

Impact 2. Impacts on fauna during construction		
Environmental Parameter	Faunal impacts due to construction activities	
Issue/Impact/Environmental Effect/Nature	Vegetation clearing, the use of heavy machinery and human presence during construction is likely to negatively affect resident fauna during construction.	
Extent	The extent of the impact will be restricted the site and as such would be local in nature.	
Probability	This impact is likely to occur and some impact is certain to occur.	
Reversibility	Noise and disturbance is largely reversible but habitat loss due to transformation of intact habitat is not considered easily reversible.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources in terms of fauna.	
Duration	The construction phase itself will be of relatively short duration.	
Cumulative effect	The clearing would contribute to cumulative habitat loss for fauna in the area, but this would be largely local in nature and limited in extent.	
Intensity/magnitude	The intensity of the impact would be moderate to low.	
Significance Rating	Construction phase impact would be of relatively short duration (2 years) but of low to moderate intensity. Overall significance is likely to be low before mitigation and very low thereafter.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	2

<table>
<tr><th colspan="3">Impact 2. Impacts on fauna during construction</th></tr>
<tr><td>Cumulative effect</td><td>2</td><td>1</td></tr>
<tr><td>Intensity/magnitude</td><td>2</td><td>1</td></tr>
<tr><td>Significance rating</td><td>-24 (low negative)</td><td>-20 (low negative)</td></tr>
<tr><td>Mitigation measures</td><td colspan="2">Mitigation measures to reduce residual risk or enhance opportunities:
1) Pre-construction walk-through of the substation and powerline sites to identify areas of faunal sensitivity.
2) During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
3) Any trenches that are required for cabling etc., should not be left open for extended periods as fauna such as tortoises will fall in an become trapped. Any open trenches should be checked regularly for trapped fauna.
4) The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
5) No fires should be allowed within the site as there is a risk of runaway veld fires.
6) No fuelwood collection should be allowed on-site.
7) No dogs or cats should be allowed on site apart from that of the landowners.
8) If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards.
9) All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
10) No unauthorized persons should be allowed onto the site and site access should be strictly controlled
11) All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares.
12) All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and snakes which are often persecuted out of fear or superstition.</td></tr>
</table>

- Operation

Table 36: Increased Erosion Risk

Impact 3. Increased Soil Erosion Risk		
Environmental Parameter	Ecosystem integrity and the delivery of ecosystem services such as grazing and clean water.	
Issue/Impact/Environmental Effect/Nature	Following construction, the site will be vulnerable to soil erosion due to the disturbance created and likely low natural revegetation of disturbed areas.	
Extent	The extent of the impact will be restricted to the grid connection and as such would be local in nature.	
Probability	This impact would be likely to occur due to the disturbance generated during construction.	
Reversibility	Reversibility would be high for mild erosion, but would become increasingly low with increasing severity of erosion.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Duration	The risk of this impact is likely to persist for several years after construction.	
Cumulative effect	Erosion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.	
Intensity/magnitude	The intensity of the impact would be low as the site is not considered highly vulnerable to erosion.	
Significance Rating	Without mitigation, this impact would be of moderate to low significance, but with avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-24 (low negative)	-10 (very low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. 2) All hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.	

Impact 3. Increased Soil Erosion Risk	
	3) Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. 4) All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 5) All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.

Table 37: Alien plant invasion risk

Impact 4. Alien Plant Invasion		
Environmental Parameter	Biodiversity, ecosystem integrity and the delivery of ecosystem services such as forage.	
Issue/Impact/Environmental Effect/Nature	Following construction, the site will be vulnerable to alien plant invasion due to disturbance.	
Extent	The extent of the impact will be restricted the powerline and substation sites and as such would be local in nature.	
Probability	This impact would be likely to occur as there are already some alien species at the site and these would be likely to increase in response to disturbance.	
Reversibility	Reversibility would be high for mild infestation, but would become increasingly low with extensive invasion.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Duration	This impact is likely to persist for several years after construction.	
Cumulative effect	Alien invasion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.	
Intensity/magnitude	The intensity of the impact would be low as the site is not considered highly vulnerable to invasion.	
Significance Rating	With avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2

Impact 4. Alien Plant Invasion		
Irreplaceable loss	2	2
Duration	3	2
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-24 (Low negative)	-10 (very low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2) Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the sites and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled. 3) Regular monitoring for alien plants within the development footprint should be carried out. 4) Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	

- Decommissioning

Table 38: Impacts on fauna due to decommissioning phase activities

Impact 5. Impacts on fauna during decommissioning	
Environmental Parameter	Faunal impacts due to decommissioning activities
Issue/Impact/Environmental Effect/Nature	Fauna will be negatively affected by the decommissioning of the grid connection due to the human disturbance, the presence and operation of vehicles and heavy machinery on the site and the noise generated.
Extent	The extent of the impact will be restricted the site and as such would be local in nature.
Probability	This impact is likely to occur to some degree.
Reversibility	Noise and disturbance would be of relatively short duration and are considered reversible.
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources in terms of fauna.
Duration	This impact would be transient and persist for the active decommissioning period only.

Impact 5. Impacts on fauna during decommissioning		
Cumulative effect	There would be transient contribution to cumulative disturbance impacts, but this would cease after decommissioning and ultimately if decommissioned, the impacts associated with the development would largely cease.	
Intensity/magnitude	The intensity of the impact would be moderate.	
Significance Rating	This impact would occur at a moderate intensity but would be transient in nature and overall significance is likely to be moderate before mitigation and low thereafter.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	-20 (low negative)	-18 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities. 2) All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. 3) All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. 4) No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped. 5) All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the decommissioning and recycling plan, and as per the agreements with the land owners concerned.	

Table 39: Increased Erosion Risk due to Decommissioning

Impact 6. Increased Soil Erosion Risk		
Environmental Parameter	Ecosystem integrity	
Issue/Impact/Environmental Effect/Nature	Following decommissioning, the site will be vulnerable to soil erosion due to the disturbance created by the removal of infrastructure from the site.	
Extent	The extent of the impact will be restricted the powerline and substation sites and as such would be local in nature.	
Probability	This impact would be likely to occur due to the large amount of disturbance generated during decommissioning.	
Reversibility	Reversibility would be high for mild erosion, but would become increasingly low with increasing severity of erosion.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Duration	This impact is likely to persist for several years after decommissioning.	
Cumulative effect	Erosion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.	
Intensity/magnitude	The intensity of the impact would be low as the site is not considered highly vulnerable to erosion and is limited in extent.	
Significance Rating	Without mitigation, this impact would be of moderate significance, but with avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-24 (low negative)	-9 (very low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.	

Impact 6. Increased Soil Erosion Risk	
	2) All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. 3) All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.

Table 40: Alien plant invasion risk following decommissioning

Impact 7. Alien Plant Invasion		
Environmental Parameter	Ecosystem integrity and diversity.	
Issue/Impact/Environmental Effect/Nature	Following decommissioning, the site will be vulnerable to alien plant invasion due to disturbance	
Extent	The extent of the impact will be restricted to the site and as such would be local in nature.	
Probability	This impact would be likely to occur as there are already some alien species at the site and these would be likely to increase in response to disturbance.	
Reversibility	Reversibility would be high for mild infestation, but would become increasingly low with extensive invasion.	
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources if this impact is managed.	
Duration	This impact is likely to persist for several years after decommissioning.	
Cumulative effect	Alien invasion would contribute to cumulative ecosystem degradation in the area, but with mitigation, this impact can be avoided.	
Intensity/magnitude	The intensity of the impact would be moderate as the site is not considered highly vulnerable to invasion and is limited in extent.	
Significance Rating	Without mitigation, this impact would be of moderate significance, but with avoidance this impact can be reduced to a very low level.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	3	2
Cumulative effect	1	1
Intensity/magnitude	3	2
Significance rating	-33 (medium negative)	-18 (low negative)

Impact 7. Alien Plant Invasion	
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. 2) Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. 3) Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning or until alien invasives are no longer a problem at the site. 4) Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

- Cumulative Impacts

Table 41: Cumulative Impact 1 - Cumulative habitat loss and fragmentation

Impact 8. Cumulative impacts and loss of broad-scale connectivity	
Environmental Parameter	Broad-scale ecological processes, especially habitat fragmentation.
Issue/Impact/Environmental Effect/Nature	Transformation and presence of the development will contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation.
Extent	Should all the developments in the area go ahead, then this would result in a landscape-level impact.
Probability	This impact is likely to occur as some facilities have already been built and some additional habitat loss would occur if the current development proceeds.
Reversibility	This impact would to some degree be reversible when the facilities are decommissioned.
Irreplaceable loss of resources	It is not likely that there would be significant irreplaceable loss of resources.
Duration	This impact would persist for the lifespan of the development.
Cumulative effect	The development would contribute to cumulative impacts on habitat loss and fragmentation in the area, and while the contribution of a single facility would be low, there are several facilities in the area and so overall cumulative impacts are likely to be moderate.

Impact 8. Cumulative impacts and loss of broad-scale connectivity		
Intensity/magnitude	The intensity of the impact would be moderate to low as the area is not sensitive and the overall total footprint is not highly significant.	
Significance Rating	Due to the relatively low contribution of the development and the low overall current level of impact in the area, the significance of this impact is likely to be low.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	3
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-30 (medium negative)	-26 (low negative)
Mitigation measures	Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimise the development footprint within the high sensitivity areas. 2) There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora. 3) All disturbed areas should be rehabilitated with locally occurring shrubs and grasses after construction and decommissioning to reduce the overall footprint of the development.	

8.2.2 Avifauna

- Planning

No impacts are expected during planning.

- Construction

Table 42: Displacement of Red Data species due to disturbance during construction phase

IMPACT TABLE 1	
Environmental Parameter	*Avifauna*
Issue/Impact/Environmental Effect/Nature	*Displacement of Red Data species due to disturbance during **construction** phase*
Extent	*The impact will only affect the site.*

IMPACT TABLE 1	
Probability	*Impact may occur (between a 25% to 50% chance of occurrence) for some species, particularly the larger ones.*
Reversibility	*Partly reversible. The construction activities will inevitably cause temporary displacement of some Red Data species. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, species should re-colonise the areas which have not been transformed by the footprint. However, the indirect effect of habitat fragmentation could result in lower densities of Red Data species.*
Irreplaceable loss of resources	*Marginal loss of resources. The displacement of Red Data species is likely to be partial.*
Duration	*Short term. Once the source of the disturbance has been removed, i.e. the noise and movement associated with the construction activities, Red Data species should re-colonise the areas which have not been transformed by the footprint, albeit possibly at a lower density.*
Cumulative effect	*Minor cumulative impact. The Red Data species that occur (or are likely to occur) at the proposed site all have large distribution ranges, the cumulative impact of displacement would therefore be at most locally significant in some instances, rather than regionally or nationally significant (see also Section 11 below).*
Intensity/magnitude	*Medium. Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.*
Significance Rating	*Low significance.*

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-22 (low negative)	-9 (low negative)
Mitigation measures	▪ Restrict the construction activities to the construction footprint area. ▪ Do not allow any access to the remainder of the property during the construction period. ▪ Measures to control noise and dust should be applied according to current best practice in the industry.	

IMPACT TABLE 1	
	▪ Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ Ideally, Corridor 1 or 3 should not be used as the two (2) corridors pose a disturbance risk to an active Martial Eagle nest. ▪ A 1.2km exclusion zone should be implemented around the active Martial Eagle nest on the Aries – Helios 400kV line at -30.517644°; 19.550840° in the powerline study area where no construction activity or disturbance should take place, in the event of Corridor 1 or 3 being implemented.

Table 43: Displacement of Red Data species due to habitat destruction during construction phase

IMPACT TABLE 2		
Environmental Parameter	*Avifauna*	
Issue/Impact/Environmental Effect/Nature	*Displacement of Red Data species due to habitat destruction during **construction** phase*	
Extent	*The impact will only affect the site.*	
Probability	*Impact may occur (between a 25% to 50% chance of occurrence) for some species, particularly the larger ones.*	
Reversibility	*Partly reversible. The footprint of the powerline is an inevitable result of the development, but it is likely that Red Data species will still utilise the site.*	
Irreplaceable loss of resources	*Marginal loss of resources. It is likely that Red Data species will still utilise the site.*	
Duration	*Long term. The habitat transformation will be permanent in the footprint of the poles.*	
Cumulative effect	*Moderate cumulative impact. There are several renewable energy developments planned around Loeriesfontein which could result in a significant area of transformed habitat, but only at a local scale, for some species (see also Section 11 below).*	
Intensity/magnitude	*Medium. It is likely that Red Data species will still utilise the site.*	
Significance Rating	*Low significance.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3

IMPACT TABLE 2		
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-13 (low negative)
Mitigation measures	▪ The recommendations of the specialist ecological study must be strictly adhered to, especially as far as rehabilitation of vegetation is concerned. ▪ Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

- Operation

Table 44: Collisions of Red Data species with the powerline in the operational phase

IMPACT TABLE 5		
Environmental Parameter	*Avifauna*	
Issue/Impact/Environmental Effect/Nature	*Collisions of Red Data species with the powerline in the operational phase*	
Extent	*The impact will affect the local area or district*	
Probability	*Probable. The impact will likely occur (between 50% - 75% chance of occurrence).*	
Reversibility	*Partly reversible. Mitigation measures could reduce the risk of collisions, but not significantly as far as bustards are concerned.*	
Irreplaceable loss of resources	*Significant loss of resources.*	
Duration	*Long term. The risk of collision will be present for the life-time of the development.*	
Cumulative effect	*Moderate cumulative impact. The cumulative impact will depend largely on which species are killed. Depending on the number of Ludwig's Bustards that are killed, the regional impact could be significant (see also Section 11 below).*	
Intensity/magnitude	*Medium. The powerline could cause mortality of some Red Data species.*	
Significance Rating	*High significance.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	3	3
Irreplaceable loss	3	3
Duration	3	3
Cumulative effect	3	3

IMPACT TABLE 5		
Intensity/magnitude	3	3
Significance rating	-51 (high negative)	-48 (medium negative)
Mitigation measures	▪ The powerline should be marked with BFDs for its entire length on the earth wire of the line, 5m apart, alternating black and white. See Appendix D of the Avifauna Impact Assessment Report for the type of BFD which is recommended.	

8.2.3 Surface Water

- Planning / Pre-construction

No impacts are expected during the planning / pre-construction phase.

- Construction

Table 45: Potential Construction Impacts to Surface Water Resources Habitat

IMPACT TABLE		
Environmental Parameter	Major / Minor Drainage Lines and Wetlands	
Issue/Impact/Environmental Effect/Nature	Impacts associated with the degradation of drainage line and wetland habitat	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 42 (medium negative)	- 26 (low negative)

Mitigation measures	**Designation of Highly Sensitive Areas** The wetlands and drainage lines must be designated as "highly sensitive" and any impact must be limited to the minimum possible extent. All wetlands and drainage lines to be directly affected must be visibly demarcated prior to construction activities taking place. The demarcation of wetlands and drainage lines must be visible and last for the duration of the construction activities. **Avoidance of Direct Impacts due to Surface Water Resources** The construction lay-down area must not be situated directly within or within a proximity of 500m from any wetlands and / or drainage lines or within a 100m from any major drainage lines adhering to the stipulated buffer zones. The potential future access / service roads must be planned to route around and not directly through surface water resources as far as practically possible. Where this is not possible, a Right of way (RoW) will need to be established. **Establishment of Internal Road Access Areas** For general access to erect the pylons for the grid line, existing roads are to be used as far as possible. No roads are to be routed through any wetlands and / or drainage lines (including buffer zones) as far as practically possible. Where this is not possible however, and where no other access exists to the desired construction areas, environmental authorisation and a water use license will be required before construction takes place and all mitigation measures are to be implemented accordingly. A single access route or internal road access area is then to be established before construction takes place, if required. This should be planned to cross perpendicularly through any drainage line(s). For wetlands, the internal road access area must be planned for minimal impact on wetlands (i.e. shortest route, not routed through the core of the wetlands, minimal destruction of habitat etc.). The access route should follow existing routes where present. However, where new routes are to be established, temporary or permanent Ford (or low-water) crossings and/or similar design crossings using the stream / wetland bed as part of the road can be established. Temporary ford crossings and / or similar

	design crossings can be planned where construction vehicles need to access proposed construction areas during construction the construction phase only. Where the access route will form part of permanent access and / or service roads, permanent ford crossings and / or similar design crossings will however be required. Given the study area, and the temporary nature of surface water resources to be potentially affected, this design should be adequate since it enables hydrological continuity of the identified temporary surface water resources, maintains substrate continuity as well as allows movement of riparian and wetland bound species. To establish a temporary ford crossing, little to no modification of the stream banks or wetland will be required where banks are low (approximately 1,2m) for drainage lines or topography is flat for wetlands, where the grade or approach to the drainage line does not exceed 5:1 (horizontal to vertical) and lastly, where the stream bed is firm rock or gravel. Ideally, fords and / or similar design crossings should maintain the natural shape and elevation of the drainage line(s) and / or wetland(s). However, where modification is required, the banks and bed will have to be reinstated after construction has finished. Modifications to the banks may include limited grading, excavation of steep slopes, establishment of clean gravel approach to drainage line and wetland banks, placement of road base, etc. Such modifications are likely to be required for crossings through surface water resources with soft substrate. To establish the temporary bed crossing, use of materials to construct temporary mats made of wood or tyres can be used. Modifications will however need to be approved from the relevant environmental and water regulatory authorities prior to construction. For permanent ford crossings and / or similar design crossings, rock or gravel may be used on weak drainage line and / or wetland beds. The weak substrate layer will need to be excavated an infilled by the rock or gravel material to the same level of the original drainage line or wetland bed. A minimum of approximately 30cm of infill should typically be used unless soil depth is limited. A geotextile can be used to separate the infill from the bed of the surface water resource thereby providing additional support.

	Where other designs are more appropriate and these can be implemented, this is to be on approval from the relevant environmental and water regulatory authorities prior to construction. In general, the width of the internal access road areas must be limited to the width of the vehicles required to move through the relevant surface water resource(s). The internal access road areas must be made clearly visible by means of demarcation during construction. Ideally, for temporary ford crossings, vegetation should not be totally cleared across the entire internal access road areas. Rather, only the vehicle tracks should be cleared. Remaining vegetation can be kept trimmed to below 20cm but not lower than 5cm in height. Trees or shrubs may however require removal. Permits must be obtained where sensitive or protected vegetation species are to be removed. Preferably, these should be relocated. Erosion inspections will need to be undertaken regularly (as often as environmental compliance monitoring is undertaken by a suitably qualified Environmental Compliance Officer (ECO) during the construction phase, and monthly during the operation phase) in order to manage the integrity of the temporary and permanent ford crossings and / or similar design crossings. Additionally, rehabilitation will need to take place if and where required. Overall, no wetlands and or drainage lines are to be crossed during or directly after a rainfall event. Use of internal road access areas are only permissible after rainfall events once flows have ceased. Preferably light vehicles are to be utilised where possible and the usage of heavy vehicles must be avoided as far as possible. Where heavy vehicles (such as TLB's) must be used, extreme caution is to be exercised when entering the internal road access areas of the wetland and drainage lines due soil instability factors. Construction workers are only allowed in the designated internal road access areas maintenance areas. Any personnel traversing through the wetlands and / or drainage

	lines must be instructed not to light any fires, and / or remove any vegetation. **Control of Alien and Invasive Vegetation in Surface Water Resources** Control of alien and invasive vegetation within surface water resources will be required. Where alien and invasive vegetation encroachment / colonization takes place, these areas are to be cleared as soon as practically possible. Clearing should take place by means of mechanical removal, either by physically pulling or slashing and clearing of unwanted alien and invasive vegetation near or within the surface water resources. Monitoring of alien and invasive vegetation should be undertaken in accordance with the environmental compliance monitoring during the construction phase. **Emergency Measures** Operational fire extinguishers are to be available in the case of a fire emergency. Given the dry seasons and variable winds that the region experiences, it is recommended that a fire management and emergency plan is compiled. A suitably qualified health and safety officer must compile the fire management and emergency plan for the operation and maintenance phase of the project. **Post-construction Rehabilitation** Rehabilitation of the internal road access areas that will not be used as service roads for maintenance activities following the construction period will be required post-construction. Ideally, the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion until vegetation has re-established where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped to the pre-existing natural state. **Buffer Zone Specific Mitigation Measures** During construction activities, the outer extent of the buffer zones of the wetlands and drainage lines must be designated as "sensitive" and any impact must be limited to

	the minimum possible extent. The buffer zone extent must be visibly demarcated prior to construction activities taking place where construction is directly within the buffer zone. The demarcation of the buffer zones must be visible and last for the duration of the construction activities. See above for same internal road access areas mitigation measures to be implemented within buffer zones.

Table 46: Potential Construction Impacts to the Geomorphology of the Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Major / Minor Drainage Lines and Wetlands	
Issue/Impact/Environmental Effect/Nature	Impacts associated with the degradation of the soils associated with the drainage lines and wetlands	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 42 (medium negative)	- 26 (low negative)
Mitigation measures	**General Mitigation Measures** Apply same mitigation measures stipulated in **Section 8.1.1** of the Surface Water Impact Assessment Report in terms of the following: ▪ Designation of Highly Sensitive Areas; ▪ Establishment of Internal Road Access Areas; ▪ Avoidance of Direct Impact to Surface Water Resources ▪ Emergency Measures; ▪ Post-construction Rehabilitation; and ▪ Buffer Zone Specific Mitigation Measures.	

	Preventing Increased Run-off, Erosion and Sedimentation Impacts – Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future. In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to prevent erosion in susceptible construction areas. Erosion control management will need to be undertaken at the onset of construction. Regular monitoring and adequate erosion preventative measures (such as run-off protection as stipulated above) are to be implemented as and where required.

Table 47: Potential Construction Impacts to the Soil and Water Contamination Impacts to Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Major / Minor Drainage Lines and Wetlands	
Issue/Impact/Environmental Effect/Nature	Impacts associated with the contamination of the soils and water associated with the drainage lines and wetlands	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3

Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 42 (medium negative)	- 26 (low negative)
Mitigation measures	**General Mitigation Measures** Apply same mitigation measures stipulated in **Section 8.1.1** of the Surface Water Impact Assessment Report above in terms of the following: ▪ Designation of Highly Sensitive Areas; ▪ Establishment of Internal Road Access Areas; ▪ Avoidance of Direct Impact to Surface Water Resources; ▪ Emergency Measures; ▪ Post-construction Rehabilitation; and ▪ Buffer Zone Specific Mitigation Measures. **Preventing Soil and Water Contamination** No vehicles are to be allowed in the highly sensitive and sensitive areas unless authorised. Should vehicles be authorized in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. Should there be any oil, fuel or any other fluid leaks, vehicles and machinery are not to be allowed into any drainage sensitive and highly sensitive areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive and sensitive areas. Sufficient spill contingency measures must be available throughout the construction process. These include, but are not limited to, oil spill kits to be available and fire extinguishers. Storage areas for fuel, oil, paints and other hazardous substance are not to be stored directly within surface water resources or the associated buffer zones. These substances must also be contained in bunded areas with a capacity of at least 110%. No “long drop” toilets are allowed on the construction site. Suitable temporary chemical sanitation facilities are to be	

	provided. Temporary chemical sanitation facilities must not be placed directly within any surface water resource(s) or the associated buffer zones. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills. No cement mixing is to take place in any surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the highly sensitive and sensitive areas.

Table 48: Potential Construction Impacts to the Fauna associated with Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Major / Minor Drainage Lines and Wetlands	
Issue/Impact/Environmental Effect/Nature	Impacts to fauna associated with drainage lines and wetlands	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be reduced to an even lower level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 22 (low negative)	- 6 (low negative)
Mitigation measures	**Preventing Impacts to Fauna Associated with Drainage lines and Wetlands** No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten by construction workers or any	

	other project team members. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed Environmental Control Officer (ECO) or suitably qualified individual may only remove animals, where such animals (including snakes, scorpions, spiders etc.) are a threat to construction workers. The ECO or appointed individual is to be contacted should removal of any fauna be required during the construction phase. Animals that cause a threat and need to be removed, may not be killed. Additionally, these animals are to be relocated outside the RoW or construction areas, within relative close proximity where they were found.

- Operation

Table 49: Impacts to the Geomorphology of Surface Water Resources

IMPACT TABLE		
Environmental Parameter	Major / Minor Drainage Lines and Wetlands	
Issue/Impact/Environmental Effect/Nature	Impacts associated with the geomorphological and hydrological impacts associated with the drainage lines and wetlands	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low level.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 45 (medium negative)	- 24 (low negative)

Mitigation measures	**Minimising Vehicle Damage to the Surface Water Resources** Potential impacts can be avoided by planning and routing of access / service roads outside of and away from all surface water resources and the associated buffer zones. Where access through surface water resources are unavoidable and are absolutely required, it is recommended that any road plan and associated structures (such as ford crossings, stormwater flow pipes, culverts, culvert bridges etc.) be submitted to the relevant environmental and water departments for approval prior to construction. Internal access and services roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every month. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified. Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified wetland / aquatic specialist must be obtained in this respect should this be required. Control of erosion on the construction site in general must be managed through implementation of an erosion management plan. Erosion and subsequent sedimentation of surface water resources are considered significant impacts in terms of the proposed development that must be managed adequately throughout the operation of the proposed development.

- Decommissioning

Should the proposed development need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Similar impacts are therefore expected to occur and the stipulated mitigation measures where relevant and appropriate must be employed as appropriate to minimise impacts.

8.2.4 Soils and Agricultural Potential

- Planning

No impacts are expected during planning.

- Impacts associated with all phases of the development - Construction, Operation and Decommissioning

Table 50: Loss of Agricultural Land Use (Grazing)

Environmental parameter: agricultural land (grazing)		
Impact 1: Loss of agricultural land use, caused by direct occupation of land by footprint of development infrastructure and having the effect of taking affected portions of land out of agricultural production (grazing). This applies only to the direct footprint of the development which comprises pylon bases and substations. This represents only an insignificant proportion of the land surface area. During the construction phase there is somewhat more disturbance due to construction activities.		
	Pre-mitigation	**Post-mitigation**
Extent	1 Site	n/a
Probability	4 Definite	n/a
Reversibility	2 Partly reversible	n/a
Irreplaceable loss	2 Marginal	n/a
Duration	3 Long term	n/a
Cumulative effect	1 Negligible	n/a
Intensity	1 Low	n/a
Significance	13 Low negative	n/a
Mitigation measures: none possible		

Table 51: Erosion due to alteration of the land surface run-off characteristics

Environmental parameter: soil
Impact 2: Erosion 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, and the establishment of roads. Erosion will cause loss and deterioration of soil resources. Risk of

water erosion is low, but the area is susceptible to wind erosion. Electricity grid infrastructure has a low surface disturbance impact and therefore little erosion impact is expected.		
	Pre-mitigation	**Post-mitigation**
Extent	1 Site	1 Site
Probability	2 Possible	1 Unlikely
Reversibility	2 Partly reversible	2 Partly reversible
Irreplaceable loss	2 Marginal	2 Marginal
Duration	3 Long term	3 Long term
Cumulative effect	1 Negligible	1 Negligible
Intensity	1 Low	1 Low
Significance	11 Low negative	10 Low negative
Mitigation measures: ▪ 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. This should be in place and maintained during all phases of the development. ▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize the soil against erosion.		

- Impacts associated with the construction phase of the development

Table 52: Loss of topsoil caused by poor topsoil management during construction related soil profile disturbance

Environmental parameter: soil		
Impact 3: Loss of topsoil caused by poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (excavations, disposal of spoils from excavations etc.) and having the effect of loss of soil fertility on disturbed areas after rehabilitation. The very low proportion of surface area that is likely to be impacted, reduces the significance of this impact.		
	Pre-mitigation	Post-mitigation
Extent	1 Site	1 Site
Probability	2 Possible	1 Unlikely
Reversibility	2 Partly reversible	2 Partly reversible
Irreplaceable loss	2 Marginal	2 Marginal
Duration	3 Long term	3 Long term
Cumulative effect	1 Negligible	1 Negligible

Intensity	1 Low	1 Low
Significance	11 Low negative	10 Low negative
Mitigation measures: ▪ 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.		

Table 53: Degradation of veld vegetation beyond the direct development footprint caused by trampling due to vehicle passage, and deposition of dust

Environmental parameter: veld vegetation (grazing)		
Impact 4: Degradation of veld vegetation beyond the direct development footprint caused by trampling due to vehicle passage, and deposition of dust.		
	Pre-mitigation	Post-mitigation
Extent	1 Site	1 Site
Probability	2 Possible	1 Unlikely
Reversibility	2 Partly reversible	2 Partly reversible
Irreplaceable loss	2 Marginal	2 Marginal
Duration	2 Medium term	2 Medium term
Cumulative effect	1 Negligible	1 Negligible
Intensity	1 Low	1 Low
Significance	10 Low negative	9 Low negative
Mitigation measures: ▪ Minimize road footprint and control vehicle access on approved roads only. ▪ Control dust as per standard construction site practice.		

Table 54: Impact on Air Quality due to Dust Generation

Environmental parameter: air quality
Impact 5: Dust generation is likely to result from disturbance of surface and surface vegetation cover, and consequent exposure to wind erosion. Dust has a negative impact on surrounding veld vegetation, animals and humans. Electricity grid infrastructure has a low surface disturbance impact and therefore little dust impact is expected.

	Pre-mitigation	Post-mitigation
Extent	1 Site	1 Site
Probability	2 Possible	1 Unlikely
Reversibility	2 Partly reversible	2 Partly reversible
Irreplaceable loss	2 Marginal	2 Marginal
Duration	2 Medium term	2 Medium term
Cumulative effect	1 Negligible	1 Negligible
Intensity	1 Low	1 Low
Significance	10 Low negative	9 Low negative
Mitigation measures: ▪ Control dust as per standard construction site measures which may include damping down with water or other appropriate and effective dust control measures. Maintain, where possible, all vegetation cover and facilitate re-vegetation of denuded areas throughout the site.		

Table 55: Soil contamination

Environmental parameter: soil		
Impact 6: Soil contamination can occur from hydrocarbon spillages from construction activities. The very low proportion of surface area that is likely to be impacted and its low consequence for farming activities, reduces the significance of this impact.		
	Pre-mitigation	Post-mitigation
Extent	1 Site	1 Site
Probability	2 Possible	1 Unlikely
Reversibility	2 Partly reversible	2 Partly reversible
Irreplaceable loss	2 Marginal	2 Marginal
Duration	2 Medium term	2 Medium term
Cumulative effect	1 Negligible	1 Negligible
Intensity	1 Low	1 Low
Significance	10 Low negative	9 Low negative
Mitigation measures: ▪ Implement effective spillage and waste management system.		

8.2.5 Heritage and Palaeontology

The proposed WEF layout in relation to the identified heritage resources is shown in **Figure 70**.

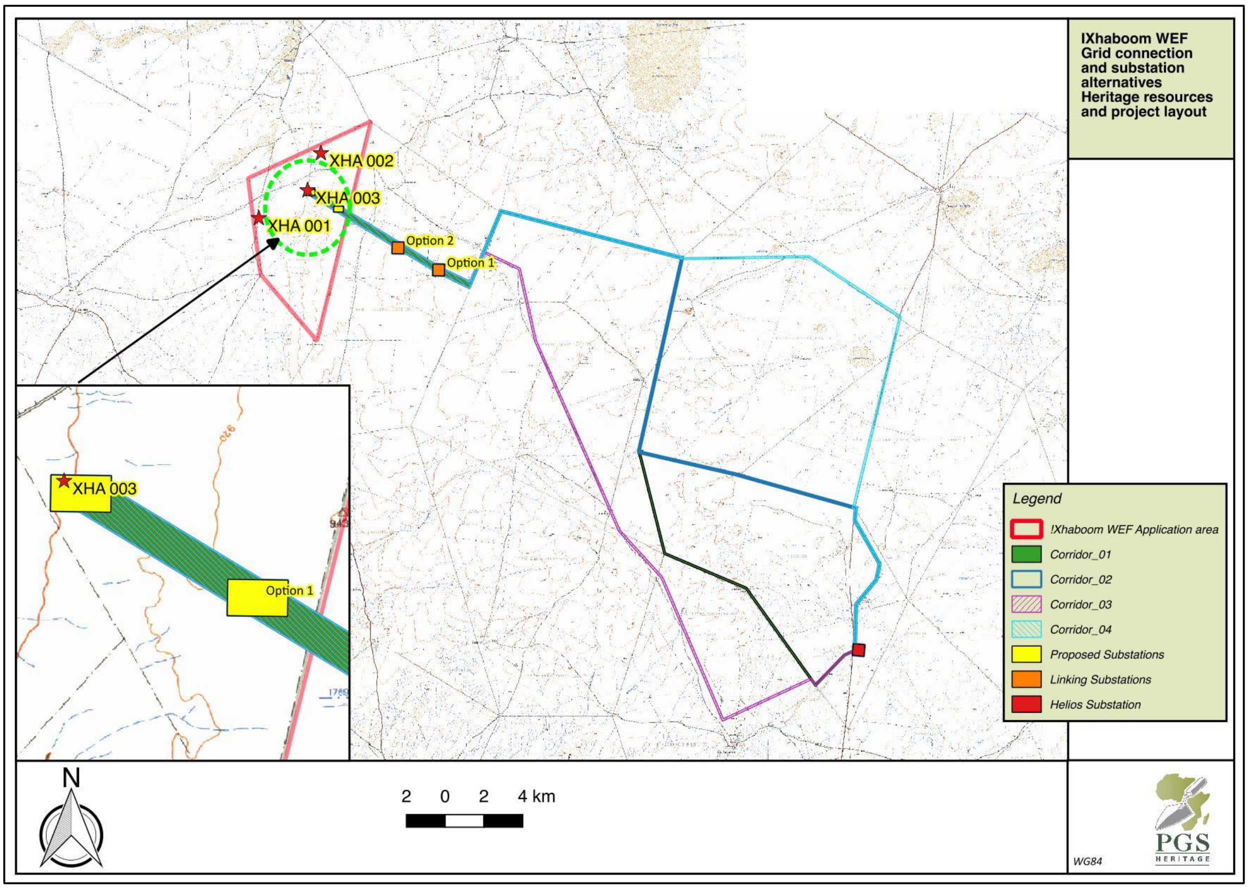

Figure 70: Proposed !Xha Boom WEF grid connection and substation alternatives in relation to the identified heritage resources

The impact rating and analysis was done based on the methodology as explained and summarised in Appendix C of the Heritage Impact Assessment Report. The design process and methodology followed by the developer for this project has enabled the heritage assessment to provide input into the proposed layouts. This resulted in cognisance being taken of the positions of the heritage resources and thus the reduction of impacts at an early design phase. Analysis of the impact matrix tables reflect this fact.

Only one (1) low significance heritage resources are affected by the proposed grid connection or substation alternatives and the following impact assessment tables are based on this fact.

- Planning

No impacts are expected during planning.

- Construction

Table 56: Palaeontology

IMPACT TABLE	
Environmental Parameter	*Impact on the Palaeontology Heritage (fossils) of the development footprint*
Issue/Impact/Environmental Effect/Nature (E)	The excavations and site clearance during the construction phase will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. This impact is likely to occur only during the construction phase. No impacts are expected to occur during the operation phase.
Extent	The Leeuwberg Wind Farm project area will be located approximately 62km north of Loeriesfontein, in the Khai-ma and Hantam Local Municipalities within the Northern Cape Province. *A brief description of the area over which the impact will be expressed*
Probability	The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal mudrocks of the lower part of the Ecca Group (Karoo Supergroup). Permian and Jurassic bedrocks are mantled with a range of superficial deposits, mostly Late Caenozoic (Quaternary to Recent) in age. The intrusive Karoo dolerites are of no palaeontological significance and the Late Caenozoic superficial deposits are generally of very low palaeontological sensitivity. The probability of significant impacts on palaeontological heritage during the construction phase is low.
Reversibility	Impacts on fossil heritage are generally irreversible. Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category. *Fossil Heritage is expected and* fossils other than trace assemblages are generally scarce and most of the Ecca sediments are of low overall palaeontological sensitivity.
Irreplaceable loss of resources	The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal mudrocks of the lower part of the Ecca Group and is rated as insignificant loss of resources
Duration	The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures

	(should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent	
Cumulative effect	Low Cumulative Impact The cumulative effect of the development area within the proposed location is considered to be low. The broader area near Loeriesfontein is underlain by the Dwyka, Lower Ecca, Karoo Dolerite and Late Caenozoic deposits. Karoo Dolerite is unfossiliferous while the fossil sensitivity in the Caenozoic is low. Fossils other than trace assemblages are generally scarce and most of the Ecca and Dwyka sediments are of low overall palaeontological sensitivity.	
Intensity/magnitude	Probable significant impacts on palaeontological heritage during the construction phase are high, but the intensity of the impact on fossil heritage is rated as low	
Significance Rating	*A brief description of the importance of an impact which in turn dictates the level of mitigation required*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	4	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-28 (low negative)	-6 (low negative)
Mitigation measures	Recommended mitigation of the inevitable damage and destruction of fossil within the proposed development area would involve the surveying, recording, description and collecting of fossils within the development footprint by a professional palaeontologist. This work should take place after initial vegetation clearance has taken place but *before* the ground is levelled for construction Impacts on fossil heritage are generally irreversible. Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category. Not deemed necessary as the Allanridge Formation is unfossiliferous.	

Table 57: Heritage Resources

IMPACT TABLE		
Environmental Parameter	Heritage resources	
Issue/Impact/Environmental Effect/Nature	Heritage Resources have been identified during the fieldwork having low archaeological significance. All the identified find spots could be impacted by construction activities however the impact is seen as negligible.	
Extent	Localised	
Probability	Probable	
Reversibility	Non- renewable.	
Irreplaceable loss of resources	Archaeological sites are irreplaceable	
Duration	Permanent	
Cumulative effect	Low cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	Negative medium impact before mitigation and low negative after mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-40 (medium negative)	-16 (low negative)
Mitigation measures	▪ A walk down of the final layout to determine if any significant sites will be affected. ▪ Monitor find spot areas, by a qualified archaeologist, if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by practitioner qualified archaeologist during the construction phase.	

Table 58: Chance Finds

IMPACT TABLE

Environmental Parameter	Unidentified heritage structures	
Issue/Impact/Environmental Effect/Nature	Due to the size of the area assessed and the design process requiring fieldwork before identification of the layout. The possibility of encountering heritage features in unsurveyed areas does exist.	
Extent	Localised and in most cases no more than 1000m^2	
Probability	Probable	
Reversibility	Heritage resources are non-renewable.	
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	Permanent	
Cumulative effect	Medium	
Intensity/magnitude	Medium	
Significance Rating	Medium negative before mitigation and low negative after mitigation for both the expanded and the constrained layout.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	2	1
Significance rating	-34 (medium negative)	-17 (low negative)
	Post mitigation impact rating	
Mitigation measures	▪ A walk down of the final approved layout will be required before construction commence; ▪ Any heritage features of significance identified during this walk down will require formal mitigation or where possible a slight change in design could accommodate such resources. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.	

- Operation

Table 59: Cumulative Impacts

IMPACT TABLE	
Environmental Parameter	Heritage Resources
Issue/Impact/Environmental Effect/Nature	The extent that the addition of this project will have on the overall impact of developments in the region on heritage resources

Extent	Local
Probability	Possible
Reversibility	Non- renewable.
Irreplaceable loss of resources	The nature of heritage resources are that they are non-renewable. The proper mitigation and documentation of these resources can however preserve the data for research
Duration	Permanent
Cumulative effect	It is my reserved but considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.
Intensity/magnitude	Low
Significance Rating	Negative low impact before mitigation and low negative after mitigation.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-18 (medium negative)	-18 (low negative)
Mitigation measures	▪ A walk down of the final approved layout will be required before construction commence; ▪ Any heritage features of significance identified during this walk down will require formal mitigation or where possible a slight change in design could accommodate such resources. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.	

- **Confidence in Impact Assessment**

It is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some heritage sites.

The impact assessment conducted for heritage sites assumes the possibility of finding heritage resources during the project life and has been conducted as such.

- **Reversibility of Impacts**

Although heritage resources are seen as non-renewable the mitigation of impacts on possible finds through scientific documentation will provided sufficient mitigation on the impacts on possible heritage resources.

8.2.6 Visual

- Planning

No visual impacts are expected during planning.

- Construction

Table 60: Rating of visual impacts of the proposed !Xha Boom Substation, Linking Substation and 132kV power line (including associated infrastructure) during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. A network of gravel access roads will be required in order to provide access to the proposed power line and substation sites. Considering the largely flat nature of the terrain in the study area, it is likely that the visual impact associated with these roads would be limited to the impact resulting from the clearing of vegetation. However, if these roads are not maintained correctly during the construction phase, maintenance vehicles travelling along these roads could increase dust emissions and create dust plumes. The increased traffic on the gravel roads and the dust plumes could therefore also create a visual impact and may evoke negative sentiments from surrounding viewers. It should however be noted that the existing roads which can be found around the project site are also gravel. As such, the proposed gravel access roads are not expected to internally contribute to the overall visual impact from the proposed development. The visual intrusion of the construction activities associated with the proposed substations and power line could adversely affect farmsteads / homesteads within the visual assessment zone. Surface disturbance during construction would also

	expose bare soil which could visually contrast with the surrounding environment. Additionally, the temporary stockpiling of soil during construction may alter the generally flat landscape and wind blowing over these disturbed areas could result in dust which would have a visual impact. Vegetation clearance required for the construction of the proposed substations is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact.	
Extent	Local / District (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	Marginal loss (2)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-24 (negative low)	-20 (negative low)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Vegetation clearing should take place in a phased manner. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Limit the number of vehicles and trucks travelling to and from the proposed site, where possible.	

	▪ If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible. ▪ If dust plumes become an issue, dust suppression must be implemented in all areas where vegetation clearing has taken place. ▪ Ensure that all soil stockpiles are covered in order to reduce dust. ▪ Select the power line and substation site alternatives that will have the least impact on visual receptors. ▪ Establish erosion control measures on areas which will be exposed for long periods of time. This is to reduce the potential impact heavy rains may have on the bare soil.

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

- Operation

Table 61: Rating of visual impacts of the proposed !Xha Boom Substation, Linking Substation and 132kV power line (including associated infrastructure) during operation

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	The proposed on-site !Xha Boom Substation, Linking Substation and 132kV power line could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. This is especially true for the power line towers, which are tall structures and will most likely be visible for greater distances. However, where existing power lines are present the visual environment would already be visually 'degraded' and thus the introduction of a new power line in this setting may be considered to be less of a visual impact than if no existing built infrastructure were visible. A network of gravel access roads will be required in order to provide access to the proposed power line and to the substations. Considering the largely flat nature of the terrain within the study area, it is likely that the visual impact associated with these roads would be limited to the impact resulting from the clearing of vegetation.

	However, if these roads are not maintained correctly, vehicles travelling along the gravel access roads could increase dust emissions and create dust plumes. The increased traffic on the gravel roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. It should however be noted that the existing roads which can be found around the project site are also gravel. As such, the proposed gravel access roads are not expected to internally contribute to the overall visual impact from the proposed development. Security and operational lighting at the proposed substations could result in light pollution and glare, which could be an annoyance to surrounding viewers. The visual intrusion of the proposed !Xha Boom Substation, the Linking Substation and the 132kV power line could also adversely affect farmsteads / homesteads within the visual assessment zone.	
Extent	Local/district (2)	
Probability	Definite (4)	
Reversibility	Barely reversible (3)	
Irreplaceable loss of resources	Marginal (2)	
Duration	Long term (3)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	3	3
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-34 (negative medium)	-34 (negative medium)
Mitigation measures	▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ Where possible, limit the amount of security and operational lighting present at the on-site substation.	

	▪ Where possible, limit the number of maintenance vehicles using access roads. ▪ Non-reflective surfaces should be utilised where possible.

* Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.

- Decommissioning

Visual impacts during the decommissioning phase are potentially similar to those during the construction phase.

8.2.7 Socio-economic

- Planning

No impacts are expected during planning.

- Construction

Table 62: Production and temporary employment creation during construction

Production and temporary employment creation during construction	
Environmental Parameter	Production in the national and local economy and employment associated with these activities.
Issue/Impact/Environmental Effect/Nature	Investment in construction of the power line and the substation will lead to procurement of goods and services and will result in creation of employment opportunities for the members of the local communities and nationally.
Extent	The impact will affect the entire country.
Probability	The impact will likely occur (between 50% and 75% chance of occurrence.
Reversibility	The impact is completely reversible.
Irreplaceable loss of resources	The impact will not result in any loss of resources.
Duration	Short-term. The impact will only last for the duration of the construction period (12 months and above).
Cumulative effect	Considering the nature of the proposed development and the fact that the area that the proposed development will be in is already imbued with a presence of a number of RE projects; it is highly unlikely that it will result in a significant cumulative effect. This is so because of the size of the

	project as well as the expected coinciding nature of the all RE projects.	
Intensity/magnitude	The impact is rated as positive low.	
Significance Rating	**Prior to mitigation measures**: Positive low impact **After mitigation measures**: The rating remains the same.	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	4	4
Probability	3	3
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	+ 12 (positive low)	+ 12 (positive low)
Mitigation measures	• To increase the profitability of the project and ensure the trickling down effect to the local economy, the project proponent must source the materials and equipment in South Africa. • Where feasible (i.e. in cases where the appointed individuals match the skills required), the proponent is to ensure the employment of local labour. • Ensure effective lines of communication and disseminate as much information to local communities regarding the project and employment opportunities for contracting small businesses. Although the proposed mitigation measures could increase the positive impact on the local economy, it would not change the overall total impact. Therefore, the ratings for the impact will remain the same.	

Table 63: Increased risk of threat to personal safety and livestock theft during construction

Increased risk of threat to personal safety and livestock theft during construction	
Environmental Parameter	Threat to personal safety and security of assets such as livestock.
Issue/Impact/Environmental Effect/Nature	Increased foot traffic in and around the farms is expected to increase the risk of local landowners to criminal activities.
Extent	The impact will affect the site.
Probability	The impact will likely occur (between 50% to 75% chance of occurrence).
Reversibility	The impact is partly reversible.

Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Short term. The effects of the impact (increased risk to personal safety) will only last for the duration of the construction phase.	
Cumulative effect	If approved, the building of the proposed project will occur during the building of the Graskoppies wind farm and will most probably coincide with the simultaneous development of other projects that have received environmental authorisation or are at the EIA stage. This means that the cumulative effect of this project will not result in any significant changes and will therefore be low.	
Intensity/magnitude	Low. Though it is uncertain, it is possible that the people employed for the development of the Graskoppies wind farm will be the same people employed for the construction of the power line. If this is the case, then the intensity of the impact will be barely perceptible.	
Significance Rating	Negative low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	- 10 (negative low)	- 9 (negative low)
Mitigation measures	• Minimise the possibility of attracting a number of people in search for employment in the vicinity of the farms by ensuring clear communication regarding the project. • Engage with property owners prior to the developing of the substations and erection of the power line to ensure that the expectations (rules) of the farmers regarding access to farms are understood and effectively adhered to. • Construction workers must be thoroughly informed of the rules made by farmers and be made to understand the accompanying consequences. • Implement controlled access to farm properties where the power line and substations will be built and will	

	ensure that the construction workers are on site during reasonable working hours. Although the proposed mitigation measures will minimise the negative impact, it will not change the total impact; therefore, the rating significance remains the same.

Table 64: Change in sense of place during construction

Change in sense of place during construction		
Environmental Parameter	Sense of place.	
Issue/Impact/Environmental Effect/Nature	The addition of physical infrastructure will change the landscape and alter the sense of place of farm owners.	
Extent	The impact will affect the local area.	
Probability	The impact will certainly occur (greater than 75% chance of occurrence).	
Reversibility	The impact is expected to be reversible during the decommissioning phase.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	The impact will most probably last past the operation phase.	
Cumulative effect	With the construction of other power lines and substations, the cumulative effect of this project is expected to be low.	
Intensity/magnitude	Considering the expected occurrence of other power lines from the currently under construction wind farms, the intensity of this impact is barely perceptible.	
Significance Rating	Negative low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	4	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	- 13 (negative low)	- 12 (negative low)
Mitigation measures	• Implement mitigation measures recommended by the relevant specialist (i.e. visual). • Deconstruct the power line and substations once the wind facility is decommissioned.	

- Operation

Table 65: Change in sense of place during operation

Change in sense of place during construction		
Environmental Parameter	Sense of place.	
Issue/Impact/Environmental Effect/Nature	The addition of physical infrastructure will change the landscape and alter the sense of place of farm owners.	
Extent	The impact will affect the local area.	
Probability	The impact will certainly occur (greater than 75% chance of occurrence).	
Reversibility	The impact is expected to be reversible during the decommissioning phase.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	The impact will most probably last past the operation phase.	
Cumulative effect	With the construction of other power lines and substations, the cumulative effect of this project is expected to be low.	
Intensity/magnitude	Considering the expected occurrence of other power lines from the currently under construction wind farms, the intensity of this impact is barely perceptible.	
Significance Rating	Negative low	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	2	2
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	4	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	- 13 (negative low)	- 12 (negative low)
Mitigation measures	• Implement mitigation measures recommended by the relevant specialist (i.e. visual). • Deconstruct the power line and substations once the wind facility is decommissioned.	

Table 66: Impact on service infrastructure

Impact on service infrastructure	
Environmental Parameter	Electricity distribution infrastructure.

Issue/Impact/Environmental Effect/Nature	The proposed 132 kV power line and substation will allow the evacuation of generated electricity at the proposed Graskoppies facility to the national grid.	
Extent	The impact will affect the entire country.	
Probability	The impact will certainly occur (greater than 75% chance of occurrence).	
Reversibility	The impact is reversible.	
Irreplaceable loss of resources	The impact will not result in any loss of resources.	
Duration	Effect of the impact will extend beyond the operation phase.	
Cumulative effect	The impact would result in negligible to no cumulative impacts.	
Intensity/magnitude	Medium. The impact will feed 235 MW to the national grid.	
Significance Rating	Positive medium	
	Pre-mitigation impact rating	**Post mitigation impact rating**
Extent	4	4
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	+ 30 (positive medium)	+ 30 (positive medium)
Mitigation measures	• No enhancement measures proposed.	

9 SPECIALIST RECOMMENDATIONS AND MITIGATION MEASURES

9.1 Mitigation Measures

9.1.1 Biodiversity

- Placement of pylons and other infrastructure within the High Sensitivity areas and drainage lines should be avoided.
- Preconstruction walk-through of the approved development footprint to ensure that sensitive habitats and species are avoided where possible.
- Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.
- Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.

- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However caution should be exercised to avoid using material that might entangle fauna.
- Pre-construction walk-through of the substation and powerline sites to identify areas of faunal sensitivity.
- During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- Any trenches that are required for cabling etc., should not be left open for extended periods as fauna such as tortoises will fall in and become trapped. Any open trenches should be checked regularly for trapped fauna.
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
- No fires should be allowed within the site as there is a risk of runaway veld fires.
- No fuelwood collection should be allowed on-site.
- No dogs or cats should be allowed on site apart from that of the landowners.
- If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site and site access should be strictly controlled
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and snakes which are often persecuted out of fear or superstition.
- Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan.
- All hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.
- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.

- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the sites and a long-term control plan will need to be implemented. Problem woody species such as Prosopis are already present in the area and are likely to increase rapidly if not controlled.
- Regular monitoring for alien plants within the development footprint should be carried out.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
- Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped.
- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the decommissioning and recycling plan, and as per the agreements with the land owners concerned.
- There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.
- Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned.
- Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning or until alien invasives are no longer a problem at the site.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
- Minimise the development footprint within the high sensitivity areas.
- There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora.
- All disturbed areas should be rehabilitated with locally occurring shrubs and grasses after construction and decommissioning to reduce the overall footprint of the development.

9.1.2 Avifauna

- Restrict the construction activities to the construction footprint area.
- Do not allow any access to the remainder of the property during the construction period.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Ideally, Corridor 1 or 3 should not be used as the two corridors pose a disturbance risk to an active Martial Eagle nest.
- A 1.2km exclusion zone should be implemented around the active Martial Eagle nest on the Aries – Helios 400kV line at -30.517644° 19.550840° in the powerline study area where no construction activity or disturbance should take place, in the event of Corridor 1 or 3 being implemented.
- The recommendations of the specialist ecological study must be strictly adhered to, especially as far as rehabilitation of vegetation is concerned.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The power line should be marked with BFDs for its entire length on the earth wire of the line, 5m apart, alternating black and white. See Appendix D of the Avifauna Impact Assessment Report for the type of BFD which is recommended.

9.1.3 Surface Water

- **Designation of Highly Sensitive Areas**
  The wetlands and drainage lines must be designated as "highly sensitive" and any impact must be limited to the minimum possible extent. All wetlands and drainage lines to be directly affected must be visibly demarcated prior to construction activities taking place. The demarcation of wetlands and drainage lines must be visible and last for the duration of the construction activities.

- **Avoidance of Direct Impacts due to Surface Water Resources**
  The construction lay-down area must not be situated directly within or within a proximity of 500m from any wetlands and / or drainage lines or within a 100m from any major drainage lines adhering to the stipulated buffer zones.

  The access / potential future service roads must be planned to route around and not directly through surface water resources as far as practically possible. Where this is not possible, a Right of way (RoW) will need to be established.

- **Establishment of Internal Road Access Areas**
  For general access to erect the pylons for the grid line, existing roads are to be used as far as possible. No roads are to be routed through any wetlands and / or drainage lines (including buffer zones) as far as practically possible. Where this is not possible however, and where no other access exists to the desired construction areas, environmental authorisation and a water use

license will be required before construction takes place and all mitigation measures are to be implemented accordingly.

A single access route or internal road access area is then to be established before construction takes place, if required. This should be planned to cross perpendicularly through any drainage line(s). For wetlands, the internal road access area must be planned for minimal impact on wetlands (i.e. shortest route, not routed through the core of the wetlands, minimal destruction of habitat etc.). The access route should follow existing routes where present. However, where new routes are to be established, temporary or permanent Ford (or low-water) crossings and / or similar design crossings using the stream / wetland bed as part of the road can be established. Temporary ford crossings and / or similar design crossings can be planned where construction vehicles need to access proposed construction areas during construction the construction phase only. Where the access route will form part of permanent access and / or service roads, permanent ford crossings and / or similar design crossings will however be required. Given the study area, and the temporary nature of surface water resources to be potentially affected, this design should be adequate since it enables hydrological continuity of the identified temporary surface water resources, maintains substrate continuity as well as allows movement of riparian and wetland bound species. To establish a temporary ford crossing, little to no modification of the stream banks or wetland will be required where banks are low (approximately 1,2m) for drainage lines or topography is flat for wetlands, where the grade or approach to the drainage line does not exceed 5:1 (horizontal to vertical) and lastly, where the stream bed is firm rock or gravel. Ideally, fords and / or similar design crossings should maintain the natural shape and elevation of the drainage line(s) and / or wetland(s). However, where modification is required, the banks and bed will have to be reinstated after construction has finished. Modifications to the banks may include limited grading, excavation of steep slopes, establishment of clean gravel approach to drainage line and wetland banks, placement of road base, etc. Such modifications are likely to be required for crossings through surface water resources with soft substrate. To establish the temporary bed crossing, use of materials to construct temporary mats made of wood or tyres can be used. Modifications will however need to be approved from the relevant environmental and water regulatory authorities prior to construction.

For permanent ford crossings and / or similar design crossings, rock or gravel may be used on weak drainage line and / or wetland beds. The weak substrate layer will need to be excavated an infilled by the rock or gravel material to the same level of the original drainage line or wetland bed. A minimum of approximately 30cm of infill should typically be used unless soil depth is limited. A geotextile can be used to separate the infill from the bed of the surface water resource thereby providing additional support.

Where other designs are more appropriate and these can be implemented, this is to be on approval from the relevant environmental and water regulatory authorities prior to construction.

In general, the width of the internal access road areas must be limited to the width of the vehicles required to move through the relevant surface water resource(s). The internal access road areas must be made clearly visible by means of demarcation during construction. Ideally, for temporary ford crossings and / or similar design crossings, vegetation should not be totally cleared across the entire internal access road areas. Rather, only the vehicle tracks should be cleared. Remaining vegetation can be kept trimmed to below 20cm but not lower than 5cm in height. Trees or shrubs may however require removal. Permits must be obtained where sensitive or protected vegetation species are to be removed. Preferably, these should be relocated.

Erosion inspections will need to be undertaken regularly (as often as environmental compliance monitoring is undertaken by a suitably qualified Environmental Compliance Officer (ECO) during the construction phase, and monthly during the operation phase) in order to manage the integrity of the temporary and permanent ford crossings and / or similar design crossings. Additionally, rehabilitation will need to take place if and where required.

Overall, no wetlands and or drainage lines are to be crossed during or directly after a rainfall event. Use of internal road access areas are only permissible after rainfall events once flows have ceased.

Preferably light vehicles are to be utilised where possible and the usage of heavy vehicles must be avoided as far as possible. Where heavy vehicles (such as TLB's) must be used, extreme caution is to be exercised when entering the internal road access areas of the wetland and drainage lines due soil instability factors.

Construction workers are only allowed in the designated internal road access areas maintenance areas. Any personnel traversing through the wetlands and / or drainage lines must be instructed not to light any fires, and / or remove any vegetation.

- **Control of Alien and Invasive Vegetation in Surface Water Resources**
  Control of alien and invasive vegetation within surface water resources will be required. Where alien and invasive vegetation encroachment / colonization takes place, these areas are to be cleared as soon as practically possible. Clearing should take place by means of mechanical removal, either by physically pulling or slashing and clearing of unwanted alien and invasive vegetation near or within the surface water resources. Monitoring of alien and invasive vegetation should be undertaken in accordance with the environmental compliance monitoring during the construction phase.

- **Emergency Measures**
  Operational fire extinguishers are to be available in the case of a fire emergency. Given the dry seasons and variable winds that the region experiences, it is recommended that a fire management and emergency plan is compiled. A suitably qualified health and safety officer must compile the fire management and emergency plan for the operation and maintenance phase of the project.

- **Post-construction Rehabilitation**
  Rehabilitation of the internal road access areas areas that will not be used as service roads for maintenance activities following the construction period will be required post-construction. Ideally, the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the

study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion until vegetation has re-established where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped to the pre-existing natural state.

- **Buffer Zone Specific Mitigation Measures**

  During construction activities, the outer extent of the buffer zones of the wetlands and drainage lines must be designated as “sensitive” and any impact must be limited to the minimum possible extent. The buffer zone extent must be visibly demarcated prior to construction activities taking place where construction is directly within the buffer zone. The demarcation of the buffer zones must be visible and last for the duration of the construction activities.

  See above for same internal road access areas mitigation measures to be implemented within buffer zones.

- **Preventing Increased Run-off, Erosion and Sedimentation Impacts**

  Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future.

  In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian “sausage” nets can be used to prevent erosion in susceptible construction areas.

  Erosion control management will need to be undertaken at the onset of construction. Regular monitoring and adequate erosion preventative measures (such as run-off protection as stipulated above) are to be implemented as and where required.

- **Preventing Soil and Water Contamination**

  No vehicles are to be allowed in the highly sensitive and sensitive areas unless authorised. Should vehicles be authorized in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. Should there be any oil, fuel or any other fluid leaks, vehicles and machinery are not to be allowed into any drainage sensitive and highly sensitive areas.

  All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive and sensitive areas.

  Sufficient spill contingency measures must be available throughout the construction process. These include, but are not limited to, oil spill kits to be available and fire extinguishers.

Storage areas for fuel, oil, paints and other hazardous substance are not to be stored directly within surface water resources or the associated buffer zones. These substances must also be contained in bunded areas with a capacity of at least 110%.

No “long drop” toilets are allowed on the construction site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must not be placed directly within any surface water resource(s) or the associated buffer zones. Temporary chemical sanitation facilities must be checked regularly for maintenance purposes and cleaned often to prevent spills.
No cement mixing is to take place in any surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the highly sensitive and sensitive areas.

- **Preventing Impacts to Fauna Associated with Drainage lines and Wetlands**
  No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten by construction workers or any other project team members. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed Environmental Control Officer (ECO) or suitably qualified individual may only remove animals, where such animals (including snakes, scorpions, spiders etc.) are a threat to construction workers. The ECO or appointed individual is to be contacted should removal of any fauna be required during the construction phase. Animals that cause a threat and need to be removed, may not be killed. Additionally, these animals are to be relocated outside the internal road access areas or construction areas, within relative close proximity where they were found.

- **Minimising Vehicle Damage to the Surface Water Resources**
  Potential impacts can be avoided by planning and routing of access / service roads outside of and away from all surface water resources and the associated buffer zones.

  Where access through surface water resources are unavoidable and are absolutely required, it is recommended that any road plan and associated structures (such as ford crossings, stormwater flow pipes, culverts, culvert bridges etc.) be submitted to the relevant environmental and water departments for approval prior to construction.

  Internal access and services roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every month. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified.

  Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified wetland / aquatic specialist must be obtained in this respect should this be required.

Control of erosion on the construction site in general must be managed through implementation of an erosion management plan. Erosion and subsequent sedimentation of surface water resources are considered significant impacts in terms of the proposed development that must be managed adequately throughout the operation of the proposed development.

- Other recommendations include the following:
  - All surface water resources and buffer zones must be avoided as far as practically possible in the final layouts (including access / service roads and power lines, including tower positions) to be designed in order to minimise and potentially avoid potential impacts as far as possible.
  - Where it is not possible to avoid impacts to surface water resources as a result of roads and power lines, the necessary water use license / general authorisation and environmental authorisations as relevant will be required prior to construction.
  - All stipulated mitigation measures are to be adhered to in order to minimise potential impacts to surface water resources.
  - With the implementation of mitigation measures, it is the opinion of this specialist that the proposed development components as per the layout are acceptable (notwithstanding final access / service road layouts, final grid line routes and tower positions) and therefore, may by environmentally authorised.

9.1.4 Soils and Agricultural Potential

- 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. This should be in place and maintained during all phases of the development.
- Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize the soil against erosion.
- 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.
- Minimize road footprint and control vehicle access on approved roads only.
- Control dust as per standard construction site measures which may include damping down with water or other appropriate and effective dust control measures. Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site.
- Implement effective spillage and waste management system.

9.1.5 Heritage and Palaeontology

<u>Pre-Construction</u>

- A walk down of the final layout to determine if any significant sites will be affected.
- Monitor find spot areas, by a qualified archaeologist, if construction is going to take place through them.
- A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by a qualified archaeologist during the construction phase.
- Avoid the historical farmstead at BHL001.

<u>Palaeontology</u>

- In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.
- However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional paleontologist.
- The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.
- Recommended mitigation of the inevitable damage and destruction of fossil within the proposed development area would involve the surveying, recording, description and collecting of fossils within the development footprint by a professional palaeontologist. This work should take place after initial vegetation clearance has taken place but before the ground is levelled for construction.

<u>Chance Finds</u>

- A walk down of the final approved layout will be required before construction commence.
- Any heritage features of significance identified during this walk down will require formal mitigation or where possible a slight change in design could accommodate such resources.
- A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

9.1.6 Visual

- Carefully plan to reduce the construction period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Vegetation clearing should take place in a phased manner.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.

- Limit the number of vehicles and trucks travelling to and from the proposed site, where possible.
- If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible.
- If dust plumes become an issue, dust suppression must be implemented in all areas where vegetation clearing has taken place.
- Ensure that all soil stockpiles are covered in order to reduce dust.
- Select the power line and substation site alternatives that will have the least impact on visual receptors.
- Establish erosion control measures on areas which will be exposed for long periods of time. This is to reduce the potential impact heavy rains may have on the bare soil.
- Light fittings for security at night should reflect the light toward the ground and prevent light spill.
- Where possible, limit the amount of security and operational lighting present at the on-site substation.
- Where possible, limit the number of maintenance vehicles using access roads.
- Non-reflective surfaces should be utilised where possible.

9.1.7 Socio-economic

- To increase the profitability of the project and ensure the trickling down effect to the local economy, the project proponent must source the materials and equipment in South Africa.
- Where feasible (i.e. in cases where the appointed individuals match the skills required), the proponent is to ensure the employment of local labour.
- Ensure effective lines of communication and disseminate as much information to local communities regarding the project and employment opportunities for contracting small businesses.
- Minimise the possibility of attracting a number of people in search for employment in the vicinity of the farms by ensuring clear communication regarding the project.
- Engage with property owners prior to the developing of the substations and erection of the power line to ensure that the expectations (rules) of the farmers regarding access to farms are understood and effectively adhered to.
- Construction workers must be thoroughly informed of the rules made by farmers and be made to understand the accompanying consequences.
- Implement controlled access to farm properties where the power line and substations will be built and will ensure that the construction workers are on site during reasonable working hours.
- Implement mitigation measures recommended by the relevant specialist (i.e. visual).
- Deconstruct the power line and substations once the wind facility is decommissioned.

10 CUMULATIVE IMPACTS

The area has seen a notable interest from developers of various renewable energy projects, which could be associated with the wind and solar energy resource potential found in the region, proximity to the existing Helion MTS and its evacuation capacity, as well as other factors. Such developments, whether already approved or only proposed, need to be considered together as they have the potential to create numerous cumulative impacts, whether positive or negative, if all are implemented. **Table 67** lists the projects that have been considered when examining the cumulative impacts; their location relative to the project under review is illustrated in **Figure 71**. The specialists have identified specific cumulative impacts and these are outlined below.

Table 67: Renewable energy developments (both wind and solar) proposed within a 55km radius of the proposed development

Development	Current status of EIA/development	Proponent	Capacity	Farm details
Dwarsrug Wind Farm	EA issued	Mainstream Renewable Power	140MW	Remainder of the Farm Brak Pan No 212
Khobab Wind Farm	Under Construction	Mainstream Renewable Power	140MW	Portion 2 of the Farm Sous No 226
Loeriesfontein 2 Wind Farm	Under Construction	Mainstream Renewable Power	140MW	Portions 1 and 2 of the Farm Aan de Karree Doorn Pan No 213
Graskoppies Wind Farm	EIA ongoing	Mainstream Renewable Power	235MW	▪ Portion 2 of the Farm Graskoppies No 176; and ▪ Portion 1 of the Farm Hartebeest Leegte No 216
Hartebeest Leegte Wind Farm	EIA ongoing	Mainstream Renewable Power	235MW	Remainder of the Farm Hartebeest Leegte No 216
Ithemba Wind Farm	EIA ongoing	Mainstream Renewable Power	235MW	▪ Portion 2 of the Farm Graskoppies No. 176; and ▪ Portion 1 of the Farm Hartebeest Leegte No. 216.
Loeriesfontein PV3 Solar Energy Facility	EA issued	Mainstream Renewable Power	100MW	Portion 2 of the Farm Aan de Karree Doorn Pan No 213
Hantam PV Solar Energy Facility	EA issued	Solar Capital (Pty) Ltd	Up to 525MW	Remainder of the Farm Narosies No 228
PV Solar Power Plant	EA issued	BioTherm Energy	70MW	Portion 5 of the Farm Kleine Rooiberg No 227
Kokerboom 1 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No.	240MW	▪ Remainder of the Farm

		1788 (Pty) Ltd (BVI)		Leeuwbergrivier No. 1163; and ▪ Remainder of the Farm Kleine Rooiberg No. 227.
Kokerboom 2 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No. 1788 (Pty) Ltd (BVI)	240MW	▪ Remainder of the Farm Leeuwbergrivier No. 1163; and ▪ Remainder of the Farm Kleine Rooiberg No. 227.
Kokerboom 3 Wind Farm	Environmental Impact Assessment (EIA) underway	Business Venture Investments No. 1788 (Pty) Ltd (BVI)	240MW	▪ Remainder of the Farm Aan De Karree Doorn Pan No. 213; ▪ Portion 1 of the Farm Karree Doorn Pan No. 214; and ▪ Portion 2 of the Farm Karree Doorn Pan No. 214.
Wind Farm	EA issued, however the project is no longer active.	Mainstream Renewable Power	50MW	Portion 1 of the Farm Aan de Karree Doorn Pan 213

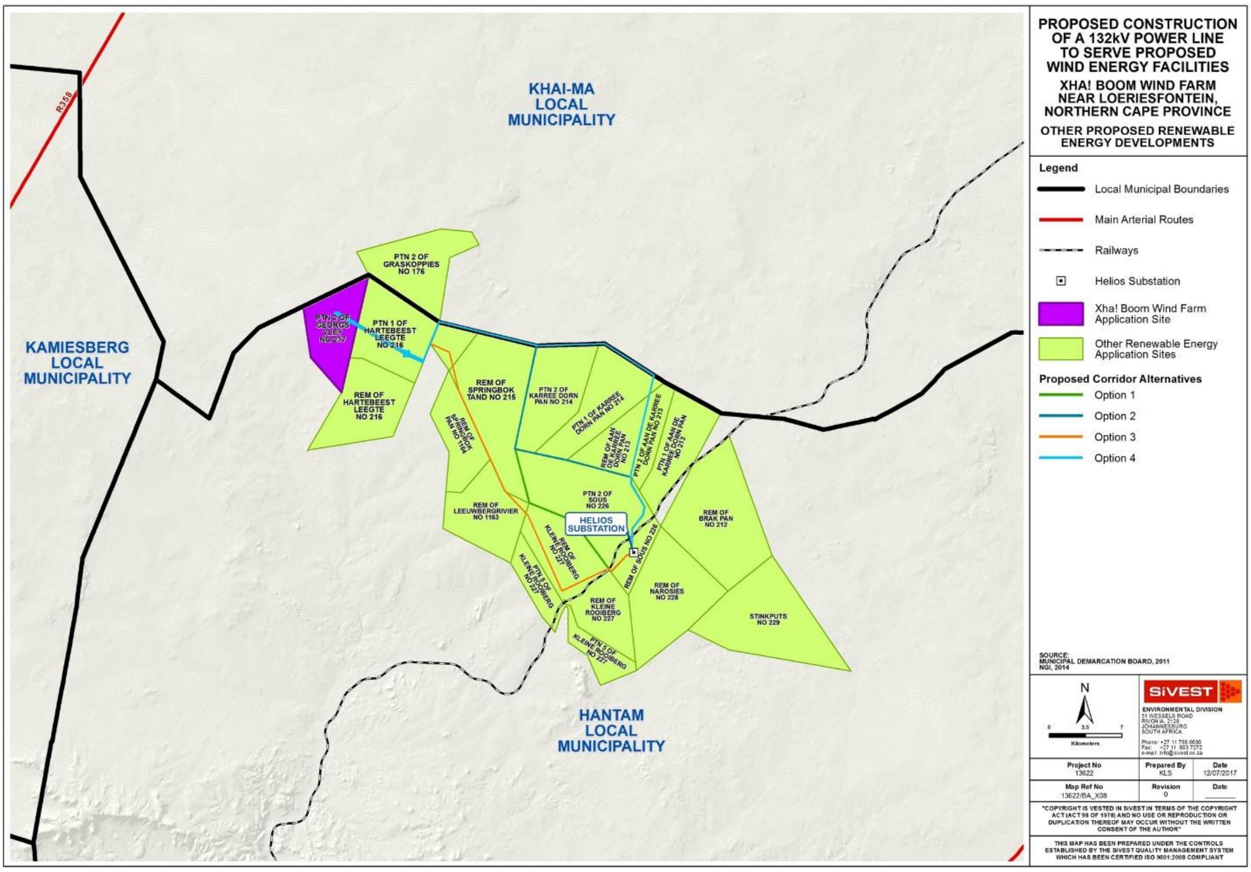

Figure 71: Location of the renewable energy developments proposed within a 55km radius of the proposed development

10.1 Biodiversity Impacts

Where there are other renewable energy developments within 30km of a site, a cumulative impact assessment is required. This includes a general assessment of cumulative impact as well as an assessment of different potential cumulative impact sources and an indication of the size or extent of the identified cumulative impact. It is important to note that this consultant has worked on all of the wind farms in the area and as such has intimate knowledge of the affected environment of each as well as the distribution of impact and the recommended mitigation measures associated with each approved or in-process facility.

The majority of the footprint from the grid connection would come from the substations, with the on-site substation listed at 15ha and the linking substation listed at 36ha. These are however the maximum values required and the actual size of the substations that would be built would occupy only about 25% of this area. Some of this footprint has already been considered as part of the wind farm, but as the features are shared, a portion of the footprint is allocated to the power line as well. The grid connection is however associated with a wind energy facility and as such, the development of the two (2) components of the wind farm are not independent of one another. As such, the consideration of cumulative impact for the power line considered here, includes the associated wind farm impact. The analysis and discussion of cumulative impact provided below is taken from the Ecological Study for the !Xha Boom Wind Farm, but is repeated here for consistency. The total footprints listed below for the wind farms has taken account of and included the footprint of the power line and substations.

In terms of existing impacts in the area and the potential for the !Xha Boom grid connection sites to contribute to cumulative impacts, other renewable energy developments are detailed in **Table 67** and the affected land portions shown in **Figure 71**. Although the DEA also maintains a map of approved and in-process renewable energy facilities that are part of the RE IPPP, this is currently not up to date and is not illustrated here as a result. All of the other wind energy and grid connection developments in the area are to the east of the !Xha Boom site, mostly between the site and the Helios substation, with only the Dwarsrug facility further east.

It is clear that a node of renewable energy development is developing around the Helios Substation. The large amount of development in the area would potentially generate significant cumulative impact in terms of habitat loss and potential disruption of landscape connectivity. These two (2) major potential cumulative impacts are further explored and described with regards to the area.

In terms of developments that are preferred bidders or under construction, there are three (3) projects, the Khobab and Loeriesfontein 2 Wind Farms and the Hantam Solar Facility. The total extent of habitat loss from these developments is approximately 500ha. In terms of already authorised wind farm projects that have not been awarded preferred bidder status and thus may or may not be built, there is only the 140MW Dwarsrug Wind Farm with the remaining authorised projects in the area being four solar PV projects. There are a number of projects which are currently still in the EIA process, which includes the Graskoppies, Hartebeest Leegte and Ithemba Wind Farms which are part of the larger Leeuwberg development of which the current development is a part and then the three (3) Kokerboom wind farms. All of the latter projects are 235-240MW in output but would not have a significantly larger footprint than the older 140MW projects due to technology advances and the larger output of the current and future turbines. The estimated footprint of each wind farm is estimated to be 100ha. As such, there is 100ha of potential habitat loss due to the authorised Dwarsrug Wind Farm and approximately 700ha of habitat loss due to the projects currently in process if they are all authorised. The total extent of habitat loss from the four (4) solar projects would be up to 1600ha, although it is highly unlikely that all proposed projects would ever be built. It is important to note that the footprint of wind energy facilities is decreasing relative to solar PV plants on a per MW basis due to the increasing output of wind turbines but the relatively static nature of PV panel output. The total actual and potential extent of habitat loss is therefore 500ha of existing habitat loss, about 1700ha of potential habitat loss due to already approved projects and 700ha due to projects in process, giving rise to a total of just under 3000ha of total habitat loss.

The majority of the above footprint is located within the Bushmanland Basin Shrubland vegetation type. This vegetation unit has an extent of 34 690 km^2 and is one (1) of the most extensive vegetation types in the country. The total extent of potential habitat loss from all developments in the current study area would amount to less than 0.1% of this vegetation unit. Consequently, it is clear that there is no potential for habitat loss to significantly impact the national availability of this unit or elevate it to a higher threat status.

Within a 30km radius of the Helios substation, the potential habitat loss from all projects would amount to approximately 1% of the area. This suggests that even if all projects are built, the total extent of habitat loss would not be significant at this local landscape level either. At a more local level, the affected area is relatively homogenous and there are few species or habitats of conservation concern that would be affected by the developments in the area. There are also no large drainage features or other obvious environmental corridors present in the area that would be directly affected by the development of the area. These results indicate that direct habitat loss is not a highly significant concern in the area and the low fauna and flora diversity of the area further reduces the potential significance of cumulative impact in the area due to habitat loss.

The potential impacts of the current developments on landscape connectivity are more difficult to quantify as this is not directly related to the footprint of the facilities. Wind energy facilities are not fenced but occur within the general farming landscape, whereas solar PV plants are generally fenced with electrified fencing and thus prevent most fauna from traversing the fenced area. On the other hand, PV facilities are concentrated within a limited area compared to wind farms which occupy a large area at low density. A significant proportion of the impact associated with wind farms results from access roads which usually far exceed the footprint of the turbines and their hard stands. Roads pose a significant obstacle to some fauna which cannot or do not cross roads and experience habitat fragmentation as a result. Species that are typically affected by roads include subterranean and fossorial mammals and reptiles as well as many smaller above-ground species which avoid open ground on account of predation risk. However, as there is little soil in the study area, which consists mostly of exposed gravels or calcrete, subterranean species are not common at the site so this is not likely to be a significant impact. In addition, the arid nature of the area means that vegetation cover is naturally low with the result that most fauna are adapted to or accustomed to traversing open ground and not likely to be significantly affected by wind farm roads, which are gravel in any case.

Some fauna may be affected by turbine noise and thus experience habitat loss as a result of wind farms. However, this has not been documented for any fauna and indications are that most fauna quickly become habituated to turbines and do not avoid them to any significant degree. Wind farms are thus not likely to significantly contribute to landscape connectivity for most fauna present in the area and would remain porous for most species. The potential for significant disruption of landscape connectivity due to the wind farms of the area is therefore considered low. In addition, this is not considered directly relevant here as the power line and substations considered under this application would generate low operational impacts on fauna.

In terms of the potential for the !Xha Boom Wind Farm to contribute to the above cumulative impacts, the total extent of habitat loss would be about 100ha, which is not highly significant and the potential for habitat fragmentation would also be low. In terms of the acceptability of a node of high renewable energy development and associated grid connection infrastructure to occur at the site, this is seen as a positive aspect rather than a negative factor. The area has generally low ecological sensitivity and the concentration of development within this low sensitivity area is seen as positive compared to a more dispersed development pattern which would generate an overall greater impact. As such, the current development is therefore seen as being acceptable in terms of its contribution to cumulative impact.

10.2 Avifauna Impacts

A cumulative impact, in relation to an activity, is the impact of an activity that may not be significant on its own but may become significant when added to the existing and potential impacts arising from similar or other activities in the area.

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.

10.2.1 Species to be considered

The potential cumulative impacts on the priority species listed in **Table 26** were considered.

10.2.2 Area considered in the cumulative assessment

The Helios MTS approximately 50km north of the town of Loeriesfontein forms the hub of a proposed renewable energy node which is situated within a 40km radius around the MTS (See **Figure 71**). Within this 40km radius around the MTS, the habitat (Bushmanland Basin Shrubland) and land-use (small-stock farming) is very uniform.

Table 67 lists the other renewable energy projects which are currently approved, under construction or in an environmental impact assessment process within a 40km radius around Helios MTS.

10.2.3 Current Impacts

Below is a summary of the typical threats currently facing avifauna in the Karoo environment (Marnewick *et al*. 2015):

- **<u>Overgrazing</u>**

This results in a depletion of palatable plant species, erosion, and encroachment by Karoo shrubs. The result is loss of suitable habitat and a decrease in the availability of food for large terrestrial birds, including Red Data species such as Kori Bustard, Karoo Korhaan and Ludwig's Bustard.

- **Poisoning**

Strychnine poison was used extensively in the past to control damage-causing predators, such as Black-backed Jackal *Canis mesomelas* and Caracal *Caracal caracal*, and reduced scavenging raptor populations. The use of poison may be continuing, and the potential impacts on Red Data raptor species such as Martial Eagle has not been confirmed or quantified.

- **Road-kills**

Many birds are commonly killed on roads, especially nocturnal species such as Spotted Eagle-Owl.

- **Renewable energy developments**

Several wind and solar developments have been approved for development within a 40km radius around Helios MTS (see **Table 67**). The combined footprint of these proposed developments is approximately 36 282 hectares*. This has implications for several Red Data species, both in terms of collision mortality for some species, especially raptors, and displacement due to permanent habitat transformation, which affects most of the Red Data species to some degree.

** This figure refers to the actual infrastructure footprint and not the land parcels, which are naturally much bigger than the area that will be actually developed. This information was obtained through internet searches.*

- **Power lines**

Numerous existing and new power lines are significant threats to large terrestrial Red Data species in the Karoo. Power lines kill substantial numbers of all large terrestrial bird species in the Karoo, including threatened species such as Karoo Korhaan, Kori Bustard and Ludwig's Bustard (Jenkins *et al*. 2010; Shaw, J. 2013). There is currently no completely effective mitigation method to prevent collisions. There are currently approximately 130km of Eskom HV lines within a 40km radius around Helios MTS. This figure will increase by at least 100km if all proposed renewable energy developments get to be developed, including the !Xha Boom WEF.

- **Climate change**

Climate change scenarios for the region predict slightly higher summer rainfall by 2050, and increased rainfall variability. Droughts are expected to become more severe. The climate change is predicted to have both positive and negative consequences for Red Data species. Increased summer rainfall could improve survival, and conversely drought years can lower long-term average survival. Large, mainly resident species dependent on rainfall are also more vulnerable to climate change. This would include the slow-breeding Martial Eagle, which also exhibit extended parental care. Severe hailstorms kill many Red Data species and could become more frequent.

- **Shale gas fracking**

There is a potential threat of shale gas fracking throughout the Karoo. Populations of bird species may be locally reduced through disturbance caused by lights, vibration, vehicles and dust, and may be affected by pollutants in ponds containing contaminated water produced by returned fracking fluids.

- **Persecution**

Although it is difficult to prove, the direct persecution of raptors such as Verreaux's Eagle and Martial Eagle for stock predation is still taking place (R. Visagie pers. comm).

10.2.4 Methods

The cumulative impact of the proposed WEF was assessed individually for each Red Data species (see **Table 68** below).

Table 68: Framework for assessing significance of cumulative effects

Significance	Effect
Severe	Effects that the decision-maker must take into account 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.

10.2.5 Assumptions and Limitations: Cumulative Impacts

The information on proposed WEFs and grid connections in the study area was received from SiVEST and from various websites. The assessment was made on this basis, but it cannot be guaranteed that these are the only proposed developments.

10.2.6 Assessment

See Table 69 below for a systematic exposition of the expected cumulative impacts of the proposed !Xha Boom grid connection on Red Data species.

Table 69: The expected cumulative impact of the !Xha Boom Grid Connection on Red Data species within the 40km development node.

Priority species	Taxonomic name	Level of current and future impacts on species	Susceptibility to powerline impacts	Expected combined cumulative impact of existing HV network and proposed renewable projects HV network: Pre-mitigation	Expected combined cumulative impact of existing HV network and proposed renewable projects HV network: Post-mitigation
Karoo Korhaan	*Eupodotis vigorsii*	Low: Powerlines, solar, overgrazing, climate change	Medium	Moderate	Minor
Kori Bustard	*Ardeatis kori*	High: Powerlines,solar, overgrazing, climate change	High	High	Moderate
Lanner Falcon	*Falco biarmicus*	Low: Powerlines, poisoning, road kills, solar, WEF	Low	Low	Not significant
Ludwig's Bustard	*Neotis ludwigii*	High: Powerlines, solar, overgrazing, climate change	High	High	Moderate
Martial Eagle	*Polemaetus bellicosus*	High: Powerlines, persecution, solar, overgrazing, WEFs, climate change	High	Moderate	Minor
Secretarybird	*Sagittarius serpentarius*	High: Powerlines, solar , overgrazing, WEFs, climate change	High	High	Moderate
Sclater’s Lark	*Spizocorys sclateri*	Low: Powerlines, solar, overgrazing, climate change	Low	Minor	Not significant
Red Lark	*Calendulauda burra*	Low: Powerlines, solar, overgrazing, climate change	Low	Minor	Not significant
Burchell’s Courser	*Cursorius rufus*	Medium: Solar, overgrazing, WEFs, climate change	Low	Not significant	Not significant
Verreaux's Eagle	*Aquila verreauxii*	High: Powerlines, persecution, solar, overgrazing, WEFs, climate change	High	Moderate	Minor

Overall, the combined cumulative impacts of the proposed !Xha Boom grid connection and the existing and proposed HV networks on Red Data species, assuming implementation of appropriate mitigation measures, are expected to be minor to moderate within the 40km development node around Helios Substation. The overall cumulative assessment has been produced with a moderate level of certainty.

10.3 Surface Water Impacts

Cumulative impacts are the combined impacts from different developments / facilities which, in combination, result in significant impacts that may be larger than sum of all the impacts.

The proposed renewable energy developments in the surrounding area (55km radius) outside of the study site are identified in **Table 67** and shown in **Figure 71**.

It must be noted that surface water resources change from one (1) site to another and can range from a number of surface water resources in one (1) area to very few on a neighbouring property depending on factors such as topography, geology, local rainfall and other environmental factors. Additionally, the characteristics of surface water resources can change along its course where longitudinal hydrological systems are involved. Nonetheless, the most important factor to consider when evaluating surface water impacts from a cumulative perspective is downstream impacts. Where a development takes place upstream, should impacts occur, these are likely to have an impact downstream to some degree.

The main potential cumulative surface water impacts from a catchment perspective in the local area include both potential direct and indirect impacts. Direct impacts include cumulative loss of as well as further degradation of surface water resources due to the footprints of developments encroaching or destroying surface water resources in the greater catchment. The indirect impacts relate mainly to increased run-off, sedimentation and erosion for linear and endorheic hydrological systems. The indirect impacts to hydrological systems (i.e. drainage lines) which are connected across several farm boundaries have a greater risk for potential cumulative impacts from developments upstream.

From a direct cumulative potential impact perspective, where there is no direct impact to surface water resources on the proposed project site, there will be no direct cumulative impact to surface water resources from a project site specific level.

The nearest surrounding development that could potentially be impacted as a result of the proposed development from an indirect perspective is the Kokerboom 2 Wind Farm. This wind farm is located approximately 9km from the proposed development site. Therefore, there is a fair distance between the proposed development and the nearest surrounding development. The two (2) sites are also separated by a watershed and occupy separate local catchments. Drainage from the proposed development is in a northern direction, whilst drainage for the Kokerboom 2 Wind Farm is in a south eastern direction. As a result, it is therefore highly unlikely that the proposed development will affect the Kokerboom 2 Wind Farm should this development proceed to construction. Indirect impacts such as increased run-off, consequent sedimentation and erosion are highly unlikely.

Over and above the negligible potential cumulative impact to Kokerboom 2 Wind Farm, the potential cumulative impact on the remaining surrounding renewable energy developments is negligible for the same reasons, as stated above. The negligible cumulative impact is compounded by the fact that there is an increased distance to the remaining surrounding proposed renewable energy developments.

10.4 Soil and Agricultural Potential Impacts

Cumulative impact has been assessed by reviewing the available soil and agriculture specialist reports for all renewable energy developments within 30km of this development. These are shown in **Figure 71** and **Table 67**. Of those included in **Table 67**, only the specialist report for Hantam PV Solar Energy Facility was not available for review. In none of the reviewed reports were there any additional specialist recommendations or mitigation measures to the ones already included in this report. The conclusion of all reports was that the agricultural impact was of low significance.

The potentially most significant cumulative impact is the loss of agricultural land. However, the impact is low because of the small surface area of impact and the extremely limited agricultural potential of all land in the area, predominantly as a result of climatic limitations, and the fact that there is no particular scarcity of such land in South Africa.

Furthermore it is preferable to incur a cumulative 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.

The cumulative impact is assessed in detail in table form below.

Table 70: Loss of agricultural land use (Grazing)

Environmental parameter: agricultural land (grazing)		
Cumulative Impact: Loss of agricultural land use, caused by direct occupation of land by footprint of the development infrastructure of all renewable energy developments in the surrounding area. This applies to the direct footprint of the developments which comprises the turbine foundations, hard standing areas, roads and the footprint of other infrastructure, including panel areas in the case of PV. This represents only a small proportion of the land surface area.		
	Pre-mitigation	**Post-mitigation**
Extent	2 Local / district	n/a
Probability	4 Definite	n/a
Reversibility	2 Partly reversible	n/a
Irreplaceable loss	2 Marginal	n/a

Duration	3 Long term	n/a
Cumulative effect	2 Low	n/a
Intensity	1 Low	n/a
Significance	15 Low negative	n/a
Mitigation measures: none possible		

10.5 Heritage and Palaeontology Impacts

This section evaluates the possible cumulative impacts on heritage resources with the addition of the !Xha Boom WEF grid connection and substation. The cumulative impact on heritage resources evaluated a 30km radius (**Figure 71**). It must further be noted that the evaluation is based on available heritage studies and cannot take the findings of outstanding studies on current on-going EIA's in consideration.

The following must be considered in the analysis of the cumulative effect of development on heritage resources:

- **Fixed datum or dataset:** There is no comprehensive heritage data set for the Loeriesfontein region and thus we cannot quantify how much of a specific cultural heritage element is present in the region. The region has never been covered by a heritage resources study that can account for all heritage resources. Further to this none of the heritage studies conducted can with certainty state that all heritage resources within the study area has been identified and evaluated ;
- **Defined thresholds**: The value judgement on the significance of a heritage site will vary from individual too individual and between interest groups. Thus implicating that heritage resources' significance can and does change over time. And so will the tipping threshold for impacts on a certain type of heritage resource;
- **Threshold crossing**: In the absence of a comprehensive dataset or heritage inventory of the entire region we will never be able to quantify or set a threshold to determine at what stage the impact from developments on heritage resources has reached or is reaching the danger level or excludes the new development on this basis. (Godwin, 2011)

Keeping the above shortcomings in mind, the methodology in evaluating cumulative impacts on heritage resources will be followed for the Impact Assessment phase.

The analysis of the competed studies as listed below (**Figure 71**), taking in to account the findings and recommendation of each of the nine evaluated HIA's.

- MORRIS, DAVID. 2007. Archaeological Specialist input with respect to the upgrading railway infrastructure on the Sishen-Saldahna ore line in the vicinity of Loop 7a near Loeriesfontein. McGregor Museum.
- FOURIE, WOUTER. 2011. Heritage Impact Assessment for the proposed Solar Project on the farm Kaalspruit, Loeriesfontein. PGS Heritage and Grave Relocation Consultants.

- ALMOND, J.E. 2011. Palaeontological Desktop Study for the Proposed Mainstream Wind Farm Near Loeriesfontein, Namaqua District Municipality, Northern Cape Province.
- VAN SCHALKWYK, J. 2011. Heritage Impact Assessment for the proposed establishment of a wind farm and PV facility by Mainstream Renewable Power in the Loeriesfontein Region, Northern Cape Province.
- VAN De WALT, JACO. 2012. Archaeological Impact Assessment for the proposed Hantam PV Solar Energy Facility on the farm Narosies 228, Loeriesfontein, Northern Cape Province.
- WEBLEY, L & HALKETT, D. 2012. Heritage Impact Assessment: Proposed Loeriesfontein Photo-Voltaic Solar Power Plant On Portion 5 of the Farm Klein Rooiberg 227, Northern Cape Province.
- MORRIS, DAVID. 2013. Specialist Input for the Environmental Basic Assessment and Environmental Management Program for the Khobab Wind Energy Facility: Power Line Route Options, Access Road and Substation Positions.
- ORTON, JAYSON. 2014. Heritage Impact Assessment for the proposed re-alignment of the authorized 132kV Power Line for the Loeriesfontein 2 WEF, Calvinia Magisterial District, Northern Cape.
- Fourie, W. 2015. Heritage Impact Assessment for the proposed establishment of the Dwarsrug wind farm and PV facility in the Loeriesfontein Region, Northern Cape Province.

It the Heritage Specialist's considered opinion that the additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.

- **Palaeontology:**

The cumulative effect of the development of the proposed construction of the proposed development is considered to be low. This is as a result of the broader Loeriesfontein area not having numerous well preserved fossils.

10.6 Visual Impacts

Although it is important to assess the visual impacts of the proposed development itself, it is equally important to assess the cumulative visual impact that could materialise in the area should other large scale developments and in particular renewable energy facilities (both solar and wind) be grated environmental authorisation to proceed and are ultimately constructed. Cumulative impacts are the impacts from different developments / facilities which may, in combination, result in significant impacts that may be larger than the sum of all the impacts combined.

The renewable energy developments that are being proposed in the surrounding area, are specified in **Table 67** and **Figure 71**.

These renewable energy developments and their potential for large scale visual impacts could significantly alter the sense of place and visual character within the study area, once constructed. The cumulative visual impact experienced from each potentially sensitive visual receptor location will depend on the number of proposed renewable energy developments and their associated electrical infrastructure within viewing distance of the receptors. As mentioned above, the height of the development in combination with distance from the receptor are critical factors when assessing visual impacts. As such, solar energy facilities are unlikely to result in visual impacts beyond 5km, while wind energy facilities are unlikely to result in visual impacts beyond 8km and as such the degree of visual impact on receptors beyond these distances would be considered to be insignificant. On this basis, renewable energy developments constructed on all of the above mentioned sites, except for the farm Stinkputs No. 229 which accommodates a portion of the Dwarsrug Wind Farm, will be within viewing distance of most of the potentially sensitive receptor locations identified within the study area. However, it is envisaged that the biggest cumulative impact would be the change in the visual character within the study area due to the presence of these large scale industrial-type developments. These facilities will therefore significantly alter the visual baseline within the study area, thereby reducing the visual impact of the proposed power line on the surrounding potentially sensitive receptor locations. The impact of the proposed power line would therefore be outweighed by the impact of the other renewable energy developments being proposed and/or constructed in the surrounding area.

10.7 Socio-Economic Impacts

10.7.1 Cumulative Effect Analysis

The development of numerous RE facilities in the same area has the potential to result in positive cumulative impacts. Such impacts often include the creation of employment opportunities for the local community, skills development as well as the creation of local business opportunities. However, negative impacts such as the change in sense of place as a result of the development footprint of the various projects cannot be ignored.

The area chosen for the proposed development has a notable presence of RE projects. Although such RE projects highlight the suitability of the area, all projects are at different stages of application. Currently, only two of these projects, namely Khobab and Loeriesfontein 2 wind farms, are under construction whilst the Solar Capital Orange PV facility is in the approval and financing stage (**Figure 72**).

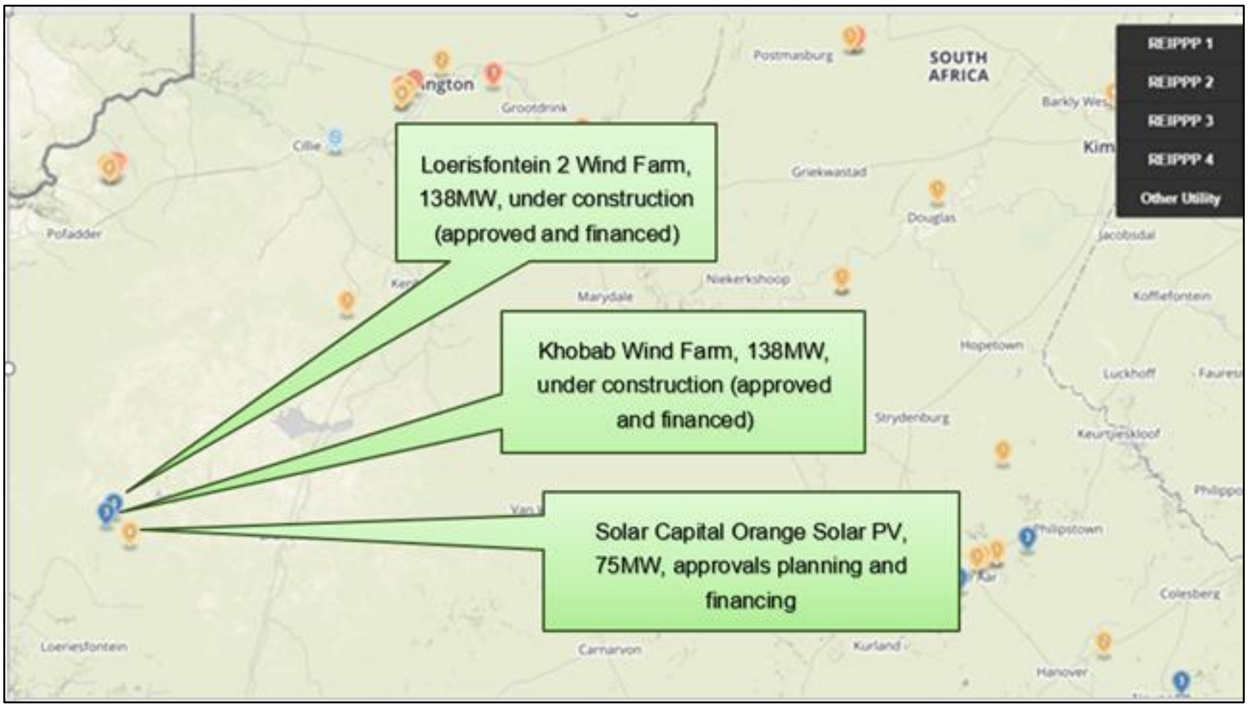

Figure 72: Map for approved for construction renewable energy projects in the area as part of the REIPPPP

In the event that more than one (1) RE facility is built in the immediate vicinity of the !Xha Boom Substation facility, both positive and negative impacts are likely to be amplified. As illustrated in **Table 67**, almost all the projects listed below are located in close proximity to the !Xha Boom Substation facility. Furthermore, four (4) of the ten (10) projects have received environmental authorisation whilst the rest (six projects) are at the environmental impact assessment (EIA) stage.

10.7.1.1 Literature Review Sources

The following documents were reviewed in relation to the above-mentioned projects to identify the potential cumulative effect of the proposed development considering the existing and planned projects in the area.

Table 71: Reviewed literature concerning the selected developments in the area

Development	Reviewed Report	Author	Date of Release
Dwarsrug Wind Farm	Socio-economic Impact Study	Urban-Econ Development Economists	May 2015
Khobab Wind Farm	Socio-economic Impact Assessment Report	Master-Q Research	2 May 2012
Loeriesfontein 2 Wind Farm	Socio-economic Impact Assessment Report	Master-Q Research	2 May 2012
Loeriesfontein PV3 Solar Energy Facility	Socio-economic Impact Assessment Report	Master-Q Research	2 May 2012

Graskoppies Wind Farm	Socio-economic Impact Assessment Report	Urban-Econ Development Economists	November 2016
Hartebeest Leegte Wind Farm	Socio-economic Impact Assessment Report	Urban-Econ Development Economists	November 2016
Ithemba Wind Farm	Socio-economic Impact Assessment Report	Urban-Econ Development Economists	November 2016
Hantam PV Solar Energy Facility	Not Available	N/A	N/A
PV Solar Power Plant	Draft Environmental Management Programme	Digby Wells	15 September 2015
Kokerboom 1 Wind Farm	Final Scoping Report	Aurecon	December 2016
Kokerboom 2 Wind Farm	Final Scoping Report	Aurecon	December 2016
Kokerboom 3 Wind Farm	Final Scoping Report	Aurecon	December 2016
Wind Farm	Socio-economic Impact Assessment Report	Master-Q Research	2 May 2012

10.7.2 Identification of Cumulative Effects

The following table summarises the key socio-economic impacts that were identified and analysed by other specialists for the above-mentioned projects. The table indicates the rating of the identified socio-economic impacts as proposed by the other specialists in their respective studies, and based on the combination of these ratings indicates the importance of the socio-economic impact from a cumulative effect perspective. Only cumulative effects that are expected to reach high importance level are included in further analysis.

Table 72: Reviewed literature concerning similar developments and impact rating

Capital	Environmental Parameter	Description/Impact	Rating by Specialist	Identified Importance
Natural Capital	Agricultural activities in zone of influence	**Dwarsrug Wind Farm**: Impact on agricultural activities on the directly affected farms due to movement of vehicles and workers, and established infrastructure.	Low negative	Low-medium negative
		Kokerboom 1, 2 and 3 Wind Farms: Transforming the land to industrial use will result in the loss of agricultural land.	Low negative	

	Access to resources for Sustainable livelihood	**Loeriesfontein PV3 Solar Energy Facility, Wind farm, Khobab wind farm, Loeriesfontein 2 wind farm:** Site access and clearance of land can result in long-term loss of land, resulting in a change in access to resources to sustain livelihoods.	Low negative	
Human Capital	Temporary employment creation	**Dwarsrug Wind Farm:** The establishment of the wind farm will create employment opportunities from direct, indirect and induced impacts.	Low positive	Medium-high positive
		Khobab and Loeriesfontein 2 Wind Farms: Unemployed residents will benefit from being trained and receiving employment		
		Loeriesfontein PV3 Solar Energy Facility and Wind Farm: It is estimated that the development will create a few temporary jobs		
		Graskoppies, Hartebeest Leegte, Ithemba, Kokerboom 1, 2 and 3 wind farms: During the establishment of a wind farm, large numbers of workers are required for the duration of the construction phase.	Medium positive	
Social capital	Skills development	**Dwarsrug wind Farm:** Long terms skills transfer & skills development will take place as a result of the establishment of the project.	Medium positive	Medium-high positive
		Graskoppies, Hartebeest Leegte and Ithemba Wind Farms: Skills development can be expected to be enhanced as those who will receive employment will either be improving an existing skill or acquiring a new skill.	High positive	
		Khobab and Loeriesfontein 2 Wind Farms:	Low positive	

		The developer is most likely to include foreign experts to encourage knowledge transfer.		
		Kokerboom 1, 2 and 3 Wind Farms: There are many unemployed individuals who will benefit from being trained in a specific skill and employed.	Medium positive	
	Investment in local community	**Dwarsrug Wind Farm:** Project owners are required to spend a portion of their turnover on the upliftment of the community where the project is located.	Medium positive	High positive
		Graskoppies, Hartebeest Leegte and Ithemba wind farms: Part of the IPPPP; project owners are required to allocate a percentage of the projects' revenue towards community development.	High positive	
	Demographic Changes	**Graskoppies, Hartebeest Leegte, Ithemba and Dwarsrug wind farms:** An influx in migrant workers and increase in jobseekers is expected to ensue.	Medium negative	Medium negative
		Kokerboom 1, 2 and 3 Wind farms: The establishment of these wind farms present attractive job opportunities.	Low negative	
	Social pathologies	**Dwarsrug wind farm:** Increase in foot traffic results in an increase in social ills such as poor health, substance abuse, prostitution etc.	Medium negative	Medium-high negative
		Graskoppies, Hartebeest Leegte and Ithemba wind farms: The increase in the number of construction workers is expected to cause a further increase in social pathologies.	High negative	

Cultural & Spiritual Capital	Socio-cultural: Health and Safety	**Khobab and Loeriesfontein 2 wind farm:** Construction workers employed by the developer increase the average no. of men in the vicinity thus increasing the incidence of communicable diseases.	High negative	High negative
		Kokerboom 1,2 and 3 Wind farms: Impact of heavy vehicles including damage to roads, safety and health.	Low negative	
Physical Capital	Sustainable increase in production & Temporary stimulation of GDP-R	**Dwarsrug, Graskoppies, Hartebeest Leegte and Ithemba wind farms:** The initial capital injection will set of a range of value adding activities resulting in the stimulation of GDP-R and long term production.	High positive	High positive
	Added pressure on infrastructure	**Graskoppies, Hartebeest Leegte, Ithemba and Dwarsrug wind farms:** An increase in the number of people in Loeriesfontein, could create additional pressure on the local municipality and aggravate service provision related challenges.	Medium negative	Medium negative
Financial Capital	Establishment of informal hospitality industry	**Graskoppies, Hartebeest Leegte and Ithemba wind farms:** Formation of informal hospitality industry as a result of the increased demand for accommodation.	Medium positive	Medium positive
	Increased household income and standard of living	**Dwarsrug wind farm:** New jobs that will be created will result in increased household income for benefitting individuals.	High positive	High positive
		Graskoppies, Hartebeest Leegte and Ithemba wind farms: Increase in household income expected to accrue due to job creation as well as skills development.	Low positive	
Political & Institutional Capital	Increase in government revenue	**Dwarsrug wind farm:** Government obtains its revenue by collecting taxes and rates from the country's citizen's and business.	Low positive	Medium positive

		Graskoppies, Hartebeest Leegte and Ithemba wind farms: Government obtains its revenue from collecting taxes and rates from the country's residents and business.	Medium positive	
		Wind Farm and Loeriesfontein PV3 Solar Energy Facility: Increased central and local tax income.	Low positive	

The Department of Environmental Affairs and Tourism's guidelines (DEAT, 2004) suggest that the identification of cumulative effects should focus on important and meaningful issues as "it is not practical to analyse the cumulative effects of an action on every environmental receptor". Furthermore, it is advised that the analysis should focus on "what is needed to ensure long-term productivity or sustainability of the resource" (DEAT, 2004).

Considering the range of socio-economic impacts predicted to ensue as a result of other planned developments in the area, only one (1) negative cumulative effect was identified, which is expected to be of some concern. This cumulative effect is the envisaged changes to health and safety (specifically infectious diseases such as STI's including HIV/AIDS) of the local communities, and specifically the residents of the town of Loeriesfontein.

However, the possible addition of the proposed development (!Xha Boom Substation and powerline development) to the RE projects approved under the REIPPPP, those that have already received environmental authorisation, as well as the ones at the EIA stage is not expected to result in any significant changes to the identified impacts in the literature review. This is due to the size and nature of the proposed development relative to the other developments planned and already implemented in the area.

11 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALTERNATIVES

As previously mentioned, design or layout alternatives are being considered in the BA process. Various environmental specialists assessed the sites during their respective field investigations. The specialist assessments included the identification of sensitive areas. These sensitive areas were used to perform a preliminary comparison of layout alternatives. These layout alternatives were also extensively investigated. Four (4) corridor alternatives were assessed for the proposed power line route, as well as two (2) alternative site locations for the proposed On-site Eskom substation (namely the !Xha Boom Substation) and linking substation respectively.

The proposed layout alternatives that were investigated and assessed by each specialist in relation to environmentally sensitive areas are shown in **Figure 73** - **Figure 75**below.

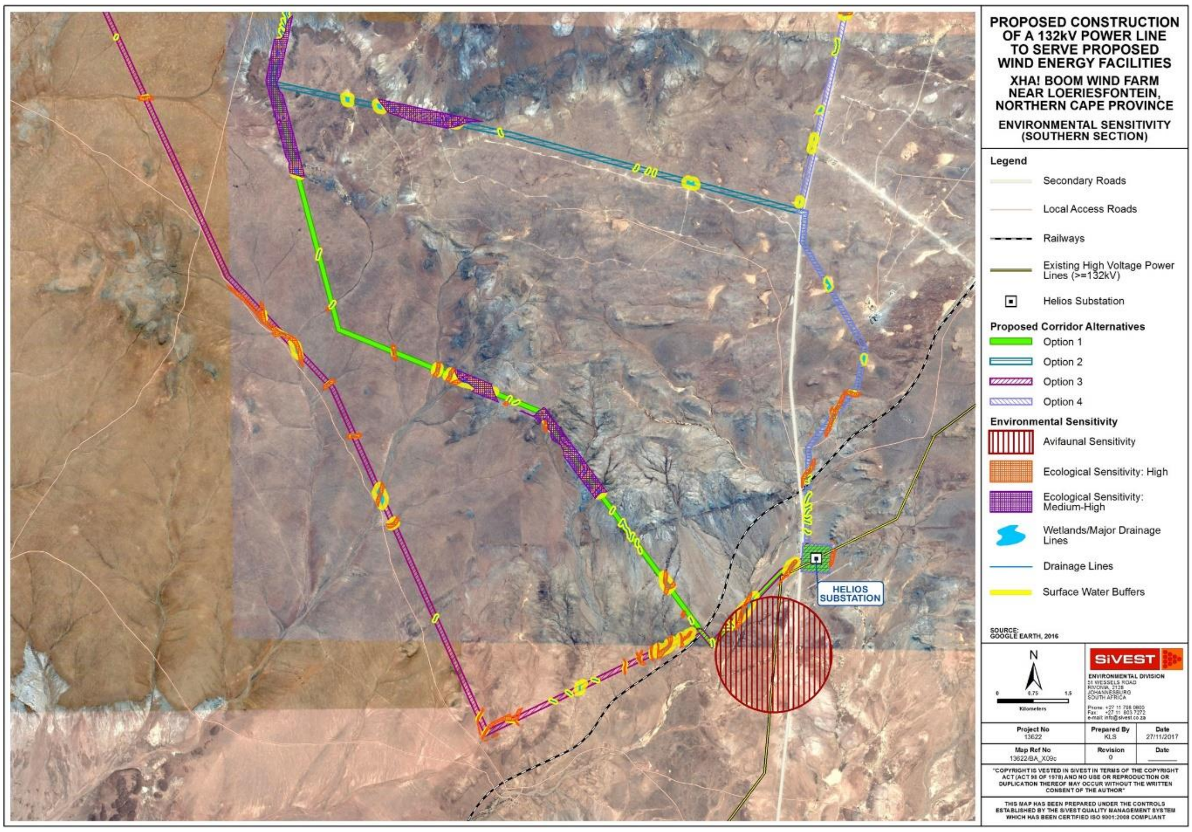

Figure 73: Southern section of the proposed layout alternatives in relation to environmentally sensitive areas which were investigated and assessed by the specialists

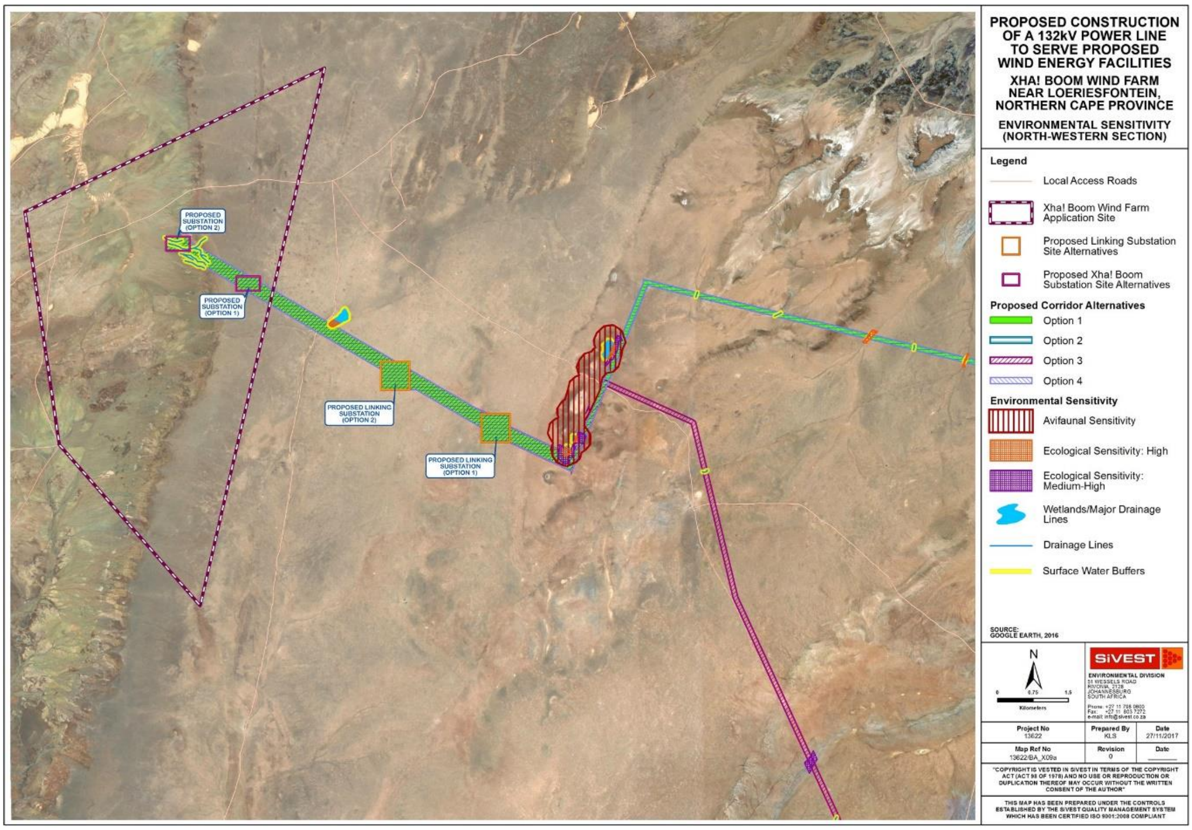

Figure 74: North-western section of the proposed layout alternatives in relation to environmentally sensitive areas which were investigated and assessed by the specialists

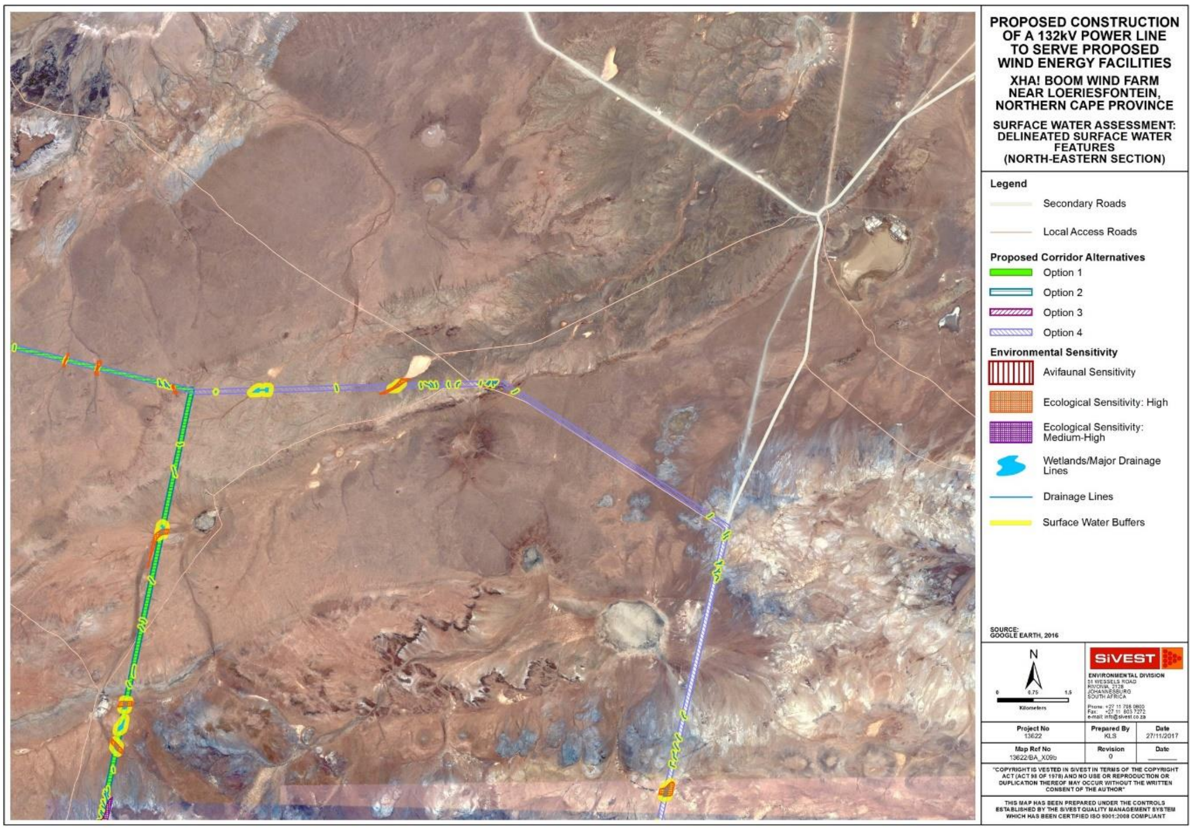

Figure 75: North-eastern section of the proposed layout alternatives in relation to environmentally sensitive areas which were investigated and assessed by the specialists

Each of the above-mentioned alternatives were comparatively assessed in terms of the findings from the specialist studies. The selected preferred alternatives will be based on both environmental constraints and design factors. It should be noted that the findings of the specialist studies and sensitivity mapping will be used to inform the layout of the proposed development within the preferred sites. As such, the selected preferred layout will incorporate the environmentally sensitive areas identified by some of the specilists. Additionally, several no-go areas which were identified by some of the specialists will subsequently also be incorporated into the selected preferred layout.

Table 73 below highlights the issues and preferences associated with each alternative thereby identifying the preferred alternative.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 73: Alternatives Assessment summarising the impacts, highlighting issues/concerns and indicating the preference associated with each alternative

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
132kV ON-SITE ESKOM SUBSTATION ALTERNATIVES				
Option 1	Biodiversity	PREFERRED	The site is located on the eastern plateau area of the site dominated by *Stipagrostis* grasslands. There are no sensitive features of SCC within the footprint area. No significant issues associated with the site. This is clearly the preferred option for the substation.	No Fatal Flaws
	Avifauna	NO PREFERENCE	The envisaged impact will be similar irrespective of which alternative is used, because of the similarity of the habitat.	No Fatal Flaws
	Surface Water	PREFERRED	No surface water resources are found directly within the footprint of this alternative site. The nearest surface water resources include a several minor drainage lines located approximately 600m on the opposite side of a ridgeline (watershed). Drainage therefore does not lead from the substation alternative location towards these drainage lines. Indirect impacts are therefore negligible since the ridgeline acts as a physical barrier to the drainage lines. The potential for direct and indirect impacts is negligible considering the physical barrier and distance to these nearby (<600m) surface water resources. This option is therefore preferred.	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No heritage resources were identified that can potentially be impacted by this option locality	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Visual	FAVOURABLE	Two (2) potentially sensitive visual receptors can be found within 5km of !Xha Boom Substation Option 1, these being VR 13 and VR 18. Both of these receptors are more than 3kms from the substation site and therefore in the low impact zone. There is no notable preference between the two (2) options and both are considered to be favourable. In addition, the proposed substation would form part of the proposed !Xha Boom Wind Farm and would be dwarfed by the large number of wind turbines that would be visible.	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No differentiation between this and the other option, equally acceptable.	No Fatal Flaws
Option 2	Biodiversity	NOT PREFERRED	The site is located in a transitional area between the arid grasslands in the east and the Klipveld in the west. There are numerous small drainage features or washes in the site and it is not considered favourable in comparison with the preferred alternative.	No Fatal Flaws
	Avifauna	NO PREFERENCE	The envisaged impact will be similar irrespective of which alternative is used, because of the similarity of the habitat.	No Fatal Flaws
	Surface Water	NOT PREFERRED	Two (2) drainage lines are found directly within the footprint of this alternative site. Moreover, six (6) additional minor drainage lines can be found within 200m of the alternative site. The potential for direct and indirect impacts is moderate to high considering the location of the proposed substation as	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			well as the proximity to nearby (<200m) surface water resources. This option is therefore not preferred.	
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No heritage resources were identified that can potentially be impacted by this option locality	No Fatal Flaws
	Visual	FAVOURABLE	Two (2) potentially sensitive visual receptors are located within 5kms of !Xha Boom Substation Option 2, these being VR 13 and VR 18. Both of these receptors are more than 3kms from the substation site and therefore in the low impact zone. There is however no notable preference between the two (2) options and both are considered to be favourable. In addition, the proposed substation would form part of the proposed !Xha Boom Wind Farm and would be dwarfed by the large number of wind turbines that would be visible.	No Fatal Flaws
	Socio-economic	NO PREFERENCE	No differentiation between this and the other option, equally acceptable.	No Fatal Flaws
LINKING SUBSTATION ALTERNATIVES				
Option 1	Biodiversity	PREFERRED	Located within the Arid Grassland habitat type, there are no features of concern within the site and it is considered favourable. The only distinguishing feature which makes this	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			alternative less preferred is the proximity to the nearby pans as well as the slightly greater slope of the site.	
	Avifauna	NO PREFERENCE	The envisaged impact will be similar irrespective of which alternative is used, because of the similarity of the habitat.	No Fatal Flaws
	Surface Water	FAVOURABLE	No surface water resources are found directly within the footprint of this alternative site. The nearest surface water resources are the cluster of saline depression wetlands, of which the nearest saline depression wetland within the common grid line corridor for all alternatives is located approximately 1,1km to the east. The potential for indirect impacts is minimal to considering the distance to the depression wetland. This option is therefore favourable.	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No heritage resources were identified that can potentially be impacted by this option locality	No Fatal Flaws
	Visual	FAVOURABLE	There is only one (1) potentially sensitive visual receptor located within 5km of the proposed Linking Substation Option 1, this being VR 13 which is approximately 4.2kms from the substation site and therefore in the low impact zone. Although Substation Option 1 is located further from the potentially sensitive receptor, there is no notable preference between the two (2) options and both are considered to be favourable.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Socio-economic	NO PREFERENCE	No differentiation between this and the other option, equally acceptable.	No Fatal Flaws
Option 2	Biodiversity	FAVOURABLE	Located on a homogenous open *Stipagrostis ciliata*-dominated plain. There are no features of significance in the footprint or vicinity of the site. This is identified as the preferred alternative as the site is flatter than the alternative, but the difference in preference is marginal and there is not real difference between the two (2) alternatives.	No Fatal Flaws
	Avifauna	NO PREFERENCE	The envisaged impact will be similar irrespective of which alternative is used, because of the similarity of the habitat.	No Fatal Flaws
	Surface Water	PREFERRED	No surface water resources are found directly within the footprint of this alternative site. The nearest surface water resources are the cluster of saline depression wetlands, of which the nearest saline depression wetland within the common grid line corridor for all alternatives is located approximately 3,5km to the south east. The potential for indirect impacts is very minimal considering the distance to the depression wetland. This option is therefore preferred.	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	NO PREFERENCE	No heritage resources were identified that can potentially be impacted by this option locality	No Fatal Flaws
	Visual	FAVOURABLE	As with Option 1, there is only one (1) potentially sensitive visual receptor located within 5km of the proposed Linking Substation Option 2, this being VR 13 which is approximately	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			2.5kms from the substation site and therefore in the low impact zone. Although Substation Option 2 is located closer to the potentially sensitive receptor, there is no notable preference between the two (2) options and both are considered to be favourable.	
	Socio-economic	NO PREFERENCE	No differentiation between this and the other option, equally acceptable.	No Fatal Flaws
132kV !XHA BOOM POWER LINE CORRIDOR ALTERNATIVES				
Option 1	Biodiversity	(LESS) FAVOURABLE	Traverses some low hills in the south that are considered moderately sensitive as well as some succulent shrubland habitat that is also more sensitive than the other shrubland and grassland types. Considered acceptable, but only as the third Option, with both Option 2 and Option 4 being seen as more favourable alternatives.	No Fatal Flaws
	Avifauna	NOT PREFERRED	Ideally this option should not be used due to its proximity to the active Martial Eagle nest on the Aries – Helios 400kV line.	No Fatal Flaws
	Surface Water	FAVOURABLE	There is one (1) depression wetland, thirteen (13) major drainage lines and fifty nine (59) drainage lines within grid line option 1. A total of seventy four (74) surface water resources may potentially be affected by the proposed development for the option. The grid line however, can be routed to avoid, and span any features where avoidance is not possible. Given the	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			number and types of surface water resources that may potentially be affected, this option is considered to be favourable.	
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No heritage resources were identified that can potentially be impacted by this alignment.	No Fatal Flaws
	Visual	FAVOURABLE	A total of eleven (11) potentially sensitive visual receptors are located within 5kms of Option 1. Of these, one (1) receptor is within 500m of the corridor (i.e. high impact zone), this being VR 25. One (1) receptor (namely VR 32) is also located in the moderate impact zone (between 500m and 2km) and the remaining nine (9) are located in the low impact zone (between 2km and 5km). It should be noted that VR 25 is relatively close to Khobab Wind Farm and is thus located in an area already undergoing significant visual transformation. Much of the route alignment for Option 1 traverses areas which have remained largely natural, although a section of the route passes within 1km of the Khobab Wind Farm where the landscape is undergoing significant transformation. Visual impacts are likely to be negligible in these transformed areas, and although the development overall is expected to alter the character of the surrounding area to some degree, visual impact associated with this option is expected to be moderate. Option 1 is therefore considered favourable.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Socio-economic	FAVOURABLE	Considering the identified potential negative and positive impacts, corridor option 3 (pink) appears to be slightly more preferred among the four alternatives. Although it will result in the lowest economic benefits to the national and local economy, such benefits would be temporary and would not be significant regardless of the route option chosen. Importantly, Option 3 affects the least farms and is associated with the shortest power line length. Option 1 and 2 are considered favourable and are slightly more preferred than Option 4 from the reviewed socio-economic impacts perspective. However, considering that the owner of the Portion 2 of Farm Karree Doorn Pan No. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to Section 5.3 of the Socio-Economic Report), it would be advisable to consider Option 1 and Option 4 before selecting Option 2.	No Fatal Flaws
Option 2	Biodiversity	PREFERRED	No highly sensitive features along the route and the last third of the line towards Helios is located along existing roads and disturbed areas. Overall impact is considered the lowest of the options. Proximity to existing disturbance and power lines make this the preferred option.	No Fatal Flaws
	Avifauna	FAVOURABLE	The option is acceptable with the necessary mitigation.	No Fatal Flaws
	Surface Water	FAVOURABLE	There are three (3) depression wetlands, eight (8) major drainage lines and sixty three (63) drainage lines within grid line option 2. A total of seventy five (75) surface water	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			resources may potentially be affected by the proposed development for the option. The grid line however, can be routed to avoid, and span any features where avoidance is not possible. Given the number and types of surface water resources that may potentially be affected, this option is considered to be favourable.	
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No heritage resources were identified that can potentially be impacted by this alignment.	No Fatal Flaws
	Visual	PREFERRED	A total of eight (8) potentially sensitive visual receptors are located within 5kms of Power Line Corridor Option 2. Of these, one (1) receptor is within 500m of the corridor (i.e. high impact zone), this being VR 34. Two (2) receptors (namely VR 25 and VR 32) are located in the moderate impact zone (between 500m and 2km) and the remaining five (5) are located in the low impact zone (between 2km and 5km. Although Option 2 traverses some areas which have remained largely natural, much of the route alignment passes through areas which are undergoing considerable visual transformation as a result of the development of the Khobab and Loeriesfontein Wind Farms. As such, the visual impact associated with this option is expected to be negligible.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			As Option 2 has the least number of potentially sensitive receptors within 5kms of the corridor, this is considered to be the preferred option from a visual perspective.	
	Socio-economic	FAVOURABLE	Considering the identified potential negative and positive impacts, corridor option 3 (pink) appears to be slightly more preferred among the four alternatives. Although it will result in the lowest economic benefits to the national and local economy, such benefits would be temporary and would not be significant regardless of the route option chosen. Importantly, Option 3 affects the least farms and is associated with the shortest power line length. Option 1 and 2 are considered favourable and are slightly more preferred than Option 4 from the reviewed socio-economic impacts perspective. However, considering that the owner of the Portion 2 of Farm Karree Doorn Pan No. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to Section 5.3 of the Socio-Economic Report), it would be advisable to consider Option 1 and Option 4 before selecting Option 2.	No Fatal Flaws
Option 3	Biodiversity	NOT PREFERRED	This Option traverses more drainage features than the other alternatives and the also runs through a long section where there are no other power lines and as such the additional disturbance is considered greater than for the other routes. The route traverses an extensive area of currently little-disturbed habitat and includes some more sensitive succulent	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			shrubland habitat in the south. As a result this is considered the least favourable option.	
	Avifauna	NOT PREFERRED	Ideally this option should not be used due to its proximity to the active Martial Eagle nest on the Aries – Helios 400kV line.	No Fatal Flaws
	Surface Water	PREFERRED	There is one (1) depression wetland, eight (8) major drainage lines and twenty two (22) drainage lines within grid line option 3. A total of thirty two (32) surface water resources may potentially be affected by the proposed development for the option. The grid line however, can be routed to avoid, and span any features where avoidance is not possible. Given the number and types of surface water resources that may potentially be affected, this option is considered to be preferred.	No Fatal Flaws
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No heritage resources were identified that can potentially be impacted by this alignment.	No Fatal Flaws
	Visual	NOT PREFERRED	A total of thirteen (13) potentially sensitive visual receptors are located within 5kms of Power Line Corridor Option 3. None of these are located within 500m of the corridor. Five (5) receptors are however located in the moderate impact zone (between 500m and 2km) and the remaining eight (8) are located in the low impact zone (between 2km and 5km). Most of the route alignment for Option 3 traverses areas which have remained largely natural with few anthropogenic	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			elements in evidence. As such, the development of a power line along this route alignment is expected to alter the character of the surrounding area to some degree and to have a significant visual impact in these untransformed parts of the study area. As such, Option 3 is not preferred from a visual point of view.	
	Socio-economic	PREFERRED	Considering the identified potential negative and positive impacts, corridor option 3 (pink) appears to be slightly more preferred among the four alternatives. Although it will result in the lowest economic benefits to the national and local economy, such benefits would be temporary and would not be significant regardless of the route option chosen. Importantly, Option 3 affects the least farms and is associated with the shortest power line length. Option 1 and 2 are considered favourable and are slightly more preferred than Option 4 from the reviewed socio-economic impacts perspective. However, considering that the owner of the Portion 2 of Farm Karree Doorn Pan No. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to Section 5.3 of the Socio-Economic Report), it would be advisable to consider Option 1 and Option 4 before selecting Option 2.	No Fatal Flaws
Option 4	Biodiversity	(MORE) FAVOURABLE	There are no high sensitivity features along the route and as it runs adjacent to existing roads for much of its length, the additional disturbance generated during construction is likely to be low.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			The route is adjacent to existing main access routes for large sections of the route with the result that overall impact is low and is identified as the next preferred alternative after Option 2.	
	Avifauna	PREFERRED	▪ It follows the main Loeriesfontein access road and existing HV lines for about a third of the way, thereby reducing the impact of habitat fragmentation, and reducing the risk of collisions; ▪ About 50% of the alignment is oriented in an east-west direction, which is parallel to the main migration movement of Ludwig's Bustard, therefore reducing the risk of collisions for the species; and ▪ It never comes closer than 2km from the active Martial Eagle nest on the Aries – Helios 400kV line, which reduces the risk of disturbance to the birds.	No Fatal Flaws
	Surface Water	FAVOURABLE	There are five (5) depression wetlands, six (6) major drainage lines and fifty five (55) drainage lines within grid line option 4. A total of sixty seven (67) surface water resources may potentially be affected by the proposed development for the option. The grid line however, can be routed to avoid, and span any features where avoidance is not possible. Given the number and types of surface water resources that may potentially be affected, this option is considered to be favourable.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Soils and Agricultural Potential	NO PREFERENCE	Impact is low with no significant differences between the locations	No Fatal Flaws
	Heritage and Palaeontology	FAVOURABLE	No heritage resources were identified that can potentially be impacted by this alignment.	No Fatal Flaws
	Visual	FAVOURABLE	A total of nine (9) potentially sensitive visual receptors are located within 5kms of Power Line Corridor Option 4. Of these, one (1) receptor is within 500m of the corridor (i.e. high impact zone), this being VR 34. One (1) (1) receptor (namely VR 33) is also located in the moderate impact zone (between 500m and 2km) and the remaining seven (7) are located in the low impact zone (between 2km and 5km). Although Option 4 traverses some areas which have remained largely natural, much of the route alignment passes through areas which are undergoing considerable visual transformation as a result of the development of the Khobab and Loeriesfontein Wind Farms with associated infrastructure. As such, the visual impact associated with this option is expected to be negligible. Option 4 is therefore considered favourable from a visual point of view.	No Fatal Flaws
	Socio-economic	FAVOURABLE	Considering the identified potential negative and positive impacts, corridor option 3 (pink) appears to be slightly more preferred among the four alternatives. Although it will result in the lowest economic benefits to the national and local economy, such benefits would be temporary and would not	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
			be significant regardless of the route option chosen. Importantly, Option 3 affects the least farms and is associated with the shortest power line length. Option 1 and 2 are considered favourable and are slightly more preferred than Option 4 from the reviewed socio-economic impacts perspective. However, considering that the owner of the Portion 2 of Farm Karree Doorn Pan No. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to Section 5.3 of the Socio-Economic Report), it would be advisable to consider Option 1 and Option 4 before selecting Option 2.	

!XHA BOOM 132kV ON-SITE ESKOM SUBSTATION ALTERNATIVES

As depicted in **Table 73** above, the two (2) 132kV On-site Eskom Substation site alternatives are relatively similar in terms of which is the environmentally preferred alternative. Almost all of the specialists found there to be no preference between the two (2) alternatives, with the only exceptions being the biodiversity, surface water and visual specialists. The biodiversity and surface water specialists found Option 1 to be preferred. In addition, the visual specialist found both Option 1 and Option 2 to be favourable. However, Option 2 was found to be not preferred from biodiversity and surface water perspectives respectively. In light of this, **132kV On-site Eskom Substation Option 1** is deemed to be the preferred alternative from an environmental perspective. It should be noted that Mainstream are considering Option 1 as their preferred On-site Eskom substation site alternative. This is deemed to be acceptable as Option 1 was found to be the preferred alternative from an environmental perspective and would not result in any significant environmental impacts. In addition, the extent of the preferred On-site Eskom substation site has been reduced in order to avoid the identified environmentally sensitive areas. As such, in combination with the shorter distance to the connecting linking substation, this On-site Eskom substation site alternative is considered to be preferred. From a technical perspective, the shorter distance between the On-site Eskom substation and the linking substations reduces the amount of electrical losses experienced, which is also preferred.

132kV LINKING SUBSTATION ALTERNATIVES

As depicted in **Table 73** above, the two (2) Linking Substation site alternatives are relatively similar in terms of which is the environmentally preferred alternative. Almost all of the specialists found there to be no preference between the two (2) alternatives, with the only exceptions being the biodiversity, surface water and visual specialists. The biodiversity specialist found Option 1 to be preferred, while Option 2 was found to be preferred from a surface water perspective. Option 2 was however still found to be favourable from a biodiversity perspective, while the surface water specialist found Option 1 to be favourable. In addition, the visual specialist found both Option 1 and Option 2 to be favourable. In light of this, Linking Substation Option 1 and Option 2 are deemed to be equally preferred from an environmental perspective and thus both options are deemed to be acceptable. It should be noted that Mainstream are considering Option 1 as their preferred linking substation site alternative. This is deemed to be acceptable as both options were found to be equally preferred from an environmental perspective and would not result in any significant environmental impacts. In addition, Option 1 would reduce the length of the overhead power line which will connect to the Helios MTS by approximately 3km and will also reduce the length of the required access roads to the On-site Eskom substation site. Therefore, from environmental and technical perspectives, **Linking Substation Option 1** is deemed to be acceptable and is thus the preferred alternative.

132kV !XHA BOOM POWER LINE CORRIDOR ALTERNATIVES

As depicted in **Table 73** above, Option 1 was found to be not preferred from an avifauna perspective and thus this option is not preferred from an environmental perspective. The same can be said for Option 3, as this option was found to be not preferred from biodiversity, avifauna and visual perspectives respectively, despite being preferred from a socio-economic perspective. The biodiversity and visual specialists found Option 2 to be preferred, while this option was found to be favourable from avifauna, surface water, socio-economic and heritage and palaeontology perspectives respectively. In addition, Option 4 was found to be preferred from an avifauna perspective, while the biodiversity, surface water,socio-economic, heritage and palaeontology and visual specialists found this option to be favourable. In light of this, **132kV Power Line Corridor Option 2** and **132kV Power Line Corridor Option 4** were both found to be favourable alternatives from an environmental perspective due to the preference from biodiversity, avifauna and visual perspectives respectively. It is thus recommended that both **132kV Power Line Corridor Option 2** and **132kV Power Line Corridor Option 4** be considered as favourable options for the construction of the proposed power line. However, during the socio-economic specialist's interviews with the I&APs, the owner of Portion 2 of the Farm Karree Doorn Pan No. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to Section 5.3 of the Socio-economic Report). As such, **132kV Power Line Corridor Option 4** is considered to be a slightly more favourable alternative from an environmental perspective. A preferred power line corridor alternative will however be selected and will be presented in the FBAR once comments on the DBAR have been received and all objections have been considered.

It is important to note that no fatal flaws were identified. The preferred substation site and favourable power line corridor alternatives are indicated in **Figure 76**. As previously mentioned, a preferred power line corridor alternative will only be selected once comments on the DBAR have been received and all objections have been considered and will be presented in the FBAR. It should be noted that the selected preferred alternatives will be based on both environmental constraints and design factors. In addition, the findings of the specialist studies and sensitivity mapping will be used to inform the layout of the proposed development within the preferred sites. The preferred site layout in relation to environmentally sensitive areas identified by the specialists will be presented in the FBAR.

In addition, the no-go areas which were identified by some of the specialists will also subsequently be incorporated into the layout. As a result of the no-go areas, the site layout will be amended in order to avoid these areas. The preferred site layout in relation to the no-go areas identified by the specialists will also be presented in the FBAR.

Refer to **Appendix 9** for the coordinates of the preferred site layout.

It should be noted that micro-siting may be required within the development area and authorised power line corridor during the detailed design phase to avoid any additional sensitive areas. In addition, the alignment of the power line within the authorised power line corridor will be determined during the detailed design phase. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction. In addition should the layout change subsequent to the issuing of an EA (should such authorisation be granted), any alternative layout or revisions to the layout occurring within the boundaries of the buildable area would not be regarded as a change to the scope of work or the findings of the impact assessments undertaken during the BA process. This is based on the understanding that the specialists have assessed the larger area in detail and all identified sensitive areas have been excluded from this area. Therefore, moving the components within the buildable area would not change the impact significance. Any changes to the layout within the boundaries of the buildable area following the issuing of the EA (should it be granted) will therefore be considered to be non-substantive.

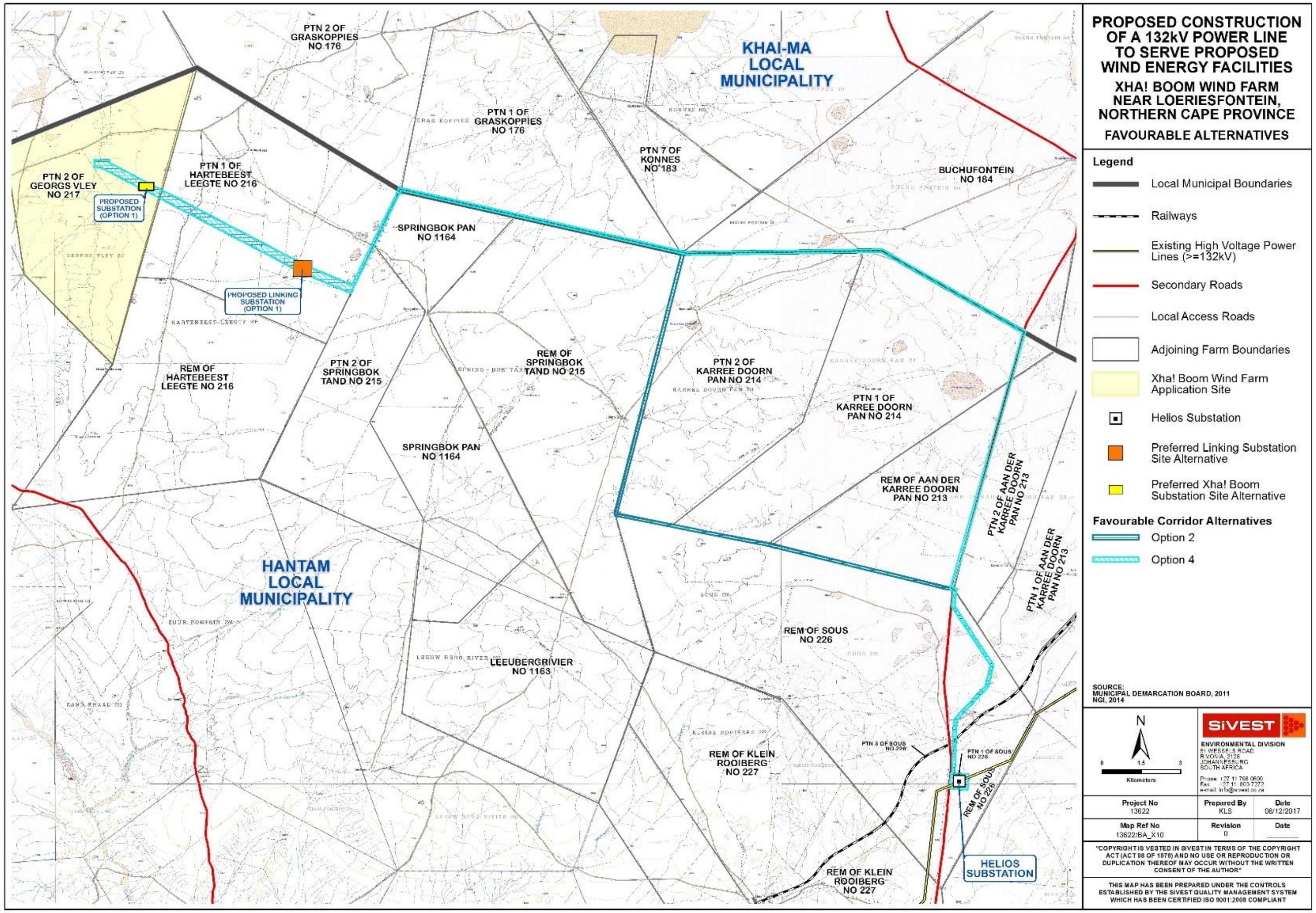

Figure 76: Preferred substation site and favourable power line corridor alternatives

11.1 No-go Alternative

The option of not implementing the activity, or **the 'no-go' alternative, is considered in the BA process**. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although wind power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed development would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. This is due to the fact that the proposed On-site Eskom substation, linking substation and power line are intrinsically linked to Mainstream's proposed !Xha Boom Wind Farm (part of a separate on-going EIA process) and will feed the electricity generated by this proposed wind farm into the national grid. As such, should this proposed development not be implemented, electricity generated by the proposed !Xha Boom Wind Farm cannot be fed into the national grid. It is thus a suitable sustainable solution to the energy crisis and this project would contribute to addressing the problem. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

The 'no-go' option would therefore result in not contributing to meeting the demand for electricity and more specifically renewable energy targets in South Africa. This would also hinder the economic injection that the project promises to provide for the town of Loeriesfontein in the form of short term employment, long term job creation and financial injection.

Although the negative impacts identified would not occur if the project did not go ahead, the socio-economic benefits of the proposed project should not be overlooked. The 'no-go' alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated and that by not building the project, the socio-economic benefits would be lost.

12 ENVIRONMENTAL MONITORING AND AUDITING

The Environmental Management Programme (EMPr) becomes a tool by which compliance on the proposed site can be measured against. In order to utilise this tool, environmental monitoring needs to take place with regular audits against the EMPr to ensure that all aspects are attended to.

Environmental monitoring establishes benchmarks to judge the nature and magnitude of potential environmental and social impacts.

Some of the key parameters for monitoring and auditing of the proposed project include the following inter alia:

- Soil erosion and siltation;
- Oil spillages;

- Dust and gaseous emissions;
- Water quality;
- Noise and vibration;
- Change in biodiversity;
- Socio-economic change; and
- Land use changes.

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable responses to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMPr.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social / environmental requirements. This person will maintain regular contact with the local / district Environmental Officers. The contractor and proponent will have a responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

- Encroachment into sensitive areas;
- Maintenance of project footprint;
- Vegetation maintenance around project work sites, workshops and camps; and
- Health and Safety.

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the implementing agencies. It is not the Contractor's responsibility to monitor land acquisition and compensation issues. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an independent environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

The Draft EMPr is included in **Appendix 8**.

13 COMPLIANCE WITH WORLD BANK STANDARDS AND EQUATOR PRINCIPLES

This report has been prepared to comply with various environmental legislation as well as World Bank Standards (IFC Guidelines) and the Equator Principles. Thus in order to ensure compliance with these, a checklist has been compiled to ensure that all aspects of these guidelines have been taken into account when compiling this document. **Table 74** below indicates that all applicable performance standards have been complied with.

The Equator Principles are a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. A number of banks, exchanges and organisations worldwide have adopted the Principles as requirements to be undertaken for project funding on application and approval. Furthermore, certain funding institutions have not formally adopted the Principles, but require clients to be compliant with them in order to qualify for loans. The Equator Principles are summarised below:

Principle 1: Review and Categorisation
When a project is proposed for financing, the Equator Principles Funding Institution ("EPFI") will categorise the project based on the magnitude of its potential environmental and social impacts and risks.

Principle 2: Environmental and Social Assessment
For each project assessed as being either Category A or Category B, the client / borrower must conduct a Social and Environmental Assessment ("Assessment") process to address the relevant impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Environmental and Social Standards
The Assessment will refer to the applicable IFC Performance Standards and applicable Industry Specific Environmental, Health, and Safety (EHS) Guidelines.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan
The client / borrower must prepare an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) must be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree to an Equator Principles Action Plan to outline gaps and commitments.

Principle 5: Stakeholder Engagement
For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project;

the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups.

Principle 6: Grievance Mechanism

The EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies.

Principle 7: Independent Review

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower must review the Assessment, AP and consultation process documentations in order to assist the EPFIs due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

An important strength of the Principles is the incorporation of covenants linked to compliance. For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects. For Category A and B projects, the client / borrower will covenant in financing documentation:

- To comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and

- To provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that i) document compliance with the ESMPs and Equator Principles AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country environmental and social laws, regulations and permits; and

- To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

Principle 9: Independent Monitoring and Reporting

To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower to retain qualified and experienced external experts to verify its monitoring information, which would be shared with EPFIs.

Principle 10: Reporting and Transparency

For all Category A and, as appropriate, Category B Projects:

- The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online.
- The client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

Although this report is not written in terms of the Equator Principles (EPs), it fully acknowledges that EPs will need to be complied with should funding for the project be required. In general, the following documentation will need to be considered in that regard:

- The "Equator Principles" 2013
- International Finance Corporations Performance Standards on Social and Environment, IFC, January 2012, namely:
    - Performance Standard 1: Social and Environmental Assessment and Management Systems
    - Performance Standard 2: Labour and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement
    - Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
    - Performance Standard 7: Indigenous Peoples
    - Performance Standard 8: Cultural Heritage

- International Finance Corporation – World Bank Guidelines, General EHS Guidelines 2007.

EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. These EHS Guidelines are applied as required by the World Bank's respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

- The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

The performance standards which have not been addressed at this stage as indicated in **Table 74** below will be addressed at a later stage when the proponent has reached financial closure. Therefore, the compliance level is partially compliant at this stage. It is important to note that the project proponent is committed to achieving compliance with the EPs.

The coding key is as follows:

Compliance level			
Clear			
Not assessed/determined	Not compliant	Partially compliant	Compliant

Appendix 1 includes the IFC Performance Standards on Environmental and Social Sustainability.

Table 74: Compliance with Equator Principles

Principles	Compliance Level	Reference
General, Performance Standard 1 Environmental and Social Reporting		
1. Baseline Information		Refer to **Chapter 4** – Technical Details and **Chapter 5** – Description of the receiving environment
2. Alternatives (Assessment of alternatives)		Refer to **Section 4.2** and **Chapter 11**
3. Impacts and risks		Refer to **Chapters 8** and **10**
4. Global impacts		N/A
5. Legal requirements		Refer to **Chapter 1, Section 1.3** for legal requirements and guidelines
6. Transboundary		N/A
7. Disadvantaged / vulnerable groups		Refer to **Section 7.7**
8. Third party		Refer to **Section 7.7**
9. Mitigation measures		Addressed in **Section 8** and **9**. These will be addressed as part of the EMPr
10. Documentation of Assessment Process		Refer to **Section 8**
11. Action Plans		Partially addressed in **Section 14.** No major Action Plans required as mostly generic mitigation measures have been required.
12. Organisational capacity		Refer to **Appendix 1**
13. Training		Refer to **Appendix 1**
14. Grievance mechanism		Refer to **Appendix 1**. The proponent will commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.
15. Report content		**Chapter 1, Section 1.1**
Performance Standard 2, Labour and Working Conditions		

Principles	Compliance Level	Reference
1. Human Resource Policy		Refer to **Appendix 1**. The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.
2. Working relationship		Refer to **Appendix 1**.
3. Working conditions with and terms of employment		Refer to **Appendix 1**.
4. Workers organisation		Refer to **Appendix 1**.
5. Non-discrimination and equal opportunities		Refer to **Appendix 1**. Partly addressed in **Section 7.7** as part of the Socio-economic assessment. This issue will also be addressed as part of the EMPr
6. Grievance mechanism		Refer to **Appendix 1**. To be addressed as part of the EMPr
7. Occupational Health and Safety		Refer to **Appendix 1**. To be addressed as part of the EMPr
8. Non-employee workers		Refer to **Appendix 1**. To be addressed as part of the EMPr
9. Supply Chain		Refer to **Appendix 1**. To be addressed as part of the EMPr
10. Labour Assessment Component of a Social and Environmental Assessment		Refer to **Appendix 1**. To be addressed as part of the EMPr
Performance Standard 3, Pollution		
1. Pollution Prevention, Resource Conservation and Energy Efficiency		Refer to EMPr in **Appendix 8**.
2. Wastes		Refer to EMPr in **Appendix 8**.
3. Hazardous material		Refer to EMPr in **Appendix 8**.
4. Dangerous substances		Refer to EMPr in **Appendix 8**.
5. Emergence preparedness and response		Refer to EMPr in **Appendix 8**. The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this

Principles	Compliance Level	Reference
		standard and this information will be made available in due course as part of the development planning for the project.
6. Technical guidance – ambient considerations		Refer to **Appendix 1**.
7. Greenhouse gas emissions		N/A. No greenhouse gas emissions will result from the proposed development.
Performance Standard 4, Health and Safety		
1. Hazardous materials safety		Refer to EMPr in **Appendix 8**.
2. Environmental and natural resource issues		Refer to **Sections 5** and **7.**
3. Emergency preparedness and response		Refer to EMPr in **Appendix 8**. The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.
Performance Standard 5, Land Acquisition		Refer to **Sections 3** and **4.**
Performance Standard 6, Biodiversity		Refer to **Section 5.7**, S**ection 7.1** and **Section 8.2.1** which summarises the findings of the Biodiversity Impact Assessment Study
Performance Standard 7, Indigenous People		Refer to **Sections 5.13** and **7.7** which detail the findings of the Socio-economic assessment. In addition, **Section 6** describes public participation.
Performance Standard 8, Cultural Heritage		Refer to **Section 7.5**.

14 EVALUATION AND RECOMMENDATIONS

Table 75 summarises the key recommendations for the environmental issues identified in the Draft Basic Assessment Report (DBAR). In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this BA (where practical and possible) have been included within an Environmental Management Programme (EMPr). This EMPr should form part of the contract with the contractors appointed to construct and maintain the proposed project. The EMPr would be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

A Draft EMPr is included with this DBAR as **Appendix 8**.

It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this BA process, and, in particular, during the construction phase associated with the proposed project.

The preferred substation site and favourable power line corridor alternativesare indicated in **Figure 76**. As previously mentioned, a preferred power line corridor alternative will only be selected and presented in the FBAR once comments on the DBAR have been received and all objections have been considered.

14.1 Summary of Findings

Table 75: Summary of findings and Recommendations

Environmental Parameter	Summary of major findings	Recommendations / Conclusions
Biodiversity	The on-site substation Option1 as well as both the Linking Substation alternatives are located within the Bushmanland Arid Grassland habitat type. The on-site Substation Option 2 is located within the Western Bushmanland Klipveld. These are extensive vegetation units with low diversity and low abundance of species of conservation concern. Consequently, nearly all of the substation alternatives are considered acceptable and would generate low impact. Only on-site Substation Option 2 is considered unfavourable as there a numerous small drainage lines in the affected area. On-site Substation Option 1 was identified as the preferred on-site substation alternatives and while differences are small, Linking Substation Option 1 was identified as the preferred linking substation alternative. In terms of the grid corridors, there was also not a lot of difference between the alternatives and preferences were based on relatively small differences in potential impact as no alternatives were considered fatally-flawed. Grid Corridor Option 2 was identified as the preferred route as there are no highly sensitive features along the route and the last third of the line towards Helios substation is located along existing roads and disturbed areas. The overall impact of this option would be the lowest of the options considered. Grid Corridor	The report concludes that with the application of relatively simple mitigation and avoidance measures, the impact of the !Xha Boom Wind Farm's grid connection can be reduced to a low overall level. There are no specific long-term impacts likely to be associated with the grid connection that cannot be reduced to an acceptable level through mitigation and avoidance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. All recommended mitigation measures should be implemented and adhered to.

	Option 4 is considered the next most favourable option as the route is adjacent to existing access routes or power lines for large sections of the route with the result that construction-phase disturbance is likely to be relatively low. Although the current assessment is only for the grid connection and substations, the grid connection is contingent on a wind energy facility being built and as such, the development of the power line and the wind farm are not independent of one another. Consequently, cumulative impacts for the power line have been considered in context of the wind farm as a whole, including the grid connection. An analysis of potential cumulative impacts in the area indicates that a node of renewable energy facilities is developing round the Helios Substation. The total potential extent of direct habitat loss from all proposed developments if they were all to be built would amount to about 3000ha. This represents about 1% of the local area and less than 0.1% of the Bushmanland Basin Shrubland or Bushmanland Arid Grassland vegetation type. This indicates that the current developments at the site do not pose a risk of significantly impacting the national availability of the affected units or elevate them to a higher threat status. The development of the !Xha Boom Wind Farm with associated grid connection would generate about 100ha of direct habitat loss which is not considered highly significant and the potential for habitat fragmentation from the development would also be low. The broader study area has low ecological sensitivity and the concentration of development	

	within this low sensitivity area is seen as having significantly less ecological impact compared to a more dispersed development pattern over a wider area. Based on these results, total cumulative impacts and the contribution of the !Xha Boom Wind Farm and associated grid connection to cumulative impacts in the region are seen as being acceptable and would remain of low overall significance.	
Avifauna	The proposed !Xha Boom grid connection and associated substations will have potential impacts on Red Data avifauna. The impacts are the following: ▪ Displacement due to disturbance during construction; ▪ Displacement due to habitat change and loss; and ▪ Collisions with the earthwire of the 132kV grid connection **Displacement due to habitat destruction and disturbance** 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. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in	**Displacement due to disturbance during construction** While the habituation is a factor to be considered, it would still be preferable to have an alignment as far as possible from the nest as a pre-cautionary measure to limit the potential for displacement during construction of the grid connection. The proposed !Xha Boom grid connection will have potential impacts on avifauna, ranging from high to low, prior to the implementation of mitigation. With the implementation of mitigation measures, the high impacts could be reduced to medium, while the low impacts can be further reduced. All four the proposed alignments are situated in the same habitat and are of comparable length. The associated impacts are therefore expected to be very similar in nature and extent. However, when looking very carefully at the four respective alignments, Options 1 and 3 are less favourable due to their proximity to the active Martial Eagle nest near Helios Substation. Option 4 emerges as most preferred:

	electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through transformation of habitat, which could result in temporary or permanent displacement. **<u>Displacement due to disturbance during construction</u>** Construction and maintenance activities could potentially displace Red Data species through disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities could be a source of disturbance and could lead to temporary or even permanent abandonment of nests. The most obvious potential issue that need to be addressed in this instance is the active Martial Eagle nest on the Aries - Helios 400kV line near the Helios substation. The nest was active in June 2017, which indicates that the birds have become habituated to the constant traffic on the dirt road that runs 450m from the nest. This is the main access road to Helios Substation, and is also constantly used by construction vehicles active at the Loeriesfontein 2 and Khobab WEFs. While the habituation is a factor to be considered, it would still be preferable to have an alignment as far as possible from the nest as a pre-cautionary measure to limit the potential for displacement during construction of the grid connection. Options 1 and 3 are approximately 1.2km from the nest at their closest point, while Options 2 and 4 are 2km from the nest at their closest point.	▪ It follows the main Loeriesfontein access road and existing HV lines for about a third of the way, thereby reducing the impact of habitat fragmentation, and reducing the risk of collisions; ▪ About 50% of the alignment is oriented in an east-west direction, which is parallel to the main migration movement of Ludwig's Bustard, therefore reducing the risk of collisions for the species; and ▪ It never comes closer than 2km from the active Martial Eagle nest on the Aries – Helios 400kV line, which reduces the risk of disturbance to the birds.

	The pre-mitigation risk of displacement due to disturbance during the construction phase is rated as low, but could be further reduced through appropriate mitigation. **<u>Displacement through habitat destruction during the construction phases</u>** In the present instance, the risk of displacement of Red Data species due to habitat destruction is likely to be fairly limited given the nature of the vegetation. Very little if any vegetation clearing will have to be done in the power line servitude itself. The habitat at the proposed !Xha Boom substation sites is common in the greater study area and the transformation of a few hectare of habitat should not impact any of the Red Data species significantly. The risk of displacement through habitat destruction during construction is rated as low, which could be reduced through appropriate mitigation. **<u>Collisions of Red Data species with the earthwire of the 132kV grid connection</u>** The most likely Red Data candidates for collision mortality on the proposed 132kV grid connection are Ludwig's Bustard, Karoo Korhaan, both whom have high reporting rates in the study area. Kori Bustard and Secretary Bird may also be at risk, although they occur at much lower densities than the previous two species.	

	The risk of collision mortality through collisions with the earthwire of the 132kV grid connection is rated as high which can be reduced to medium through appropriate mitigation. **Concluding Statement** Overall, the combined cumulative impacts of the proposed !Xha Boom grid connection and the existing and proposed HV networks on Red Data species, assuming implementation of appropriate mitigation measures, are expected to be moderate to minor within the 40km development node around Helios Substation. The overall cumulative assessment has been produced with a moderate level of certainty.	
Surface Water	Findings from the fieldwork undertaken show that the following surface water resources were identified on the study site: ▪ Five (5) Depression Wetlands; ▪ Twenty six (26) Major Drainage Lines including Klein-Rooiberg, Leeuberg and Hartbeeslaagte (drainage line with a channel width >5m); ▪ One hundred and eighty (180) Minor Drainage Lines (drainage lines with a channel width <5m). An ecological buffer zone of 100m for the major drainage lines and a buffer of 50m for minor drainage lines and the natural depression wetlands have been applied in consideration of the potential direct and indirect impacts which may occur, so as to limit these impacts on the surface water resources as far as practically possible.	Once a final layout (including a road plan and grid line, showing tower positions) is available, it is recommended that an assessment using the risk assessment protocol in terms of Government Notice 509 of 2016 (No. 40229) is undertaken to potentially determine whether a General Authorisation (GA) can be issued in this regard for water uses (c) and (i) instead of undertaking a full water use license application. Should it be identified that the proposed development falls within the Low risk category, a GA registration process may be applicable as opposed to a full water use license application. Specialist recommendations include the following: ▪ All surface water resources and buffer zones must be avoided as far as practically possible in the final layouts (including access / service roads and power

	A comparative assessment was undertaken to determine the environmentally preferred options include the following: ▪ On-site Substation Option 1 ▪ Linking Substation Option 2 ▪ Grid Line Option 3 The above preferred options were chosen given the fewer amount of surface water resources to be directly and indirectly affected as well as to ability of the grid line to avoid / span potentially affected surface water resources. It was identified that several potential impacts may affect the surface water resources within the proposed development area during the construction, operation and decommissioning phases as alluded to above. **Construction Phase:** ▪ Loss of Wetland and Riparian Habitat; ▪ Impacts to the Geomorphology of Surface Water Resources; ▪ Impacts to Soil and Water in Surface Water Resources; and ▪ Impacts to the Fauna associated with Surface Water Resources. **Operation Phase:** ▪ Impacts to the Geomorphology of Surface Water Resources.	lines, including tower positions) to be designed in order to minimise and potentially avoid potential impacts as far as possible. ▪ Where it is not possible to avoid impacts to surface water resources as a result of roads and power lines, the necessary water use license / general authorisation and environmental authorisations as relevant will be required prior to construction. ▪ All stipulated mitigation measures are to be adhered to in order to minimise potential impacts to surface water resources. ▪ With the implementation of mitigation measures, it is the opinion of this specialist that the proposed development components as per the layout are acceptable (notwithstanding final access / service road layouts, final grid line routes and tower positions) and therefore, may by environmentally authorised.

	From a direct cumulative potential impact perspective, where there is no direct impact to surface water resources on the proposed project site, there will be no direct cumulative impact to surface water resources from a project site specific level. The nearest surrounding development that could potentially be impacted as a result of the proposed development from an indirect perspective is the Kokerboom 2 Wind Farm. This wind farm is located approximately 9km from the proposed development site. Therefore, there is a fair distance between the proposed development and the nearest surrounding development. The two sites are also separated by a watershed and occupy separate local catchments. Drainage from the proposed development is in a northern direction, whilst drainage for the Kokerboom 2 Wind Farm is in a south eastern direction. As a result, it is therefore highly unlikely that the proposed development will affect the Kokerboom 2 Wind Farm should this development proceed to construction. Indirect impacts such as increased run-off, consequent sedimentation and erosion are highly unlikely. Over and above the negligible potential cumulative impact to Kokerboom 2 Wind Farm, the potential cumulative impact on the remaining surrounding renewable energy developments is negligible for the same reasons, as stated above. The negligible cumulative impact is compounded by the fact that there is an increased distance to the remaining surrounding proposed renewable energy developments.	

	In terms of NEMA (1998) and the EIA Regulations (2017), based on the current layout, it has been identified that Activities 12 and 19 of Government Notice 327 Listing Notice 1 may be triggered due to potential direct impacts due to access / service roads and power lines, thereby requiring Environmental Authorization. In terms of the NWA (1998), it has been identified that based on the current layout, there are a number of surface water resources which may be affected by access / service roads and power lines. Water uses (c) and (i) will therefore be applicable. However, once a final layout (including a road plan and grid line, showing tower positions) is available, it is recommended that an assessment using the risk assessment protocol in terms of Government Notice 509 of 2016 (No. 40229) is undertaken to potentially determine whether a General Authorisation (GA) can be issued in this regard for water uses (c) and (i) instead of undertaking a full water use license application. Should it be identified that the proposed development falls within the Low risk category, a GA registration process may be applicable as opposed to a full water use license application.	
Soils and Agricultural Potential	The proposed development is on land zoned and used for agriculture (grazing). 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 development is on land which is of extremely low agricultural potential, and which is only suitable as grazing land.	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. The following mitigation measures were recommended: ▪ Implement an effective system of storm water run-off control;

	The key findings of the Soils and Agricultural Potential study include the following: ▪ Soils across the study area are predominantly shallow, sandy soils on underlying rock or hard-pan carbonate, of the Coega, Mispah, Glenrosa and Askham soil forms. ▪ The major limitations to agriculture are the extremely limited climatic moisture availability and the poor soils. ▪ As a result of these limitations, the study area is unsuitable for cultivation and agricultural land use is limited to low intensity grazing. ▪ The land capability is classified as Class 7 - non-arable, low potential grazing land. The study area has a very low grazing capacity of 45 hectares per large stock unit. ▪ There are no agriculturally sensitive areas and no parts of the study area need to be avoided by the development. ▪ The significance of all agricultural impacts is kept low by two important factors. The first is that the actual footprint of disturbance of the development is very small in relation to the available grazing land. The second is the fact that the proposed study area is on land of extremely limited agricultural potential that is only viable for low intensity grazing. ▪ Six potential negative impacts of the development on agricultural resources and productivity were identified as:	▪ Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas; ▪ Control dust through appropriate dust suppression methods; ▪ Strip and stockpile topsoil before disturbance and re-spread it on the surface as soon as possible after disturbance; ▪ Manage any sub-surface spoils from excavations in such a manner that they will not bury the topsoil of agricultural land; ▪ Minimise road footprint and control vehicle access on designated roads only; and ▪ Implement effective spillage and waste management system. No additional investigation of agricultural issues is required for the Environmental Impact Assessment of the proposed development.

	◦ Loss of agricultural land use caused by direct occupation of land by the development's footprint of disturbance. ◦ Soil Erosion caused by alteration of the surface characteristics. ◦ Generation of dust caused by alteration of the surface characteristics. ◦ Loss of topsoil in disturbed areas, causing a decline in soil fertility. ◦ Degradation of surrounding grazing land due to vehicle trampling. ◦ Soil contamination from hydrocarbon spills during construction. ▪ All impacts were assessed as having low significance. ▪ 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. ▪ Cumulative impact is also assessed as low. Furthermore 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. ▪ There are no conditions resulting from this assessment that need to be included in the environmental authorisation. ▪ There is no difference and therefore no preference between the proposed alternatives, in terms of agricultural impacts.	

Heritage	The background research completed in October 2016 has shown that the proposed !Xha Boom WEF grid connection and substation to be developed as a WEF may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites. The subsequent field work completed for October 2016 and June 2017, has confirmed the presence of 1 heritage resource (XHA003) as well as several areas with existing infrastructure such as fenced off camps, windmills and reservoirs. **<u>Impact and Cumulative Impact:</u>** Only one low significance identified heritage resources is affected by the proposed grid connection and substation layout. The impact by the proposed development on heritage resources will be low to negligible. It is the specialist's considered opinion that this additional load on the overall impact on heritage resources will have a low to negligible cumulative impact. None of the alternatives are deemed to be unfavourable and all can be utilised from a heritage point of view. **<u>Palaeontology</u>** In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of	The design process and methodology followed by the developer for this project will enabled the heritage assessment to provide input into the proposed layouts. This resulted in cognisance being taken of the positions of the heritage resources and thus the reduction of impacts at an early design phase The mitigation measures proposed is as follows: ▪ **<u>Pre-Construction:</u>** 1. A walk down of the final layout to determine if any significant sites will be affected. 2. Monitor find spot areas, by a qualified archaeologist, if construction is going to take place through them. 3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by practitioner qualified archaeologist during the construction phase. 4. Avoid the historical farmstead at BHL001. ▪ **<u>Palaeontology</u>** In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.

	significant new fossil material here, no further specialist studies are considered to be necessary.	However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.
Palaeontology (Desktop)	The development footprint is underlain by the Permo-Carboniferous Dwyka Group and Early to Middle Permian basinal mudrocks of the lower part of the Ecca Group (Karoo Supergroup). This include the Prince Albert, Whitehill and Tierberg Formations (in order of decreasing age). Permian and Jurassic bedrocks are mantled with a range of superficial deposits, mostly Late Caenozoic (Quaternary to Recent) in age. The intrusive Karoo dolerites are of no palaeontological significance and the Late Caenozoic superficial deposits are generally of low palaeontological sensitivity. Fossil material of aquatic vertebrates (fish, mesosaurid reptiles,) invertebrates (*e.g.* crustaceans) and petrified wood	Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional paleontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum

	is known from the Whitehill Formation. These fossils are more scarce in the Prince Albert and Tierberg Formations. However, fossils other than trace assemblages are generally scarce and most of the Ecca sediments are of low overall palaeontological sensitivity. The proposed Leeuwberg wind farm development is thus unlikely to pose a substantial threat to local fossil heritage. In Palaeontological terms the significance is rated as LOW (negative). Consequently, pending the discovery of significant new fossil material here, no further specialist studies are considered to be necessary.	standards for palaeontological impact studies developed by SAHRA. Recommended mitigation of the inevitable damage and destruction of fossil within the proposed development area would involve the following: ▪ Surveying, recording, description and collecting of fossils within the development footprint by a professional palaeontologist. This work should take place after initial vegetation clearance has taken place but before the ground is levelled for construction ▪ Well-documented records and further palaeontological studies of any fossils exposed during construction would represent a positive impact from a scientific perspective. ▪ The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the implementation of adequate damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category.
Visual	It is SiVEST's opinion that the visual impacts are not significant enough to prevent the project from proceeding and that an EA should be granted. It should be noted that no visually sensitive receptors with tourism significance have been identified within the study area. A total number of nineteen (19) potentially sensitive visual receptors were however identified. These included scattered farmsteads / homesteads which house the local farmers as well as their	It is recommended that all mitigation measures should be implemented.

	farm workers. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. From a visual impact perspective, only three (3) of the potentially sensitive visual receptors (namely VR 27, VR 32 and VR 34) are expected to experience a high degree of visual impact from the proposed development. In addition, the proposed development is expected to alter the largely natural / scenic character of the study area and contrast significantly with the typical land use and/or pattern and form of human elements present as the study area is largely natural / scenic and untransformed. The existing anthropogenic elements already present in the study area have however already altered the natural character of the surrounding environment to a degree and are expected to lower the visual contrast of the proposed development with the surrounding area. SiVEST is therefore of the opinion that the visual impact associated with the construction and operation phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.	
Socio-economic	The relevant national, provincial, and local government policies reveal that the development of RE technologies is strongly supported by government. It is seen as the means to diversify the energy mix in the country, achieve climate change commitments, and stimulate economic development in the country while creating new employment opportunities. As such, the assessment of the proposed project revealed that the stimulation of the economy, job creation and	Mitigation measures include the following: ▪ To increase the profitability of the project and ensure the trickling down effect to the local economy, the project proponent must source the materials and equipment in South Africa. ▪ Where feasible (i.e. in cases where the appointed individuals match the skills required), the proponent is to ensure the employment of local labour.

	improved service infrastructure are among the positive impacts that can ensue from the proposed project during both construction and operational phase. According to the Hantam IDP, the economy of the Hantam LM is characterised by heavy dependence on the primary sector, low education and skill levels. Therefore, the introduction of the proposed development is expected to benefit the local municipality specifically due to its small economic base and large unemployment rate. The following positive and negative impacts are anticipated during the construction and operation phases: ▪ Stimulation of the economy and creation of temporary employment during construction; ▪ Increased risk of threat to personal safety and livestock theft during construction; ▪ Impact on the sense of place; and ▪ Impact on service infrastructure. Based on the results of the comparative review of the proposed alternatives and options for the power line route and substations, the following can be recommended: ▪ **<u>Substation route alternative</u>:** In all instances (impacts) related to the substation alternatives (both on-site and linking substations), no preferences were identified for any of the alternatives. ▪ **<u>Power line route option</u>:** Considering the identified potential negative and positive impacts, corridor option 3 (pink) appears to be slightly more preferred among the	▪ Ensure effective lines of communication and disseminate as much information to local communities regarding the project and employment opportunities for contracting small businesses. ▪ Minimise the possibility of attracting a number of people in search for employment in the vicinity of the farms by ensuring clear communication regarding the project. ▪ Engage with property owners prior to the developing of the substations and erection of the power line to ensure that the expectations (rules) of the farmers regarding access to farms are understood and effectively adhered to. ▪ Construction workers must be thoroughly informed of the rules made by farmers and be made to understand the accompanying consequences. ▪ Implement controlled access to farm properties where the power line and substations will be built and will ensure that the construction workers are on site during reasonable working hours. ▪ Implement mitigation measures recommended by the relevant specialist (i.e. visual). ▪ Deconstruct the power line and substations once the wind facility is decommissioned.

	four alternatives. Although it will result in the lowest economic benefits to the national and local economy, such benefits would be temporary and would not be significant regardless of the route option chosen. Importantly, Option 3 affects the least farms and is associated with the shortest power line length. Option 1 and 2 are considered favourable and are slightly more preferred than Option 4 from the reviewed socio-economic impacts perspective. However, considering that the owner of the Portion 2 of Farm Karree Doorn Pan no. 214 raised an objection against Option 2 and expressed a preference for Option 4 (refer to section 5.3), it would be advisable to consider Option 1 and Option 4 before selecting Option 2.	

A summary of the impact rating of the proposed development according to each environmental aspect are provided in **Table 76** - **Table 78** below.

Key

LOW NEGATIVE	**LOW POSITIVE**
MEDIUM NEGATIVE	**MEDIUM POSITIVE**
HIGH NEGATIVE	**HIGH POSITIVE**

Table 76: Impact rating summary for the proposed !Xha Boom On-site Eskom Substation, Linking Substation and associated 132kV Power Line during the construction phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Impacts on vegetation and protected plant species	- 28 (low negative)	- 13 (very low negative)
	Impacts on fauna	- 24 (low negative)	- 20 (low negative)
	Cumulative habitat loss and fragmentation	- 30 (medium negative)	- 26 (low negative)
Avifauna	Displacement of Red Data species due to disturbance during construction phase	- 22 (low negative)	- 9 (low negative)
	Displacement of Red Data species due to habitat destruction during construction phase	- 26 (low negative)	- 13 (low negative)
Surface Water	Potential Construction Impacts to Surface Water Resources Habitat	- 42 (medium negative)	- 26 (low negative)
	Potential Construction Impacts to the Geomorphology of the Surface Water Resources	- 42 (medium negative)	- 26 (low negative)
	Potential Construction Impacts to the Soil and Water Contamination Impacts to Surface Water Resources	- 42 (medium negative)	- 26 (low negative)
	Potential Construction Impacts to the Fauna associated with Surface Water Resources	- 22 (low negative)	- 6 (low negative)
Soils and Agricultural Potential	Loss of Agricultural Land Use (Grazing)	- 13 (low negative)	N/A
	Erosion due to alteration of the land surface run-off characteristics	- 11 (low negative)	- 10 (low negative)
	Loss of topsoil caused by poor topsoil management during construction related soil profile disturbance	- 11 (low negative)	- 10 (low negative)
	Degradation of veld vegetation beyond the direct development footprint caused by trampling due to vehicle passage, and deposition of dust	- 10 (low negative)	- 9 (low negative)

	Impact on Air Quality due to Dust Generation	- 10 (low negative)	- 9 (low negative)
	Soil contamination	- 10 (low negative)	- 9 (low negative)
	Cumulative loss of agricultural land use (Grazing)	- 15 (low negative)	N/A
Heritage and Palaeontology	Impact on the Palaeontology Heritage (fossils) of the development footprint	- 28 (low negative)	- 6 (low negative)
	Impact on the Heritage Resources	- 40 (medium negative)	- 16 (low negative)
	Impact on Chance Finds (unidentified heritage structures)	- 34 (medium negative)	- 17 (low negative)
Visual	Visual impacts of the proposed !Xha Boom Substation, Linking Substation and 132kV power line (including associated infrastructure) during construction	- 24 (low negative)	- 20 (low negative)
Socio-economic	Production and temporary employment creation during construction	+ 12 (low positive)	+ 12 (low positive)
	Increased risk of threat to personal safety and livestock theft during construction	- 10 (low negative)	- 9 (low negative)
	Change in sense of place during construction	- 13 (low negative)	- 12 (low negative)

Table 77: Impact rating summary for the proposed !Xha Boom On-site Eskom Substation, Linking Substation and associated 132kV Power Line during the operational phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Increased Erosion Risk	- 24 (low negative)	- 10 (very low negative)
	Alien plant invasion risk	- 24 (low negative)	- 10 (very low negative)
	Cumulative habitat loss and fragmentation	- 30 (medium negative)	- 26 (low negative)
Avifauna	Collisions of Red Data species with the power line in the operational phase	- 51 (high negative)	- 48 (medium negative)
Surface Water	Impacts to the Geomorphology of Surface Water Resources	- 45 (medium negative)	- 24 (low negative)
	Loss of Agricultural Land Use (Grazing)	- 13 (low negative)	N/A

Soils and Agricultural Potential	Erosion due to alteration of the land surface run-off characteristics	- 11 (low negative)	- 10 (low negative)
	Cumulative loss of agricultural land use (Grazing)	- 15 (low negative)	N/A
Heritage and Palaeontology	Cumulative Impacts on Heritage Resources	- 18 (low negative)	- 18 (low negative)
Visual	Visual impacts of the proposed !Xha Boom Substation, Linking Substation and 132kV power line (including associated infrastructure) during operation	-34 (medium negative)	-34 (medium negative)
Socio-Economic	Change in sense of place during operation	- 13 (negative low)	- 12 (negative low)
	Impact on service infrastructure	+ 30 (positive medium)	+ 30 (positive medium)

Table 78: Impact rating summary for the proposed !Xha Boom On-site Eskom Substation, Linking Substation and associated 132kV Power Line during the decommissioning phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Impacts on fauna due to decommissioning phase activities	- 20 (low negative)	- 18 (low negative)
	Increased Erosion Risk due to Decommissioning	- 24 (low negative)	- 9 (very low negative)
	Alien plant invasion risk following decommissioning	-33 (medium negative)	-18 (low negative)
Soils and Agricultural Potential	Loss of Agricultural Land (Grazing)	- 13 (low negative)	N/A
	Erosion due to alteration of the land surface run-off characteristics	- 11 (low negative)	- 10 (low negative)

14.2 Conclusion and Environmental Impact Statement

The findings of the specialist studies undertaken within this BA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the construction of the proposed !Xha Boom On-site Eskom substation, linking substation and associated 132kV power line. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding. Areas of special concern have however been identified which will require site specific mitigation measures to reduce impacts. These are included within the EMPr to ensure that these areas receive special attention.

It was determined during the BA that the proposed development will result in limited potential negative impacts and certain positive impacts. A preferred layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

A detailed public participation process was followed during the BA process which conforms to the public consultation requirements as stipulated in the EIA Regulations, 2014. In addition, all issues raised by I&APs will be captured in the FBAR and where possible, mitigation measures provided in the EMPr to address these concerns.

As sustainable development requires all relevant factors to be considered, including the principles contained in section 2 of NEMA, the DBAR has strived to demonstrate that where impacts were identified, these have been considered in the determination of the preferred layout.

It should be noted that micro-siting may be required within the development area during the detailed design phase to avoid any additional sensitive areas, and any new palaeontological outcrops. In addition, the final layout will be determined during the detailed design phase. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction.

It is the opinion of the EAP that the information and data provided in this DBAR is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Furthermore, it is the opinion of the EAP, that based on the findings of the BA that the proposed development should be granted an EA and allowed to proceed provided the following conditions are adhered to:

- The proposed 132kV On-site Eskom Substation should be constructed within the preferred substation site for Option 1. This is also the option which Mainstream are considering as their preferred alternative. This is deemed to be acceptable as Option 1 was found to be the preferred alternative from an environmental perspective and would not result in any significant environmental impacts. In addition, the extent of the preferred On-site Eskom substation site has been reduced in order to avoid the identified environmentally sensitive areas. As such, in combination with the shorter distance to the connecting linking substation, this alternative is considered to be preferred.

From a technical perspective, the shorter distance between the On-site Eskom substation and the linking substations reduces the amount of electrical losses experienced, which is also preferred.

- The proposed 132kV Linking Substation could be constructed within either Option 1 or Option 2 as both alternatives were deemed to be equally preferred from an environmental perspective. Both options are thus deemed to be acceptable. It should however be noted that Mainstream are considering Option 1 as their preferred linking substation site alternative. This is deemed to be acceptable as both options were found to be equally preferred from an environmental perspective and would not result in any significant environmental impacts. In addition, Option 1 would reduce the length of the overhead power line which will connect to the Helios MTS by approximately 3km and will also reduce the length of the required access roads to the On-site Eskom substation site. Therefore, from environmental and technical perspectives, Option 1 is deemed to be acceptable and is thus the preferred alternative.
- The proposed 132kV power line should be constructed within either Power Line Corridor Option 2 or Power Line Corridor Option 4 as these alternatives were found to be preferred from avifauna, biodiversity, visual and socio-economic perspectives. Power Line Corridor Option 2 and Option 4 are thus both considered to be favourable from an environmental perspective. It should however be noted that Power Line Corridor Option 4 is considered to be a slightly more favourable alternative. A preferred power line corridor alternative will however be selected and will be presented in the FBAR once comments on the DBAR have been received and all objections have been considered.
- Final routing of the proposed power line within the corridor should avoid tower placement within 32m of any identified surface water resources (such as the drainage lines and wetlands), and associated environmentally sensitive areas located within the power line corridor and no construction activities should take place within these areas.
- All feasible and practical mitigation measures recommended by the various specialists must be implemented, where applicable to the authorised substation site and power line corridor.
- Final EMPr should be approved by DEA prior to construction.
- The final power line and access road alignment should be submitted to the DEA for approval prior to commencing with the activity.

SiVEST, as the EAP, is therefore of the view that:

- Preferred On-site Eskom and Linking Substation sites have been identified which are less environmentally sensitive compared to the alternative sites considered throughout the BA process.
- Favourable power line corridors have been identified which are environmentally acceptable and will not result in significant impacts, provided that the recommended mitigation measures are implemented and the routing of the power line within the corridor avoids tower placement within environmentally sensitive areas. As previously mentioned, a preferred power line corridor alternative will only be selected once comments on the DBAR have been received and all objections have been considered and will be presented in the FBAR.

- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the proposed project can be mitigated to acceptable levels.

The date on which the activity will commence cannot be determined at this stage as they are based on the timeframes dictated by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows. The date of the next round of bid submissions has not yet been announced. The construction of the !Xha Boom On-site Eskom Substation, Linking Substation and associated 132kV Power Line is dependent on being selected as a preferred bidder. The project will therefore require an environmental authorisation of at least 5 years.

It is trusted that the DBAR provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

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