

RED CAP HOOGLAND NORTHERN WIND FARM CLUSTER FINAL ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

Prepared for: Red Cap Hoogland 1 (Pty) Ltd and
Red Cap Hoogland 2 (Pty) Ltd

Authority References:

Hoogland 1 Wind Farm - 14/12/16/3/3/2/2147

Hoogland 2 Wind Farm - 14/12/16/3/3/2/2146



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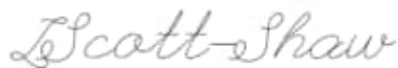
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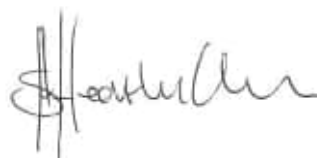
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REPORT SIGN OFF AND APPROVALS



Liandra Scott-Shaw
(Project Manager and assistant author)



Stuart Heather-Clark
(Author and Reviewer)

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GENERAL SITE INFORMATION AS REQUIRED BY DFFE:

Hoogland 1 Wind Farm – Ref: 14/12/16/3/3/2/2147

The infrastructure associated with the Hoogland 1 Wind Farm (14/12/16/3/3/2/2147) includes the following:

- Wind turbines (up to a max of 60) with targeted nameplate generation capacity up to a maximum of 420 MW (see Table 2-3 for turbine specifications).
- Turbine foundations (circular foundation for each turbine with diameter of up to 35 m, alongside 40 m hardstand - 1,400 m²).
- Hardstands/laydown areas (temporary areas up to max of 5,200 m² per turbine), which include the following:
 - permanent 80 m x 40 m crane pad placed adjacent to each turbine foundation;
 - additional 20 m x 40 m temporary hardstand area near each crane pad;
 - 104 m x 20 m blade laydown area;
 - approx. 104 m x 5 m additional embankment area (where necessary due to slopes); and
 - temporary 120 x 15 m crane boom assembly area.
- Underground cabling (up to 66kV) to connect turbines to on-site Substation.
- Internal wind farm overhead powerlines (up to 66 kV lines supported by structures up to approx. 22 m high, as well as tracks for access to pylons) where burying is not possible due to technical, geological, environmental or topographical constraints.
- Permanent and temporary site roads, which include the following:
 - permanent 6 m wide roads (may require side drains on one or both sides, depending on topography);
 - up to 15 m wide temporary road corridor (temporarily impacted during construction & rehabilitated to allow for 6 m road surface after construction); and
 - total road network also includes upgrades to sections of public roads and shared road infrastructure with Hoogland 2 Wind Farm (14/12/16/3/3/2/2146).
- Wind Farm substations (2 x 75 m substation yards that will include an O&M building, Substation building & High Voltage Gantry).
- Battery Energy Storage System (BESS) (2 x ±3.5 ha areas which may be adjacent or slightly removed from each of the 2 Substations, depending on local constraints).
- Operations and maintenance (O&M) area (includes all offices, stores, workshops & laydown area).
- Security gate and hut at most entrances to Wind Farm site (4 x entrances each at 20 m²).
- Up to 2.4 m high fence for enclosure of temporary and permanent yard areas (with access control). No fencing around individual turbines (existing fencing shall remain around perimeter of properties).
- Temporary areas required for the construction/decommissioning phase, which include the following:
 - temporary site camp area/s of ±20,000 m²;
 - batching plant area of ±2,000 m²;
 - general laydown area of ± 36,000 m²; and
 - bunded fuel & lubricants storage facility at the site camp of Wind Farm.
- Shared offsite infrastructure in the form of temporary bypass road on N1 to avoid the town of Beaufort West for major Wind Farm components (also previously authorised as part of Nuweveld Wind Farms), as follows¹:
 - up to 6 m wide road surface (with side drains), however, a 12 m wide road corridor may be temporarily impacted during construction and rehabilitated once construction is complete;
 - temporary road will be approx. 5.6 km in length (of which approx. 2.5 km is along existing track); and
 - road will also be used by Hoogland 1 Wind Farm and Hoogland 2 Wind Farm (hence why it is shared infrastructure between Nuweveld projects and Hoogland 1 and 2 Wind Farm projects).

¹ More information on shared infrastructure (upgrades to watercourse crossings outside wind farm site boundaries and temporary N1 Bypass around Beaufort West) can be found in Section 2.4.4 and shown in Figure 2-17.

- Other offsite shared infrastructure in the form of stream crossings upgrades (along R381 to north of project area & along DR02314 to north-west of project area)¹.

Please refer to Section 2.2 (specifically Table 2-3) and Section 2.4 for full descriptions related to the technical details of the infrastructure associated with the Hoogland 1 Wind Farm. This includes the footprints associated with all project infrastructure. A summary of the technical details for the proposed Wind Farm, including descriptions and/or dimensions, is provided in the table below.

Information requested by DFFE	Description / Details		
Descriptions of all affected farm portions; and 21-Digit Surveyor General (SG) code of all affected farm portions	Farm Number	Farm Name	21-Digit SG Code
	Wind Farm Site		
	RE1/6	Slange Fontein	C0090000000000600001
	2	Bastards Poort	C0090000000000200000
	1/24	Elands Fontein	C00900000000002400001
	RE/6	Slange Fontein	C0090000000000600000
	2/5	Duikerfontein	C0090000000000500002
	RE1/5	Duikerfontein	C0090000000000500001
	2/1	Droog Fontein	C0090000000000100002
	3/1	Droog Fontein	C0090000000000100003
	RE/5	Duikerfontein	C0090000000000500000
	3/5	Duikerfontein	C0090000000000500003
	7/6	Slange Fontein	C0090000000000600007
	Temporary bypass road around Beaufort West (shared infrastructure)		
	Farm 185	Farm 185	C0090000000018500000
	RE Erf 5372	Beaufort West Township	C00900010000537200000
	Offsite watercourse crossing upgrades (shared infrastructure)²		
	DR02314-1		
	1/330	Riet Poort	C0260000000033000001
	DR02314-2&3		
	1/330	Riet Poort	C0260000000033000001
	330	Farm 330	C0260000000033000000
	DR02314-4		
	28	Platfontein	C0090000000002800000
	1/336	Fonk Fontein	C0260000000033600001
	R381-5 & R381-6		
	143	Farm 143	C0800000000014300000
Central co-ordinates of the site and activity location	Also refer to Figure 1-2 and <i>Appendix B: Maps</i> for Locality Plan		
	31° 38' 18,90" S	22° 18' 0,44" E	
<u>BESS 1A Centre coordinates of the site and activity location</u>	<u>31° 38' 32,242" S</u>	<u>22° 22' 18,562" E</u>	
<u>Substation 1A Centre coordinates of the site and activity location</u>	<u>31° 38' 32,150" S</u>	<u>22° 22' 25,041" E</u>	
<u>BESS 1B Centre coordinates of the site and activity location</u>	<u>31° 38' 20,703" S</u>	<u>22° 21' 58,516" E</u>	

² Application will also include upgrades to a number of watercourse crossings outside the wind farm site boundary along existing roads (and therefore linear infrastructure). These watercourse crossing upgrades are considered shared infrastructure (i.e., authorisation is sought for these in both the Hoogland 1 and Hoogland 2 Wind Farm Applications). More information on these can be found in Section 2.4.4 and shown in Figure 2-17

Substation 1B Centre coordinates of the site and activity location	<u>31° 38' 25.578" S</u>	<u>22° 21' 54.053" E</u>	
Corner point coordinates of the site and activity location	31° 35' 33.130" S	22° 16' 22.528" E	
	31° 35' 0.429" S	22° 18' 44.232" E	
	31° 40' 8.157" S	22° 29' 34.941" E	
	31° 43' 49.533" S	22° 28' 6.067" E	
	31° 39' 49.468" S	22° 15' 1.050" E	
	31° 39' 41.628" S	22° 15' 34.998" E	
	31° 42' 20.331" S	22° 14' 8.936" E	
	31° 41' 51.643" S	22° 17' 49.637" E	
	31° 39' 25.999" S	22° 21' 16.752" E	
	31° 38' 58.268" S	22° 21' 12.216" E	
	31° 42' 10.693" S	22° 14' 14.564" E	
	31° 41' 21.623" S	22° 20' 45.684" E	
	31° 41' 13.980" S	22° 21' 0.386" E	
	31° 41' 8.128" S	22° 21' 29.849" E	
	31° 40' 54.255" S	22° 21' 30.529" E	
	31° 40' 30.911" S	22° 22' 20.308" E	
	31° 40' 43.262" S	22° 22' 25.192" E	
	31° 40' 2.745" S	22° 23' 42.813" E	
	31° 40' 7.080" S	22° 23' 57.280" E	
	31° 39' 14.341" S	22° 22' 10.211" E	
31° 40' 59.214" S	22° 19' 57.802" E		
31° 40' 43.829" S	22° 19' 59.009" E		
31° 40' 45.043" S	22° 19' 43.761" E		
31° 40' 24.154" S	22° 19' 32.200" E		
31° 40' 1.061" S	22° 18' 54.082" E		
31° 39' 43.489" S	22° 19' 3.222" E		
Offsite watercourse crossing upgrades (shared infrastructure)			
Watercourse Crossing	Province and Municipality	Coordinates (North)	Coordinates (South)
DR02314-1	Northern Cape, Namakwa DM, Karoo Hoogland LM	31° 46' 37" S; 22° 4' 22" E	31° 47' 2" S; 22° 4' 26" E
DR02314-2&3	Northern Cape, Namakwa DM, Karoo Hoogland LM	31° 48' 36" S; 22° 5' 24" E	31° 49' 43" S; 22° 5' 42" E
DR02314-4	Northern Cape, Namakwa DM, Karoo Hoogland LM; and Western Cape, Central Karoo DM, Beaufort West LM	31° 52' 49" S; 22° 5' 21" E	31° 53' 2" S; 22° 5' 20" E
R381-5	Northern Cape, Pixley ka Seme DM, Ubuntu LM	31° 32' 1" S; 22° 20' 27" E	31° 32' 23" S; 22° 20' 19" E
R381-6	Northern Cape, Pixley Ka Seme DM, Ubuntu LM	31° 33' 17" S; 22° 21' 2" E	31° 33' 33" S; 22° 21' 7" E
Photos of areas that give a visual perspective of all parts of the site	Photos from Visual Impact Assessment illustrating the characteristics of the site (Lawson and Oberholzer, 2022):		



Photos from Terrestrial Biodiversity Assessment illustrating the characteristics of the site (Todd, 2022):

	
<p>Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)</p>	<p>Please refer to Section 7 for more photographs of the site, as provided by the specialists. The Visual Impact Assessment (<i>Appendix C11: Visual</i>) shows photomontages from key viewpoints with high visibility.</p>
<p>Facility design specifications including:</p>	
<p>Type of technology</p>	<p>Wind Energy – onshore turbines</p>

Number of turbines	Up to a maximum of 60 wind turbine generators ³ .
Structure height	The following wind turbine envelope is proposed: <ul style="list-style-type: none"> • Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius) • Hub height: 80 m to 150 m • Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5m blade = 247.5m) • Rotor bottom tip height: minimum of 20 m (and not lower). See Figure 2-7 in Section 2.4.1 for a visual representation of the wind turbine envelope proposed.
Surface area to be covered (including associated infrastructure such as roads)	Total disturbance footprint: 165.7 ha temporary and 141 ha permanent* Turbine foundations (40 m x 35 m): 8.4 ha permanent Crane pads (80 m x 40 m): 19.2 ha permanent Turbine hardstands (20 m x 40 m), including blade laydown area (104 m x 20 m), embankment where necessary (104 m x 5 m) & crane boom assembly area (120 x 15 m): 31.2 ha temporary Cabling: 11.2 km in length and 6.7 ha (temporary) in extent Internal WEF overhead powerlines: 3.4 km in length and 2 ha (permanent) in extent Site Roads: total road network = 122.2 km. 97.7 ha permanent* and 110 ha temporary* N1 Bypass Road (Shared offsite infrastructure): 6.8 ha temporary (shared) Two Wind farm substation and two battery energy storage systems (BESS): 2.3 ha permanent for substations and 7 ha permanent for BESSs Operations and maintenance (O&M) area: Forms part of substation yard Security: 80 m ² Temporary construction area (including site camp, batching plant, general laydown area and bundler fuel & lubricants storage facility): 6 ha temporary Other offsite shared infrastructure (stream crossings upgrades along R381 to north of project area and along DR02314 to south-west of project area): 4.4 ha permanent (shared) and 5 ha temporary (shared)
Structure orientation	The turbine blades will not be fixed and will be able to rotate in order to catch the prevailing winds.
Laydown area dimensions (construction period and thereafter)	See above - taken into account in the overall surface area.
Generation of the facility as a whole at delivery points	Up to a maximum of 420 MW
<i>*Note these areas represent more than will be impacted given the road values are based on all the turbines shown in the layout being constructed wherein reality only 60 of these turbines will be developed as part of this application</i>	

Please refer Table 2-3 to in Section 2.2 for all details related to the project components, including specifications.

³ 87 potential turbine locations are considered feasible for Hoogland 1 (14/12/16/3/3/2/2147) and have been assessed as part of the EIA Phase, however, only 60 of these potential sites will ever be developed.

Hoogland 2 Wind Farm – Ref: 14/12/16/3/3/2/2146


The infrastructure associated with the Hoogland 2 Wind Farm (14/12/16/3/3/2/2146) includes the following:

- Wind turbines (up to a max of 60) with targeted nameplate generation capacity up to a maximum of 420 MW (see Table 2-3 for turbine specifications).
- Turbine foundations (circular foundation for each turbine with diameter of up to 35 m, alongside 40 m hardstand - 1,400 m²).
- Hardstands/laydown areas (temporary areas up to max of 5,200 m² per turbine), which include the following:
 - permanent 80 m x 40 m crane pad placed adjacent to each turbine foundation;
 - additional 20 m x 40 m temporary hardstand area near each crane pad;
 - 104 m x 20 m blade laydown area;
 - approx. 104 m x 5 m additional embankment area (where necessary due to slopes); and
 - temporary 120 x 15 m crane boom assembly area.
- Underground cabling (up to 66kV) to connect turbines to on-site Substation.
- Internal wind farm overhead powerlines (up to 66 kV lines supported by structures up to approx. 22 m high, as well as tracks for access to pylons) where burying is not possible due to technical, geological, environmental or topographical constraints.
- Permanent and temporary site roads, which include the following:
 - permanent 6 m wide roads (may require side drains on one or both sides, depending on topography);
 - up to 15 m wide temporary road corridor (temporarily impacted during construction & rehabilitated to allow for 6 m road surface after construction);
 - total road network includes upgrades to sections of public roads and shared road infrastructure with Hoogland 1 Wind Farm (14/12/16/3/3/2/2147); and
 - total road network also includes shared road infrastructure with Nuweveld North and West Wind Farm.
- Wind Farm substations (2 x 75 m substation yards that will include an O&M building, Substation building & High Voltage Gantry).
- Battery Energy Storage System (BESS) (2 x ±3.5 ha areas which may be adjacent or slightly removed from each of the 2 Substations, depending on local constraints).
- Operations and maintenance (O&M) area (includes all offices, stores, workshops & laydown area).
- Security gate and hut at most entrances to Wind Farm site (4 x entrances each at 20 m²).
- Up to 2.4 m high fence for enclosure of temporary and permanent yard areas (with access control). No fencing around individual turbines (existing fencing shall remain around perimeter of properties).
- Temporary areas required for the construction/decommissioning phase, which include the following:
 - temporary site camp area/s of ±20,000 m²;
 - batching plant area of ±2,000 m²;
 - general laydown area of ± 36,000 m²; and
 - bunded fuel & lubricants storage facility at the site camp of Wind Farm.
- Shared offsite infrastructure in the form of temporary bypass road on N1 to avoid the town of Beaufort West for major Wind Farm components (also previously authorised as part of Nuweveld Wind Farms), as follows¹:
 - up to 6 m wide road surface (with side drains), however, a 12 m wide road corridor may be temporarily impacted during construction and rehabilitated once construction is complete;
 - temporary road will be approx. 5.6 km in length (of which approx. 2.5 km is along existing track); and
 - road will also be used by Hoogland 1 Wind Farm and Hoogland 2 Wind Farm (hence why it is shared infrastructure between Nuweveld projects and Hoogland 1 and 2 Wind Farm projects).
- Other offsite shared infrastructure in the form of stream crossings upgrades (along R381 to north of project area & along DR02314 to north-west of project area)¹.

Please refer to Section 2.2 (specifically Table 2-3) and Section 2.4 for full descriptions related to the technical details of the infrastructure associated with the Hoogland 2 Wind Farm. This includes the footprints associated with all project

infrastructure. A summary of the technical details for the proposed Wind Farm, including descriptions and/or dimensions, is provided in the table below.


Information requested by DFFE	Description / Details			
Descriptions of all affected farm portions; and 21-Digit Surveyor General (SG) code of all affected farm portions	Farm Number	Farm Name	21-Digit SG Code	
	Wind Farm Site			
	RE1/22	Drooge Onrust	C0090000000002200001	
	RE2/22	Drooge Onrust	C0090000000002200002	
	RE1/6	Slange Fontein	C009000000000600001	
	1/7	Farm 7	C009000000000700001	
	23	Drooge Onrust	C0090000000002300000	
	2/7	Farm 7	C009000000000700002	
	2/18	Gert Adriaans Kraal	C0090000000001800002	
	RE/18	Gert Adriaans Kraal	C0090000000001800000	
	1/21	Snydersfontein	C0090000000002100001	
	2	Bastards Poort	C009000000000200000	
	1/24	Elands Fontein	C0090000000002400001	
	RE/6	Slange Fontein	C009000000000600000	
	RE/7	Farm 7	C009000000000700000	
	2/5	Duikerfontein	C009000000000500002	
	RE1/5	Duikerfontein	C009000000000500001	
	Temporary bypass road around Beaufort West (shared infrastructure)			
	Farm 185	Farm 185	C00900000000018500000	
	RE Erf 5372	Beaufort West Township	C00900010000537200000	
	Offsite watercourse crossing upgrades (shared infrastructure)2			
	DR02314-1			
	1/330	Riet Poort	C02600000000033000001	
	DR02314-2&3			
	1/330	Riet Poort	C02600000000033000001	
	330	Farm 330	C02600000000033000000	
	DR02314-4			
	28	Platfontein	C0090000000002800000	
	1/336	Fonk Fontein	C02600000000033600001	
	R381-5 & R381-6			
	143	Farm 143	C08000000000014300000	
	Central co-ordinates of the site and activity location	Also refer to Figure 1-2 and <i>Appendix B: Maps</i> for Locality Plan		
		31° 43' 16.68" S	22° 19' 50.27" E	
<u>BESS 2A centre coordinates of the site and activity location</u>	<u>31° 42' 37,969" S</u>	<u>22° 19' 30,572" E</u>		
<u>Substation 2A centre coordinates of the site and activity location</u>	<u>31° 42' 33,253" S</u>	<u>22° 19' 35,588" E</u>		
<u>BESS 2B centre coordinates of the site and activity location</u>	<u>31° 42' 11,237" S</u>	<u>22° 19' 56,773" E</u>		

Substation 2B centre coordinates of the site and activity location	<u>31° 42' 16,037" S</u>	<u>22° 19' 55,581" E</u>	
Corner point coordinates of the site and activity location	31° 42' 20.331" S	22° 14' 8.936" E	
	31° 40' 7.080" S	22° 23' 57.280" E	
	31° 39' 56.918" S	22° 23' 59.161" E	
	31° 39' 2.994" S	22° 22' 21.985" E	
	31° 43' 37.885" S	22° 21' 43.198" E	
	31° 48' 2.883" S	22° 21' 35.846" E	
	31° 45' 29.496" S	22° 14' 17.498" E	
	31° 43' 35.080" S	22° 13' 25.245" E	
	31° 41' 51.643" S	22° 17' 49.637" E	
	31° 38' 44.303" S	22° 21' 9.928" E	
	31° 39' 25.999" S	22° 21' 16.752" E	
	31° 43' 49.533" S	22° 28' 6.067" E	
	31° 43' 17.323" S	22° 26' 1.035" E	
Offsite watercourse crossing upgrades (shared infrastructure)			
Watercourse Crossing	Province and Municipality	Coordinates (North)	Coordinates (South)
DR02314-1	Northern Cape, Namakwa DM, Karoo Hoogland LM	31° 46' 37"; 22° 4' 22"	31° 47' 2"; 22° 4' 26"
DR02314-2&3	Northern Cape, Namakwa DM, Karoo Hoogland LM	31° 48' 36"; 22° 5' 24"	31° 49' 43"; 22° 5' 42"
DR02314-4	Northern Cape, Namakwa DM, Karoo Hoogland LM; and Western Cape, Central Karoo DM, Beaufort West LM	31° 52' 49"; 22° 5' 21"	31° 53' 2"; 22° 5' 20"
R381-5	Northern Cape, Pixley ka Seme DM, Ubuntu LM	31° 32' 1"; 22° 20' 27"	31° 32' 23"; 22° 20' 19"
R381-6	Northern Cape, Pixley Ka Seme DM, Ubuntu LM	31° 33' 17"; 22° 21' 2"	31° 33' 33"; 22° 21' 7"
Photos of areas that give a visual perspective of all parts of the site	Photos from Visual Impact Assessment illustrating the characteristics of the site (Lawson and Oberholzer, 2022):		
			



Photos from Terrestrial Biodiversity Assessment illustrating the characteristics of the site (Todd, 2022):



	
<p>Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)</p>	<p>Please refer to Section 7 for more photographs of the site, as provided by the specialists. The Visual Impact Assessment (<i>Appendix C11: Visual</i>) shows photomontages from key viewpoints with high visibility.</p>
<p>Facility design specifications including:</p>	
<p>Type of technology</p>	<p>Wind Energy – onshore turbines</p>
<p>Number of turbines</p>	<p>Up to a maximum of 60 wind turbine generators⁴.</p>
<p>Structure height</p>	<p>The following wind turbine envelope is proposed:</p> <ul style="list-style-type: none"> • Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius) • Hub height: 80 m to 150 m • Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5m blade = 247.5m) • Rotor bottom tip height: minimum of 20 m (and not lower). <p>See Figure 2-7 in Section 2.4.1 for a visual representation of the wind turbine envelope proposed.</p>
<p>Surface area to be covered (including associated)</p>	<p>Total disturbance footprint: 164.6 ha temporary and 136.3 ha permanent* Turbine foundations (40 m x 35 m): 8.4 ha permanent Crane pads (80 m x 40 m): 19.2 ha permanent</p>

⁴ 80 potential turbine locations are considered feasible for Hoogland 2 (14/12/16/3/3/2/2146) and have been assessed as part of the EIA Phase, however, only 60 of these potential sites will ever be developed.

<p>infrastructure such as roads)</p>	<p>Turbine hardstands (20 m x 40 m), including blade laydown area (104 m x 20 m), embankment where necessary (104 m x 5 m) & crane boom assembly area (120 x 15 m): 31.2 ha temporary Cabling: 26.4 km in length and 15.9 ha (temporary) in extent Internal WEF overhead powerlines: 10.7 km in length and 6.4 ha (permanent) in extent Site Roads: total road network = 110.8 km. 88.7 ha permanent* and 99.7 ha temporary* N1 Bypass Road (Shared offsite infrastructure): 6.8 ha temporary (shared) Two Wind farm substations and two battery energy storage systems (BESS): 2.3 ha permanent for substations and 7 ha permanent for BESSs Operations and maintenance (O&M) area: Forms part of substation yard Security: 80 m² Temporary construction area (including site camp, batching plant, general laydown area and bunker fuel & lubricants storage facility): 6 ha temporary Other offsite shared infrastructure (stream crossings upgrades along R381 to north of project area and along DR02314 to south-west of project area): 4.4 ha permanent (shared) and 5 ha temporary (shared)</p>
<p>Structure orientation</p>	<p>The turbine blades will not be fixed and will be able to rotate in order to catch the prevailing winds.</p>
<p>Laydown area dimensions (construction period and thereafter)</p>	<p>See above - taken into account in the overall surface area.</p>
<p>Generation of the facility as a whole at delivery points</p>	<p>Up to a maximum of 420 MW</p>
<p><i>*Note these areas represent more than will be impacted given the road values are based on all the turbines shown in the layout being constructed wherein reality only 60 of these turbines will be developed as part of this application</i></p>	

Please refer Table 2-3 to in Section 2.2 for details regarding the project components and specifications.

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AC	- Alternating Current
BA	- Basic Assessment
BAR	- Basic Assessment Report
BESS	- Battery Energy Storage System
BID	- Background Information Document
CARA	- Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	- Critical Biodiversity Area
CKDM	- Central Karoo District Municipality
DBAR	- Draft Basic Assessment Report
DC	- Direct Current
DFFE	- Department of Forestry, Fisheries and the Environment
DEIAr	- Draft Environmental Impact Assessment Report
DM	- District Municipality
DoE	- Department of Energy
DSR	- Draft Scoping Report
DWS	- Department of Water and Sanitation
EA	- Environmental Authorisation
EAP	- Environmental Assessment Practitioner
ECA	- Environmental Conservation Act (ECA) (Act No. 73 of 1989)
ECO	- Environmental Control Officer
EHS	- Environmental, Health, and Safety
EIA	- Environmental Impact Assessment
EIAr	- Environmental Impact Assessment Report
EMPr	- Environmental Management Programme
EP	- Equator Principles
ERA	- The Electricity Regulation Act No. 4 of 2006
ESA	- Ecological Support Area
FBAR	- Final Basic Assessment Report
FEIAr	- Final Environmental Impact Assessment Report
FSR	- Final Scoping Report
GA	- General Authorisation
GDP	- Gross Domestic Product
GHG	- Green House Gases
GIS	- Geographic Information System
GW	- Gigawatts
GWh	- Gigawatt Hours
Ha	- Hectares
HIA	- Heritage Impact Assessment

Acronym / Abbreviation	Definition
HV	- High Voltage
I&AP(s)	- Interested and/or Affected Party/Party(ies)
IBA(s)	- Important Bird Area(s)
IDP	- Integrated Development Plan
IEP	- Integrated Energy Plan
IFC	- International Finance Corporation
IPP(s)	- Independent Power Producer(s)
IRP	- Integrated Resource Plan
IUCN	- International Union for the Conservation of Nature and Natural Resources
kV	- Kilo Volt
LM	- Local Municipality
LED	- Local Economic Development
MSL	- Mean Sea Level
MW	- Megawatt
NEA	- The National Energy Act (Act No. 34 of 2008)
NEMA	- National Environmental Management Act (Act No. 107 of 1998) as amended
NEM:AQA	- National Environmental Management: Air Quality Act (Act No. of 2004) as amended
NEM:BA	- National Environmental Management: Biodiversity Act (Act No. 10 of 2004), as amended
NEM:PAA	- National Environmental Management: Protected Areas Act (Act No. 57 of 2003), as amended
NFA	- The National Forest Act (Act No. 84 of 1998) as amended
NFEPA	- National Freshwater Ecosystem Priority Areas
NHRA	- National Heritage Resources Act (Act No. 25 of 1999) as amended
NPAES	- National Protected Area Expansion Strategy
NRTA	- National Road Traffic Act (Act No. 93 of 1996) as amended
NWA	- National Water Act (Act No. 36 of 1998) as amended
OHSA	- Occupational Health and Safety Act (Act No. 85 of 1993) as amended
O&M	- Operations and Maintenance
OoS	- Organs of State
PDP	- Provincial Development Plan
PES	- Present Ecological Status
PoS	- Plan of Study
PM	- Public Meeting
PPA	- Power Purchase Agreement
PPP	- Public Participation Process
PP Plan	- Public Participation Plan
PIA	- Palaeontological Impact Assessment
PV	- Photovoltaic
RDP	- Rural Development Plan

Acronym / Abbreviation	Definition
REDZ	- Renewable Energy Development Zone
REIPPPP	-Renewable Energy Independent Power Producer Procurement Programme
RE	- Renewable Energy
SA	- South Africa
SABAP2	- Southern African Bird Atlas Project 2
SACAA	- South African Civil Aviation Authority
SAHRA	- South African Heritage Resources Agency
SAHRIS	- South African Heritage Resources Information System
SALA	- Subdivision of Agricultural Land Act (Act No. 70 of 1970)
SANBI	- South African National Biodiversity Institute
SDF	- Spatial Development Framework
SEF	- Solar Energy Facility
SKA	- Square Kilometre Array
STP	- Screening Tool Report
SWMP	- Storm Water Management Plan
TASCS	- Terrestrial Animal Species Compliance Statement
VIA	- Visual Impact Assessment
VU	- Vulnerable
WC	- Western Cape
WEF	- Wind Energy Facility
WMA	- Water Management Area
WUL	- Water Use License
WULA	- Water Use License Application

DEFINITIONS

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

Archaeological resources: This includes:

- i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- iii. wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Basic Assessment Report: An assessment report compiled in accordance with Appendix 1(3) of the NEMA: EIA Regulations of 2014, as amended, to relay the information gathered and assessments undertaken during the Impact Assessment phase of a project.

Battery Energy Storage System: A technology developed for storing electric charge by using specially developed batteries. These systems complement intermittent sources of energy such as wind, tidal and solar power in an attempt to balance energy production and consumption.

Biodiversity: The diversity of genes, species and ecosystems, and the ecological and evolutionary processes that maintain that diversity.

Construction Phase: The stage of project development involving site preparation as well as all construction activities associated with the development of the project.

Cultural landscape: A representation of 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 (World Heritage Committee, 1992).

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.

Endemic: Restricted or exclusive to a particular geographic area and occurring nowhere else. Endemism refers to the occurrence of endemic species.

Environmental Assessment Practitioner: An independent individual with the appropriate qualifications and experience who is appointed by the Applicant to manage the Environmental Impact Assessment process.

Environmental Authorisation: An approval granted by the Competent Authority allowing the Applicant to undertake listed activities in terms of the NEMA: EIA Regulations 2014, as amended.

Environmental Impact Assessment: In relation to an application, means the process of collecting, organising, analysing, interpreting, assessing and communicating environmental and socio-economic information that is relevant to the consideration of the application.

Environmental Impact Assessment Report: An assessment report compiled in accordance with Appendix 3(3) of the NEMA: EIA Regulations of 2014, as amended, to relay the information gathered and assessments undertaken during the Environmental Impact Assessment phase of a project.

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.

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

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Habitat: The area of an environment occupied by a species or group of species, due to the particular set of environmental conditions that prevail there.

Heritage: That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage Resources: This means any place or object of cultural significance, such as the caves with archaeological deposits identified close to both development sites for this study.

Impact: A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.

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).

Mitigate: The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action. Design or management mitigation measures are those that are intended to minimise or enhance an impact, depending on the desired effect.

‘No-Go’ option: The “no-go” development alternative option assumes the site remains in its current state, i.e. there is no construction of a facility and associated infrastructure in the proposed project area.

Operational Phase: The project phase following the Construction Phase, during which the development will function or be used as per the design.

Palaeontology: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

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.

Red List: A publication that provides information on the conservation and threat status of species, based on scientific conservation assessments.

Rehabilitation: Less than full restoration of an ecosystem to its pre-disturbance condition.

Restoration: To return a site to an approximation of its condition before alteration.

Riparian: The area of land adjacent to a river or stream that is, at least periodically, influenced by flooding.

Scoping Report: An assessment report compiled in accordance with Appendix 2(2) of the NEMA: EIA Regulations of 2014, as amended, to relay the information gathered and assessments undertaken during the Scoping phase of a project.

Sense of place: The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.

Specialist study: A study into a particular aspect of the project, undertaken by a suitably qualified expert in that discipline.

Species of Special / Conservation Concern: Species that have particular ecological, economic or cultural significance, including but not limited to threatened species.

Stakeholders: All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others.

Sustainable development: Sustainable development is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. NEMA defines sustainable development as the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

Threatened Ecosystems: An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on analysis of ecosystem threat status. A threatened ecosystem has lost, or is losing, vital aspects of its structure, composition or function. The Biodiversity Act makes provision for the Minister or Environmental Affairs, or a provincial MEC of Environmental Affairs, to publish a list of threatened ecosystems.

Threatened Species: A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

Visual Assessment Zone: The visual assessment zone or study area is assumed to encompass a zone of 10km from the outer boundary of the proposed application site.

CONTENTS OF AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

Contents of an Environmental Impact Assessment (EIA) Report as per Appendix 3 of the 2014 NEMA EIA Regulations, as amended on 7 April 2017

NEMA requirements for EIA Report		
Appendix 3	Content as required by NEMA	Section
3 (1)(a)	(i) details of the EAP who prepared the report; and	1.3.1 and Appendix A: EAP Details
	(ii) details of the expertise of the EAP, including a curriculum vitae;	
(b)	the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including:	2.1 and Appendix B: Maps
	(i) the 21-digit Surveyor General code of each cadastral land parcel;	
	(ii) where available, the physical address and farm name;	
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-	2.4 and Appendix B: Maps
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	
(d)	a description of the scope of the proposed activity, including-	4.2.1
	(i) all listed and specified activities triggered and being applied for; and	
	(ii) a description of the associated structures and infrastructure related to the development;	
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	4.1
(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 development footprint within the approved site as contemplated in the accepted scoping report	5
(g)	a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	3 and 10
(h)	a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	2, 3 and 6
	(i) details of the development footprint alternatives considered;	
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	6.2
	(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;	

NEMA requirements for EIA Report		
Appendix 3	Content as required by NEMA	Section
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	7
	(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	6.3 and 6.4
	(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;	7 and 8
	(viii) the possible mitigation measures that could be applied and level of residual risk;	
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	3
	(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	3 and 10.2
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report 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;	3, 6, 7 and 8
(j)	an assessment of each identified potentially significant impact and risk, including - (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	7
(k)	where applicable, a summary of the findings and recommendations of 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 assessment report;	8

NEMA requirements for EIA Report		
Appendix 3	Content as required by NEMA	Section
(l)	an environmental impact statement which contains -	8 and 10.2
	(i) a summary of the key findings of the environmental impact assessment;	
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and	8 and <i>Appendix B: Maps</i>
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	8 and 10
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	7, 8.3 and 10.3
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	3 and 10
(o)	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;	7 and 10.3
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	6.5 and <i>Appendix C: Specialist Reports</i>
(q)	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;	10.2
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	10.3
(s)	(s) an undertaking under oath or affirmation by the EAP in relation to—	<i>Appendix A: EAP Details</i>
	(i) the correctness of the information provided in the reports;	
	(ii) the inclusion of comments and inputs from stakeholders and I&APs;	
	(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 or affected parties;	
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	No financial provisions for the rehabilitation, closure, and on-going post decommissioning management of negative environmental impacts are required.

NEMA requirements for EIA Report		
Appendix 3	Content as required by NEMA	Section
		Decommissioning has been dealt with in the EMPs (Appendix F). Section 7 details all identified impacts associated with the proposed development during all phases (i.e., planning, construction, operation and decommissioning).
(u)	<p>an indication of any deviation from the approved scoping report, including the plan of study, including–</p> <p>(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and</p> <p>(ii) a motivation for the deviation;</p>	The EAP can confirm that no deviations from the approved scoping report, including the plan of study, have taken place.
(v)	any specific information that may be required by the competent authority; and	Any specific information required by the competent authority is detailed in the respective formal comment letters provided in <i>Appendix D: Public Participation</i> . Where any specific information has been requested, this has been incorporated into the EIA Report. Please refer to the C&RRs in <i>Appendix D: Public Participation</i> for responses to comments provided by the competent authority and/or requests for information (where required).
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	<i>Appendix A: EAP Details to Appendix H: Additional Information</i>
(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to an environmental impact assessment report the requirements as indicated in such notice will apply.	

NEMA requirements for EIA Report		
Appendix 3	Content as required by NEMA	Section
	The Scoping & EIA process has been based on the findings of the Site Sensitivity Verification and guided by the Specialist Protocols which has been applied by the specialists in their assessments (in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020).	

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Red Cap Energy (Pty) Ltd ('Red Cap') is proposing to develop four Wind Farms and associated grid connections (together referred to as the Hoogland Project) in an area located between Loxton and Beaufort West in the Western Cape Province. Hoogland 1 Wind Farm (14/12/16/3/3/2/2147) and Hoogland 2 Wind Farm (14/12/16/3/3/2/2146) are located to the north closer to Loxton and form the Northern Cluster of Wind Farms that will share a grid connection named the Hoogland Northern Grid Connection. The applications for Hoogland 1 and Hoogland 2 also include some limited offsite activities in the Northern Cape, namely upgrades of existing watercourse crossings. Hoogland 3 (14/12/16/3/3/1/2604) and 4 (14/12/16/3/3/1/2605) Wind Farms are located closer to Beaufort West and comprise the Southern Cluster which will similarly share a separate grid connection, named the Southern Grid Connection. The two Grid Connections are each in the form of 132 kV overhead power lines and will connect the Hoogland Wind Farms to the Nuweveld Collector Substation on Red Cap's adjacent Nuweveld Wind Farms Project. It is intended that these projects would be bid in a forthcoming round of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

The proposed development area falls primarily within the Central Karoo District Municipality and is adjacent to Red Cap's three Nuweveld Wind Farm Projects which have environmental authorisation (Figure 1-1 and Figure 1-2). The Wind Farms are predominantly located to the west of the R381 which runs between Beaufort West and Loxton, but both extend across to the east of the R381 as well. The predominant land use of the Wind Farm sites, and surrounding properties is low-density livestock farming (grazing).

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations (4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof.

Red Cap has appointed SLR Consulting (South Africa) (Pty) Ltd as the Independent Environmental Assessment Practitioner (EAP) to undertake the required Scoping and EIA (SEIA) and Basic Assessment (BA) processes for the proposed Hoogland Wind Farms and Grid Connection Projects in terms of the EIA Regulation 2014 (as amended) promulgated under the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA). The Northern Wind Farm Cluster is subject to a Scoping and EIA process and this is explained in Section 4.2.1.

The scope of this report is the **Hoogland 1 Wind Farm** and **Hoogland 2 Wind Farm** (the **Northern Wind Farm Cluster**). The Applicant for these Wind Farms is Red Cap Hoogland 1 (Pty) Ltd, and Red Cap Hoogland 2 (Pty) Ltd respectively. Even though these are two separate applications (14/12/16/3/3/2/2147 & 14/12/16/3/3/2/2146), they have been considered in the same Scoping and EIA Reports. The Department of Forestry, Fisheries and the Environment (DFFE) has granted Red Cap permission to combine the two Wind Farms into one Environmental Authorisation (EA) Application processes under Regulation 11 (1) of GN R. 982⁵ (*Appendix D: Public Participation*). The baseline environment and impact assessment in Section 7 distinguishes features and impacts respective to either the Hoogland

⁵ Regulation 11 of Government Notice 982 (National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment Regulations, 2014) states that

"(1) If a proponent or proponents intend to undertake one or more than one activity of the same type at different locations within the area of jurisdiction of a competent authority, the competent authority may, on written request, grant permission for the submission of a single application. (2) If the competent authority grants permission in terms of subregulation (1), the application must be dealt with as a consolidated assessment process, but the potential environmental impacts of each activity must be considered in terms of the location where the activity is to be undertaken. (5) Where a combined application is submitted as contemplated in these Regulations, the proponent must, prior to submission of the application, confirm with the competent authority the fee payable in terms of the applicable regulations for such combined application."

1 Wind Farm and Hoogland 2 Wind Farm, where they differ. Further to this the Summary of impacts and mitigation measures are documented separately for each of the two Wind Farms (Section 8).

The Hoogland Wind Farm Projects aim to achieve a targeted nameplate generation capacity of a maximum of 420MW per wind farm. Red Cap originally identified approximately 68,500 hectares (ha) of land for the development of the four wind farm projects. It is proposed that each of the Northern Cluster Wind Farms will comprise of up to 60 turbines (Section 2.4). However, as part of the assessment process, more than 60 potential turbine locations are considered and assessed by the specialists (See Table 2-3 for wind farm specifications). This is to account for dropping potential turbine locations due to environmental constraints identified in the Impact Assessment process. Further to this, should an EA be obtained, some additional turbine positions may be dropped due to other permitting or technical issues.

It is therefore important to have extra positions approved, with the proviso that only a maximum of 60 turbines can physically be developed per Wind Farm. For the Hoogland Northern Clusters, 87 potential turbine locations are considered feasible for Hoogland 1, and 80 potential turbine locations are considered feasible for Hoogland 2. These have been assessed in this EIA Phase of the process. Having extra positions assessed and approved ensures that the assessment is conservative as it reports on the impact of more than 60 turbines when only 60 of these potential sites will ever be developed.

Ancillary infrastructure for each Wind Farm would include underground cables linking the turbines to each other and to the substation (with limited overhead powerlines to get over steep slopes/ drainage lines etc), two onsite substations, two battery energy storage systems (BESS), foundations to support turbine towers, a transformer at the base of each turbine, hardstands to support cranes at each turbine, and permanent operations/maintenance buildings, office, stores, workshop and laydown areas (included in the substation footprint). Service and access roads will be constructed in addition to upgrading existing roads, with the relevant stormwater infrastructure and gates constructed as required. Activities will include upgrades to sections of public roads within the sites as well as upgrades of selected offsite watercourse crossings. Designated construction areas will include temporary site camp/s and general laydown areas and associated maintenance and storage buildings/areas along with guard cabins, as well as a concrete batching plant. Individual turbine temporary laydown areas including crane boom laydown areas and blade laydown areas will be established at each turbine.

The Environmental Process for the Hoogland Northern Cluster, in summary, comprises of the following main phases:

- Screening and initial design phase;
- Formal EIA Process comprising of:
 - Submission of Application for Environmental Authorisation to the DFFE;
 - Scoping Phase; and
 - Environmental Impact Reporting (EIR) Phase (*current phase*).

The purpose of an Environmental Impact Assessment (EIA) Report (this report), amongst others, is to provide the background and context to the projects and to describe the process and outcome of how the most suitable location and layout were identified. The EIR presents the assessment of the impacts and the respective mitigation measures. In summary, an EIA Report aims to:

- Describe the project.
- Outline the legal and policy framework.
- Describe the process/tasks undertaken to date.
- Describe the PPP undertaken to date as well as future PPP to be undertaken during the EIR Phase.
- Provide a description of the methodology used to assess the environmental impacts.
- Present the baseline biophysical and socio-economic context as per specialist assessments.
- Present the impacts identified by each specialist, the specialists' assessment of each impact and proposed mitigation measures.

- Discuss alternatives and outline the detailed screening and iterative design approach adopted and how this informs an environmentally, socio-economically and technically feasible project layout.

The Final EIA Report (this report) has been informed by the outcomes of the detailed Screening and Initial Design Phase, the formal Scoping Phase (including Final Scoping Report), the EIA Phase and Specialist Assessments (refer to Section 6.1 for more detail).

The formal Scoping and EIA process commenced with the submission of the application for EA and Draft Scoping Report to the DFFE. The Draft Scoping Report was made available to the public and authorities for a 30-day review and comment period. The Scoping Phase provided the proponent an opportunity to engage with relevant stakeholders, to receive inputs and comments regarding the proposed projects and to address or provide clarifications relating to any issues or concerns that arose through stakeholder engagement.

After the Scoping Report PPP, the Draft Scoping Report was updated, and the Final Scoping Report was submitted to the DFFE for decision-making/acceptance. The DFFE issued their decision/acceptance of the Scoping Report by way of the acceptance letters dated 17 June 2022 respectively, and confirmed that the EAP/Applicant may proceed with the EIA process in accordance with the tasks contemplated in the Plan of Study (as required in terms of the EIA Regulations, 2014, as amended).

The Draft EIA Report was made available to all registered I&APs, including the public and key stakeholders (including authorities) for a 30-day review and comment period, from 15 August 2022 – 14 September 2022 (excluding public holidays). All comments and inputs received during the comment period for the Draft EIA Report have been considered and responded to by the project team.

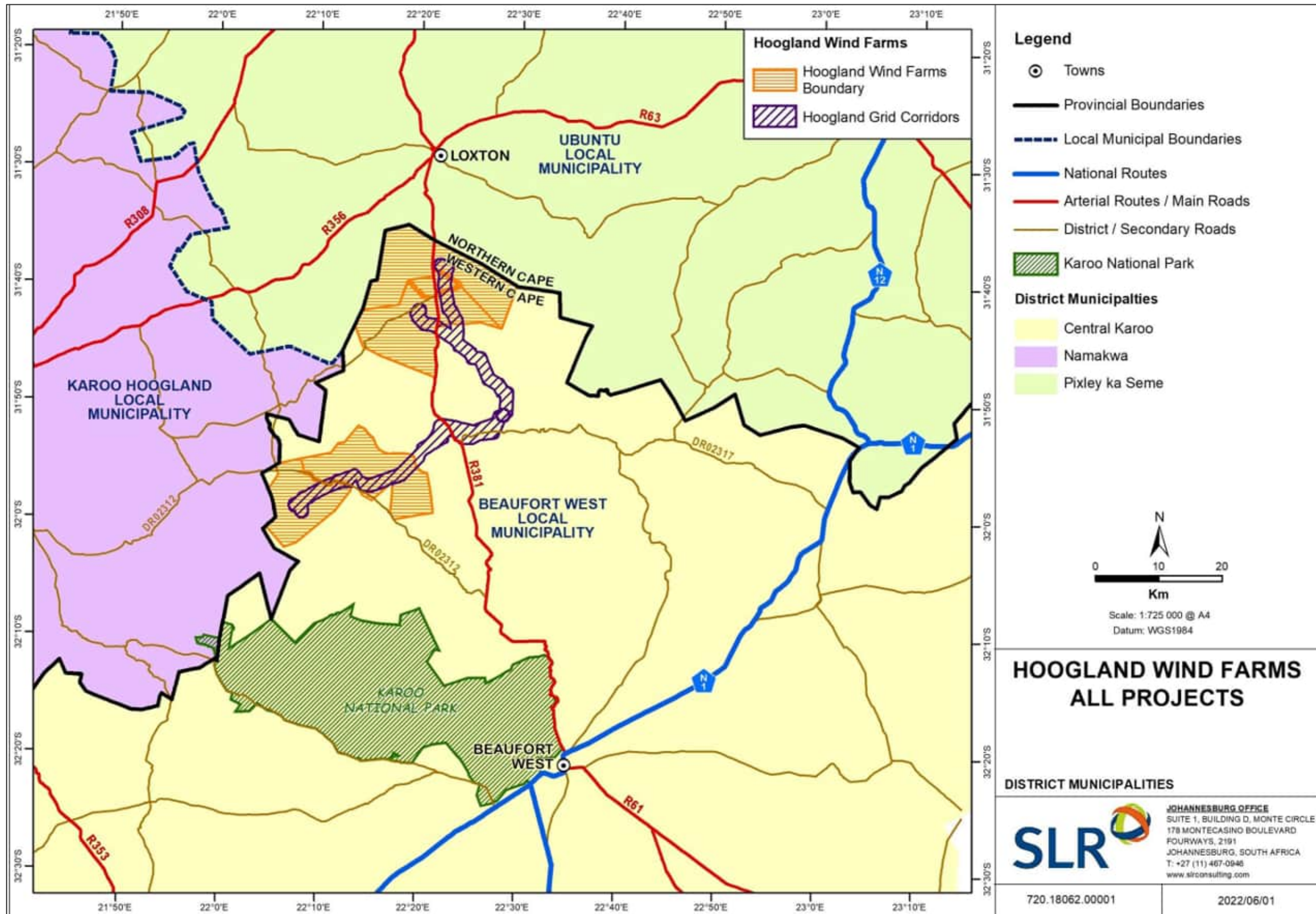


Figure 1-1: Regional Locality Map presenting the location of the Hoogland Wind Farms and Grid Connection

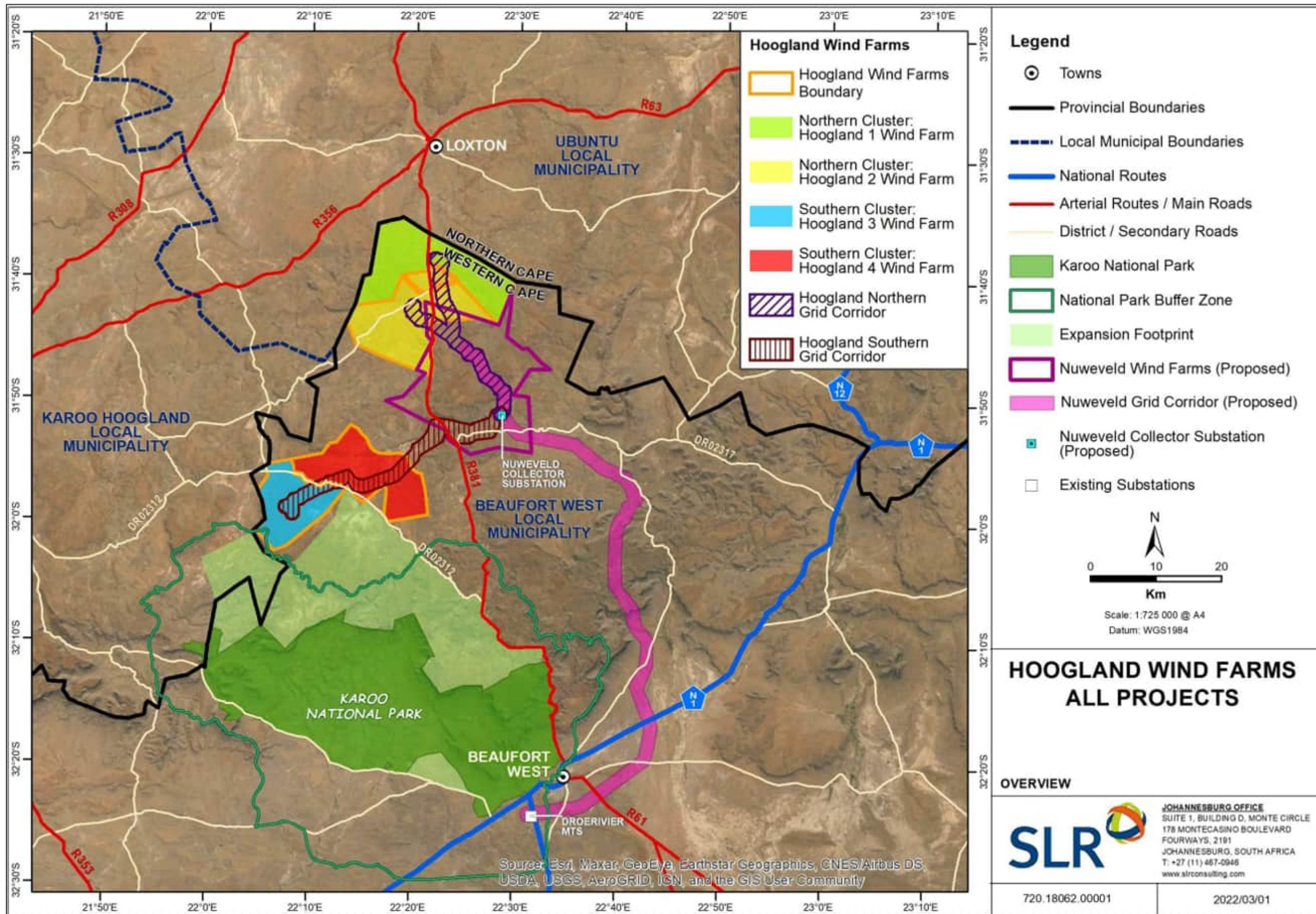


Figure 1-2: Locality Map presenting the context of the project components (including location of the Nuweveld Wind Farms Project)

1.2 STRUCTURE OF THE EIA REPORT

This EIA Report has been prepared in compliance with Appendix 3 of the EIA Regulations 2014 (as amended) and is divided into various chapters and appendices, the contents of which are outlined below.

Table 1-1: Structure of the EIA Report

SECTION	CONTENTS
General Site Information as Required by DFFE / Technical Details Summary	Provides a comprehensive summary of the project components and specifications (i.e., technical details) for each wind farm (including surface area to be covered), as required by the DFFE as part of the FSR Acceptance Letter.
Section 1	Introduction Provides a background of the project; describes the purpose of the EIA Report; outlines the structure of the report; and provides information on the project team.
Section 2	Project description Provides general project information; presents a description of the proposed projects; and presents a motivation for not considering project alternatives.
Section 3	Alternatives Provides an overview of the comprehensive iterative design process has been undertaken to inform the respective Wind Farm layouts and associated Grid Connection infrastructure for the Hoogland Projects.
Section 4	Administrative and Legal Framework Outlines the key legislative requirements applicable to the proposed projects.
Section 5	Need and desirability Provides an overview of the need and desirability for the proposed projects and guided by the DFFE and Western Cape DEA&DP
Section 6	Approach and Process Outlines the iterative and comprehensive design process and provides the methodology for the assessment. It also includes a summary of the public participation process undertaken to date, including the results thereof, as well as further public participation tasks planned.
Section 7	Baseline Environment and Impact Assessment Describes the receiving environment respective to each specialist discipline and assesses the significance of each identified impact for all phases of the development, including cumulative impacts. Provides appropriate mitigation measures.
Section 8	Summary of Impact Assessment and Key Recommendations Provides a summary of the potential environmental impacts that have been identified, including cumulative impacts; as well as a summary of key recommendations provided by each specialist.
Section 9	Sensitivity Maps Visual representation of the Specialist findings based on the iterative and comprehensive design process, as well as inputs/comments receive during the Scoping Phase.
Section 10	Conclusion Provides a summary of the process, the findings and the overall conclusion, including an environmental impact statement and cumulative environmental impact statement. The proposed conditions of authorisation are also detailed in this section.
Section 11	References Provides a list of the references used in compiling this report.
Appendices	Appendix A: EAP Details Appendix B: Maps Appendix C: Specialist Reports Appendix C1: Climate Change Appendix C2: Geotechnical

SECTION	CONTENTS
	Appendix C3: Agriculture Appendix C4: Terrestrial Biodiversity Appendix C5: Flora Appendix C6: Riverine Rabbit Appendix C7: Karoo Dwarf Tortoise Appendix C8: Bats Appendix C9: Avifauna Appendix C10: Aquatic Ecology Appendix C11: Visual Appendix C12: Heritage Appendix C13: Palaeontology Appendix C14: Noise Appendix C15: Shadow Flicker Appendix C16: Traffic Appendix C17: Socio-Economic Appendix C18: Geohydrology Appendix D: Public Participation Appendix D1: Screening Phase Appendix D2: Scoping Phase Appendix D3: EIA Phase Appendix E: DFFE Screening Tool Reports Appendix F: Environmental Management Programmes Appendix G: Battery Energy Storage Risk Assessment Appendix H: Additional Information

1.3 PROJECT TEAM

The details of the independent EAP Project Team that were involved in the preparation of this report are provided in Table 1-2. SLR has no vested interest in the proposed projects other than fair payment for consulting services rendered as part of the EIA process and has declared its independence as required by the EIA Regulations 2014, as amended. The project team's *curricula vitae* (include proof of registrations and membership) and the Declaration of Independence and Affirmation under Oath by the EAP are included in *Appendix A: EAP Details* of this Report.

1.3.1 Details of the EAP

Table 1-2: Details of the EAP Project Team

General						
Organisation	SLR Consulting (South Africa) (Pty) Ltd					
Postal address	PO Box 798 RONDEBOSCH 7701					
Tel No.	+27 (0)21 461 1118 / 9					
Fax No.	+27 (0)21 461 1120					
Name	Qualifications	Professional registrations / memberships	Experience (Years)	Tasks and roles		
Stuart-Heather Clark	B.Sc. (Hons) Civil Engineering M.Sc. Environmental Management	IAIA EAPASA	24	Report writing and process review		

Liandra Scott-Shaw	B.Sc. (Hons) Ecological Science B.Sc. Biological Science	SACANASP (<i>Pri.Sci. Nat</i>) SAWEA	7	Management of the EIA process, including process review, specialist study review, management of the public participation process and report compilation
Stephan Jacobs	B.Sc. (Hons) Environmental Management & Analysis B.Sc. Environmental Sciences	IAIA	6	Project administration, undertaking of public participation process activities and report compilation

1.3.2 Qualifications and Experience of the EAP Project Team

- **Stuart Heather-Clark** is a Technical Director in SLR’s Environmental Management Planning and Approvals (EMPA) team in Africa and EAP for the Hoogland Wind Farms and Grid Connection Projects. He holds a B.Sc. (Honours) in Civil Engineering and a Master’s degree in Environmental Science and has 24 years of relevant experience. He has expertise in a wide range of environmental disciplines, including EIAs, EMPs, environmental planning and review and public consultation and is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA).
- **Liandra Scott-Shaw** is the Project Manager for the Hoogland Wind Farms and Grid Connection Projects. She has a B.Sc. and B.Sc. (Honours) in Ecological Science from the University of KwaZulu-Natal and has worked as an EAP since 2013. She has been involved in a number of projects covering a range of environmental disciplines, including Basic Assessments, Environmental Impact Assessments and Environmental Management Programmes. She has gained experience in a wide range of projects relating to renewable energy.
- **Stephan Jacobs** is the Project Assistant for the Hoogland Wind Farms and Grid Connection Project and holds a B.Sc. undergraduate degree in Environmental Sciences as well as a B.Sc. Honours degree in Environmental Management & Analysis from the University of Pretoria. He has worked as an Environmental Consultant / EAP since 2015. His key focus is undertaking and managing Basic Assessment (BA) and Environmental Impact Assessment (EIA) processes for various types of projects, especially for renewable energy projects which form part of South Africa’s Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) as well as the 2020 Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP). He also has experience in compiling Environmental Management Programmes (EMPrs) and undertaking and facilitating Public Participation and stakeholder engagement processes, especially for renewable energy projects. He has gained e experience in a wide range of projects relating to infrastructure development and renewable energy.

1.3.3 Details of Independent Specialists

As described in Section 4.2.2, the DFFE National Screening Tool prescribes a number of specialist studies. Table 1-3 lists the specialist studies undertaken for the report as guided by the Screening Tool. More detail regarding their level of study with reference to the relevant protocols is described in Table 6-2 in Section 6.1.3.1. It should be noted Specialist reports have been compiled to comply with the content requirements for specialist reports applicable, as detailed in Section 6.1.3.1.

Table 1-3: Details of the specialist team

Discipline	Company	Specialist
Climate Change	Promethium Carbon	Robbie Louw
Geotechnical	R.A. Bradshaw & Associates cc	Richard Bradshaw
Agriculture	Johann Lanz Consulting	Johann Lanz
Terrestrial Ecology (including Flora and Riverine Rabbits)	3Foxes Biodiversity Solutions	Simon Todd
Herpetology (specifically Karoo Dwarf Tortoise)	Sungazer Faunal Surveys	Marius Burger
Bats	Animalia Consultants	Werner Marais

Discipline	Company	Specialist
Avifauna	Wildskies Ecological Services	Jon Smallie
Aquatic Ecology	EnviroSci (Pty) Ltd	Dr Brian Colloty
Geohydrology	GEOSS	Shane Teek, Dale Barrow and Julian Conrad
Visual	Bernard Oberholzer Landscape Architects (BOLA) and qARC	Bernard Oberholzer, Quinton Lawson
Archaeology	ASHA Consulting	Dr Jayson Orton
Palaeontology	Natura Viva	Dr John Almond
Palaeontology (Northern Cape watercourse crossings only)	Banzai Environmental	Dr Elize Butler
Noise	Enviro-Acoustic Research	Morné de Jager
Shadow Flicker	Arcus	Emma Lewis; Martin Stevenson
Traffic	Athol Schwarz	Athol Schwarz
Socio-economic / tourism	Independent Economic Researchers	Dr Hugo van Zyl, James Kinghorn

2 PROJECT DESCRIPTION

2.1 SITE LOCATION AND DESCRIPTION

The Hoogland Northern Wind Farm Cluster comprising Hoogland 1 Wind Farm and Hoogland 2 Wind Farm is proposed for development in the Nuweveld hinterland within the Central Karoo District Municipality. These two Wind Farms share a Grid Connection, named the Hoogland Northern Grid Connection. The Hoogland Wind Farms are more than 10km away from the Karoo National Park (KNP) and outside its Protected Area Expansion Area and Buffer Zone (Figure 1-2). The Hoogland Northern Cluster is not within the Beaufort West Renewable Energy Development Zone (REDZ) (GN R 786 of 2020)⁶ and thus will follow a Scoping and EIA process (Figure 2-3)⁷.

Both Wind Farms are located approximately 70km north of Beaufort West and approximately 20km south of Loxton along the R381 (Figure 1-2). The Hoogland 1 Wind Farm (HL01) site is centred on the following coordinates 31° 37.474'S, 22° 21.191'E and has an area of approximately 16,772 ha, and the layout supports 87 turbine locations. The Hoogland 2 Wind Farm (HL02) site is centred on the following coordinates 31° 42.997'S, 22° 19.973'E and has an area of approximately 17,832 ha, and the layout supports 80 turbine locations. The maximum number of turbines that will however be constructed on each Wind Farm, if construction goes ahead, will not exceed 60 turbines.

The proposed Hoogland Northern Wind Farms (HL01 and HL02) are located on the Nuweveld plateau in the Great Karoo. Both Wind Farms straddle the R381 Provincial Main Road between Beaufort West and Loxton. The site is located on, and surrounded by, active agricultural properties with low-density livestock grazing being the main land use. An arid climate with poor soil development and low moisture precludes most cropping. The landscape is characterised by horizontal sills of erosion-resistant dolerite forming steep cliffs in places, boulder-strewn mesas or plateaus and flat-topped koppies while the gentler, lower hillslopes and plains consist of more easily weathered mudstone, with occasional narrow ledges of harder sandstone (Figure 2-1). Of key interest to wind energy development are the high lying areas where the wind resources are at their best, like those shown in Figure 2-2. Detailed descriptions of the various baseline environmental factors making up the site are included in Section 7.

⁶ Notice of Identification in Terms of Section 24(5)(a) and (b) of the National Environmental Management Act, 1998, of the Procedure to be Followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities Identified in Terms of Section 24(2)(a) of the National Environmental Management Act, 1998, when occurring in Geographical Areas of Strategic Importance.

⁷ The Northern Cluster Wind Farms are situated outside of the Beaufort West Renewable Energy Zone (REDZ) (GN R 786 of 2020) while the Southern Cluster Wind Farms are situated within the Beaufort West REDZ. Although the layout and sites are not yet final due to the iterative nature of the process, the current proposals indicate that the Northern Cluster require a Scoping and EIA process while the Southern Cluster, which is situated in the REDZ, will require a Basic Assessment (BA). The Hoogland Grid Connections comprise two 132kV powerlines (Northern Grid and Southern Grid), connecting the Northern and Southern Cluster Wind Farms to the Nuweveld Collector Substation. The Northern Grid is not within the thresholds of the REDZ (GN R 145 of 2021) and thus will require a traditional Basic Assessment (BA) in terms of the GN R. 982. The greater part of the Southern Grid is within the REDZ and as such will qualify for a BA process as outlined in GN R 145.



Figure 2-1: Illustrating the topography that characterises the Hoogland Northern Wind Farm Cluster

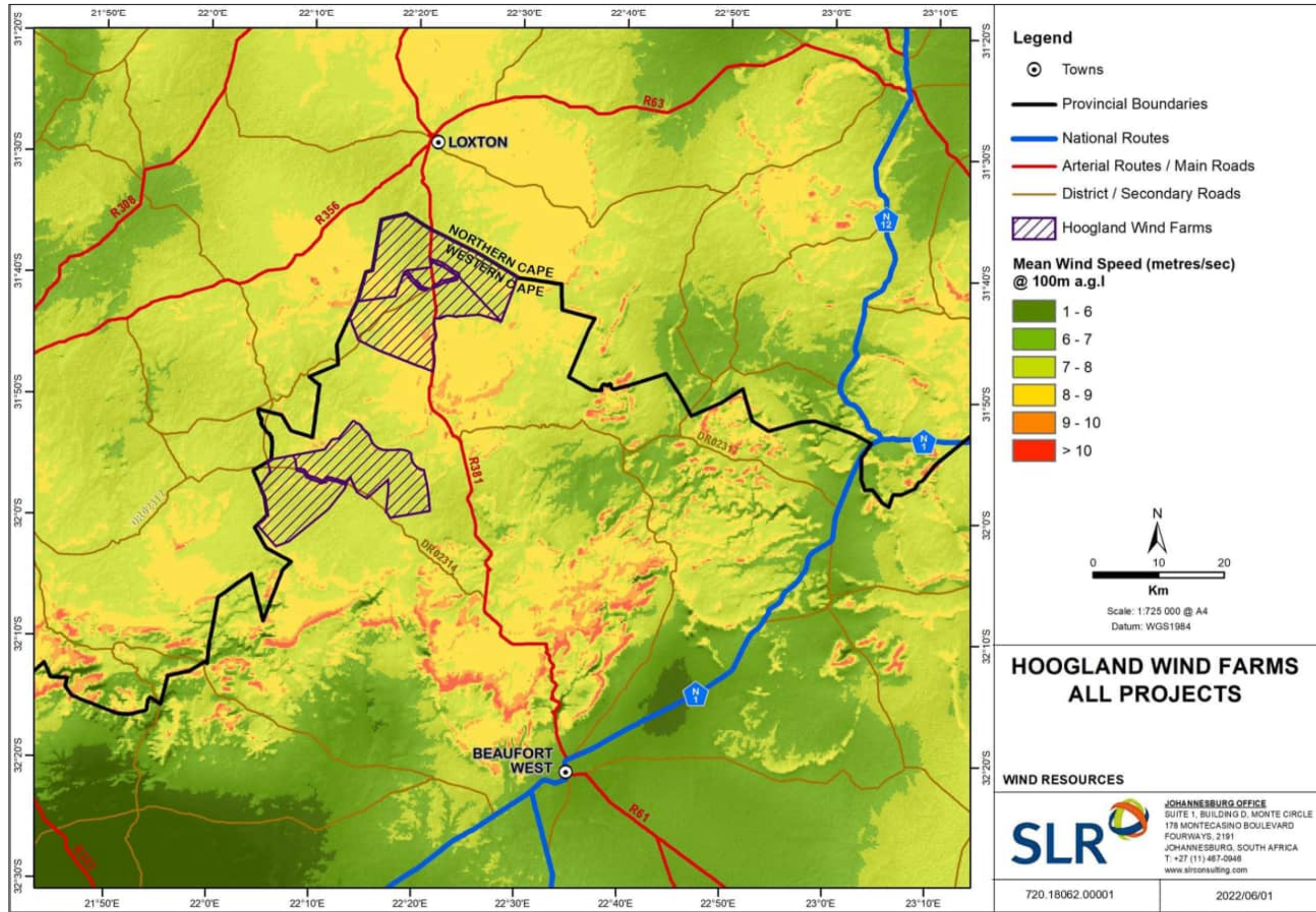


Figure 2-2: Wind resources map for the Hoogland Wind Farms

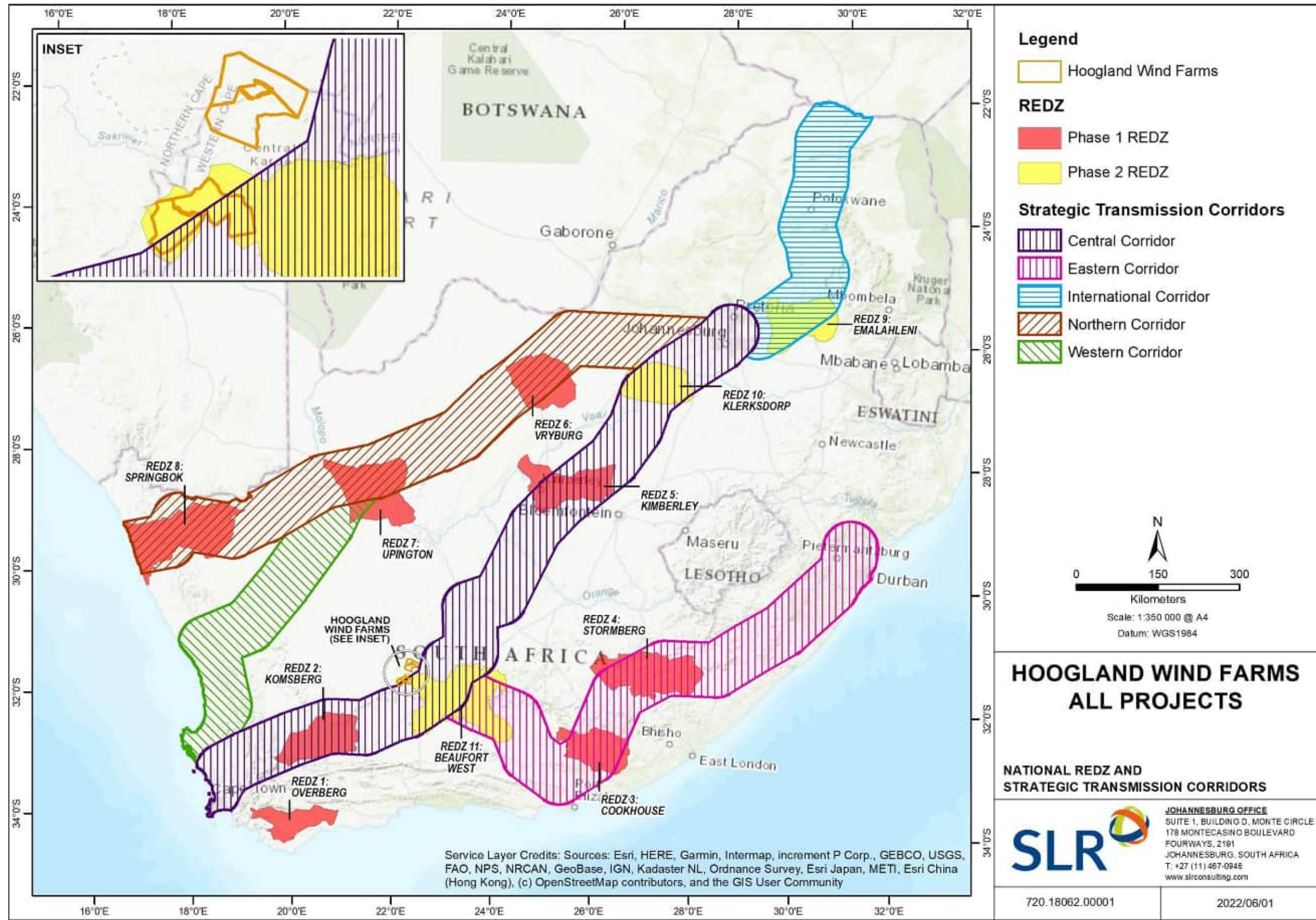


Figure 2-3: REDZ map showing the Hoogland Wind Farm Projects

The Hoogland 1 and Hoogland 2 Wind Farms are made up of a number of adjoining farm properties as listed in Table 2-1 and shown on Figure 2-4.

Table 2-1: Details of the properties affected by the proposed Hoogland Northern Cluster Wind Farms Projects (Appendix B: Maps for Cadastral Map)

Hoogland Northern Cluster		
SG Code	Farm Number	Farm name
Hoogland Wind Farm 1 - 14/12/16/3/3/2/2147		
C0090000000000600001	RE1/6	SLANGE FONTEIN
C0090000000000200000	2	BASTARDS POORT
C00900000000002400001	1/24	ELANDS FONTEIN
C0090000000000600000	RE/6	SLANGE FONTEIN
C0090000000000500002	2/5	DUIKERFONTEIN
C0090000000000500001	RE1/5	DUIKERFONTEIN
C0090000000000100002	2/1	DROOG FONTEIN
C0090000000000100003	3/1	DROOG FONTEIN
C0090000000000500000	RE/5	DUIKERFONTEIN
C0090000000000500003	3/5	DUIKERFONTEIN
C0090000000000600007	7/6	SLANGE FONTEIN
Hoogland Wind Farm 2 - 14/12/16/3/3/2/2146		
C00900000000002200001	RE1/22	DROOGE ONRUST
C00900000000002200002	RE2/22	DROOGE ONRUST
C0090000000000600001	RE1/6	SLANGE FONTEIN
C0090000000000700001	1/7	FARM 7
C00900000000002300000	23	DROOGE ONRUST
C0090000000000700002	2/7	FARM 7
C00900000000001800002	2/18	GERT ADRIAANS KRAAL
C00900000000001800000	RE/18	GERT ADRIAANS KRAAL
C00900000000002100001	1/21	SNYDERSFONTEIN
C0090000000000200000	2	BASTARDS POORT
C00900000000002400001	1/24	ELANDS FONTEIN
C0090000000000600000	RE/6	SLANGE FONTEIN
C0090000000000700000	RE/7	FARM 7
C0090000000000500002	2/5	DUIKERFONTEIN
C0090000000000500001	RE1/5	DUIKERFONTEIN

Both wind farm applications will also include for upgrades to a number of watercourse crossings outside the wind farm site boundaries, as well as the temporary N1 Bypass around Beaufort West (which was also previously authorised as part of the Nuweveld Wind Farms¹⁴). These properties and locations are included in Table 2-1 and are considered to be shared infrastructure (i.e., authorisation is sought for these in *both* the Hoogland 1 and Hoogland 2 Wind Farm Applications). More information on these can be found in Section 2.4.4 and shown in Figure 2-17.

Table 2-2: Details of the properties and locations affected by the shared (offsite) infrastructure for the proposed Hoogland Northern Cluster Wind Farms Projects (Appendix B: Maps)

Hoogland Northern Cluster – Shared Infrastructure			
SG Code	Farm Number	Farm name	
Temporary N1 Bypass			
C00900000000018500000	Farm 185	FARM 185	
C00900010000537200000	RE Erf 5372	BEAUFORT WEST TOWNSHIP	
Offsite watercourse crossing upgrades (shared infrastructure)			
DR02314-1			
C02600000000033000001	1/330	RIET POORT	
DR02314-2&3			
C02600000000033000001	1/330	RIET POORT	
C02600000000033000000	330	FARM 330	
DR02314-4			
C0090000000002800000	28	PLATFONTEIN	
C02600000000033600001	1/336	FONK FONTEIN	
R381-5 & R381-6			
C08000000000014300000	143	FARM 143	
See Figure 2-17 for locations			
Watercourse Crossing	Province and Municipality	Coordinates (North)	Coordinates (South)
DR02314-1	Northern Cape, Namakwa DM, Karoo Hoogland LM	31° 46' 37" S; 22° 4' 22" E	31° 47' 2" S; 22° 4' 26" E
DR02314-2&3	Northern Cape, Namakwa DM, Karoo Hoogland LM	31° 48' 36" S; 22° 5' 24" E	31° 49' 43" S; 22° 5' 42" E
DR02314-4	Northern Cape, Namakwa DM, Karoo Hoogland LM; and Western Cape, Central Karoo DM, Beaufort West LM	31° 52' 49" S; 22° 5' 21" E	31° 53' 2" S; 22° 5' 20" E
R381-5	Northern Cape, Pixley ka Seme DM, Ubuntu LM	31° 32' 1" S; 22° 20' 27" E	31° 32' 23" S; 22° 20' 19" E
R381-6	Northern Cape, Pixley Ka Seme DM, Ubuntu LM	31° 33' 17" S; 22° 21' 2" E	31° 33' 33" S; 22° 21' 7" E

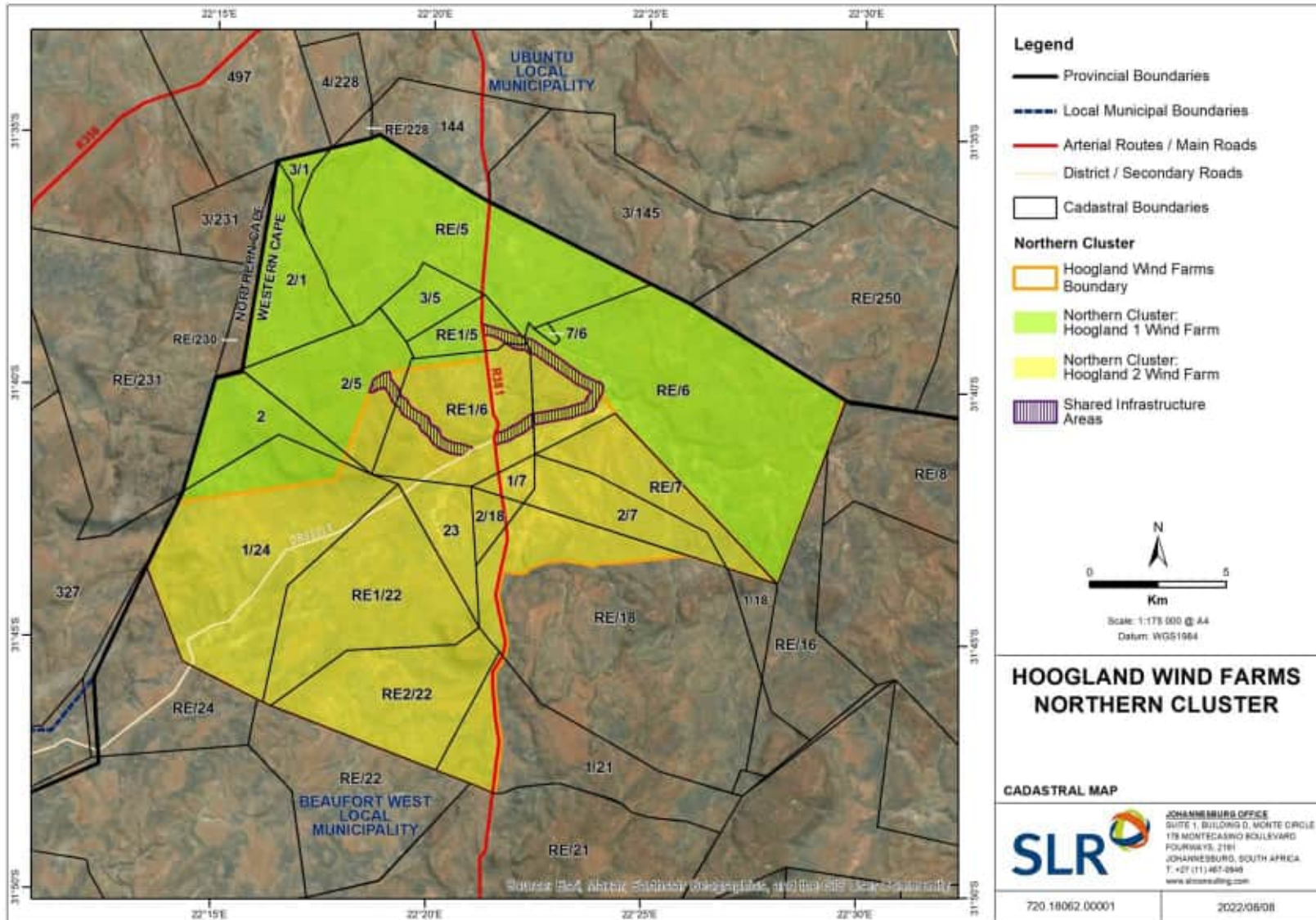


Figure 2-4: Hoogland Northern Wind Farms Cluster Cadastral map

2.2 SUMMARY

An operational Wind Farm is comprised of several components which support large scale energy generation. These components are described in this section and a summary of the projects components and specifications are included in Table 2-3 below.

Table 2-3: Summary of the components, specifications, and approximate areas of impact of each of the Hoogland Wind Farms based on a maximum of 60 turbines*

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 1 (14/12/16/3/3/2/2147)	HOOGLAND 2 (14/12/16/3/3/2/2146)
Location	Central coordinates:	31°38'18.90"S, 22°18'0.44"E	31°43'16.68"S, 22°19'50.27"E
Access	For commuter traffic and some small loads, access from the south would be via Beaufort West via the N1 and R381 travelling between Beaufort West and Loxton. For abnormal loads the main access routes for each Wind Farm are as follows:	Through Loxton, south along the R381 towards HL01 and HL02	
Extent	The total area of the site being considered for developing each Wind Farm (including shared infrastructure sections where relevant):	16,772 ha	17,832 ha
Number of wind turbines and generation capacity	Up to a maximum of 60 wind turbines per Wind Farm will be developed. The targeted nameplate generation capacity for each Wind Farm is up to a maximum of 420 MW.	60	60
	However, the number of turbines included in the layout for approval for each Wind Farm is as follows:	87	80
Wind turbine specifications	<ul style="list-style-type: none"> • Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius) • Hub height: 80 m to 150 m • Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5 m blade = 247.5 m) • Rotor bottom tip height: minimum of 20 m (and not lower). <p>See Figure 2-7 below.</p>	-	-
Turbine Foundations	Each turbine will have a circular foundation with a diameter of up to 35 m, alongside the 40 m hardstand (1,400 m ²). The permanent total footprint is as follows:	8.4 ha (permanent)	8.4 ha (permanent)
Turbine Hardstands and Laydown Areas	Each turbine will have a permanent crane pad of 80 m x 40 m placed adjacent to each turbine foundation. The total permanent footprints are as follows:	19.2 ha (permanent)	19.2 ha (permanent)
	An additional 20 m x 40 m of temporary hardstand area will also be required near each of the crane pads. Further, a blade laydown area of 104 m x 20 m and an additional embankment area (where necessary due to slopes) of approximately 104 m x 5 m will be required. A temporary crane boom assembly area of 120 x 15 m will also be accommodated.	31.2 ha (temporary)	31.2 ha (temporary)

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 1 (14/12/16/3/3/2/2147)	HOOGLAND 2 (14/12/16/3/3/2/2146)
	Temporary areas are up to a maximum of a maximum of 5,200 m ² per turbine. The total temporary footprints per Wind Farm are as follows:		
Cabling	Turbines to be connected to on-site Substation via up to 66 kV cables. Cables to be laid underground in trenches mainly adjacent to proposed Wind Farm roads (as part of the temporary impact of 'Site roads' below) but in some instances the cables will deviate from the road. Such sections of off-road cables amount to the following length and footprint:	10.7 km 6.4 ha (temporary)	7.6 km 4.6 ha (temporary)
	Where it has been possible, cables have been routed along existing local roads. Note that cables running next to public roads will not be able to run within the road reserve, but as close as possible to the road reserve in the adjacent private owned land. These have the following length and footprint:	0.5 km 0.3 ha (temporary)	18.8 km 11.3 ha (temporary)
Internal Wind Farm overhead power lines	In limited instances, overhead lines will be used where burying is not possible due to technical, geological, environmental or topographical constraints. <u>The potential locations of these are depicted in the layout and they will be subject to walkdowns by the relevant specialists and micro-siting.</u> Up to 66 kV overhead power lines supported by <u>structures of up to approximately 22 m in height are proposed</u> , as well as tracks for access to the pylons. The total length of the indicative overhead lines and the footprint of the pylons and tracks are as follows:	0.2 km 0.1 ha (permanent)	0.5 km 0.3 ha (permanent)
	Where possible, to reduce areas of new impact, sections of overhead line have been routed next to proposed Eskom overhead lines. Such sections of overhead lines have the following additional length and footprint:	3.2 km 1.9 ha (permanent)	10.2 km 6.1 ha (permanent)
Site roads	The total road network for each Wind Farm* is as follows:	122.2 km	110.8 km
	Permanent roads will be 6 m wide and over above this may require side drains on one or both sides depending on the topography. Many roads will have underground cables running next to them. The permanent footprint of the road network for each Wind Farm is as follows:	*97.7 ha (permanent)	*88.7 ha (permanent)
	An up to 15 m wide road corridor may be temporarily impacted during construction and rehabilitated to allow for a 6 m road surface after construction. The temporary footprint of the road network for each Wind Farm is as follows:	*110 ha (temporary)	*99.7 ha (temporary)
	This total road network also includes upgrades to sections of public roads, to the following extent:	4.7 km (permanent)	3.6 km (permanent)

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 1 (14/12/16/3/3/2/2147)	HOOGLAND 2 (14/12/16/3/3/2/2146)
	This total road network also includes shared road infrastructure with the other wind farm in the respective cluster:	16.9 km (permanent)	16.9 km (permanent)
	This total road network also includes shared road infrastructure with Nuweveld North and West Wind Farm as follows:	N/A	11.6 km (permanent)
Wind Farm Substations	Each Wind Farm will have two 150 m x 75 m Substation yards that will include an Operation and Maintenance (O&M) building, Substation building and a High Voltage Gantry. The area for the two Substation yards per wind farm are as follows:	2.3 ha (permanent)	2.3 ha (permanent)
Battery energy storage system (BESS)	Each Wind Farm will also potentially have two ±3.5 ha areas for battery energy storage systems (BESS) which may be adjacent or slightly removed from each of the two Substations depending on the local constraints. Each BESS may either be connected to the Wind Farm Substation by an underground or overhead cable or may require its own substation which would be located within the BESS footprint and would be connected directly to the Eskom Switching Station via a short 132 kV overhead line.	7 ha (permanent)	7 ha (permanent)
Operations and maintenance (O&M) area	The O&M area will include all offices, stores, workshops and laydown area. The Substation building will be housed in the Substation yard.	Forms part of Substation yards	Forms part of Substation yards
Security	Security gate and hut to be installed at most entrances to each Wind Farm site (estimated as 4 entrances each at 20 m ²). No fencing around individual turbines, existing fencing shall remain around perimeter of properties. Temporary and permanent yard areas to be enclosed (with access control) with an up to 2.4 m high fence.	80 m ²	80 m ²
Temporary areas required for the construction / decommissioning phase	Each Wind Farm will have the following temporary construction areas: <ul style="list-style-type: none"> • Temporary site camp/s areas of ±20,000 m² • Batching plant area of ±2,000 m² • General laydown area of ± 36,000 m² • Each Wind Farm will have a bunded fuel & lubricants storage facility at the site camp. Individual turbine temporary laydown areas including crane boom laydown areas, blade laydown areas and other potential temporary areas are detailed above under “turbine hardstands”.	6 ha (temporary)	6 ha (temporary)
Shared offsite infrastructure:	As part of the Nuweveld Wind Farms, a temporary bypass road is required on the N1 to avoid the town of Beaufort West with the major Wind Farm components. The road surface will be up to 6 m wide, with side	6.8 ha (shared, temporary)	6.8 ha (shared, temporary)

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 1 (14/12/16/3/3/2/2147)	HOOGLAND 2 (14/12/16/3/3/2/2146)
N1 Bypass Road	drains, but a 12 m wide road corridor may be temporarily impacted during construction and rehabilitated once construction is complete. The length of the temporary road will be about 5.6 km of which about 2.5 km is along an existing track. It is planned that this road will also be used by the Hoogland Wind Farms, and this is why it is shared infrastructure between the Nuweveld projects and these projects.		
Other offsite shared infrastructure	Stream crossings upgrades along the R381 to the north of the project area and along the DR02314 to the south-west of the project area are required.	4.4 ha (shared, permanent) 5 ha (shared, temporary)	4.4 ha (shared, permanent) 5 ha (shared, temporary)
Total disturbance footprint		165.7 ha temporary and 141 ha permanent	164.6 ha temporary and 136.3 ha permanent
<p><i>*Note these areas represent more than will be impacted given the road values are based on all the turbines shown in the layout for each individual Wind Farm being constructed wherein reality only 60 of these turbines will be developed per Wind Farm.</i></p>			

2.3 SITE LAYOUT

The site layout has been through various iterations during the Screening and Initial Design Phase, Scoping Phase and EIR Phase (described in Section 6) and the outcomes of these phases have guided the layout presented and assessed within this EIR. The layout makes provision for the development of 87 potential turbine positions in Hoogland 1 Wind Farm and 80 potential turbine positions in Hoogland 2 Wind Farm with associated infrastructure, as shown in the following maps (Figure 2-5 and Figure 2-6, A3 maps available in *Appendix B: Maps*).

Please refer to Section 6.1 for details regarding the layout updates throughout the process.

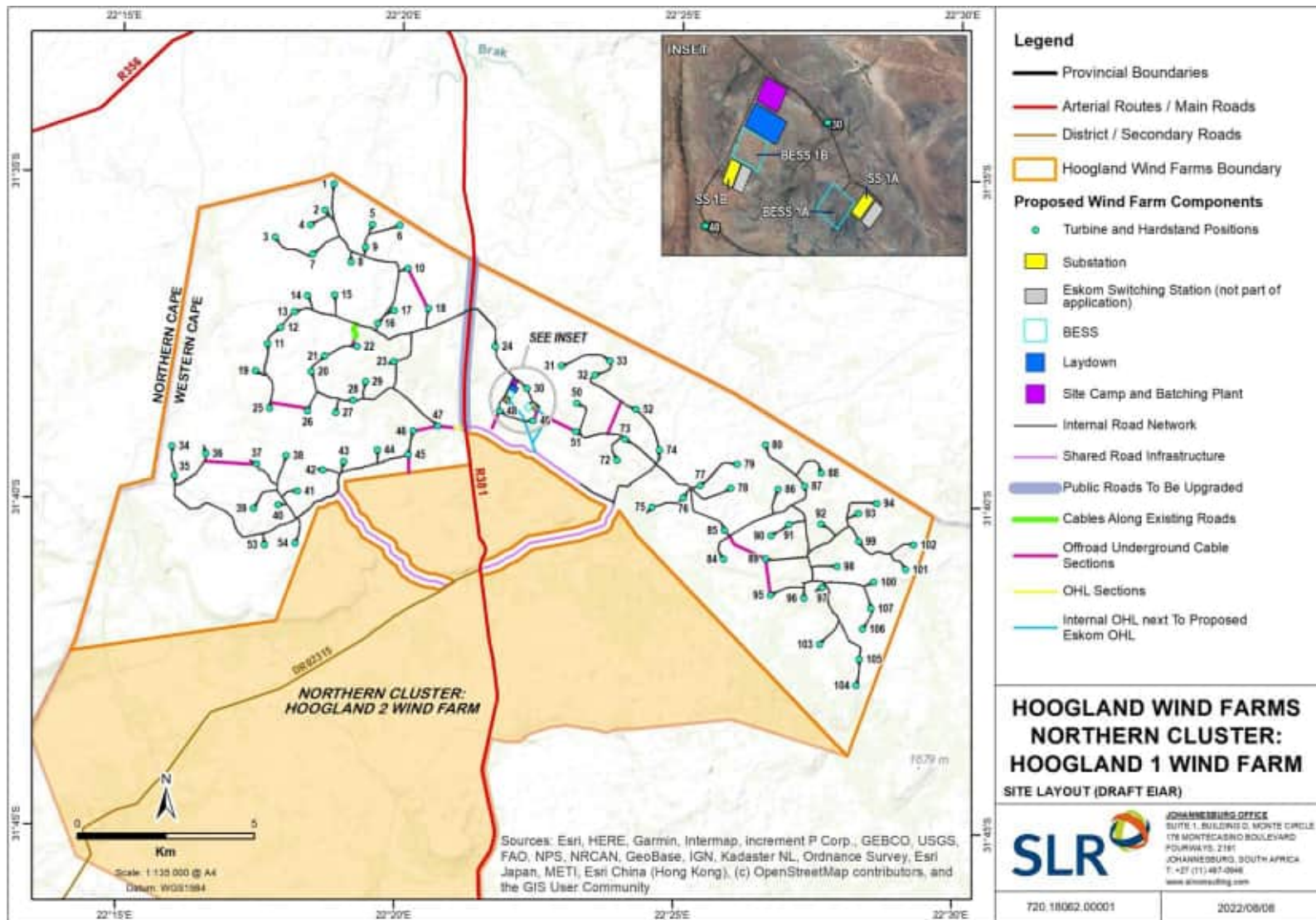


Figure 2-5: Hoogland 1 Wind Farm Layout (87 turbines)

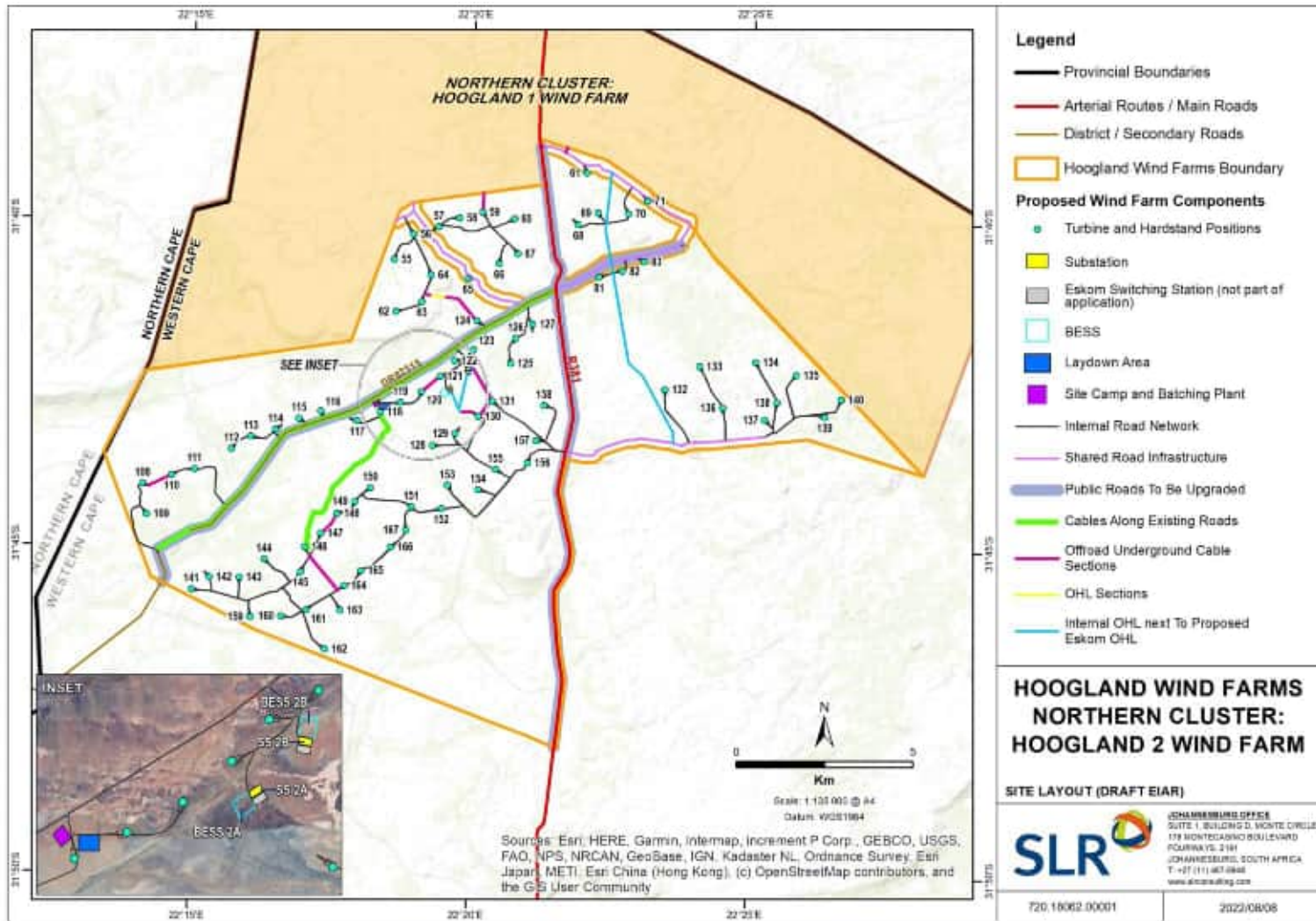


Figure 2-6: Hoogland 2 Wind Farm Layout (80 turbines)

2.4 WIND FARM COMPONENTS

Each Wind Farm requires several key components to facilitate the generation of electricity at a large scale. This includes:

- Wind turbines;
- Roads;
- Underground cables and overhead high voltage power lines (up to 66 kV);
- Two Substations (including and operations and maintenance area for control, operation, workshop, storage buildings / areas); and
- A battery storage facility in the vicinity of each Substation.

The various Wind Farm components are described, and illustrative figures are also provided within this section.

2.4.1 Wind Turbines

A wind turbine is a rotary device that extracts energy from the wind. The mechanical energy generated is converted to electricity. Wind turbines can rotate either on a horizontal or vertical axis. Larger capacity turbines used in large scale Wind Farms for the commercial production of electricity are typically horizontal axis wind turbines (HAWT), which are three-bladed and mechanically pointed into the wind by computer-controlled motors, as is proposed for this project. These have high blade tip speeds of up to about 325 km/hour, high efficiency, and low torque ripple, which contribute to good reliability. Figure 2-8 illustrates the external and internal components that make up a typical wind turbine and also key aspects associated with the turbine erection process.

Since the turbine technology is continually evolving it is not possible at this early stage in the development process to specify the exact turbine model and specification (or even what would be available in the marketplace). Assumptions have been made as to the maximum possible area of impact by the potential turbine blades based on a range of turbine sizes. This area of impact is referred to as the “exaggerated rotor swept area envelope”, as it 1) takes into account multiple turbine size scenarios at once, and 2) assumes each turbine has the largest blade it can from the lowest hub height and extends this all the way up to the highest hub height (see Figure 2-7). This reflects an exaggerated worst-case area of impact that would never be realised in any scenario of turbine model. Therefore, specialist assessments using this exaggerated envelope will result in their findings being more conservative and thereby ensuring a precautionary approach to the assessment (i.e., ensuring the impacts associated with the actual swept area are likely to be less than that reported in the assessment).

For the Hoogland Wind Farms the following wind turbine envelope is proposed (Figure 2-7):

- Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius)
- Hub height: 80 m to 150 m
- Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5 m blade = 247.5 m)
- Rotor bottom tip height: minimum of 20 m (and not lower).

The nameplate capacity of each Wind Farm will be up to a maximum of 420 MW.

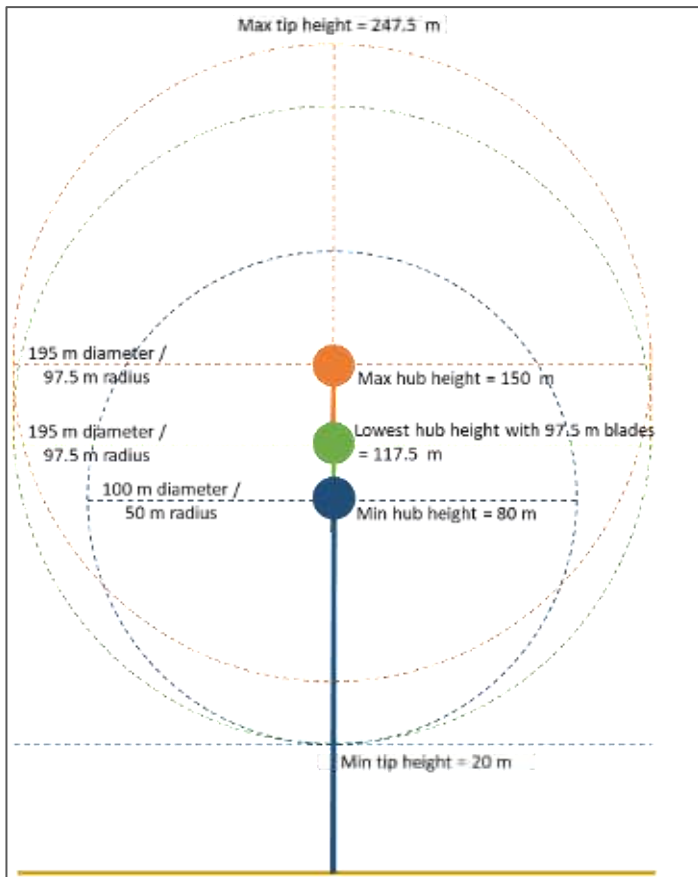


Figure 2-7: Rotor swept area envelope

2.4.1.1 Rotor and Blades

The rotor has three blades that are usually coloured white or light grey for aviation safety and thermal reflectivity.

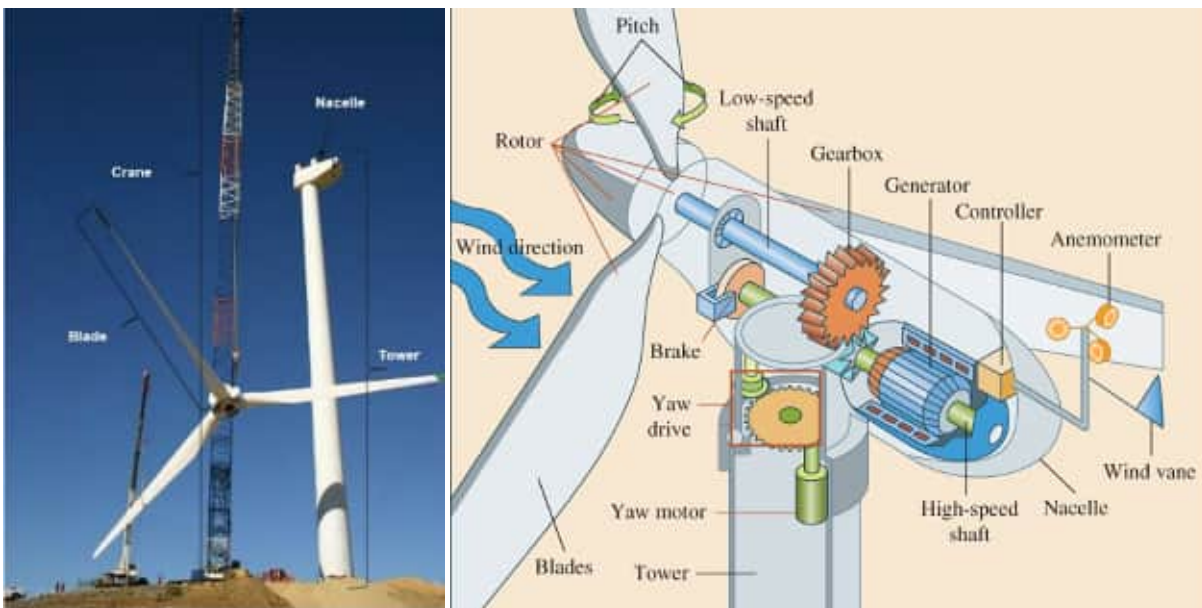


Figure 2-8: External (left) and internal⁸ (right) components of a typical wind turbine.

⁸ <http://9.dragonpark-bonn.de/this-diagram-describe-the-wind-turbine-parts.html>

2.4.1.2 Nacelle

Larger wind turbines are actively controlled to face the oncoming wind direction, which is measured by a wind vane situated on the back of the nacelle. By reducing the misalignment between wind and turbine pointing direction (yaw angle), the power output can be maximised, and non-symmetrical loads minimised. The nacelle turns the turbine to face into the wind ('yaw control'). The nacelle also contains the generator, control equipment, gearbox and wind speed instrument (anemometer) to monitor the wind speed and direction.

The turbine controls the angle of the blades ('pitch control') to make optimal use of the available wind and avoid damage at high wind speeds. By turning the blades sideways into the wind, i.e., away from the direction of the wind ('furling'), the turbine ceases its rotation, accompanied by both electromagnetic and mechanical brakes. This would typically occur at very high wind speeds, typically over 72 km/h (20 m/s), depending on the characteristics of the specific turbine. The wind speed at which shut down occurs is called the cut-out speed. The cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level. Refer to Figure 2-8 illustrating the typical components of the nacelle.

2.4.1.3 Generator and Transformer

The generator converts the mechanical turning motion of the blades into electricity. A gear box is commonly used for stepping up the speed of the generator. Inside the generator, wire coils rotate in a magnetic field to produce electricity. Each turbine has a transformer that steps up the voltage to match the power line frequency and voltage for transmission to the Wind Farm Substation. The transformer may be located inside the turbine tower, or within a small housing at the base of the tower depending on the make and model. Refer to Figure 2-8 for the typical location of generator inside the nacelle.

2.4.1.4 Tower

The tower is constructed from tubular steel or steel reinforced concrete and supports the rotor and nacelle. Towers can vary in height and are dependent on the turbine make and model. The nacelle is attached to the top of the tower and the point or axis where the rotor attaches to the nacelle is referred to as "hub height." Wind velocity and consistency generally increases with altitude, therefore increasing the height of a turbine places the rotor into the higher velocity laminar winds that are good for power generation. For this, and other reasons, there has been steady increase in turbine size as the industry and technology have developed.

2.4.1.5 Hardstand and Foundation

Development of each turbine would require a permanent and temporary disturbance footprint to allow for their construction and maintenance. This area includes the permanent turbine gravity foundation as well as the compacted construction area (hardstand) required to support the heavy-duty equipment (most notably the cranes), machinery and components (e.g., blades) during the construction and maintenance phases. Additional areas will be temporarily required in the construction phase for the staging, assembly and erection of the crane and turbine blades. These areas may also be used for temporary stockpiling of excavated materials and topsoil. The various components of the hardstand and the specifications are included in Table 2-4 below whilst a typical hardstand design is illustrated in Figure 2-10.

Gravity foundations (footings) are designed to withstand both the weight (static vertical load) and lateral loads exerted by wind pressure and rotor movements (dynamic horizontal loads). Considerable attention is given to the design the footings to ensure that the turbines are adequately grounded and able to operate safely and efficiently. Due to the high loads, large and heavy steel-reinforced concrete gravity foundations are required to keep the turbines upright. Figure 2-9 provides a view of a gravity foundation under construction. In terms of the footprint, a circular foundation with a diameter up to 35 m is proposed.

Table 2-4: Turbine hardstand specification and approximate disturbance footprint (Figure 2-10)

HARDSTAND COMPONENT	DESCRIPTION	FOOTPRINT (ESTIMATED)	TEMPORARY/PERMANENT
Turbine Foundation	Concrete turbine foundation	± 1,400 m ² (35 x 40 m)	Permanent
Crane Pad	Area where construction crane would be placed	± 3,200 m ² (80 x 40 m)	Permanent
Additional temporary hardstand area near Crane Pad	Additional temporary hardstand area near Crane Pad	± 800 m ² (20 x 40 m)	Temporary
Blade Laydown Area	Area where blades would be stored prior to installation (with potential additional embankment area if on slope)	± 2,600 m ² (25 x 104 m)	Temporary
Crane Boom Assembly Area	Area where the crane boom would be assembled	± 1,800 m ² (120 x 15 m)	Temporary



Figure 2-9: Example of a typical turbine foundation under construction

The layout and orientation of the foundation, hardstand and laydown areas and access roads will vary from location to location based on slope, terrain and other constraints that characterise each site. The general layout of a turbine work site is set out in Figure 2-10 to follow.

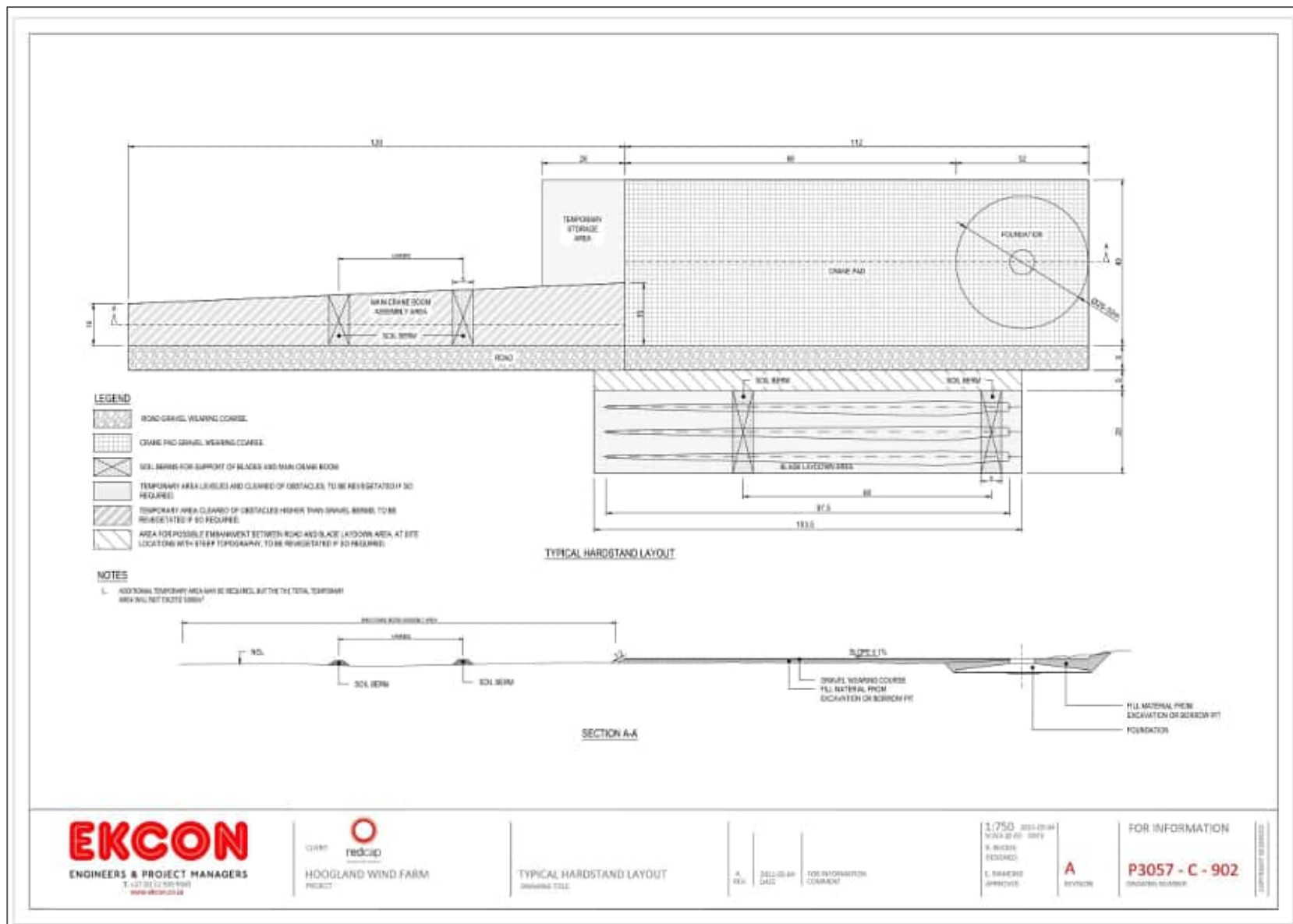


Figure 2-10: Plan of a typical wind turbine hardstand

2.4.2 Power transmission

The electricity generated by the turbines on each Wind Farm needs to be collected, transformed and then evacuated to the national grid. To allow efficient transmission, the electricity undergoes a voltage “step-up” process that occurs at each wind turbine where power is stepped up to a maximum of 66 kV (either in the turbine or in a transformer container next to the turbine), and again at one of the Wind Farm Substations where power is stepped up to 132 kV. The power is then transferred through a Switching Station next to the Substation along a 132 kV line to the proposed Nuweveld Collector Substation (refer to Figure 2-11). The Wind Farm Grid Connection infrastructure, which consists of a Switching Station next to each Wind Farm Substation and the 132 kV power line to the Nuweveld Collector Substation, is the subject of a separate application as once constructed it will be handed over to Eskom who will own and manage it as part of the national grid. The Wind Farm Substation and all the up to 66 kV internal lines are part of each respective Wind Farm application.

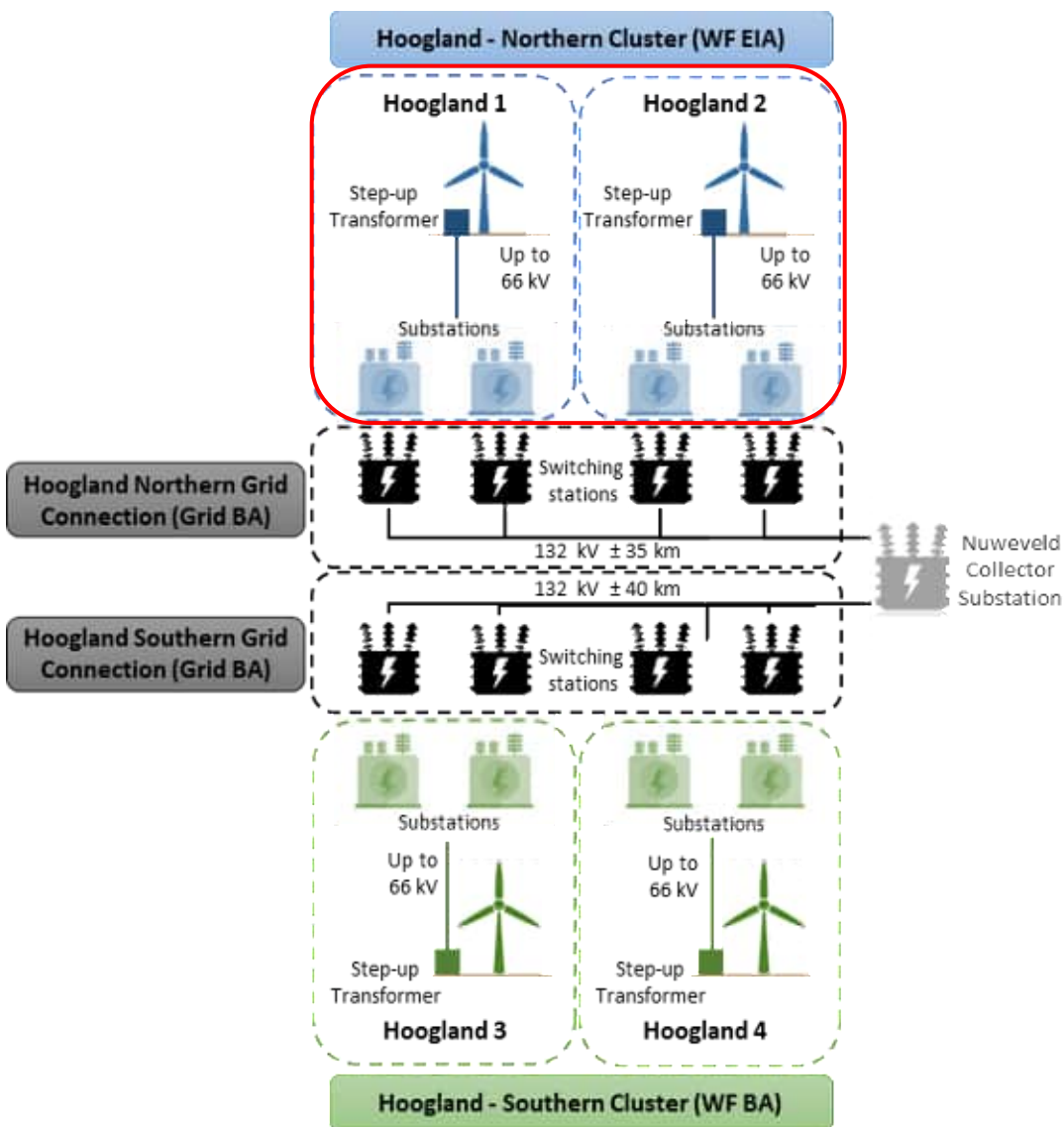


Figure 2-11: Power transmission - Wind Farm and Grid Connection interface (Hoogland 1 and Hoogland 2 Wind Farms shown in the red block)

2.4.2.1 Cabling

At each turbine, power is stepped up to a maximum of 66 kV (either in the turbine or in a transformer container next to the turbine). Each turbine will be connected to their respective Wind Farm Substation via high voltage power lines

(~66 kV lines). For the most part cables will be laid underground in trenches (~1 m deep), generally running alongside new or proposed internal roads, but sometimes deviating from these. In limited instances, where burying of cables is not possible due to technical, geological, environmental or topographical constraints, then short overhead power lines will be erected to traverse these constrained areas. Indicative locations for these have been assessed however, these will be subject to walkdowns by the relevant specialists and micro-siting.

Figure 2-5 and Figure 2-6 depicts the Hoogland 1 Wind Farm and Hoogland 2 Wind Farm site layouts respectively and differentiate between 'Roads and Cables' where cables run alongside proposed or existing roads, 'Off-road Cables' where cables will not run alongside proposed or existing roads, and the 'Internal Overhead Power Lines' where trenching is not possible and overhead cables must be spanned. Where possible, to reduce areas of new impact, sections of overhead line have also been routed next to proposed Eskom overhead lines.

Internal overhead power lines will be spanned using short metal 132 kV type monopoles (Figure 2-12) or custom made wooden structures (Figure 2-13) of not more than approximately 22 m in height. These structures have been selected rather than the standard 33 or 66 kV structure as they significantly reduce the risk of bird electrocutions and are therefore preferred by the bird specialist. In some sections, two parallel rows of lines and pylons could be required.

As described in Section 2.4.3, there is the potential that each BESS may require its own Substation and would be connected directly to the respective Eskom Switching Station via a short 132 kV overhead line which would be supported in monopoles up to 32 m in height. This is the only section of 132 kV overhead line included in each Wind Farm application.

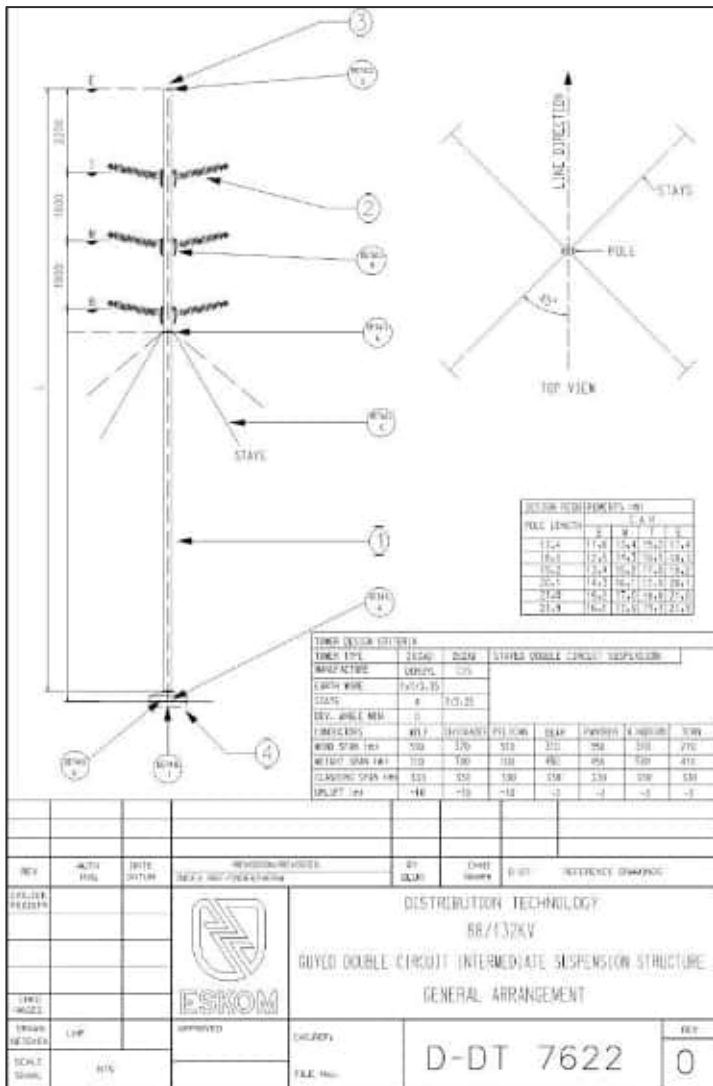


Figure 2-12: Typical design of the proposed metal monopoles to be used for the up to 66 kV internal overhead power lines

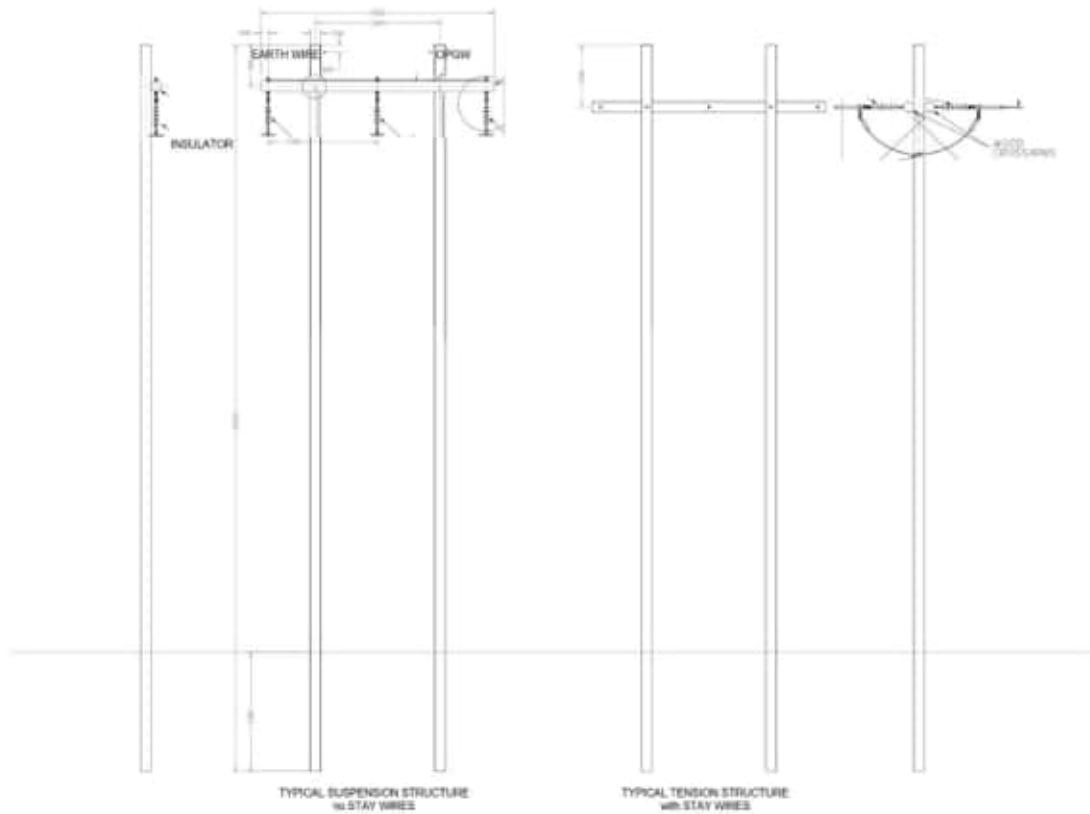


Figure 2-13: Custom made wooden structures for the up to 66kV internal overhead power lines

2.4.2.2 On-Site Substations

Two substations have been provided for each wind farm. Once the high voltage (~66 kV) electricity reaches each on-site Wind Farm Substation (with transformer), it will be stepped-up to 132 kV. The Substation yard will house Operation and Maintenance (O&M) buildings, Substation building and a High Voltage Gantry, and will be approximately 11,250 m² in extent (150 m x 75 m). The Substation would typically include an area with a subterranean earthing mat onto which a number of concrete plinths are constructed. This, together with several earthing rods, will provide an earth for lightning and possible short circuit currents. Switching gear, step-up transformers and protection equipment are also mounted on concrete plinths as part of the Substation.

Once stepped-up to 132 kV the electricity would pass to a ringfenced Eskom Switching Station abutting each Substation (the Switching Station is part of the separate Grid Connection application). The adjoining Eskom Switching Station would be of a similar size to that of the Wind Farm Substation and include metal gantries where the Eskom power lines are connected in a “busbar” arrangement so that multiple lines can be joined together and where specialised equipment is used to switch these lines on and off. The adjacent Eskom Switching Station is described in Section 2.4.2.3.1 below. Figure 2-5 and Figure 2-6 show two potential substation / switching locations for each Wind Farm site.

Information relating to the Grid Connection (132 kV power line and Switching Stations) is provided below for information purposes, but the reader should note the Grid Connection is the subject of a separate application and should refer to that application for details.



Figure 2-14: Example of a Wind Farm Substation (right) and adjoining Eskom Switching Station (left) on the Kouga Wind Farm

2.4.2.3 Grid Connection (Not part of this application – included for contextual purposes)

The Nuweveld Project¹⁴ falls to the east of the Hoogland Project and comprises three Wind Farms. In order to evacuate the energy generated by the Nuweveld Wind Farms, Red Cap is proposing to develop the Nuweveld Collector Substation for Eskom and from this a ~120 km (400 kV) high voltage overhead transmission power line to the Eskom Droërivier Substation (see Figure 1-2 for Locality Map). The Nuweveld Gridline and associated Collector Substation has received environmental authorisation⁹ and if developed will be considered part of the Eskom national power line network. The Hoogland Projects will connect to the national Grid via the Nuweveld Collector Substation.

The proposed Hoogland Northern Grid Connection is the 132 kV overhead power line required to connect the Hoogland Northern Wind Farm Cluster (Hoogland 1 Wind Farm and Hoogland 2 Wind Farm) to the Nuweveld Collector Substation as part of the grid. Similarly, the Hoogland Southern Grid Connection is required to connect the Hoogland Southern Wind Farm Cluster (Hoogland 3 Wind Farm and Hoogland 4 Wind Farm) to the Nuweveld Collector Substation as part of the grid. These are two separate applications for Environmental Authorisation, which will be formally submitted to the DFFE and will include the Switching Stations next to each respective Wind Farm Substation as well as the 132 kV overhead lines connecting into the Nuweveld Collector Substation. These applications will run as far as possible in parallel to the Wind Farm EIA/BA processes. Refer to Figure 2-12 in the previous section. These would be developed by Red Cap but handed over to Eskom once constructed for Eskom to own and operate and thus to become part of the national grid network.

2.4.2.3.1 Switching Stations

Each Wind Farm will interface with its respective Grid Connection via the Eskom Switching Station adjacent to each of the two Wind Farm Substations as referred to in Section 2.4.2.2 above. The Eskom Switching Station abutting each Substation would be ringfenced and of a similar size to that of the Wind Farm Substation (11,250 m² in extent, 150m

⁹ 14/12/16/3/3/1/2336

x 75 m). It will include metal gantries where the Eskom power lines are connected in a “busbar” arrangement so that multiple lines can be joined together and where specialised equipment is used to switch these lines on and off.

2.4.2.3.2 Overhead Power Lines

The Switching Stations will then connect to the Nuweveld Collector Substation via two overhead 132 kV high voltage power lines; one serving Hoogland 1 and 2 Wind Farms in the Northern Cluster; and another serving Hoogland 3 and 4 Wind Farms in the Southern Cluster. The overhead lines will largely be supported by monopole style pylons and these specifications are described in the respective Grid Connection Basic Assessment report/s.

2.4.3 Battery Storage Facility

Each Wind Farm proposal includes the possibility for the development of a battery energy storage system (BESS). This will allow for a more continuous source of electricity to the grid as battery facilities can help to smooth out the fluctuations in energy generation from the renewable energy sources and allow them to be closer to conventional generation systems in this regard.

A BESS will be located in close proximity to each respective Wind Farm Substation and therefore there will be two BESS per wind farm. Each BESS will be fenced off and will be linked to the Substation via up to 66 kV cables and will not have any additional office / operation / maintenance infrastructure as those of the Substation. However, each BESS may require its own substation, and if this is the case this substation would include typical substation components and be located within the BESS footprint. If the BESS does have its own substation, then it will not have an up to 66 kV cable connection to the Wind Farm Substation but would rather have a short 132 kV connection from the BESS substation to the Eskom Switching Station (which is situated next to the Wind Farm Substation), and this would use monopole pylons up to 32 m in height.

The battery facilities will either be Lithium Ion or Redox Flow and both technologies will be assessed as it is unknown which technology will be selected. Each BESS will be compliant with all local laws and regulations and health and safety requirements governing battery facilities. A risk assessment is included in *Appendix G: Battery Energy Storage Risk Assessment*. The physical footprint of each BESS, regardless of technology and grid connection will be approximately 3.5 ha with a peak discharge value of 140 MWac. A brief description of each technology is provided below.

2.4.3.1 Lithium-Ion

Charged lithium ions are carried via electrolytes between anode (negative electrode) and cathode (positive electrode) within each Lithium-Ion battery cell. There are a number of different battery chemistries that are available. These cells are combined into battery modules, which are housed in battery racks, a number of which are collectively enclosed in sealed containers. These are all assembled in factories and no electrolytic liquid is handled on site. In addition to the battery racks, other components within the containers includes a HVAC or air conditioning system, a fire detection and suppression system (that normally uses inert gas), battery management system and other electrical components required to manage the batteries. The containers are normally a standard size of about 12 m long x 2.5 m wide x 2.7-3 m high. The BESS on the Wind Farm site will comprise multiple containers (e.g., approximately 240, with an extra 3-5 containers for electrical connections and controls), refer to Figure 2-15 for an example of an installation. The main risk to health and the environment relating to for Lithium-Ion BESS is overheating that leads to spontaneous ignition and subsequent explosion i.e., fire. Since the batteries arrive on site sealed and kept in racks inside sealed containers the risk of chemical spills are extremely low.



Figure 2-15: Example of a Lithium-Ion BESS installation

2.4.3.2 Redox Flow

Redox flow batteries are charged and discharged by means of the oxidation–reduction reaction of a chemical whereby ions are transferred from one element to another. Redox flow batteries therefore comprise an electrochemical battery cell and a flowable electrolyte which is pumped through the cell for charging or discharging electricity and is stored in electrolyte tanks (one tank acting as a cathode and one as an anode). The most common Flow battery electrolytes are based on a water solution including vanadium, zinc or iron salts. Electrolyte storage tanks and cells are typically installed in specially designed steel containers providing secondary and tertiary containment measures (double wall). The containers are filled with electrolyte on site during project installation. Adjacent to this is another container housing the conversion systems and auxiliary systems necessary for the operation of the system (these include HVAC, fire detection and suppression, leak detection and suppression, BESS management), refer to Figure 2-16. The height of the installation will not exceed 3 m. The main environmental risk specific to Flow batteries during construction and operation is the accidental leak or spillage to the environment of the liquid electrolyte. The risk of fire and explosion is low.

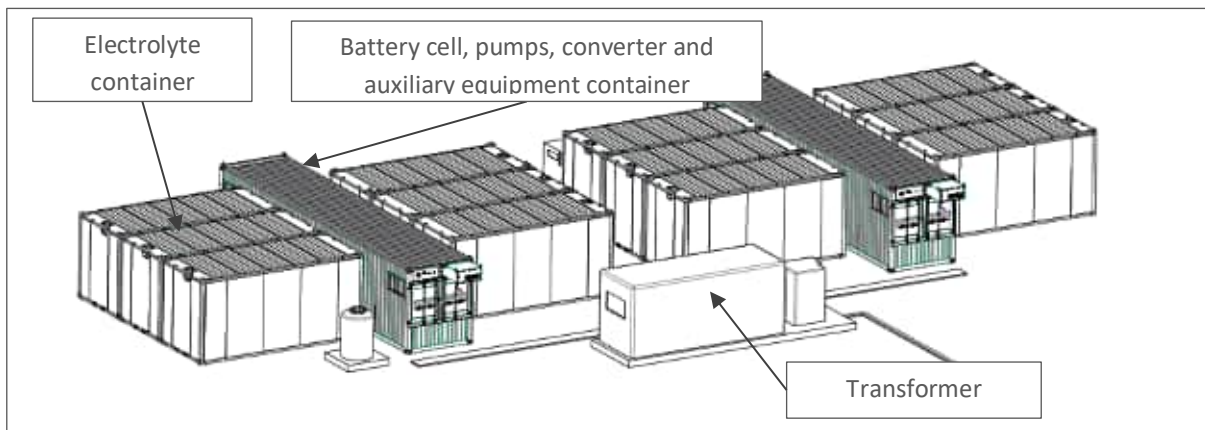


Figure 2-16: Indicative layout of a Flow battery of approximately 0.1 ha

2.4.4 Additional Infrastructure

2.4.4.1 Access, Service Roads and Sidings

The site can be accessed via the well-established existing road network in the area. For commuter traffic and some small loads, access from the south would be via Beaufort West using the N1 and R381 travelling between Beaufort West and Loxton. Due to restrictions in this route, the abnormal loads (including the large turbine components like blades, towers and nacelle etc) will be delivered from the north. The Northern Cluster (Hoogland 1 and 2 Wind Farms) will primarily use the R381 (south of Loxton) for the delivery of abnormal loads, whilst the Southern Cluster (Hoogland

3 and 4 Wind Farms) will primarily use the DR02314 and DR02312 (off the R356). Both of these routes require upgraded watercourse crossings which occur outside the Wind Farm boundaries in both the Western and Northern Cape. These are included in the Hoogland 1 and 2 application/s as shared infrastructure i.e., they are being included in both Hoogland 2 and Hoogland 2 Applications. Refer to Table 2-2 and Figure 2-17.

On site access and service roads will be required to access each turbine site and related Wind Farm infrastructure. These roads are shown in Figure 2-5 (Hoogland 1) and Figure 2-6 (Hoogland 2).

The internal gravel roads will have an approximate 6 m wide surface and there will be up to 15 m wide impacted during the construction phase, with additional space required for cut and fill, side drains and other stormwater control measures, turning areas and vertical and horizontal turning radii to ensure safe delivery of the turbine components. Where possible, existing roads have been proposed to be upgraded to avoid additional clearance of vegetation. New roads will be established where needed and aim to avoid sensitive areas and features, but specific allowances and exceptions provided for by the specialists. In exceptional circumstances short sections of the roads may be surfaced with bitumen or concrete on steeper areas to provide necessary traction and limit erosion.

2.4.4.2 Other off-site shared infrastructure

As part of the Nuweveld Wind Farms, a temporary bypass road is required on the N1 to avoid the town of Beaufort West for transport of the major Wind Farm components. The road surface will be up to 6 m wide, with side drains, but a 12 m wide road corridor may be temporarily impacted during construction and rehabilitated once construction is complete.

The length of the temporary road will be about 5.6 km of which about 2.5 km is along an existing track. It is planned that this road will also be used by the Hoogland Wind Farms, and this is why it is shared infrastructure between the Nuweveld projects and the Hoogland Northern Cluster Wind Farms (Figure 2-17). Furthermore, the N1 bypass will be included in both the Hoogland 1 and Hoogland 2 Applications.

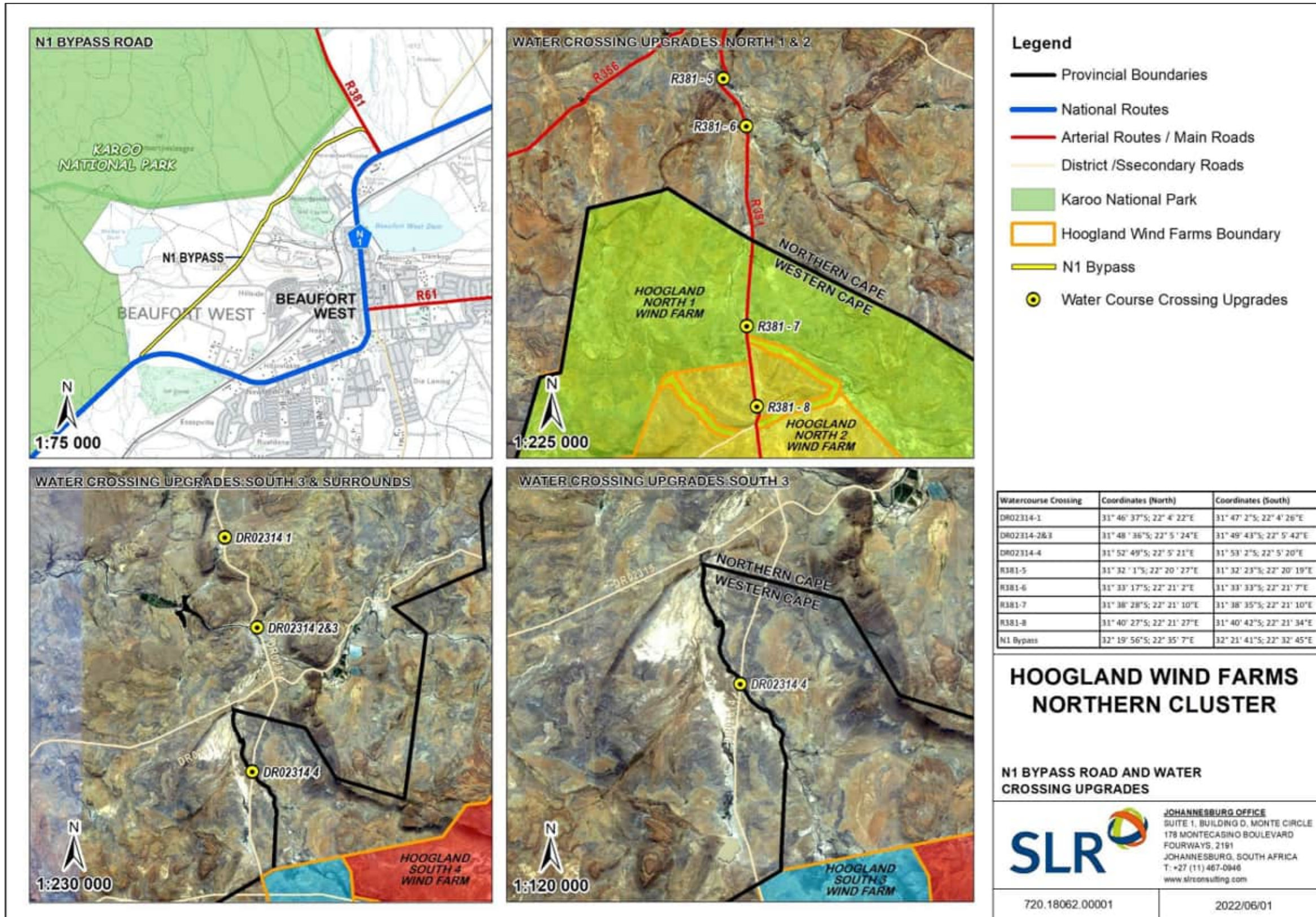


Figure 2-17: Shared infrastructure included in the Northern Wind Farms Cluster Applications

2.4.4.3 Security (Fencing, gates and access control)

A security gate and guard house may be placed at the entrances to each Wind Farm site. This is aimed at preventing unauthorised vehicular access to the facility. No fencing will be used around individual turbines and existing fencing will remain around the perimeter of the properties. This will enable livestock and wild fauna to continue to utilise the area underneath the turbines as rangeland or a migratory corridor. Fencing will be erected around each onsite Substation and Battery Facility operations and maintenance complex for security and safety reasons during the operational phase. The temporary construction/site camp (described further below) will also be fenced and should be kept secure for the duration of the construction period. Additional construction phase fencing will be used where needed in consultation with landowners.

2.4.4.4 Water, Electricity and Communications

A preliminary approximation of the water requirements for the construction phase of the proposed Wind Farm are as follows:

- During the construction period (18 - 24 months) water will largely be used for road construction; hardstand compaction; concrete foundations; cleaning equipment after concrete pours and dust suppression on roads. It is anticipated that 90,000 m³ per year during construction phase would be required.
- During the 20-year operational phase water would be required for staff ablutions. It is anticipated that water consumption would be approximately 2,500 m³ per annum.

Several water header tanks will likely be used to provide potable water and the water will be sourced from licensed boreholes and treated to potable quality where required.

Basic sanitation will be provided on site during the construction and operational phases in the form of portable/chemical toilets and conservancy tanks. Wastewater will be collected at regular intervals and transported to a Municipal Wastewater Treatment Works with sufficient capacity. Sections 22 and 40 of the National Water Act (36 of 1998) must be complied with when disposing sewage.

Electricity for construction could be obtained from Eskom through the existing 22 kV network in the area, alternatively temporary diesel generators and/or possibly small scale mobile photovoltaic units will be used to provide power.

Communication on site will be "wired"/ fibre. The project is located on the eastern boundary the Karoo Central Astronomy Advantage Area 1, an area set aside for the purposes of radio Astronomy in 100 MHz to 2,170 MHz range and related scientific endeavours. The advantage area does not extend across the provincial boundary into the Western Cape. However, in keeping with the protection of this area against Electromagnetic interference (EMI), or radio-frequency interference (RFI), and through consultation with the Square Kilometre Array (SKA) radio telescope, it has been agreed the turbine communication systems will be hardwired as opposed to telemetric (wireless communications).

2.4.5 Temporary infrastructure for construction

All temporary areas required for construction of the plant will be restored to near pre-impact condition wherever possible. During construction, temporarily impacted areas will be stripped of topsoil to allow for the works to occur, and the topsoil reinstated on completion. Revegetation will be implemented to reduce further risk of erosion and to restore ecological function as far as possible. This will apply to all temporary disturbance areas.

2.4.5.1 Site Camp (yards, offices laydowns and staff areas)

During the construction phase of each Wind Farm, the Contractor/s would require space for equipment and operations i.e., site camps. The areas identified for the site camps will have a total combined area of 2 ha on each Wind Farm and the proposed locations are depicted on the respective Wind Farm Layout maps in Figure 2-5 and Figure 2-6 above

(refer to *Appendix B: Maps* for A3 Layout Map). The area would be stripped of topsoil and vegetation, grubbed of rocks and debris, levelled where necessary for the duration of the disturbance and reinstated on completion.

Contractors would likely establish a series of temporary or mobile structures for offices, staff areas, storage areas, and workshops. Portable/chemical toilets and wash facilities will be provided for staff.

The remainder of the area would serve as a yard for the parking of equipment and vehicles, stockpiling of key construction materials and supplies, and spoil and waste items.

2.4.5.2 Laydown area

Each Wind Farm proposal includes an additional temporary laydown area on the site of ± 3.6 ha which could get used for turbine component storage or storage of other large components required for construction. Refer to Figure 2-5 above for the proposed location on each Wind Farm site.

2.4.5.3 Waste management

During the construction phase solid domestic waste would need to be collected in rubbish bins placed in the contractor yards and at various work areas across the site. Rubbish bins will be emptied at regular intervals and the waste collected at a weather shielded central waste area located in the contractor's yard. Waste will be separated wherever possible. Once sufficient volume of waste has been collected, the Contractor would remove the wastes for disposal at a registered waste disposal facility, which would likely be the municipal facilities located in Beaufort West (namely the Vaalkoppies waste disposal facility – see comments from WC DEA&DP in *Appendix D2: Scoping Phase*), or other registered facilities in neighbouring towns.

2.4.5.4 Fuel and lubricants storage

Due to the remoteness of site, the Contractor would establish a temporary fuel and lubricants storage area on the site to ensure that they can fuel and maintain the various items of equipment and plant machinery. In addition, as is standard practise, transformers in Substations are located within a bunded area. The combined storage capacity of all of the above facilities/infrastructure will fall above 80 m^3 but below 500 m^3 . As these qualify as dangerous goods, they would need to be stored in bespoke area with necessary protections including spill protection measures, secondary containment, oil separator/s, adequate weather proofing, firefighting equipment and added security (i.e., fencing and lockable access points, etc. to ensure that untrained or unauthorised persons cannot gain access). The site would need to carry the necessary hazard warning signage typical for such facility. The facility may have to be outfitted with a forecourt and dispensing equipment to allow vehicles to fill up at the facility or otherwise decant into mobile bowsers that would transport fuel out to the site works areas.

2.4.5.5 Concrete batching plant

Due to the distance from large towns and the remoteness of the area, concrete (e.g., for the turbine gravity foundations, road stabilisation and stormwater structures where needed, potential concrete turbine towers etc) would need to be batched on each Wind Farm site to ensure timeous delivery. Concrete materials (cement, sand, aggregate and water – plus any additives) would be brought to and stored at a batching plant. Batches of concrete would then be made and dispatched via truck to the work site. Since cement powder can be dangerous to handle, harmful to the environment and reactive with water, this will need to be stored in weather (wind and rain) proof areas to ensure it is contained and remains suitable to use. The batching facility would also need to have necessary provisions to container and prevent pollution of the environment by cement powder and concrete wash and spoil.

Each batching plant will be included in the respective site camp and comprise an area of 0.2 ha, refer to Figure 2-5 and Figure 2-6 for the proposed location of each Site Camp and Batching Plant area.

2.5 MATERIALS, RESOURCES AND HAULAGE

There will be the movement of materials, resources and waste onto and off the site for the duration of the construction period. This will include turbine components that require abnormal load transportation.

It must be noted that the final haulage route/s will be confirmed pre-construction by the appointed logistics company/contractor in line with the requirements of the traffic impact study and all relevant outstanding transport permits will be obtained.

During construction, internal roads are needed to accommodate low bed trucks delivering turbine components and large electrical equipment as well as the mobile high lift cranes where needed to erect the turbines themselves, amongst other heavy construction vehicles. Typical heavy loads are illustrated in Figure 2-18. Existing farm roads and tracks will be used and upgraded as far as practical as part of this road network, to reduce the disturbance footprint. In rough terrain, additional measures will be required for the reinforcement of the site roads whereby they may require hard surfacing on steeper areas to support the traffic and avoid erosion.



Figure 2-18: Tower section in low load configuration shown in top figure and blade shown in bottom figure

2.6 EMPLOYMENT

During the construction phase of the project, a number of temporary job opportunities will be created. These include highly-, medium- and low-skilled positions. To meet the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) objectives or requirements (see Section 4.3.5) many of these jobs will be reserved for individuals from the local community, where the skills are available.

It is estimated that the construction phase of each individual Wind Farm would result in an estimated 160-200 direct jobs (27-33 highly-skilled, 62-78 medium-skilled and 71-89 low-skilled jobs). Most of low-skilled jobs (60%) will likely come from the local municipal area.

Similarly, each Wind Farm will also generate permanent job opportunities throughout operation. It is intended that preference will be given, as far as possible, to those people living in the area.

2.7 TIMEFRAMES

The formal EIA process typically takes 1 to 2 years to complete and if authorised, it is the intention that the developer / applicant would then prepare the project for submission to the REIPPPP during a forthcoming bidding window. It is currently unknown when the future bidding windows will be (See Section 4.3.5).

Should any of the Wind Farm projects be selected and given “preferred bidder” status, the project would then move into the next phase which includes obtaining other permits, licenses, including Water Use Licences, Rezoning permission, and other consents before reaching financial close which is normally less than 1 year after preferred bidder status is announced. Thus, construction is likely to commence no earlier than about 1 to 1.5 years after the issuing of an EA, but this is all dependent on how soon after obtaining the EA the next bidding window is and what the requirements are in the bidding round. The construction period for each Wind Farm is estimated to be between 18 to 24 months and could run concurrently with the other Hoogland Wind Farm projects if also developed.

The operational life of a Wind Farm is typically around 20 years where after it could be refurbished / upgraded, or decommissioned depending on the situation at the time, and all subject to the relevant environmental processes and authorisations.

3 ALTERNATIVES

A comprehensive iterative design process has been undertaken to inform the respective Wind Farm layouts and associated Grid Connection infrastructure for the Hoogland Projects.

By integrating the screening and assessment of environmental and social constraints alongside the technical components of the project, early in a project lifecycle, allowed for the reduction in risks to the project and supports the application of the mitigation hierarchy by demonstrating the avoidance and minimisation of impacts. This integrated design approach negates the need for an alternative’s assessment in the detailed Environmental Impact Assessment (EIA) process (as per NEMA) as due to the thorough process entailed, it is unlikely that there will any fatal flaws to prevent the project proceeding.

However, the preferred layouts of the Hoogland Wind Farms, and respective Grid Corridors, have each been assessed against the ‘no-go’ alternative. The ‘no-go’ alternative is the option of not constructing the Project where the *status quo* of the current farming activities on the sites would prevail.

The table below highlights the iterative approach:

Table 3-1: Description of the main layout iterations and key change drivers

Date	Number of Turbines			Comments
	Northern Cluster	Southern Cluster	Total	
October 2020	N/A		493	Preliminary layout based on developer identified environmental and technical constraints. This was based on one continuous site. Refer to Figure 3-1.
January 2021	N/A		451	Layout revised to exclude nests identified in Avifauna Screening Study, VERA modelling and EWT data re: Riverine Rabbits. Potential for five Wind Farms.
January 2021	212	117	429	Site area adjusted to remove large central corridor namely on the basis of the Sak River sensitivities. This layout was circulated to specialist upon appointment.
February 2021	150	117	367	Martial Eagle nest confirmed in north west area and therefore site area adjusted to remove a number of properties and turbines from the Northern Cluster. Refer to Figure 3-2.
Sept 2021	176	172	348	Specialists initial Screening No-Go mapping applied to refine the preliminary layout. This included the discovery of a new Martial Eagle nest in the Southern Cluster with its resultant no-go buffer. The technical team also spent considerable effort optimising the layout based on a higher confidence in the layers provided by the specialists. Input regarding constraints from landowners and adjacent landowners was also considered. This layout was the basis for the Scoping Phase and was presented in the Scoping Report, as shown in Figure 3-3. The detailed Scoping layouts for Hoogland 1 and Hoogland 2 are included in <i>Appendix B: Maps</i> .

Date	Number of Turbines			Comments
	Northern Cluster	Southern Cluster	Total	
April 2022	167	134	301	<p>The site layouts presented in the Scoping Phase (as part of the Scoping Report) were refined mainly based on specialist recommendations, as well as relevant information that has arisen during the PPP (including input from landowners and adjacent landowners). The technical team also spent considerable effort optimising the layout based on technical changes (see Section 6.1.3.2) and updated layers provided by the specialists following additional work undertaken.</p> <p>For the Northern Cluster, these layouts are the basis for the EIA Phase (current phase), as shown in Figure 2-5 and Figure 2-6.</p>
May 2022	167	113	280	<p>Current layouts for EIA Phase (Northern Cluster) and BA Phase (Southern Cluster) (See Figure 3-4).</p> <p>Only the Southern Cluster (Hoogland 3 and Hoogland 4) layout was updated, and the reasons are detailed in the Southern Cluster BA Report (separate standalone report).</p> <p>The individual layouts for the Northern Cluster Wind Farms remain as shown in Figure 2-5 and Figure 2-6.</p>

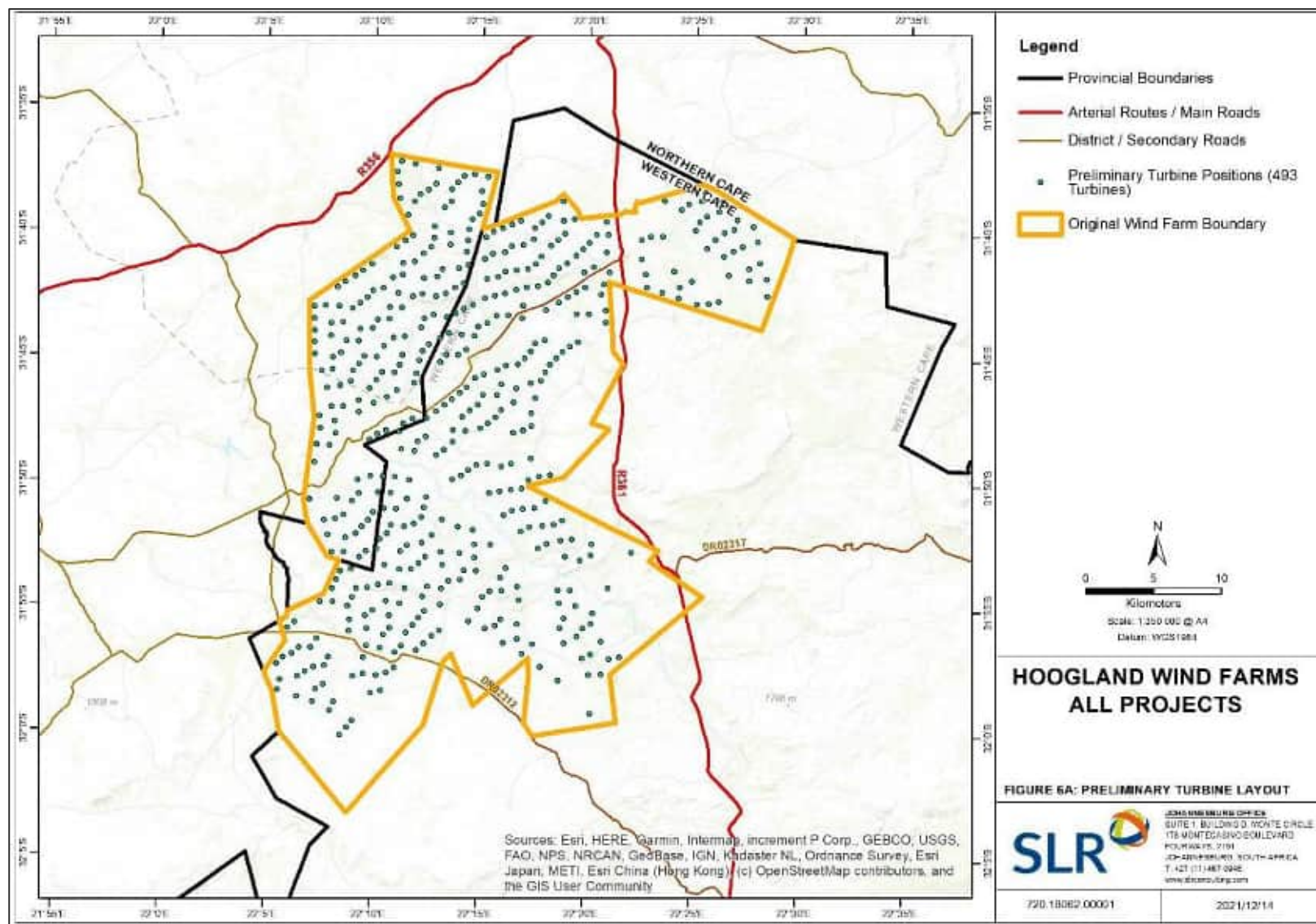


Figure 3-1: Preliminary 493 turbine layout based on developer identified environmental and technical constraints (October 2020)

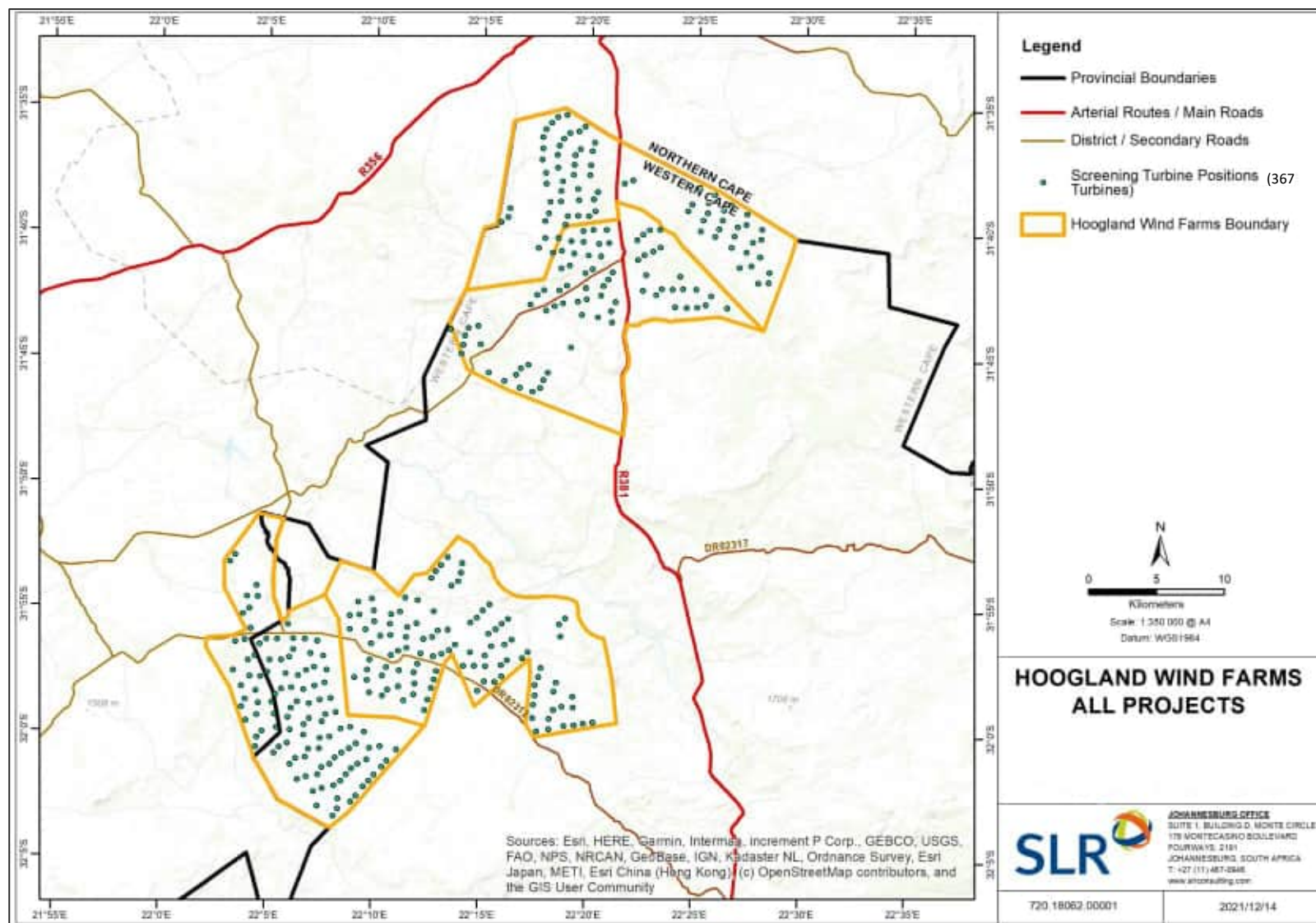


Figure 3-2: Screening Phase 367 turbine layout (February 2021)

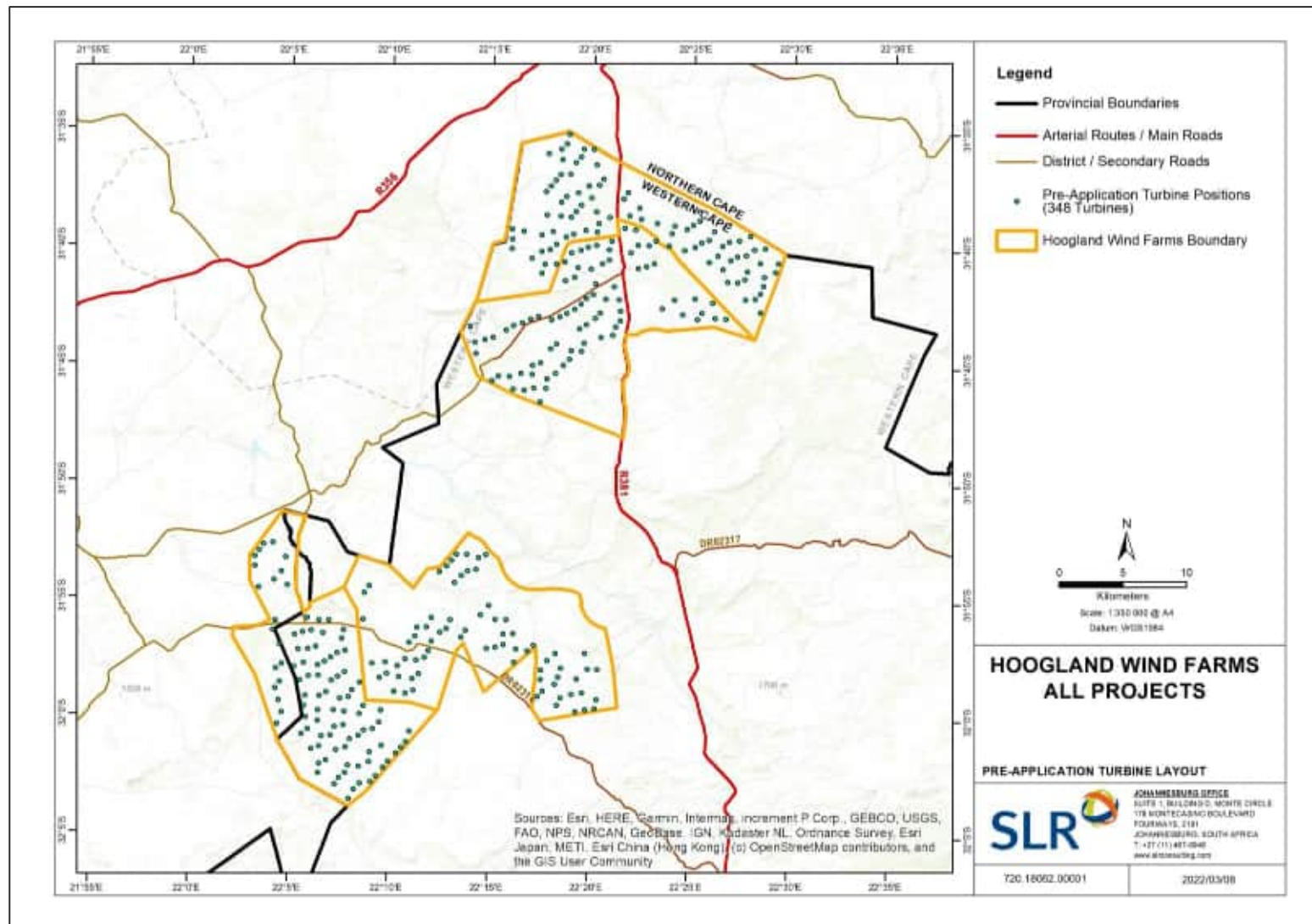


Figure 3-3: Scoping Phase 348 turbine layout (September 2021)

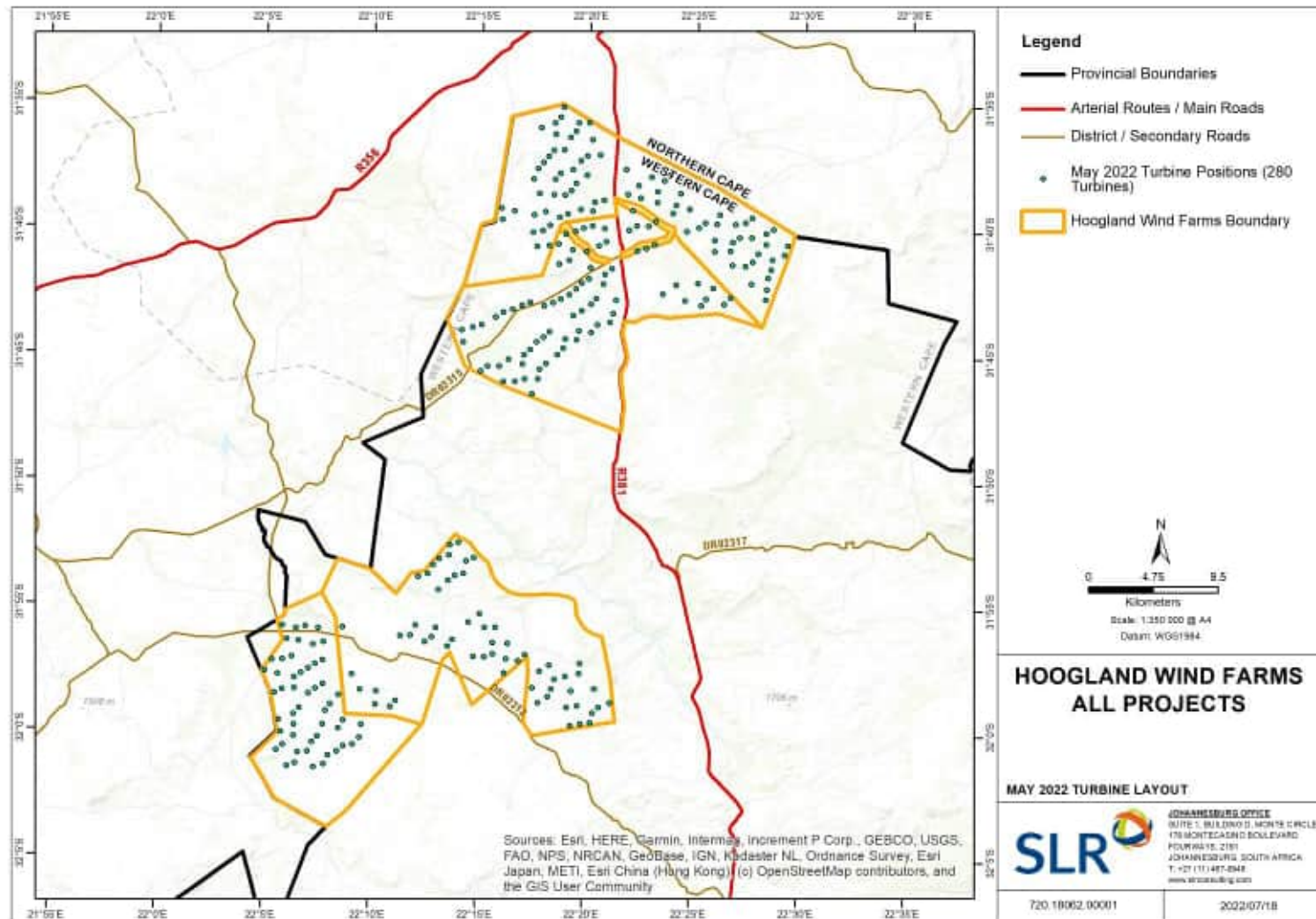


Figure 3-4: EIA Phase (Northern Cluster) and BA Phase (Southern Cluster) 280 turbine layout currently proposed (May 2022)

4 ADMINISTRATIVE AND LEGAL FRAMEWORK

This section provides an overview of the legal framework, with consideration given to legislation that is of relevance to the way the EIA process is conducted. It therefore covers more than the requirements of the National Environmental Management Act; 1 07 of 1998 (NEMA) and the regulations made under it (the EIA regulations).

4.1 RELEVANT LEGISLATION

Table 4-1: Relevant legislation

Legislation	Relevant Organ of State / Authority	Relevance
Astronomy Geographic Advantage (Act 21 of 2007)	Department of Science & Technology transitioning to Department of Science and Innovation and the Square Kilometre Array (SKA))	<p>Electromagnetic interference (EMI), also called radio-frequency interference (RFI) when in the radio frequency spectrum, is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction. This aspect is of importance to the Radio telescopes associated with the Square Kilometre Array (SKA). According to the DFFE Screening Tool, the site is in a Very High sensitive rating area partly within the Karoo Central Astronomy Advantage Area (KCAAA). The Applicant engaged with SARAO with regard to the proposed development and SARAO undertook a preliminary risk assessment, the outcome of which found that “the project presented a medium risk of interference to the SKA radio telescope”. The recommendations were as follows:</p> <p><i>“The developer will be required to implement an EMC control plan and mitigation measure prior to construction to ensure that these are retained to levels that do not produce harmful interference to the SKA radio telescopes.</i></p> <p><i>Due to the above-mentioned medium risk to the SKA, SARAO hereby request, that if the EA is granted, a detailed EMC Control Plan should be developed by the renewable energy facility developer and that the development will not resume prior to complying with the AGA Act. The level of risk and possible mitigations should be included in the EMPPr that will be submitted as part of the Final Impact Assessment Reports (EIA)”.</i></p> <p>On this basis, the RFI assessment as stipulated in the DFFE Screening Tool will not be required at this stage of the Project.</p>
Aviation Act (74 of 1962)	Civil Aviation Authority (CAA)	<p>Wind turbine generators can interfere with radio navigation equipment. Turbines are also present potential physical obstacles and may need to be a certain colour (white) or fitted with aviation warning lights as required by the CAA. Comment on the project will be sought from the CAA as part of the public participation process. As part of the REIPPPP requirements the Applicant will apply with the CAA for approval of the final site layout.</p> <p>The site DFFE screening tool has identified the Wind Farms as Low Sensitivity and the Civil Aviation protocol therefore does not identify any assessment requirement.</p>

Legislation	Relevant Organ of State / Authority	Relevance
Conservation of Agricultural Resources Act (43 of 1983) (CARA)	Department of Agriculture, Land Reform and Rural Development (DALRRD)	The purpose of this Act is to ensure that natural agricultural resources of South Africa are conserved through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of water sources, protecting vegetation, and combating weeds and invader plants. Most of the provisions are accounted for in more recent legislation such as NEMBA and NEMA and no applications are required in terms of CARA. Measures to mitigate potential impacts on agricultural resources, such as soil erosion, alien invasion and protection of vegetation and water resources, have been included in the Environmental Management Programme (EMPr).
Environmental Conservation Act (73 of 1989) (ECA)	Department of Forestry, Fisheries and the Environment (DFFE)	<p>In terms of Section 25 of the ECA, the national Noise Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCR) was promulgated. The NCRs were revised under Government Notice Number R55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. In accordance with the Act, two procedures exist for assessing and controlling noise, respectively:</p> <ul style="list-style-type: none"> • South African National Standard (SANS) 10328:2008 'Methods for environmental noise impact assessments'. • SANS 10103:2004 'The measurement and rating of environmental noise with respect to annoyance and to speech communication' • Other South African National Standards. <p>The proposed development is likely to increase ambient noise levels during operation as well as temporarily during construction. Noise emitted by Wind Farms include aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc.</p> <p>A noise assessment has been conducted in accordance with the relevant SANS and is included in this Report.</p>
Hazardous substances Act (15 of 1973)	Department of Health (DOH)	<p>Hazardous Substances Act aims to control the production, import, use, handling and disposal of hazardous substances. Under the Act, hazardous substances are defined as substances that are toxic, corrosive, irritant, strongly sensitising, flammable and pressure generating under certain circumstances and may injure, cause ill-health or even death in humans.</p> <p>Where hazardous substances from any of the 4 groups below are to be used, care must be taken to ensure that or sourced from a licensed sourced, transported, handled and disposed of in compliance with the provisions of the Act.</p> <ul style="list-style-type: none"> • Group I: industrial chemicals (IA) and pesticides (IB)

Legislation	Relevant Organ of State / Authority	Relevance
		<ul style="list-style-type: none"> Group II: 9 classes of wastes excluding Class 1: explosives and class 7: radioactive substances Group III: electronic products and group Group IV: radioactive substances The list of group IA hazardous substances provided in the Act).
Minerals and Petroleum Resources Development Act (28 of 2002) (MPRDA)	Department of Mineral Resources (DMR) transitioning to Department of Mineral Resources and Energy (DMRE)	<p>In terms of section 53 of the MPRDA, any person who intends to use the surface of any land in a manner which may be contrary to the objects of the MPRDA or is likely to impede such objects, must apply to the Minister for approval in the prescribed manner. Later in the assessment process, once the layout is fairly certain an application will be made to the Minister to obtain a letter of approval.</p> <p>As per the requirements of the MPRDA, all mining activities, including the extraction of material from borrow pits and quarries, require authorisation from DMR. No mining permits for borrow pits are included in this application, however, should borrow pits be required, the appropriate approvals in terms of the MPRDA would need to be sought from the DMR.</p>
National Environmental Management Act (107 of 1998) (NEMA), as amended	Department of Forestry, Fisheries and the Environment (DFFE)	<p>The National Environmental Management Act 107 of 1998 (NEMA, as amended) provides the framework for environmental decision-making predominantly through the EIA Regulations (GN No. R982 in the Government Gazette of 8 December 2014, as amended) which serve as the instrument through which development decisions can be made. Specifically, for those developments which comprise certain 'listed activities' identified in GN R983, R984 and R985 (as amended), that are considered to have potentially detrimental impacts on the environment.</p> <p>Several listed activities (detailed in Table 4-2 below) will be triggered by each proposed Wind Farm and Environmental Authorisation must therefore be sought as per the requirements of the 2014 EIA Regulations (GN R982, as amended).</p> <p>The Act also sets out various principles that have been adopted in this assessment process e.g., the precautionary principle, duty of care, and polluter pays principle.</p>
National Environmental Management: Air Quality Act (39 of 2004)	Western Cape Government: Department of Environmental Affairs and Development Planning (DEA&DP) Northern Cape Government: Department of Environment and	<p>The Act aims to regulate and protect the environment by providing reasonable measures for the prevention of air pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incidental thereto. No activities are envisaged that would require an Atmospheric Emissions License.</p>

Legislation	Relevant Organ of State / Authority	Relevance
	Nature Conservation (DENC)	Specific to the project are the regulations pertaining to the control of fugitive noise and dust emissions that may arise from the project activities.
National Environmental Management: Biodiversity Act (10 of 2004) (NEMBA)	Department of Forestry, Fisheries and the Environment (DFFE)	<p>The Act aims for the management of all biodiversity within South Africa. The 2007 Threatened or Protected Species Regulations (GN R150, as amended) provides protection through a permit system as well as through the identification of restricted activities. If required, the relevant permits will be applied for.</p> <p>The Act also provides for duty of care with regards to control of alien species and provides a listing of threatened or protected ecosystems and species in one of the following four categories: critically endangered (CR), endangered (EN), vulnerable (VN), protected (species only), and least threatened (LT).</p> <p>A terrestrial ecologist has been appointed to assess the impact of the proposed development on the natural biodiversity of the area.</p>
National Environmental Management: Waste Act (Act 59 of 2008)	<p>Western Cape Government: Department of Environmental Affairs and Development Planning (DEA&DP) (for general waste), DFFE (for hazardous waste) and Municipalities and their register landfill and Waste Management facilities</p> <p>Northern Cape Government: Department of Environment and Nature Conservation (DENC) (for general waste), DFFE (for hazardous waste) and Municipalities and their register landfill and Waste Management facilities</p>	<p>The Act aims to regulate waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.</p> <p>The project would not trigger any waste management activities requiring a permit but must manage solid hazardous and domestic waste streams in phases of the project and wastes must be handled, stored and disposed of in a manner that is consistent with the provisions of this legislation.</p>
National Forests Act (84 of 1998), as amended (NFA)	Department of Forestry, Fisheries	There are 47 protected tree species in terms of the NFA, that may not be cut, destroyed, damaged or removed unless a permit has

Legislation	Relevant Organ of State / Authority	Relevance
	and the Environment (DFFE)	been granted by the DAFF. To date no protected tree species have been identified on the project sites.
National Heritage Resources Act (25 of 1999) (NHRA)	South African Heritage Resource Agency (SAHRA) and Heritage Western Cape (HWC)	<p>In terms of the National Heritage Resources Act (25 of 1999) (NHRA), any person who intends to undertake “any development ... which will change the character of a site exceeding 5,000 m² in extent”, “the construction of a road...powerline, or pipeline...exceeding 300 m in length” must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely SAHRA or the relevant provincial heritage agency.</p> <p>In response, to the respective Notifications of Intent to Develop (NIDs), the relevant provincial heritage agency (Heritage Western Cape, HWC) indicated that a full Heritage Impact Assessment (HIA) making specific reference to visual impacts on cultural landscape, archaeological impacts and palaeontological impacts, is required. <i>Appendix D1: Screening Phase</i></p> <p>Heritage, archaeological and palaeontological assessments have been undertaken to fulfil these requirements. In addition, SAHRA and HWC have been provided opportunities to comment on the HIA for the projects as part of the public participation process (<i>Appendix D2: Scoping Phase and Appendix D3: EIR Phase</i>). <u>This includes a Final Comment from HWC and SAHRA.</u></p>
National Environmental Management: Protected Areas Act (Act 57 of 2003) (NEM:PAA) and the National Protected Areas Expansion Strategy (2016) (NPAES)	Department of Forestry, Fisheries and the Environment (DFFE) and relevant NPAES implementing agencies such as provincial conservation authorities (agencies and government departments) and SANParks	<p>The Act provides for the establishment and management of protected areas in South Africa. It specifies that protected areas in terms of the Act require management plans and sets out the contents thereof.</p> <p>The NPAES for South Africa sets out targets for protected area expansion, identifies possible expansion areas and recommends mechanisms for protected area expansion.</p> <p>The Karoo National Park is the closest protected area to the Hoogland Wind Farms, and is over 35km to the south. All of the Hoogland project sites are outside the Karoo National Park’s potential expansion areas and buffer zones identified in the Park Management Plan (2017-2027).</p>
National Road Traffic Act (93 of 1996) (NRTA)	Western Cape Department of Transport and Public Works Northern Cape Department of Roads and Public Works	<p>Certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass as prescribed in the Regulations of the NRTA. Due to the large size of many of the facility’s components (e.g., tower segments and blades) they will need to be transported via “abnormal loads”. Access to the site will be via existing roads. SANRAL, Northern Cape Department of Roads and Public Works and Western Cape Department of Transport and Public Works have been included as I&APs for the project. A traffic assessment has been undertaken and is included in this Report. If the project goes ahead, traffic and transport related permits and approvals will be obtained from all the relevant transport authorities.</p>

Legislation	Relevant Organ of State / Authority	Relevance
National Water Act (36 of 1998) (NWA)	Department of Water and Sanitation (DWS)	<p>Section 21 of the NWA recognises and defines water uses that require the approval of DWS in the form of a General Authorisation or Water Use Licence. There are restrictions on the extent and scale of identified activities, determined through a risk assessment, for which General Authorisations apply.</p> <p>The project may constitute the following water uses in terms of Section 21 of the Act:</p> <ul style="list-style-type: none"> (a) Abstraction of water from boreholes and rivers or dams; (b) Storage of water (dams or reservoirs); (c) Impeding or diverting flows when construction occurs within a watercourse or within 500m of a wetland; (g) Storage of domestic waste in conservancy tanks; and (i) Alteration of the bed or banks of a watercourse of any activities within 500m of a wetland. <p>The information in the aquatic specialist's report must be used in support of any Water Use Licence Applications (WULA). <i>(Appendix C10: Aquatic Ecology)</i></p>
Subdivision of Agricultural Land Act (70 of 1970) (SALA)	Department of Agriculture, Land Reform and Rural Development (DALRRD)	<p>The purpose of this Act is to control the subdivision and, in connection therewith, the use of agricultural land. Applications should be made to DALRRD to allow for long term leases, the subdivision or rezoning of agricultural land, as well as other prohibited actions in terms of the Act. An application will be submitted to DALRRD for approval should an EA be granted. DALRRD has been included as an I&AP in order to obtain preliminary consent as part of the process.</p>
Western Cape Land Use Planning Act (3 of 2014) (LUPA)	Beaufort West Local Municipality	Should the proposed development go ahead, the appropriate subdivision, rezoning or consent use applications in terms of LUPA must be submitted.
Northern Cape Planning and Development Act, No.7 of 1998 (NCPDA)	Karoo Hoogland and, Ubuntu Municipalities	Should the proposed development go ahead, the appropriate planning applications in terms of the NCPDA must be submitted <u>if relevant</u> .
Western Cape Nature Conservation Laws Amendment Act (Act 3 of 2000)	CapeNature	Should the proposed development go ahead, and protected plants species have been identified for removal, the necessary permits for such removal must be obtained from CapeNature.

4.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT 107 OF 1998 (AS AMENDED) (NEMA)

NEMA, as amended, establishes principles, and provides a regulatory framework for decision-making on matters affecting the environment. Section 2 of NEMA sets out a range of environmental principles that are to be applied by all organs of state when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically, and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural, and social interests equitably. The participation of I&APs is stipulated, as is that decisions must consider the interests, needs and values of all I&APs.

Chapter 5 of NEMA provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 specifically provides a framework for granting of environmental authorisations. To give effect to the general objectives of Integrated Environmental Management (IEM), the potential impacts on the environment of listed or specified activities must be considered, investigated, assessed, and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment, management, and communication of the potential impacts.

4.2.1 Environmental Impact Assessment (EIA) Regulations 2014

The EIA Regulations, 2014 (as amended) ('EIA Regulations'), promulgated in terms of Chapter 5 of NEMA, control certain listed activities. These activities are listed in GN R983 (Listing Notice 1), R984 (Listing Notice 2) and R985 (Listing Notice 3) and are prohibited until an EA has been obtained from the competent authority. Such an EA, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations.

The EIA Regulations set out the procedures and documentation that need to be complied with when applying for an EA. A BA process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notices 1 and/or 3, whereas a full SEIA process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notice 2. As the proposed Wind Farms trigger activities listed in Listing Notices 1, 2 and 3 (see Table 4-2), it is necessary that a full SEIA process is undertaken for the DFFE to consider the application in terms of NEMA.

Note that with reference to Table 4-2, the same project components, and therefore listed activities, apply to both the Hoogland 1 Wind Farm and Hoogland 2 Wind Farm and therefore the table is applicable to both projects.

Table 4-2: NEMA listed activities to be applied for as part of each proposed project

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
LISTING NOTICE 1 (GN R 983): BASIC ASSESSMENT ACTIVITY(IES)		
11(i)	The development of facilities or infrastructure for the transmission and distribution of electricity – outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	The proposed site is zoned as Agricultural land which falls outside of an Urban area. The infrastructure will include two 132kV substations (including control, operation, workshop, storage buildings / areas) and high voltage (maximum up to 66kV) underground cables and overhead powerlines. Short sections of 132kV overhead powerlines may also be required.
12(ii)(a)(c)	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; and (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The proposed project will require the placement of linear infrastructure, i.e., internal access roads, underground cables, and internal overhead power lines with a combined physical footprint of more than 100m ² within a watercourse, or within 32m of a watercourse. Watercourse crossing upgrades will also be required both on and offsite.
14	The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80	Fuel (and lubricants), electrolyte solution and powder cement may be required on site during various stages of the project.

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
	cubic metres or more but not exceeding 500 cubic metres	The combined capacity of all of the above goods will exceed 80m ³ but will be below 500m ³ .
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 proposed project will require the infilling or depositing of material from a watercourse in excess of 10m ³ or the dredging, excavation, removal or moving of material in excess of 10m ³ from a watercourse, as a result of the construction of internal roads, upgrades to existing roads and laying of underground cables on and offsite.
24(ii)	The development of road with (ii) a road reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 m.	A temporary road corridor of up to 15m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 6m wide road surface, with side drains on one (1) or both sides where necessary. The temporary N1 Bypass would also constitute the development of a road.
28(ii)	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 will (ii) occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	The land is currently used for agriculture however some areas will be converted to commercial / industrial land use to accommodate the wind farm infrastructure. These areas equate to an area of more than 1ha.
48(i)(a)(c)	The expansion of (i) infrastructure or structures where the physical footprint is expanded by 100 square metre or more, (a) within a watercourse and (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The proposed project will require the upgrading of existing roads within the project area, as well as onsite and offsite watercourse crossing upgrades, where such upgrades may take place within watercourses and within 32m from the edge of these watercourses. The total footprint of the upgrades to be undertaken on the existing roads would be in excess of 100m ² within a watercourse, or within 32m of a watercourse.
56(i)(ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (i) where the existing reserve is wider than 13, 5 meters; or (ii) where no road reserve exists, where the existing road is wider than 8 metres.	Existing roads will be upgraded where possible. A temporary road corridor up to 15m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 6 m wide road surface with side drains on one (1) or both sides where necessary. The development will also involve the lengthening of these existing roads, where required, in excess of 1km. The temporary N1 Bypass would also constitute the expansion of a road.
LISTING NOTICE 2 (GN R 984): ENVIRONMENTAL IMPACT ASSESSMENT ACTIVITY(IES)		
1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	The proposed wind farm will have a total generating capacity of up to 420 MW.

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
15	The clearance of an area of 20 hectares or more of indigenous vegetation.	The proposed project will require the clearance of more than 20ha of indigenous vegetation for the placement of infrastructure. Footprints are depicted in Table 2-3.
LISTING NOTICE 3 (GN R 985): BASIC ASSESSMENT ACTIVITY(IES)		
4 (g)(ii) (ee) (i)(ii)(aa)	The development of a road wider than 4 metres with a reserve less than 13,5 metres in the (g) Northern Cape (ii) outside urban areas (ee) within critical biodiversity areas identified in systematic biodiversity plans adopted by the competent authority or bioregional plans (i) Western Cape (ii) areas outside urban areas and (aa) areas containing indigenous vegetation.	A temporary road corridor up to 15m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 6m wide road surface with side drains on one (1) or both sides where necessary. Although the Northern Cape CBAs have not been gazetted, the impact on these features will be assessed as part of the impact assessment process. Most of the site in the Western Cape constitutes indigenous vegetation.
12 (g)(ii) (i)(ii)	The clearance of an area of 300 square metres or more of indigenous vegetation in the (g) Northern Cape (ii) within critical biodiversity areas identified in bioregional plans; (i) Western Cape (ii) within critical biodiversity areas identified in bioregional plans.	In some areas, development of infrastructure will require the clearance of more than 300m ² of indigenous vegetation. Although the Northern and Western Cape CBAs have not been gazetted, the impact on these features will be assessed as part of the impact assessment process.
14(ii)(a)(c) (g)(ii)(ff) (i)(i)(ff)	The development of infrastructure or structures with (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse; and (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse in the (g) Northern Cape within (ii) outside urban areas (ff) within critical biodiversity areas (i) Western Cape (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	Internal roads, underground cables, and overhead power lines with a total physical footprint in excess of 10m ² will be required within and adjacent to watercourses and will traverse CBAs in places. Although the Northern and Western Cape CBAs have not been gazetted, the impact on these features will be assessed as part of the impact assessment process.
18 (g)(ii) (ee)(ii) (i)(ii)(aa)	The widening of a road by more than 4 metres and the lengthening of a road by more than 1 kilometre in the (g) Northern Cape (ii) outside urban areas (ee) within critical biodiversity areas, and (ii) areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland (i) Western Cape (ii) all areas outside urban areas (aa) areas containing indigenous vegetation.	Existing roads may require widening of up to 6m (up to 15m during construction) and/or lengthening by more than 1km, to accommodate the movement of heavy vehicles and cable trenching activities. This includes a number of watercourse crossing upgrades, both on and offsite in the Northern and Western Cape. Although the Northern Cape CBAs have not been gazetted, the impact on these features will be assessed as part of the impact assessment process.

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
		Most of the site in the Western Cape constitutes indigenous vegetation.

4.2.2 National Screening Tool

Government Notice 960, gazetted on 05 July 2019, in accordance with regulation 19 and regulation 21 of the NEMA EIA Regulations 2014 (as amended) requires the applicant must submit the report generated by the National Web Based Screening Tool with their EA application to the DFFE from 05 October 2019 and onwards (90 days after the date of notice publication).

These reports are appended in *Appendix E: DFFE Screening Tool Reports*. These reports show, on a high level, the site’s sensitivity to wind development based on different environmental themes (including, *inter alia*, terrestrial biodiversity, avifauna, heritage) and outlines assessment protocols for some of these themes that must be applied depending on the environmental theme’s sensitivity rating within the development site.

The assessment protocols GN 320 and GN 1150 were gazetted on 20 March 2020 and 30 October 2020, respectively under the notice the “*procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes in terms of section 24(5)(a) and (h) of the national environmental management act, 1998, when applying for environmental authorisation*”. In short, this notice requires, *inter alia*, that a Site Sensitivity Verification process must be undertaken, which confirms or disputes the findings of each of the environmental themes included in the Screening Tool Report.

Each specialist study has its own Site Sensitivity Verification report (SSVR) included either within the report or in its respective appendices. The relevant protocols that have also been gazetted with this notice have been incorporated into the specialist studies where necessary. Table 1-2 lists the specialists studies undertaken to inform the applications while more detail regarding the specifics is shown in the in Table 6-2, including which protocols were applicable.

4.3 National Policy Framework Governing Renewable Energy

Several policies have been developed with the aim of diversifying the electricity generation mix for South Africa, these include:

4.3.1 White Paper on the Energy Policy of the Republic of South Africa (December 1998)

The White Paper (national energy policy) set out to ensure that national energy resources will be efficiently used and developed to provide for the needs of the South African people. It was formulated to address the supply and consumption of energy over the following 10 years, however, it remains in place today. The policy laid out a set of Energy Sector Policy Objectives which included: increasing access to affordable energy services, improving energy governance, stimulating economic development, managing energy-related environmental and health impacts and securing supply through diversity. These objectives were formulated to help with the transformation of certain industries and governance systems. Energy policy priorities were also developed to help in achieving these policy objectives. The document identifies the significance of the medium and long-term potential of renewable energy, with the advantages of minimal environmental impacts and higher labour intensities than conventional energy generation technology.

4.3.2 Renewable Energy White Paper (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 be utilised for power generation and non-electric technologies such as solar water heating and biofuels. Since the White Paper was gazetted, South Africa's primary and secondary energy requirements have remained heavily fossil-fuel dependent, both in terms of 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.

4.3.3 National Climate Change Response Policy White Paper (2011)

This White Paper presents the South African Government's vision for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society. South Africa's response to climate change has two objectives:

- Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity.
- Make a fair contribution to the global effort to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.

4.3.4 Integrated Resource Plan (IRP), 2019

Section 1 of 2019 National Integrated Resource Plan (IRP) (Department of Energy, 2019) sets out targets for energy generation from renewable sources. Most of the energy targets set by the IRP will be from renewable sources, of which wind energy makes up the bulk. The IRP envisions an additional 14,400 MW of power being produced from wind, 6,000 MW from photovoltaic solar plants, 3,000 MW from gas, 2,500 MW from hydropower and an additional 1,500 MW from coal by 2030. This translates to approximately 15-18% of the country's energy needs being serviced through wind energy by 2030. The renewable energy targets are procured through a competitive tendering process called the REIPPPP run by DoE. The success of this programme has been internationally recognised, with the United Nations Environmental Programme (UNEP) 2014 Report placing South Africa among the top-10 countries in respect to renewable energy investment.

4.3.5 Renewable Energy Independent Power Producer Procurement Program (REIPPPP)

The renewable energy targets set out in the IRP are procured through a competitive tendering process called the REIPPPP run by DoE. The DoE gazetted the Electricity Regulations (GN R 399 of 4 May 2011) on New Generation Capacity under the Electricity Regulation Act (4 of 2006) (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. In terms of the New Generation Regulations, the 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.

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
- ii. Request for Proposals
- iii. Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to signature by the Regulator, namely Eskom. The programme has effectively implemented five bid windows, with bid window six having been recently launched in April 2022.

REIPPPP has determined that 6 800MW of capacity is to be generated from renewable energy sources (PV and Wind), 513MW from storage, 3 000MW from gas and 1 500MW from coal. This will enable the development of an additional 11 813MW of power in total from the year 2022. This is in addition to the 2 000MW already being procured under the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) (Gazetted on the 7th of July 2020) (as per media statement released 10 September 2020). The DMRE launched a RMIPPPP on the 23rd of August 2020. The objective of the RMIPPPP is to fill the current short-term supply gap, alleviate the current electricity supply constraints and reduce the extensive utilisation of diesel-based peaking electrical generators.

It is intended that these projects would, in the first instance, be bid in a forthcoming round of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) but there is a possibility that they could be considered for business-to-business purposes.

4.3.6 Summary

The proposed Wind Farm development thus aligns with South Africa’s national policy direction and contributes to the country being able to meet some of its international climate change obligations. These include the targets and commitments for nations that are members or signatories of the United Nations Framework Convention on Climate Change (UNFCCC) and the associated Kyoto Protocol (2005) and a Paris Agreement (2015).

4.4 National, Provincial and Municipal Planning Context

The renewable energy industry has substantial support in the South African planning context, which is detailed in Table 4-3 through the following national and provincial plans:

Table 4-3: National, Provincial and Municipal Plans and documents

National	National Development Plan (NDP) (2030)
	National Integrated Energy Plan (2016)
	National Integrated Resource Plan for Electricity (2010-2013) and successor, IRP2019
	National Infrastructure Plan (2012)
	The DEA Strategic Environmental Assessment (SEA) for the roll-out of large-scale wind and solar development which identifies strategic Renewable Energy Development Zones (REDZs) Phase 1 (2015) and Phase 2 (2020)
	The DEA National Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) which identifies the strategic Transmission Corridors linked with the REDZ
Provincial	Western Cape Provincial Spatial Development Framework (2014)
	Western Cape Land Use Planning Guidelines for Rural Areas (2019)
	Western Cape Climate Change Mitigation Scenarios for the Energy Sector Report (2015)
	Northern Cape SDF 2012 updated in 2018
Municipal	Central Karoo District Municipality IDP 2021/22
	Central Karoo District Municipality SDF 2014 and draft SDF 2019
	Namakwa District Municipality IDP 2021/22
	Namakwa District Municipality Rural Development Plan 2017
	Pixley ka Seme District Municipality draft IDP 2021–2022
	Beaufort West Municipality IDP 2017-2022 and 2021/22 Review
	Beaufort West Municipality SDF 2013
	Namakwa District Municipality Rural Development Plan 2017
	Karoo Hoogland Local Municipality IDP 2021/22

Karoo Hoogland Local Municipality SDF 2019
Ubuntu Local Municipality IDP 2020/21

The assessment of the 'Need and Desirability' of the proposed development considering the strategic planning context of the district and local municipalities is included in Section 5.

5 NEED AND DESIRABILITY

The 'need and desirability' of the project should be evaluated against the strategic context of the development proposal along with the broader societal needs and public interest. According to the DEA Guideline on Need and Desirability (DEA, 2017), the concept of 'need and desirability' relates to the *"nature, scale and location of the development being proposed, as well as the wise use of land"*. The concept of 'need and desirability' can be explained in terms of the broader meaning of its two components, need primarily referring to 'time', and desirability to 'place'. It is acknowledged that 'need and desirability' are interrelated and the two components should be considered in an integrated and holistic manner. The DEA Guideline (DEA, 2017) further states that the need and desirability of an activity should be evaluated against the principles of *"promoting justifiable economic and social development"* as well as the principles of *"securing ecological sustainable development and use of natural resources"* as set out set out in the bill of rights in the Constitution.

The overall need and desirability of the proposed development, in the context of developing renewable energy generation in South Africa and globally, is considered and described below. In summary wind energy is desirable as it:

- Creates a more **sustainable economy** by promoting South Africa's energy policy towards energy diversification.
- **Reduces the demand on scarce resources** such as water by promoting energy generating facilities which are less resource intensive.
- Assists in meeting international commitments to carbon emission targets in line with global climate change commitments.
- **Reduces pollution** by using 'cleaner' energy generating mechanisms and reducing the demand on carbon-based fuels.
- Promotes local economic development by creating jobs and promoting skills development.
- Enhances **energy security** by diversifying generation.

Table 5-1 below aims to provide more detailed responses with regards to the project specific questions raised in the Need and Desirability guidelines of DEA (2017) and the Western Cape Government: Department of Environmental Affairs and Development Planning (DEA&DP) (DEA&DP, 2013). The responses below take into consideration relevant municipal planning documents as well as the outcome of the Screening Phase (Section 6.1) which identified No-Go areas based on environmental and socio-economic considerations.

Note that the Wind Farm sites are within the Western Cape, however, activities are not limited entirely to the site. Socio-economic impacts may extend to the Northern Cape given that employment and goods and services may be derived from towns such as Loxton and Fraserberg. Also, traffic will be routed via Loxton and in this regard a few watercourse crossing upgrades in the Northern Cape for delivery of abnormal loads during construction have also been included in the application. For the purpose of the Need and Desirability, however, the focus remains on the Western Cape.

Table 5-1: Need (timing) of the proposed project (based on the 2017 DEA and 2013 DEA&DP Guidelines)

NEED	
CONSIDERATION	RESPONSE / MOTIVATION
Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority i.e., is the proposed development in line with the projects and programmes identified as priorities within the Integrated Development Plan (IDP)?	<p>Yes. Renewable energy projects have been prioritised in strategies at various municipal scales in the area.</p> <p>At a provincial level, the 2014 Western Cape Provincial Spatial Development Framework (PSDF) (DEA&DP, Western Cape Provincial Spatial Development Framework, 2014) identifies the development of wind energy facilities as one of the focus areas for mitigating climate change impacts. The PSDF recognises the potential positive economic impact, but also mentions that Wind Farms could have negative impacts on scenic resources and that the possible impact needs to be investigated.</p> <p>At a District Municipal level, the 2019 Draft CKDM SDF recognises the Karoo region’s potential in terms of wind energy generation and states “<i>The Karoo should leverage this asset to encourage Independent Power Producers to locate in the region, also making the Central Karoo a well-managed and desirable place to locate, if one is connected to this industry.</i>” Both CKDM IDP Revision 2021/2022 and Namakwa District Municipality (NDM) IDP 2021/2022 recognises investment in wind energy facilities as an opportunity through which significant economic and social benefits can be derived. The NDM has a Rural Development Framework which balances various development priorities including agriculture, tourism and mining. It lists renewable energy generation as one of six development priorities within the area (DRDLR, 2017).</p> <p>Within both the Beaufort West Local Municipality and the Karoo Hoogland Local Municipality, renewable energy (wind and solar) has been identified as key contributors to the economy of each municipality. The relevant SDFs and IDPs for each municipality note the wind resource of the area and supports the development of renewable energy generation facilities as they are major infrastructure projects that would contribute to the economic development.</p>
Should development, or if applicable, expansion of the town/ area concerned in terms of this land use (associated with the activity being applied for) occur at this point in time?	<p>Yes. The 2019 IRP supports a diverse energy mix and has indicated significant growth targets in terms of wind energy developments.</p> <p>The proposed project is in line with the Districts’ and Local Municipalities strategic framework that focuses on investment in renewable energy sources, that will stimulate secondary opportunities for economic growth.</p> <p>The proposed project aligns with national policy direction as well as contributing to South Africa being able to meet some of its international climate change obligations, by aligning domestic policy with internationally agreed strategies and standards as those set by the United Nations Framework Convention on Climate Change.</p> <p>At present South Africa’s power supply is highly constrained. Any downtime (breakdowns or maintenance) may lead to the need for load shedding which has significant adverse effects for the South African economy and the safety and wellbeing of its citizens. There is an urgent need for new, low carbon energy generation capacity that can be quickly deployed and linked into the national grid (with wind and solar being suitable options). This strategy is evident in the 2019 IRP whereby the largest portion share of new generation capacity between now and 2030 will be wind energy.</p>
Does the community/ area need the activity and the associated land use concerned (is it a societal priority)?	<p>Yes. Both the CKDM 2019 Draft SDF and the NDM 2021/2022 IDP note that such investments are likely to have significant economic spinoffs for the region.</p> <p>The proposed Wind Farms would also directly benefit the local community. Firstly, they would be a source of income to the landowners of the properties on which the wind turbines are located and would improve the economic viability of the landowner’s current farming operations (i.e.,</p>

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	<p>mainly low-density grazing). Secondly, they would also create direct and indirect job opportunities (with associated skills development and transfer) for the community (local, district/regional and provincial).</p> <p>Secondary economic benefits may include an increase in service amenities through an increase in contractors and associated demand for accommodation and other services.</p> <p>A percentage of the operational revenue of the project will be utilised to support local socio-economic development initiatives, due to the requirements in this regard of the REIPPPP. The local municipality will play a strong role in guiding how the funds are utilised, thus ensuring that relevant and pressing needs in the community will be addressed.</p>
<p>Are there necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?</p>	<p>Access to the site will be from existing roads in the area with new internal roads will be constructed as part of the Wind Farm development.</p> <p>No municipal services will be required at the site, as the project contractor or appointed sub-contractor/s will be responsible for providing the necessary services to the site during the construction and decommissioning phases.</p> <p>Electricity will be supplied to the site via existing Eskom lines (existing 22kV in the area), generators and/or on-site renewable energy installations (e.g., solar panels).</p> <p>Waste produced at the site (construction waste and wastewater collected in the conservancy tanks or chemical toilets) will be collected and taken to an appropriate facility with sufficient capacity to accept the waste, for recycling, re-use, treatment or disposal (as appropriate). This will be done by the contractor or their sub-contractor/s in the construction phase and the owner's team in operations phase and thus no municipal waste collection will be required at the site.</p> <p>Should any need for other services arise the relevant authority will be communicated with, and the necessary approvals/ agreements obtained before proceeding.</p>
<p>Is this development provided for in the infrastructure planning of the municipality, and if not, what will the implication be on the infrastructure planning of the municipality (priority and placements of services)?</p>	<p>Yes. Although the proposed project is not specifically mentioned in the municipal planning reports, reference is however made to renewable energy generation projects and growing this sector within the CKDM's and NDM's jurisdiction.</p> <p>Both Districts recognise that national and provincial governments have prioritised renewable energy developments to supplement the national grid.</p> <p>The economic and social benefits associated with employment of renewable energy development are noted in both District and Local Municipal planning documents and forms part of the Municipal strategies and policies to create a sustainable municipal area.</p> <p>The proposed development will have little bearing on the infrastructure planning of the municipality. Water will be sourced from licenced boreholes and electrical services required for the construction of the project will be via existing Eskom lines (existing 22kV in the area), generators and/or on-site renewable energy installations (e.g., solar panels), and apart from trucking waste to licenced waste sites and sewerage from conservancy tanks / chemical toilets to municipal waste water plants, no additional municipal services are required for the proposed development. Should any other municipal services be required, these will be confirmed and agreed with the municipality prior to commencing. Should the municipality be unable</p>

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	to provide the necessary services, then the applicant (or their appointed contractor) will be responsible for providing the necessary services to the site via use of private service providers.
Is this project part of a national programme to address an issue of national concern or importance?	<p>Yes. The establishment of the proposed project would maintain the national DoE mandate to ensure efficient supply of electricity to service the South African economy and society by augmenting electrical supply. Since 2015 South Africa has experienced serious energy constraints which act as a barrier to economic growth. The proposed development will promote the delivery of reliable and sustainable energy to the national grid and therefore contribute to resolving an issue of national concern.</p> <p>Moreover, the project would contribute towards meeting the national energy targets as set by the DoE, of which a share of all new power generation is derived from IPPs.</p> <p>The 2019 Integrated Resource Plan (IRP) developed by the DoE for the 2010 to 2030 period aims to achieve a “<i>balance between an affordable electricity price to support a globally competitive economy, a more sustainable and efficient economy, the creation of local jobs, the demand on scarce resources such as water and the need to meet nationally appropriate emission targets in line with global commitments</i>”. The final IRP provides for an additional 20,409 MW of renewable energy in the electricity mix in South Africa by 2030.</p> <p>Furthermore, the National Development Plan (NDP) proposes to create 11 million jobs and grow the economy at an average rate of 5.4% per annum by 2030. In respect of renewable energy, the NDP seeks to ensure that half of the new future generation capacity comes from renewable energy sources. It also recognises the importance of the transition to a low carbon economy. As such the NDP suggests the following modified from (Greening the South African Economy: Scoping the issues, challenges and opportunities, 2016, p. 199):</p> <ul style="list-style-type: none"> • Supporting carbon budgeting. • Establishing an economy wide price for carbon by 2030 complemented by energy efficiency and demand management interventions. • Support a target of 5 million solar water heaters by 2030. • Implementing zero emission building standards that promote energy efficacy. • Simplifying regulatory regime to encourage renewable energy, regional hydroelectric initiatives and independent power producers (IPPs). <p>The project will also contribute toward South Africa’s transition to low carbon economy and its commitments to under the Paris Agreement.</p>
Do location factors favour this land use (associated with the activity applied for) at this place?	<p>Yes. The site is very favourable due to reliable wind sources.</p> <p>The location favours this land use also based on the ability of wind energy to operate in conjunction with farming (mainly natural grazing) which is the current main land use on site; the support of the landowners concerned; being situated close to the Beaufort West REDZ whilst also being situated away from the Karoo National Park and outside its proposed buffers and expansion areas; as well as various economic considerations which include the feasibility of the project in terms of financial and technical perspectives.</p> <p>However, the changes in the visual (scenic) environment could also impact the local tourism industry which is an important contributor to the economy in this area. Visual and socio-economic specialist assessments have considered the impact to the tourism industry (refer to Section 7.8 and 7.14) and have found the impact to be of Medium to Low (negative) significance</p>

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	<p>The ecological sensitivity of the site has been considered in detail through a screening and iterative design process detailed in Section 6.1 of this report and various site assessments. The environmental Screening Phase investigated the environmental sensitivities of the site and the possible impact on the receiving environment because of the proposed development. This screening process allowed for the design of an optimised, site specific, Wind Farm layout which can be assessed in the formal EIA process. Unacceptable locations within the site have been identified through these assessments and the layouts determined have been informed by the findings.</p> <p>Refer to Section 7 for a description of the baseline environment and potential impacts, as identified by the various specialists.</p>
<p>Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements / aspects), and specifically also on the socio-economic objectives of the area? Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programmes?</p>	<p>Yes. According to the Socio-economic Specialist Study (see Section 7.14 and Appendix C: Specialist Reports), the proposed project would have positive impacts related to GDP growth, limited local and preferential procurement (BBBEE, etc.), enterprise development, the creation of employment and skills development opportunities, which is compatible with the economic development vision of the District and Local municipalities.</p> <p>Renewable energy developments would create direct and indirect job opportunities (with associated skills development and transfer) for the community (local, district/regional and provincial). The proposed development would thus create employment (temporary and full-time) and business opportunities in addition to skills development and on-site training.</p>
<p>What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?</p>	<p>The potential for the proposed development to negatively impact on the natural, social and economic environments have been recognised and a number of investigative steps have been identified to ensure a good understanding of these potential impacts throughout the project's life cycle. The first step involved a screening exercise undertaken with specialists which resulted in a proposed layout which minimised impact to sensitive receptors as far as possible.</p> <p>The outcome of the formal Scoping and EIA process has culminated in an EMPr that is applicable to the pre-construction, construction, operational and decommissioning phases of the proposed projects (see Section 8) to ensure that an environmentally and socio-economically sustainable approach is implemented. The EMPr will be managed and implemented as a living document, to allow the projects to adapt to and accommodate unforeseen environmental and/or social and/or political and/or economic changes and needs. For more information on the identified impacts please refer to Section 7.</p>
<p>What measures were taken to ensure the participation of all interested and affected parties? What measures were taken to ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of</p>	<p>The regulated EIA processes are stringently bound by legislative timeframes in terms of NEMA, and thus provide limited opportunity to incorporate and respond to issues raised by I&APs. To identify possible community issues and concerns early in the process, key stakeholders were identified and engaged (authorities, organs of state and affected and adjacent landowners) during the Screening Phase.</p> <p>The approach to stakeholder engagement is detailed in Section 6.2. All stakeholder engagement related documents and proofs are included in <i>Appendix D</i>.</p>

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knowledge, including traditional and ordinary knowledge?	It is important to note that Red Cap have followed a similar process for their adjacent authorised Nuweveld Wind Farms and Grid connections projects, and as such many of the stakeholders for the Hoogland Wind Farms were involved in the stakeholder engagement process for the Nuweveld Wind Farm applications and are familiar with Red Cap's approach and process.
Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area.	<p>Please refer to Section 7 for information on anticipated cumulative impacts which was assessed in accordance with the methodology outlined in Section 6.4. The project is situated away from highly populated areas so direct impacts are minimal. Employing between 160 and 200 people in the construction phase and 40-60 in the operational phase of the project is likely to have a medium (positive) impact on the local socio-economic environment. The socio-economic specialist identified the following impacts (Van Zyl & Kinghorn, 2022):</p> <ul style="list-style-type: none"> • Positive impacts on regional employment and household income associated with project activities and expenditure in all phases. • Negative impacts on surrounding landowners and communities arising from construction, increased crime, poaching, damage to infrastructure, litter, fire risk, dust, noise, safety concerns, deterioration of roads, etc. • Negative impacts on local communities associated with the influx of job seekers in the construction phase through increased alcohol and drug use, increased HIV and TB risks, prostitution and unwanted pregnancies, etc. • Negative impacts on tourism associated with visual impacts of the Wind Farm and increased traffic and disturbance in the construction phase.
Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e., what are the opportunity costs of using these resources for the proposed development alternative?)	<p>Yes. As described above, the provincial, district and local strategic planning documents have identified the socio-economic and environmental benefits of the renewable energy developments and promotes investment in these projects for growth and development. The proposed use of the natural resources of the area is therefore in line with these planning documents.</p> <p>Project infrastructure will be located on agricultural land with low productivity and according to the agricultural specialist such use would not negatively impact existing agricultural activities as the total footprint of the facility excludes agricultural land use or impacts agricultural land. The specialist states that the Wind Farm infrastructure would have an added benefit to the local farmers by providing an alternative income source that would improve the economic viability of existing farming operations.</p> <p>Please also refer to Section 7.3 and Section 7.13 for further detail on potential impacts and recommendations with regards to anticipated agricultural and socio-economic impacts.</p>
What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who	<p>Stakeholder engagement is as an important aspect of sustainable development to ensure that adverse environmental impacts are appropriately addressed and not result in discriminating distribution of these impacts. For this reason, the public participation process has been expanded beyond what is legally required and to enable the project team to better incorporate and communicate the views of the I&APs into the proposed development. Please refer to Section 6.2 and <i>Appendix D: Public Participation</i> which details the public engagement process.</p> <p>National government places significant emphasis on the local economic development initiatives which renewable energy project developers must commit to in their bids. The Hoogland projects will be such projects. This should ensure that only projects which have made significant commitments to this aspect will be selected as preferred bidders in the REIPPPP. The DoE scorecard includes aspects such as job creation, local content, ownership, management control, preferential procurement, enterprise development and socio-economic development. Among other things, the</p>

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CONSIDERATION	RESPONSE / MOTIVATION
are the beneficiaries and is the development located appropriately)?	<p>scorecard should ensure that project developers pay attention to (1) Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. (2) Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. (3) Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. The following provisional mitigations are proposed in this regard:</p> <ul style="list-style-type: none"> • The applicant must establish a communications committee early in the project to ensure regular feedback from stakeholders. • Community development should be guided by a community needs analysis, drawn up by a third party and based on local socio-economic conditions, a review of planning documents such as the IDP, and discussions with local government and community representatives. Interventions should be planned in collaboration with other energy developers in the area where relevant. • Close liaison with local municipal managers, local councillors and other stakeholders involved in socio-economic development is required to ensure that any projects are integrated into wider socio-economic development strategies and plans.
What measures were taken to ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge?	To date meetings have been undertaken with key stakeholders, authorities and some of the affected landowners, land occupiers and registered I&APs, to inform them of the proposed development. Refer to Section 6.1 and <i>Appendix D: Public Participation</i> which details the PPP undertaken to date, as well as any activities still to be undertaken.
How was a risk-averse and cautious approach applied in terms of socio-economic impacts?	Screening was undertaken at the pre-feasibility stage to allow environmental and social impacts to be considered early in the project lifecycle and evaluated in an integrated manner with the engineering design considerations. The screening process was specifically based on the identification and mapping of No-Go areas of the site to avoid all environmental and socio-economic sensitive areas and considered both impacts from turbines and other infrastructure (internal overhead power lines, roads, underground cables and buildings) to inform separate No-Go layers (see Section 9). Further avoidance recommendations proposed by the specialists during the Scoping Phase have been taken into account to refine the layout for the EIA Phase. The overall approach has therefore been avoidance as advocated for in the mitigation hierarchy in NEMA, which is a risk averse approach. For example, the proposed wind turbines have not been in visual, cultural (incl. sense of place) and noise sensitive areas, nor in crop areas which are socio-economically valuable. Furthermore, the project is sited in a remote rural area with a very low and dispersed population. The study to date has shown that the project is viable and that there are no fatal flaws that should prevent the project moving forward.

Table 5-2: Desirability (placing) of the proposed project (based on the 2017 DEA guideline and 2013 DEA&DP Guideline).

DESIRABILITY	
CONSIDERATIONS	RESPONSE / MOTIVATION
Is the development the best practicable environmental option (BPEO) for this land / site?	<p>The land use within the project site boundary is low density livestock farming (arid rangeland grazing) which, according to the agricultural specialist, will be able to successfully co-exist with the proposed Wind Farms. The specialist also stated that the Wind Farm infrastructure would have benefit to the local farmers by providing an alternative income source that would improve the economic viability of existing farming operations.</p> <p>During the Screening and Initial Design Phase a screening exercise with the project specialists was undertaken and No-Go areas were mapped and incorporated in the proposed layout. Refer to Section 6.1.1 for further detail. Some further No-Go areas were identified during the Scoping Phase (refer to Section 6.1.3). The layout was therefore updated accordingly and is being assessed and made available for comment as part of the EIR Phase (current phase). As explained above, the overall approach has therefore been avoidance as advocated for in the mitigation hierarchy in NEMA, which would ensure the least cost to the environment. As an example, habitat for threatened species such as the Riverine Rabbit habitat and Verreaux's Eagle has been avoided in the various design iterations as the project seeks to avoid and minimise impacts to these species and their potential habitat.</p>
How will this development use and/or impact on non-renewable and renewable natural resources and the ecosystem of which they are part?	<p>The Screening process was undertaken in support of the mitigation hierarchy advocated in NEMA to avoid and minimise impacts as the most preferred approach to mitigation. This process and the outputs were collaborative and involved a large multi-disciplinary team of environmental specialists, the EAP, the project engineers and Red Cap as the developer, most of which have extensive knowledge of the area and experience in Wind Farm assessments generally. The results from this exercise (i.e., the preferred project layout as documented in Section 6.1) have guided the development of the layout assessed within this report to further the effect of potential negative impacts and enhance positive impacts to ensure an environmentally sensitive and sustainable project is taken forward.</p>
Would the approval of this application compromise the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities?	<p>No. The proposed development aligns with the Municipal IDPs and SDFs which recognises the need for development of renewable energy and pursues economic development through renewable alternatives and promotion of energy efficiency.</p> <p>A focus group meeting was also undertaken with key stakeholders, including the municipalities, to involve them with the planning process and to better incorporate and communicate the stakeholder's views into the proposed development, as documented in Section 6.2. This was in addition to the public participation process undertaken as part of the EIA process (see Section 6.2 and <i>Appendix D: Public Participation</i>). No fatal flaws or issues compromising IDPs and SDFs have been raised by municipal representatives to date.</p>
Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g., as defined in Environmental Management Framework (EMF)), and if so, can it be justified in terms of sustainability considerations?	<p>No. Currently there is no EMF adopted by the area.</p> <p>However, the Western Cape Biodiversity Spatial Plan (WCBSPP), which sets out the land use objectives spatially, has been considered in the listed activities of the project. Sensitive areas such as CBAs as identified in the WCBSPP have been largely avoided in this regard (Section 7.4.1.4).</p>

DESIRABILITY	
CONSIDERATIONS	RESPONSE / MOTIVATION
How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural / natural environment)?	A screening exercise and detailed specialist assessments have been undertaken to identify sensitive No-Go areas and avoid and/or minimise development (within acceptable limits) within these areas. Information on potential impacts related to natural and cultural areas are available in Section 7 and have been assessed according to the methodology contained in Sections 6.2.5 and 6.4.
How will the development impact on people's health and wellbeing (e.g., in terms of noise, odours, visual character and sense of place, etc.)?	<p>Preliminary impacts were identified during the preceding assessment phases and the results have been incorporated in the current proposed Wind Farm layout plan. The revised turbine layout has helped to reduce the siting of the proposed wind turbines in environmental, visual, cultural (incl. sense of place) and noise sensitive areas. The direct impacts associated with the wind energy facility are not deemed to be significant as the project is sited in a remote rural area with a very low and dispersed population.</p> <p>The socio-economic specialist has considered impacts relating to the influx of workers into surrounding towns and communities during construction phase and the risks for local communities including increases in drug and alcohol use, unwanted pregnancies, prostitution, crime, HIV and TB risks, etc. The specialist is of the opinion that these will be of Low - Medium (negative) significance.</p> <p>Baseline environmental information and anticipated impacts are included in Section 7.14. These impacts and mitigation measures have been assessed and refined for the EIA Phase in accordance with the methodology proposed in Section 6.1.3.</p>
How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage?	Visual, palaeontological and archaeological specialists were appointed to undertake specialist investigations that would contribute towards the Screening and S&EIR phases of the project. No-Go areas were identified during the Screening and Scoping Phase and have been avoided or minimised (within acceptable limits) in the layout of the proposed infrastructure, as presented in this EIA Report (Figure - Figure 9-8). Mitigation has been identified where avoidance has not been possible. The aspects considered in the heritage impact assessment include: archaeology, palaeontology, graves, built environment and the cultural landscape. For more detail on potential impacts related to heritage resources, please refer to Section 7.8, 7.9, 7.10.
Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area	Terrestrial ecology and aquatic assessments have been completed and are in <i>Appendix C: Specialist Reports</i> , as well as summarised in Sections 7.4 and 7.7 respectively. In terms of impact to terrestrial and aquatic ecology, none of the impacts or cumulative impacts have been found to be unacceptable or considered to be a fatal flaw to the development.
Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area	The approach developed for this project is based on the precautionary principles of NEMA and has aimed to avoid impacts as the primary form of mitigation, as identified through spatial plans, specialist desktop and site-based research, and stakeholder engagement. Specialist studies have also applied acceptable thresholds where relevant to their discipline where avoidance is not possible in certain circumstances.

DESIRABILITY	
CONSIDERATIONS	RESPONSE / MOTIVATION
	<p>The residual impacts were therefore assessed as part of the Scoping phase and have also been further interrogated by specialists during the EIR phase of the project (current phase), as a result of the layout changes that occurred. To minimise, manage and remedy the potential negative residual impacts, and enhance the positive impacts, identified mitigation measures are proposed by specialists and have been included in an EMPR (<i>Appendix F: Environmental Management Programmes</i>).</p> <p>The project area is largely an open rural setting with low levels of human impact. Sheep farming is the predominate land use and this will continue alongside the Wind Farm. As a result of this, the site does provide habitat for numerous fauna and serves an ecological function. Most of this function would remain largely unaffected by the Wind Farm with the notable exceptions pertaining to Avifauna and potentially the endangered Riverine Rabbit and Karoo Dwarf Tortoise habitat.</p> <p>As per the Site Verification (SSV) assessment for the Karoo Dwarf Tortoise, the occurrence of Karoo Dwarf Tortoise has been confirmed from within the Hoogland Northern Cluster of wind farms. Comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises. Accordingly, the impacts on Karoo Dwarf Tortoises in the context of the proposed Hoogland Northern Cluster are projected to be LOW after mitigation. As a result, and with the application of the recommended mitigation and avoidance measures, the impacts associated with the Hoogland Northern Cluster of wind farms are considered acceptable.</p> <p>While the Hoogland 1 and 2 Wind Farm sites are within the Riverine Rabbit range and includes habitat that appears is suitable for Riverine Rabbit, the potentially suitable Riverine Rabbit Habitat identified by the specialist has been deemed as No-Go areas and set aside from development of turbines. Although Riverine Rabbits and associated habitat have been confirmed present within the Hoogland 1 Wind Farm, the buffers implemented around these areas are seen to be sufficient to minimise long-term impacts on this species. As a result, long-term impacts on the Riverine Rabbit are likely to be low. Consequently, the development of the Hoogland 1 and Hoogland 2 Wind Farm is considered acceptable with the implementation of the suggested avoidance and monitoring as indicated.</p> <p>A recommendation has been made that a Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. The details of the monitoring programme should be developed in collaboration with the EWT Dryland Programme and should at minimum include certain components and outcomes detailed by the specialist. The findings from the camera trapping have been presented in this EIA Report as part of the EIR Phase (current phase) and have indicated for both construction and operation, a medium negative impact that can be reduced to low with the proposed mitigation. Please refer to <i>Appendix C: Specialist Reports</i> for the terrestrial ecology studies (including Karoo dwarf tortoise and Riverine Rabbit) and the summary in Section 7.4 and Section 8.</p> <p>The other ecological aspect relates to avifauna and particularly the presence of raptor species (namely Martial and Verreaux's eagles) which may be susceptible to the harm by wind turbines and to a lesser extent other project infrastructure. Potential nesting sites on and around the site have been identified and buffered with setback distances depending on the bird species in question as well as buffering of other habitat such as watercourses, dams and escarpments. This reduces the magnitude of the impact and its likely significance to medium levels, in the opinion of the</p>

DESIRABILITY	
CONSIDERATIONS	RESPONSE / MOTIVATION
	avifaunal specialist. In addition, a modelling exercise has been undertaken to inform the risk of collision of the Verreaux's eagle with the proposed turbines. The outcomes of the modelling exercise have been incorporated into the layout of the Wind Farms. This, as with any Wind Farm, remains an area where ongoing monitoring is required to manage the impact. In this regard, mortality thresholds will be applied, and an adaptive management approach has been recommended. Refer to the Avifauna specialist report in <i>Appendix C9: Avifauna</i> . A summary is included in Section 7.6.

6 EIA APPROACH AND PROCESS

6.1 APPROACH AND PROCESS

As the EA process ascribes stringent timeframes once the Application for Environmental Authorisation has been submitted, the approach has been to allow for as much detailed investigation and participation of I&APs upfront as possible. Therefore, a lengthy and detailed Screening and Iterative Design Phase has been provided for in the process (Figure 6-1).

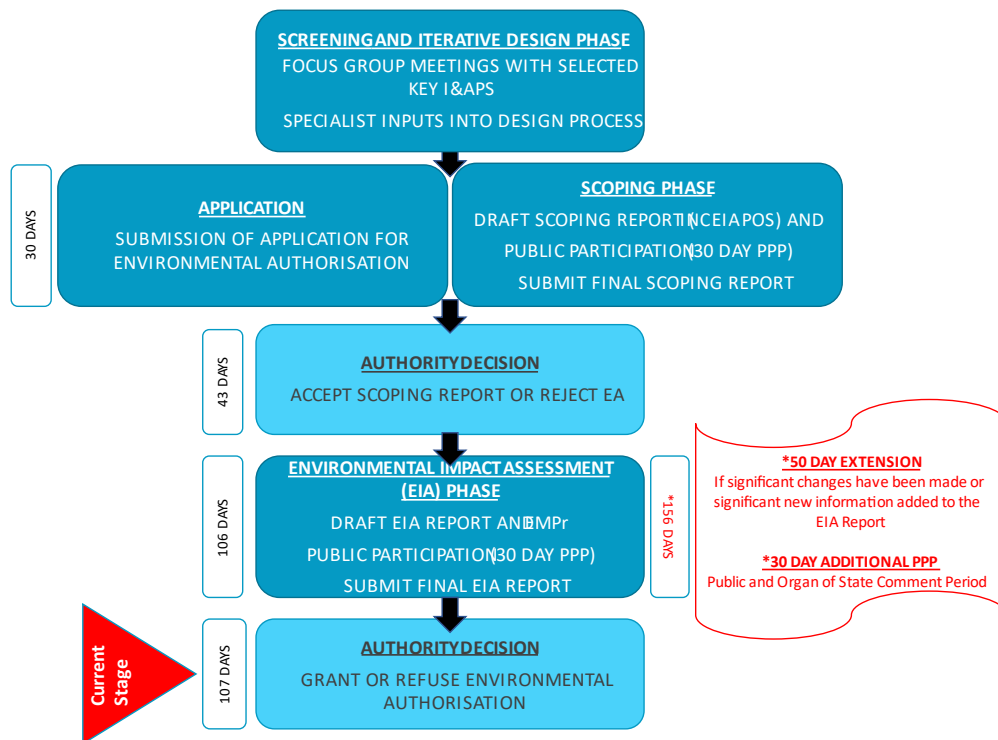


Figure 6-1: Environmental assessment process

6.1.1 Screening and Iterative Design Phase

6.1.1.1 Rationale

A summary of the Screening Phase and Iterative Design Approach and how it forms part of the Environmental Process is provided in this section. Red Cap have proactively sought to identify the best practical environmental option possible for the identified project site through a rigorous, iterative and multi-disciplinary process, that drew on the considerable body of existing knowledge and specialist expertise relating to the study area. This approach aligns with the NEMA principles advocating for sustainable development through the adoption of the mitigation hierarchy as set out in section 2 of NEMA and depicted in Figure 6-2. Through application of this hierarchy, 'avoidance' of environmental impacts was then the basis for the approach to the process.



Figure 6-2: Mitigation hierarchy

6.1.1.2 Process

The detailed screening process for the Hoogland Wind Farms was specifically based on identification and mapping of No-Go areas of the site in order to avoid all environmental, socio-economic and technical sensitive areas, and considered both impacts from turbines and other infrastructure (internal overhead power lines, roads and underground cables and buildings) as separate No-Go layers. This allowed all suitable areas for turbine locations, and associated infrastructure within the site to be identified, which would then be geographically split into four separate potential Wind Farm sites and layouts, two of which comprise the Northern Cluster: Hoogland 1 Wind Farm and Hoogland 2 Wind Farm projects and two of which comprise the Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm projects. These layouts are the basis for the Wind Farms that are taken forward for environmental assessment.

Through the application of environmental sensitivities and associated developmental No-Go areas that should be avoided by a developer, the screening assessment allows the most environmentally favourable alternative to be identified, in the form of an environmentally preferred site layout. It can also guide selection of mitigation measures in certain areas. Thus, the outcome of the Screening process is the most feasible and reasonable alternative (also known as the preferred alternative) to be considered for detailed assessment in the EIA process.

It is the intention that the detailed description of the Screening process presented in this section provides the motivation for not considering alternatives in the environmental assessment process as it documents the process through which environmental sensitivities were avoided at an early stage in the project lifecycle. Through this process the most environmentally and socio-economically favourable site layout was thus identified for assessment in this environmental assessment process.

The approach was as follows:

1. Red Cap undertook preliminary turbine placement on an initial larger site to test viability of the project and **493** potential turbine locations were identified across the consolidated site. Refer to Figure 3-1.
2. A detailed nest survey was then undertaken as well as VERA modelling (November 2020), Red Cap also engaged further with EWT regarding the potential Riverine Rabbit habitat in and around the site.
3. Using this information, the turbine layout was then further revised to **451** potential turbine locations. However, a decision was made to split the site into a Northern and Southern Wind Farm Cluster to avoid a large corridor along the Sak River and the various eagle nests and this layout of **429** potential turbine locations was circulated to specialists prior to their commencing their screening studies in March 2020. In the interim a Martial Eagle nest was discovered in the north west area eliminating a

- number of properties and turbines from the Northern Cluster, resulting in **367** potential turbine locations.
4. Selected specialists (aquatic, terrestrial ecology, bird, bat, heritage, palaeontology and visual) undertook a desktop-based study, engaging with the project information provided by Red Cap and documenting the environmental baseline of the study site from available literature and data sources, including environmental assessment work already done in the area such as for the Nuweveld Wind Farms. Some specialists undertook site visits to inform their studies especially aquatic specialist, whose layers were used for reference by other specialists.
 5. Specialists identified likely No-Go, high-sensitive, medium-sensitive and low-sensitive areas of the site, for both the turbine layout, and the other associated infrastructure types (internal overhead power lines, roads underground cables and buildings). These were based on the categories defined in Table 6-1 below.
 6. SLR undertook initial targeted stakeholder engagement with landowners, adjacent landowners and local authorities who were invited to a focus group meeting to discuss the project and raise potential issues or concerns. The EAP and/or Red Cap further engaged with key stakeholders one-on-one, including DEA&DP, CapeNature, DENC, EWT, Birdlife SA and SANParks.
 7. Noise and shadow flicker modelling was also performed to inform the design.
 8. A one-week multi-disciplinary site visit including workshops was undertaken in May 2021 with relevant specialists to interrogate and refine the identified impacts and sensitivities, collaborate and build consensus between the specialists. The workshop involved the following:
 - a. Each specialist reported on their findings which had been informed by further site visits.
 - b. Specialists also reported on the criteria that they used to identify and establish their specialist specific No-Go areas and the high-sensitive, medium-sensitive and low-sensitive developable areas.
 - c. The synergies and overlaps between the specialists' sensitive areas/features were presented, discussed and refined in the workshop.
 - d. The preliminary turbine and roads layout was presented for discussion specifically where conflicts with sensitive areas may exist. Input was provided by the Wind Farm engineer to describe the site with regards to wind regime and which parts of the site were most suitable for turbine locations.
 9. Following the workshop, specialists provided refined spatial datasets showing their revised No-Go, high-sensitive, medium-sensitive and low-sensitive developable areas, for both the turbine layout, and the other associated infrastructure (internal overhead power lines, roads, underground cables and buildings). The Consolidated No-Go Map for each infrastructure type was then revised based on all the updated information.
 10. On 25 July 2021, during the third avifauna monitoring site visit, a new Martial Eagle nest was discovered to the east of the Southern Cluster within the associated Grid Connection Corridor. The respective No-Go Maps were revised to take the nest buffers into account. The Martial Eagle nest buffer for turbine positions is 6 km in extent and therefore resulted in the sterilisation of a fairly substantial area of the site.
 11. Throughout the process, input was also received from landowners and adjoining landowners and their input regarding constraints was also used to inform the potential turbine locations.
 12. The preliminary project turbine layout was iteratively designed as a product of all the steps identified above. Through application of the Consolidated No-Go Maps, 176 potential turbine locations were identified in the Northern Cluster and 172 in the Southern Cluster (total of **348** potential turbine locations) (Figure 3-3). The optimal turbine layout aimed to maximise the energy outputs after taking account of the No-Go layers and therefore took into account internal wake effect as well as wind modelling of the site. The turbines were then also arranged into four feasible Wind Farms.

13. The roads design was developed on the basis of the latest turbine positions as well as the Consolidated No-Go Map for roads and was refined iteratively with inputs from certain specialists including ecology, aquatic, heritage, visual.
14. Following this, the internal overhead power lines and buildings Consolidated No-Go Maps were used to identify possible areas for the Wind Farm overhead power lines, as well as substations, battery sites and camps. Collectively the layout of all of this infrastructure formed the basis of the Scoping report. Refer to Section 6.1.2 for the process undertaken during Scoping after which the layout was further refined.

Table 6-1: Sensitivity categories used during the screening and constraints process

No-Go	Areas or features that are considered of such sensitivity or importance that any adverse effects upon them may be regarded as a fatal flaw.
High	Areas or features that are considered to have high sensitivity. Development in these areas must be limited and must remain within any acceptable limits of change as determined by the specialist. Development should also comply with any other restrictions or mitigation measures identified by the specialist.
Medium	Medium sensitivity areas are considered to be developable; however, the nature of the effects should remain within any acceptable limits of change as determined by the specialist. Development should also comply with any other restrictions or mitigation measures identified by the specialist.
Low	Low sensitivity areas that are considered to be developable, however, specialists may still wish to define acceptable limits of change should they deem this necessary.

6.1.1.3 Outputs

Resulting from the screening process, as discussed above, was a 348 proposed turbine layout which emerged into 176 potential turbine locations in the Northern Cluster and 172 potential turbine locations in the Southern Cluster. Each cluster has been divided into two separate Wind Farms.

The Northern Cluster layout was divided into two separate Wind Farms namely: Hoogland 1 Wind Farm and Hoogland 2 Wind Farm with potential turbine location numbers to be assessed as follows:

- Hoogland 1 Wind Farm 94 turbines
- Hoogland 2 Wind Farm 82 turbines

The Screening phase Consolidated No-Go maps for each of the infrastructure types, namely: turbines; internal overhead powerlines, roads and underground cables; and buildings were developed.. The No-Go layer is a combination of all the No-Go areas as identified by the various specialists, without differentiating between the specialist fields. Every No-Go area, regardless of the discipline that assigned the status, is treated with equal gravitas.

This phase also involved a Pre-Application meeting with the DFFE on 29 July 2021 and subsequent request to combine applications for EA as per Regulation 11 of the EIA Regulations (GN R. 982 2014). Refer to *Appendix D: Public Participation* for the correspondence. This information was used in refining the Plan of Study for the EIA process and Terms of Reference (ToR) for the specialist studies presented in the Scoping Report.

The outcome of this Screening Phase was a proposed site layout for the project which could be assessed by the team of specialists for the inclusion in the Scoping Report. The Scoping Phase layout is depicted in the layout maps provided in *Appendix B: Maps*.

6.1.2 Scoping Phase

The objective of the Scoping process, as set out in Appendix 2(1) of the 2014 EIA Regulations (GN R982 of 2014, as amended) is summarised as follows:

- Identify the relevant policies and legislation;
- Motivate the need and desirability of the proposed activity;
- Identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;
- Identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all alternatives;
- Identify the key issues to be addressed in the assessment phase;
- Agree on the level of assessment to be undertaken, including the methodology, expertise and consultation to determine the impacts on the preferred site and to inform the location of the development footprint within the site; and
- Identify suitable mitigation measures.

Although not always required at the Scoping Phase, specialists were requested to assess the impacts of the proposed site layout to meet the requirements of in accordance with Appendix 6 (Contents of Specialist Reports) of GN R982 of 2014 as amended, or specialist protocols outlined in GN 320 (March 2020) and GN 1150 (October 2020), where relevant. This allowed for a full investigation of potential environmental impacts early in the process and includes detailed mitigation measures that can be explored iteratively at an early stage to ensure that where impacts cannot be 'avoided', they can be mitigated to 'minimise' or 'reduce' impacts to as lower acceptable levels.

As mentioned above, the Northern Cluster Wind Farms included the following number of potential turbine locations during the Scoping Phase:

- Hoogland 1 Wind Farm – 94 turbines
- Hoogland 2 Wind Farm – 82 turbines

As an outcome of the Scoping level assessment, the specialists all provided revised sensitivity maps including No-Go areas to avoid which were documented in the Scoping Report. Some specialists identified additional features/areas that required avoidance by the development. The recommended changes to avoid such features/areas have been implemented in the design of the layouts for the EIA Phase (current phase – see Section 6.1.3) and these are the basis for the Sensitivity maps shown in Section 9.

The official Scoping Phase and circulation of the Draft Scoping Report for public comment commenced simultaneously with the submission of the Applications for environmental authorisation to DFFE on 18 March 2022, as indicated in Figure 6-1. The DFFE acknowledged (via email) having received both the Applications for environmental authorisation and DSR on 18 March 2022 and the following DFFE references numbers: 14/12/16/3/3/2/2147 and 14/12/16/3/3/2/2146 were allocated for the proposed Hoogland 1 Wind Farm and Hoogland 2 Wind Farm applications respectively (see *Appendix D2: Scoping Phase*). The draft version of the Scoping Report (i.e., DSR) was made available for review and comment from 18 March 2022 to 22 April 2022 (excluding public holidays).

Following this official 30-day review and comment period, the EAP converted the Draft Scoping Report to a Final version for submission to the DFFE for approval. The comments received during this period were documented and addressed in the final Scoping Report (FSR), where necessary. The Comments and Responses Report in *Appendix D2: Scoping Phase* provides the details of how the comments have or will be dealt with.

As stipulated in Regulation 22 of the 2014 EIA Regulations (GN R982, as amended), the Final Scoping Report was submitted to the DFFE for review within the legislated 44 days after the receipt of the Application Form, on 6 May 2022. The DFFE were required to, within 43 days of receipt of the Final Scoping Report, consider it, and in writing:

- (a) *Accept the report and advise the EAP to proceed with the tasks contemplated in the Plan of Study for EIA;*
- or
- (b) *Refuse environmental authorisation if;*
 - (i) *The proposed activity is in conflict with a prohibition contained in legislation; or*
 - (ii) *If the Scoping Report does not substantially comply with the objectives and content requirements for scoping reports in terms of the 2014 EIA Regulations and the applicant cannot ensure compliance with these regulations within the prescribed timeframe.*

It should be noted that on 17 June 2022, the DFFE accepted the Final Scoping Report, including the Plan of Study for the EIA Phase, for the Hoogland 1 and Hoogland 2 Wind Farms respectively. The Final Scoping Report acceptance letters are included in *Appendix D2: Scoping Phase*.

6.1.3 EIA Phase

The EIA Phase commenced once the DFFE's had accepted the Final Scoping Report and comprised an Environmental Impact Report (EIR) (this report) and Environmental Management Programme (EMPr) (*Appendix F: Environmental Management Programmes*) that had been informed by the Plan of Study (PoS) for the EIA. This phase included a 30-day public comment period on the Draft EIR and EMPr (Section 6.2.3).

6.1.3.1 Environmental Aspects Assessed

This EIA Report was based on a number of specialist studies, most of which were identified in the Screening Tool, these reports complied with the content requirements for specialist reports applicable, as follows:

- **Site Sensitivity Verification Report** in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020 (all projects);
- Assessment Report:
 - a. **Specialist Assessment Report / Compliance Statement** as applicable in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020 (where applicable the Species Environmental Assessment Guideline may apply¹⁰); or
 - b. Compliance with **Appendix 6** of the EIA Regulations, 2014 (as amended) if no protocols apply to the discipline.

Table 6-2 below is based on the findings of the DFFE Screening Tool (*Appendix E: DFFE Screening Tool Reports*) and indicates the level of specialist inputs that were required. Noting the following:

- The terrestrial ecologist has prepared a standalone Terrestrial Biodiversity Report (Appendix C4) as summarised in the Terrestrial Ecology section of this EIR. The Plant Compliance Statement and SSVR have been prepared and the findings / results also presented in the Terrestrial Ecology section of this EIA Report (as part of Section 7.4).
- Riverine Rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*) species assessments have been prepared and the findings / results have been presented in this EIA Report (as part of Section 7.4).
- The Avifauna theme also includes avifauna species from the Animal theme as identified in the Screening Tool and is included in Section 7.6.

¹⁰ Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 2.1 2021.

- The Aviation theme is of low sensitivity and according to the protocol there is no requirement for a site with a low sensitivity rating. However, any engagements with CAA have been included in the PPP, and the CAA will also undertake their own assessment as part of the REIPPPP bidding process.
- RFI impacts have been addressed through engagement with the respective authority SARAo who has undertaken a preliminary risk assessment in this regard and found that the project presents a medium risk of interference with the SKA telescope. They do not require any further studies and have stipulated “that if the EA is granted, a detailed EMC Control Plan should be developed by the renewable energy facility developer and that the development will not resume prior to complying with the AGA Act.” (see Appendix D1: Screening Phase). This has been included as a requirement in the EMPr (Appendix F: Environmental Management Programmes).
- The Defense theme is rated as low sensitivity and no assessment is required. The South African Army / Department of Defense have, however, been provided with an opportunity to review and comment on the projects as part of the Scoping & EIA process. It should be noted that no comments have been received to date, however, the proposed developments are not expected to impact directly on defense installations and no significant impacts on defense installations are expected (due to their Low Sensitivity, according to environmental screening tool).

Table 6-2: Level of specialist inputs required for the Hoogland Northern Wind Farm Cluster

SPECIALISM / THEME	SITE SENSITIVITY VERIFICATION REPORT	LEVEL OF IMPACT ASSESSMENT AND RELEVANT LEGISLATION			SECTION OF EIR
	SSV REPORT IN TERMS OF GN 320 OF 20 MARCH 2020	COMPLIANCE STATEMENT IN TERMS OF GN 320 / GN 1150 OF 20 MARCH 2020	SPECIALIST ASSESSMENT REPORT IN TERMS OF GN 320 MARCH 2020 / GN 1150 OF OCT 2020	APPENDIX 6 OF NEMA 2014	
Climate change				x (*)	7.1
Geotechnical	x			x	7.2
Agriculture	x	x			7.3
Terrestrial – Biodiversity	x		x		7.4
Terrestrial – Animal Species (mammals and reptiles)	x		x		7.4
Terrestrial – Plant Species	x	x			7.4
Bats	x			x	7.5
Avifauna including Animal Species -avifauna)	x		x		7.6
Aquatic ecology	x		x		7.7
Visual (Landscape)	x			x	7.8
Heritage	x			x	7.9
Palaeontology	x			x	7.10
Noise	x			x	7.11
Shadow flicker	x			x	7.12
Traffic	x			x	7.13
Socio-economic	x			x	7.14

*Not identified in Screening Tool, voluntary study

The impacts of the proposed development (during the Construction, Operation and Decommissioning phases) have been assessed by the specialists according to the methodology described in Section 6.3 (specifically Table 6-6) which was developed by SLR to align with the requirements of the EIA Regulations. This includes an assessment and rating of potential cumulative impacts. The cumulative impact assessment methodology is described in Section 6.4.

In accordance with the PoS presented in the Scoping Report and as accepted by the DFFE, the EIA Phase has also included the following additional specialist field work or modelling to support the above-mentioned studies:

- 12 months bird monitoring completed, and results incorporated into Specialist Report and EIA Report (this report);
- 12 months bat monitoring completed, and results incorporated into Specialist Report and EIA Report (this report);
- Ecology camera trapping completed, and results incorporated into Specialist Report and EIA Report (this report);
- Plant Compliance Statement completed, and results incorporated into EIA Report (this report);
- Riverine Rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*) species assessments completed, and results incorporated into EIA Report (this report) (see Section 7.4);
- Remodelling of noise, shadow flicker and visual impacts and results incorporated into EIA Report (this report); and
- Additional heritage surveys undertaken, and results incorporated into EIA Report (this report).

6.1.3.2 Layouts Assessed

As detailed in Section 6.1.2, the refined No-Go layers supplied by the specialists were applied by the Applicant to refine and optimise the Scoping layout, with the EIA layout being the outcome and the subject of the assessment in this EIR. The main contributions by specialists were as follows (Noting the turbine numbering is as per the Scoping layout, as included in Appendix B as the remaining turbines were re-numbered for the EIA layout):

Hoogland 1 Wind Farm:

1. **Terrestrial Ecology** - Turbine 34 (as numbered in the Scoping layout) was removed/excluded from the layout as it was within a terrestrial ecology no-go area (namely Riverine Rabbit habitat).
2. **Visual** - Slopes steeper than 1:10 gradient have been avoided in the layout design. Previously only 1:4 slopes were avoided. Turbines have also been setback from the R381 by 750m (up from 500m in the Scoping layout). This includes Turbine 35 (as numbered in the Scoping layout).
3. **Heritage** - The road around the stone walls of the Slangfontein farm complex for the Hoogland 1 Wind Farm has been realigned, as required, to ensure that no physical impacts to the walling will occur. Turbine 75 (as numbered in the Scoping layout) for the Hoogland 1 Wind Farm were also dropped due to their proximity to the Slangfontein homestead, which is a IIIA cultural landscape, as well as for Noise concerns (see point 4 below).
4. **Noise** – Turbine 75 (as numbered in the Scoping layout) was removed from near the Slangfontein farmstead (NSR 18); and Turbine 63 (as numbered in the Scoping layout) was removed from near Midlands farmstead (NSR 19) to reduce cumulative noise impacts (with associated improvements for shadow flicker as well).
5. **Avifauna** – Layout was revised, based on the discovery of a Verreaux’s Eagle nest on an adjacent property and the Verreaux’s Eagle Risk Assessment (VERA) model was re-run for the overall Hoogland project site. This led to 6 turbines being dropped (Turbine numbers 51, 52, 79, 80, 81, 82) (as numbered in the Scoping layout). In addition, the Applicant decided to remove all of the turbines in the VERA medium sensitivity areas (the high areas were already avoided during Scoping). This resulted in the additional loss of three turbines (Turbine numbers 28, 37, 53) (as numbered in the Scoping layout). For more information on the

VERA model, please refer to the Avifaunal Impact Assessment detailed in Section 7.6 and included in *Appendix C9: Avifauna*.

Therefore, for the **Hoogland 1 Wind Farm**, the layout changes are summarised as follows and shown on Figure 2-5 (with No-Go maps as Figure 9-1, Figure 9-3, Figure 9-5 and Figure 9-7):

1. Turbines reduced from 94 to 87 and some micro-siting of turbines and roads to avoid sensitives based on specialist recommendations.
2. An additional substation and BESS added, therefore two of each required (although two were assessed during Scoping, originally it was intended only one would be developed).
3. Shared infrastructure with Hoogland 2 added (namely roads). This is where both wind farms (Hoogland 1 and 2) will need to use the same roads, so they need to be included in the assessment for both wind farms.
4. Boundary change to accommodate shared road infrastructure. As above, the boundaries of both wind farms (Hoogland 1 and 2) have been changed to ensure these shared roads are included.
5. Substation and Battery 1B position moved by about 500m to the northwest.
6. Internal reticulation increased to 'up to 66 kV' from 33 kV, to take account of any future efficiencies in using a higher voltage. Structures increased to approximately 22m (from 20m).
7. Reduced sections of internal overhead lines based on sensitivities.

Hoogland 2 Wind Farm:

1. **Terrestrial Ecology** - Turbine 153 (as numbered in the Scoping layout) was removed/excluded from the layout as it was within a terrestrial biodiversity no-go area (namely Riverine Rabbit habitat).
2. **Visual** - Slopes steeper than 1:10 gradient have been avoided in the layout design. Previously only 1:4 slopes were avoided. Turbines have also been setback from the R381 by 750m (up from 500m in the Scoping layout). This includes Turbines 62 and 63 (as numbered in the Scoping layout).
3. **Aquatic Ecology** – relocation of building areas located within alluvial areas for the Hoogland 2 Wind Farm. Turbine towers 70, 83, 139 and 158 (as numbered in the Scoping layout), and/or their hard stands, have also been micro-sited for the Hoogland 2 Wind Farm to avoid minor watercourses, as required.
4. **Avifauna** – Layout was revised, based on the discovery of a Verreaux's Eagle nest on an adjacent property and the VERA model was re-run for the overall Hoogland project site. The Applicant decided to remove all of the turbines in the VERA medium sensitivity areas (the high areas were already avoided during Scoping). This led to the loss of one turbine (Turbine number 117) (as numbered in the Scoping layout). For more information on the VERA model, please refer to the Avifaunal Impact Assessment included in *Appendix C9: Avifauna*.

Therefore, for the **Hoogland 2 Wind Farm** the layout changes are summarised as follows and shown on Figure 2-6 (with No-Go maps as Figure 9-2, Figure 9-4, Figure 9-6 and Figure 9-8):

1. Turbines reduced from 82 to 80 and some micro-siting of turbines and roads to avoid sensitives based on specialist recommendations.
2. An additional substation and BESS added, therefore two of each required (although two were assessed during Scoping, originally it was intended only one would be developed).
3. Shared infrastructure with Hoogland 1 added (namely roads). This is where both wind farms (Hoogland 1 and 2) will need to use the same roads, so they need to be included in the assessment for both wind farms.
4. Shared infrastructure with Nuweveld¹⁴ added (namely roads). This is where both Hoogland 2 and the Nuweveld Wind Farms will need to use the same road, so they need to be included in the assessment for Hoogland 2 even though already authorised as part of Nuweveld North and West applications.
5. Boundary change to accommodate shared infrastructure. As above, the boundaries of both wind farms (Hoogland 1 and 2) have been changed to ensure these shared roads are included.
6. Camp and laydown area moved by about 1.3km southwest across the DR02315 to avoid sensitivities.

7. Internal reticulation increased to 'up to 66 kV' from 33 kV, to take account of any future efficiencies in using a higher voltage. Structures increased to approximately 22m (from 20m).
8. Reduced sections of internal overhead lines based on sensitivities.

6.1.3.3 Final EIA Report and Way Forward

Following the completion of the official 30-day review and comment period of the Draft EIR, the EAP converted the Draft EIR to a Final version (namely a Final EIR) for submission to the DFFE for approval. The Final EIR was submitted to the DFFE within 106 days of acceptance of the Final Scoping Report. The DFFE has a 107-day decision-making period once the Final EIR (inclusive of the EMPr) is submitted for decision-making. Should the DFFE accept the applications and issue EAs, the EAP would have to notify all registered I&APs and key stakeholders of the decisions and their right to appeal. In this regard, registered I&APs and key stakeholders must be notified within 14 days from the date of the decisions, whereafter I&APs and key stakeholders have a 20-day period from the date of notification to submit an appeal (should this be required).

6.2 PUBLIC PARTICIPATION PROCESS (PPP)

6.2.1 Definition of PPP

Section 1 of NEMA defines public participation in the context of environmental authorisation as follows:

“Public participation process” ... “means a process by which potential interested and affected parties are given opportunity to comment on, or raise issues relevant to, the application to ensure compliance with these regulations within the prescribed timeframe”.

Public participation is an iterative two-way process between the Applicant and the EAP, and the I&APs, whether these be individuals, organisations, or organs of state. The 2014 EIA Regulations (as amended) prescribe minimum Public Participation Process (PPP) requirements to be adhered to as part of an Environmental Process. The PPP planned as part of the Environmental Process for the proposed Wind Farms will comply with these requirements and include several steps/tasks over and above the minimum requirements. It is also noted that the PPP for the Hoogland Northern Wind Farm Cluster Projects are being undertaken in an integrated manner and therefore the PPP for this Project coincides with the PPP for the Southern Wind Farm Cluster (Hoogland 3 and Hoogland 4), the Northern Grid Connection and the Southern Grid Connection (which form part of separate respective BA applications).

The C&RR with supporting documentation is included in *Appendix D: Public Participation* and will be updated for each consecutive round of PPP as the project progresses. Section 6.2 summarises and provides the order of events regarding the PPP to date and the proposed activities going forward.

6.2.2 Stakeholder identification

The first steps initiated during the Screening Process, identified key stakeholder groups and sourced and verified their contact information (as best as possible). This included communications with, amongst others:

- Affected and adjacent landowners;
- Relevant district and local municipalities, including ward councillors;
- Relevant national and provincial government departments;
- Relevant national and provincial parastatals and organisations;
- Key stakeholders in renewable energy projects in the area;
- Conservation groups; and
- Other organisations in the area.

This is an ongoing process and registered I&APs will be added to the database after each PPP round (see *Appendix D2: Scoping Phase* for the latest database).

Also noting that a process of engaging with occupiers of affected and adjacent properties has occurred simultaneously during the Scoping PPP and was managed by an independent specialist, Mrs Anelle Lötter. The aim was to identify and register any occupiers, explain the project and collect any initial comments. The outcome of this process has been documented in the Occupier Engagement Report in *Appendix D2: Scoping Phase* (and incorporated in the Scoping Phase C&RR - *Appendix D2: Scoping Phase*).

6.2.3 Scope of the PPP

Table 4.1 summarises the PPP to date and the proposed activities going forward as part of the EIA Phase, all proofs of notifications and engagements are included in *Appendix D1: Screening Phase Appendix D2: Scoping Phase, Appendix D3: EIR Phase*.

Table 6-3: Scope of Public Participation

Phase	Purpose	Method
<p>Screening Phase (April and May 2021)</p> <p>Refer to Appendix D1</p>	<p>Introduce proposed project to key I&APs, and to gather initial comments</p>	<p>Stakeholder Engagement Meetings with Key Stakeholders:</p> <ul style="list-style-type: none"> • DENC (7 April 2021) • Birdlife (14 April 2021) • DEA&DP (6 May 2021) • CapeNature (7 May 2021) • Landowners and Adjacent Landowners (20 May 2021)
<p>Scoping Phase (for the Northern Cluster Wind Farms) and Pre-Application Phase (for the Southern Cluster Wind Farms and the Grid Connection projects)</p> <p>(March/April 2022)</p> <p>Refer to Appendix D2</p>	<p>Formal 30 days to review and comment on the Draft Scoping Report for Hoogland 1 and 2 Wind Farms (Northern Cluster).</p> <p>Informal 30 days to review and comment on the Pre-application Phase Report(s) for Hoogland 3 and 4 Wind Farms (Southern Cluster) and the 2 Grid Connection projects.</p>	<ul style="list-style-type: none"> • Key Stakeholder Engagement Meetings: <ul style="list-style-type: none"> ○ DEA&DP (2 March 2022) ○ SANParks site visit (13 April 2022)¹¹ • Occupier engagements (February 2022 – March 2022) • Written Notifications (March 2022) • Site Notices at conspicuous locations at the affected properties¹² (18 March 2022) • Posters erected at conspicuous locations (Beaufort West Public Library, Klein Karoo Agricultural Cooperative in Beaufort West, Loxton Public Library, Central

¹¹ It should be noted that SANParks requested a site visit in relation to the Southern Wind Farm Cluster (Hoogland 3 & Hoogland 4) (the subject of a separate BA process). However, SANParks had no concerns with the Northern Wind Farm Cluster (Hoogland 1 and Hoogland 2 – the subject of this report). Refer to Table 6-4 and Scoping Phase C&RR in *Appendix D2: Scoping Phase* for SANParks response to the Northern Cluster Wind Farms).

¹² Rocklands Farm gate (-31.725161°, 22.361817°); farm gate on DR02315 (Molteno gate) (-31.691058°, 22.342520°) and Le Riche Gate along DR02312 (-31.936870°, 22.137912°) – refer to site notice proof provided in *Appendix D2: Scoping Phase*

Phase	Purpose	Method
		<p>Karoo District Municipality Offices in Beaufort West, Loxton Lekker and Loxton Agricultural Cooperative) (18 March 2022)</p> <ul style="list-style-type: none"> • Adverts in Local / Regional Newspapers (“Die Courier and “Die Burger”) (18 March 2022) • Release of reports for public comment to venues accessible by the public (Beaufort West Public Library, Klein Karoo Agricultural Cooperative in Beaufort West, Loxton Public Library, Central Karoo District Municipality Offices, Loxton Lekker and Loxton Agricultural Cooperative) (in the form of digital tablets) and website (SLR website & SLR data-free website) (18 March 2022 – 22 April 2022, excluding public holidays) • Non-technical Summary (NTS) hardcopies available at the same public venues as the reports above. • Virtual presentations on digital tablets available at the same public venues as the reports above, and on the websites above.
<p>EIA Phase for the Northern Cluster Wind Farms and BA Phase of the Southern Cluster Wind Farms and the Grid Connection projects</p> <p><i>(August – September 2022)</i></p>	<p>Allow I&APs 30 days to review and comment on the Draft EIA Report(s) for Hoogland 1 and 2 wind farms (Northern Cluster) and Draft BA Reports for Hoogland 3 and 4 wind farms (Southern Cluster) and the 2 grid connection projects.</p>	<ul style="list-style-type: none"> • Written Notifications • Adverts in Local / Regional Newspapers (“Die Courier and “Die Burger”) • Site Notices at conspicuous locations at the affected properties (as per Scoping locations) • Posters erected at conspicuous locations (as per Scoping locations) • Release of Draft EIA and Draft BA report(s) for legislated 30-day public comment to venues accessible by the public as per Scoping locations (in the form of digital tablets) and website (SLR

Phase	Purpose	Method
		website and SLR data-free website) <ul style="list-style-type: none">• Non-technical Summary (NTS) hardcopies available at public venues• Virtual presentations on digital tablets (available at public venues) as well as for download on the SLR websites above.

6.2.4 Summary of Comments from Key Stakeholders

Focus group meetings were held during the screening phase with Key Stakeholders (Table 6-4). The proposed project was introduced along with specialist input gathered at the time. An overview of the process in Section 6.1 was presented to all stakeholders. Furthermore, comments were provided by certain Key Stakeholders following the completion of the 30-day review and comment period for the DSR and DEIR, which were factored into the C&RR (*Appendix D2: Scoping Phase* and *Appendix D3: EIR Phase*) and responded to accordingly, where required.

The following table captures the prevalent comments and recommendations gathered from the stakeholder engagement to date. The meeting minutes, presentations and written comments can be found in the public participation appendices for the respective phases - *Appendix D1: Screening Phase*, *Appendix D2: Scoping Phase* and *Appendix D3: EIR Phase*.

Table 6-4: Summary of Comments from Key Stakeholders

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
Department of Environment, Forestry & Fisheries (DFFE)	29 July 2021 (Appendix D2)	<ul style="list-style-type: none"> Regulation 11 approval granted to combine Hoogland 1 & 2 (Northern Cluster) (this application) and Hoogland 3 & 4 (Southern Cluster) (separate BA Application) Procedural and reporting advice with regards to the combination of the processes
	03 March 2022 (Pre-Application Meeting - Appendix D2)	<ul style="list-style-type: none"> Confirmation of approach to cumulative impact assessment Confirmation of specialist studies required Confirmation that a BESS Risk Assessment is required No objection letter required from the Nuweveld Project Confirmation that the project is intended for REIPPP as it affects which competent authority has jurisdiction
	8 April 2022 (formal comment letters – Appendix D2)	<ul style="list-style-type: none"> Provided comment letters for Hoogland 1 and Hoogland 2 applications requesting information to be included in the FSR. Please refer to Appendix D2 (C&RR) for details of the information requested by the DFFE as well as the EAP and the Applicant’s responses to these requests
	17 June 2022 (formal FSR acceptance letters – Appendix D2)	<ul style="list-style-type: none"> Accepted the Scoping Report and advised the EAP to proceed with the tasks contemplated in the Plan of Study for the EIA as detailed in the Final Scoping Report

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
		<ul style="list-style-type: none"> Requested additional information as part of the EIAR, which is detailed as part of the C&RR (including responses from the EAP and/or Applicant, where required) (<i>Appendix D3: EIR Phase</i>)
	<u>14 September 2022 (formal comment – Appendix D3)</u>	<ul style="list-style-type: none"> <u>Provided comment letters for Hoogland 1 and Hoogland 2 applications ensuring information required to be included in the FEIAR is included. Please refer to Appendix D3 (C&RR) for details of the information requested by the DFFE as well as the Applicant’s responses to these requests</u>
Department of Environment, Forestry & Fisheries (DFFE) - Directorate: Protected Areas Planning and Management Effectiveness	20 April 2022 (Email comment - Appendix D2)	<ul style="list-style-type: none"> Confirmed that the proposed development will not take place within any kind of protected areas in terms of Section 9 of the National Environmental Management: Protected Areas Act (NEMPAA), Act No. 57 of 2003 and that the directorate therefore do not have comments.
Department of Environment, Forestry & Fisheries (DFFE) - Directorate: Biodiversity Conservation	<u>14 September 2022 (Email comment – Appendix D3)</u>	<ul style="list-style-type: none"> <u>Confirmed that any development in very highly sensitive areas that will result with significant negative residual impacts after mitigation is prohibited. Please refer to Appendix D3 (C&RR) for details of the information requested by the DFFE as well as the EAP and the Applicant’s responses to these requests</u>
Northern Cape Department of Environment and Nature Conservation (DENC)	7 April 2021 (Meeting - Appendix D1)	<ul style="list-style-type: none"> Indicated that development in CBA areas trigger the need for off-sets DENC will engage with CapeNature to simultaneously align inputs, especially as the project falls within the Western Cape while only road crossings fall within the Northern Cape. Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
Birdlife South Africa	14 April 2021 (Meeting - Appendix D1)	<ul style="list-style-type: none"> Recommended avoidance of VERA high and medium buffers Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
	21 April 2022 (formal comment letter - Appendix D2)	<ul style="list-style-type: none"> Raised issue regarding ambiguity of avifaunal and draft scoping reports with regards to the duration of data collection, should areas identified as medium sensitivity by VERA not be avoided Welcomed inclusion of Adaptative Management Plans, thresholds and response strategies to address impacts on birds during the operational phase

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
		<ul style="list-style-type: none"> Suggested environmental management objective be clearly stated in the EMPr and Adaptative Management Plan Recommended management actions in the EMPr should be specific, time-bound and measurable and that the duration and nature of post-construction monitoring should be informed by what is required to measure the effectiveness of the Adaptative Management Plan and EMPr (in addition to recommendations of latest version of Best Practice Guidelines)
	<u>13 September 2022</u> (Email comment – Appendix D3)	<ul style="list-style-type: none"> <u>Confirmed the avifaunal studies are thorough and have no further comments.</u>
Western Cape (WC): DEA&DP	6 May 2021 (Meeting - Appendix D1)	<ul style="list-style-type: none"> Requested ample time to comment on various projects Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
	3 March 2022 (Meeting - Appendix D2)	<ul style="list-style-type: none"> Subsequent agreement in relation to revised process and timing as proposed in March 2022
	22 April 2022 (formal comment letter - Appendix D2)	<ul style="list-style-type: none"> Various directorates within the department provided recommendations to be considered by the Applicant and incorporated into the EMPrs, where possible The Waste Management Directorate also informed the Applicant that there is no waste disposal facility (WDF) in Loxton and confirmed the closest WDF within the Western Cape province is Vaalkoppies WDF, located in Beaufort West
	<u>20 September 2022</u> (formal comment letter - Appendix D3)	<ul style="list-style-type: none"> <u>The various directorates within the department are satisfied that previous comments made on the DEIAr were adequately addressed and responded to, and therefore had no further comments on the Draft EIA Report.</u> <u>The Air Quality Management Directorate requested clarity on aspects relating to the Noise study. Please refer to Appendix D3 (C&RR) for details of the information requested by the Directorate as well as the EAP and the Applicant’s responses to these requests</u>

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
Western Cape Government: Road Planning	30 August 2022 (formal comment letter – Appendix D3)	<ul style="list-style-type: none"> The Branch lists the affected provincial roads and requests that they are offered the opportunity to comment on the land use application The Branch also stipulates the other applications and approvals necessary prior to construction and abnormal load transportation
CapeNature	7 May 2021 (formal comment letter - Appendix D2)	<ul style="list-style-type: none"> Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
	29 April 2022 (formal comment letter - Appendix D2)	<ul style="list-style-type: none"> Provided comments for the Applicant to take into consideration related to avoidance of loss to natural habitat, impact on CBAs and ESAs, as well as impacts on endangered or protected species and the noted that relevant permits are to be obtained from CapeNature in this regard Confirmed that some limited loss of CBA and natural habitat might be acceptable if in line with the Western Cape Land Use Guideline Handbook, provided the underlying biodiversity objectives and ecological functioning of CBAs and ESAs are not compromised Provided several recommendations (including the compilation of relevant management plans) to be considered by the Applicant, with certain plans also to be incorporated into the Final EMPs, where possible Stated that infrastructure located in high sensitive areas will not be supported Confirmed support for recommendation to remove turbine 34 situated in the buffer area for riverine rabbit Requirements for borehole exploration, testing and monitoring Topsoil and waste management requirements
	22 September 2022 (formal comment letter - Appendix D3)	<ul style="list-style-type: none"> Reiterated comments for the Applicant to take into consideration related to avoidance of loss to natural habitat, impact on CBAs Confirmed support for recommendations of buffer area for riverine rabbit
Endangered Wildlife Trust (EWT)	22 April 2022 (formal comment letter – Appendix D2)	<ul style="list-style-type: none"> Confirmed support for renewable energy projects as an alternative to generation of electricity through burning of fossil fuels, although acknowledged they have impacts on species, habitat, and society and need to be properly evaluated

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
		<ul style="list-style-type: none"> • Stated there is a strong need for developers to adhere to and initiate environmental best practices • Confirmed support for recommendations made in the terrestrial specialist report and recommended their implementation (should the projects be approved) • Confirmed satisfaction with steps taken to avoid the placement of infrastructure in priority Riverine Rabbit riparian habitat areas (particularly along Sak River and tributaries) • Expressed concerns regarding the impact of this and other developments on the Karoo dwarf tortoises, including the Karoo dwarf tortoise (<i>Chersobius boulengeri</i>) and the greater dwarf tortoise (<i>Homopus femoralis</i>), and recommended certain measures for post-development monitoring of power lines • Requested to see the specialist report pertaining to reptiles (including the dwarf tortoises) and reserve the right for further comment on this aspect once report has been reviewed • Provided several recommendations related to birds and terrestrial ecology to be considered by the Applicant and incorporated into the EMPs, where possible and/or required
	<u>16 September 2022</u> (email – Appendix D3)	<ul style="list-style-type: none"> • <u>Endangered Wildlife Trust Drylands Conservation Programme has no further comments</u>
South African National Parks (SANParks)	23 March 2022 (formal comment letter – Appendix D2)	<ul style="list-style-type: none"> • SANParks supports the Hoogland Northern Cluster as the project location is outside of the Karoo National Park buffer zone or expansion footprint and the project will not have a direct negative impact on the Park
Landowners and Adjacent Landowners	21 May 2021 (Meetings - Appendix D1)	<ul style="list-style-type: none"> • Questions were asked about the REIPPPP process • Confirmed rehabilitation would be undertaken after construction was complete • Confirmed the level of communication required with regards to landowners and adjacent landowners
	22 April 2022 (comment email from Mr Christo Scholtz – Appendix D2)	<ul style="list-style-type: none"> • Mr Christo Scholtz (adjacent landowner) expressed his concern about the proposed Hoogland projects, with specific mention / reference to visual impacts and impacts on tourism and wildlife

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
	<u>15 August 2022</u> (comment email from Mr Rick Haw – Appendix D2)	<ul style="list-style-type: none"> • <u>Mr Rick Haw (adjacent landowner) the proposed layout of the wind turbines and the positioning of the main feeder lines to the Eskom substation</u>
Land occupiers	March 2022 (direct engagement – Appendix D2)	<p>Comments were generally positive, however, it should be noted that many occupiers did not have comments as the purpose of the engagement with them was not per se to solicit comments, but to inform them and to provide future opportunities for participation by obtaining their contact details. Land occupiers, especially those on directly adjacent farms, maintain that they should also benefit from the proposed project as opposed to only those living in the formal towns of Beaufort West and Loxton. Other comments include:</p> <ul style="list-style-type: none"> • Positivity on opportunity for future job creation; • Concerned about potential construction impacts, especially dust and theft; • Concerned about potential socio-economic impacts, e.g., contractors visiting the area and the potential influence that they could have on local labour, potential change in character of people who may receive compensation; and • Proposed project will not assist with provision of electricity on farms.
Municipalities	21 May 2021 and 21 April 2022 (email from Beaufort West Local Municipality – Appendix D2)	<ul style="list-style-type: none"> • Confirmed that appointed road contractors will be responsible for road construction and the Municipality will be responsible for maintenance once construction is complete • Confirmed that any waste will be formally and appropriately dealt with in compliance with legislation • Confirmed labour will be sourced locally where possible and the developer together with the Contractor will engage the municipalities with regards to the availability of a skills database • District Municipalities are responsible for town planning applications • Beaufort West Local Municipality’s Building inspector stated that the Applicant must apply for a consent use to be able to set up a renewable energy structure after the completion of the public participation process
	<u>9 September 2022</u> (email from Beaufort	<ul style="list-style-type: none"> • <u>Reiterated that before the development can take place, the owner of the property must apply to a consent use.</u>

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
	<u>West Local Municipality – Appendix D3)</u>	
Eskom	11 April 2022 – 21 April 2022 (email from John Geeringh – Appendix D2)	<ul style="list-style-type: none"> • Provided Eskom requirements for work at or near Eskom servitudes and infrastructure, as well as the Eskom setbacks guideline for renewable energy developments documents for the Developer’s attention • Requested KMZ files of the proposed development, layouts and grid connection, which were subsequently forwarded by the EAP
Heritage Western Cape (HWC)	29 April 2022 (formal comment letter – Appendix D2)	<ul style="list-style-type: none"> • Confirmed that the Impact Assessment Committee (IACom) supports the HIA for Hoogland 1 and Hoogland 2 Wind Farms dated March 2022 (Appendix C9) and the recommendations within the respective reports • Further confirmed that the Committee has no concerns with the proposals, and do not anticipate any heritage, any significant heritage impacts of concern
	22 July 2022 (email – Appendix D2)	<ul style="list-style-type: none"> • Acknowledged receipt of the permit application submitted by the heritage specialist for the Hoogland 1 and 2 Wind Farms (northern cluster), which was received on 21 July 2022. • Informed the heritage specialist about the pre-assessment of the application submitted, as per the application guideline of documentation required.
	<u>31 August 2022 (letter – Appendix D3)</u>	<ul style="list-style-type: none"> • <u>Confirmed that the APM supports the HIA for Hoogland 1 and Hoogland 2 Wind Farms dated July 2022 (Appendix C9) and the recommendations within the respective reports.</u> • <u>Provided conditions and mitigation recommendations based on the HIA</u>
South African Heritage Resources Agency (SAHRA)	26 May 2022 (formal interim comment letter via SAHRIS – Appendix D2)	<ul style="list-style-type: none"> • The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit requests that a field-based PIA of the stream crossings in the Northern Cape section be conducted as part of the EIA phase as fossils have been identified in streams in the Western Cape section of the development • Confirmed that further comments will be issued upon receipt of the draft EIA documents inclusive of appendices and updated PIA
	10 June 2022 (formal interim comment)	<ul style="list-style-type: none"> • The SAHRA APM Unit responded to Dr John Almond’s (paleontological specialist) motivation for not undertaking a field-based PIA of the stream crossings in the Northern

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
	letter via SAHRIS – Appendix D2)	<p>Cape section and stated that it is not satisfied with the motivation, as it does not comply with the 2012 PIA Minimum Standards. As such, the stream crossings must be assessed to the satisfaction of SAHRA during the EIA phase¹³</p> <ul style="list-style-type: none"> SAHRA awaits the requested field-based PIA of the stream crossings before further comments will be issued
	<u>14 September 2022</u> (formal comment letter via SAHRIS – Appendix D3)	<ul style="list-style-type: none"> <u>SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit has no objections to the proposed development</u> <u>The recommendations of the specialists are supported and must be adhered to</u> <u>The requirements in terms of section 3(4) of the NEMA Regulations and section 38(8) of the NHRA in the format provided in section 38(4) of the NHRA must be included in the Final EIA and EMPr</u>

The key stages of consultation with the competent authority, the DFFE, are set out in the section below.

¹³ Based on the comments above, a supplementary specialist report was undertaken by Elize Butler of Banzai Environmental to assess the watercourse crossing upgrades required on Northern Cape roads as shared infrastructure for the Hoogland Northern Projects (Table 2-3 and Figure 2-17), the findings of which have been incorporated into and presented within this report (Section 7.10).

6.2.5 Consultation with Competent Authority

Key stages of consultation with the DFFE, as the competent authority, are set out in Table 6-5 below:

Table 6-5: Consultation with DFFE

CONSULTATION PHASE	DESCRIPTION
Pre-application meeting	A Pre-application meeting was held with DFFE on 29 July 2021 to provide the DFFE with information of the proposed project and get consensus on the approach to the EIA process. The minutes are contained <i>Appendix D1: Screening Phase</i> .
2 nd pre-application meeting	A second pre-application meeting was held on 02 March 2022 with the DFFE prior to the Pre-application Phase to verify and reaffirm the project approach and methodology. The minutes are contained <i>Appendix D1: Screening Phase</i> .
Comment on the Scoping Report	<p>The DFFE were requested to submit comments on the Draft Scoping Report when it was made available to the public for a 30-day comment period (18 March 2022 – 22 April 2022, excluding public holidays). The request for comment on the Draft Scoping Report coincided with the submission of the EA application forms for the respective projects.</p> <p>After evaluating the DSR, the DFFE issued a comment letter for each application, both dated 8 April 2022 (<i>Appendix D2: Scoping Phase</i>), which served to inform the EAP and Applicant that certain information must be included in the FSR. Where possible, the requested information was provided, and the report addressed the comments made by the DFFE (where required). It should be noted that some of the information requested and/or comments made could only be provided and/or addressed in the EIA phase of the projects. The information requested and/or comments made has been provided and/or addressed in this Draft EIR, where possible and/or required. Refer to the C&RR (<i>Appendix D2: Scoping Phase</i>) for information on how the Scoping Report addressed the comments provided by the DFFE, where possible.</p>
Submit Final Scoping Report (incl. EIA plan of study) for decision-making	<p>Where applicable, the Draft Scoping Report was updated as a result of the PPP and was converted to a Final Scoping Report that was submitted to the DFFE for decision-making within the legislated time period (namely on 6 May 2022).</p> <p>In terms of Regulation 22 of GN R982, the competent authority must, within 43 days of receipt of the Final Scoping Report, consider it, and in writing –</p> <p>(a) Accept the report and advise the environmental assessment practitioner (EAP) to proceed with the tasks contemplated in the Plan of Study for the EIA;</p> <p>(b) Refuse the environmental authorisation if;</p> <p>(i) The proposed activity is in conflict with a prohibition contained in legislation;</p> <p>or</p> <p>(ii) If the Scoping Report does not substantially comply with the objectives and content requirements for scoping reports in terms of the 2014 EIA Regulations, as amended, and the applicant cannot ensure compliance with these regulations within the prescribed timeframe.</p>
Acceptance of Final Scoping Report	Following the submission of the Final Scoping Report to the DFFE for decision-making/acceptance, the DFFE accepted the report and advised the EAP to proceed with the tasks contemplated in the Plan of Study for the EIA presented in the Final Scoping Report. In addition, certain amendments and additional information required for the EIAR were also requested. The DFFE issued their decision/acceptance of the Scoping Report by way of the acceptance letter dated

CONSULTATION PHASE	DESCRIPTION
	17 June 2022 (<i>Appendix D2: Scoping Phase</i>). Please refer to the C&RR (<i>Appendix D2: Scoping Phase</i>) for details regarding the amendments and/or additional information requested by the DFFE, as well as responses from the EAP and/or Applicant (where required). The EIA Phase (current phase) has thus officially commenced.
Comment on Draft EIR	The DFFE <u>were</u> requested to submit comments on the Draft Environmental Impact Report (EIR) , which <u>was</u> made available to the public at the same time, for a 30-day comment period (excluding public holidays). The request for comment on the Draft EIR coincided with the submission of the updated EA application forms for the respective projects. <u>Refer to the C&RR (<i>Appendix D3: EIR Phase</i>) for information on how the EIA Report addressed the comments provided by the DFFE, where applicable.</u>
Comment and decision on Final EIR	Where applicable, the Draft EIR <u>has been</u> updated as a result of the PPP , and <u>now</u> includes any new <u>and</u> additional information. It <u>has been</u> converted to a Final EIR (<u>this report</u>) that <u>has been</u> submitted to the <u>DFFE</u> for decision-making. In terms of Regulation 24 of GN R982, the DFFE must within 107 days of receipt of the Final EIR and Environmental Management Programme (EMPr), in writing- (a) Grant environmental authorisation in respect of all or part of the activity applied for; or (b) Refuse environmental authorisation.

6.3 ASSESSMENT METHODOLOGY

The impacts of the proposed development (during the Construction, Operation and Decommissioning phases) have been assessed and rated according to the methodology described below and which was developed by SLR to align with the requirements of Appendix 3 of the EIA Regulations (GN 654 of 2010).

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in Table 6-6. This method complies with the method provided in the EIA guideline document (GN 654 of 2010). Part A provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent and duration). In Part B, a matrix is applied to determine this impact consequence. In Part C, the consequence rating is considered together with the probability of occurrence in order to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in Part D.

Table 6-6: Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA		
Determination of CONSEQUENCE		Consequence is a function of intensity, spatial extent and duration
Determination of SIGNIFICANCE		Significance is a function of consequence and probability
Criteria for ranking of the INTENSITY of environmental impacts	Very High	Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required.
	High	Prominent change, or large degree of modification, disturbance or degradation caused to receptors or which may affect a large proportion of receptors, possibly entire species or community.

	Medium	Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.				
	Low	Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.				
	Very Low	Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.				
Criteria for ranking the DURATION of impacts	Very Short-term	The duration of the impact will be < 1 year or may be intermittent.				
	Short-term	The duration of the impact will be between 1 - 5 years				
	Medium-term	The duration of the impact will be Medium-term between, 5 to 10 years.				
	Long-term	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)				
	Permanent	The duration of the impact will be permanent				
Criteria for ranking the EXTENT of impacts	Site	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.				
	Local	Impact is confined to within the project site / area and its nearby surroundings.				
	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.				
	National	Impact may extend beyond district or regional boundaries with national implications.				
	International	Impact extends beyond the national scale or may be transboundary.				
PART B: DETERMINING CONSEQUENCE						
		EXTENT				
		Site	Local	Regional	National	International
Intensity- Very Low						
DURATION	Permanent	Low	Low	Medium	Medium	High
	Long-term	Low	Low	Low	Medium	Medium
	Medium-term	Very Low	Low	Low	Low	Medium
	Short-term	Very low	Very Low	Low	Low	Low
	Very Short-term	Very low	Very Low	Very Low	Low	Low
Intensity -Low						
DURATION	Permanent	Medium	Medium	Medium	High	High
	Long-term	Low	Medium	Medium	Medium	High
	Medium-term	Low	Low	Medium	Medium	Medium
	Short-term	Low	Low	Low	Medium	Medium
	Very Short-term	Very low	Low	Low	Low	Medium
Intensity- Medium						
DURATION	Permanent	Medium	High	High	High	Very High
	Long-term	Medium	Medium	Medium	High	High

	Medium-term	Medium	Medium	Medium	High	High
	Short-term	Low	Medium	Medium	Medium	High
	Very Short-term	Low	Low	Low	Medium	Medium
Intensity -High						
DURATION	Permanent	High	High	High	Very High	Very High
	Long-term	Medium	High	High	High	Very High
	Medium-term	Medium	Medium	High	High	High
	Short-term	Medium	Medium	Medium	High	High
	Very Short-term	Low	Medium	Medium	Medium	High
Intensity - Very High						
DURATION	Permanent	High	High	Very High	Very High	Very High
	Long-term	High	High	High	Very High	Very High
	Medium-term	Medium	High	High	High	Very High
	Short-term	Medium	Medium	High	High	High
	Very Short-term	Low	Medium	Medium	High	High
		Site	Local	Regional	National	International
EXTENT						

PART C: DETERMINING SIGNIFICANCE						
PROBABILITY (to exposure of events)	Definite / Continuous	Very Low	Low	Medium	High	Very High
	Probable	Very Low	Low	Medium	High	Very High
	Possible / frequent	Very Low	Very Low	Low	Medium	High
	Conceivable	Insignificant	Very Low	Low	Medium	High
	Unlikely / improbable	Insignificant	Insignificant	Very Low	Low	Medium
		Very Low	Low	Medium	High	Very High
CONSEQUENCE						

PART D: INTERPRETATION OF SIGNIFICANCE		
Very High -	Very High +	Represents a key factor in decision-making. In the case of adverse effects, the impact would be considered a fatal flaw unless mitigated to lower significance.
High -	High +	These beneficial or adverse effects are considered to be very important considerations and are likely to be material for the

		decision-making process. In the case of negative impacts, substantial mitigation will be required.
Medium -	Medium +	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor. In the case of negative impacts, mitigation will be required.
Low -	Low +	These beneficial or adverse effects may be raised as localised issues. They are unlikely to be critical in the decision-making process but could be important in the subsequent design of the project. In the case of negative impacts, some mitigation is likely to be required.
Very Low -	Very Low +	These beneficial or adverse effects will not have an influence on the decision, neither will they need to be taken into account in the design of the project. In the case of negative impacts, mitigation is not necessarily required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

6.4 CUMULATIVE ASSESSMENT METHODOLOGY

In relation to an activity, cumulative impact means “*the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*” (NEMA EIA Reg GN R982 of 2014).

Other than the authorised Nuweveld Wind Farms (including grid connection), there are currently no approved renewable energy EA applications within a 30km (or even 50km) radius of the project site (Figure 6-3). The nearest operational Wind Farm from the site is the Noblesfontein Wind Farm located approximately 65km to the Northeast. In addition at the time of writing this report, the latest South African Renewable Energy EIA Application Database (REEA) (“REEA_OR_2022_Q1”), which was released by the DFFE on 31 May 2022, was used during the EIA Phase to confirm whether any updates were required to the Cumulative Impact Assessment presented in the Scoping Report, due to new information becoming available. Subsequent to the draft report going out for public participation, the REEA second quarter dataset (REEA OR 2022 Q2) was released on the 30th of August 2022. After interrogation of the new dataset, it was determined that no new projects / applications were included in the most-recent version of the database (Q2, 2022), and the database still shows the same renewable energy projects (solar) authorised close to Beaufort West as presented in the Final Scoping Report and draft EIA Report. Further research previously undertaken had already confirmed that none of these projects are going ahead/have a valid EA. The cumulative impact assessed will therefore be the collective impact of the four Hoogland Wind Farms and Grid Connection applications with the three Nuweveld Wind Farm and Gridline applications¹⁴.

The results of the cumulative impact assessment undertaken by each specialist as part of their respective studies are provided in Section 7, with a summary provided in Section 8.

¹⁴ Nuweveld North: 14/12/16/3/3/2/2042, Nuweveld West: 14/12/16/3/3/2/2043, Nuweveld East: 14/12/16/3/3/2/2044, Nuweveld Gridline: 14/12/16/3/3/2/2336

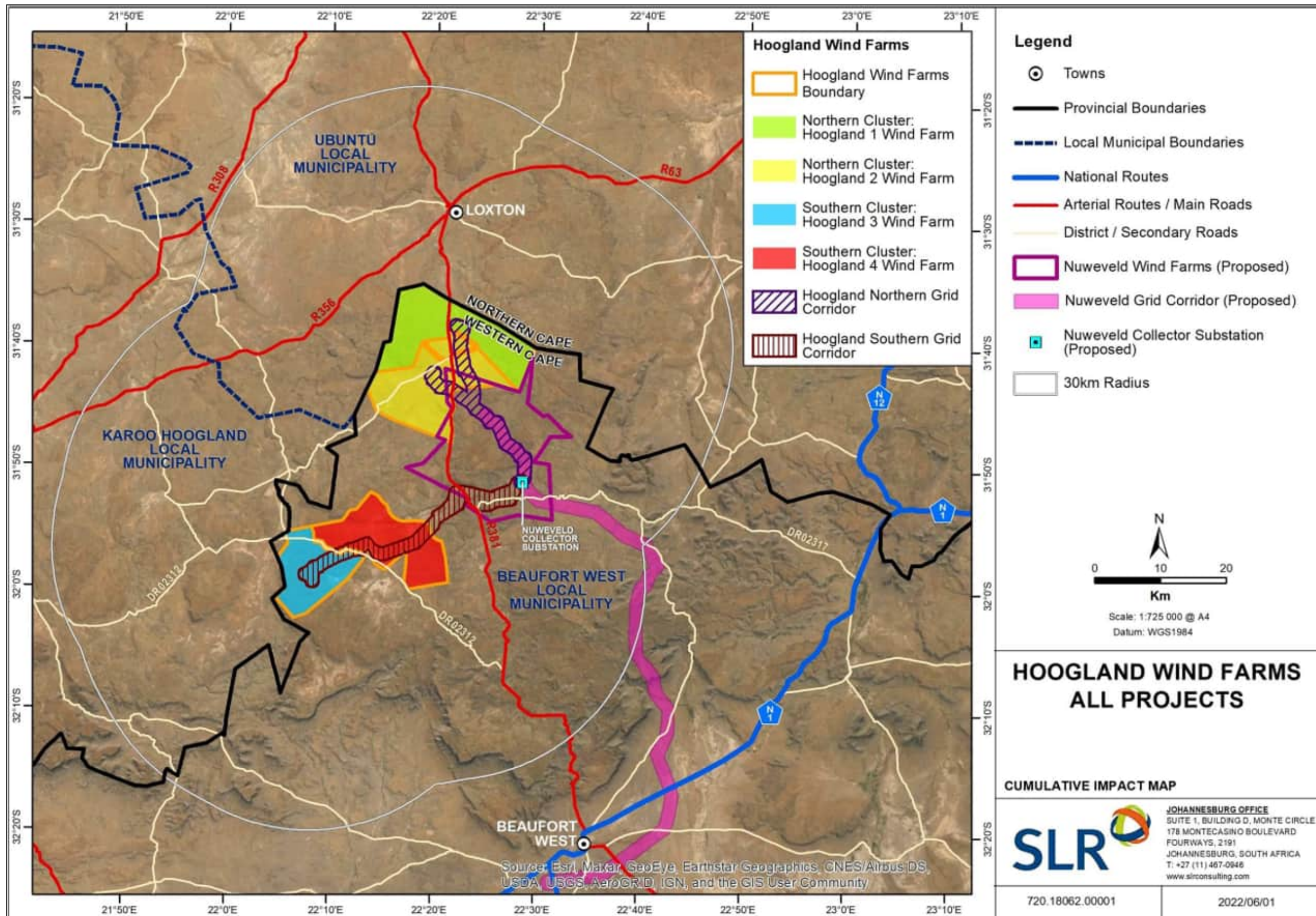


Figure 6-3: Map showing Renewable Energy facilities within 30km of the proposed Hoogland Wind Farms

6.5 ASSUMPTIONS AND LIMITATIONS

In undertaking this investigation and compiling this report, the following assumptions and limitations have been identified:

1. It is assumed that all information provided to the EAP by the applicant was correct and accurate at the time of assessment.
2. Every effort has been made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or organisations will/have conveyed the necessary information to these associations/organisations.
3. It is assumed that the information provided by the various specialists is unbiased and accurate.
4. The degree of the impact that the proposed development will have on the immediate environment has been determined based on specialist input. Actual impacts can only be determined following the commencement of construction and/or operation.
5. All information that could be obtained for the surrounding planned renewable energy developments within 30km) existing or planned (having started their official environmental assessment process) was taken into account as part of the cumulative impact assessment for this project. This includes the latest South African REEA Database (“REEA_OR_2022_Q1”), which was released by the DFFE on 31 May 2022¹⁵.
6. The exact turbine specifications are not known at this stage and hence the maximum number of turbines to be constructed and the maximum MW of energy to be generated has been clearly defined and a “worst-case scenario” in this regard has been assessed. A ‘worst-case scenario rotor swept area envelope’ is also assessed as detailed in Section 1.3. This is in line with the precautionary principle.
7. External wake effect from surrounding Wind Farms has not been included in the assessment as the Red Cap Nuweveld Wind Farms (also developed by Red Cap) are the only potentially affected Wind Farms and therefore have no conflict of interest. Nevertheless, for the purpose of reducing any potential wake effect, a 1.6km buffer around the Nuweveld turbines has been used when locating turbines on the Hoogland Wind Farm site.
8. It is intended that these projects would, in the first instance, be bid in a forthcoming round of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) but there is a possibility that they could be considered for business-to-business purposes.
9. Any limitations and gaps in knowledge that have been encountered by the specialists are identified in their respective assessments (*Appendix C: Specialist Reports*).

¹⁵ Subsequently to this report going out for public participation, the REEA second quarter (REEA_OR_2022_Q2) was released on the 30th of August 2022. After interrogation of the new dataset, it was determined that no new projects / applications were included in the most-recent version of the database (Q2, 2022), and the database still shows the same renewable energy projects (solar) authorised close to Beaufort West as presented in the Final Scoping Report and Draft EIA Report.

7 BASELINE ENVIRONMENT AND IMPACT ASSESSMENT

The environmental baseline conditions have been extracted and collated from the specialists' reports. The summary is based on the individual specialist knowledge and experience working in the area, especially with regards to the adjacent Nuweveld project, and desk-top investigations as well as field work undertaken as part of the Screening and S&EIR processes. The baseline information has informed the site constraints and sensitivity categories which in turn has informed the design and layout of the proposed Hoogland Projects. The specialist studies are appended under *Appendix C: Specialist Reports*.

The site sensitivity, potential impacts, likely impact significance, proposed impact mitigations (to reduce negative impacts or enhance positive impacts) and conclusions for the EIA Phase are discussed per relevant specialist field, noting that the key recommendations for each study are reiterated in Section 8.3. The impact assessment methodology used by the specialists to determine the likely impact significance of the impacts identified are detailed in the Impact Assessment Methodology (refer to Section 6.3). A consolidated No-Go site sensitivity map (which combines the sensitivities of all specialist fields) and table which outlines the various sensitivities identified on site for each infrastructure type per specialist study is provided in Section 9, and includes inputs from the summary section hereunder. The reader should also be reminded that the assessment considers a worst case in terms of turbines and rotor swept area envelope as described in Section 2.

Importantly, note that this report is the basis for a combined application for the Hoogland 1 (14/12/16/3/3/2/2147) and Hoogland 2 (14/12/16/3/3/2/2146) Wind Farms and in many cases the baseline descriptions are the same or similar, as with the impact descriptions and ratings. Therefore, to avoid repetition, only where specific features or impacts differ has this been specifically noted in the text, and where necessary separate impact tables have been provided.

7.1 Climate Change

This section provides a short summary of the Climate Change specialist report compiled by Promethium Carbon which is available in *Appendix C1: Climate Change*. The report has provided an assessment of the four Hoogland Wind Farms holistically and is twofold, it considers the impact of climate change on the Project and the impact of the Project on climate change.

7.1.1 Baseline Description

Promethium (2022) undertook an analysis of the historical climate trends in the area to provide the current status quo but also to identify trends that provide the basis for future projections.

7.1.1.1 Regional climate change considerations

The climate change projections for the Project within the Western Cape indicate that annual average ambient temperatures are likely to increase, while overall precipitation is becoming more variable and decreasing, and risk to droughts is likely (Figure 7-1).

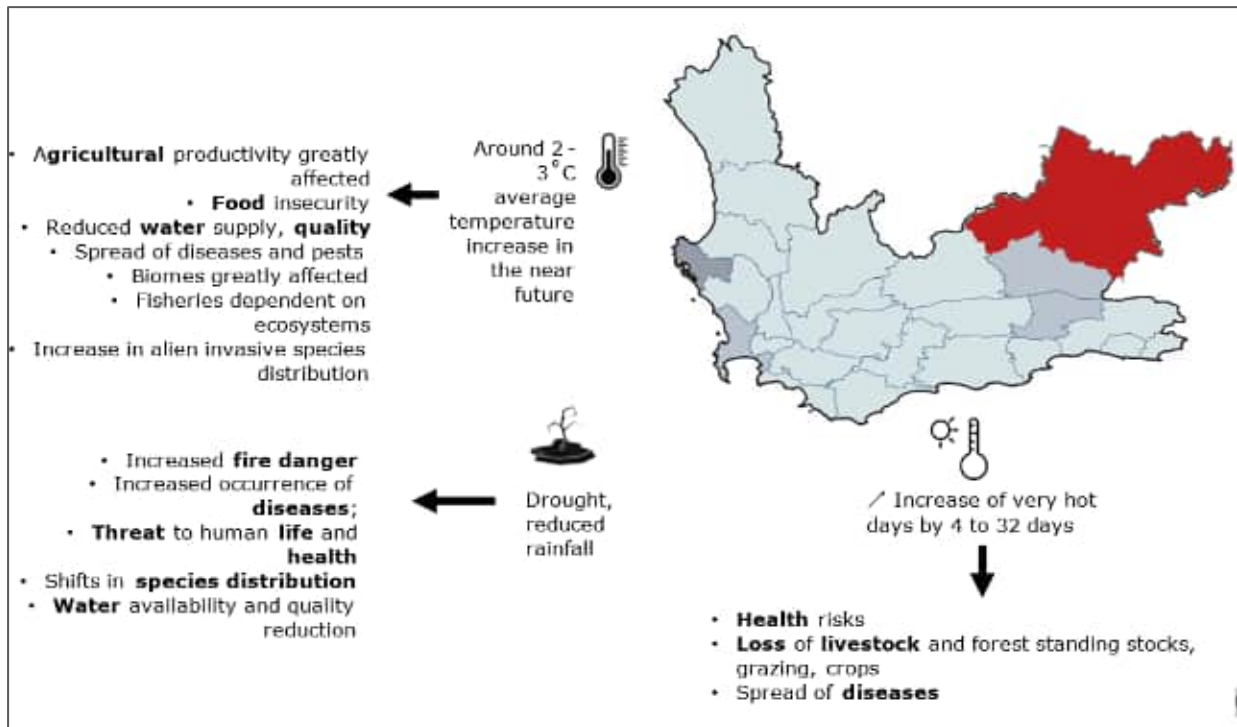


Figure 7-1: Project climatic conditions within the Western Cape Province showing Beaufort West Local Municipality (SSP5) in red

By use of the Greenbook (Le Roux et al, 2019), the current and future change in climate for the Hoogland Wind Farms, being located within the Beaufort West Local Municipality, is summarised in the below table. The future scenarios include an intermediate (SSP 2)¹⁶ and worst-case (SSP 5)¹⁷.

Table 7-1: Current and future temperature and rainfall projections for the Hoogland Wind Farms within the Beaufort West Municipality

CLIMATE CHANGE IMPACT	CURRENT	SSP 2		SSP 5	
		The projected change for the period 2021 to 2050, relative to the baseline period (1961 to 1990).			
Temperature	Average annual temperature between 13-17 °C.	Average annual temperature increase by approximately 2°C to 3°C	Average annual temperature increase by between 2°C to 3°C	Average annual temperature increase by between 2°C to 3°C	Average annual temperature increase by between 2°C to 3°C
Very Hot Days (>35 degrees Celsius) ^{18,19}	The region experiences a range from 10 to 35 days per annum.	Potential annual increase in the number of very hot days by between 1 days to 25 days. This will take the annual number of very	Potential annual increase in the number of very hot days by between 1 days to 25 days. This will take the annual number of very	Average annual increase in the number of very hot days could increase between 4 days to 32 days. This will take the annual number of	Average annual increase in the number of very hot days could increase between 4 days to 32 days. This will take the annual number of

¹⁶ SSP 2:(Previously RCP 4.5) “[T]he Middle of the road” or medium pathway [which] extrapolates the past and current global development into the future. [...] There is a certain cooperation between states, but it is barely expanded. Global population growth is moderate, levelling off in the second half of the century. Environmental systems are facing a certain degradation.”

¹⁷ SSP 5:(Previously RCP 8.5) “Fossil-fuelled Development. Global markets are increasingly integrated, leading to innovations and technological progress. The social and economic development, however, is based on an intensified exploitation of fossil fuel resources with a high percentage of coal and an energy-intensive lifestyle worldwide. The world economy is growing and local environmental problems such as air pollution are being tackled successfully.”

¹⁸ Very hot days: the number of days (per 8 x 8 km grid point) where the maximum temperature exceeds 35°C.

¹⁹ Heat wave days: where temperature exceeds maximum temperature of the warmest month of the year by 5°C for a period of 3 or more consecutive days.

CLIMATE CHANGE IMPACT	CURRENT	SSP 2		SSP 5	
		The projected change for the period 2021 to 2050, relative to the baseline period (1961 to 1990).			
		hot days to between 11 and 60.	very hot days to between 14 and 67.		
Rainfall	Average annual rainfall within the municipality is between 500 – 700 mm.	Average annual rainfall may decrease by 99 mm or increase by 84 mm	Average annual rainfall may decrease by 97 mm or increase by 87 mm		
Extreme Rainfall Days²⁰	<i>Information is not available for the baseline</i>	The region could experience a change of 2 days fewer extreme rainfall days or up to 1 day more.	The region could experience a change of 3 days fewer extreme rainfall days or up to 2 days more.		
Flood Risk²¹	Regions within municipality range from very low to medium-high	<i>Information is not available for the SSP 2 scenario</i>	Low risk in the region		
Drought Risk²²	Increase in drought tendencies in most region of the municipality	<i>Information is not available for the SSP 2 scenario</i>	There is an extreme risk in the region		
Fire Risk²³	Very rare	<i>Information is not available for the SSP 2 scenario</i>	Medium risk in the region		

Climatic projections for the Hoogland Wind Farms suggest that the Beaufort West Local Municipality, could experience an increase in average annual temperatures of at least 2 °C to 3 °C from the baseline period. It is further projected that the number of very hot days will increase between 1 to 25 days, which will increase the annual number of days to between 11 and 60. The change in temperature and increase in very hot days, increases the drought risk and as a result, will impact the fire risk within the region, particularly within the SSP5 projection.

The main climate change impacts at the Beaufort West Local Municipality are **increased temperature**, extreme **heat**, fire risk and high risk of **droughts**. The climate in the area is thus likely to become hotter and drier.

7.1.1.2 Historical Climate Trends

Both the CustomWeather daily data for the Project area (from 1998 to 2021, based on centre points of each site) and the World Resources Institute’s (WRI) Aqueduct tool were consulted. Noting that the data was collected and presented for the Northern and Southern Cluster Wind Farm projects as a whole.

²⁰ 20mm of rain occurring within 24 hours over the 8 x 8 km grid point

²¹ Flood, drought and fire risk data were modelled for the RCP 8.5 scenario only (see greenbook.co.za), therefore no RCP 4.5 data could be included in this analysis. Floods, drought and fires are the most destructive and have the greatest environmental and social impact. RCP 8.5 scenario was selected to give a good indication of how climate change would precipitate as a function of the current conditions under these three aspects. Providing a current and worst case scenario will help to provide a more conservative approach upon which actions can be based.

²² Number of cases exceeding near-normal per decade for the period 1995-2024 relative to 1986-2005 baseline period, under the low mitigation scenario.

²³ Rainfall Variability: The degree to which rainfall amounts vary across an area or through time.

7.1.1.2.1 Rainfall data

It was deduced that rainfall has decreased from 1998 to 2020 due to the downward trends present. It is evident from this downward trend that overall precipitation in the Project area has decreased over time.

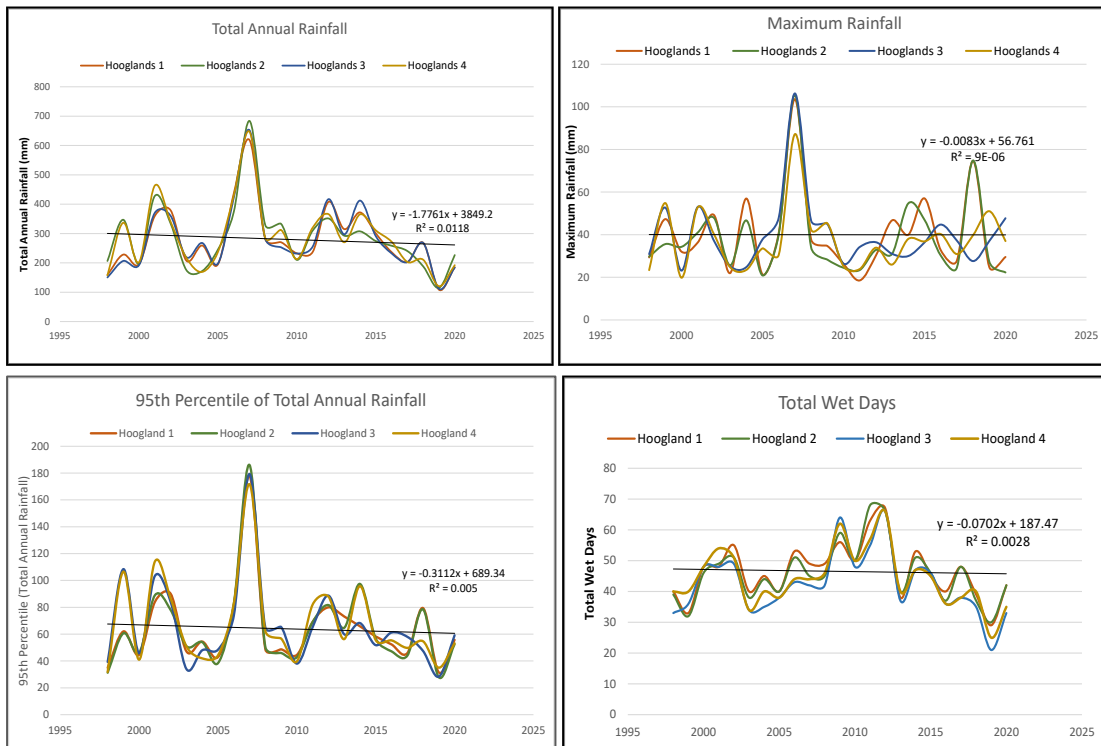


Figure 7-2: Historical rainfall data from 1998 to 2020 for the Project area

An analysis of the variability of annual rainfall implies that the Project being exposed to a combination of erratic rainfall, periods of drought but then also periods of intense rainfall has decreased over time.

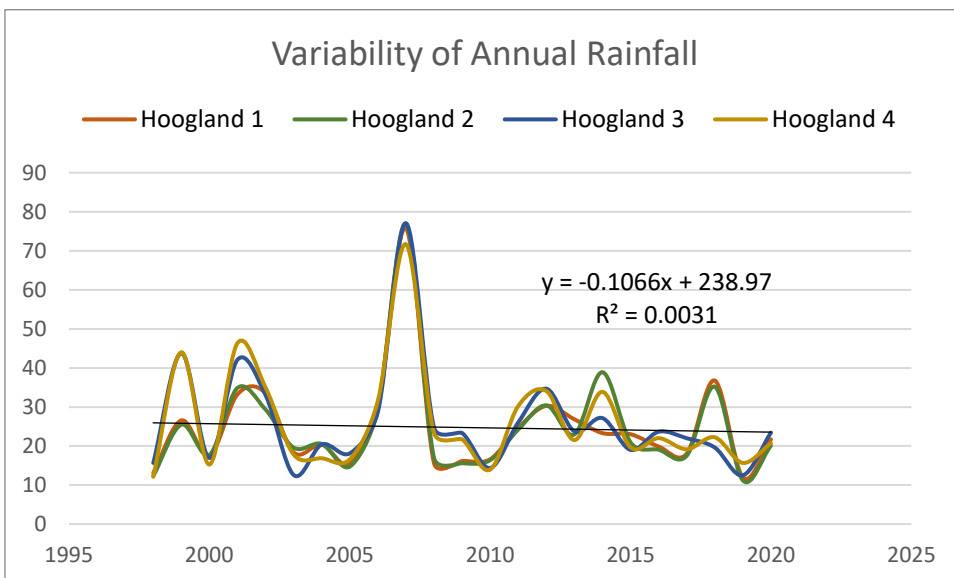


Figure 7-3: Variability of average annual rainfall at the Project area from 1998 to 2020

7.1.1.2.2 Temperature data

It was found that there is an upward trend for the average annual temperature and maximum temperature parameters. It is also noted that the Project area is currently experiencing a drought event. An increase in

temperature, in conjunction with the downward trends in rainfall, could be an indication that drought events are likely to become more frequent, as well as more severe over time.

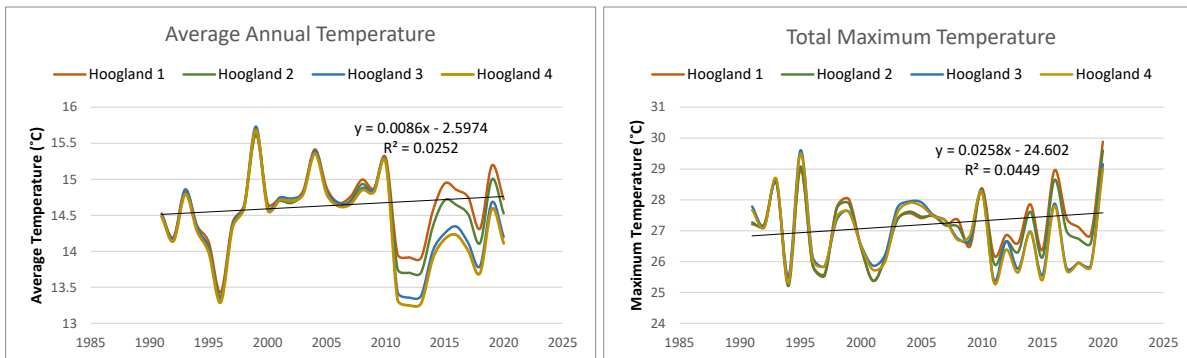


Figure 7-4: Historical temperature data of the Project area from 1991 to 2020

7.1.1.2.3 Wind data

There is a slight upward trend present in the graphs above. It is evident from this upward trend that the average and maximum windspeed at the Project area has increased slightly over time.

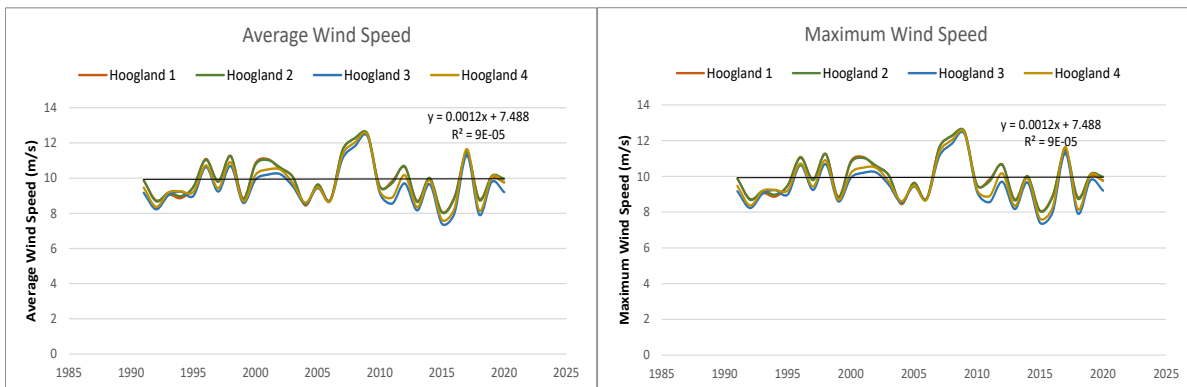


Figure 7-5: Historical wind data for the Project area from 1991 to 2020

7.1.1.3 Projected Climate Change

7.1.1.3.1 Rainfall

Projected annual average rainfall from 1998 to 2035 exhibits a downward trend is present in average annual rainfall. From this projection, it can be deduced that precipitation is forecasted to decrease over time and the Project area will most likely become drier in the future (Figure 7-6).

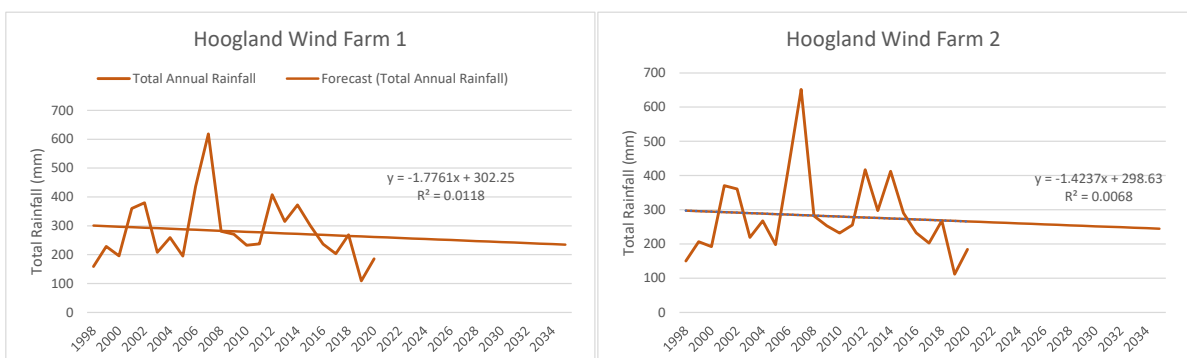


Figure 7-6: Projected total annual rainfall from 1998 to 2035 for the Project area

7.1.1.3.2 Temperature

Projected annual average temperature from 1991 to 2035 is shown in Figure 7-7 below. It is seen that an upward trend is present for Hoogland 1 and 2 therefore from this projection, it can be deduced that average annual temperature is forecasted to increase over time. This, in conjunction with decreased rainfall, could bring about drier conditions in the future and possibly exacerbate the drought event that is currently occurring in the area

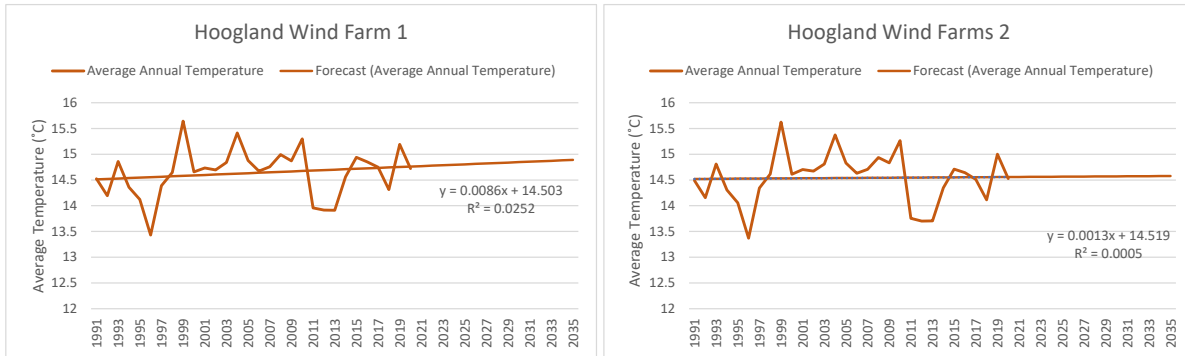


Figure 7-7: Temperature projections of the Project area from 1991 to 2035

7.1.1.3.3 Windspeed

Projected average annual windspeed from 1991 to 2035 is shown in Figure 7-8 below. It is seen that an upward trend is present for Hoogland 1 and Hoogland 2 Wind Farms. From these projections, it can be deduced that average annual windspeed is forecasted to increase over time.

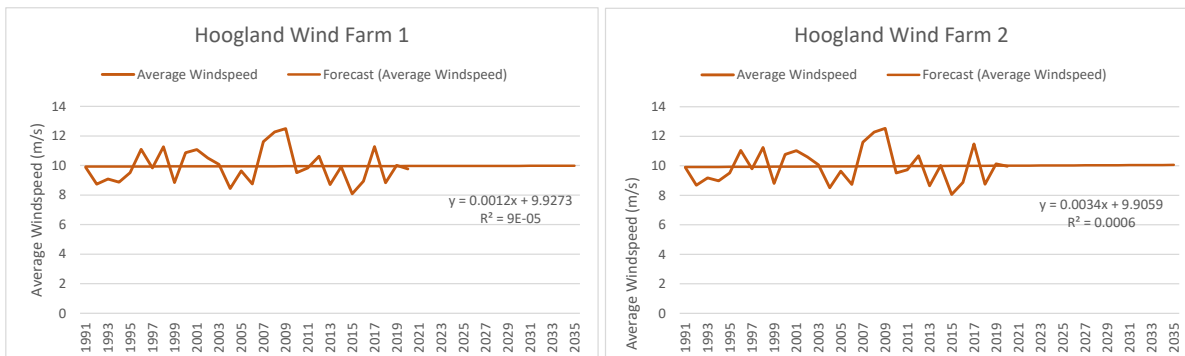


Figure 7-8: Average windspeed projections at the Project area from 1991 to 2035

7.1.1.3.4 Water Risk

By use of the World Resources Institute’s (WRI) Aqueduct Tool, the overall water risk for the Hoogland Wind Farms can be analysed. Two aspects are considered in this report: water stress and seasonal variability of water availability.

In terms of projected water stress, the area surrounding the Hoogland Wind Farms is currently considered as an “arid and low water use” region in relation to water stress and will remain arid with low water use in 2030 under a “business-as-usual” scenario. In other words, the baseline water stress for the project area is projected to remain stable in the future.

In terms of the projected change in seasonal variability of water, the WRI Aqueduct Tool indicates that seasonal variability in the Project area is considered “High”. Seasonal variability measures the average within-year variability of available water supply, including both renewable surface and groundwater supplies. Higher values indicate wider variations of available water supply within a year. The projected change in seasonal variability of water moves from “High” to “Low-medium” in 2030 under a “business-as-usual” scenario. Lower values indicate

narrower variations of available water supply within a year. This indicates that seasonal variability²⁴ may become less extreme in 2030.

7.1.2 Impact Assessment and Mitigation

7.1.2.1 Impact of Climate Change on the Project

In terms of the impact of climate change on the core operations of the Project, there are two main ways, namely (i) the physical impacts on Wind Farms infrastructure and (ii) the impact on the workforce.

7.1.2.1.1 Physical Risks

Such risks relate to the direct impacts climate change conditions may have on numerous sectors of society and the environment. In conjunction to Hoogland Wind Farms project, the physical risks will consider the impacts temperature and rainfall will have on the project as well as the workforce.

Temperature

It is expected that Beaufort West Municipality will experience an increase in average temperature as well as an increase in the frequency of hot days. As shown in Table 7-1, the GreenBook tool indicates that by 2050 the average temperature will increase by between 1.73 degrees Celsius to 2.52 degrees Celsius under the SSP 2 (RCP 4.5) scenario and between 2.27 degrees Celsius to 2.86 degrees Celsius under an SSP 5 (RCP 8.5) scenario. The number of very hot days is also predicted to increase by up to 25 days under SSP2. Typical risks associated with the relationship between increased temperatures and Wind Farms include the following:

- The increased annual temperatures and an increased frequency in the number of hot days/ heatwaves will result in equipment thresholds being exceeded more frequently. Hence, the equipment will reach its limit more often and impact its productivity over time.
- The increased annual temperature will impact the air density, which may lessen the energy output of the wind turbines.
- In addition, the onsite offices will make increased use of air conditioning due to higher temperatures, thus increasing the energy demand and associated costs.

Rainfall

With reference to the climatic data provided by CustomWeather, it is expected that the annual rainfall and rainfall variability will decrease. As for the information provided by the Greenbook, it is identified that the Beaufort West Local Municipality will experience an increase in rainfall variability and drought risk. However, it is important to note that such information is more high level and broad and significant to the municipality in which the project is located in, rather than the actual location of the Wind Farms. Therefore, the information provided by CustomWeather is more significant to the project than the Greenbook. We also acknowledge that the operation of the Hoogland Wind Farms is not water/rainfall dependent. Thus, the information regarding rainfall variability and annual rainfall poses a small risk to direct operations and does not have a significant impact on the project.

7.1.2.1.2 Labour and working conditions

In terms of the Project's workforce, the existing hot and dry environment, coupled with expected increased daytime temperatures, could have a negative impact on the health of employees, particularly for individuals working outside that are exposed to extreme heat. Heat stress is a major occupational health risk and can directly impact workforce productivity and thereby operations at the Hoogland Wind Farm Project. High heat exposure restricts an employee's physical functions, their capabilities and ultimately work productivity and capacity.

²⁴ Seasonal variability is an indicator of the variability between months of the year. Increasing seasonal variability may indicate wetter wet months and drier dry months, and higher likelihood of droughts or wet periods.

7.1.2.2 Impact of the Project on Climate Change

In terms of the Project's impact on climate change, the proposed Hoogland Wind Farm Project will result in some Green House Gas (GHG) emissions being released into the atmosphere during its lifetime. Its impact is quantified by developing a GHG inventory (See specialist report in *Appendix C1: Climate Change* for calculations).

Two types of design are being considered for the wind turbines, a steel-based and a concrete-based design and the GHG inventory reported below is based on the concrete-based design which is a worst case scenario. The total number of wind turbines to be developed per Wind Farm has also not yet been set and thus a range of 30 to 60 wind turbines per farm has been applied. Table 7-2 and Table 7-3 summarise the direct operational and construction emissions (Category 1)²⁵ and the upstream operational and construction emissions (Category 3-6) associated with each Wind Farm as well as the four Wind Farms in totality, for a maximum and minimum number of turbines. They also provide the emissions per wind turbine.

Table 7-2: Construction- and operation-related emissions for the proposed Hoogland Wind Farm Project (maximum of 60 turbines)

ACTIVITY	CONSTRUCTION EMISSIONS (TCO ₂ E)	ANNUAL OPERATIONAL GHG EMISSIONS (TCO ₂ E/A)	EMISSIONS OVER THE LIFE OF PLANT (TCO ₂ E)
Per Wind Turbine			
Construction Category 1	*		*
Construction Category 3-6	2 100		2 100
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Turbine	2 100	*	2 100
Per Wind Farm			
Construction Category 1	*		*
Construction Category 3-6	128 000		128 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Farm	128 000	*	128 000
Across all 4 Wind Farms			
Construction Category 1	*		*
Construction Category 3-6	512 000		512 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total across all 4 Wind Farms	512 000	*	512 000

* Data regarding direct emissions during construction and operation (such as onsite fuel combustion in vehicles) as well as indirect emissions during operations were not available at this stage. Based on the specialist's experience, these were assumed to be immaterial relative to the magnitude of the Category 3 - 6 emissions during construction.

²⁵ Category 1: Direct GHG emissions and removals; Category 2: Indirect GHG emissions from imported energy; Category 3-6: All other indirect GHG emissions.

Table 7-3: Construction- and operation-related emissions for the proposed Hoogland Wind Farm Project (maximum of 30 turbines)

ACTIVITY	CONSTRUCTION EMISSIONS (TCO ₂ E)	ANNUAL OPERATIONAL GHG EMISSIONS (TCO ₂ E/A)	EMISSIONS OVER THE LIFE OF PLANT (TCO ₂ E)
Per Wind Turbine			
Construction Category 1	*		*
Construction Category 3-6	2 100		2 100
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Turbine	2 100	*	2 100
Per Wind Farm			
Construction Category 1	*		*
Construction Category 3-6	64 000		64 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Farm	64 000	*	64 000
Across all 4 Wind Farms			
Construction Category 1	*		*
Construction Category 3-6	256 000		256 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total across all 4 Wind Farms	256 000	*	256 000

* Data regarding direct emissions during construction and operation (such as onsite fuel combustion in vehicles) as well as indirect emissions during operations were not available at this stage. Based on the specialist's experience, these were assumed to be immaterial relative to the magnitude of the Category 3 - 6 emissions during construction.

Each Wind Farm will only contribute between 64 and 128 ktCO₂e emissions from the construction phase (or 2.1 ktCO₂e per wind turbine), with a total contribution of between 0.25 and 0.5 million tons CO₂e emissions from the construction phase for all four wind farms. Most emissions during the construction phase are associated with the upstream production of construction materials. The emissions that would occur from operating and maintenance activities are negligible.

South Africa's grid is expected to decarbonise in the future. However, it will still rely heavily on GHG intensive technologies, such as coal-fired power stations and gas-to-power technologies. The Hoogland Wind Farm Project will contribute renewable energy onto the grid to replace the use of energy from GHG intensive technologies. This will lead to avoided emissions. Over the lifetime of the project, the avoided emissions are approximately between 5.8 and 11.6 million tonnes CO₂e of emissions per Wind Farm (for a range of 30 to 60 turbines). This equates to 23.2 to 46.3 million tons CO₂e of emissions for the four Wind Farms (or 41 000 tonnes CO₂e per MW installed).

Overall, the Hoogland Wind Farm Projects (all four) project will lead to between approximately 0.25 and 0.5 million tons CO₂e of emissions associated with the construction of the Wind Farms. These emissions are insignificant relative the potential avoided emissions of between 23.2 and 46.3 million tons CO₂e. This results in net avoided emissions of between 22.9 and 45.8 million tons CO₂e.

Table 7-4: All Phases: Impact of the Project on Climate Change for 30-60 turbines

Issue	Climate change impacts of the Hoogland Wind Farm Project.	
Description of Impact		
The Hoogland Wind Farms will have emissions relating to the construction phase of the project. The emissions during the operational phase are negligible. The magnitude of the impact of the Hoogland Wind Farm Project's GHG emissions during construction is determined in Table 7-2 (60 turbines) and Table 7-3 (30 turbines). However, during the operation of the Project, the electricity generated by the Project will displace the use of more emission intensive technologies, such as coal-fired power stations. The magnitude of the impact of the Hoogland Wind Farm Project's avoided GHG emissions during operation is quantified as between 23.2 and 46.3 million tons CO ₂ e of emissions (the former being based on 30 turbines, the latter being based on 60 turbines per wind farm).		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	N/A
Duration	Permanent	N/A
Extent	International	N/A
Consequence	Very High	N/A
Probability	Definite / Continuous	N/A
Significance	Very High +	N/A
Degree to which impact can be reversed	N/A	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	The Hoogland Wind Farms themselves serve as a mitigation to reduce the current level of exhaustion of South Africa's carbon budget as currently experienced through the existing fossil fuel intensive grid.	
Mitigation actions		
The following measures are recommended:	Mitigation measures to address the impact of the Hoogland Wind Farms on climate change is not required as they are classified as renewable energy and therefore overall have an overall impact of very high positive significance.	
Monitoring		
The following monitoring is recommended:	N/A	

7.1.3 Cumulative Impact

According to Promethium (2022), the cumulative impact of these projects on climate change is considered to be very high (+), as although not quantified, the Nuweveld Projects further increase the opportunity for avoided emissions.

7.1.4 No-Go Alternative

The no-go alternative is less preferred than the Project as it is a lost opportunity to reduce the current level of exhaustion of South Africa's carbon budget as currently experienced through the existing fossil fuel intensive grid.

7.1.5 Conclusion and Recommendations

From a climate change perspective, each of the Wind Farms comprising the Hoogland Wind Farm Project should receive authorisation based on the following key aspects:

1. In accordance with South Africa’s Nationally Determined Contribution (NDC) which presents South Africa’s commitment to the Paris Agreement, provision has been made in the Integrated Resources Plan (IRP) for the addition of renewable energy onto the national grid as part of the commitment to decarbonise the grid.
2. The Project increases the renewable energy generating capacity in South Africa and can reduce the reliance of the national grid on GHG intensive technologies, such as coal-fired power stations. If all four wind farms are developed, it will have a positive impact on the country’s GHG inventory and contribute to the inventory by avoiding emission equivalent to between 0.6 to 1.2% of the country’s carbon budget over its lifetime.
3. The Hoogland Wind Farm Project includes the potential for battery storage, which could improve the dispatchability of electricity from the project to the national grid adding to peak generation capacity.

The benefits associated with the Hoogland Wind Farm Project cannot be viewed in isolation. Considering that this is most likely one of the first Climate Change Impact Assessments (CCIA) conducted for a renewable energy project in South Africa, we do not at this time propose any conditions which need to be included in the Environmental Authorisation for the four Hoogland Wind Farms.

7.2 Geotechnical

This section provides a short summary of the desktop geotechnical specialist report compiled by Richard Bradshaw of RABA which is available in *Appendix C2: Geotechnical*.

7.2.1 Baseline description

7.2.1.1 Climate and Soils

RABA (2022) noted that, rock weathering and the formation of residual soils are significantly influenced by the climate. The effect of climate on weathering processes in a particular area can be determined from the climatic N-value as defined by Weinert (1980).

Table 7-5: Border values as proposed by Weinert for different types of weathering

N-value	Types of weathering
N < 2	Wet region, Decomposition of Rock, Montmorillonite (fine) Clay
N > 10	Very arid region, Disintegration of Rock
2 < N < 5	Moderate region, Decomposition of Rock, Kaolinite Clay
10 > N > 5	Dry region, Disintegration of Rock, Very little clay

According to Weinert, physical weathering (disintegration) will predominate in areas where the N-value is larger than 5 and the residual soils are typically only thinly developed. Chemical weathering (decomposition) will predominate in areas where there is a water surplus and N-values are less than 5. Chemical weathering will result in the formation of secondary minerals such as hydromica, clay minerals and sesquioxides. The type of secondary minerals that will develop will depend on the underlying geology, the time the rock has been exposed to weathering processes and climate. The climatic conditions where N-values are less than 5 are therefore typically favourable for the development of a deep soil profile.

The N-values for Beaufort West and Calvinia are 18.4 and 17.6 respectively and the N-value for the site is therefore approximately 18, implying that a shallow soil profile is developed in the area and very shallow bedrock can be expected unless it is covered by alluvium or other transported soils.

7.2.1.2 Topography and Drainage

Based on the 1:50 000 topographic maps, both Hoogland 1 Wind Farm and Hoogland 2 Wind Farm are in areas characterised by generally undulating topography with local ridges and scattered koppies, both formed due to the presence of rocks resistant to erosion. Shallow sloping ground is present between the ridges and koppies with the slope of the ground steepening near and at the positive topographic features.

The study area and in particular Hoogland 2 Wind Farm, is characterised by generally undulating topography with local ridges and scattered koppies, both formed due to the presence of rocks resistant to erosion. Steep, cliff-like ground, 30m to 80m high, runs approximately east-west through the northern part of Hoogland 2 and tapering into Hoogland 1. Another cliff-like area extends along the southeastern boundary of Hoogland 2 and extending a short distance into its central eastern parts. Shallow sloping ground is present between the ridges and kopjes with the slope of the ground steepening near and at the positive topographic features.

Northward draining ephemeral streams occur in several areas in Hoogland 1 Wind Farm and these are commonly fed during periods of rainfall from a local dendritic array of streamlets, but local trellis-type drainage patterns are also present. Similar drainage patterns are developed in Hoogland 2 Wind Farm, but the northward draining streams are less well developed. Several streams coalesce in an area immediately south of Slangfontein farmhouse in the eastern parts of Hoogland 2. The area is illustrated as a yellow coloured alluvial area in Figure 7 10, but in reality the alluvial deposit comprises a series of strip-like occurrences of alluvium either side of approximately northwest-southeast orientated streams and streamlets. Based solely on the plethora of farms with names like Slangfontein and Sterkfontein, either historical or perhaps active springs were or are present in places in the project area.

7.2.1.3 Geology

The bedrock geology at Hoogland 1 and 2 Wind Farms is illustrated on Figure 7-9 which is a portion of the 1:250 000 geological map, 3122 Victoria West which has a short accompanying sheet explanation by Le Roux & Keyser (1988).

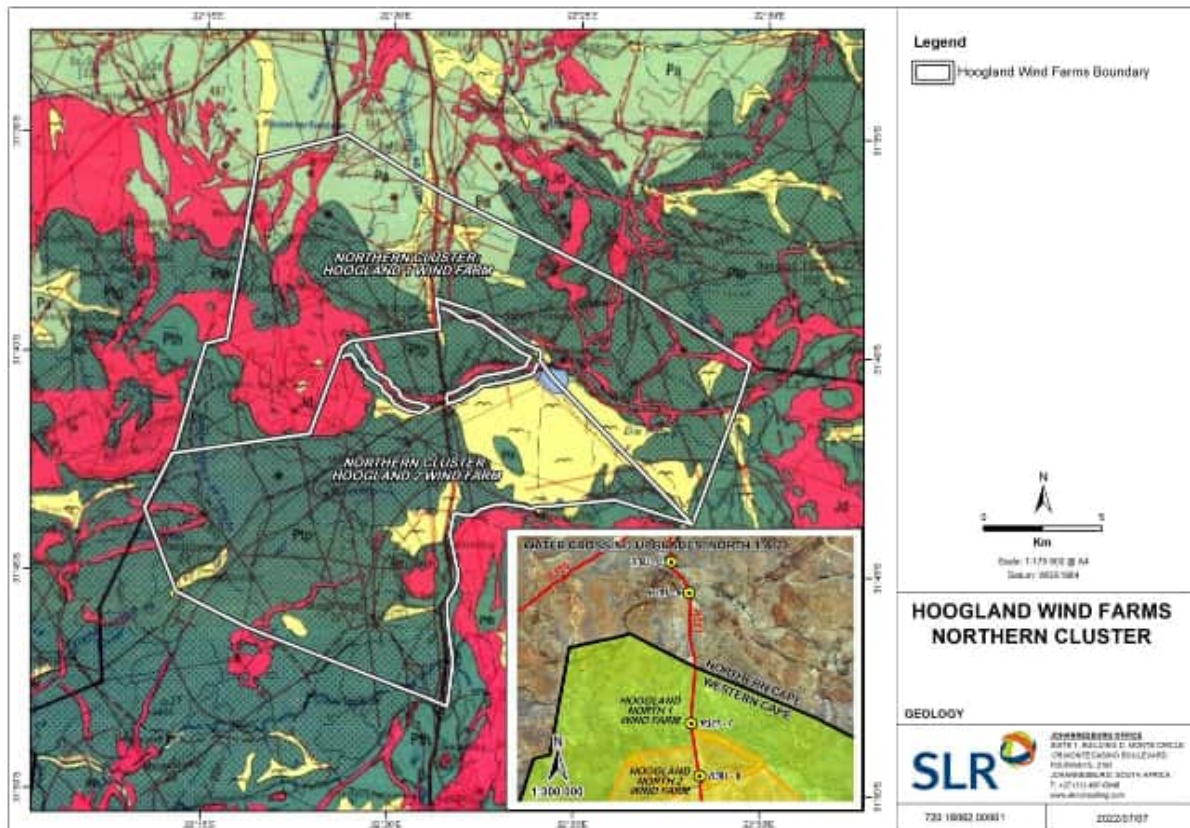


Figure 7-9: Geological Map

The area is situated towards the northern margin of the Main Karoo Basin of South Africa. It is underlain by continental (fluvial, lacustrine) sediments of the Beaufort Group (Karoo Supergroup) of late Middle Permian to early Late Permian age (c. 262-257 Ma). The Beaufort Group in the project area is represented by the Adelaide Subgroup which is sub divided at Hoogland 1 and 2 into the Hoedemaker and Poortjie Members of the Teekloof Formation and by the older Abrahamskraal Formation. The sedimentary rocks are extensively intruded by dolerite of the Karoo Dolerite Suite of Early Jurassic age (c. 183 Ma).

The chronological sequence of formation and the stratigraphic nomenclature of these rocks are as follows:

<i>Caenozoic</i>	Soils (alluvium and talus and scree deposits)			
<i>Jurassic</i>	Dolerite			
}	Hoedemaker Member }	Teekloof }		
<i>Permian</i> }	Poortjie Member }	Formation }	Adelaide }	Beaufort
}		Abrahamskraal }	Subgroup }	Supergroup
}		Formation }		

The mudrock dominated Abrahamskraal Formation (Pa), which is the oldest series of rocks in the area, occurs in the northern central parts of Hoogland 1 Wind Farm. The Poortjie Member (Ptp) comprises mudstones and sandstones which dominates the bedrock geology of Hoogland 2 Wind Farm, and it underlies large areas in the southern half of Hoogland 1 Wind Farm. The younger Hoedemaker Member (Pth) is represented by a higher percentage of red and purple mudstone and thin sandstone bands, and it only occurs in a strip along the southwestern margins of Hoogland 1 Wind Farm. The Beaufort Group sediments are intensively intruded and often

thermally metamorphosed (baked, leached and secondarily mineralized) by an extensive network of dolerite sills and dykes, some of considerable volume.

The dolerite in the project area has mainly intruded as a series of extensive, sub horizontal sills and as subordinate sub vertical dykes. Dolerite outcrop occurs most extensively in the southwestern parts of Hoogland 1 and as sills in its north-eastern parts. By comparison, relatively little dolerite outcrops in Hoogland 2. The dolerites in the project area are commonly characterised by areas of bouldery outcrop. No faults are indicated on the geological series map but lineaments probably representing vertical, or sub vertical, dolerite dykes occur throughout the area. These features are generally orientated either approximately north-south or east-west.

No mining activities have taken place in the project area.

Thicknesses of gravelly to silty Late Cenozoic alluvium are associated with major drainage lines within the combined Hoogland project area (yellow areas in Figure 7-9) and also cover large portions of lower-lying terrain whereas gravelly colluvial deposits (e.g., sandstone and dolerite gravel and boulders) mantle plateau areas and most hill slopes.

7.2.2 Site Sensitivity

Based on the desktop study, the area can be sub divided into three generalized ground or mapping units where similar ground conditions are expected. These units correspond to areas underlain by the sedimentary rocks of the Abrahamskraal Formation and the Hoedemaker and Poortjie Members, the dolerite and the more extensively developed alluvium.

All three units are expected to be suitable for the development of the infrastructure for the Wind Farm provided that standard engineering design and construction measures are adopted to mitigate identified geotechnical constraints.

The ground conditions in the sedimentary ground units is considered most suitable for the development due to their relatively geotechnical uniform condition, whereas bouldery and variable conditions might characterize the dolerite. The more extensively developed alluvium will be unconsolidated and potentially loose, and the turbine bases must either be founded on bedrock below the alluvium, provided that it is not thickly developed, or supplementary geotechnical measures such as dynamic compaction or construction of a soil raft must be considered to provide suitable foundations.

Areas which display some sensitivity to the development are illustrated on Figure 7-10.

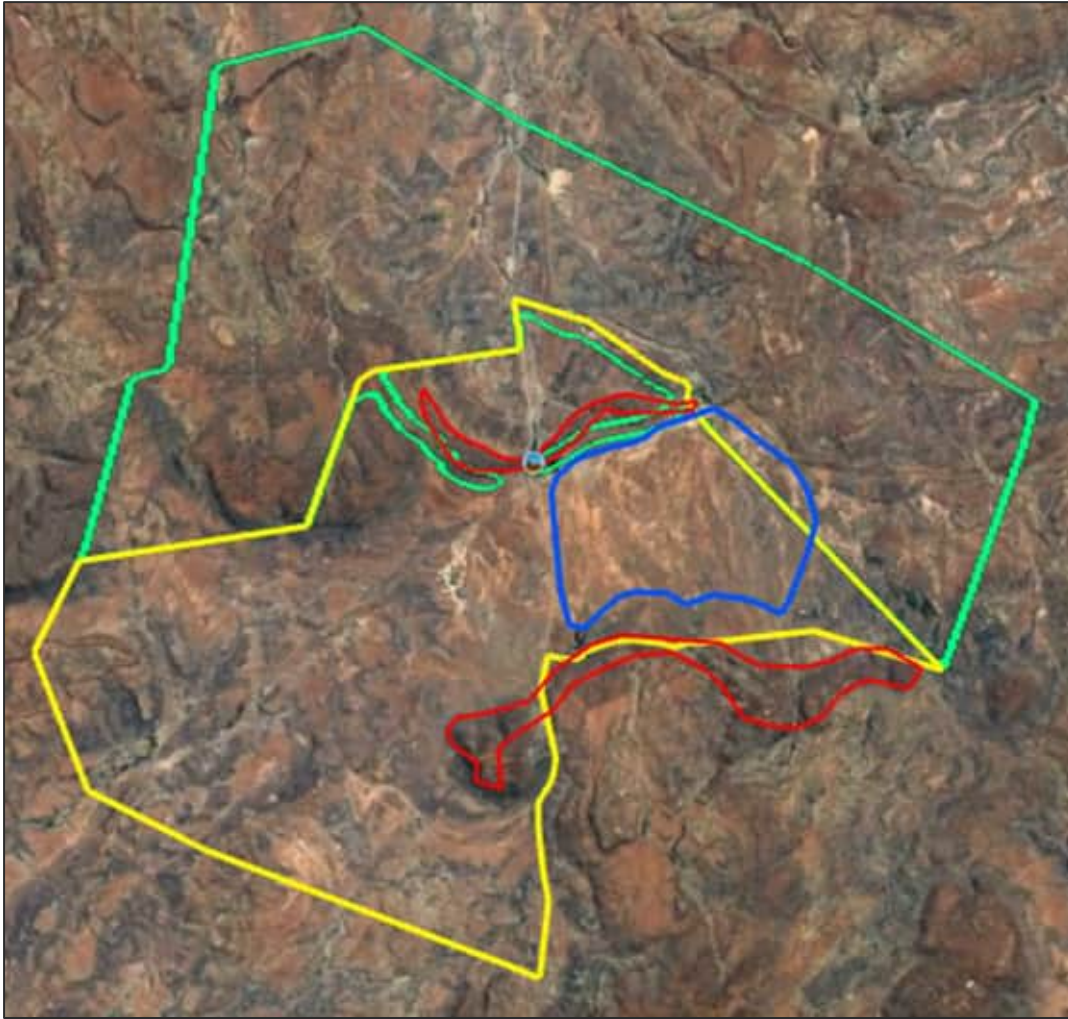


Figure 7-10: Geotechnical Sensitivity Map (yellow: alluvial area: areas of steep ground and green: major changes in elevation)

The alluvial areas variably comprise a series of northerly or northwesterly draining streams with intervening strips and banks of alluvium. In places, the streams coalesce into one defined drainage channel. Only narrow areas in and immediately adjacent to channels are considered highly sensitive from a geotechnical perspective.

The tools available to assess the nature and extent of the alluvium in a desk study are not adequate to enable a detailed assessment of the composition and thickness of the alluvium, but, provided that the turbines are not located within prescribed flood lines to be defined by the Civil Engineer, positioning of turbines in alluvial areas is expected to be acceptable. Detailed topographic survey, hydrological studies and micro siting of turbine positions would be required.

Areas of steep ground and major changes in elevation are indicated in red on Figure 7-10. These areas commonly represent cliff-like features, and the associated very steep slopes result from a capping of the areas by rocks less resistant to weathering such as sandstone and mainly dolerite. The impact of this topography is that turbines must not be located within 30m of 1:4 slopes to ensure the tops of the cliff faces are avoided and that access to some turbines would require circuitous routes to avoid slope constraints. It is noted that in the current layout turbines and their platforms have avoided 1:4 slopes.

Defining the exact extent of the steep, cliff-like areas is extremely difficult from the available, large scale data and refinement of the extent of the occurrences will be required when a detailed topographic survey of the project

area has been undertaken. The topography of the site is variable with local steep slopes and intervening relatively flat ground and significant earthworks are therefore anticipated in places.

The risk of soil erosion is also increased during construction activities by the removal of vegetation and by possible disturbance to the natural surface drainage environment. These activities may prevent infiltration of rainwater, increase stormwater runoff and cause concentration of surface water flow. Erosion will increase the disturbance and displacement of soils and the impact may extend beyond the infrastructure footprints over time.

7.2.3 Impact Assessment and Mitigation

The following geotechnical impacts have been identified and rated by RABA (2022).

7.2.3.1 Construction Phase

Table 7-6: Construction: Ground disturbance

Issue	Ground disturbance during construction	
Description of Impact		
Ground disturbance during earthworks for turbine bases, access roads, platforms and laydown areas.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	High	High
Probability	Definite / Continuous	Definite / Continuous
Significance	High -	Medium -
Degree to which impact can be reversed	The impact is reversible in respect of the laydown areas where the surfacing can be removed and the ground rehabilitated, but the impact will be irreversible for the access roads, cuttings and platform at the individual turbine locations during the operational phase.	
Degree to which impact may cause irreplaceable loss of resources	The access roads, cuttings, platforms and turbine base areas will be irreplaceably lost during the operational phase.	
Degree to which impact can be mitigated	The impact in the laydown areas can be mitigated and significant mitigation around the turbine bases is possible.	
Mitigation actions		
The following measures are recommended:	The surfacing must be removed in the laydown areas and the ground rehabilitated.	
Monitoring		
The following monitoring is recommended:	No specific monitoring is required except for the normal weekly check inspections by the Resident Engineer and ECO/ESO.	

Table 7-7: Construction: Soil erosion

Issue	Soil erosion during construction	
Description of Impact		
Erosion due to clearing of vegetation and alteration of natural drainage		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	

Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Permanent	Short-term
Extent	Site	Site
Consequence	High	Low
Probability	Probable	Unlikely / improbable
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact can be mitigated but noting that loss of topsoil is irreversible in this environment respect of the turbine bases, the laydown areas, platforms and access roads even after the ground has been rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	Topsoil is very thinly developed or absent in this environment and therefore difficult to replace if extensive erosion occurs.	
Degree to which impact can be mitigated	The impact in the areas described above can be mitigated.	
Mitigation actions		
The following measures are recommended:	Temporary berms and drainage channels to divert water, where required, that rehabilitation of disturbed areas is undertaken timeously, that the designs of the road and site drainage are undertaken correctly, and only designated access routes are used for trafficking around the site.	
Monitoring		
The following monitoring is recommended:	Routine monitoring of the construction of mitigating measures is required by the Resident Engineer and ESO/ECO on the site.	

7.2.3.2 Operational Phase

Table 7-8: Operation: Soil erosion

Issue	Soil erosion during operational phase	
Description of Impact		
Increased erosion due to alteration of natural drainage		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Permanent	Long-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact is reversible in respect of the laydown areas after the ground has been rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	This impact will not lead to irreplaceable loss of resources provided that the mitigation actions indicated below are adopted.	
Degree to which impact can be mitigated	The impact in the laydown areas can be mitigated.	
Mitigation actions		
The following measures are recommended:	Maintain drainage channels and other drainage structures such as culverts. Monitor for erosion and remediate and rehabilitate timeously.	

Monitoring	
The following monitoring is recommended:	Routine monitoring by Site Staff during the operational phase. Add the requirement to the standard operating procedures for the site.

7.2.3.3 Decommissioning Phase

Table 7-9: Decommissioning: Ground disturbance

Issue	Ground disturbance during decommissioning	
Description of Impact		
Ground disturbance during earthworks to remove platforms, turbine bases, road rehabilitation and removal of surface and sub surface structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Medium	High
Probability	Definite / Continuous	Definite / Continuous
Significance	High -	Medium -
Degree to which impact can be reversed	The impact is reversible but the rehabilitation period over the areas in which degradation has occurred will be slow in this arid environment where indigenous vegetation is not extensively developed.	
Degree to which impact may cause irreplaceable loss of resources	In the long-term, resources (the use of land) will not be irreplaceably lost but as indicated above, slow rehabilitation of vegetation is expected.	
Degree to which impact can be mitigated	The impact can be mitigated with the limitation regarding re-growth of vegetation mentioned above.	
Mitigation actions		
The following measures are recommended:	The natural site topography must be restored as fully as possible, and landscaping and rehabilitation of disturbed areas must be undertaken timeously.	
Monitoring		
The following monitoring is recommended:	Routine monitoring by Site Staff and ESO/ECO during the decommissioning phase.	

Table 7-10: Decommissioning: Soil erosion

Issue	Soil erosion during decommissioning stage	
Description of Impact		
Increased erosion due to ground disturbance during rehabilitation activities		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Permanent	Short-term
Extent	Site	Site

Consequence	Medium	Medium
Probability	Probable	Possible / frequent
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact is reversible in respect of the laydown and platform areas, roads and turbine bases after the ground has been rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	This impact will not lead to irreplaceable loss of resources provided that the mitigation actions indicated below are adopted.	
Degree to which impact can be mitigated	The impact can be mitigated as described below.	
Mitigation actions		
The following measures are recommended:	Temporary berms and drainage channels to divert surface water where needed. The natural site topography should be restored wherever possible. Use of designated access routes to minimise the disturbance in surrounding areas.	
Monitoring		
The following monitoring is recommended:	Routine weekly monitoring by Site Staff and Environmental Practitioners during the decommissioning phase and at four monthly intervals thereafter until final sign-off is achieved.	

7.2.4 Cumulative Impact

The following cumulative impacts have been identified and rated by RABA (2022):

Table 7-11: Cumulative impact: ground disturbance during construction

Issue	Ground disturbance during construction	
Nature of cumulative impacts	As indicated in Table 2-2, 165.7Ha of land will be temporarily disturbed in Hoogland 1 and 306.7Ha permanently impacted. The areas in Hoogland 2 are 136.3Ha (temporary) and 300.9Ha (permanent). Mitigation measures can be successfully undertaken for the temporarily disturbed areas such as the laydown areas but the changes in other areas will be impossible to reverse during the lifetime of the project.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-12: Cumulative impact: soil erosion during construction

Issue	Soil erosion during construction	
Nature of cumulative impacts	Provided that the mitigating measures described in the impact tables above are instituted, the cumulative effect of the project on soil erosion is considered low and issues arising during construction can be mitigated or obviated by the mitigating measures.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-13: Cumulative impact: ground disturbance during the operational phase

Issue	Soil erosion during operational phase	
Nature of cumulative impacts	Provided that the maintenance and monitoring measures described in the impact tables above are instituted, the cumulative effect on the project is considered low.	

Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-14: Cumulative impact: ground disturbance during decommissioning

Issue	Ground disturbance during decommissioning	
Nature of cumulative impacts	Provided that the mitigation measures including the rehabilitation described in the impact tables above and the on-site monitoring are undertaken, the cumulative effect on the project is considered low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-15: Cumulative impact: soil erosion during decommissioning

Issue	Soil erosion during decommissioning stage	
Nature of cumulative impacts	Provided that the mitigation measures including the rehabilitation described in the impact tables above and the on-site monitoring are undertaken, the cumulative effect on the project is considered low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.2.5 No-Go Alternative

The ‘no-go’ alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail. In geological or geotechnical terms, this impact has been assessed as neutral since no changes can be expected.

In terms of the layout, no geologically or geotechnically sensitive areas were identified within the study area. Whereas the areas underlain by the sedimentary rocks are considered geotechnically marginally more suitable for the development than those areas underlain by dolerite and particularly by alluvium, other factors are likely to be more critical in determining the final layout. No preferences for the final layout within the area assist are therefore provided.

7.2.6 Conclusion and Recommendations

From a geotechnical and geological perspective, no fatal flaws, major sensitivities, or areas to be avoided completely have been identified within the area assessed for Hoogland 1 and Hoogland 2 Wind Farms. Sensitive areas have been identified but normal civil engineering and construction best practice and optimisation of the positions of the turbine positions and access roads will address the potential issues in these areas. It is therefore recommended that the proposed activity be authorised subject to adoption of the mitigating and monitoring measures outlined in this report.

7.3 Agriculture

This section provides a short summary of the agricultural specialist report, in the form of a Compliance Statement compiled by Johann Lanz which is available in *Appendix C3: Agriculture*.

7.3.1 Baseline Description

According to Lanz (2022), the aim of the Protocol for the Specialist Assessment and Minimum Report Content Requirements of Environmental Impacts on Agricultural Resources is to preserve valuable agricultural land for agricultural production. Valuable land is considered to be predominantly scarce arable land that is suitable for the viable production of cultivated crops.

Lanz (2022) states that an average rainfall as low as 190mm and high evaporation of between 1,250 and 1,350 mm per annum, proves the area to be arid and the proposed site is significantly constrained in terms of its possible agricultural productivity (including grazing). In addition, the land type data shows the dominant soils to be shallow soils on underlying rock or hard-pan carbonate. A low to medium agricultural sensitivity is entirely appropriate for this land which is unsuitable for crop production.

Agricultural infrastructure of the area includes wind pumps, stock watering points, several small farm dams are located at the Wind Farm sites, fencing, and farm complexes. Grazing of both sheep and game is the dominant agricultural land use in the area. Grazing capacity of the site is fairly low at 26 to 28 hectares per large stock unit. There is almost no cultivation in the area and what there is, is confined to small, isolated patches of pasture or fodder crops around farmsteads.

7.3.2 Site Sensitivity

While the Hoogland Wind Farms have been classified by the DFFE National Screening tool as being sensitive, this classification was on the basis of the presence of crop boundaries. Lanz (2022) advised that the avoidance of mapped crop boundaries (cultivated fields) would decrease the sensitivity low, and this was taken into consideration in the design of the layouts.

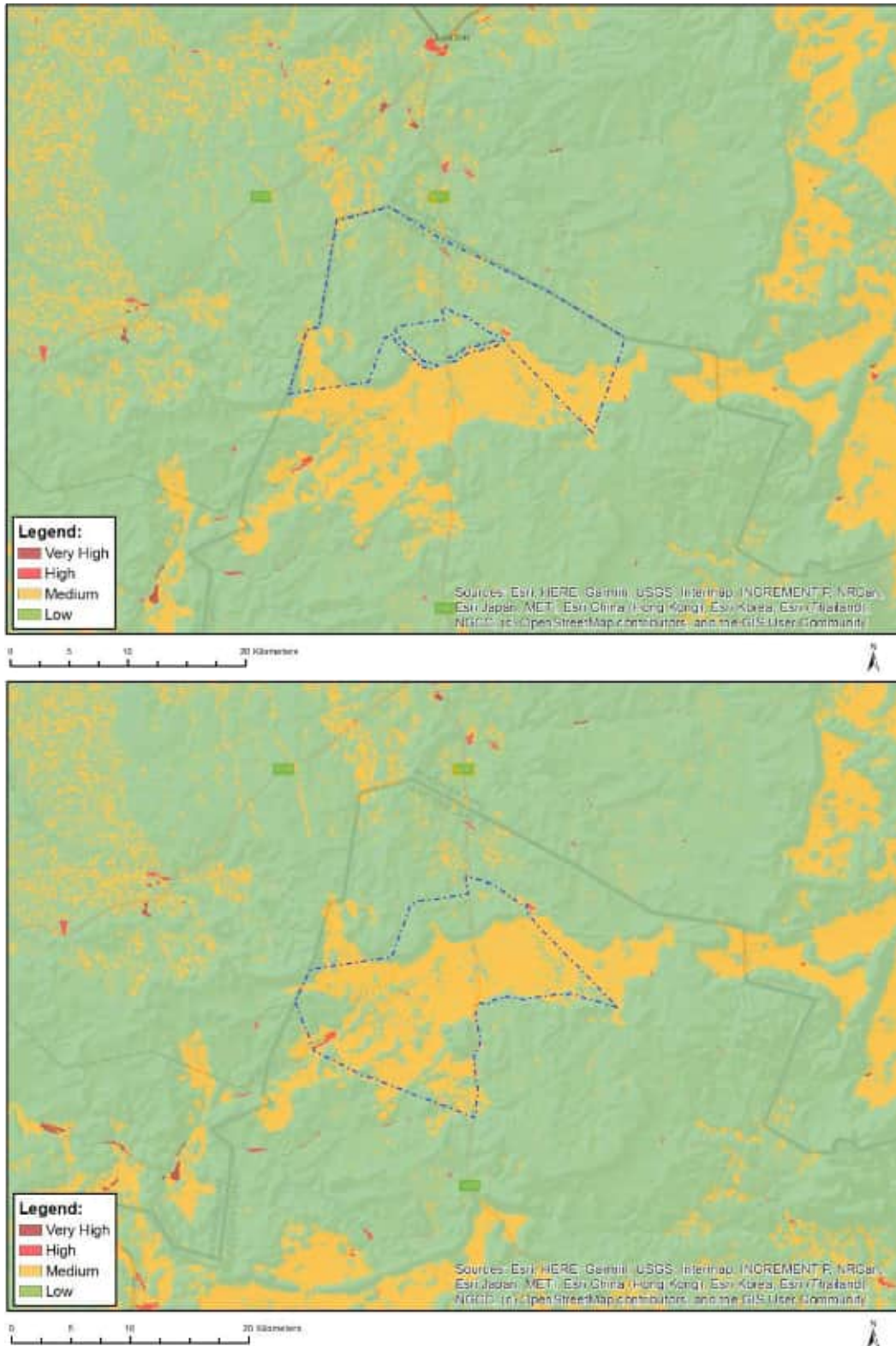


Figure 7-11: Map of relative agriculture theme sensitivity for Hoogland 1 Wind Farm (top) and Hoogland 2 Wind Farm (bottom). High sensitivity shown in red

Agricultural sensitivity, in terms of environmental impact, and as used in the national web-based environmental screening tool, is a direct function of the capability of the land for agricultural production. This is because a negative impact, or exclusion of agriculture, on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. The general assessment of agricultural sensitivity that is

employed in the national web-based environmental screening tool, identifies all arable land that can support viable production of cultivated crops, as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable production of cultivated crops is much less of a priority to conserve for agricultural use and is rated as medium or low agricultural sensitivity.

The Screening Tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is cultivated or not. All cultivated land is classified as at least high sensitivity, based on the logic that if it is under cultivation, it is indeed suitable for cultivation, irrespective of its land capability rating.

The Screening Tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability values (≥ 8 to 15) are likely to be suitable as arable land for the production of cultivated crops, while lower values are only likely to be suitable as non-arable, grazing land, or at the lowest extreme, not even suitable for grazing.

A map of the proposed agricultural footprint of the development, which is the total footprint of the facility that actually excludes agricultural land use, overlaid on the screening tool sensitivity is given in Figure 7-12. Within the development area there are small, isolated patches of cultivation around farmsteads that are classified as cultivated land and therefore allocated high agricultural sensitivity because of it (red in Figure 7-12). The Wind Farm footprint entirely avoids all of these areas, and this was purposefully considered in the design. Across the rest of the site, agricultural sensitivity is purely a function of land capability. The land capability of the site on the screening tool is predominantly 5 and 6 but varies from 1 to 7. Values of 1 to 5 translate to a low agricultural sensitivity, and values of 6 to 7 translate to a medium agricultural sensitivity.

Because the environment is unsuited to cultivation, the differences in land capability across the project area are not very significant and are more a function of how the land capability data is generated by modelling, and strongly influenced by terrain in this environment, than actual meaningful differences in agricultural potential on the ground.

The Site Sensitivity Verification by Lanz (2022) verifies the entire agricultural footprint as being of less than high agricultural sensitivity. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement (refer to *Appendix C3: Agriculture*).

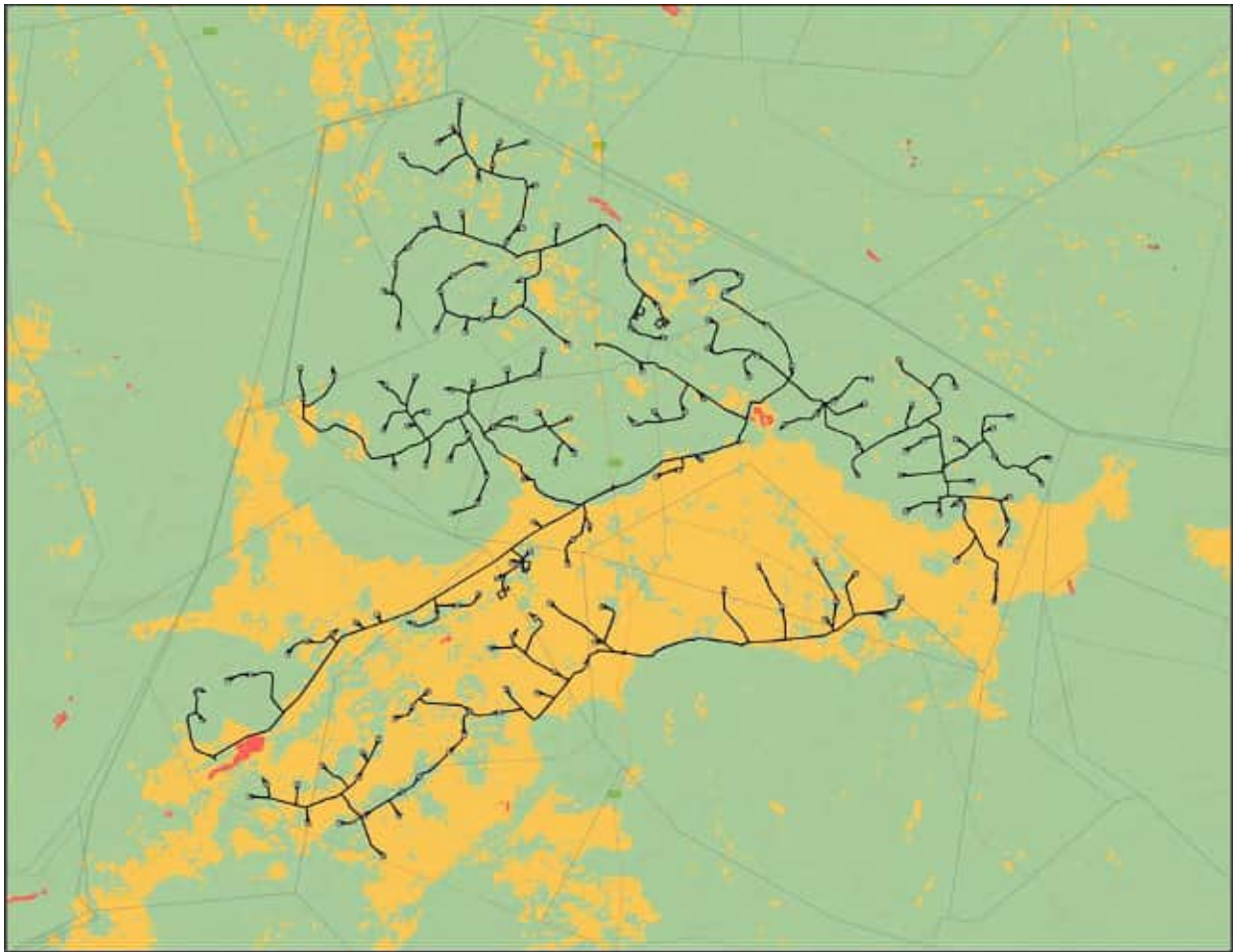


Figure 7-12: The proposed footprint of the facilities, overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high).

7.3.3 Impact Assessment and Mitigation

For reasons explained above a Compliance Statement has been compiled which does not require an assessment in accordance with the NEMA compliant SLR methodology.

7.3.3.1 Impacts

Three potential negative direct agricultural impacts have been identified and described below:

1. Loss of agricultural potential by occupation of land - Agricultural land directly occupied by the development infrastructure will become unavailable for agricultural use, with consequent potential loss of agricultural productivity and employment. This impact is relevant only in the construction phase. No further loss of agricultural land use occurs in subsequent phases. Only an insignificant proportion (0.77%) of the available agricultural land is impacted in this way.
2. Loss of agricultural potential by soil degradation – Soil can be degraded by impacts in two different ways: erosion and topsoil loss. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Soil degradation will reduce the ability of the soil to support vegetation growth. This impact occurs only during the construction and decommissioning phases. Although the site is susceptible to soil erosion, it can be completely managed

with an effective erosion management plan. Because the agricultural footprint impacts such a small proportion of the land, it only has the possibility to cause degradation on a very small proportion of the land.

3. Loss of agricultural potential by dust generation – The disturbance of the soil surface, particularly during construction, will generate dust that can negatively impact surrounding veld and farm animals.

One positive agricultural impact has been identified, that is an indirect impact:

1. Enhanced agricultural potential through increased financial security for farming operations - Reliable income will be generated through the lease of the land to the energy facility. This is likely to increase cash flow and financial security of landowners and could improve farming operations and productivity through increased investment into farming.

The extent to which any of these impacts is likely to affect levels of agricultural production is very small and the significance of all agricultural impacts is therefore very low.

7.3.3.2 Mitigation

1. Design an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion. This is included in the stormwater management plan.
2. Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.

If an activity will mechanically disturb the soil 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. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.

7.3.4 Cumulative Impact

According to Lanz (2022), the potential cumulative agricultural impact of importance is a regional loss (including by degradation) of agricultural land, with a consequent decrease in agricultural production.

In quantifying the cumulative impact, the area of land taken out of grazing as a result of all of these projects will amount to a total of 816 hectares. As a proportion of the total area within a 30 km radius (approximately 282,700 ha), this amounts to only 0.29% of the surface area. That is considered to be within an acceptable limit in terms of loss of agricultural land that is only suitable for grazing, of which there is no scarcity in the country.

The risk of a loss of agricultural potential by soil degradation is low because it can effectively be mitigated for renewable energy developments. If the risk for each individual development is low, then the cumulative risk is also low.

Furthermore, there are no significant other land uses, apart from renewable energy, that are competing for agricultural land in the area, and so the total cumulative loss of agricultural land from all competing land uses is not significantly higher than what has been considered above.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use is assessed as being very low and will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

7.3.5 No-Go Alternative

Lanz (2022) states that the no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The one identified potential impact is that due to continued low rainfall in the area, which is likely to be exacerbated by climate change, agriculture in the area will come under increased pressure in terms of economic viability.

The development offers an additional income source to agriculture, without excluding agriculture from the land. Therefore, the negative agricultural impact of the no-go alternative is more significant than that of the development, and so, purely from an agricultural impact perspective, the proposed development is the preferred alternative between the development and the no-go.

7.3.6 Conclusion and Recommendations

All agricultural impacts of the proposed Hoogland 1 and Hoogland 2 Wind Farms are assessed as being of very low significance. However, an Agricultural Compliance Statement is not required to formally rate agricultural impacts. It is only required to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site. It must provide a substantiated statement on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development.

The conclusion of this assessment is that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the following points:

- The proposed development will occupy land that is of very limited land capability, is only suitable as grazing land, and is unsuitable for the production of cultivated crops. There is not a scarcity of such agricultural land in South Africa and its conservation for agriculture is not therefore a priority.
- The amount of agricultural land loss is well within the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with low agricultural production potential.
- The proposed development poses a low risk in terms of causing soil degradation, and only to a very small proportion of the land. Degradation can be adequately and easily managed by mitigation management actions. In addition, the degradation risk is only to land of low agricultural value, and the significance of the impact is therefore low.
- The proposed development offers some positive impact on agriculture by way of improved financial security for farming operations, as well as wider, societal benefits.

Therefore, from an agricultural impact point of view, it is recommended that the Hoogland 1 and Hoogland 2 Wind Farms be approved.

7.4 Terrestrial Ecology

This section provides a short summary of the suite of terrestrial ecology reports compiled largely by Simon Todd of 3Foxes Biodiversity Solutions and supplemented by Marius Burger of Sungazer Faunal Surveys.

Terrestrial ecology includes high level floral and faunal (reptile, mammal and amphibians) components of the environment and the study has been guided by the requirements of the DFFE Screening Tool outputs. This section therefore includes the findings of a Terrestrial Biodiversity Impact Assessment (*Appendix C4: Terrestrial Ecology*), a detailed standalone Plant species compliance statement (*Appendix C5: Flora*), a Riverine Rabbit species assessment report (*Appendix C6: Riverine Rabbit*) all compiled by 3Foxes Biodiversity Solutions as well as a Karoo Dwarf tortoise species assessment report (*Appendix C7: Karoo Dwarf Tortoise*) compiled by Marius Burger of

Sungazer Faunal Surveys. The findings of these reports have been considered in Sections 7.4.1.3, 7.4.1.3.1 and 7.4.1.3.2 respectively, to provide a comprehensive holistic representation of the various terrestrial ecological findings.

Bats (refer to Section 7.5) and Avifauna (refer to Section 7.6) findings have been excluded from this section and are dealt with separately since this is a different specialist field of expertise. Aquatic ecology has also been considered separately in Section 7.7.

7.4.1 Baseline Description

Simon Todd of 3Foxes visited the site in April 2021, September 2021, February 2022, March 2022 and June 2022, spending 16 days on site, furthermore the Nuweveld component was visited on four occasions between June 2019 and February 2020. Herpetological specialist Marius Burger of Sungazer Faunal Surveys visited the site between 21 to 27 September 2021. During these visits, various sensitive areas (identified via aerial imagery) were investigated and ground-truthed. Activities also included installation of 48 camera traps placed to monitor Riverine Rabbit and other mammal activity in the field in June 2021 and retrieved in- June 2022 giving rise to 12 months of camera trapping to inform the study.

7.4.1.1 Vegetation Types

The National Vegetation Map (Mucina & Rutherford 2006 & SANBI 2018 update) for the study area is depicted below in Figure 7-13. The whole of the Hoogland Northern Cluster is classified as Eastern Upper Karoo vegetation type. This is clearly an oversimplification of the vegetation of the site and based on work on the adjacent Nuweveld site as well as the on-site field assessment, there are extensive tracts of Upper Karoo Hardeveld at the site, as well as fairly extensive areas of riparian vegetation which would currently fall into the Bushmanland Vloere vegetation type but are more-closely allied to the Southern Karoo Riviere vegetation type. These vegetation types are described and illustrated briefly below as observed at the site.

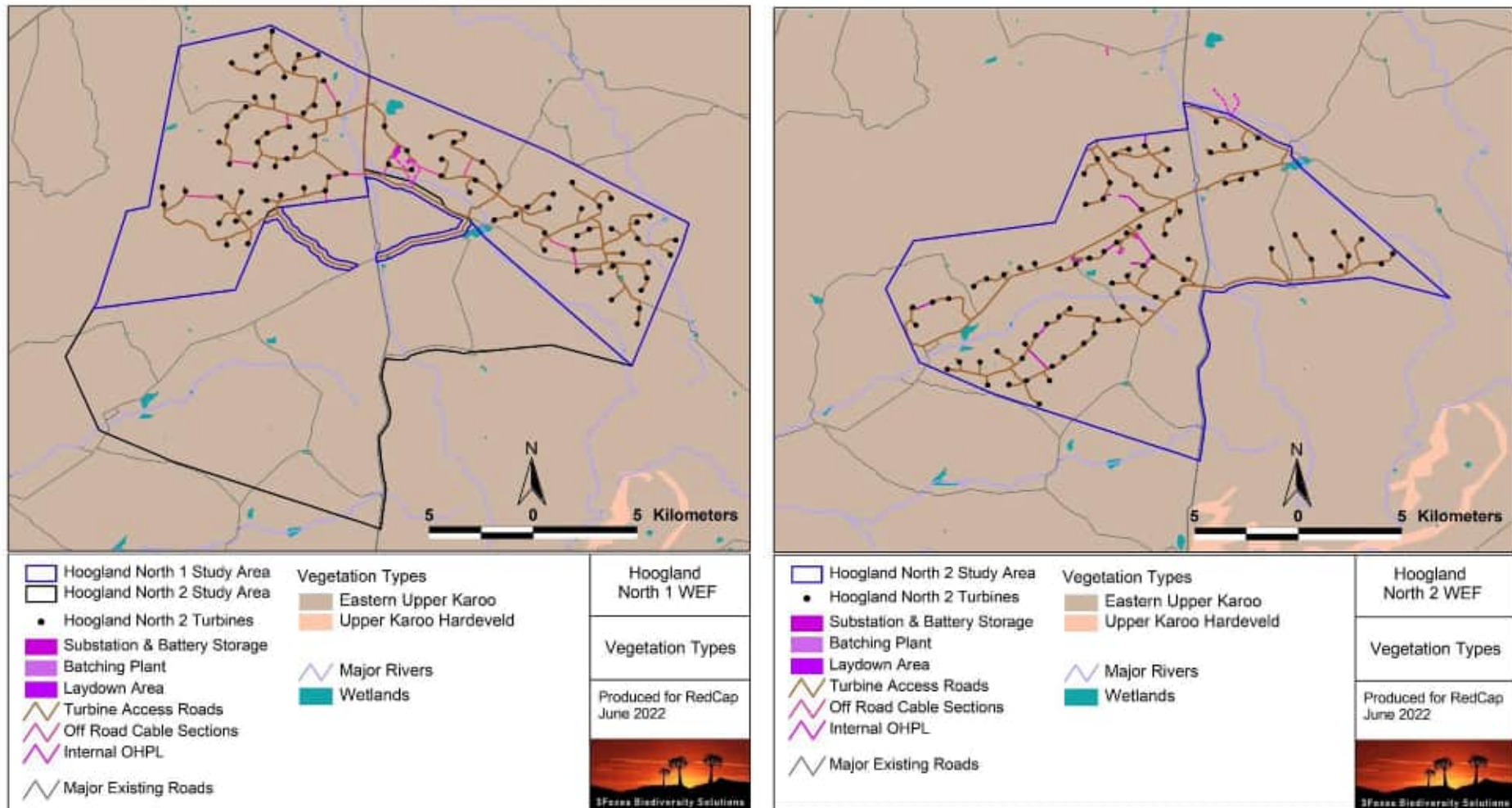


Figure 7-13: The National Vegetation Map (SANBI 2018 Update) for the Hoogland North 1 Wind Farm (left) and Hoogland North 2 Wind Farm (right) and surrounding area

7.4.1.1.1 Eastern Upper Karoo

Both Hoogland North 1 Wind Farm and Hoogland North 2 Wind Farm site are mapped entirely as Eastern Upper Karoo vegetation type. Eastern Upper Karoo has an extent of 49 821 km² and is the most extensive vegetation type in South Africa and forms a large proportion of the central and eastern Nama Karoo Biome. This vegetation type is classified as Least Threatened, and about 2% of the original extent has been transformed largely for intensive agriculture. Eastern Upper Karoo is however poorly protected and less than 1% of the 21% target has been formally conserved. Mucina & Rutherford (2006) list eight endemic species for this vegetation type, which considering that it is the most extensive unit in the country, is not very high. As a result, this is not considered to represent a sensitive vegetation type.

Within the study area, this is the dominant vegetation type and forms the matrix in which the other vegetation units are embedded. There is however a fairly large degree of variation in the structure and composition of Eastern Upper Karoo within the site, driven largely by the substrate conditions, with the main differences being associated with dolerite-derived soils vs. shale and mudstone- derived soils. Overall, these tend to be represented by large tracts of fairly homogenous landscapes of low plant diversity. Dominant and characteristic species include low woody shrubs such as *Pentzia globosa*, *Rosenia humulis*, *Asparagus capensis*, *Eriocephalus ericoides*, *Pteronia sordida*, *Pteronia incana*, *Plinthus karoicus*, *Helichrysum luciloides*, *Felicia muricata*, with a varying density of low succulent shrubs such as *Roepera lichtensteinii*, *Aridaria noctiflora* and *Ruschia spinosa*, with a variable grass layer dominated by *Aristida adscensionis*, *Stipagrostis ciliata*, *Stipagrostis obtusa*, *Enneapogon desvauxii* and *Tragus berteronianus*.





Figure 7-14: Typical open plains present in the Hoogland North 1 Wind Farm (top) and Hoogland North 2 Wind Farm (bottom) study areas, corresponding with the Eastern Upper Karoo vegetation type. The typical plains of the study area are considered low sensitivity and considered suitable for Wind Farm development

7.4.1.1.2 Upper Karoo Hardeveld

Although there are no areas mapped under the Vegmap as Upper Karoo Hardeveld within the site, the majority of dolerite hills within the site can be considered to represent this vegetation type. The Upper Karoo Hardeveld vegetation type is associated with 11 734 km² of the steep slopes of koppies, buttes mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation type occurs as discrete areas associated with slopes and ridges from Middelpos in the west and Strydenburg, Richmond and Nieu-Bethesda in the east, as well as most south-facing slopes and crests of the Great Escarpment between Teekloofpas and eastwards to Graaff-Reinet. Altitude varies from 1000-1900m. Mucina & Rutherford (2006) list 17 species known to be endemic to the vegetation type. This is a high number given the wide distribution of most karoo species and illustrates the relative sensitivity of this vegetation type compared to the surrounding Eastern Upper Karoo.

Most of the hills, outcrops and steep slopes within the Hoogland North site consist of Upper Karoo Hardeveld and this unit has been significantly under-mapped within the national vegetation map. This vegetation type usually consists of very rocky ground and is often associated with steep slopes, with the result that it is considered vulnerable to disturbance but is also an important habitat for fauna. Although it contains a higher diversity of species than the adjacent areas of Eastern Upper Karoo, no red-listed plant species were observed within these areas. Thus, while the rocky hills are considered sensitive from an overall ecological perspective, no particular plant species of concern were observed within this habitat.



Figure 7-15: Dolerite ridges within the Hoogland North 1 Wind Farm (left) and Hoogland North 2 Wind Farm (right), with the Upper Karoo Hardeveld vegetation type.

7.4.1.1.3 Southern Karoo Riviere

Although not all areas associated with this vegetation type have been mapped in the VegMap, the vegetation along the major rivers within the site corresponds with the Southern Karoo Riviere vegetation type. To the north of the site, the riparian areas are mapped as Bushmanland Vloere in the VegMap, but this is not an appropriate designation for these areas and the riparian areas within the site and within the upper Sak and Krom rivers more generally, corresponds better with the Southern Karoo Riviere vegetation type. The Southern Karoo Riviere vegetation type is associated with the rivers of the central karoo such as the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers. About 12% has been transformed as a result of intensive agriculture and the construction of dams. Although it is classified as Least Threatened, it is associated with rivers and drainage lines and as such represents areas that are considered ecologically significant. Common and dominant species in the drainage lines and within the adjacent floodplain vegetation include *Sporobolus ioclados*, *Helichrysum pentzioides*, *Drosanthemum lique*, *Pentzia globosa*, *Salsola aphylla*, *Tribulis terrestris*, *Felicia muricata*, *Atriplex vestita*, *Roepera retrofractum*, *Cynodon dactylon*, *Chrysocoma ciliata*, *Stipagostis namaquensis*, *Lycium pumilum*, *Lycium cinereum*, *Artemisia africana*, *Tripteris spinescens*, *Exomis microphylla* and *Derrera denudata*. These areas are considered important for ecological processes and the provision of ecosystem services.



Figure 7-16: Landscape within the Hoogland 1 Wind Farm, illustrating a view over the Slangfontein River, with riparian vegetation along the left bank of the river.

7.4.1.2 Listed Plant Species

As many as 18 red-listed plant species are known from the broad area around the Northern Cluster. The listed species known from the area are provided in Table 7-16 below. Investigation of the list however reveals that at least 6 of these are erroneous and included on the list due to outdated taxonomy and do not in fact occur in the vicinity of the site (Species have been split into several species or they were incorrectly identified at the time). Of the remainder, about half have a reasonable probability of occurring at the site or in the general broader area. None of these species were observed within the site or in the immediate vicinity. While some of these species such as *Cliffortia arborea* are large and conspicuous with the result that it can be confirmed with a relatively high degree of certainty that these species are not present on the site, some of the other species are inconspicuous or only present at certain times of the year, with the result that it is possible that these species are present but have not been observed on the site. While it is not possible to definitively ascertain that these species are not present, a large amount of time has been spent on the site and the degree of uncertainty around the more cryptic species is considered acceptable. Should any of these species be present on the site, it is clear that they would be highly localised and can ultimately be avoided at the preconstruction stage.

Table 7-16: Listed plant species known from the broad area around the Hoogland North site. None of these species were observed at the site.

Family	Species	Status	Probability
GERANIACEAE	<i>Pelargonium chelidonium</i>	EN	Not Observed
ASPHODELACEAE	<i>Kniphofia ensifolia</i> subsp. <i>autumnalis</i>	EN	Incorrect ID
MESEMBRYANTHEMACEAE	<i>Scelletium expansum</i>	VU	Incorrect ID
ROSACEAE	<i>Cliffortia arborea</i>	VU	Not Present
ASPARAGACEAE	<i>Asparagus stipulaceus</i>	NT	Incorrect ID
ASTERACEAE	<i>Gnaphalium declinatum</i>	NT	Incorrect ID
GERANIACEAE	<i>Pelargonium exhibens</i>	NT	Not observed
AMARYLLIDACEAE	<i>Gethyllis longistyla</i>	Rare	Not observed
ASTERACEAE	<i>Phymaspermum schroeteri</i>	Rare	Not observed
CRASSULACEAE	<i>Adromischus humilis</i>	Rare	Not observed
FABACEAE	<i>Lotononis azureoides</i>	Rare	Not observed
LOBELIACEAE	<i>Lobelia eckloniana</i>	Rare	Incorrect ID
MALVACEAE	<i>Anisodonteia malvastroides</i>	Rare	Not observed
ASTERACEAE	<i>Cineraria lobata</i> subsp. <i>lobata</i>	Declining	Not observed
APOCYNACEAE	<i>Duvalia angustiloba</i>	DDD Revised to LC	Not observed
APIACEAE	<i>Annesorhiza filicaulis</i>	DDT	Incorrect ID

7.4.1.3 Faunal Communities

7.4.1.3.1 Mammals

As many as 70 mammals are listed for the wider study area in the MammalMap database, but many of these are introduced or conservation dependent and approximately 48 can be considered to be free-roaming and potentially impacted by the development. This includes several red-listed species including the Riverine Rabbit *Bunolagus monticularis* (CR), Black-footed Cat *Felis nigripes* (VU), Grey Rhebok *Pelea capreolus* (NT), Mountain Reedbuck *Redunca fulvorufula* (EN) and Brown Hyena *Hyaena brunnea* (NT). Based on the camera trapping conducted on the site, only the Riverine Rabbit can only be confirmed present within Hoogland 1. Hoogland 2 has suitable habitat, specifically relatively large intact and contiguous patches of riparian vegetation. An analysis of the potential presence and the possible impact of the development on these species is provided below in Table 7-17.

Table 7-17: Red-listed mammals known from the broad area and their likely presence in the Hoogland Northern Cluster sites and the likely consequence thereof

Species	Status	Likely Presence & Consequence		
		Wider Hoogland Northern Area	Hoogland 1 Wind Farm	Hoogland 2 Wind Farm
Riverine Rabbit <i>Bunolagus monticularis</i>	CR	Confirmed present within the Hoogland 1 Wind Farm, and more widely within the Sak River and along the Krom and these rivers' tributaries.	Confirmed present within the Hoogland 1 site. Common locally within suitable habitat. Significant avoidance and mitigation has been implemented to reduce the impact of the development on this species. Please refer to the Riverine Rabbit Species Assessment for further details.	Confirmed present within the adjacent Hoogland 1 site. Appears to be fairly common within suitable habitat. Although there are some areas of potentially suitable habitat within Hoogland 2, no Riverine Rabbits have been confirmed present within these areas. Significant avoidance and mitigation has been implemented to reduce the impact of the development on this species. Please refer to the Riverine Rabbit Species Assessment for further details.
Black-footed Cat <i>Felis nigripes</i> (VU)	VU	There are historical records from the Hoogland area and it is considered to be possibly present within the Karoo National Park but not confirmed.	This is a secretive species and while it may be present in the area, this species was not detected by the camera traps on adjacent Nuweveld or the Hoogland Northern site to date and it is likely either not present within the site or only rarely present.	
Grey Rhebok <i>Pelea capreolus</i>	NT	This species is confirmed present in the broader area and can commonly be seen in most areas of high-lying ground in the Karoo and along the Great escarpment.	This species has not been detected by the camera traps on either Hoogland North or Nuweveld Wind Farms, suggesting that it does not occur within the study area despite being present along the Nuweveld Escarpment to the south of the current site. This species has a wide distribution in the country and the wind farm is not likely to generate a significant impact on the local population of this species.	
Mountain Reedbuck <i>Redunca fulvorufula</i>	EN	This species is confirmed present in the area, both within the Karoo National Park and more generally in the area, in high-lying areas with good grass cover.	This species has been confirmed present within the adjacent Nuweveld Wind Farms but has not been detected on Hoogland North. This suggests that this species is not present within the Hoogland North site as it is frequently picked up by camera traps within suitable habitat. As with the Grey Rhebok, this species has a large range and it is not likely that the development would generate a large impact on this species.	
Brown Hyena <i>Hyaena brunnea</i>	NT	This species occurs at a naturally low density within the Karoo and is known from a few records from the Karoo National Park but may also roam freely on farmland.	Although this species may pass through the area on occasion, it is considered unlikely to be present on the site on a regular basis and has not been detected by any of the camera trapping conducted in the broad area to date.	

In terms of sensitivity mapping relating more generally to mammals, the riparian areas have been classified as Very High sensitivity based on their value as Riverine Rabbit habitat but also as a result of their general ecological significance (see Section 7.4.1.3.1.1). The rocky hills and steep slopes have been classified as High and Very High sensitivity on account of the value of these areas as habitat for mammals associated with rocky areas and the more general ecological value of these areas.

7.4.1.3.1.1 Riverine Rabbit Species Assessment

A Riverine Rabbit Species Specialist Assessment was compiled Hoogland 1 Wind Farm and Hoogland Wind Farm 2, the findings of which are detailed below.

The Riverine Rabbit was detected only within the Hoogland 1 Wind Farm at five camera trap locations (Figure 7-17). Spatially, all of the observations were restricted to the larger habitat patches distributed along the Slangfontein se Rivier, which supports the idea that this species requires relatively large intact and contiguous patches of riparian vegetation. The smaller patches that were not along the Slangfontein se Rivier, were visibly more degraded and of a poorer quality than those where rabbits were present. This indicates that the rabbits may be quite sensitive to habitat degradation. Voucher images from all cameras with Riverine Rabbit observations have been uploaded onto the iNaturalist platform (<https://www.inaturalist.org/>, Figure 7-17 and Table 7-18).

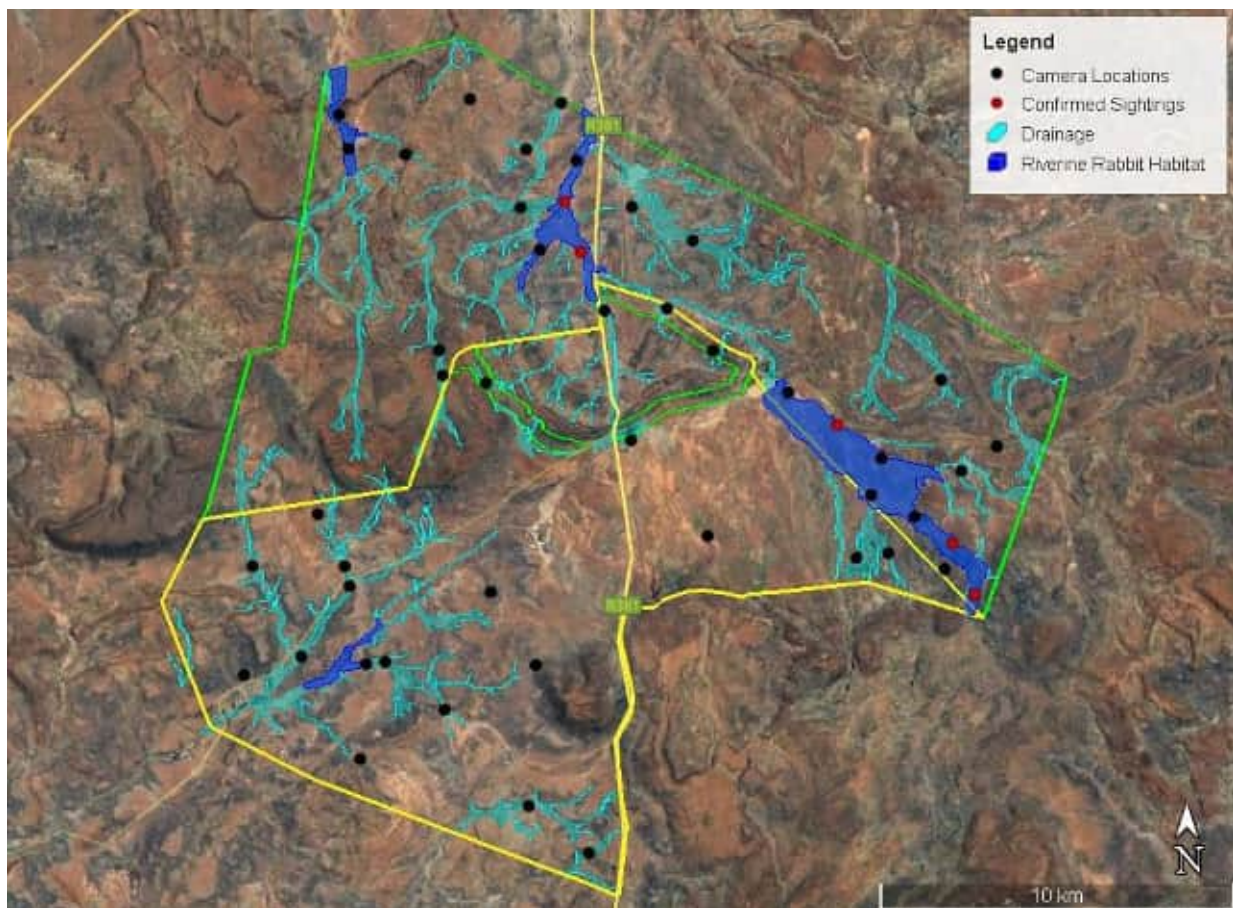


Figure 7-17. Map showing the location of camera traps within the Hoogland Northern Cluster site showing camera locations with confirmed Riverine Rabbit observations in red.



Figure 7-18: Riverine Rabbit images captured at different localities by camera traps within the Hoogland Northern site.

Table 7-18. Camera trap numbers and associated iNaturalist observations of Riverine Rabbits.

Camera Trap Number	iNaturalist Link	Observations
NC12	https://inaturalist.ca/observations/120725779	46
NC6	https://inaturalist.ca/observations/126914624	80
NC32	https://inaturalist.ca/observations/120726436	48
NC2	https://inaturalist.ca/observations/120732249	3
NC34	https://inaturalist.ca/observations/126917642	17

The Riverine Rabbit is endemic to the semi-arid central Karoo region of South Africa. It is associated with dense riparian scrub fringing the seasonal rivers of the region (Figure 7-19). This habitat specificity is assumed to be related to a dependence on soft and deep alluvial soils along the river courses for constructing stable breeding stops. Home range has been estimated as approximately 12 ha (Duthie 1989). Riverine Rabbits are nocturnal, spending daylight hours in a scrape beneath riparian vegetation. They are solitary, and will only be found in breeding pairs for short periods, or in female-juvenile pairs for rearing purposes (Duthie 1989). Results of the current camera trapping exercise indicate that they only come out to forage after dark, but may still be active in the early morning after sunrise.



Figure 7-19. Example of riparian vegetation present within the Hoogland 2 Wind Farm site, with good vegetation cover and plant species indicative of favourable habitat for Riverine Rabbits.

Geographically, Riverine Rabbits occur in two separate populations, with a population centred on the Upper Karoo (the northern population) and a second more-recently discovered population in the Little Karoo (the southern population). Population estimates vary widely and it is clear that a reliable estimate of the overall population size has yet to be made. Duthie et al. (1989) speculated that the remaining habitat might potentially support around 1,435 individuals. This is in contrast to Collins & Du Toit (2016) who estimated an adult population of between 157 and 207 individuals. This latter estimate was however based on an extrapolation from actual observations of rabbits obtained during monitoring transects, which is not a reliable manner of obtaining density estimates as Rabbits are not easily flushed from their scrapes. In addition, there have been some recent range extensions based on observations of Riverine Rabbits from novel areas including from near to the Baviaanskloof in the Eastern Cape (EWT pers. comm.). The 2016 red list assessment indicates that at the time, there were an estimated 12 subpopulations, three in the southern population and nine in the northern population.

Threats to this species include ongoing habitat degradation and fragmentation due to detrimental land-use practices (largely overgrazing and transformation for intensive agriculture), climate change and renewable energy development. It is estimated that 40–60% of the riparian habitat has been lost as a result of cultivation over the past century.

Due to the presence of the Riverine Rabbit at the Hoogland 1 Wind Farm site and the condition and extent of habitat, the areas of habitat within the site are considered to have a High Site Ecological Importance (SEI). The two main areas where Riverine Rabbits occur along the Slangfontein se Rivier are disjunct and it is assumed that Rabbits move between the areas of more extensive suitable habitat along the riparian corridors between these areas. These buffers and corridor linkages between the major habitat patches have been integrated into the turbine no-go layer and this explicitly informs the location of turbines at the site (Figure 7-20). Based on the turbine layout provided for the current assessment, there are no turbines within Riverine Rabbit habitat buffers. All planned roads through the identified areas of habitat have been located along existing major farm access roads, thereby limiting habitat loss to less than 0.5ha. With the implementation of the above avoidance as well as the other recommended mitigation measures, the overall long-term impact of the development on Riverine Rabbits

and their associated habitat is likely to be acceptable and would not be likely to compromise the local or regional population of this species.

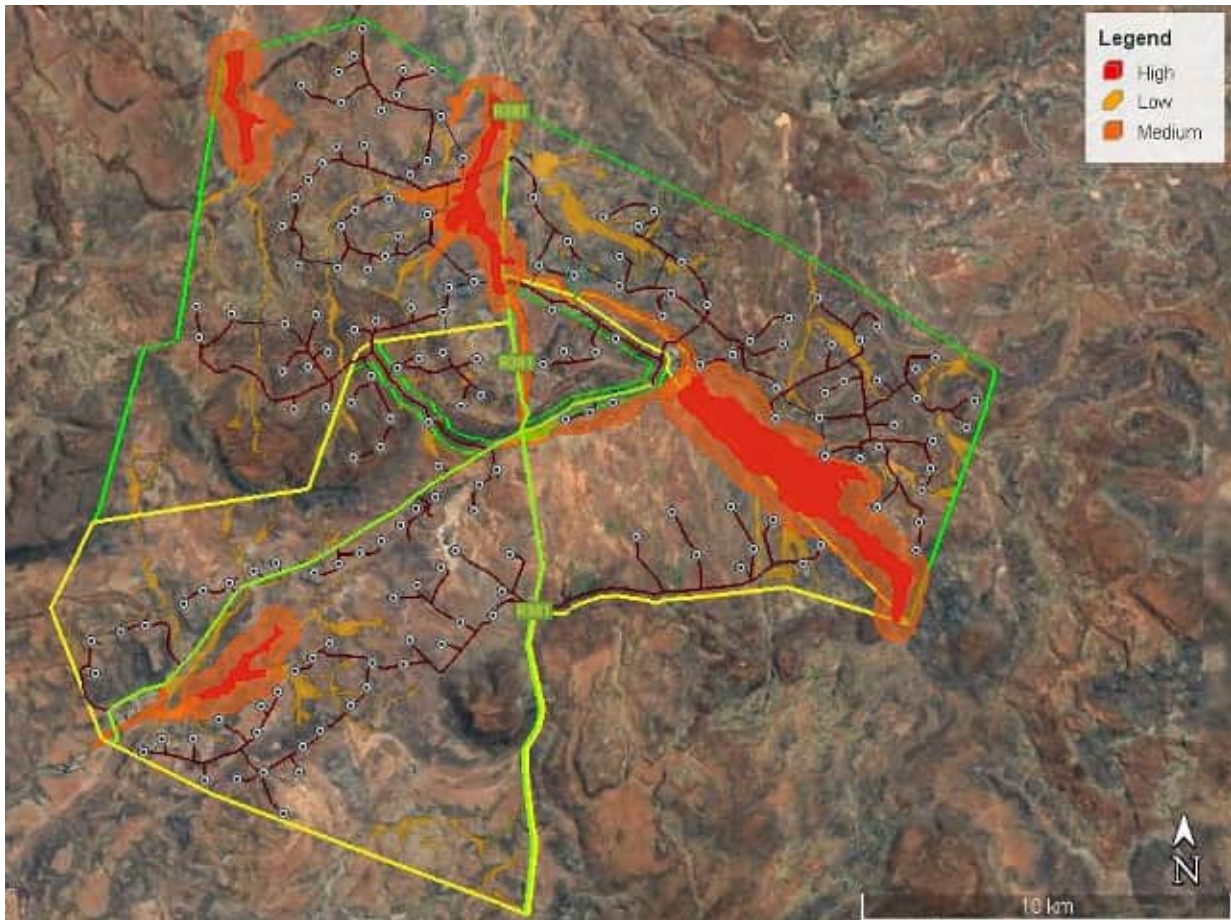


Figure 7-20. Sensitive areas for the Riverine Rabbit within the greater Northern Cluster study area

7.4.1.3.2 Reptiles

Reptile diversity in the wider area is relatively high which can be ascribed to the diversity of habitats present, especially along the Nuweveld escarpment south of the site. Based on the results of the adjacent Nuweveld Wind Farms study, which includes the contribution of the Sungazer (2020) study, approximately 63 reptile species are known from the general region and may potentially occur within the study area, with 14 being of confirmed occurrence, 45 of probable occurrence and four of possible occurrence. Species of potential concern include the local endemic, Braack's Pygmy Gecko and the Karoo Dwarf Tortoise. Braack's Pygmy Gecko *Goggia braacki* is a Western Cape endemic with an extremely restricted distribution range. Most of its distribution is associated with a section of the Hoogland Mountains range within the Karoo National Park. It is however not currently red-listed, but it can perhaps be regarded as the reptile icon for the Hoogland/Beaufort West region. It has thus far, not been recorded in the Hoogland Wind Farms study area, but it may possibly (not probably) be present within the study area.

The only threatened (Red Listed) reptile species in this region is the Karoo Dwarf Tortoise (EN) which is addressed below.

7.4.1.3.2.1 Karoo Dwarf Tortoise Species Assessment

According to Sungazer Faunal Surveys (2022), this small tortoise (max. 110 mm in length) is cryptically coloured seldom observed, and it is often difficult to detect specimens in stony habitat. The Karoo Dwarf Tortoise is a South African endemic that is distributed throughout much of the south-western Great Karoo and along the region of

the Great Escarpment, eastwards to Cradock in the Eastern Cape Province. The Karoo Dwarf Tortoise occurs mainly in the southern regions of the Succulent and Nama Karoo biomes and peripherally in the Albany Thicket biome in the southeast of its range, at elevations of approximately 800–1,500 meters above sea level. This species is generally associated with dolerite ridges, but it also inhabits various other rocky outcrops such as sandstone and shale formations. The rocky components serve as shelter for this small tortoise (Figure 7-21).



Figure 7-21: A pair of Karoo Dwarf Tortoises emerging from the shelter of a large rock, photographed by Courtney Hundermark at a DTC research site in the Williston region.

The current IUCN conservation status of the Karoo Dwarf Tortoise is Endangered (A4ace). This is because most localities (30 of 35) no longer harbour viable populations and nearly 50% of the species' range is moderately or severely degraded with changes from a shrubby to a grassy landscape (Stevens *et al.* 2015). The species is thought to be in decline based on an estimate of a reduction in population size of approximately 30% over the past 25 years (one generation) and a projected reduction of at least another 30% over the next 50 years (two generations), for a total reduction over three generations of approximately 60% (Hofmeyr *et al.* 2018, Tolley *et al.* in press).

Threats to this species include habitat degradation due to agricultural activities and overgrazing, climate change, and predation by the Pied Crows which in recent decades have expanded in distribution range.

The vegetation type of the Hoogland Southern Cluster is comprised of Eastern Upper Karoo vegetation type (Mucina and Rutherford 2006 and SANBI 2018 update). However, there are extensive tracts of Upper Karoo Hardeveld at the site, and areas of riparian vegetation which are allied to the Southern Karoo Riviere vegetation type (3 Foxes, 2022).

According to Sungazer Faunal Surveys (2022), the two Karoo Dwarf Tortoise observations that were made during 2021/22 (Table 7-19) are the only known records of this species from within the Hoogland Northern Cluster. It is not realistically possible to make definite statements about the population size of this SCC within this study area, but the general impression is that it is extremely rare within this region. This conclusion is based on the fact that:

- In spite of several weeks of field studies that were conducted by the appointed faunal specialist (3 Foxes Biodiversity Solutions) and herpetologist, no observations of this species were made within the study area.
- There are no known historical records of this species from within the study area.
- Interviewed landowners and their staff are unfamiliar with this species, i.e., they have not encountered specimens during farming activities.

Table 7-19: A list of 20 observation records of Karoo Dwarf Tortoise at the localities nearest to the Hoogland Northern Cluster.

Institution	Year	URL/source
EWT	2022	https://www.inaturalist.org/observations/118892553
3FBS	2022	https://www.inaturalist.org/observations/119719245
3FBS	2021	https://www.inaturalist.org/observations/119741090
SANBI	2016	BioGaps Project (Telford <i>et al.</i> 2022)
SANBI	2016	BioGaps Project (Telford <i>et al.</i> 2022)
PEM	1975	http://vmus.adu.org.za/?vm=ReptileMAP-50265
PEM	1975	http://vmus.adu.org.za/?vm=ReptileMAP-50263
PEM	1975	http://vmus.adu.org.za/?vm=ReptileMAP-50264
TM	1969	http://vmus.adu.org.za/?vm=ReptileMAP-45709
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112328
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112362
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112391
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112400
TM	1969	http://vmus.adu.org.za/?vm=ReptileMAP-45056
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112356
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112336
PEM	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-50275
PEM	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-50276
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112339
PEM	1969	http://vmus.adu.org.za/?vm=ReptileMAP-50280

The occurrence of Karoo Dwarf Tortoise has been confirmed from within the Hoogland Northern Cluster of wind farms. Comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises.

7.4.1.3.3 Amphibians

The diversity of amphibians in the study area is relatively low with only 11 species having been recorded in the area. Species observed at the vicinity of the Hoogland site include the Karoo Toad, Clawed Toad and Poynton's River Frog. There are no listed amphibian species known from the area although the Giant Bull Frog *Pyxicephalus adspersus* was previously listed as Near Threatened but has revised to Least Concern. This species is associated with temporary pans in the Karoo, Grassland and Savannah Biomes, but is not commonly recorded in the study area and its presence at the site is considered unlikely. Within the site, there are several drainage lines that would have temporary pools that can be used by toads and frogs for seasonal breeding purposes. But given that these areas are considered important for Riverine Rabbits and other ecological considerations, areas important for amphibians are captured through other sensitivities and there are no areas that would need to be avoided on specific account of amphibians. Given the localised nature of important amphibian habitats at the site as well as the generally arid nature of the site and the low overall abundance of amphibians, a significant long-term impact on amphibians is unlikely.

7.4.1.4 Critical Biodiversity Areas and Broad-Scale Processes

There are several relatively restricted areas of CBA located within the Hoogland 1 site, these include the largest contiguous area of CBA along the boundary with Hoogland North 2 in the south-east of the site; the CBA along the Klein-Brak River and the CBA in the north of the site which occupies a low-lying area along the Slangfontein se Rivier (Figure 7-22). There are no turbines within any of the CBAs within the site, although there is an access road that traverses the Klein-Brak River as well as some underground cable sections through some of the other smaller CBAs.

On the Hoogland 2 site, there is only one significant contiguous area of CBA located within the east of the Hoogland 2 site as mentioned along the boundary with Hoogland 1. There are no turbines within this area or any of the other smaller CBAs within the site, although there is an access road that traverses one of the CBAs

On Hoogland 1 and 2, all of the minor drainage systems and washes (minor drainage features without well-developed riparian vegetation) of the site are mapped as ESAs and as it is not possible to avoid these features, there would be some impact on these minor features, largely through habitat loss and disturbance associated with the access roads of the development. However, with the appropriate mitigation, impacts on the ESAs would be relatively low and considered acceptable. The ESAs are small and represent buffers along the minor drainage features of the site and as such do not represent broad-scale corridors or ecological gradients that would potentially be disrupted by the development.

The majority of the CBAs in the Northern Cluster are driven by the selection of areas of Eastern Upper Karoo, with lesser significance or frequency for water resource protection, areas identified as Very High Sensitivity under the Shale Gas SEA, FEPA River Corridors and River Type.

On Hoogland 1, as none of these areas are seen as being unique or of specific significance to the study area, the affected CBAs are all seen as being of moderate to low irreplaceability and the development is highly unlikely to compromise the ecological functioning of the study area or the future ability to meet conservation targets in the Upper Karoo. In terms of the water resource protection and ecological process features, the development footprint within these areas is very low and is highly unlikely to compromise the ecological functioning of the study area or the future ability to meet conservation targets in the Upper Karoo. The crossing of the Klein-Brak River is a potential concern as this river has been identified as flagship free-flowing river and FEPA priority river corridor, but the selected crossing site is considered acceptable and occurs in area with stony banks and little potential for ecological disruption of the riparian environment.

On Hoogland 2, as none of these areas are seen as being unique or of specific significance to the study area, the affected CBAs are all seen as being of moderate to low irreplaceability and the development is highly unlikely to compromise the ecological functioning of the study area or the future ability to meet conservation targets in the Upper Karoo.

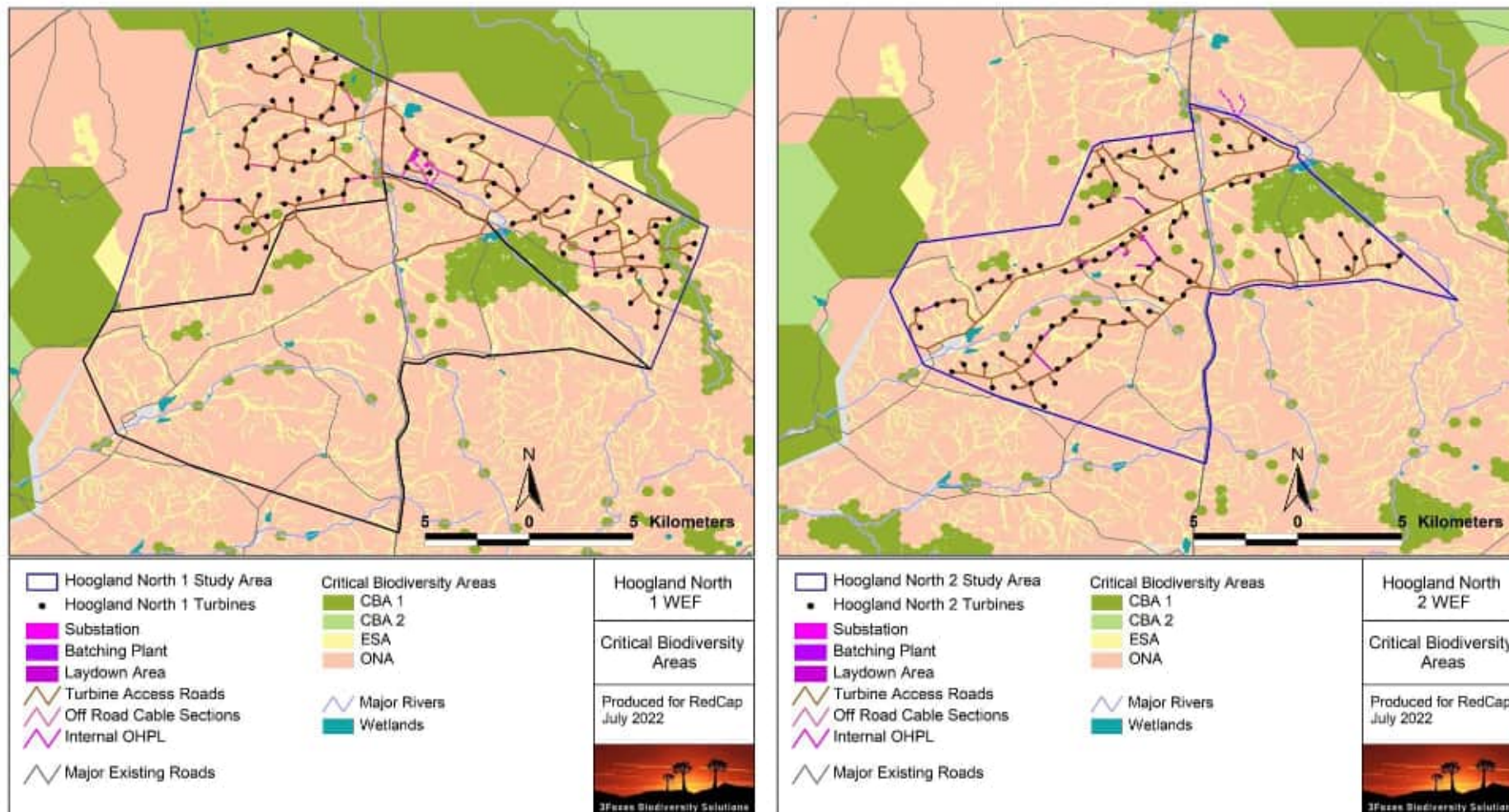


Figure 7-22: Extract of the Western Cape Biodiversity Spatial Plan for the Hoogland 1 Wind Farm (left) and Hoogland 2 Wind Farm (right) study areas, showing that there is a single extensive CBA within the east of the site, which has not been impacted by the current development layout

7.4.2 Site Sensitivity

The terrestrial biodiversity within the Hoogland Northern Wind Farms have been classified by the DFFE National Screening Tool as being sensitive (Figure 7-23). Note the Animal and Plant specific sensitivities are discussed in *Appendix C4: Terrestrial Ecology*.



Figure 7-23: Map of relative terrestrial biodiversity theme sensitivity for Hoogland 1 Wind Farm (left) and Hoogland 2 Wind Farm (right). High sensitivity shown in red.

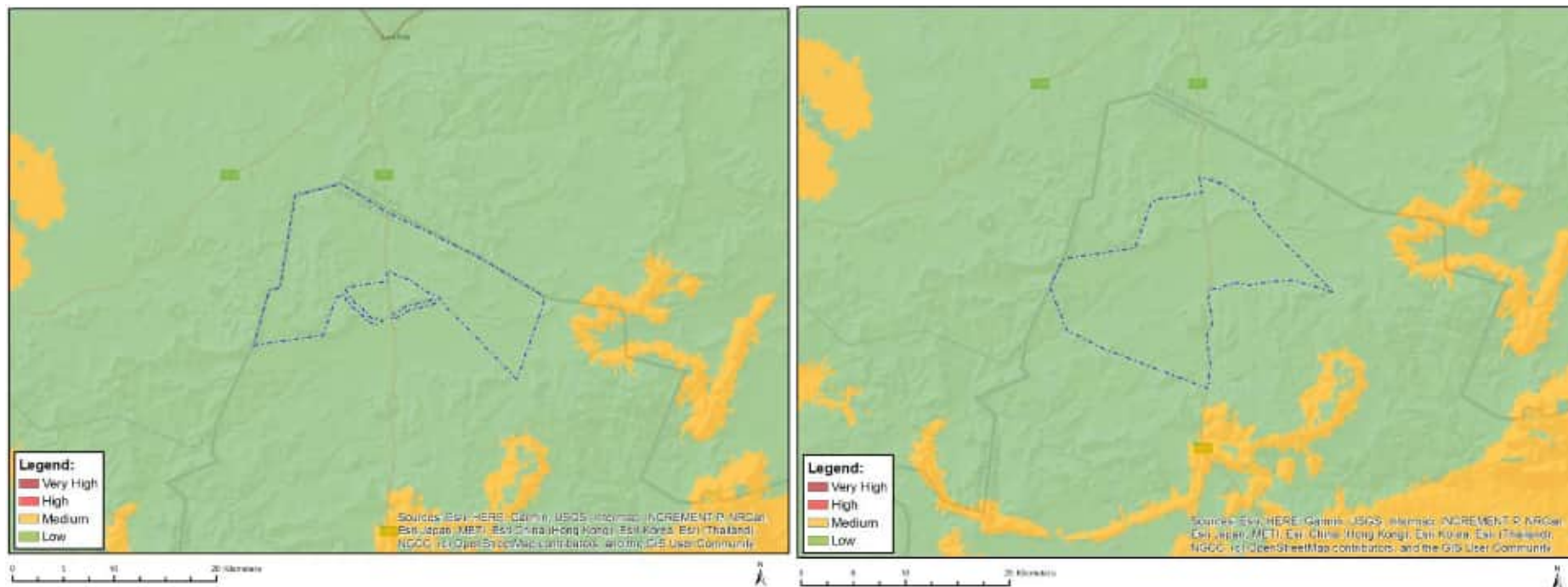


Figure 7-24: Map of relative plant species theme sensitivity for Hoogland 1 Wind Farm (left) and Hoogland 2 Wind Farm (right), medium sensitivity shown in orange and low sensitivity in green.

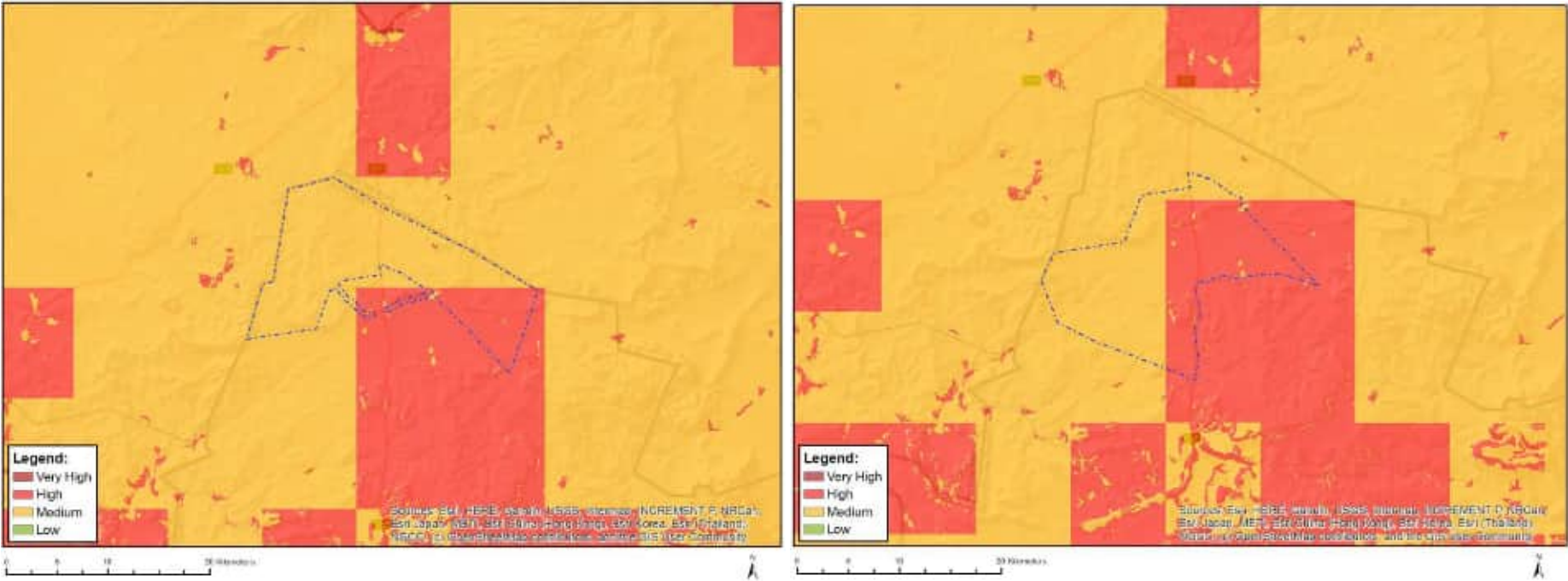


Figure 7-25: Map of relative animal species theme sensitivity for Hoogland 1 Wind Farm (left) and Hoogland 2 Wind Farm (right), medium sensitivity shown in orange and high sensitivity in red.

Sensitivity maps were produced by integrating the results of the site visits with the available ecological and biodiversity information in the literature and various spatial databases as described above. Sensitive features such as wetlands, drainage lines, rocky hills and pans were collated, mapped, and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas were then identified from the satellite imagery of the site and delineated. All created layers were merged to create a single coverage. The ecological sensitivity of the different units identified in the mapping procedure was rated to the scale below.

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium** - Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high potential impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution (such as specific consideration of the footprint within these areas and field verification of the acceptability of development within these potentially sensitive areas) as it may not be possible to mitigate all impacts appropriately.
- **Very High/No-Go** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are usually no-go areas from a developmental perspective and must be avoided.

In order to ensure the maintenance of ecological processes within the wind farm and the minimisation of impacts on terrestrial biodiversity, a constraints map for the site was produced. This has been used to inform the development layout and ensure that impacts on the sensitive features of the site are maintained within acceptable limits. Since they have differing impacts, turbines were separated from roads and other infrastructure in this regard.

The constraints/sensitivity map (for turbines) for the Hoogland Northern Wind Farm area is depicted below in Figure 7-26. There are numerous constraints operating across the site, associated largely with the drainage features of the area, Riverine Rabbit habitat and their associated applied buffers and also the steep slopes and dolerite outcrops of the site. Although these occupy a significant proportion of the site, there are also extensive open plains and low hills present across the site that are considered low to moderate sensitivity and which are suitable for wind energy development. Under the assessed layout, there are no turbines located within areas considered unsuitable for turbine placement.

In terms of the roads and other infrastructure no-go layer (Figure 7-27), these are largely similar to the turbine no-go layer but somewhat less constrained in terms of the drainage lines and somewhat more constrained in terms of slopes. Ultimately, it is the roads that generate the largest proportion of habitat loss associated with Wind Farms and as such, are the primary drivers of habitat loss within the affected area and the sensitivity mapping takes specific account of sensitive areas potentially associated with the Karoo dwarf tortoise as well as avoiding areas of rugged terrain and steep slopes where the construction of the roads would generate a lot of cut and fill or increase erosion potential of disturbance within sensitive habitats. In terms of the initial layout, there are no roads within areas that are considered no-go areas. The scale of the sensitivity map as depicted below does not allow for clear interrogation of the roads and observation of the extent to which these avoid the no-go areas. Overall, the road layer is considered acceptable and would generate low to moderate impacts on fauna and flora.

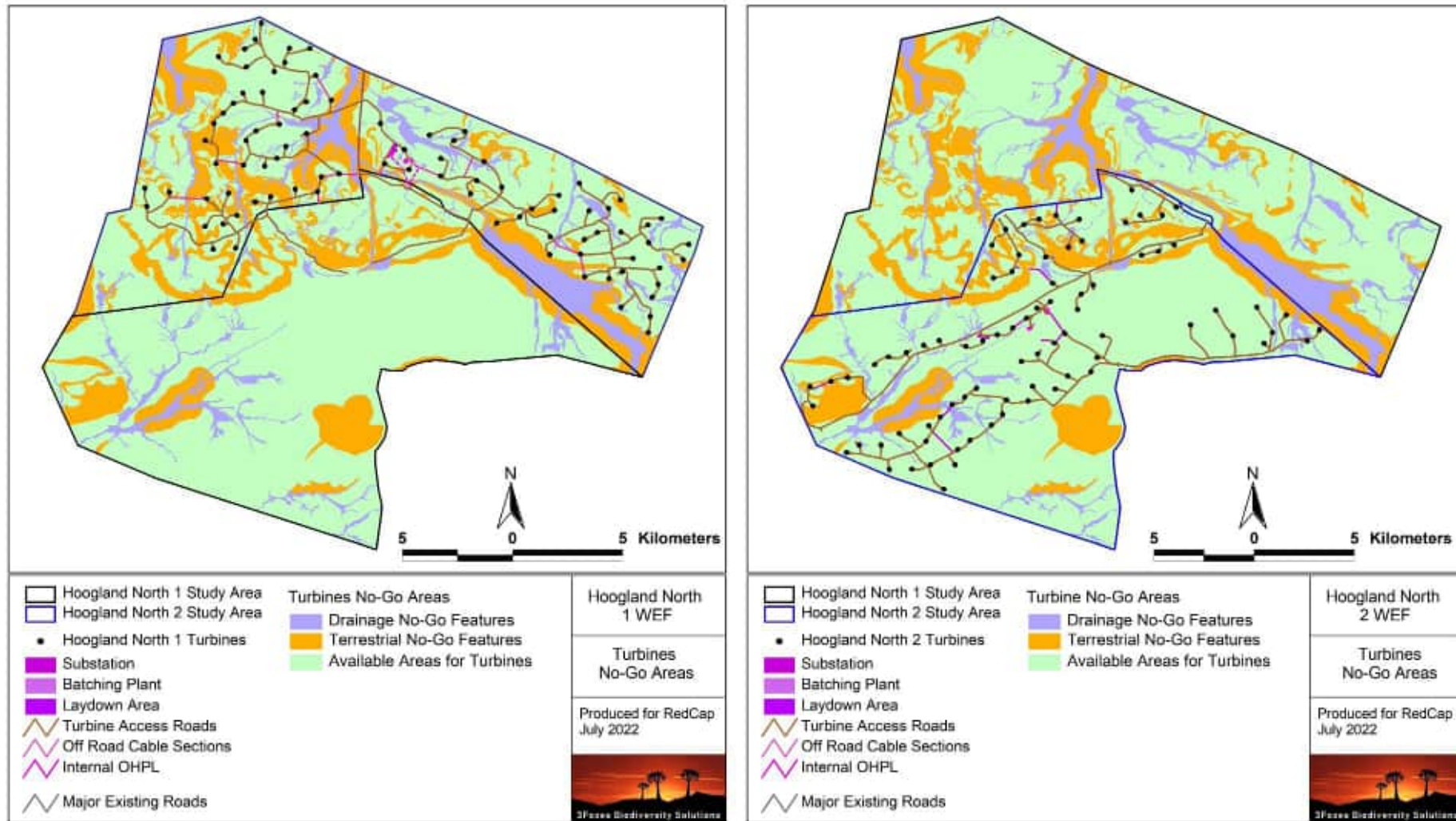


Figure 7-26: Ecological constraints map for turbines on the Hoogland 1 Wind Farm (left) Hoogland 2 Wind Farm (right)

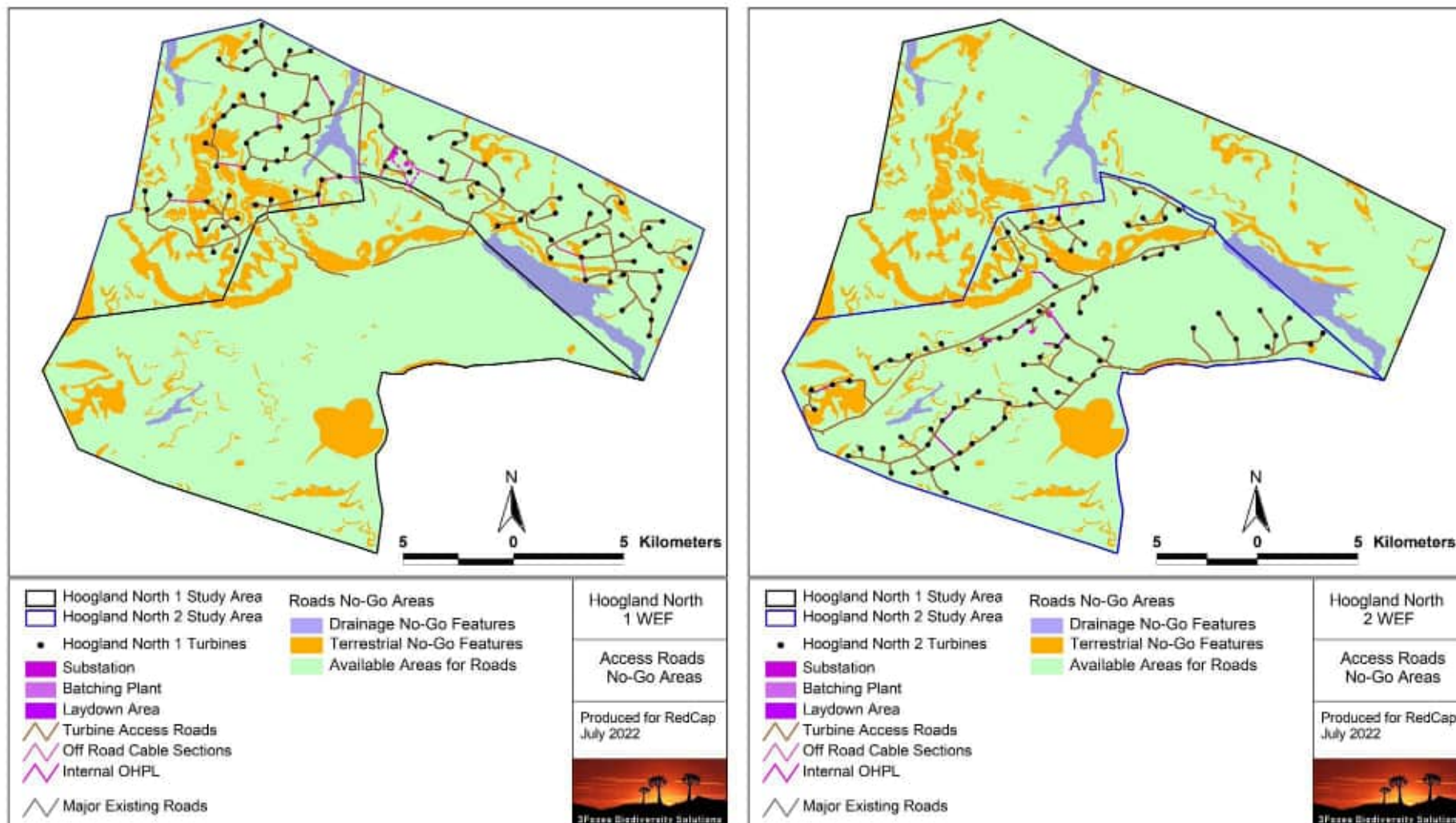


Figure 7-27: Ecological constraints map for roads and underground cabling on the Hoogland 1 Wind Farm (left) Hoogland 2 Wind Farm (right)

7.4.3 Impact Assessment and Mitigation

The following Terrestrial Biodiversity impacts and Riverine Rabbit impacts have been identified and rated by 3 Foxes (2022), while the Karoo Dwarf Tortoise Impacts have been rated by Sungazer Faunal Surveys (2022).

7.4.3.1 Construction Phase: Hoogland 1 and 2

Table 7-20: Construction: Impact on the Riverine Rabbit

Issue	Construction phase impact on the Riverine Rabbit	
Description of Impact		
Impacts on Riverine Rabbit as a result of construction phase activities, including vehicle collisions, disturbance and habitat loss.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. During construction, driving between sunset and sunrise should be reduced as far possible as this is when Riverine Rabbits are most active and the risk of collisions is highest. No dogs should be allowed on site and precautions to ensure that there is poaching or other direct faunal disturbance on site should be implemented. Where any new roads, cabling and/or overhead lines traverse areas mapped as High Riverine Rabbit habitat sensitivity, the route should be microsited by a suitably qualified ecological specialist before construction commences to ensure any potential impacts are minimised. Existing tracks through these areas should be used where present. 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> There should be a monitoring programme for Riverine Rabbit roadkill during construction that should be used to inform any additional mitigation and avoidance that should be implemented. Should rabbits be killed by traffic, then the traffic management to and from the site should be reviewed in collaboration with the EWT Drylands Programme, to identify additional mitigation and avoidance that should be implemented to further reduce roadkill. Ensure that riparian areas near to the development footprint are clearly demarcated as no-go areas with appropriate signage and barriers. 	

Table 7-21: Construction: Habitat loss and degradation Impact on the Karoo Dwarf Tortoise

Issue	Construction phase impacts on the Karoo Dwarf Tortoise.	
Description of Impact		
Habitat loss and habitat degradation may impact the Karoo Dwarf Tortoise during construction phase activities in the following three ways: 1) loss/degradation of rocky habitat, i.e. reduced shelter opportunities; 2) loss/degradation of vegetation, i.e. reduced food sources; and 3) new roads and turbine platforms adding to the fragmentation of the landscape.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Mitigation exists and will notably reduce significance of impacts.	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high sensitivity (very high = no go areas). Access to areas outside of the construction footprint during construction must be limited to minimise habitat degradation. 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> Construction activities must be monitored by ECO with the aim to guard against potential impacts on Karoo Dwarf Tortoises where feasible. 	

Table 7-22: Construction: Karoo Dwarf Tortoise mortalities due to earthworks and roadkill.

Issue	Construction phase impact on the Karoo Dwarf Tortoise	
Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed during earthworks activities when clearing habitat for new roads, turbine platforms and other associated infrastructure. Additionally, tortoises may be killed on roads by construction/support vehicles.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Local	Local
	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	Mitigation exists and will notably reduce significance of impacts	

Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts
Mitigation actions	
The following measures are recommended:	<ul style="list-style-type: none"> The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high sensitivity (very high = no go areas). Limit construction activities within the defined development footprints to minimise the chances of killing tortoise inadvertently. All vehicles must adhere to a low-speed limit, i.e. 30 km/h on site and 40 km/h in areas where Karoo Dwarf Tortoises are likely to be present, both within the wind farm as well as on the public roads to the site.
Monitoring	
The following monitoring is recommended:	<ul style="list-style-type: none"> Construction activities must be monitored by ECO with the aim to guard against potential impacts on Karoo Dwarf Tortoises where feasible.

7.4.3.2 Construction Phase: Hoogland 1

Table 7-23: Construction: Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the Hoogland 1 site

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Description of Impact		
Construction phase impact on CBAs, ESAs and ecological processes within the site.		
Type of Impact	Direct/Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts. The footprint within CBAs is low and considered acceptable. The Low intensity pre-mitigation impacts are the result of avoidance of these features at the planning stage.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> There are no turbines located in CBAs however CBAs should be avoided for roads as far as possible. The use of existing roads through these areas is considered acceptable. Therefore the current layout is suitable in this regard. Should access roads, internal cables and overhead lines traverse drainage lines and riparian areas mapped as CBAs these should 	

	<p>be micrositied by a suitably qualified ecological and aquatic specialist before construction in that area starts to ensure any potential impacts are minimised</p> <ul style="list-style-type: none"> Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas. The current layout depicts that the substations, camps and lay-down areas are in low sensitivity areas, and this is therefore acceptable. Avoid impact to restricted and specialised habitats such as pans, wetlands and rock pavements. The final development footprint to be authorised should be checked for such sensitive features in the field, such that there is a high degree of confidence that the final layout avoids such features so that significant changes to turbines or roads are not required at the preconstruction phase. Minimise the development footprint near watercourses and other ecologically significant features.
Monitoring	
The following monitoring is recommended:	<ul style="list-style-type: none"> Monitoring of construction activities to ensure that the development footprint within CBAs is restricted to the authorised development footprint.

7.4.3.3 Construction Phase: Hoogland 2

Table 7-24: Construction: Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the Hoogland 2 site

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Description of Impact		
Construction phase impact on CBAs, ESAs and ecological processes within the site.		
Type of Impact	Direct/Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Low
Probability	Conceivable	Conceivable
Significance	Low -	Very Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts. The footprint within CBAs is low and considered acceptable. The Low intensity pre-mitigation impacts are the result of avoidance of these features at the planning stage.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> There are no turbines located in CBAs however CBAs should be avoided for roads as far as possible. The use of existing roads through these areas is considered acceptable. Therefore the current layout is suitable in this regard. Should access roads, internal cables and overhead lines traverse drainage lines and riparian areas mapped as CBAs these should 	

	<p>be micrositied by a suitably qualified ecological and aquatic specialist before construction in that area starts to ensure any potential impacts are minimised</p> <ul style="list-style-type: none"> Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas. The current layout depicts that the substations, camps and lay-down areas are in low sensitivity areas, and this is therefore acceptable. Avoid impact to restricted and specialised habitats such as pans, wetlands and rock pavements. The final development footprint to be authorised should be checked for such sensitive features in the field, such that there is a high degree of confidence that the final layout avoids such features so that significant changes to turbines or roads are not required at the preconstruction phase. Minimise the development footprint near watercourses and other ecologically significant features.
Monitoring	
The following monitoring is recommended:	<ul style="list-style-type: none"> Monitoring of construction activities to ensure that the development footprint within CBAs is restricted to the authorised development footprint.

7.4.3.4 Operational Phase: Hoogland 1 and 2

Table 7-25: Operation: Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Description of Impact		
Operational phase impact on CBAs and ESAs		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts. The footprint within CBAs is low and considered acceptable. The Low intensity pre-mitigation impacts are the result of avoidance of these features at the planning stage.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> A Fauna Monitoring Programme as detailed in the Riverine Rabbit Species Assessment should be implemented at the site before and after construction so as to monitor the impact of the development on faunal presence within the facility. 	

	<ul style="list-style-type: none"> Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. Appropriate design of roads and other infrastructure to minimise faunal impacts and allow fauna to pass over, through or underneath these features as appropriate. A log should be kept detailing and fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. These should be reviewed annually and used to inform operational management and mitigation measures.
Monitoring	
The following monitoring is recommended:	<ul style="list-style-type: none"> Monitoring of construction activities to ensure that the development footprint within CBAs is restricted to the authorised development footprint.

Table 7-26: Operation: Impact on the Karoo Dwarf Tortoise: Tortoise mortalities due to roadkill.

Issue	Operation phase impact on the Karoo Dwarf Tortoise.	
Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed by vehicular traffic on the new roads.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Tortoise populations are generally able to recover from limited mortalities, and thus no irreplaceable losses are anticipated.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are applied, it is plausible that the Karoo Dwarf Tortoise population within the PAOI can overtime recover from the tortoise mortalities incurred during the operation phase, and thus no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and can partially reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high sensitivity (very high = no go areas). Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. Incorporate special design features to roads to provide safer options for tortoises to minimise the potential of roadkill mortalities. Keep a log of tortoise roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures. Adhere to speed limits and exercise vigilance of tortoises crossing the roads. 	
Monitoring		

The following monitoring is recommended:	<ul style="list-style-type: none"> Monitor (keep log of) tortoise roadkill mortalities.
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Table 7-27: Operation: Impact on the Tortoise mortalities due to predation by corvids.

Issue		
Operation phase impact on the Karoo Dwarf Tortoise.		
Description of Impact		
The addition of powerline pylons to the landscape offers additional perching and nesting structures/opportunities for crows. This may potentially result in an increase of the local crow population, which in turn may cause an increase of corvids predated on Karoo Dwarf Tortoises during the operation phase and beyond.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Probable	Possible/frequent
Significance	High -	Low -
Degree to which impact can be reversed	Mitigation exists and may notably reduce significance of impacts.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are rigidly applied during the operation phase, it is plausible that the Karoo Dwarf Tortoise population within the PAOI will be able to sustain viably in spite of corvid predation. Thus, no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> A monopole-type structure was selected for almost all of the internal overhead lines as well as the main grid connection lines. This is reputedly the best type of structure to deter nesting since it does not provide good nesting substrate compared to lattice towers for example. Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. Conduct annual inspections along powerlines to monitor the extent of corvids nesting on these structures, and to check for tortoise carcasses below these nesting sites. Based on the findings of the annual inspections, reactive measures such as crow culling and/or removal of nests may have to be implemented. Keep a log of tortoise roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures. 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> Conduct annual surveys along the powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcasses observed along the powerlines. 	

7.4.3.5 Operational Phase: Hoogland 1

Table 7-28: Operation: Impact on the Riverine Rabbit within the Hoogland 1 site

Issue	
Operational Phase impact on the Riverine Rabbit	
Description of Impact	
There would potentially be impact on Riverine Rabbits at the site during operation due to operational activities (vehicles/disturbance) as well as turbine noise.	

Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Possible / frequent
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will be able to recover from the impact	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Adherence to a Riverine Rabbit Monitoring Plan 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> A Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. As there is some potential for noise and disturbance-related impacts on Riverine Rabbits, the development presents a clear opportunity to evaluate the degree to which wind farms are compatible with the maintenance and conservation of Riverine Rabbit populations within their boundaries. The monitoring programme should be conducted with input from EWT and should include preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site. This should be followed by matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. The exact duration and frequency of monitoring would need to be determined based on the number of cameras to be used and the desired precision and statistical power to be obtained. The monitoring should include a feedback mechanism to use these findings to improve future wind energy development in Riverine Rabbit areas should be developed. All incidents involving Riverine Rabbits should be documented and reported to the local EWT field office in Loxton. If Rabbits are killed, the carcasses should be collected and provided to EWT for the collection of DNA and other samples. For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. 	

7.4.3.6 Operational Phase: Hoogland 2

Table 7-29: Operation: Impact on the Riverine Rabbit within the Hoogland 2 site

Issue	Operational Phase impact on the Riverine Rabbit	
Description of Impact		
There would potentially be impact on Riverine Rabbits at the site during operation due to operational activities (vehicles/disturbance) as well as turbine noise.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	The affected environment will be able to recover from the impact	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Adherence to a Riverine Rabbit Monitoring Plan 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> A Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. As there is some potential for noise and disturbance-related impacts on Riverine Rabbits, the development presents a clear opportunity to evaluate the degree to which wind farms are compatible with the maintenance and conservation of Riverine Rabbit populations within their boundaries. The monitoring programme should be conducted with input from EWT and should include preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site. This should be followed by matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. The exact duration and frequency of monitoring would need to be determined based on the number of cameras to be used and the desired precision and statistical power to be obtained. The monitoring should include a feedback mechanism to use these findings to improve future wind energy development in Riverine Rabbit areas should be developed. All incidents involving Riverine Rabbits should be documented and reported to the local EWT field office in Loxton. If Rabbits are killed, the carcasses should be collected and provided to EWT for the collection of DNA and other samples. For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This 	

	initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population.
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7.4.3.7 Decommissioning Phase: Hoogland 1

Table 7-30: Decommissioning: Impact on the Riverine Rabbit within the Hoogland 1 site

Issue	Decommissioning phase impact on the Riverine Rabbit	
Description of Impact		
Impacts on Riverine Rabbit as a result of decommissioning phase activities, including vehicle collisions, disturbance and habitat loss.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. During decommissioning, driving between sunset and sunrise should be reduced as far possible as this is when Riverine Rabbits are most active and the risk of collisions is highest. No dogs should be allowed on site and precautions to ensure that there is poaching or other direct faunal disturbance on site should be implemented. Where any roads, cabling and/or overhead lines traverse areas mapped as High Riverine Rabbit habitat sensitivity, any remaining open and disturbed areas after decommissioning should be rehabilitated with local plant species appropriate for the affected habitat. 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> Should rabbits be killed by traffic, then the traffic management to and from the site should be reviewed in collaboration with the EWT Drylands Programme, to identify additional mitigation and avoidance that should be implemented to further reduce roadkill. Ensure that riparian areas near to the development footprint are clearly demarcated as no-go areas with appropriate signage and barriers. 	

7.4.3.8 Decommissioning Phase: Hoogland 2

Table 7-31: Decommissioning: Impact on the Riverine Rabbit within the Hoogland 2 site

Issue	Decommissioning phase impact on the Riverine Rabbit	
Description of Impact		
Impacts on Riverine Rabbit as a result of decommissioning phase activities, including vehicle collisions, disturbance and habitat loss.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Possible / frequent	Conceivable
Significance	Low -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. During decommissioning, driving between sunset and sunrise should be reduced as far possible as this is when Riverine Rabbits are most active and the risk of collisions is highest. No dogs should be allowed on site and precautions to ensure that there is poaching or other direct faunal disturbance on site should be implemented. Where any roads, cabling and/or overhead lines traverse areas mapped as High Riverine Rabbit habitat sensitivity, any remaining open and disturbed areas after decommissioning should be rehabilitated with local plant species appropriate for the affected habitat. 	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> Should rabbits be killed by traffic, then the traffic management to and from the site should be reviewed in collaboration with the EWT Drylands Programme, to identify additional mitigation and avoidance that should be implemented to further reduce roadkill. Ensure that riparian areas near to the development footprint are clearly demarcated as no-go areas with appropriate signage and barriers. 	

7.4.4 Cumulative Impact

The following cumulative impacts have been identified and rated by 3 Foxes and Sungazer (2022).

7.4.4.1 Construction Phase: Hoogland 1 and 2

Table 7-32: Cumulative impact: Construction Phase Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Nature of cumulative impacts	As the total extent of habitat loss within CBAs within the site is very low, the potential for the Hoogland 1 Wind Farm, and Hoogland 2 Wind Farm respectively, to contribute to cumulative impacts on CBAs is also seen as being low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Low -

Table 7-33: Cumulative impact: Construction phase impact on the Riverine Rabbit

Issue	Construction phase impact on the Riverine Rabbit	
Nature of cumulative impacts	The development would contribute to cumulative impacts on Riverine Rabbits especially due to vehicle collisions, but this would be transient and the overall contribution to cumulative impact would be low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-34: Cumulative impact: Construction phase impact Karoo Dwarf Tortoise: Habitat loss and degradation.

Issue	Habitat loss and habitat degradation may impact the Karoo Dwarf Tortoise during construction phase activities in the following three ways: 1) loss/degradation of rocky habitat, i.e. reduced shelter opportunities; 2) loss/degradation of vegetation, i.e. reduced food sources; and 3) new roads and turbine platforms adding to the fragmentation of the landscape.	
Nature of cumulative impacts	Cumulative impacts of habitat loss and degradation on the Karoo Dwarf Tortoise are predicted to be low with mitigation because habitat loss in general would be low, and project roads have mostly avoided sensitive habitat.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.4.4.2 Operational Phase: Hoogland 1 and 2

Table 7-35: Cumulative impact: Operational Phase Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Nature of cumulative impacts	As the total extent of habitat loss within CBAs within the site is very low, the potential for the Hoogland 1 Wind Farm, and Hoogland 2 Wind Farm respectively, to contribute to cumulative impacts on CBAs is also seen as being low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Low -

Table 7-36: Cumulative impact: Operational Phase impact on the Riverine Rabbit

Issue	Operation phase impact on the Riverine Rabbit	
Nature of cumulative impacts	The development would contribute to cumulative impacts on Riverine Rabbits especially due to vehicle collisions, but this would be transient and the overall contribution to cumulative impact would be low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.4.4.3 Decommissioning Phase: Hoogland 1 and 2

Table 7-37: Cumulative impact: Decommissioning Phase impact on the Riverine Rabbit

Issue	Decommissioning phase impact on the Riverine Rabbit	
Nature of cumulative impacts	The development would contribute to cumulative impacts on Riverine Rabbits especially due to vehicle collisions, but this would be transient and the overall contribution to cumulative impact would be low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.4.4.4 All Phases

Table 7-38: Cumulative impact: All phases: Impact on Karoo Dwarf Tortoise: Mortalities due to earthworks, roadkill and predation by corvids.

Issue	Impacts on the Karoo Dwarf Tortoise. Mortalities due to earthworks, roadkill and predation by corvids.	
Nature of cumulative impacts	Karoo Dwarf Tortoises may inadvertently be killed during earthworks activities when clearing habitat for new roads, turbine platforms and other associated infrastructure. Additionally, tortoises may be killed on roads by construction/support vehicles during the construction phase, and by vehicular traffic on the new roads during the operation and decommissioning phases. Also, the addition of powerline pylons to the landscape offers additional perching and nesting structures/opportunities for crows. This may potentially result in an increase of the local crow population, which in turn may cause an increase of corvids preying on Karoo Dwarf Tortoises during the operation phase and beyond. The development would contribute to cumulative impacts on the Karoo Dwarf Tortoise, but this would be transient and the overall long-term contribution to cumulative impacts on this species would be low.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.4.5 No-Go Alternative

Under the 'no-go' alternative, the current land use, consisting of extensive livestock grazing, would continue. When applied correctly, such livestock grazing is considered to be largely compatible with long-term biodiversity conservation, although in practice there are some negative effects associated with such land use, such as predator control and negative impacts on habitat availability for the larger ungulates that would historically have utilised

the area. Under the current circumstances, the 'no-go' alternative is considered to represent a low long-term negative impact on the environment. The current development is however not an alternative land use for the site, but rather represents an additional stressor that would additively and cumulatively contribute to ecological impacts on the site.

7.4.6 Conclusion and Recommendations

The Hoogland Northern Cluster is mapped as falling entirely within the Eastern Upper Karoo vegetation type. The current study however indicates that significant areas of Upper Karoo Hardeveld are also present as well as some Southern Karoo Riviere along the major drainage lines of the site such as the Slangfontein se Rivier. In terms of fauna, there are several listed mammals which occur in the area and which would potentially be impacted by the development. This includes the Riverine Rabbit, Black-footed Cat, Brown Hyena, Grey Rhebok and Mountain Reedbuck. The Riverine Rabbit is of greatest potential concern as it has the highest threat status and has also been confirmed present within the Hoogland 1 site through camera trapping.

The Riverine Rabbit is of greatest potential concern as it has the highest threat status and has also been confirmed present only within the Hoogland 3 Wind Farm site through extensive camera trapping. The extent of habitat loss within the areas of Riverine Rabbit habitat would however be minimal and would not compromise the local population of this species.

Although there are several CBAs within the site, there are no turbines within any of the CBAs under the assessed layout. There is however in Hoogland 1, an access road that traverses one of the CBAs along the Klein-Brak River and some underground cabling that would traverse some of the other CBAs; and in Hoogland 2 there is an access road that would traverse one of the CBAs. The larger CBAs of the site have however been entirely avoided with the result that impacts on the CBAs would be low and restricted to a small amount of habitat loss. All of the minor drainage systems and washes of the Southern site are mapped as ESAs and it is not possible for the development to entirely avoid these features. As a result, there would be some impact on these minor features, largely through habitat loss and disturbance associated with the access roads of the development. The ESAs are however small and represent buffers along the minor drainage features of the site and as such, do not represent broad-scale corridors or ecological gradients that would potentially be disrupted by the development. The impact of the development on CBAs and ESAs is therefore considered acceptable.

In terms of potential cumulative impacts in and around the Hoogland South 3 and 4 site respectively, currently amount to approximately 760ha of planned wind farm projects. The Hoogland Southern Cluster would contribute an additional ±280ha of long-term habitat loss to this total. Although cumulative impacts on the Riverine Rabbit are a significant potential concern, significant habitat avoidance and buffering has been implemented on the Hoogland 1 site with the result that the impact on this species is likely to be low. As the Riverine Rabbit has been detected only from the Hoogland 1 site and not the Hoogland 2 site or the adjacent Nuweveld Wind Farms, the contribution of these other projects to impacts on the Riverine Rabbit would be low. As the broader area is still largely intact with no existing renewable energy facilities present, cumulative impacts associated with the current project are considered acceptable.

Potential impacts on the Riverine Rabbit have been specifically assessed through the Species Assessment for this species and are considered acceptable with the implementation of the buffers and avoidance as detailed in that report. The avoidance implemented for the Riverine Rabbit would also serve to protect other species associated with the major drainage features of the area and this would also ensure the maintenance of general ecological processes such as faunal dispersal which is likely to be associated with the major drainage systems of the area.

In terms of development recommendations, the following avoidance was implemented:

- Areas of River Rabbit habitat are considered to represent No-Go areas for turbines.

- Wind farm roads may only traverse areas of Riverine Rabbit habitat along existing major farm access roads.
- Riverine Rabbit habitat buffers are considered to be No-Go areas for turbines.
- Riverine Rabbit habitat buffers are considered to be high sensitivity for wind farm access roads and subject to individual evaluation.

The occurrence of Karoo Dwarf Tortoise has been confirmed from within the Hoogland Northern Cluster Wind Farms. However, comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises.

The sensitivity analysis for the Karoo Dwarf Tortoise was factored into Hoogland Southern Cluster design and included avoidance of dolerite outcrops as no-go areas turbines and roads, and avoidance of rocky ridges on steeper slopes where possible. The integration of the sensitivity components into the layout design is deemed to be an appropriate buffering scheme that will adequately safeguard Karoo Dwarf Tortoises within the Hoogland Northern Cluster. Accordingly, the impacts on Karoo Dwarf Tortoises in the context of the proposed development is projected to be low after mitigation. As a result, and with the application of the recommended mitigation and avoidance measures, the impacts associated with the Hoogland Northern Cluster are considered acceptable.

Potential impacts on the both the Karoo Dwarf Tortoise and Riverine Rabbit have been specifically assessed through the Species Assessment for each species and are considered acceptable with the implementation of the buffers and avoidance as detailed in their respective reports.

There are no terrestrial biodiversity, Riverine Rabbit related or Karoo Dwarf Tortoise related fatal flaws associated with the assessed Hoogland Northern Cluster. Although there are a variety of no-go areas within the cluster, these features have been avoided. As such, there are no terrestrial ecological reasons to oppose the development of the Hoogland Northern Cluster. Consequently, it is the reasoned opinion of the specialists that the Northern Cluster Wind Farms can be developed, provided that all mitigation and avoidance measures are implemented.

7.5 Bats

This section provides a short summary of the bat specialist report compiled by Werner Marais of Animalia which is available in *Appendix C8: Bats*. The information presented here draws from the pre-construction bat monitoring undertaken for the project, the results of which informed the identification of impacts and preliminary impact assessment.

7.5.1 Baseline Description

According to Animalia (2022), three factors need to be present for most South African bats to be prevalent in an area: availability of roosting space, food (insects/arthropods or fruit), and accessible open water sources. However, the dependence of a bat on each of these factors depends on the species, its behaviour and ecology. Nevertheless, bat activity, abundance and diversity are likely to be higher in areas supporting all three above mentioned factors.

The site is evaluated by comparing the amount of surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces and foraging sites), climate (can influence insect numbers and availability of fruit), and presence of surface water (influences insects and acts as a source of drinking water) to identify bat species that may be impacted by wind turbines. These comparisons are done chiefly by briefly studying the geographic literature of each site and available satellite imagery. Species probability of occurrence based on the above-mentioned factors are estimated for the site and the surrounding larger area. Pre-construction

and operational bat monitoring data from surrounding and nearby Wind Farms have also been consulted during this screening phase study.

Several site visits were carried out from March 2021 –June 2022, including a helicopter flight, to groundtruth bat sensitivity features and habitats delineated in the bat sensitivity constraints map. In July 2021, passive bat detection systems were set up on the 2 Meteorological (Met) Masts with microphones at 10m, 60m and 120m. Additionally, four Short Mast bat detection systems have also been set up, with microphones at 7m (referred to ShM1N – ShM4N) (Figure 7-28). These systems were set to gather bat activity data every night for 12 months to form part of the long-term pre-construction monitoring.



Figure 7-28: Passive bat detection systems set up on the Hoogland Northern cluster.

7.5.1.1 Land Use, Vegetation, Climate and Topography

According to Mucina and Rutherford (2012, 2018), the Hoogland Northern Cluster is situated entirely within the Eastern Upper Karoo vegetation unit (Figure 7-13).

The Eastern Upper Karoo vegetation unit on the Northern cluster is mostly flats and gently sloping plains with occasional washes (refer to Figure 7-13 in Section 7.4.1.1 above for the vegetation map). Dolerite rock tors (abrupt small koppies) and dolerite cliffs edges are located within the Northern Cluster, providing possible roosting space for crevice dwelling bats, as well as feeding spots sheltered from wind.

The Eastern Upper Karoo vegetation are mostly dwarf shrubs with some white grasses, last mentioned occurring in a lesser extent. Geology of the Eastern Upper Karoo are mudstones and sandstones. And rainfall is mostly in autumn and summer, peaking in March, with annual averages of 180mm – 200mm. Snowfall can occur in winter months and mean maximum and minimum temperature ranges from -8°C – 37°C.

Vegetation units and geology are of great importance as these may serve as suitable sites for the roosting of bats and support of their foraging habits (Monadjem *et al.* 2020). Houses and buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem *et al.* 2020). The importance of the vegetation units and associated geomorphology serving as potential roosting and foraging sites have been described in Table 7-39.

Table 7-39: Potential of the vegetation units to serve as suitable roosting and foraging spaces for bats

VEGETATION UNIT		FORAGING POTENTIAL	ROOSTING POTENTIAL	COMMENTS
Eastern Karoo	Upper	Moderate – High (seasonal)	Low - Moderate	On the Northern Cluster some exposed rocky cliffs and tors (abrupt piles of rocky boulders) are present, that can offer some roosting space. These areas are classified as part of the Eastern Upper Karoo but displays characteristics closer to that of the Karoo Upper Hardeveld. Foraging potential can be high in drainage areas and seasonally in washes.

7.5.1.2 Protected areas, known sensitivities and caves/roosts within 100km from the site

The Karoo National Park and Steenbokkie Private Nature Reserve are the closest protected areas to the site, approximately 40km to the South (Figure 7-29). None of the nature reserves are well known hotspots for bat activity or bat roosts that may influence the site, although the presence of natural vegetation may promote bat diversity and activity levels.



Figure 7-29: Protected areas within a radius of 100km (red line) around the site (DFFE, October 2021)

The Strategic Impact Assessment (SEA) assigns 50km buffers to large bat roosts for wind energy and 5km for PV energy, therefore any of the unconfirmed or possible cave/roost locations may be assigned a buffer up to 50km if they are found to be supporting large enough bat colonies. This location in Figure 7-30 is further than 50km from the site.

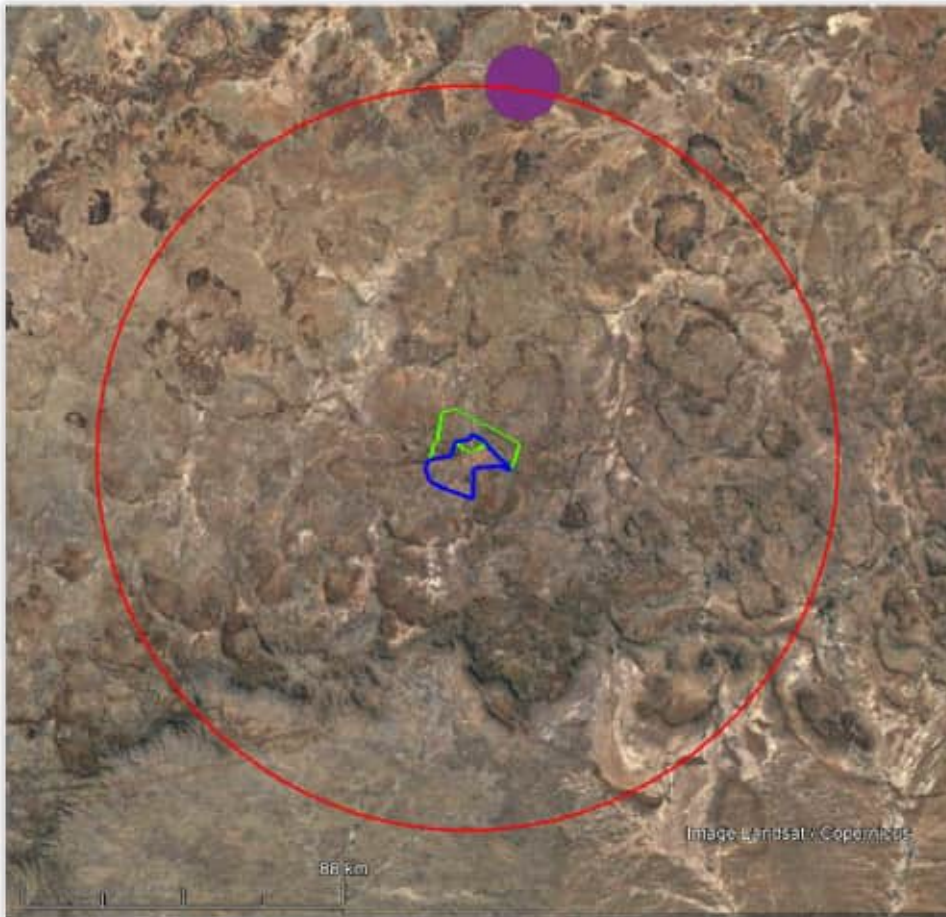


Figure 7-30: An unconfirmed bat roost almost within 100km (red radius line) from the site. The pink circle is classified by the SEA as an unconfirmed roost and has been assigned a 10km buffer by the SEA

In Figure 7-49 the red areas indicate high bat sensitivity hydrology features. The remaining areas are assigned a medium sensitivity by the Screening Tool. The sensitivities of the National Screening Tool have been considered, however the sensitivity map produced with this scoping study deviates from these sensitivities. The deviations are based on detailed site visits and assessments and the sensitivities applied are depicted in Section 7.5.1.1.

7.5.1.3 Bat species

There are several bat species in the vicinity of the site that occur commonly in the area. Some of these species are of special importance based on their likelihood of being impacted by the proposed Wind Farm, due to high abundances and certain behavioural traits. They have also been dominating records of fatalities at nearby wind farms. The relevant species are in Table 7-40 below.

7.5.1.4 Ecology of bat species that may be impacted the most by the Wind Farm

There are several bat species in the vicinity of the site that occur commonly in the area. Some of these species are of special importance based on their likelihood of being impacted by the proposed Wind Farm, due to high abundances and certain behavioural traits. They have also been dominating records of fatalities at nearby Wind Farms. The relevant species are discussed below.

7.5.1.4.1 *Tadarida aegyptiaca*

The Egyptian Free-tailed Bat, *Tadarida aegyptiaca*, is a Least Concern species (IUCN Red List 2016) as it has a wide distribution and high abundance throughout South Africa and is part of the Free-tailed bat family (Molossidae). It

occurs from the Western Cape of South Africa, north through to Namibia and southern Angola; and through Zimbabwe to central and northern Mozambique (Monadjem *et al.* 2020). This species is protected by national legislation in South Africa (ACR 2018).

They roost communally in small (dozens) to medium-sized (hundreds) groups in rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. *Tadarida aegyptiaca* has also adapted to roosting in buildings, in particular roofs of houses (Monadjem *et al.* 2020). Thus, the rocky boulder crevices and man-made structures on the site would be important roosts for this species.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert, semi-arid scrub, savannah, grassland and agricultural lands. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey (Monadjem *et al.* 2020).

After a gestation of four months, a single young is born, usually in November or December, when females give birth once a year. In males, spermatogenesis occurs from February to July and mating occurs in August. Maternity colonies are apparently established by females in November.

The Egyptian Free-tailed bat is considered to have a high likelihood of risk of fatality due to wind turbines (MacEwan *et al.* 2020) and are displaying moderate to high numbers of mortalities at operating Wind Farms in South Africa. Due to the high abundance and widespread distribution of this species, high mortality rates due to wind turbines would be a cause of concern as these species have more significant ecological roles than the rarer bat species.

7.5.1.4.2 *Neoromicia capensis*

Neoromicia capensis (Cape serotine bat) has a conservation status of Least Concern (IUCN Red List 2016) as it is found in high numbers and is widespread over much of Sub-Saharan Africa.

High mortality rates of this species due to wind turbines would be a cause of concern as *N. capensis* is abundant and widespread and as such has a more significant role to play within the local ecosystem than the rarer bat species. They do not undertake migrations and thus are considered residents of the site.

It roosts individually or in small groups of two to three bats in a variety of shelters, such as under the bark of trees, and inside the roofs of houses. They will use most man-made structures as day roosts which can be found on the site and surrounding areas (Monadjem *et al.* 2020).

Mating takes place from the end of March until the beginning of April. Spermatozoa are stored in the uterine horns of the female from April until August, when ovulation and fertilisation occurs. They give birth to twins during late October and November, but single pups, triplets and quadruplets have also been recorded (van der Merwe 1994 and Lynch 1989).

They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; indicating that they may occupy several habitat types across the site and are amenable towards habitat changes. They are however clutter-edge foragers, meaning they prefer to hunt on the edge of vegetation clutter mostly, but can occasionally forage in open spaces. They are thought to have a Medium-High likelihood of risk of fatality due to wind turbines (MacEwan *et al.* 2020). And are displaying moderate to high numbers of mortalities at operating Wind Farms in South Africa.

7.5.1.4.3 *Miniopterus natalensis*

Miniopterus natalensis (Natal long-fingered bat), occurs widely across the country but mostly within the southern and eastern regions and is listed as Near Threatened (Monadjem *et al.* 2020). This bat is a cave-dependent species

and identification of suitable roosting sites may be more important in determining its presence in an area than the presence of surrounding vegetation. It occurs in large numbers when roosting in caves with approximately 260 000 bats observed making seasonal use of the De Hoop Guano Cave in the Western Cape, South Africa. Culverts and mines have also been observed as roosting sites for either single bats or small colonies in South Africa. Separate roosting sites are used for winter hibernation activities and summer maternity behaviour, with the winter hibernacula generally occurring at higher altitudes in more temperate areas and the summer hibernacula occurring at lower altitudes in warmer areas of the country (Monadjem *et al.* 2020).

Mating and fertilisation usually occur during March and April and is followed by a period of delayed implantation until July/August. Birth of a single pup usually occurs between October and December as the females congregate at maternity roosts (Monadjem *et al.* 2020 & Van Der Merwe 1979).

The Natal long-fingered bat undertakes short migratory journeys between hibernaculum and maternity roosts. Due to this migratory behaviour, they are considered to be at high risk of fatality from wind turbines if a Wind Farm is placed within a migratory path (MacEwan *et al.* 2020). The mass movement of bats during migratory periods could result in mass casualties if wind turbines are positioned over a mass migratory route and such turbines are not effectively mitigated. Very little is known about the migratory behaviour and paths of *M. natalensis* in South Africa with migration distances exceeding 150 kilometres. If the site is located within a migratory path the bat detection systems should detect high numbers and activity of the Natal long-fingered bat, this will be examined over the course of the 12-month monitoring survey. However, it should be noted that no migration routes are known to occur on site or in the surrounding area. Also, no known caves are present in the area of the site and the geology are not prone to cave formation. However, from personal observations it has been noted that they can occur individually or in small groups in rock hollows or man-made structures such as culverts.

MacEwan *et al.* (2020) advise that *M. natalensis* faces a medium to high risk of fatality due to wind turbines. This evaluation was based on broad ecological features and excluded migratory information. And are displaying low to moderate numbers of mortalities at operating Wind Farms in South Africa.

7.5.1.4.4 *Cistugo lesueuri*

Cistugo lesueuri (Lesueur's Wing-gland bat) and has a conservation status of Least Concern (IUCN Red List 2016) and Near Threatened in the 2004 International Union for Conservation of Nature (IUCN) Red List, it has a limited distribution and is endemic to South Africa and Lesotho with only a few museum records. It appears to be associated with high altitude montane grasslands where open drinking water and rock crevices are present (Monadjem *et al.* 2020). A specimen has been collected in 1979 just outside the town of Beaufort West, indicating that the habitat of the larger area can be suitable for this species.

It has relatively short and broad wings with an intermediate wing loading and low aspect ratio, indicating it's a clutter edge forager. It may arguably therefore be placed in the same risk category as *Neoromicia capensis* at Medium-High likelihood of risk of fatality due to wind turbines.

Table 7-40: Table of species that are currently confirmed on site, and/or have been previously recorded in the area and may be occurring based on literature. Included is roosting or foraging in the study area, the possible site-specific roosts, and their probability of occurrence based on literature as well as recordings and observations in the surrounding area (Monadjem *et al.* 2020).

SPECIES	COMMON NAME	PROBABILITY OF OCCURRENCE (%)	CONSERVATION STATUS (2016 REGIONAL LISTING)	POSSIBLE ROOSTING HABITAT ON SITE	POSSIBLE FORAGING HABITAT UTILISED ON SITE	LIKELIHOOD OF RISK OF FATALITY (MACEWAN <i>ET AL.</i> 2020)
<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat	Confirmed on site	Least Concern	Roosts in rock crevices, hollows in trees, and behind the bark of dead trees. Exposed rocky cliffs and tors. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of natural and urbanised habitats.	High
<i>Neoromicia capensis</i>	Cape serotine	Confirmed on site	Least Concern	Roosts in the roofs of houses and buildings, and also under the bark of trees.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannahs. But is predominantly a medium height clutter edge forager.	Medium - High
<i>Miniopterus natalensis</i>	Natal long-fingered bat	Confirmed on site	Near Threatened (2004 National Listing)	Cave and hollow dependent, no known caves nearby. Will also roost in small groups or individually in culverts and other hollows.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium - High
<i>Sauromys petrophilus</i>	Roberts's flat-headed bat	Confirmed on site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs and tors.	Open air forager.	High
<i>Eptesicus hottentotus</i>	Long-tailed serotine	Confirmed on site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs and tors.	It generally seems to prefer foraging on the clutter edge of vegetation, such as the vegetated drainage areas and also over open water sources such as farm dams.	Medium
<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat	Confirmed in nearby area	Near Threatened (2004 National Listing)	Roosts in caves and mine adits, no known caves in the area. May utilise man made hollows, Aardvark burrows or hollows formed by rocky boulder tors.	It is associated with a variety of habitats including thickets that may be found in the vegetated drainage areas.	Low
<i>Nycteris thebaica</i>	Egyptian slit-faced bat	30 - 40	Least Concern	Roosts in rocky hollows, aardvark burrows, culverts under roads and the trunks of dead trees.	It appears to occur throughout the savannah and karoo biomes, but avoids open grasslands. May occur in the	Low

					thickets that may be found in the vegetated drainage areas.	
<i>Myotis tricolor</i>	Temmink's myotis	Confirmed on site	Near Threatened (2004 National Listing)	Usually roosts gregariously in caves, and sometimes culverts or other hollows. No known caves or mine adits close to site.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium - High
<i>Cistugo lesueuri</i>	Lesueur's wing-gland bat	Museum records within larger area around site	Near Threatened (2004 National Listing)	It is a crevice dweller roosting in rock crevices. Exposed rocky cliffs and tors.	Areas with available drinking water. Clutter edge forager. May forage in more open terrain during suitable weather.	Medium – High

7.5.1.1 Passive Bat activity

Passive bat data was collected at the Hoogland 1 and 2 Wind Farms between the period of late June 2021 (mid-July 2021 for the Met Masts) to June 2022, representing four seasons of passive bat activity monitoring.

Figure 7-31 to Figure 7-42 graphically display the data collected thus far pertaining to the total bat passes recorded at each of the Met Masts (10m, 60m and 120m) and the Short Mast systems (7m), as well as the average hourly bat passes per system. The temporal distribution of bat activity is displayed, per night, in Figure 7-43 to Figure 7-48.

Bat activity was divided into categories (Table 7-41) according to the risk of being impacted on by wind turbines, as well as other important ecological significance (as is the case with cave bats).

Table 7-41: The categories used for grouping and presenting bat activity in the passive bat activity graphs.

Graph category and abbreviation	Motivation of graph category	Species detected in graph category
High risk (H)	<ul style="list-style-type: none"> Open-air foragers High flying in rotor swept zone 	<i>Tadarida aegyptiaca</i> <i>Sauromys petrophilus</i>
High - Medium risk (HM)	<ul style="list-style-type: none"> Migrant bats, can influence multiple ecologies Cave bats, may possibly indicate presence of undiscovered bat cave roosts Can also roost in non-cave hollows Forages on the edges of vegetation clutter (clutter-edge foragers) Medium height foraging, overlapping with lower rotor swept zone 	<i>Miniopterus natalensis</i> <i>Miniopterus spp.</i> <i>Myotis tricolor</i>
Medium risk (M)	<ul style="list-style-type: none"> Forages on the edges of vegetation clutter (clutter-edge foragers) Medium height foraging, overlapping with lower rotor swept zone 	<i>Laephotis capensis</i> <i>Eptesicus hottentotus</i> <i>Cistugo lesueuri</i> Other members of Vespertilionidae family
Low risk (L)	<ul style="list-style-type: none"> Non-migrant cave and hollow dwelling bats, but may possibly indicate presence of caves, therefore presented in graphs Forages in dense vegetation clutter (clutter foragers) Low height foraging outside rotor swept zone 	<i>Rhinolophus spp.</i>

*Echolocation call overlap with *Laephotis capensis*, presence could not be determined by echolocation data.

The six bat species detected on site were: *Eptesicus hottentotus*, *Tadarida aegyptiaca*, *Sauromys petrophilus*, *Laephotis capensis*, *Myotis tricolor* and *Miniopterus natalensis*. Additionally, other members of the genera *Miniopterus spp.* and *Rhinolophus* were also detected. Even though the presence of *Cistugo lesueuri* could not be confirmed or disproved, it's included into the above table since it's endemic to South Africa and Lesotho and is represented in museum records from the larger area around site.

When considering total bat passes (Figure 7-31– Figure 7-36), the High risk category (H) dominated at all systems and at all heights, with the Medium risk category (M) displaying the second highest activity levels at all microphones. Bat activity for the High risk category was highest at 60m on the met masts, due to the open air

and higher flying foraging habits of *T. aegyptiaca* and *S. petrophilus* constituting this category. Bat activity was greater at 7m on the Met Masts than at the 120m height. Total bat passes can be used to compare activities between microphone heights, but results may be skewed by data gaps where the bat detector/microphone did not function. Some bat detectors experienced technical issues that resulted in gaps in their bat activity data. However, the other bat detectors on site gathered complete data during such periods to collectively inform the impact assessment sufficiently.

Average hourly activity (Figure 7-37 – Figure 7-42) is more accurate for bat activity comparisons between different sample points since it considers only the nights on which the systems recorded successfully, and are therefore a true indication of activity levels. On the met masts, the average hourly activity levels display a similar pattern as seen in the total bat passes graphs, where bat activity and the High risk category dominated at the 60m microphones. Met Mast HL02 showed higher peak average hourly activity than Met Mast HL01. This is likely to be due to the lower lying location of HL02 and the fact that HL02 is within Moderate bat sensitivity areas. For the short masts, in order from highest to lowest peak average hourly bat activity the sampling points can be arranged from ShM2N, ShM3N, ShM4N and ShM1N with the lowest activity. ShM2N was located within a Moderate sensitivity area and closer to rocky tors (small piled outcrops/rocky heaps) than the other systems, however the bat activity at ShM2N is not high enough to justify these rocky tors as a High sensitivity category.

The warmer months of November to March had the highest average activity levels in general, with the month of December displaying the overall highest activity across all systems on site. November had the second highest overall activity on all systems. These months with higher activity in the High risk category are important to consider in case mitigation may be required during the operational phase. The pattern of higher bat activity during summer nights is to be expected when taking insect activity into consideration. The high elevation of the site lends to frequent frosts during colder nights and there is a distinct correlation between temperature, insect activity and thus bat activity. The area also received very good rainfall over the summer of 2021/2022, thus breaking the prolonged drought over the past decade.

The yearly median of average hourly bat passes, at 120m considering both met masts, are 0.035bp/h. At 60m the median for both met masts is 1.49bp/h. According to MacEwan *et al.* (2020), for the Nama Karoo ecoregion it's considered to be medium to high bat activity levels indicating a medium to high risk of bat mortalities. Therefore, the probability of active mitigations being required during operation is medium to high and the exact mitigation measure will be based on results of the operational mortality monitoring.

Miniopterus natalensis and *Myotis tricolor* (part of the HM graph category) are cave dwelling species but may also take residence in smaller numbers in culverts and other suitable man-made hollows, these species did not show any abrupt peaks of activity that may indicate that the site is on any migration route. The species was not particularly frequently recorded on the systems, although it was present in the data from each system.

The temporal data displays the spread of bat activity over each night and season and may indicate abrupt peaks in activity. On ShM1N (Figure 7-45) and ShM2N (Figure 7-46) there was a noticeable peak on 12 November 2021 of bat activity in the High risk category. The reason for this peak is not known but may be attributed to insect movements on the northern side of the Sakrivierpoort rocky cliffs.

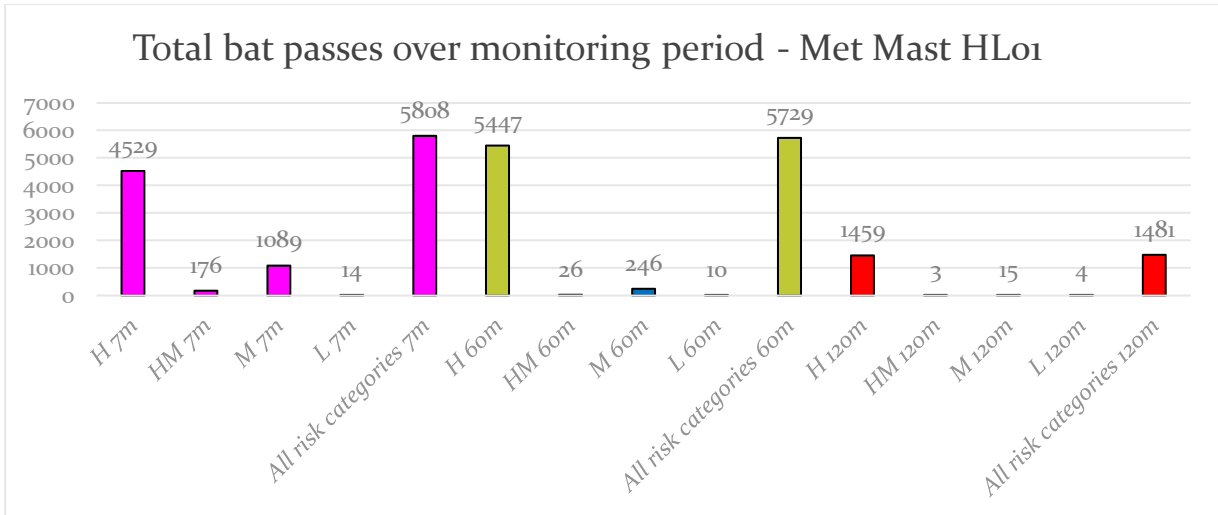


Figure 7-31: Total number of bat passes recorded over the monitoring period by Met Mast HL01.

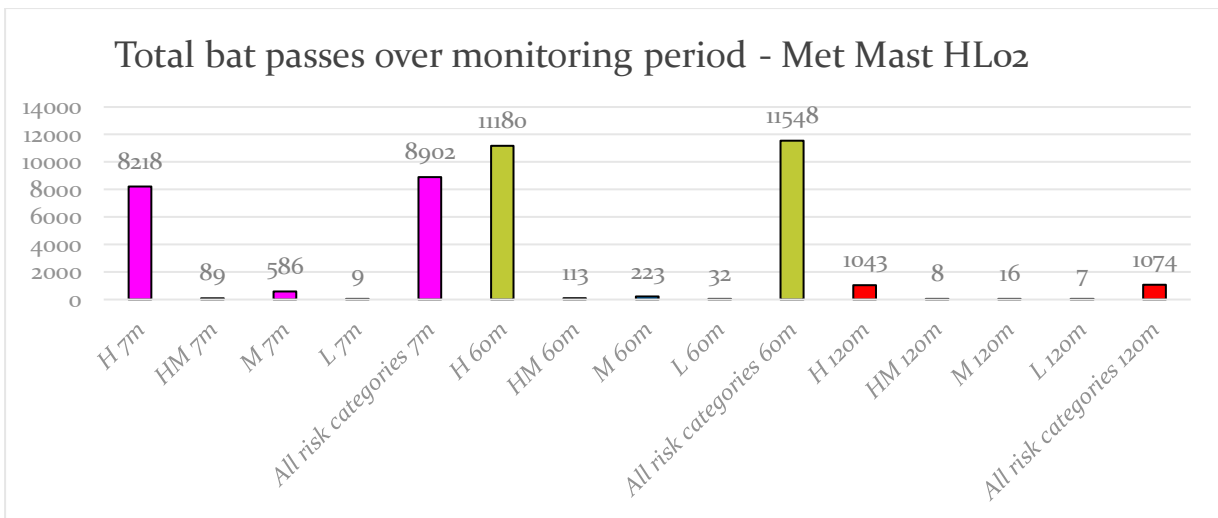


Figure 7-32: Total number of bat passes recorded over the monitoring period by Met Mast HL02.

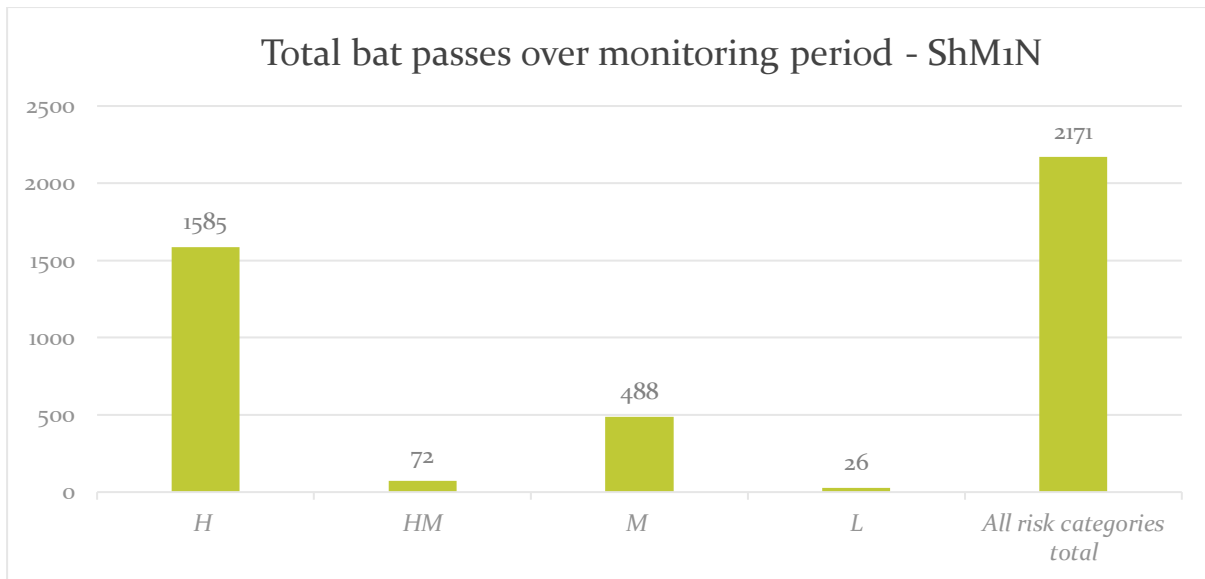


Figure 7-33: Total number of bat passes recorded over the monitoring period by ShM1N.

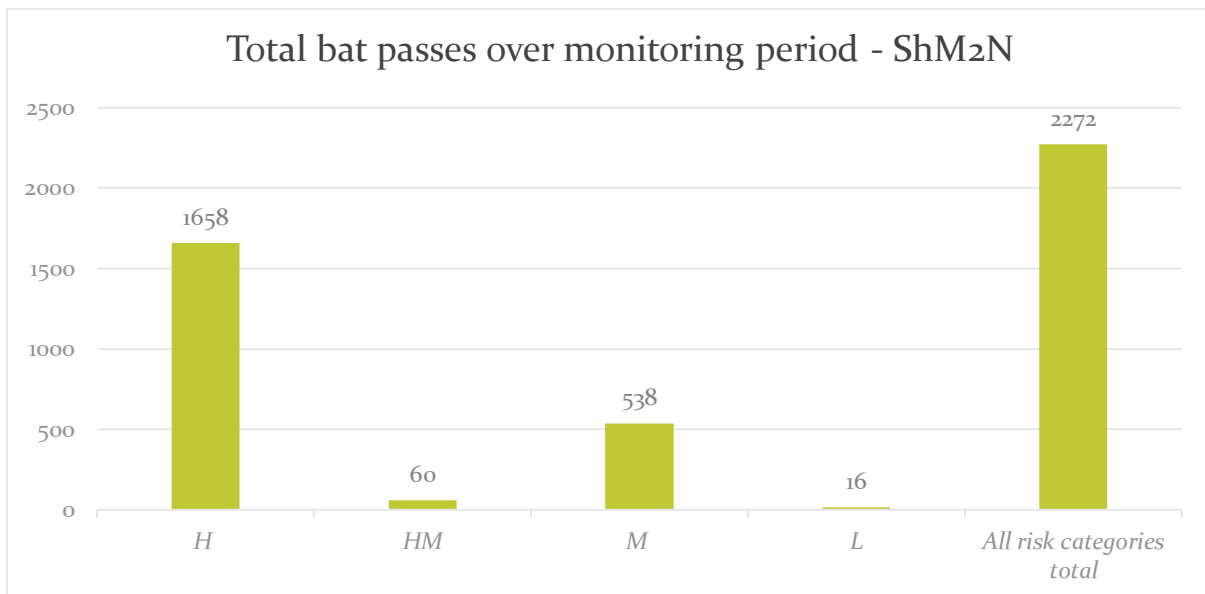


Figure 7-34: Total number of bat passes recorded over the monitoring period by ShM2N.

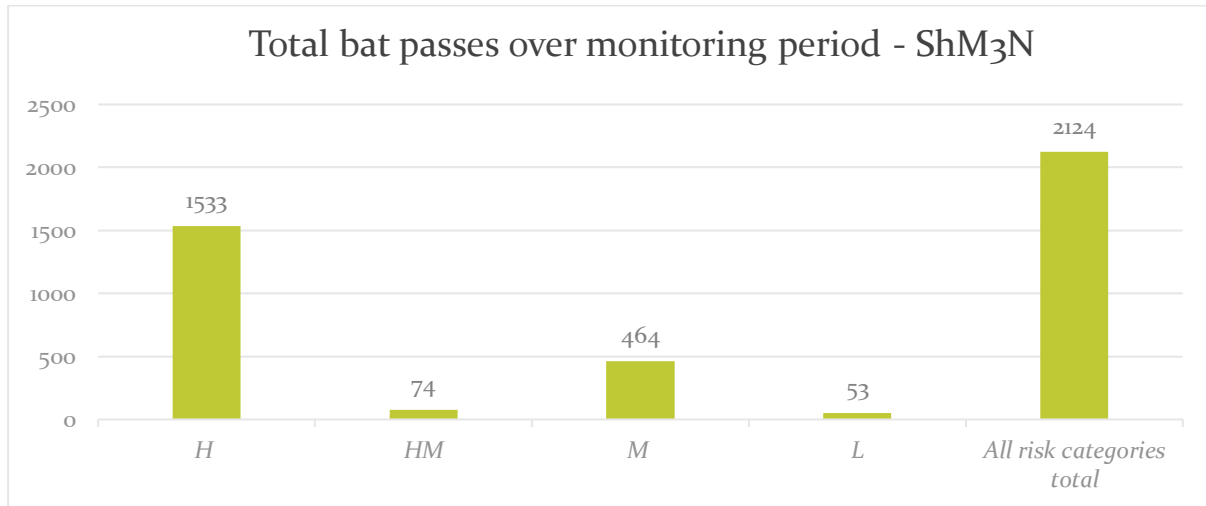


Figure 7-35: Total number of bat passes recorded over the monitoring period by ShM₃N.

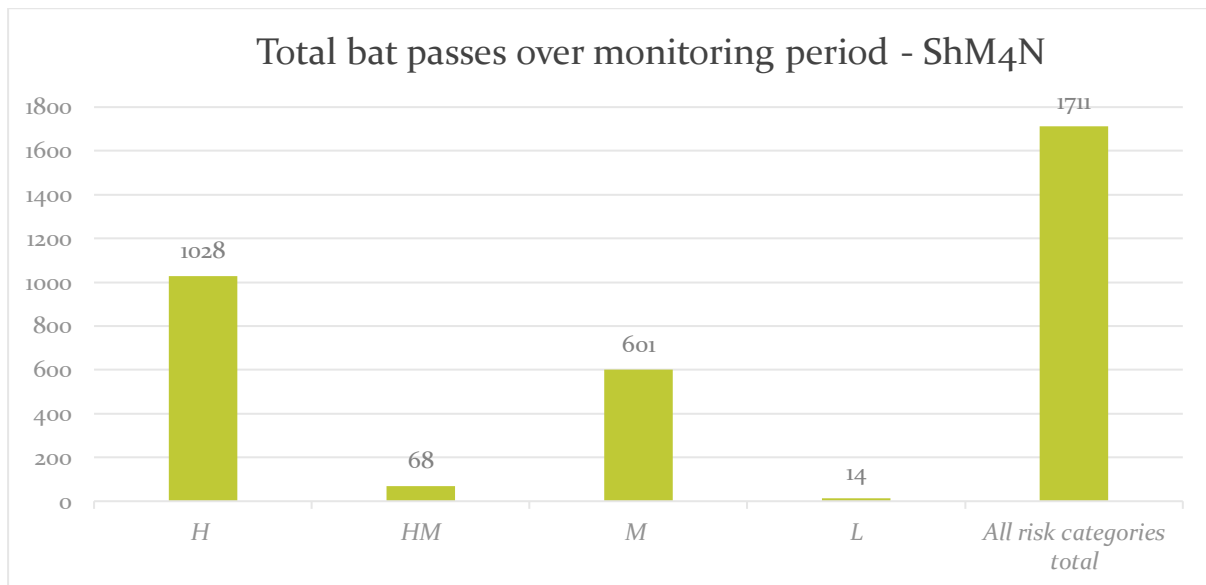


Figure 7-36: Total number of bat passes recorded over the monitoring period by ShM₄N.

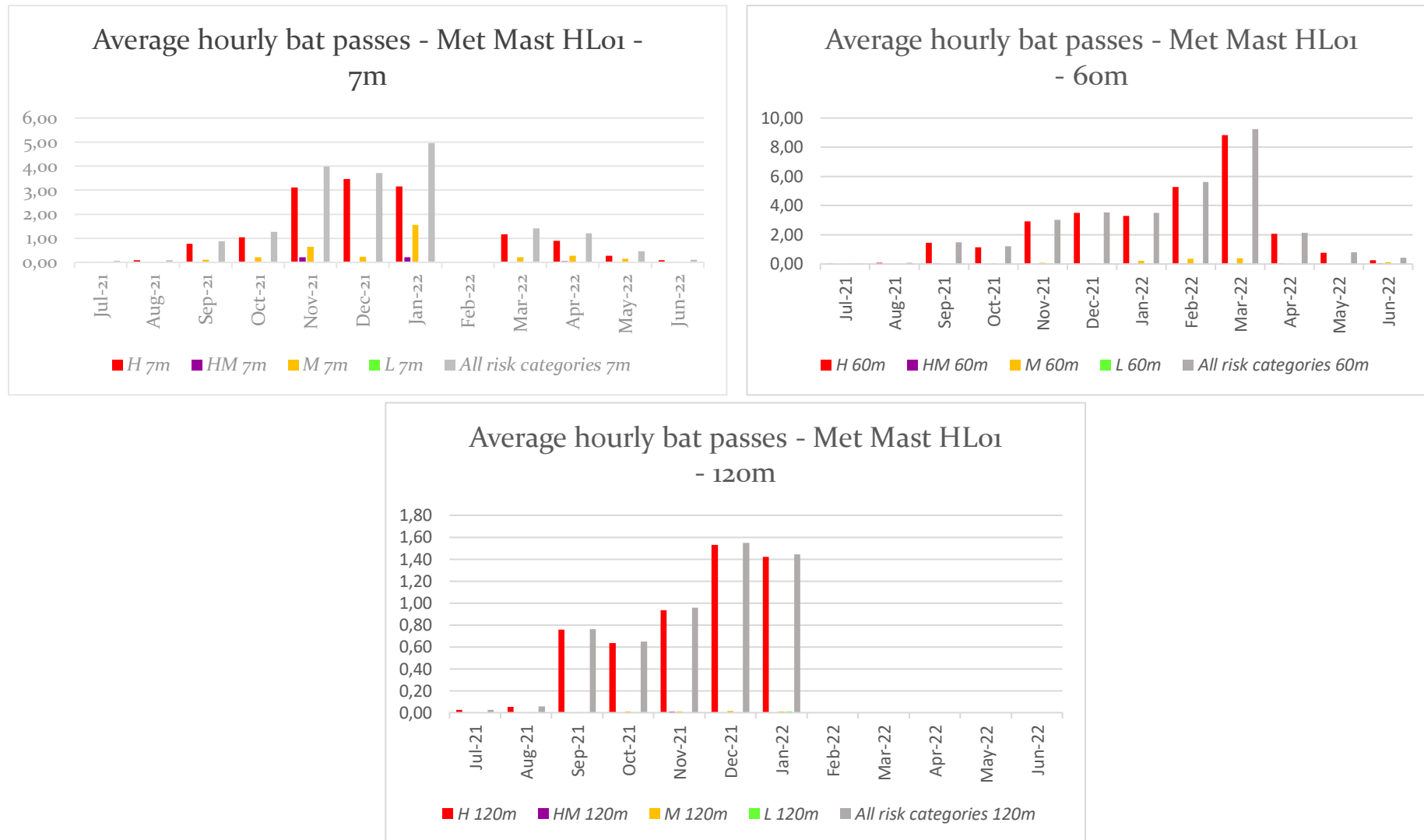


Figure 7-37: Average hourly bat passes recorded per month by Met Mast HLo1 – 10m, 60m and 120m.

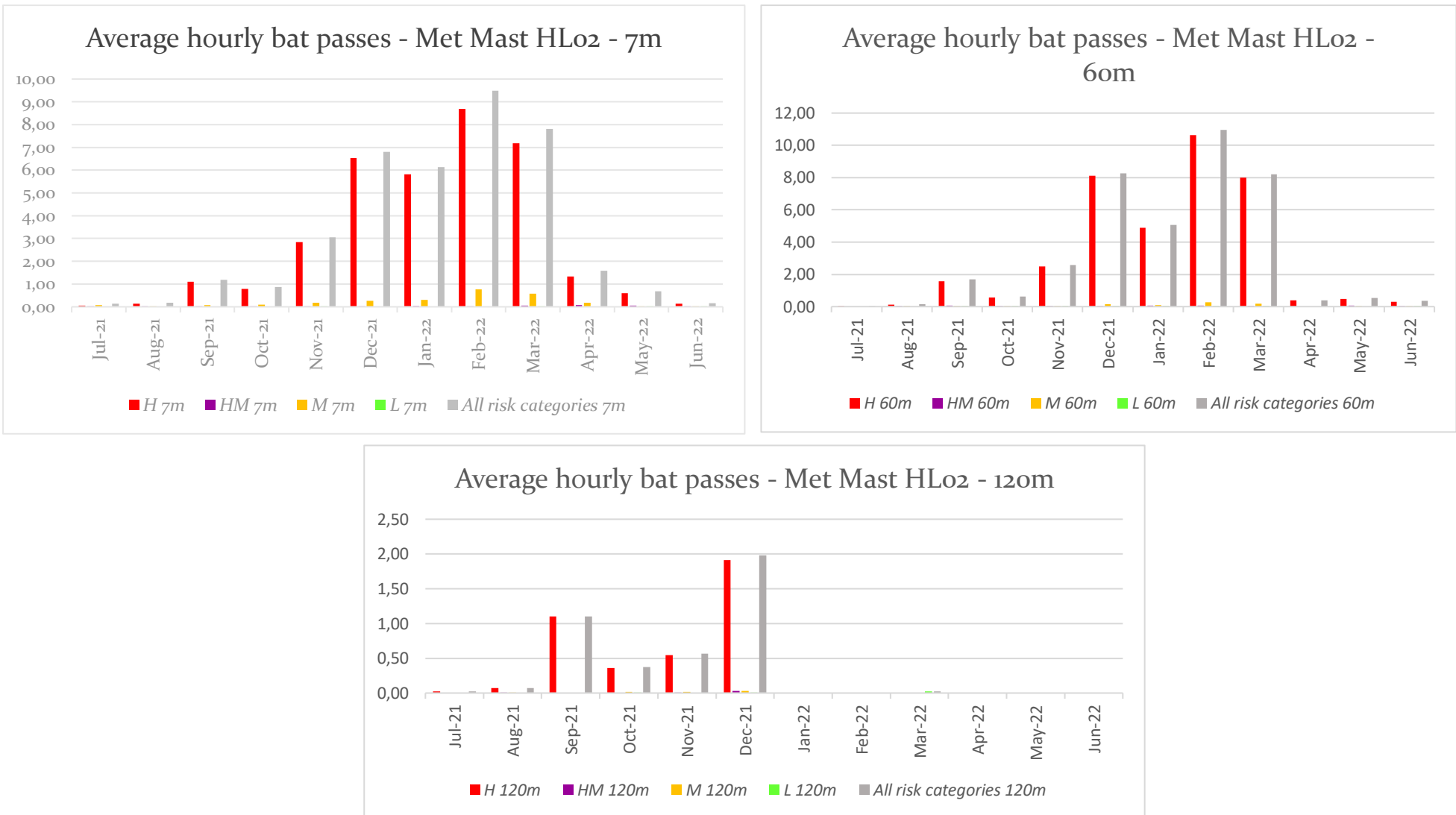


Figure 7-38: Average hourly bat passes recorded per month by Met Mast HLo2 – 10m, 60m, 120m.

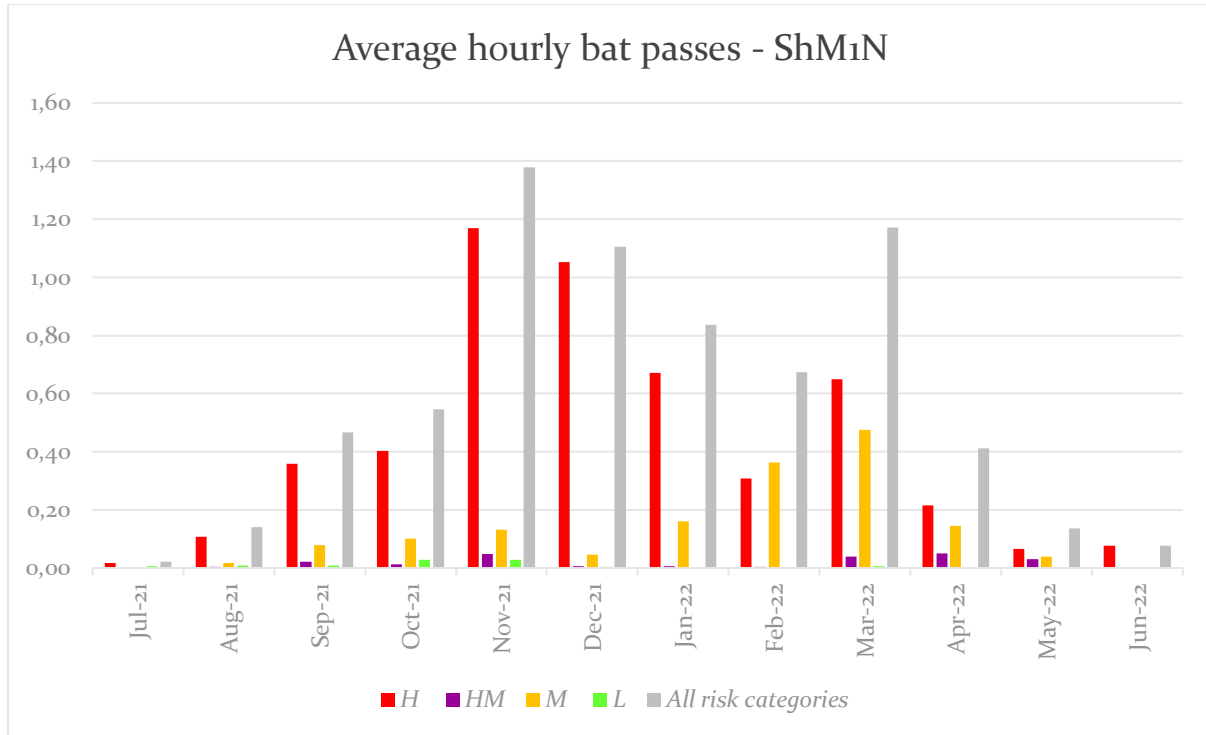


Figure 7-39: Average hourly bat passes recorded per month by ShM1N – 7m.

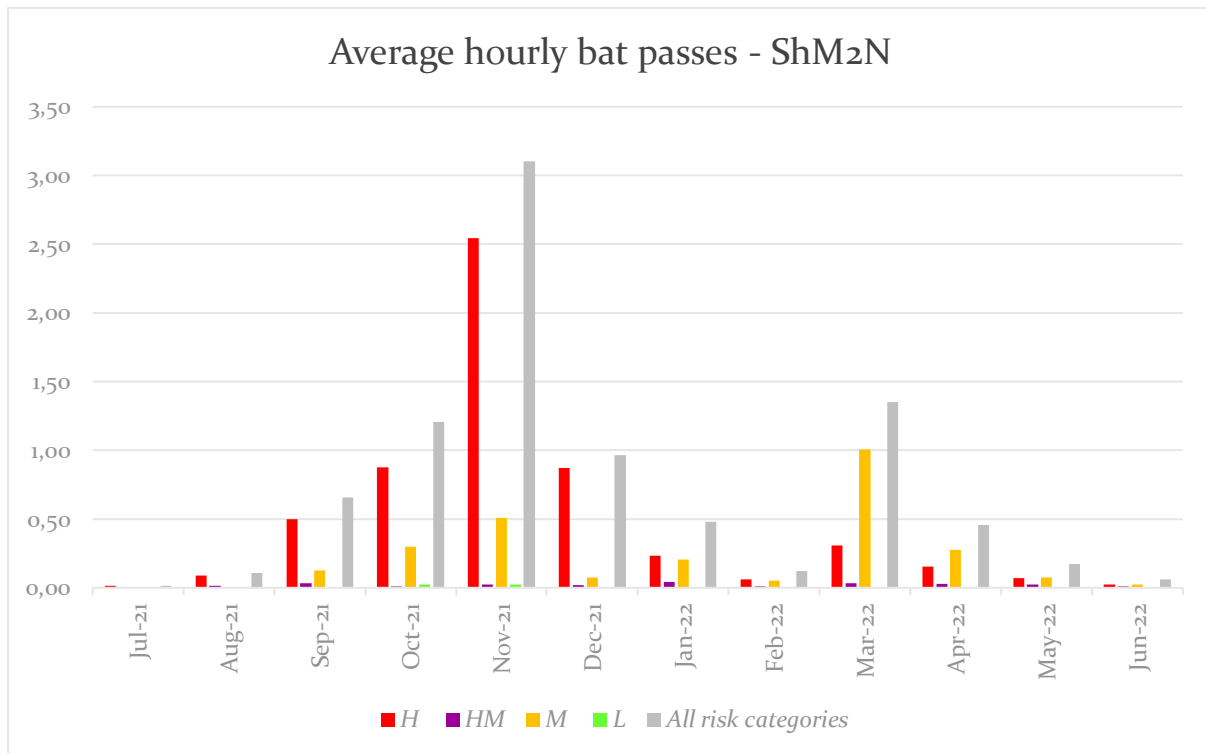


Figure 7-40: Average hourly bat passes recorded per month by ShM2N - 7m.

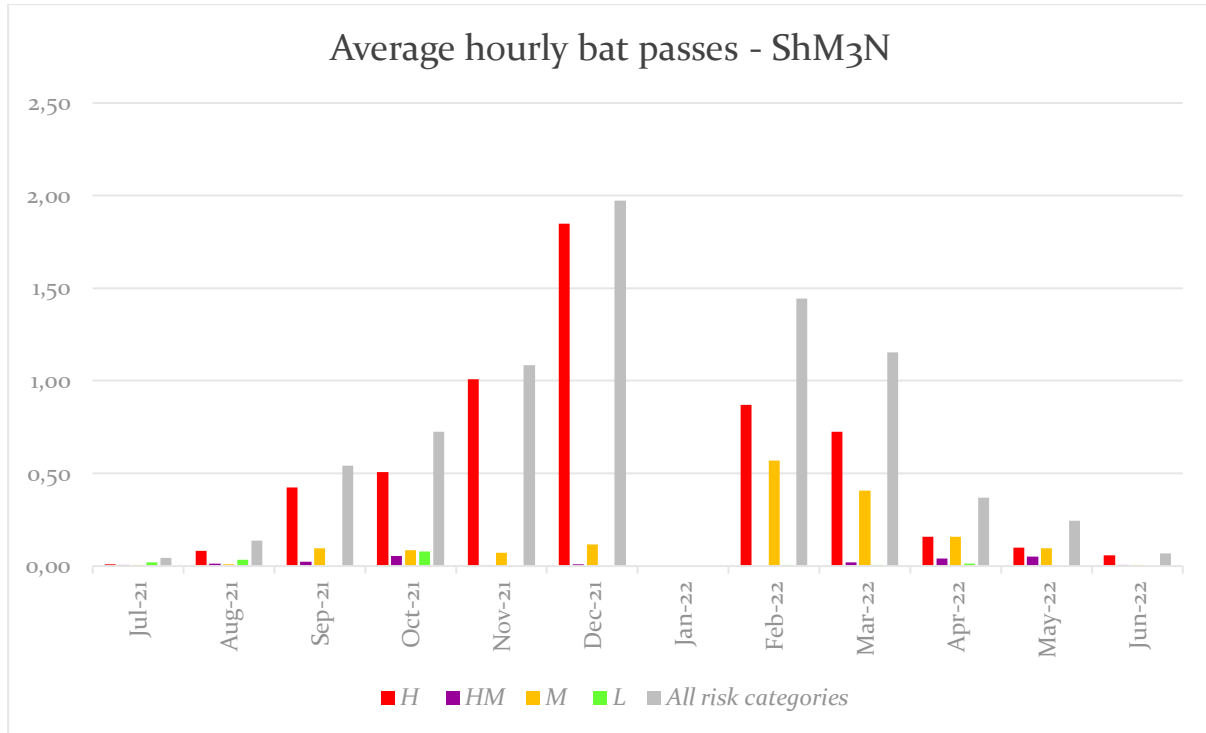


Figure 7-41: Average hourly bat passes recorded per month by ShM₃N – 7m.

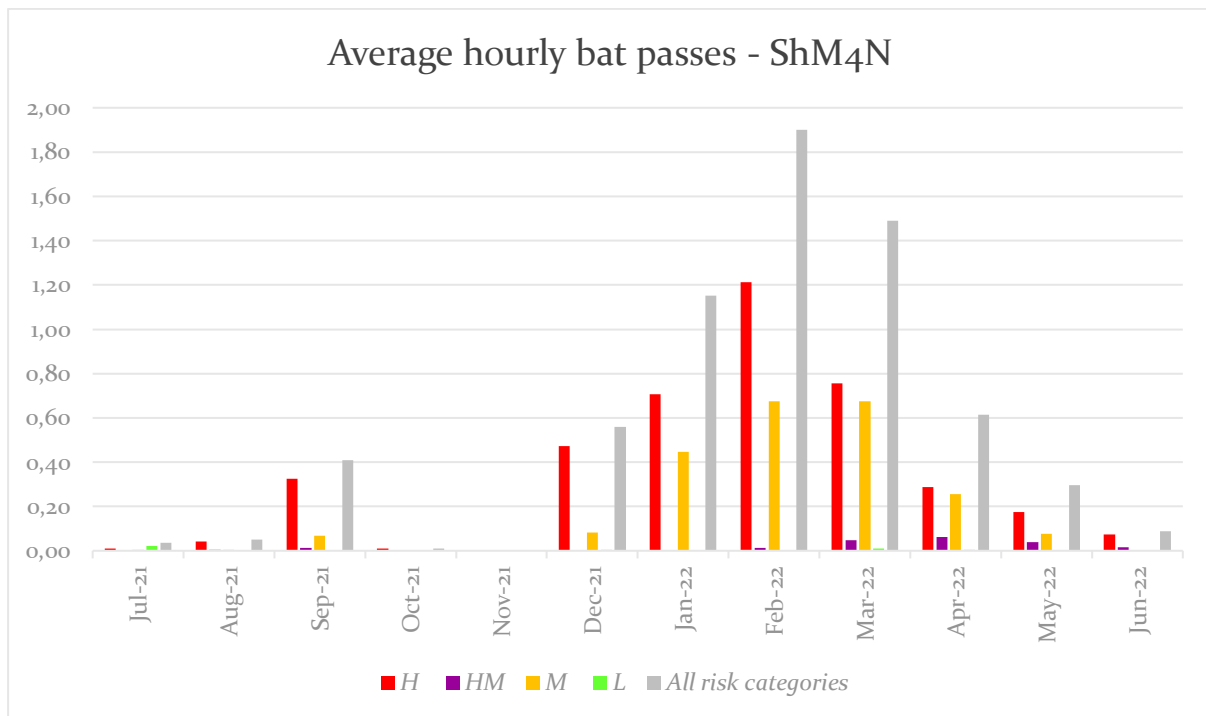


Figure 7-42: Average hourly bat passes recorded per month by ShM₄N – 7m.

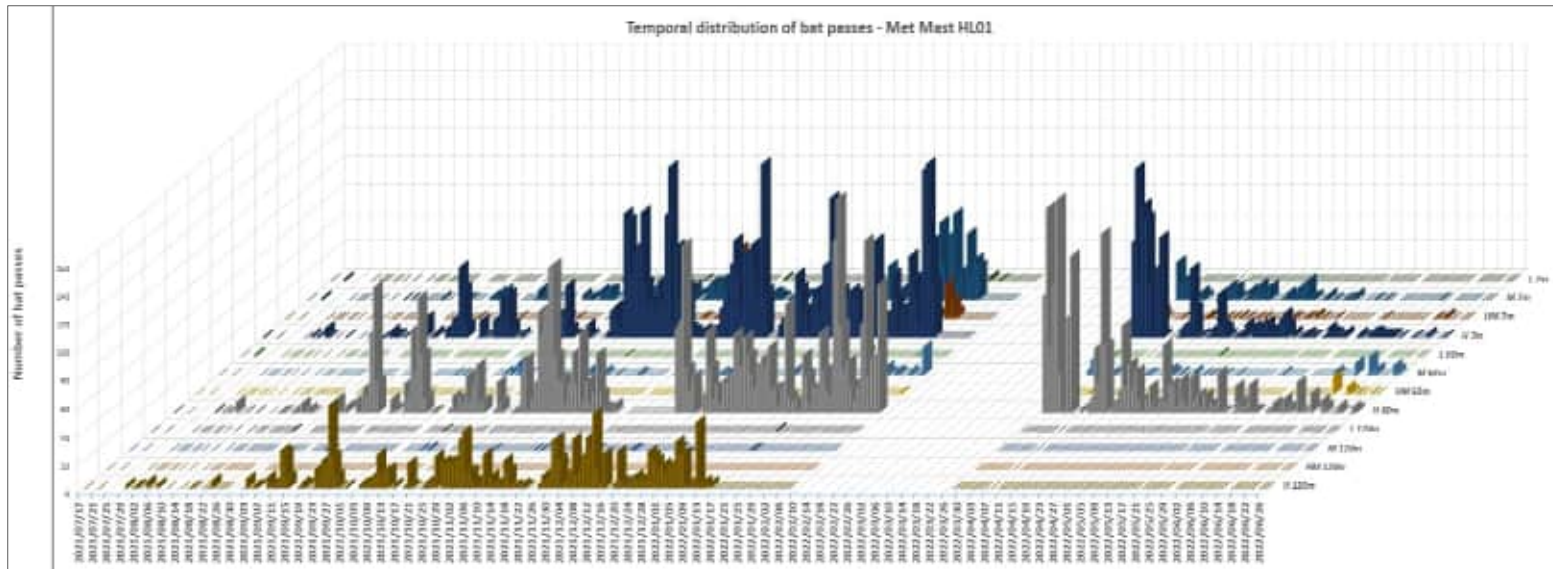


Figure 7-43: Temporal distribution of bat passes detected over the monitoring period by Met Mast HL01.

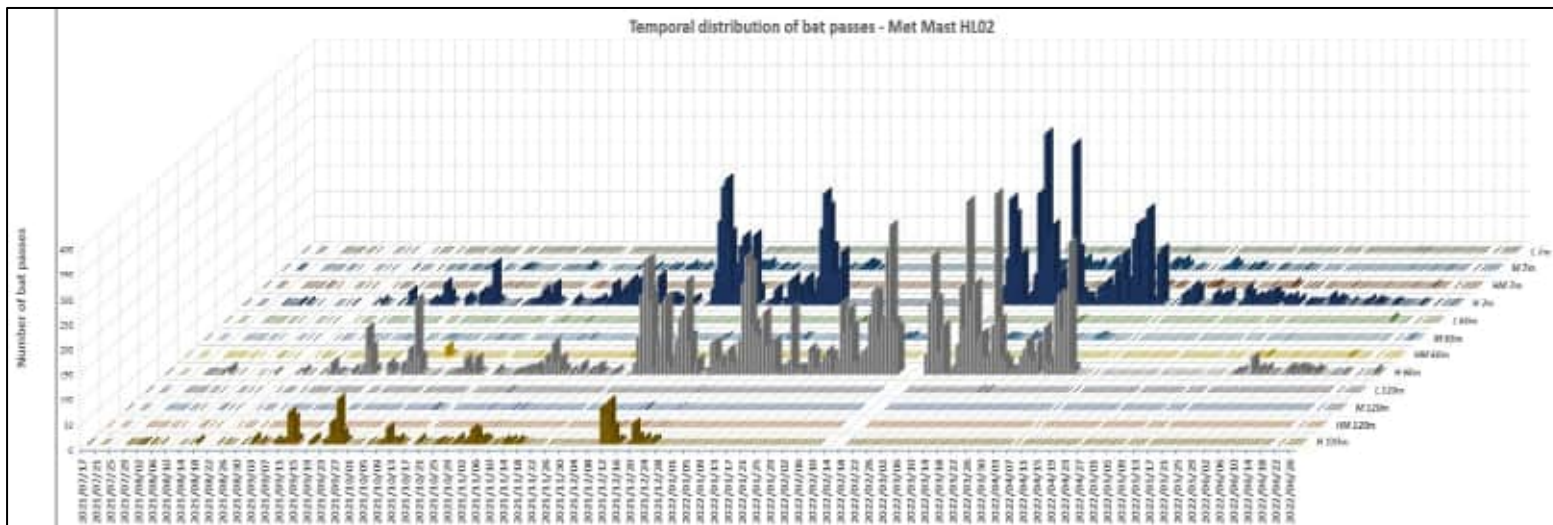


Figure 7-44: Temporal distribution of bat passes detected over the monitoring period by Met Mast HL02.

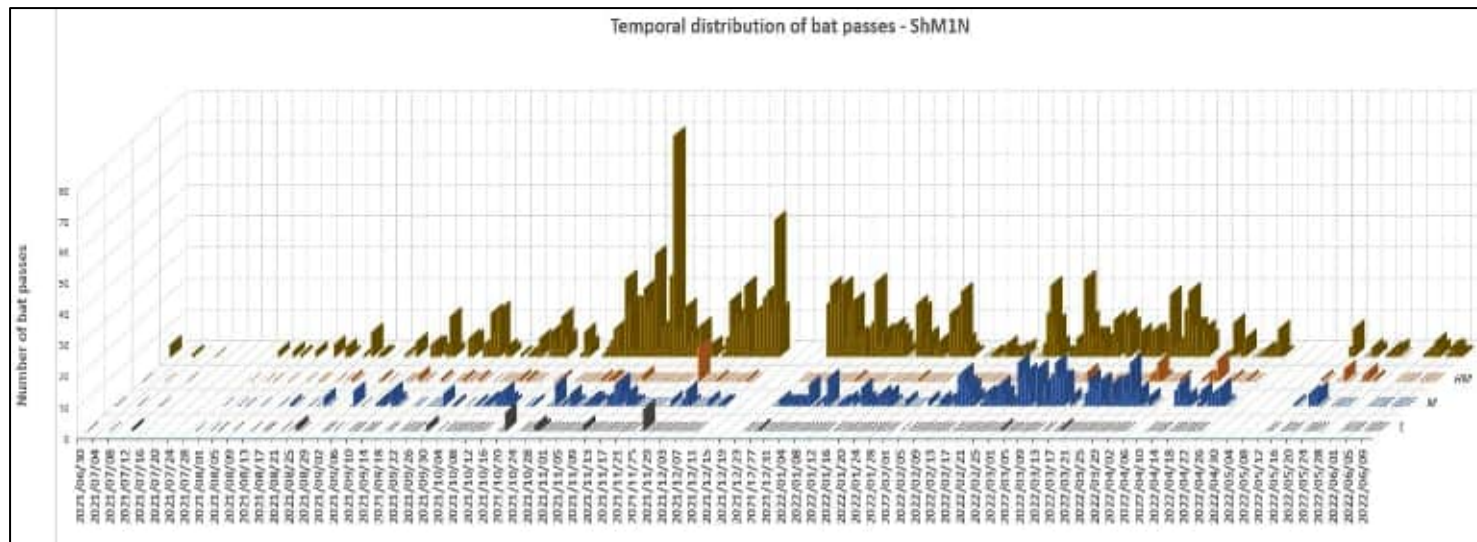


Figure 7-45: Temporal distribution of bat passes detected over the monitoring period by ShM1N.

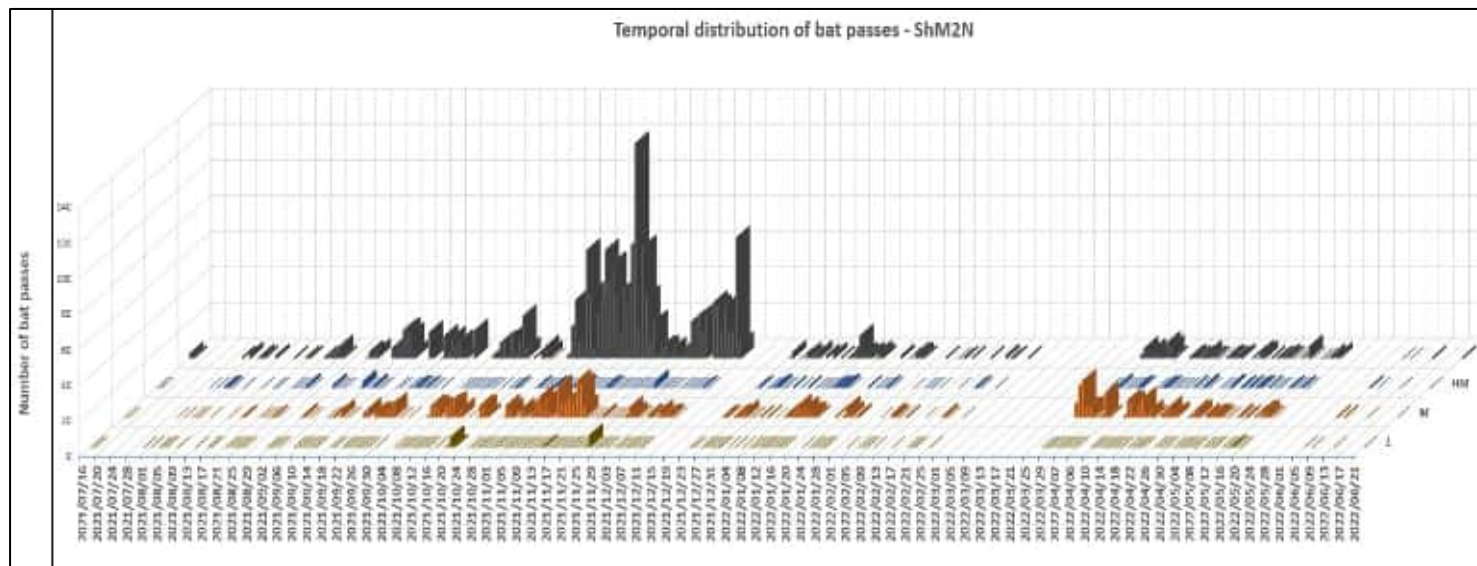


Figure 7-46: Temporal distribution of bat passes detected over the monitoring period by ShM2N.

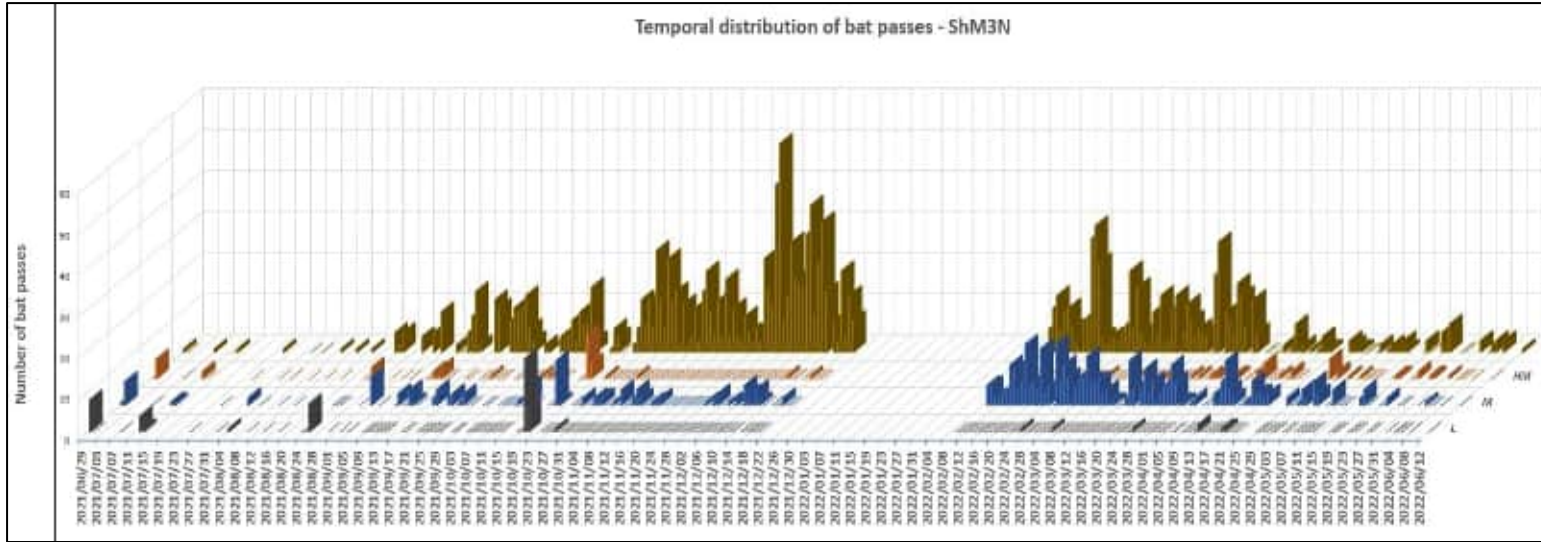


Figure 7-47: Temporal distribution of bat passes detected over the monitoring period by ShM3N.

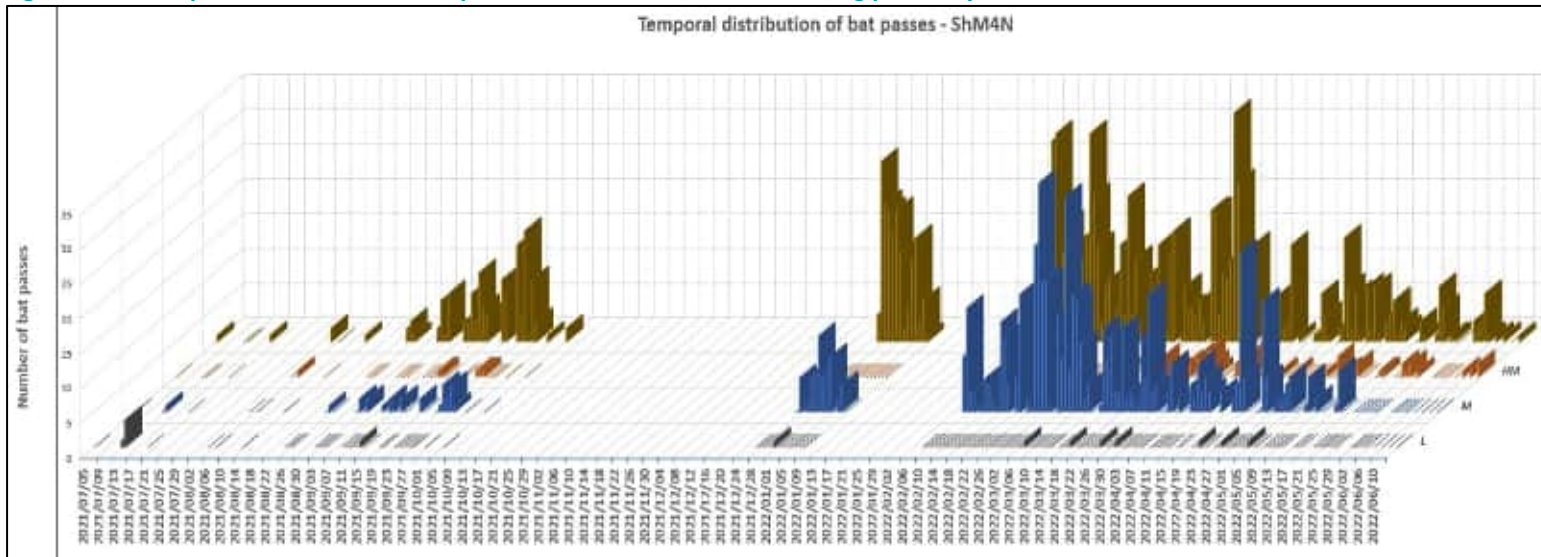


Figure 7-48: Temporal distribution of bat passes detected over the monitoring period by ShM4N.

7.5.2 Site Sensitivity

The sensitivities of the National Screening Tool have been considered, however, the sensitivity map produced with this study deviates from these sensitivities. The deviations are based on detailed site visits and assessments and the sensitivities applied are depicted in Section 7.5.1.1.

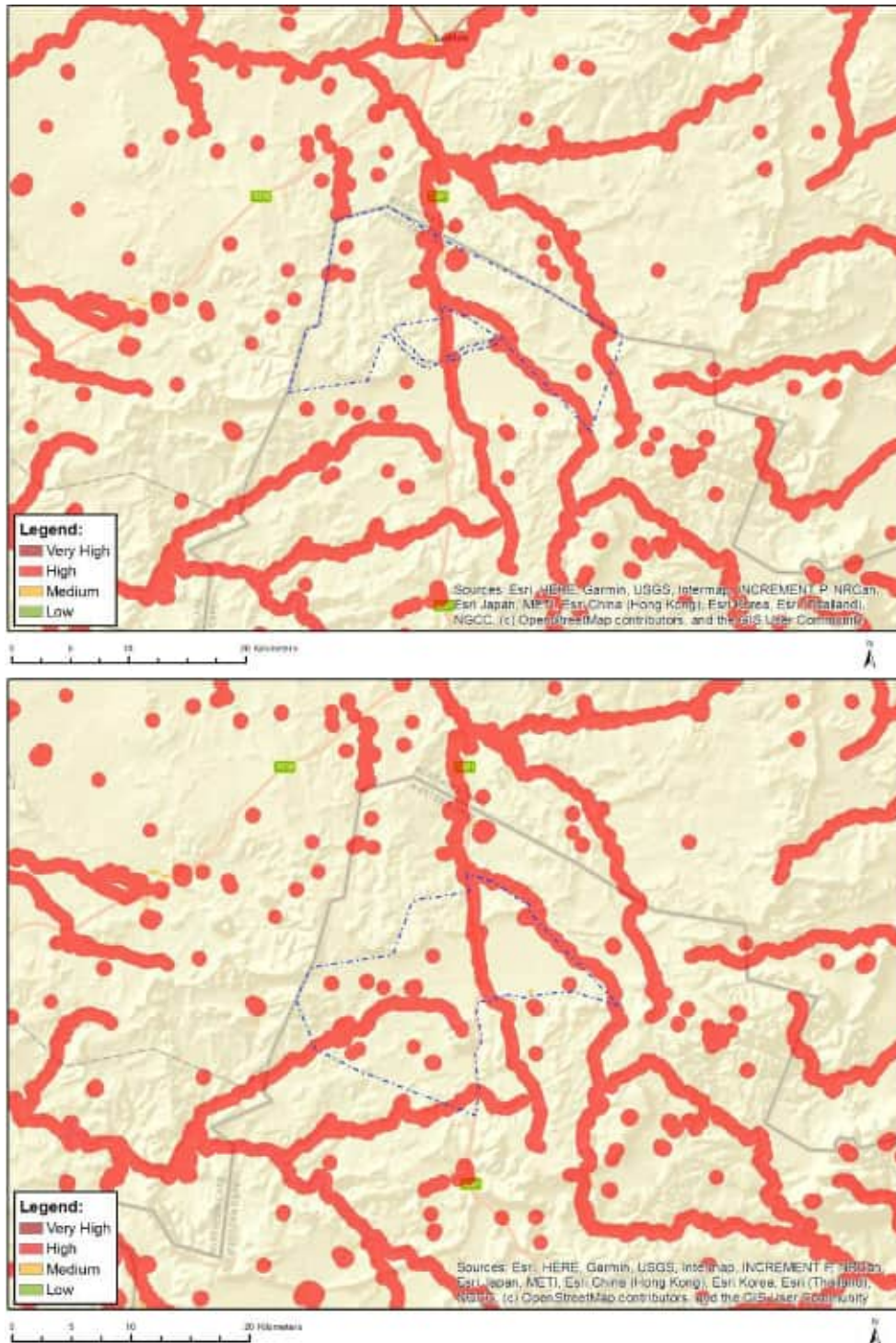


Figure 7-49: Possible bat sensitivity features and areas wind energy for HL1 (top) and HL2 (bottom) according to the National Environmental Screening Tool (May 2022)

Table 7-42 depicts the sensitive areas of the Northern Cluster site, based on features identified to be important for foraging and roosting of the species that most commonly occur on site (which are described in Table 7-40). Thus, the sensitivity map for Hoogland 1 Wind Farm (Figure 7-50) and Hoogland 2 Wind Farm (Figure 7-51) is based on species ecology and habitat preferences. This map has already been used as a pre-construction mitigation in terms of improving turbine placement with regards to bat preferred habitats on site, since the applicant amended the turbine layout considering the sensitivity map. It has also been applied to the other infrastructure types where relevant as detailed in Section 9.

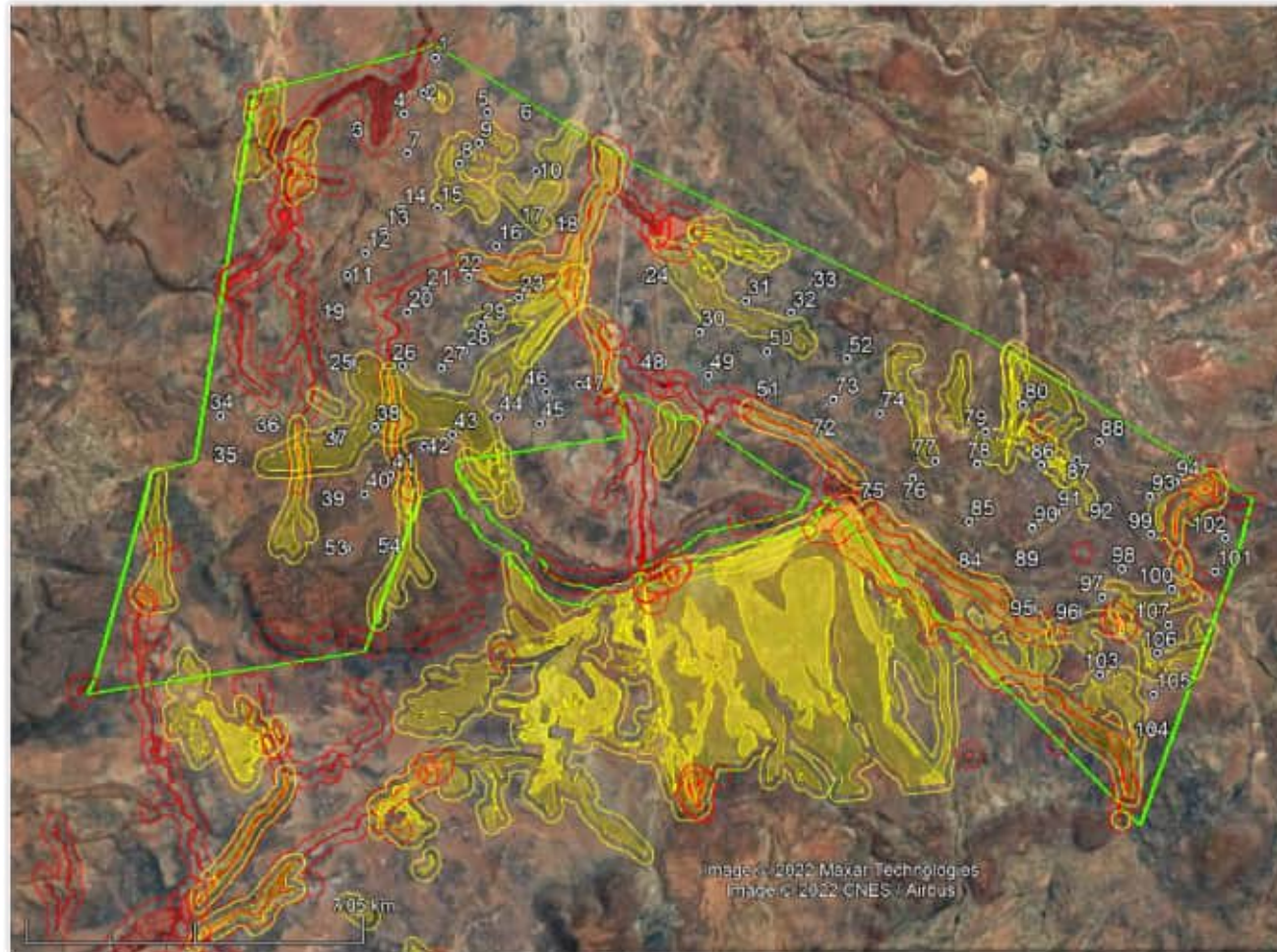
Note that for the turbine sensitivity maps, the buffers provided exclude for blade overhang and a worst-case turbine blade length of 97.5 m has been applied by the Applicant to take this into account as shown in the Consolidated Turbine No-Go map in Section 9.

Table 7-42: Description of parameters used in the construction of the sensitivity map

CLASSIFICATION	FEATURE
High sensitivities and 200m buffers	Valley bottom wetlands.
	Pans and depressions.
	Dams.
	Rocky boulder koppies (tors).
	Exposed rocky cliff edges.
	Drainage lines capable of supporting riparian vegetation.
	Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds.
Moderate sensitivities and 150m buffers	Alluvial plains and washes.
	Seasonal drainage lines.
	Small and low exposed rocky cliffs and edges.

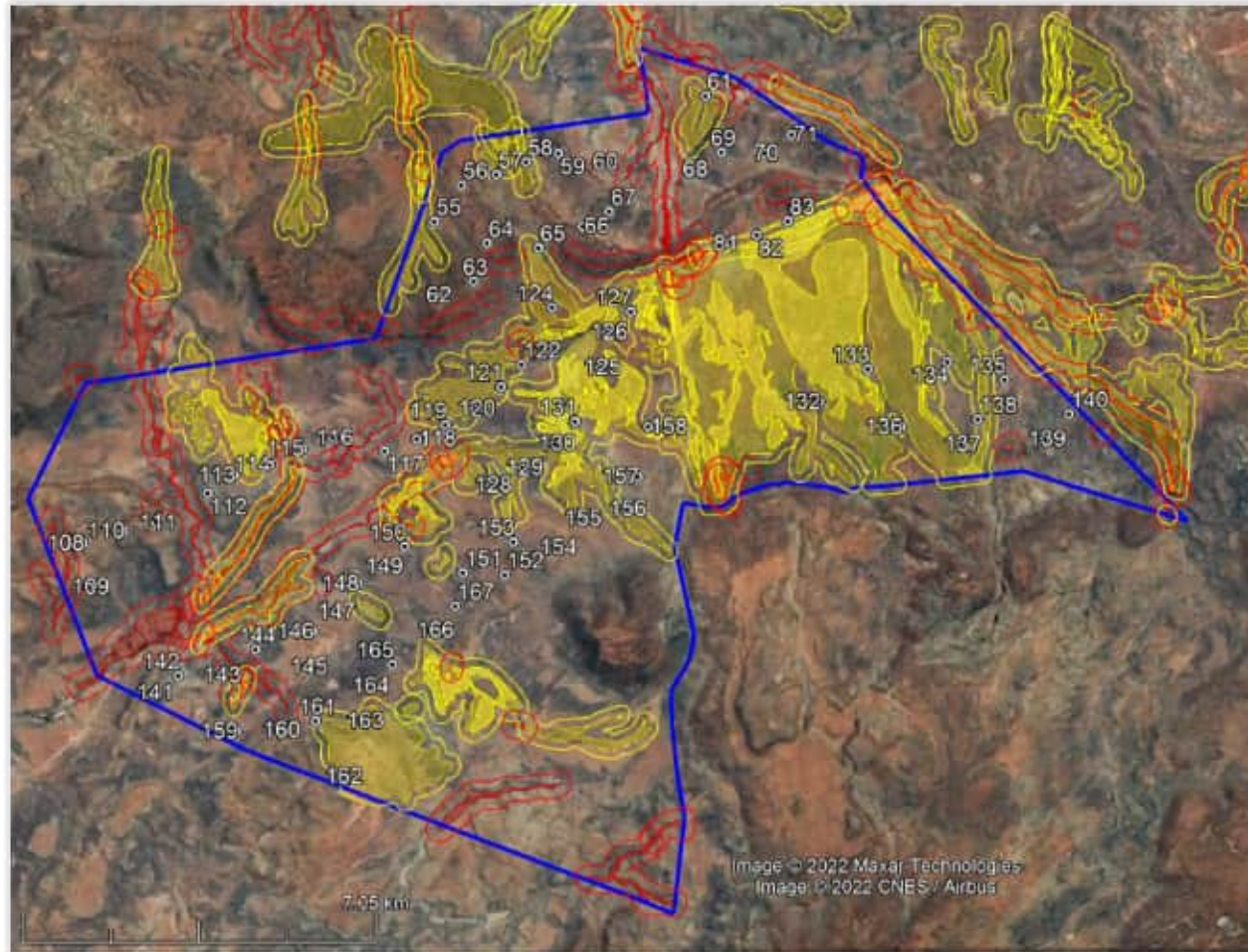
Table 7-43: Turbines located within bat sensitive areas and buffers (including 97.5m turbine blades)

Bat Sensitive Area	Hoogland 1 Turbines	Hoogland 2 Turbines
High bat sensitivity area (no-go areas)	None	None
High bat sensitivity buffer (no-go areas)	None	None
Moderate bat sensitivity area	29, 37, 38, 43, 80, 83, 100	58, 81, 81, 83, 119, 120, 121, 122, 129, 132, 133, 134, 137, 138, 161, 163,
Moderate bat sensitivity buffer	8, 9, 10, 15, 22, 23, 25, 26, 44, 65, 77, 79, 86, 93, 94, 95, 96, 97, 99, 103, 106	57, 61, 65, 113, 114, 123, 124, 125, 126, 127, 128, 130, 131, 136, 156, 158, 162,



- | | | | |
|---|-------------------------------|---|--------------------------------------|
|  | High bat sensitivity area |  | High bat sensitivity buffer 200m |
|  | Moderate bat sensitivity area |  | Moderate bat sensitivity buffer 150m |

Figure 7-50: Bat sensitivity map of the proposed Hoogland 1 Wind Farm site, showing moderate and high sensitivity zones and their buffers, in relation to turbine positions



- High bat sensitivity area
- Moderate bat sensitivity area
- High bat sensitivity buffer 200m
- Moderate bat sensitivity buffer 150m

Figure 7-51: Bat sensitivity map of the proposed Hoogland 2 Wind Farm site, showing moderate and high sensitivity zones and their buffers in relation to turbine positions

7.5.3 Impact Assessment and Mitigation

The following bat impacts have been identified and rated by Animalia (2022). Nothing that decommissioning impacts are considered insignificant and have been scoped out of this assessment.

7.5.3.1 Construction Phase

Table 7-44: Construction: Loss of foraging habitat by clearing of vegetation

Issue	Loss of foraging habitat by clearing of vegetation.	
Description of Impact		
Bat foraging habitat will be destroyed during construction, however, the relative footprint is small.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Very Low
Probability	Definite / Continuous	Probable
Significance	Low -	Very Low -
Degree to which impact can be reversed	Reversible in areas of temporary construction clearing, not reversible in areas of permanent construction.	
Degree to which impact may cause irreplaceable loss of resources	Irreplaceable loss of resources will occur in areas of permanent construction but are limited to a small footprint.	
Degree to which impact can be mitigated	Avoid No-go areas by adhering to the sensitivity map (this has been applied in the current layout to date). Rehabilitating temporary construction clearings.	
Mitigation actions		
The following measures are recommended:	Adhere to the sensitivity map criteria. Rehabilitate cleared vegetation where possible at areas such as laydown yards.	
Monitoring		
The following monitoring is recommended:	The ECO on site during construction must ensure that the sensitivity map is adhered to during construction.	

Table 7-45: Construction: Roost destruction during earthworks

Issue	Roost destruction during earthworks.	
Description of Impact		
Bat roosts in rock crevices may be destroyed during construction, this can cause bat mortalities or permanent disturbances to roosts.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site

Consequence	Medium	Low
Probability	Conceivable	Unlikely / improbable
Significance	Low -	Insignificant
Degree to which impact can be reversed	If the impact occurs, it cannot be reversed. Unlikely to occur.	
Degree to which impact may cause irreplaceable loss of resources	If the impact occurs it will cause irreplaceable loss of resources. Unlikely to occur.	
Degree to which impact can be mitigated	Can be mitigated by adhering to the sensitivity map criteria.	
Mitigation actions		
The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map (this has been applied in the current layout to date)	
Monitoring		
The following monitoring is recommended:	The ECO on site during construction must ensure that the sensitivity map is adhered to during construction.	

7.5.3.2 Operational Phase

Table 7-46: Operation: Bat mortalities during foraging

Issue	Bat mortalities during foraging.	
Description of Impact		
Foraging bats can be killed by colliding with turbine blades, or by suffering barotrauma.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Possible / frequent
Significance	High -	Low -
Degree to which impact can be reversed	Bat mortalities cannot be reversed, however impacted populations may recover over long time periods.	
Degree to which impact may cause irreplaceable loss of resources	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population.	
Degree to which impact can be mitigated	Can be mitigated by correct turbine placement and active mitigations, when required.	
Mitigation actions		
The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map (already implemented in this layout). Where needed, if indicated through operational monitoring, reducing blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Refer to the Bat Mitigation Plan as included in the specialist report and also the EMPr.	
Monitoring		
The following monitoring is recommended:	A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility.	

Table 7-47: Operation: Bat mortalities during migration

Issue	Bat mortalities during migration.	
Description of Impact		
Migrating bats influence several ecosystems since they are cave dwelling species, also over a larger area due to the distances that may be travelled. If turbines are placed within a migration path, a larger area and higher diversity of ecosystems may be impacted.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	Bat mortalities cannot be reversed, however impacted populations may recover over long time periods.	
Degree to which impact may cause irreplaceable loss of resources	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population.	
Degree to which impact can be mitigated	Can be mitigated by correct turbine placement and active mitigations, when required. Each WEF in a migration path should apply their appropriate mitigation measures.	
Mitigation actions		
The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map (already implemented in this layout). Where needed, if indicated through operational monitoring, reducing blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialed and may be recommended during operational monitoring. Each WEF in a migration path should apply appropriate mitigation measures to ensure that each facility's bat mortalities are below a sustainable threshold. Refer to the Bat Mitigation Plan as included in the specialist report and also the EMPr.	
Monitoring		
The following monitoring is recommended:	A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility.	

Table 7-48: Operation: Increased bat mortalities due to light attraction and habitat creation

Issue	Increased bat mortalities due to light attraction and habitat creation.	
Description of Impact		
Floodlights and other lights at turbine bases or nearby buildings, will attract insect eating bats and therefore significantly increase the likelihood of these bats being impacted on by moving turbine blades. Habitat creation in the roofs of nearby buildings can cause a similar increased risk factor.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	

Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Definite / Continuous	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Bat mortalities cannot be reversed, however impacted populations may recover over long time periods.	
Degree to which impact may cause irreplaceable loss of resources	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population.	
Degree to which impact can be mitigated	Can be very efficiently mitigated with low input costs.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> - Avoid No-go areas by adhering to the sensitivity map when siting buildings (this has been applied in the current layout to date). - Only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. This will be at turbine bases (if applicable) and other infrastructure buildings. - For buildings, ensure the design does not allow for any entrance holes into the roof cavity. Refer to the Bat Mitigation Plan as included in the specialist report and also the EMP.	
Monitoring		
The following monitoring is recommended:	During the operational bat mortality monitoring, the bat specialist should visit and make observations on the operational wind farm to determine that no outside lights are installed and positioned in a way where it can increase the probability of bat mortalities from turbines.	

7.5.4 Cumulative Impact

The following cumulative impacts have been identified and rated by Animalia (2022).

7.5.4.1 Construction Phase

Table 7-49: Cumulative impact: Loss of foraging habitat by clearing of vegetation

Issue	Loss of foraging habitat by clearing of vegetation.	
Nature of cumulative impacts	Several wind energy facilities will cumulatively amount to more foraging habitat loss, however, these impacts are fragmented and covers a relatively small footprint area.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

Table 7-50: Cumulative impact: Roost destruction during earthworks

Issue	Roost destruction during earthworks.
Nature of cumulative impacts	Several roosts being destroyed can impact bat populations of affected species over a larger area, however the impact is unlikely to occur.

Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

7.5.4.2 Operational Phase

Table 7-51: Cumulative impact: Bat mortalities during foraging

Issue	Bat mortalities during foraging.	
Nature of cumulative impacts	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population. If this occurs over a larger area of several Wind Farms, it decreases the chances of bat populations recovering to a prior state. Bats play an important role in controlling insect numbers, certain species of insects may increase in numbers over a larger area if bats are negatively impacted.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

Table 7-52: Cumulative impact: Bat mortalities during migration

Issue	Bat mortalities during migration.	
Nature of cumulative impacts	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population. If this occurs over a larger area of several Wind Farms, it decreases the chances of bat populations recovering to a prior state. Bats play an important role in controlling insect numbers, certain species of insects may increase in numbers over a larger area if bats are negatively impacted. For migrating bats, the area of influence are dependent on the migration routes, and may therefore involve Wind Farms not in the immediate larger area.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

Table 7-53: Cumulative impact: Increased bat mortalities due to light attraction and habitat creation

Issue	Increased bat mortalities due to light attraction and habitat creation.	
Nature of cumulative impacts	Floodlights and other lights at turbine bases or nearby buildings, will attract insect eating bats and therefore significantly increase the likelihood of these bats being impacted on by moving turbine blades. Habitat creation in the roofs of nearby buildings can cause a similar increased risk factor. Considering several Wind Farms, the overall mortality rate will be significantly higher with an increased likelihood of impact.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

7.5.5 No-Go Alternative

Due to the comprehensive iterative design process which has been undertaken for the Hoogland Wind Farms and Grid Connection, no other alternatives are being considered. The preferred layout is therefore only being assessed against the 'no-go' alternative. The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail.

Therefore, the specialist rates the No-Alternative as neutral and have no objection with further investigating the option of constructing the project.

7.5.6 Conclusion and Recommendations

The bat study considered information from several site visits were carried out from March 2021 – June 2022, including a helicopter flight, to groundtruth bat sensitivity features and habitats delineated in the bat sensitivity map. Information from literature as well as available bat activity data from site and in the surrounding area, confirms six bat species to occur in the area and another three species likely to occur. Out of this total of nine species, six of these have a medium – high or high likelihood to be impacted by wind energy due to their foraging and behavioural patterns.

The site areas have localised rocky boulder tors and exposed cliffs which can offer suitable roosting space to several bat species. But considering hydrology, the available open surface water is relatively low and foraging activity trends and ranges were therefore strongly dependent on and fluctuated according to seasonal climatic conditions.

A bat sensitivity map has been compiled to include probable roosting and foraging habitats and has already been considered by the developer with regards to initial turbine layout adjustments. Therefore, mitigation through avoidance has been applied as far as possible with current knowledge of the site.

The preconstruction bat monitoring is completed and gathered four seasons of passive bat activity, which provided comparative bat activity and species assemblages across all seasons as well as various habitats, terrain and/or areas of the site. If the proposed wind farm is approved, a minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. And if indicated by the operational monitoring data, the recommended mitigation measures must be followed for the operational phase.

According to available information consulted during this study and up to date, there are no fatal flaws from a bat sensitivity perspective which should prevent the Wind Farms from being approved. Additionally, no known bat caves or large roosts occur in the vicinity of the site. No reasons have been identified for the Hoogland 1 and 2 Wind Farms not to proceed to receive Environmental Authorisation.

7.6 Avifauna

This section provides a short summary of the avifauna specialist report, compiled by Jon Smallie of Wildskies Ecological Service (Pty) Ltd which is available as *Appendix C9: Avifauna*. The information presented here draws from part of the 12-month pre-construction avifaunal monitoring undertaken by the specialist to date.

7.6.1 Baseline Description

It must be noted that pre-construction bird monitoring and all specialist field assessments have been designed to assess the full Hoogland Northern site (i.e., Hoogland 1 Wind Farm and Hoogland 2 Wind Farm). This is an advantage when it comes to the assessment of each site on its own, as data has been collected for a larger area. Since birds are mobile this presents a far stronger assessment than would otherwise be the case. Furthermore, the Hoogland Southern Wind Farm Cluster has been assessed at the same time and presents an additional data set for the avifaunal community in the broader area.

Data for the consolidated Hoogland Northern Cluster Wind Farm Projects site is presented throughout the summary but focuses on individual Wind Farm site specific findings, where relevant.

The baseline description of the study area, prior to pre-construction bird monitoring data (discussed separately below), took into account the following available data:

- Vegetation and Habitat
- Southern African Bird Atlas Project data
- Important Bird & Biodiversity Area (IBA) data
- Co-ordinated Waterbird Count (CWAC) data

7.6.1.1 Data Collection

Pre-construction bird monitoring was initiated in March 2021 and completed in February 2022. The six site visits conducted have taken place as follows: S1 – March 2021; S2 – May 2021; S3 - July 2021, S4 – Sep/Oct 2021, S5 – Nov/Dec 2021 and S6 – February 2022. Each site visit consists of approximately 15 consecutive days on site by four teams of two skilled observers (total of 8 observers), to record data on bird species and abundance on and near site. These site visits covered summer (when summer migrants are present); winter (when raptors breed and Blue Cranes flock); spring (when summer migrants are arriving on site and many species start to breed); and autumn (when summer migrants are leaving, and many raptors are preparing to breed). This sampling is sufficient to capture data representative of conditions on site. Pre-construction bird monitoring complied with both the general and Verreaux’s Eagle best practice guidelines.

Baseline data was collected using the following methods:

- Sample counts of small terrestrial species
- Count of large terrestrial species and raptors
- Focal site survey and monitoring
- Incidental observations
- Direct observation of bird flight on site
- Control site²⁶

²⁶ A control site was monitored to the south-west of the Hoogland Wind Farms site. Monitoring at this site consisted of three Vantage Points; six Walked Transects; one Drive Transect; and two Focal Sites. The data from this site will not be reported on in the impact assessment phase as it is only applicable for comparative analyses during operation.

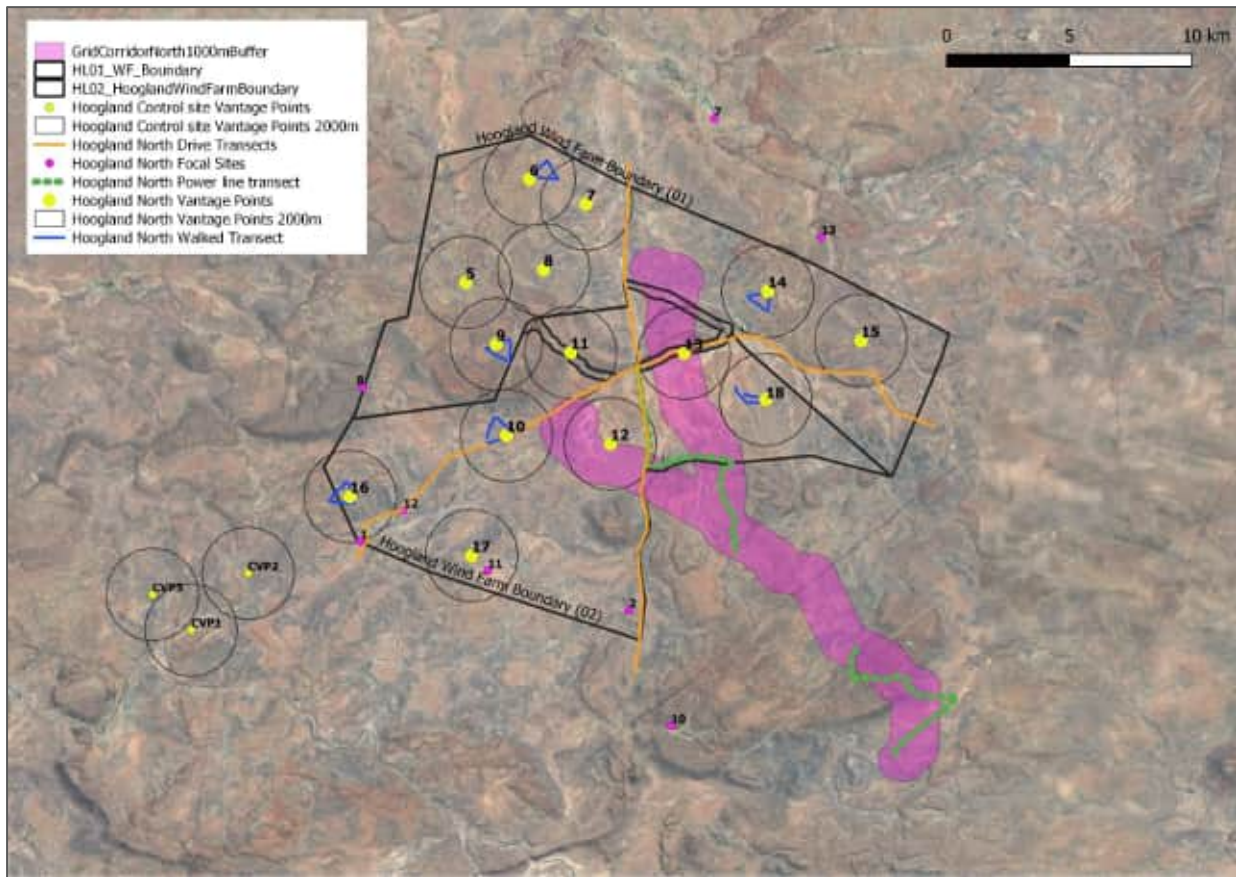


Figure 7-52: The layout of the pre-construction bird monitoring activities on the site

7.6.1.2 Priority Bird Species

For this study, it was necessary to focus on which species are most important or vulnerable as it is not possible to effectively assess the risk to all species observed on site in detail. These have been termed ‘priority species’.

Table 7-54 below lists the final priority bird species as identified by the specialist, together with seasonal presence and a qualitative assessment of risk to each species.

Several species expected to be observed during Vantage Point counts have not been recorded flying on site during the year of monitoring, or have been recorded at very low frequency. We have kept these species in Table 7-54 and assessed them to be at Low risk. These include Kori Bustard, Greater Flamingo and Lesser Flamingo.

Table 7-54: Priority species for the site

Common name	Regional, Global, Endemic	SAB AP1	SAB AP2	Retief et al 2014	S1	S2	S3	S4	S5	S6	Overall Risk	Likely impacts
Black Harrier	EN, EN, NE	1		6	1		1				Low	Collision with turbines
Ludwig’s Bustard	EN, EN	1	1	13	1	1	1	1	1	1	High	Collision with turbines
Martial Eagle	EN, VU	1	1	4	1	1	1	1	1	1	Medium	Collision with turbines
African Rock Pipit	NT, LC, SLS	1	1	77	1	1			1	1	Medium	Collision with turbines, Disturbance, displacement
Flamingo, Greater	NT, LC	1	1	27							Low	Collision with turbines
Karoo Korhaan	NT, LC	1	1	51	1	1	1	1	1	1	High	Collision with turbines, disturbance, displacement
Flamingo, Lesser	NT, NT		1	28							Low	Collision with turbines
Bustard, Kori	NT, NT	1		39							Low	Collision with turbines

Common name	Regional, Global, Endemic	SAB AP1	SAB AP2	Retief et al 2014	S1	S2	S3	S4	S5	S6	Overall Risk	Likely impacts
Crane, Blue	NT, VU	1	1	11	1	1		1	1	1	Low	Collision with turbines, disturbance, displacement
Duck, Maccoa	NT, VU		1							1	Low	Collision with turbines
Verreaux's Eagle	VU, LC	1	1	3	1	1	1	1	1	1	Medium	Collision with turbines
Stork, Black	VU, LC	1		8					1		Low	Collision with turbines
Falcon, Lanner	VU, LC	1		23						1	Low	Collision with turbines
Secretarybird	VU, VU		1	12	1		1	1	1		Low	Collision with turbines, disturbance, displacement
Jackal Buzzard	NE	1	1	44	1	1	1	1	1	1	High	Collision with turbines

EN=Endangered; VU=Vulnerable; NT=Near-threatened; LC=Least Concern; E=Endemic; NE=Near-endemic; SLS=endemic to SA, Lesotho, Swaziland.

7.6.1.3 Pre-Construction Bird Monitoring Data

The pre-construction bird monitoring data is summarised below. Detailed information relating to the data and each data collection method is included in the specialist report.

Table 7-55: Pre-construction bird monitoring provisional results

Small terrestrial bird species	<p>A total of 70 small bird species were recorded on the 18 Walked Transects conducted on the site. This includes 2,997 individual birds from 1,107 records. The first site visit (S1) recorded 38 species, S2 recorded 32, and S3 recorded 23 species, S4 recorded 33 and 46 during both S5 and S6. 11 of the 70 species are endemic or near-endemic to South Africa.</p> <p>The most abundant species on the site were not surprisingly all species already known to be common in the area, such as (in descending order of abundance): Cape Sparrow <i>Passer melanurus</i>; Lark-Like Bunting <i>Emberiza impetuani</i>, Grey-backed Sparrow-lark <i>Eremopterix verticalis</i>, Large-billed Lark <i>Galerida magnirostris</i> and Spike-heeled Lark <i>Chersomanes albofasciata</i>, Rufous-eared Warbler <i>Malcorus pectoralis</i> and White-throated Canary <i>Crithagra albogularis</i> were also notably abundant. Red-headed Finch <i>Amadina erythrocephala</i> and Black-eared Sparrow-lark <i>Eremopterix australis</i> were recorded several times in larger flocks, resulting in a high abundance.</p> <p>The endemic and near-endemic species recorded were: Large-billed Lark; Black-eared Sparrow-lark; Pied Starling, Black-headed Canary, Cape Clapper Lark, Southern Double-collared Sunbird, Sickle-winged Chat, Karoo Eremomela, Karoo Prinia, Karoo Lark, and Grey Tit.</p> <p>Overall, the small passerine bird community is as expected for this area, with no particularly sensitive species present. African Rock Pipit does occur on site, recorded by drive transects, although it has not been recorded by walked transects.</p>
Large terrestrial species & raptors	<p>A total of 10 large terrestrial and raptor species were recorded across the 4 drive transects totalling 54.4 kilometres per season on the site. This included 54 individual birds from 40 records. Five of the 10 species are regionally Red Listed: Verreaux's Eagle and Secretarybird (are Vulnerable); and Karoo Korhaan, Blue Crane and African Rock Pipit (are Near threatened). Two species are near endemic to the region: Jackal Buzzard, and African Rock Pipit.</p>

	<p>The most abundant species recorded by this method was the Jackal Buzzard, followed by Pale Chanting Goshawk and Karoo Korhaan. African Rock Pipit is included here as despite not being a target species for this method (the method aims more at larger species) however it is a priority species for the site.</p> <p>The general abundance of large terrestrials such as cranes, bustards and korhaans was relatively low on site, perhaps reflecting the dry conditions at the tail-end of a prolonged drought period.</p>
Focal Site surveys	<p>The results of the Focal Site surveys relate to the breeding status at the large eagle nests within the broader area. These territories are all occupied and in various breeding states. At the two farm dams a typical assortment of water fowl species were recorded whilst water was present but this has dried up more recently.</p> <p>At the two farm dams a typical assortment of water fowl species were recorded, although water was not present for the entire period of monitoring. Slangfontein Dam (CWAC site) remained dry, and FS20 did not contain water throughout the year of monitoring, although filled up with the good spring/summer rains of S5 & S6 and attracted a relatively large abundance and diversity of waterfowl and waders for the area.</p>
Incidental Observations of target bird species	<p>A total of 26 target bird species were recorded on the site as Incidental Observations. The first site visit, S1 recorded 15 species, S2 recorded 12 and S3 recorded 10, S4 recorded 13, and S5 & S6 recorded 17 each species. The most abundant species recorded by this method was Lesser Kestrel <i>Falco naumanni</i> in very large flocks during S6. This small migrant raptor was particularly abundant in the greater area, following the outbreak of an important prey species, the Brown Locust. Karoo Korhaan were the next most abundant target species, due mostly to being recorded frequently in pairs or groups. Jackal Buzzard was recorded frequently but predominantly as single birds. Since these data are not the product of systematic data collection methods, they should be used cautiously, and we do not discuss this any further here. As far as possible, field teams attempted to avoid recording resident species in the same location, however some replication is highly probable.</p> <p>A total of 164 bird species on site to date (considering all data collection methods), 83 in S1, 68 in S2, and 85 in S3, 91 in S4, 108 in S5 and 127 in S6. Included in the 164 species are: 4 regionally Endangered species; 4 Vulnerable species; 5 Near-threatened species; and 24 endemic or near-endemic species.</p>
Bird flight activity on site	<p>A total of 252 sessions of bird flight observation were completed to date, of 4 hours each, totalling 1,008 hours of observation at Vantage Points across the site in the three site visits. In total, 24 target bird species were recorded flying on the site during this observation period. Nine of these 24 species are regionally Red Listed (Taylor <i>et al</i>, 2015): Black Harrier, Ludwig's Bustard and Martial Eagle (Endangered); Secretarybird, Lanner Falcon and Verreaux's Eagle (Vulnerable); and Karoo Korhaan, Blue Crane and Kori Bustard (Near-threatened). Two species are regionally endemic: Grey-winged Francolin and Jackal Buzzard, the latter also by far the most frequent flier (when the Lesser Kestrel irruption of S6 is not considered).</p> <p>Overall, the most frequently recorded flying species was Lesser Kestrel, with all 29 records of 2,254 birds recorded in the first and last site visits. This is a gregarious species which occurs in loose flocks during summer only (it is a summer migrant). Thereafter, Jackal Buzzard was the next most frequent flier, with 155 individual birds recorded across 126 records. Karoo Korhaan was recorded 47 times for a total of 98 birds.</p>

	Verreaux's Eagle (Vulnerable) was the fourth most frequent flying species, with 78 birds from 55 records. Ludwig's Bustard (Endangered) was recorded flying 64 times (49 birds). Martial Eagle (Endangered) was recorded flying 10 times (10 birds), Secretarybird (Vulnerable) 10 times (7 birds), and Black Harrier (Endangered) twice (2 birds). In general, the warmer months (during S1, S5 and S6) have proven more active in terms of target species flights, compared to S2 – S4 (winter into spring). This is not the case for every species; however, for example, a greater number of Verreaux's Eagle flights were recorded in winter. This may be associated with the winter breeding season, when eagles display, nest build and forage for an extra young eagle once hatched
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7.6.1.4 Estimating turbine collision fatality rates

Crude turbine collision fatality rates were calculated for each species to estimate how many birds each of the proposed two Wind Farms could kill once operational. This was based on the species' passage rates (number of birds recorded flying per hour) recorded on site. Generally speaking, it is expected that those species which fly more often are more susceptible to turbine collision. The method of calculation and associated assumptions are described in the specialist report in detail.

Wildskies (2022) believes that the estimated fatality rates calculated represent a worst case scenario, for the following reasons: fatality rates were calculated based on the 87 turbines for Hoogland 1 Wind Farm and 80 turbines for Hoogland 2 Wind Farm applied for, rather than the maximum of 60 which will ultimately be built; flights of all heights above ground were included, whereas in reality some flights would be below or above rotor zone; no consideration is given to actual turbine locations relative to actual flight path positions (and extensive avoidance of collision risk has been applied in turbine siting already); and a relatively conservative avoidance rate of 98% was used.

The specialist notes a low confidence in the estimates (refer to specialist reports for assumptions and motivations in this regard), but the exercise is worthwhile, nonetheless. It is estimated that approximately 21,05 bird fatalities could be recorded at each of the two Wind Farms (Hoogland 1 & Hoogland 2) sites per year across the 24 target bird species recorded flying on site to date. This includes the following priority species: 1.92 Jackal Buzzards; 1.21 Karoo Korhaan; 0.97 Verreaux's Eagle; 0.79 Ludwig's Bustard; 0.3 Blue Crane; 0.12 Martial Eagle; 0.12 Secretarybird; and 0.02 Black Harrier. Estimated Lesser Kestrel mortality (13.96) constitutes a large proportion of the total number of fatalities, although this species is not currently threatened.

Human caused fatalities of Red listed or otherwise threatened bird species are always cause for concern and should be avoided as far as possible. There are currently no established thresholds for acceptable impacts on bird species in South Africa. To establish these thresholds would require complex population modelling incorporating accurate information on many factors for each species (including population size, age specific fatality rates, breeding productivity etc). Such modelling and information are not available in South Africa at present. In the absence of this information, we are forced to make a subjective finding as to the acceptability of the above estimated estimates. In terms of the impacts of unnatural sources of mortality (such as wind turbine collisions) on birds, the large, slow breeding, and long-lived bird species are most susceptible. This is because the effect of a mortality is greater than just that one bird. If it is an adult bird, there could be secondary effects of lost breeding opportunity and recruitment of young birds to the population, in addition to the single mortality. This means that of the priority bird species, it is the raptors, cranes and bustards which are probably most likely of any species to experience population level impacts.

The specialist is not aware of any published studies demonstrating population level impacts of Wind Farms on such species in South Africa. Although several international authors have suggested that population level impacts on certain species are likely or predicted such impacts on prioritised species according to their vulnerability (e.g., Loss

et al, 2013; *Beston et al*, 2016, *Watson et al*, 2018, *Carrete et al*, 2009) we are not aware of actual evidence of such effects.

Wildskies (2022) views the above fatality rates as being of medium to high significance for these species (the raptors, cranes and bustards). It is essential that all mitigation measures recommended in Section 7.6.3 be accepted to ensure that these fatality rates are reduced where possible including an adaptive management approach as explained below.

7.6.1.5 Spatial location of flight records

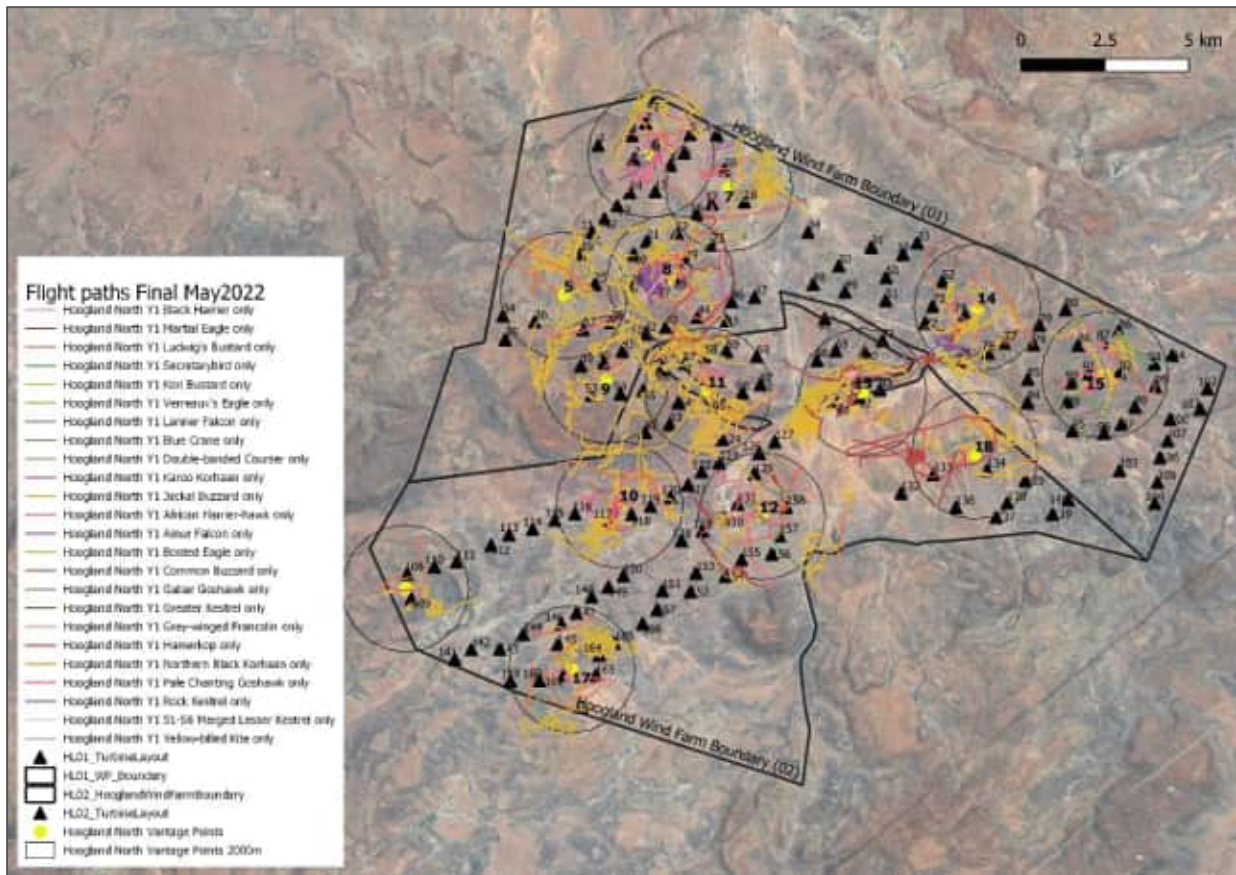
The spatial location of all target bird species flight records for the site, for the six site visits, can be seen below in Figure 7-53. In general, flight activity of all target species across the Hoogland North Cluster was fairly evenly spread, although Vantage Points 9 and 16 recorded noticeably less flight activity than the other VPs.

When analysing flight paths per species, overlaid for all site visits, we gain a deeper understanding of how the environment is used by the birds. Beginning with non-threatened species, Jackal Buzzard was the most-recorded species flying on site (when disregarding the Lesser Kestrel irruption of S6). Jackal Buzzard was recorded flying at each of the VPs at least once, although particularly high activity was observed from VPs 9, 10, 11, 13 and 18. High-use areas of the landscape are seen to the south of VP11 and to the south-west of VP13; these areas appear to mostly miss the proposed turbine layout.

A number of Jackal Buzzard nests were found on site and the species was well-represented in the year's data. While this species is still considered to be common, turbine collisions are killing many individuals in the country, and this does appear to be a cause for concern (Ralston-Paton *et al.*, 2017). The cumulative fatality estimate for the species is 3.84 birds per annum for the Hoogland Northern Cluster, and 9.13 birds killed annually when considering the cumulative impact of the Nuweveld and Hoogland South Wind Farms as well. "Buteo" as a genus has high fatality rates globally, and although Jackal Buzzards are widely distributed across the country, territories of this near endemic species are likely to overlap more and more with that of wind farm development in the future. The role common raptors play in the ecosystem is an important one, and the implications of losing resident predators such as the Jackal Buzzard can be difficult to predict.

Pale Chanting Goshawk were relatively frequently recorded on site, particularly near VPs 12 and 15. The species typically forages in a "perch and pounce" style and does not spend much time at rotor height, in contrast with Jackal Buzzard and other priority species.

Other non-threatened species such as African Harrier-hawk, Booted Eagle and Rock Kestrel were recorded using the landscape relatively infrequently and with no discernibly important flyways.



AHH=African Harrier-Hawk; BH=Black Harrier; DBC=Double-banded Courser; GK=Greater Kestrel; GWF=Grey-winged Francolin; H=Hamerkop; JB=Jackal Buzzard; KK=Karoo Korhaan; LB=Ludwig's Bustard; LK=Lesser Kestrel; ME=Martial Eagle; PCG=Pale Chanting Goshawk; RK=Rock Kestrel; SB=Secretarybird; VE=Verreaux's Eagle.

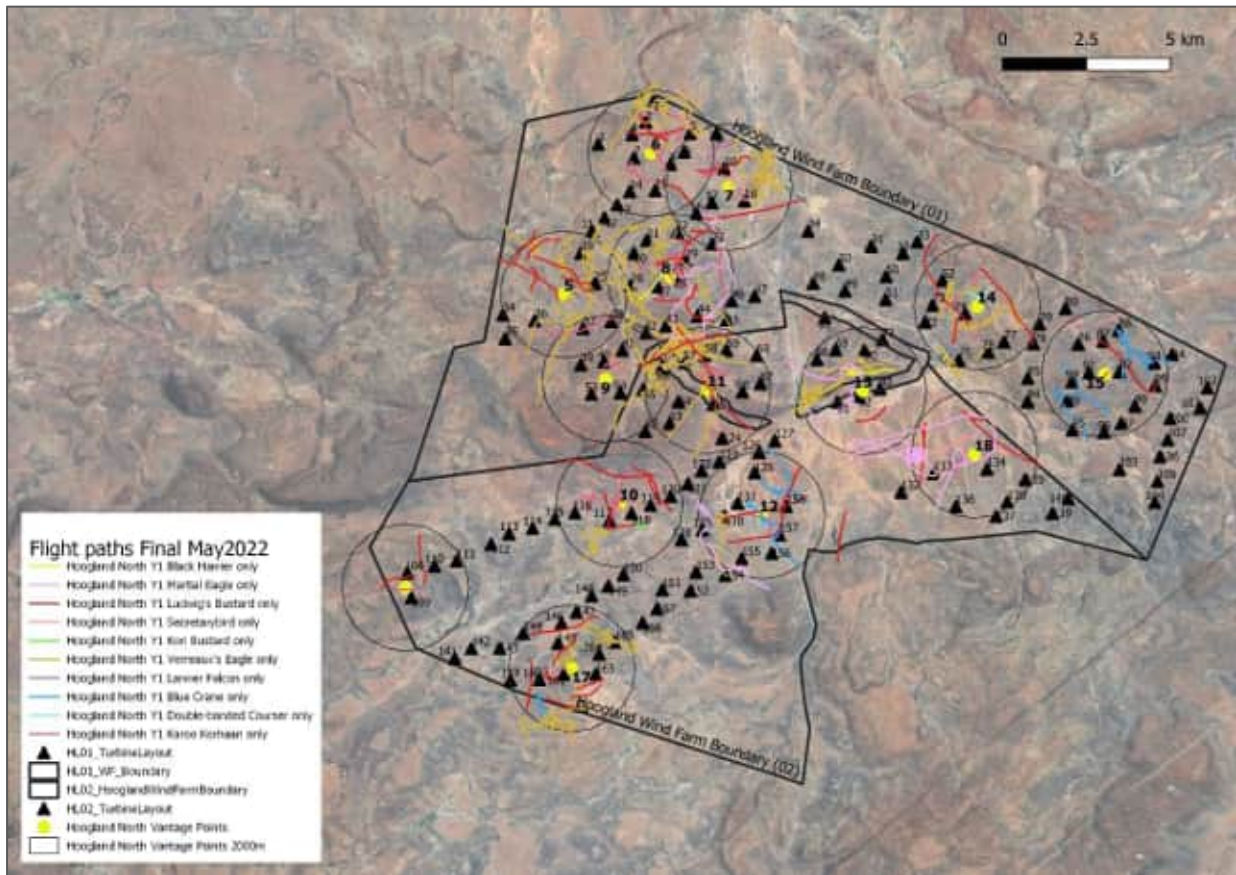
Figure 7-53. Recorded target bird species flight paths at the site (all species, 6 site visits)

Figure 7-54 presents the flight paths for the regionally Red Listed species only. Considering each of the Red Listed priority species in turn, Black Harrier, Blue Crane, Kori Bustard, Lanner Falcon and Secretarybird were recorded seldomly on site and with little to note regarding any trends in flight path activity (except that VPs 12 and 15 appeared to be where the majority of Secretarybird and Blue Cranes flew), while Karoo Korhaan, Ludwig's Bustard, Martial Eagle and Verreaux's Eagle warrant more discussion.

Karoo Korhaan were observed from all but two VPs (5 and 13), although as for Pale Chanting Goshawk, these flights were generally short in duration and below rotor-swept height. Most activity was noted around VPs 6, 7 and 8. Ludwig's Bustard flights were recorded regularly, and at all VPs on site. The species typically flies low to the ground but often enters the rotor swept area when on longer flights. The species is ranked 14th in terms of its overall risk of turbine collision (Ralston-Paton et al. 2017) and is also at high risk of collision with power line infrastructure. Martial Eagle (ranked 3rd in collision risk, Ralston-Paton et al. 2017) was recorded 10 times on site throughout the year. These flights were recorded around VPs 8, 12, 13 and 18.

Verreaux's Eagle were recorded frequently on site during the year's monitoring. A total of 55 flight records were made of 78 birds, the second highest number of records made for any target species. Flights were predominantly recorded on the northern VPs of the cluster, particularly around VPs 5, 8, 9 and with a hot-spot of activity to the north of VP11. The species is ranked second for its turbine collision risk according to Ralston-Paton et al. (2017). A number of nest Focal Sites are known from the surrounding areas, and it stands to reason that pairs will forage across the landscape, defending their territories or seeking mates or new territories in the case of immature individuals. Much of the landscape is very suitable for Verreaux's Eagle, with much habitat present that is home to

healthy populations of Rock Hyrax (*Procapra capensis*), their preferred prey. Flight activity was often, although not always, concentrated around steeper topography and along ridge lines.



BH=Black Harrier; KK=Karoo Korhaan; LB=Ludwig's Bustard; ME=Martial Eagle; SB=Secretarybird; VE=Verreaux's Eagle.

Figure 7-54. Recorded Red Listed species flight paths at the site (6 site visits)

7.6.2 Site Sensitivity

Reporting was further informed by the high sensitivity output of the Animal theme in the National Screening Tool. While the Avian theme (see *Appendix E: DFFE Screening Tool Reports* for full reports) was considered Low Sensitivity, the Animal theme flagged sensitive bird species as High and Medium sensitivity based on Ludwig's Bustard and Verreaux's Eagle presence.

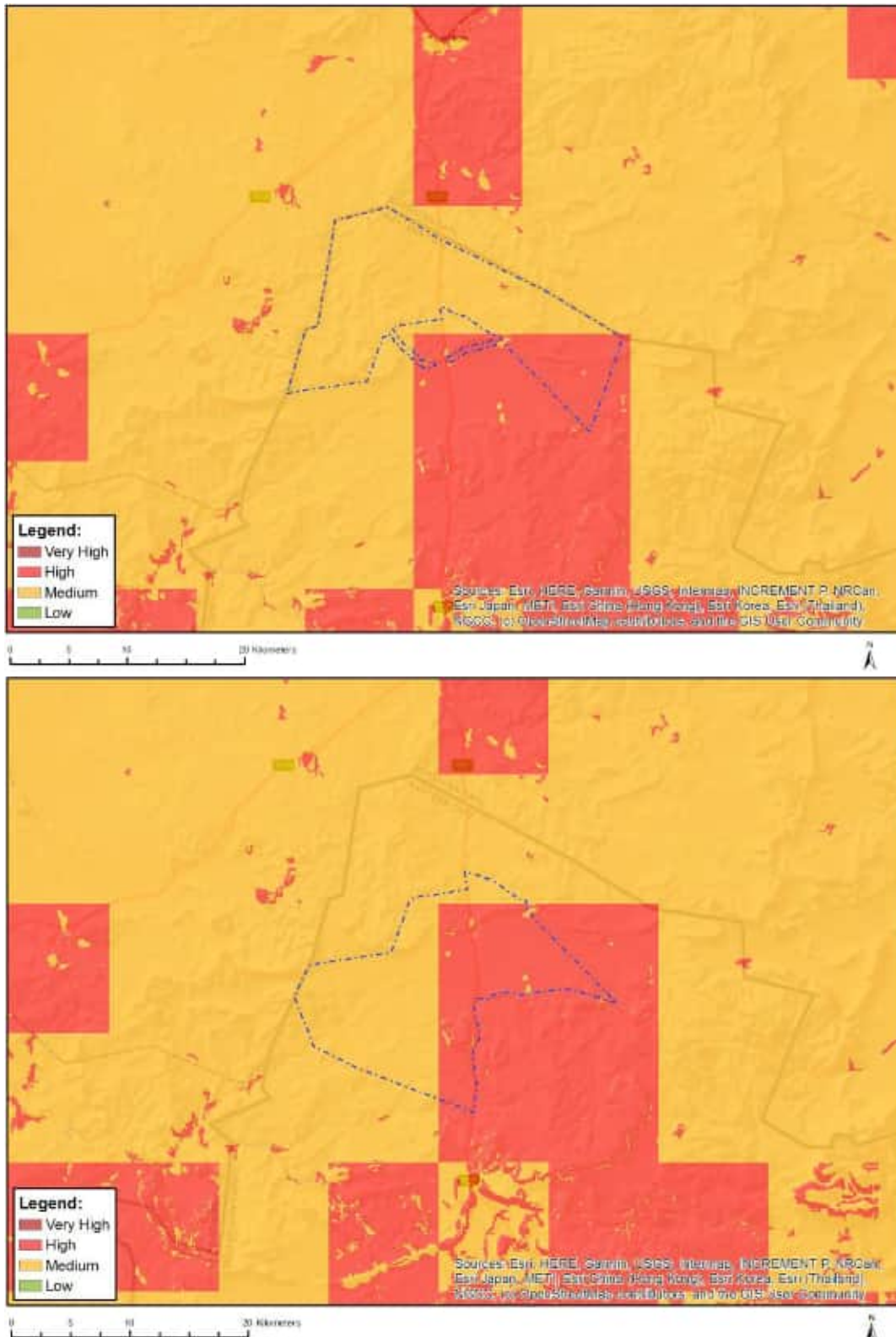


Figure 7-55: Map of relative Animal theme sensitivity for Hoogland 1 Wind Farm (top) and Hoogland 2 Wind Farm (bottom). High sensitivity shown in red.

7.6.2.1 Landscape level sensitivity

The "Avian Wind Farm Sensitivity map for South Africa" (Retief *et al*, 2011) and the Important Bird & Biodiversity Areas programme data (IBBA - Marnewick *et al*, 2015) were consulted to determine the sensitivity of the site in

national terms. Figure 7-56 shows that the site falls mostly in the lowest two sensitivity categories in terms of avifauna (darker colours indicate higher risk), although some areas are in medium and medium-high categories. For a full discussion on the methods used in producing this map see Retief *et al* (2011, 2014). The site does not fall within any IBAs (Marnewick *et al*, 2015). The closest IBA is approximately 39km south (Karoo National Park).

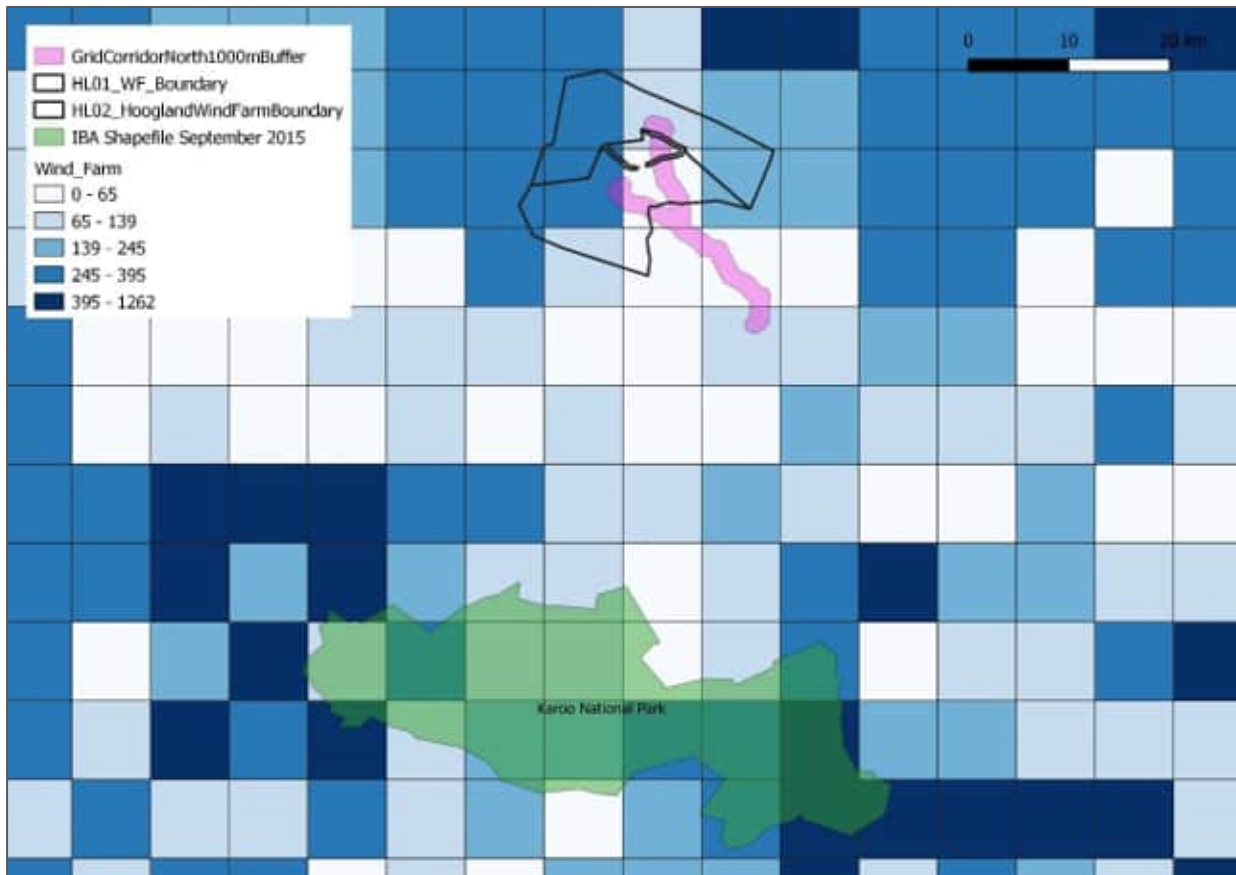


Figure 7-56. The position of the site relative to the Avian Wind Farm sensitivity map (Retief *et al*, 2011) & Important Bird Areas (Marnewick *et al* 2015) (Darker colours indicate higher avifaunal sensitivity)

The proposed site falls outside of the REDZs, and the Transmission Grid corridors identified (Figure 2-3), albeit nearby. The REDZ are areas that are being strategically identified for potential wind energy development in future (Section 4.3.5).

7.6.2.2 On site sensitivity

The study area was classified into the following classes: No-Go, High, Medium, Low and Neutral sensitivity areas. The distinction was also made between turbines; roads & cables (underground); buildings; internal overhead lines. This is a particularly appropriate distinction for avifauna as there is a collision risk with vertical turbines and overhead power lines, but not with surface level infrastructure such as roads. In the case of overhead power lines, the relevant aspect for avifauna in terms of spatial constraints is the cables themselves²⁷.

The large eagle nests are the key spatial issue determining sensitivity on the sites, with several confirmed nests as already described. For turbines, the no-go buffer size around Verreault's Eagle nests is prescribed by the Verreault's Eagle Risk Assessment (VERA) output (Appendix 4 of the Specialist report in *Appendix C9: Avifauna* of this report). The Verreault's Eagle best practice guidelines also prescribe a 1km buffer for the construction of other Wind Farm

²⁷ See separate Hoogland Northern Grid Connection reports for powerline related impacts.

infrastructure during breeding season. No buffer size is stipulated for power lines though, so a subjective judgement is made in this regard.

For Martial Eagle, no guidelines exist yet and Wildskies (2022) has determined the buffer size using the best possible available literature on the species home range. A 6km radius circular buffer was placed around the Martial Eagle nesting sites – classified as No-Go for turbines.

The site sensitivity maps for the various infrastructure types of the Hoogland Northern Cluster are shown spatially in the figures below and largely avoid the No-go and High sensitivity areas. More specifically:

- No turbines are placed in No-Go or High areas (Figure 7-57)
- No roads and cables are placed in No-Go or High areas (Figure 7-58)
- No buildings are placed in No-Go or High areas (Figure 7-59)
- No WEF Internal overhead lines are placed in No-Go areas (Figure 7-60).
- Several short pieces of WEF Internal overhead lines are placed in High areas (Figure 7-60). These exceptions have been agreed to by the avifaunal specialist. These are:
 - On Hoogland 1 – 2 x sections of approximately 520m each in a High sensitivity area on a river.
 - On Hoogland 2: 380m of line over a small ridge; 50m of line over a thin wetland area; 600m of line over a ridge; and approximately 500m of line in a river buffer area.

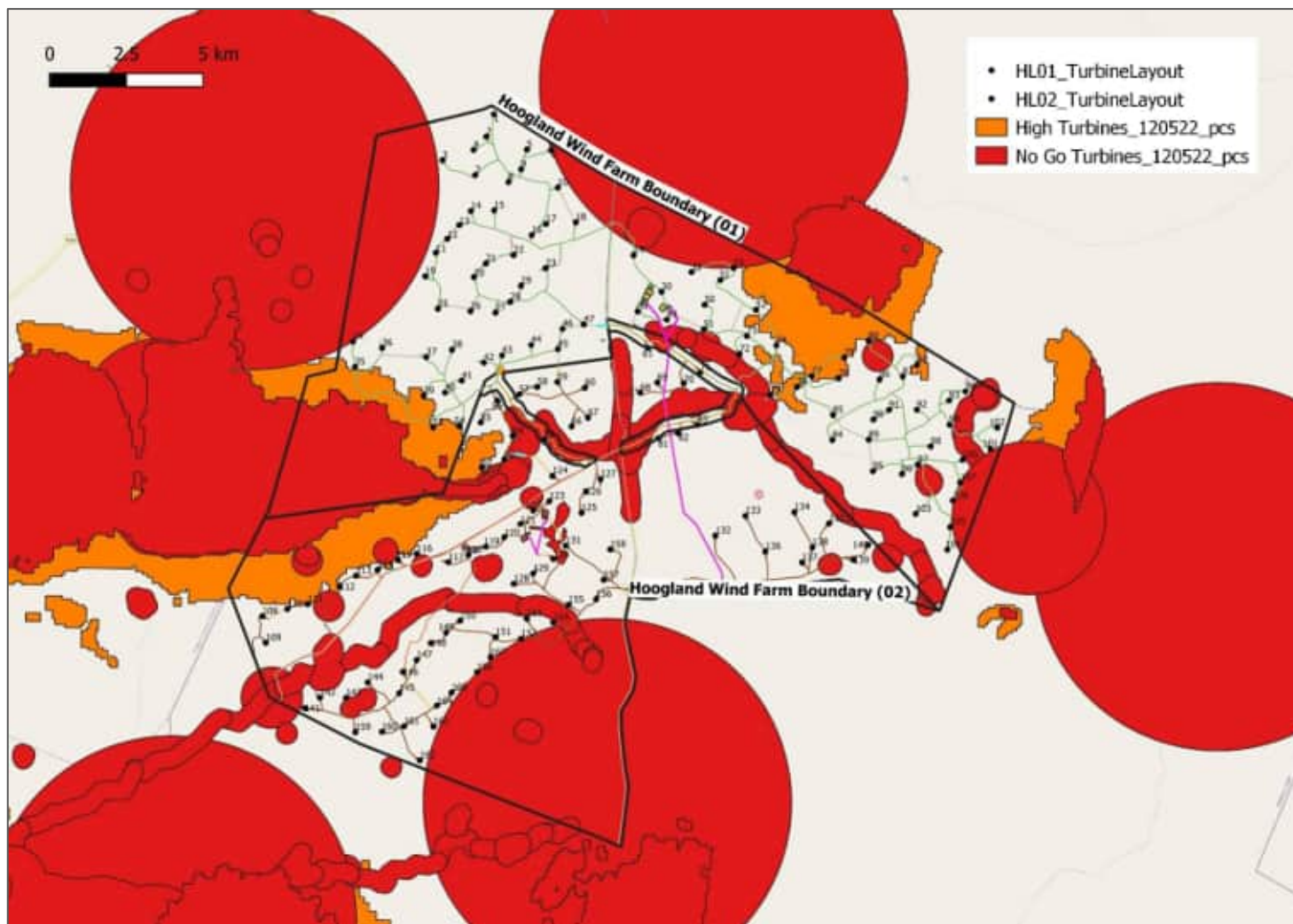


Figure 7-57: Turbine avifauna sensitivity map

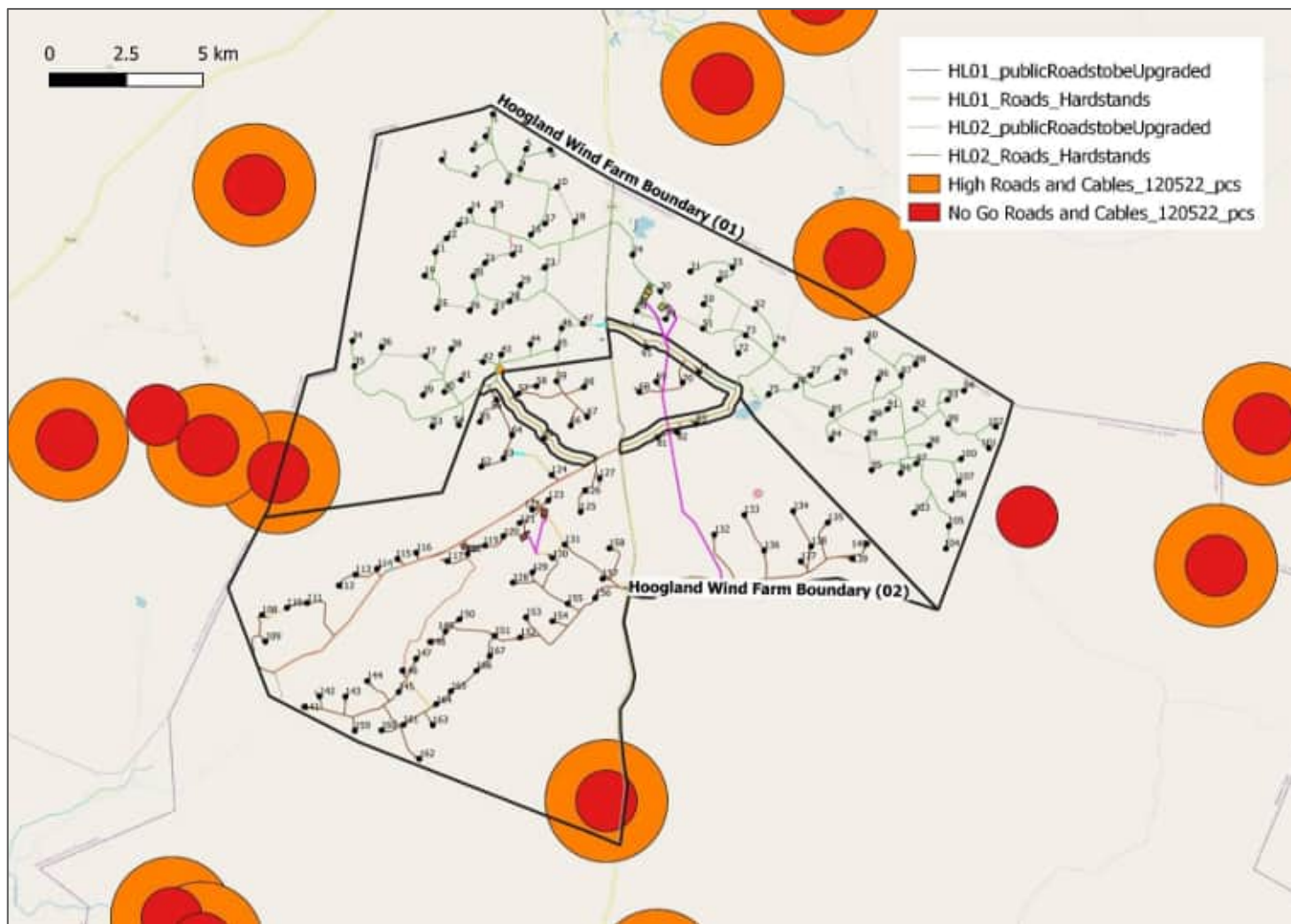


Figure 7-58: Roads and cables (underground) avifauna sensitivity map

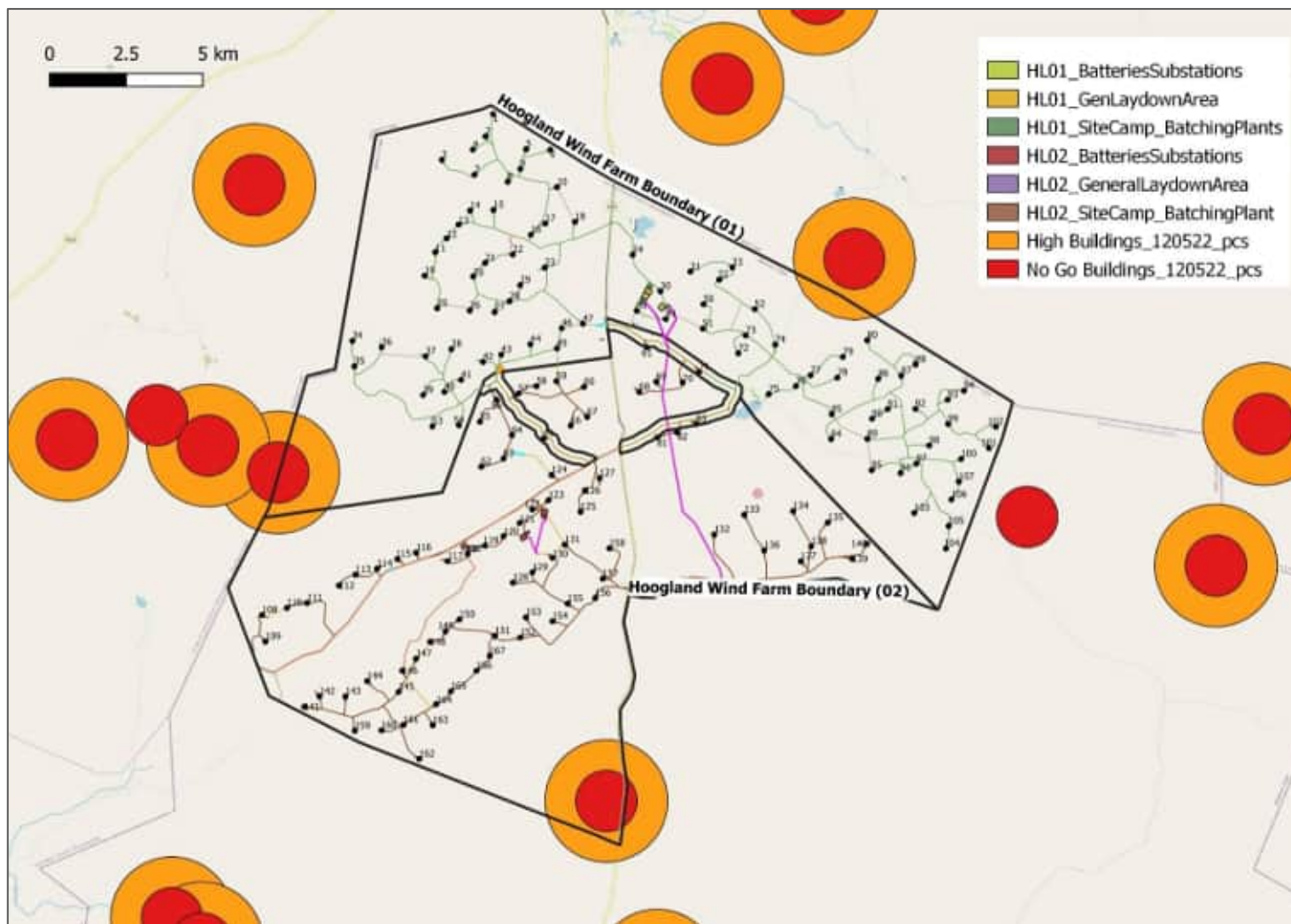


Figure 7-59: Buildings (including substation, battery storage, construction camps) avifauna sensitivity map

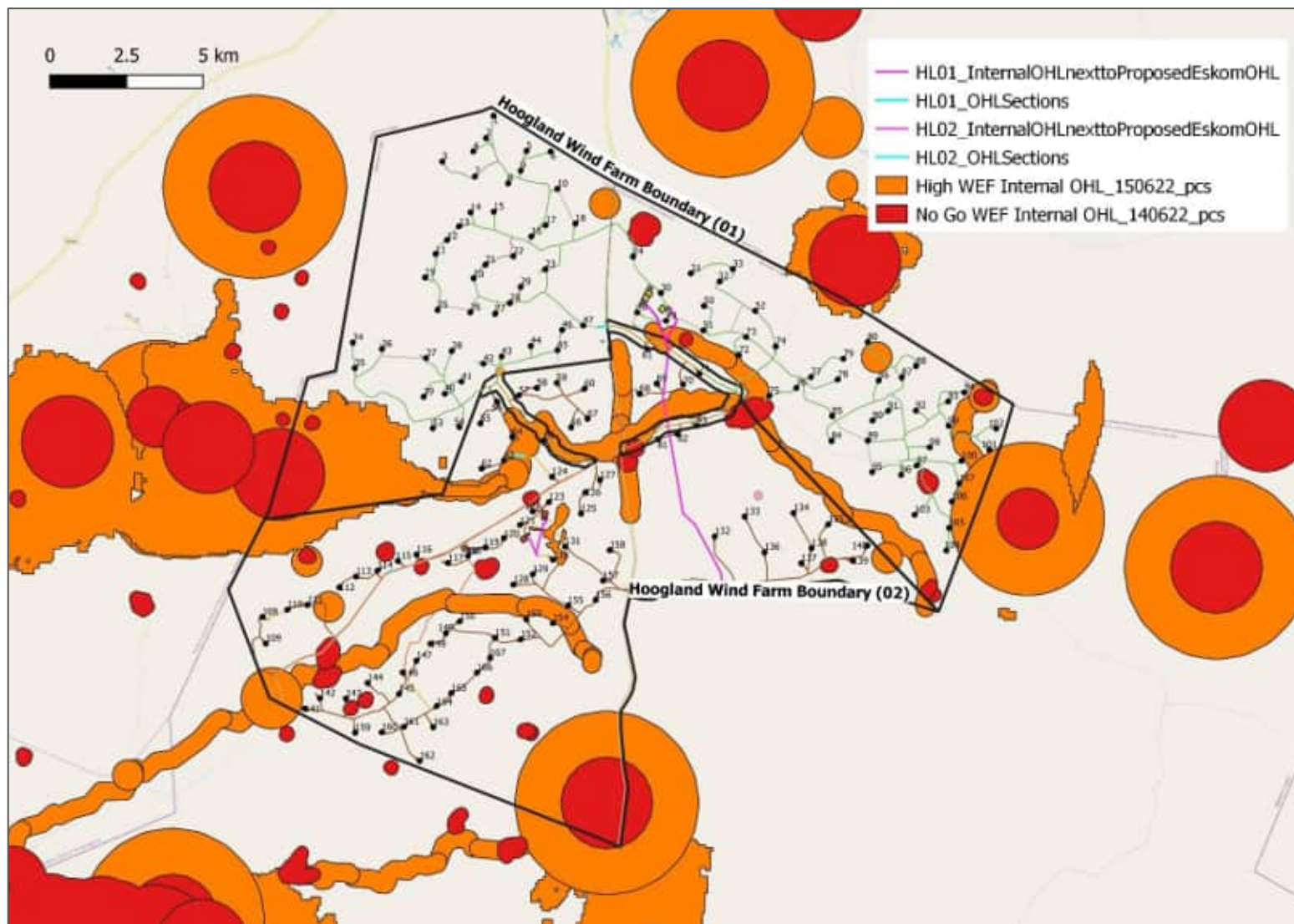


Figure 7-60: Wind Farm Internal Overhead lines avifauna sensitivity map

7.6.3 Impact Assessment and Mitigation

7.6.3.1 Impact assessment

The following avifauna impacts have been identified and rated by Wildskies (2022).

7.6.3.1.1 Construction Phase

Table 7-56: Construction: Bird habitat destruction

Issue	Habitat destruction during construction	
Description of Impact		
<p>Table 2-3 described the amount of natural habitat that will be altered and destroyed on the proposed wind farm. We include temporary areas in our calculation of habitat destruction, since in our experience these are not normally rehabilitated to their former functional state by contractors, and in order to consider the worst-case scenario. At the proposed site, a total of approximately 306.7ha (165.7ha temporary and 141ha permanent) and 300.9ha (164.6ha temporary and 136.3ha permanent) would be affected at Hoogland 1 and Hoogland 2 respectively. The two site boundaries encompass approximately 16 772ha and 17 832ha respectively. This means that approximately 1.83% and 1.69% of the site’s ground surface area would be altered or destroyed by Hoogland 1 and 2 respectively. The temporary road bypass around Beaufort West is almost all on an existing road, and the new portion is in quite disturbed habitat, so we did not include it in the calculation of area lost as it is already severely degraded. Of course, the effect on the avifaunal community is not as simple as the surface area affected. In addition to surface area alteration, the effect of large, dispersed infrastructure projects such as wind farms on birds is likely to be far more complex through factors such as habitat fragmentation, disruption of territories and other factors. These effects have however proven extremely difficult to measure.</p> <p>In order to apply a cautious approach, we conclude that the overall significance of habitat destruction is Medium (-) significance both pre and post mitigation.</p>		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	Low - natural habitat will be transformed	
Degree to which impact may cause irreplaceable loss of resources	High - habitat will not easily be restored to original state	
Degree to which impact can be mitigated	Low - certain amount of habitat transformation is inevitable	

Issue	Habitat destruction during construction
Mitigation actions	
The following measures are recommended:	<ul style="list-style-type: none"> The No-Go areas identified by this study (which build on those identified in the screening phase) and the High sensitivity areas (with associated conditions) should be adhered to. It is confirmed that the infrastructure as proposed in the current layout has no conflicts with the No-Go areas. Several minor conflicts of internal overhead line with High sensitivity areas but these meet the conditions and are therefore acceptable. A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .

Table 7-57: Construction: Disturbance of birds

Issue	Disturbance of birds during construction	
Description of Impact		
Activities associated with construction of a Wind Farm (including: heavy machinery, earth moving, vehicle and staff traffic) can disturb birds in the receiving environment. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of a nest site. Avoidance measures taken for Martial and Verreaux’s Eagle and other nests reduce the significance of this impact. Pre-mitigation this impact is Low (-) significance and will remain at Low significance post the application of mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Highly reversible, as soon as construction stops impact will cease	
Degree to which impact may cause irreplaceable loss of resources	Low - any impacts are reversible and no irreplaceable loss	
Degree to which impact can be mitigated	Low - certain amount of disturbance during construction is inevitable	

Issue	Disturbance of birds during construction
Mitigation actions	
The following measures are recommended:	<ul style="list-style-type: none"> An avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline). All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .

7.6.3.1.2 Operational Phase

Table 7-58: Operation: Disturbance of birds

Issue	Disturbance of birds during operations	
Description of Impact		
Activities associated with operation of a Wind Farm (including: heavy machinery for maintenance, vehicle and staff traffic) can disturb birds in the receiving environment. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of a nest site. The indications from operational Wind Farms are that this impact is of fairly low importance. For Hoogland 1 and 2 we consider this impact to be of Low (-) significance both pre and post mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long term	Long term
Extent	Local	Local
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Highly reversible, as soon as maintenance or operational activity stops impact will cease	
Degree to which impact may cause irreplaceable loss of resources	Low - any impacts are reversible and no irreplaceable loss	
Degree to which impact can be mitigated	Low - certain amount of disturbance during operation is inevitable	
Mitigation actions		
The following measures are recommended:	None required	

Issue	Disturbance of birds during operations
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .

Table 7-59: Operation: Displacement of birds

Issue	Displacement of birds during operations	
Description of Impact		
Operational activities can cause displacement which occurs when a facility may have a barrier effect or serve as an obstacle for birds which need to fly around or avoid it. As for disturbance above, the indications from operational Wind Farms are that this impact may be of low importance. For Hoogland 1 and 2 we consider this impact to be of Low (-) significance with the avoidance measures already implemented, both pre and post mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	High - if operations cease the effect would cease	
Degree to which impact may cause irreplaceable loss of resources	Low - no birds are killed	
Degree to which impact can be mitigated	Low	
Mitigation actions		
The following measures are recommended:	Monitoring of breeding status of Verreaux's and Martial Eagles should be conducted in all breeding seasons as per the avifaunal operational monitoring programme.	
Monitoring		
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .	

Table 7-60: Operation: Collision of birds with turbines

Issue	Collision of birds with turbines once operational	
Description of Impact		
There is a risk of collision with wind turbines when birds fly through an operational Wind Farm at rotor height. We have made our bird fatality estimates as transparent as possible so that our assumptions are clear. Table 8 summarises this information for the priority bird species We conclude that overall, this impact will be of High (-) significance before mitigation. This is mostly a precautionary finding as the estimated fatality rates based on data collected on site are very low. Mitigation measures detailed below can be expected to reduce the significance to Medium (-) significance. Due to the uncertainty around the effectiveness of some of the measures, the significance cannot be reduced further.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	

Issue	Collision of birds with turbines once operational	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Probable	Probable
Significance	High -	Medium -
Degree to which impact can be reversed	Low - birds are killed	
Degree to which impact may cause irreplaceable loss of resources	High - birds are killed	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
<p>The following measures are recommended:</p>	<ul style="list-style-type: none"> • During construction, all road and hard stand verges and other disturbed areas must be fully compacted to as hard as they were prior to construction, to ensure that these areas do not attract ground burrowing mammals in artificially high abundance and closer to turbines. These species represent prey for raptors and such situations would increase raptor-turbine collision risk. Piles of spoil material close to turbines should be avoided as far as possible as these also attract prey species. It is essential that the new Wind Farm does not create favourable conditions for such mammals in high-risk areas. If such conditions are created, this will require reactive management during the operational phase. • The bird-turbine collision risk pre-mitigation has been rated as High significance and must be mitigated to Medium through the implementation of effective mitigation measures from commercial operation date (COD) onwards. Two potential options exist to our knowledge: blade painting; and shutdown on demand (either observer or technology led). Since it will be several years before the proposed Wind Farm is constructed, there is an opportunity to learn more about these two measures in the interim and make a decision on which option is implemented at that time. Several operational Wind Farms have just begun observer led shutdown on demand programmes in SA, and two Wind Farms are about to trial blade painting. There is therefore a high likelihood of having more experience on the effectiveness of such measures a year or two from now. We recommend that either of these options be implemented across the full facility, and that a decision on which be taken within 6 months of the project achieving preferred bidder status. Any alternative that is identified in the interim that is approved by the bird specialist and which the specialist 	

Issue	Collision of birds with turbines once operational
	<p>believes would achieve similar results to these other two options may also be considered. In the meantime, all necessary financial and technical provisions must be made by the developer.</p> <ul style="list-style-type: none"> The Adaptive Management Plan developed and presented in Appendix 3 of the specialist report (<i>Appendix C9: Avifauna</i>) must be included in the EMP and implemented by each Wind Farm once operational.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .

Table 7-61: Operation: Collision and electrocution of birds on overhead power lines

Issue	Collision and electrocution of birds on overhead power lines	
Description of Impact		
<p>Overhead power lines pose a collision and possible electrocution threat to certain bird species. The majority of internal power lines will be placed underground as buried cables. Some minor sections may be required to be built above ground for technical reasons. This above ground power line results in this impact being of High (-) significance pre-mitigation as many of the Red Listed species present on site are known to be highly susceptible to collision with and/or electrocution on overhead power lines. Overhead power lines pose a collision risk to large terrestrial species such as bustards and korhaans in particular.</p> <p>Large eagles such as Verreaux’s and Martial Eagle are very susceptible to electrocution on pylons, particularly in a treeless landscape such as the proposed site where they will certainly perch on pylons if available and may also nest on them. The significance of both these impacts can be reduced to Low (-) significance through the application of the mitigation below.</p>		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Low
Duration	Long-term	Short-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Low - birds are killed	
Degree to which impact may cause irreplaceable loss of resources	High - birds are killed	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Internal power lines must be placed underground except where absolutely necessary such as to cross drainage lines or get up steep/ extremely rocky slopes. Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. 	

Issue	Collision and electrocution of birds on overhead power lines
	<p>The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these.</p> <ul style="list-style-type: none"> The <u>structure</u> design currently proposed for the overhead lines, i.e., monopole double circuit built to 88/132kV dimensions <u>or custom made wooden structures</u> are significantly safer from an electrocution point of view than a standard 33kV <u>or 66 kV</u> structure that the Applicant could have opted to use but decided not to so as to reduce this potential impact. However, the safety should be improved by using a bird perch at the very top of the pole.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .

Table 7-62: Decommissioning: Disturbance of birds

Issue	Disturbance of birds during decommissioning	
Description of Impact		
Activities associated with decommissioning of a Wind Farm (including: heavy machinery, earth moving, vehicle and staff traffic) can disturb birds in the receiving environment. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of a nest site. This impact is of Low (-) significance pre and post -mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Highly reversible, as soon as decommissioning stops impact will cease	
Degree to which impact may cause irreplaceable loss of resources	Low - any impacts are reversible and no irreplaceable loss	
Degree to which impact can be mitigated	Low - certain amount of disturbance during decommissioning is inevitable	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in the operations phase. This will allow us to judge the risk of decommissioning to birds when the time comes. All decommissioning activities should be strictly managed according to generally accepted environmental best 	

Issue	Disturbance of birds during decommissioning
	practice standards, so as to avoid any unnecessary impact on the receiving environment.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of <i>Appendix C9: Avifauna</i> .

7.6.3.2 During & post construction bird monitoring framework

The work to date on the proposed site has established a baseline understanding of the distribution, abundance and movement of key bird species on and near the site. However, this is purely the ‘before’ baseline and aside from providing input into turbine micro-siting, it is not very informative until compared to post construction data. Bird fatality estimates are a key component of operational monitoring; and fatality thresholds have been set for the high-risk bird species whereby adaptive management will be triggered when these thresholds are exceeded. Appendix 3 of the Avifauna Report (*Appendix C9: Avifauna*) sets out the monitoring framework for the construction and operational phases of the project, as well as specifics of an Adaptive Management Plan.

7.6.4 Cumulative Impact

The following cumulative impacts have been identified and rated by Wildskies (2022).

7.6.4.1 Construction Phase

Table 7-63: Cumulative impact: Destruction & alteration of habitat

Issue	Habitat destruction during construction	
Nature of cumulative impacts	<p>Approximately 306.7ha and 300.9ha of habitat will be transformed by the Hoogland 1 and 2 Wind Farms respectively. In our view this is relatively small amount of habitat transformation given the scale of the projects and amount of energy production. We recognise however that the effect on avifauna is more complex than surface area as the area is also fragmented, and aerial space is also taken up by turbines. Habitat destruction at each Wind Farm is of Medium () significance. The estimated surface areas for all proposed projects are shown below:</p> <ul style="list-style-type: none"> • Hoogland 1 – 306.7ha • Hoogland 2 – 300.9ha • Hoogland 3 – 226.6ha • Hoogland 4 – 236.2ha • Nuweveld East – 161ha • Nuweveld West – 161ha • Nuweveld North – 159ha <p>The cumulative effect of this amount of habitat destruction is now rated as High (-) significance pre and Medium (-) post mitigation. The contribution of each of Hoogland 1 and 2 to this is Medium.</p>	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

Table 7-64: Cumulative impact: Disturbance of birds during construction

Issue	Disturbance of birds during construction	
Nature of cumulative impacts	The avoidance of this risk is already applied through implementation of the eagle nest buffers. The cumulative impact of disturbance of birds across all proposed projects is Low (-) both pre and post mitigation due to similar avoidance measures applied on all projects.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Low -

7.6.4.2 Operational Phase

Table 7-65: Cumulative impact: Disturbance of birds during operation

Issue	Disturbance of birds during operations	
Nature of cumulative impacts	The avoidance of this risk is already applied through implementation of the eagle nest buffers. The cumulative impact of disturbance of birds across all proposed projects is Low (-) both pre and post mitigation due to similar avoidance measures applied on all projects.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Low -

Table 7-66: Cumulative impact: Displacement of birds from the site.

Issue	Displacement of birds during operations	
Nature of cumulative impacts	The avoidance of this risk is already applied through the application of no-go nest buffers for sensitive species. The cumulative impact of disturbance of birds across all proposed projects is Low (-) both pre and post mitigation due to similar avoidance measures applied on all projects.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Low -

Table 7-67: Cumulative impact: Direct mortality of birds through collision with turbines.

Issue	Collision of birds with turbines once operational	
Nature of cumulative impacts	Key species estimated annual fatality rates across all 7 wind farms include: Jackal Buzzard 8.86; Karoo Korhaan 5.45; Ludwig's Bustard 2.88; Martial Eagle 0.64; and Verreaux's Eagle 3.51. Based on these figures we conclude that the cumulative turbine collision impact of Wind Farms on the priority bird species in the area before mitigation is High (-), and post mitigation is Medium (-). The contribution by each of Hoogland 1 and 2 is High. If each of the proposed Wind Farms implements the required mitigation measures this cumulative impact can be reduced to Medium.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

7.6.5 No-Go Alternative

Due to the comprehensive iterative design process that has been undertaken to inform the respective Wind Farm layouts and associated infrastructure for the Hoogland Projects, no site or layout alternatives will be assessed.

However, the preferred layouts of the Hoogland Wind Farms, and respective Grid Corridors, will each be assessed against the 'no-go' alternative. The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail.

The No-go alternative will in each case result in no impact on avifauna and is therefore of neutral significance.

7.6.6 Conclusion and Recommendations

Wildskies (2022) state that overall, their impression of the Hoogland 1 Wind Farm and Hoogland 2 Wind Farm avifaunal communities is that the most sensitive features are the identified eagle nests. Given that these nests have been afforded a significant amount of spatial protection (in line with current best practice), they believe that the most significant risks to avifauna have partially been avoided. The remaining risk will still need to be mitigated carefully. Provided that the mitigation measures identified in the sections above as well as the specialist report (*Appendix C9: Avifauna*) are implemented, they recommend that the projects each be allowed to proceed.

7.7 Aquatic Ecology

This section provides a short summary of the aquatic specialist report, the full Aquatic Impact Assessment compiled by Brian Colloty of EnviroSci (Pty) Ltd and is available in *Appendix C10: Aquatic Ecology*.

7.7.1 Baseline Description

The specialist visited the site several times between February 2021 and May 2021, to refine feature mapping, improve confidence of the desktop mapping exercise and collect additional information to assess the Present Ecological State (PES) and Ecological Importance (EI) and Ecological Sensitivity (ES) ratings that will be used in the Scoping / EIA reports as well as the Water Use License Applications in future.

7.7.1.1 Aquatic Features and Catchments

According to of EnviroSci (2022), the study area is comprised of various aquatic features associated with catchments and rivers including alluvial areas, watercourses with vegetated riparian zones, head water areas with instream vegetation and valley bottom wetlands (Figure 7-61). Several artificial systems such as berms and dams are also prevalent in the area.



Figure 7-61: (Top left) Pan/Depression in low lying areas, associated with alluvial floodplain with Valley Bottom Wetland (in background), (Top right) Dry alluvial riverbed no aquatic features (clockwise from left to right), (Bottom left) Upper catchment watercourses with limited instream vegetation, (Bottom right) Watercourse with narrow riparian zones, lower valley zones

This preliminary information collected during the site visit was then compared to current wetland inventories (Figure 7-62) (van Deventer *et al.*, 2018) and 1: 50 000 topocadastral surveys mapping. A baseline map was developed to delineate the respective aquatic systems listed above for Hoogland 1 and Hoogland 2 as shown on Figure 7-61 and Figure 7-63 respectively.

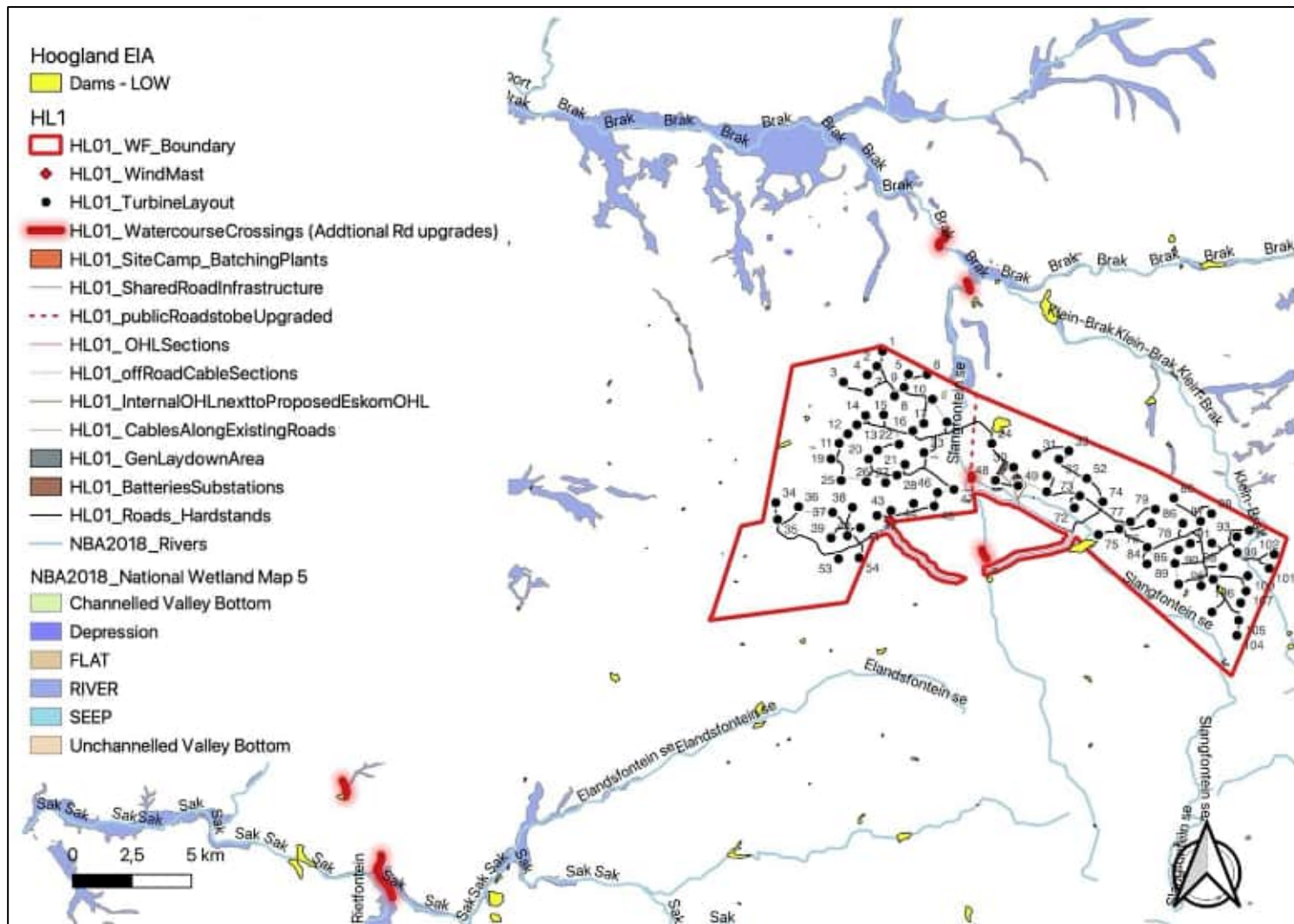


Figure 7-62: National Wetland Inventory wetlands and waterbodies (van Deventer *et al.*, 2018) for the Hoogland 1 Wind Farm area (offsite shared watercourse crossing upgrades shown in red)

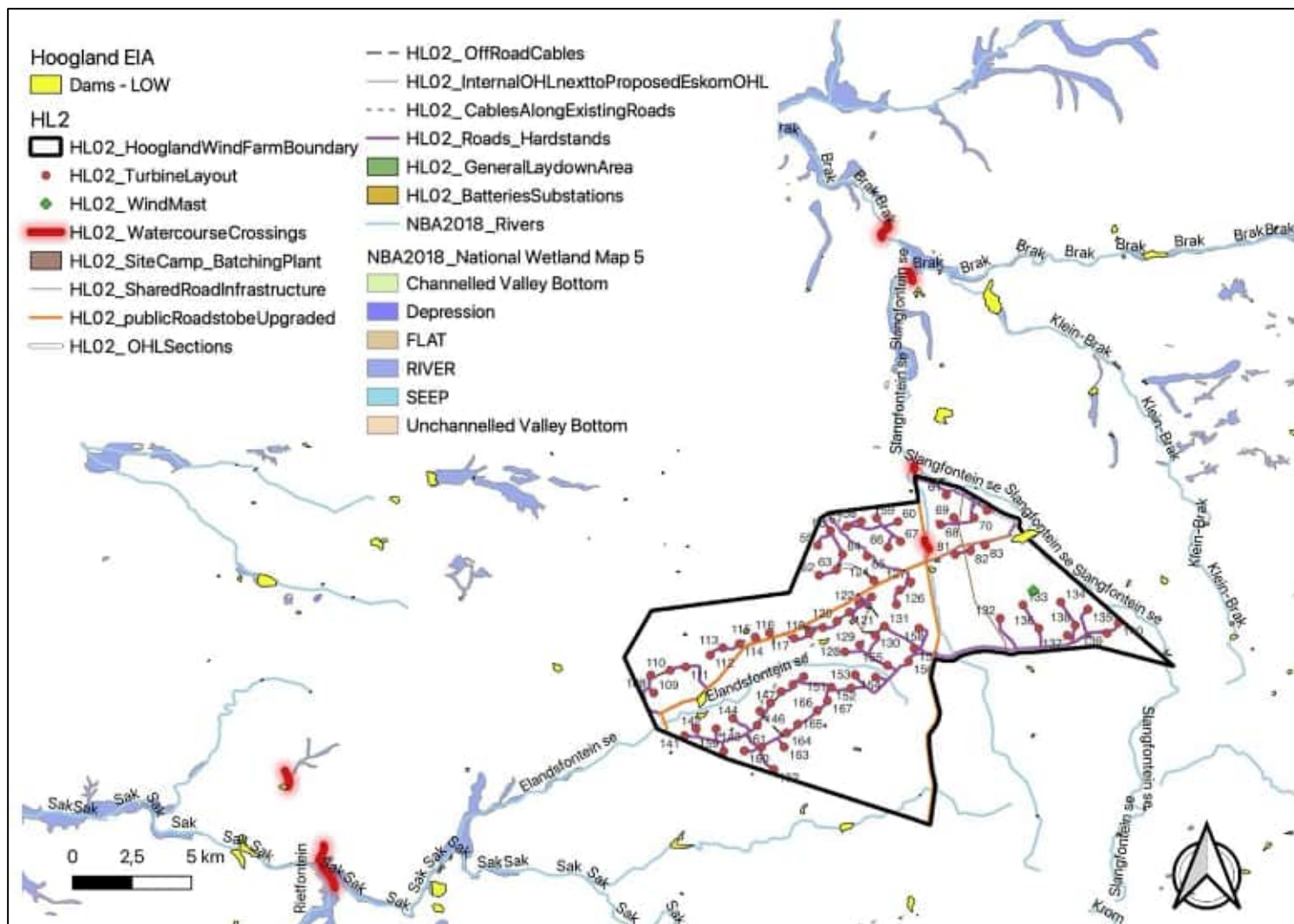


Figure 7-63: National Wetland Inventory wetlands and waterbodies (van Deventer et al., 2018) for the Hoogland 2 Wind Farm area (offsite shared watercourse crossing upgrades shown in red)

Notably most of the aquatic features within the study area are located within the riverine valleys and alluvial floodplains, of the following catchments within the Nama Karoo Ecoregion (Table 7-68):

Table 7-68: Catchments and Water Management Areas within the Nama Karoo Ecoregion

WATER MANAGEMENT AREAS	QUATERNARY CATCHMENTS	RIVER
Orange Water Management Area	D55A	Elandsfontein se Leegte, Rietfontein and Sak rivers
Orange Water Management Area	D55C	Klein Brak and Slangfontein se Leegte rivers
Orange Water Management Area	D55D	Brak River

7.7.1.2 Present Ecological State (PES) and Conservation Importance

The PES of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system also incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

With the exception of portions of the Sak River (PES = B or Largely natural), the remainder of the systems assessed by DWS were rated as PES = C or Moderately Modified. While all the rivers were rated as Moderate / Medium in terms of Ecological Sensitivity and Ecological Importance. For now, these ratings have been used in the sensitivity / constraints assessment, but may be adjusted once the design has been finalised during the EA process, and specific impacts such as crossings are identified and need more detailed assessment during the walk down post EA.

The importance of these systems is however substantiated by the fact that the mains stem systems within the study area (inclusive of alluvial systems and wetlands) are included in the Western Cape Biodiversity Spatial Plan (2017) as Critical Biodiversity Area (CBA) and Ecological Support Areas (ESA) (mapped by 3 Foxes in Figure 7-22). However for the most part the layout has avoided these areas, due to the fact that the with the exception of a few crossings, the aquatic environment will be avoided.

Overall, these catchment and subsequent rivers / watercourses are largely in a natural state. But present-day impacts occur in localised areas and included the following:

- Erosion because of road crossings;
- Several farm dams; and
- Undersized culverts within present day road crossings.

7.7.1.3 Ground water

The potential water sources, which will be focused mainly on groundwater resources must be assessed in greater detail should the project proceed. As this is a significant factor in Wind Farm construction, a detailed ground water investigation will be conducted as part of the Water Use License Application. Estimates for Wind Farm construction projects have been around 50 – 60 000m³ per year, but actual figures from Wind Farm monitoring data indicate that between 80 – 90 000m³ of water is required per year over the 24-month construction period, particularly if concrete towers for the turbines are used. The high-level assessment attached to the aquatic specialist report has indicated that water is available and in sufficient quantities (*Appendix C10: Aquatic Ecology*).

7.7.1.4 Aquatic Flora and Fauna

Coupled with the aquatic delineations, information was collected on potential species that could occur within the wetlands and watercourses, especially any areas that would contain open water for long periods and or conservation worthy species (Listed or Protected). None of the dominant riparian / wetland associated plant species observed are listed or protected under any form of legislation.

Similarly, amphibian species are known to occur within the region (Beaufort West and Karoo National Park), but little is known of the actual distribution of frogs within the study area based on mapping data contained in Minter *et al.* (2004) and the FrogMAP spatial database. The potential frogs known to occur in the area and their preferred habitat, with two frog species being observed during this assessment. None of these species are listed by the IUCN, but a special note is made by Minter *et al.* (2004), that detailed assessment of *Vandijkophrynus garipeensisgaripeensis* (Karoo toad) is needed within the Nuweveld mountains. Two ectomorphic variations were collected (Karoo National Park - 3222BC), which possibly warrants subdivision into *Vandijkophrynus garipeensis garipeensis*, a larger and duller in colour variation found on the lower plains and is different from the smaller and more brightly coloured specimens found only in isolated high lying mountain areas and should be raised to species status, namely, *Vandijkophrynus garipeensis nubicolus*.

No fish species were observed or have been recorded within the study area, although fish distributions in downstream areas, such as the Sak River, beyond the site boundaries (ca. 4km), indicate the following species, none of which are listed with conservation concern could occur: Chubbyhead Barb - *Enteromius anoplus*; and Vaal-orange Smallmouth Yellowfish - *Labeobarbus aeneus*.

7.7.2 Site Sensitivity

The Hoogland Wind Farms have been classified by the DFFE National Screening tool as being sensitive due to the presence of CBAs and rivers (Figure 7-64). However, although the specialist agrees with the environmental sensitivities as identified on site, the exact extent of the systems is disputed, as the Screening Tool shows an under representation of the aquatic waterbodies that were rated as sensitive.

To inform the site layout, these sensitive features, along with their buffers are as follows:

- Riverine (mainstems): Floodplain and riparian dominated systems (45 m)
- Riverine (minor drainage lines): Incised channels with limited riparian vegetation or part of an alluvial valley (10 m)
- Wetland: Valley bottom wetland some with seepage zones (50 m)
- Pan (wetland): Endorheic Pan/Depressions (50 m)

These are shown on Figure 7-65 and Figure 7-66 respectively and the restrictions for different infrastructure types are detailed in Table 9-1. The N1 Bypass waterbodies are shown on Figure 7-67.



Figure 7-64: Map of relative Aquatic ecology theme sensitivity for Hoogland 1 Wind Farm (top) and Hoogland 2 Wind Farm (bottom). High sensitivity shown in red.

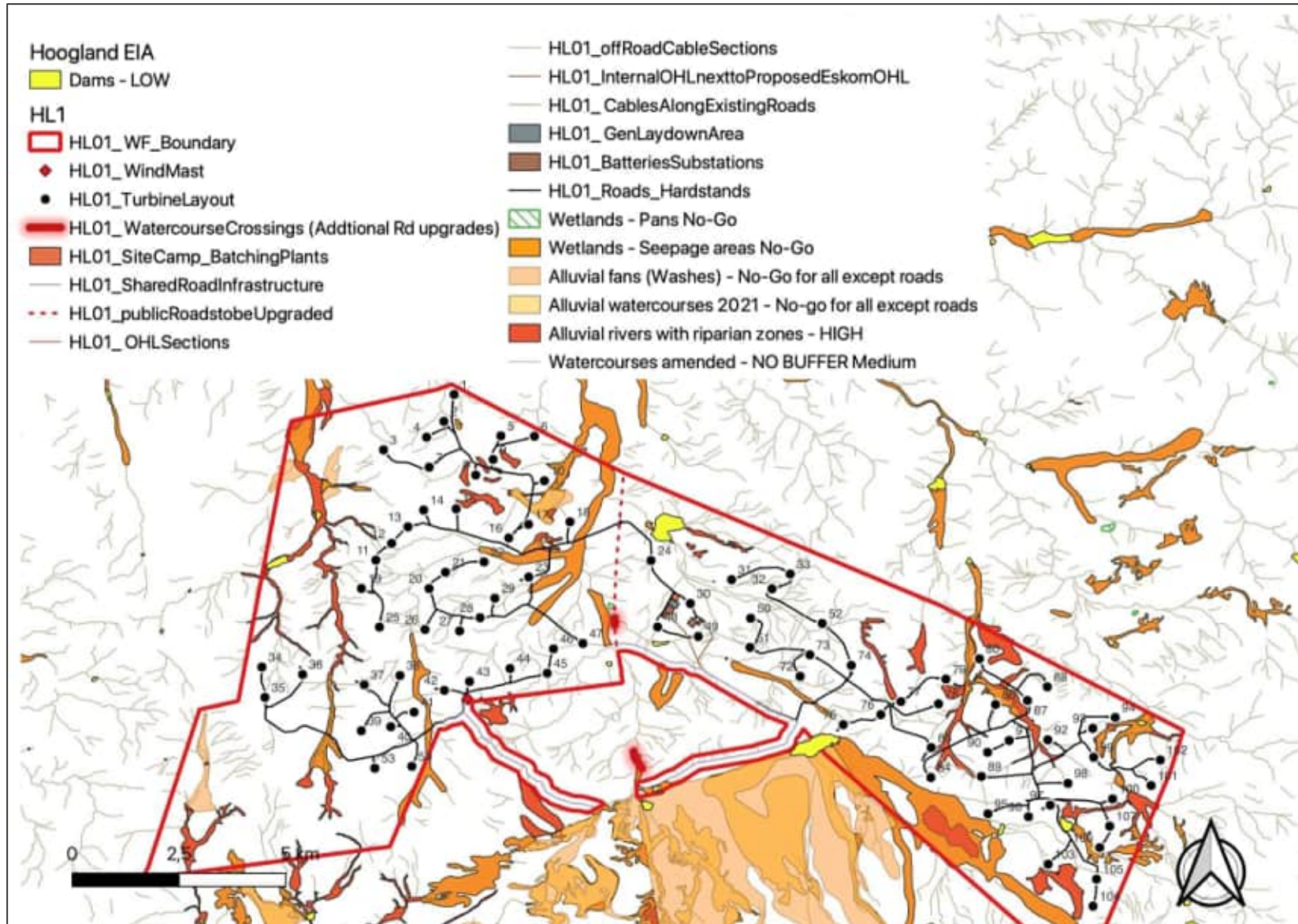


Figure 7-65: Aquatic sensitivity map showing the layout in relation to the habitats observed on Hoogland 1 (EnviroSci, 2022)

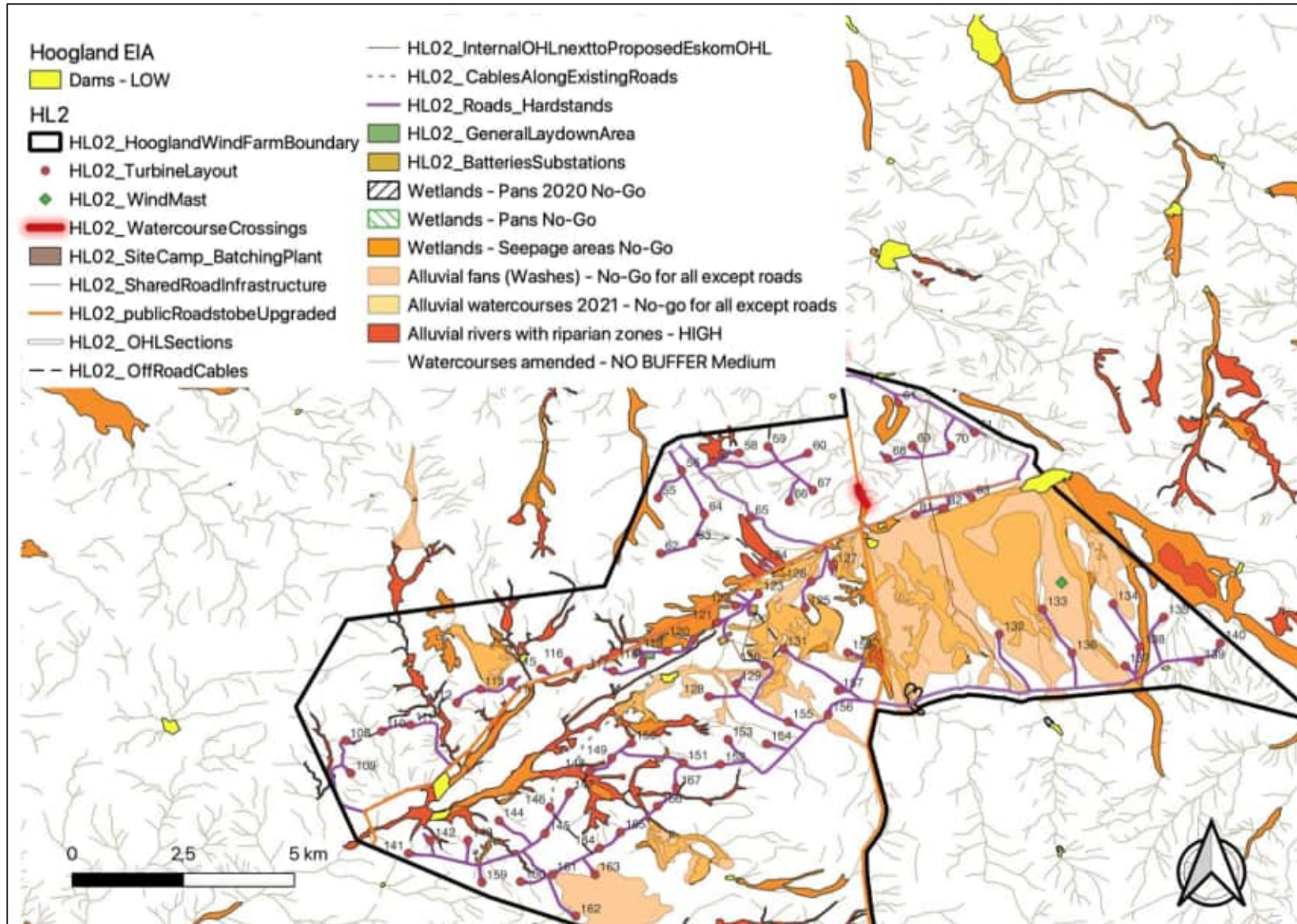


Figure 7-66: Aquatic sensitivity map showing the layout in relation to the habitats observed on Hoogland 2 (EnviroSci, 2022).

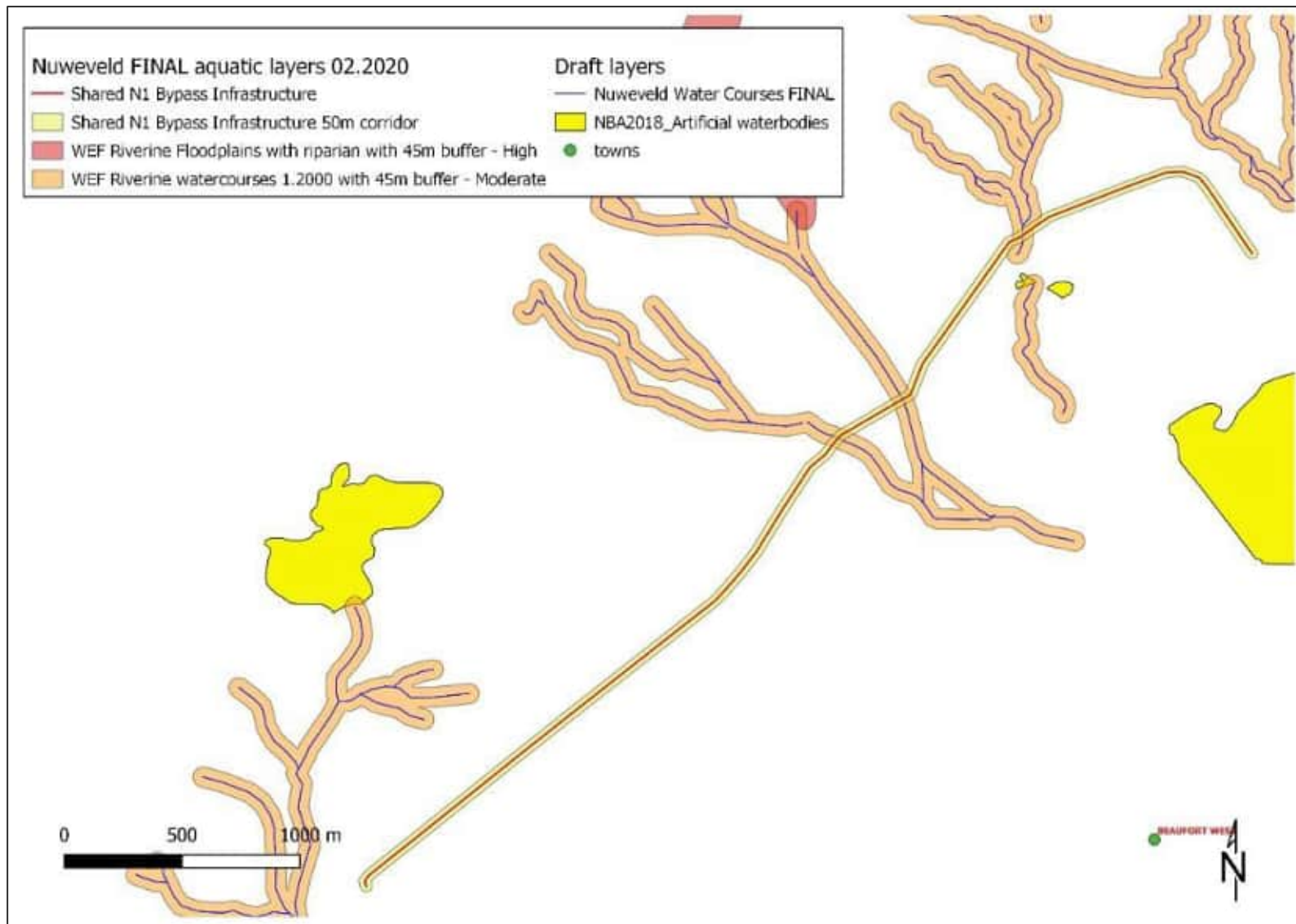


Figure 7-67: The delineated waterbodies for the N1 Bypass, natural and artificial, inclusive of the respective sensitivity ratings (Colloty, 2021)

7.7.3 Impact Assessment and Mitigation

The following direct impacts of the Wind Farms have been assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and included in Table 7-69 below.

Table 7-69: Aquatic impacts with reference to the Biodiversity Assessment Protocol

BIODIVERSITY ASSESSMENT PROTOCOL IMPACTS FOUND APPLICABLE TO THIS PROJECT	IMPACTS ASSESSED IN THIS REPORT BELOW
Faunal and vegetation communities inhabiting the site	Impact 1 and 2 (Table 7-70 and Table 7-71)
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1 and 2 (Table 7-70 and Table 7-71)
Changes in numbers and density of species	Impact 1 and 2 (Table 7-70 and Table 7-71)
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication)	Impact 3 and 4 (Table 7-72 and Table 7-73)
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 2 & 5 (Table 7-71 and Table 7-74)
Streamflow regulation	Impact 3 (Table 7-72)
Erosion control	Impact 3 (Table 7-72)
Cumulative Impacts	Impact 6 (Table 7-75 - Table 7-80)

The potential impact of groundwater abstraction on the region also needs to be addressed and this will form part of a more detailed groundwater assessment later in the project. For the purposes of this report, a preliminary analysis of the impacts is shown in Impact 5, Table 7-74 below.

Note that most of the impacts refer to multiple project phases and have not been grouped under the respective sub-headings to avoid repetition, i.e., Construction, Operation and Decommissioning.

Table 7-70: Construction and Decommissioning: Damage or loss of riparian systems and disturbance of waterbodies

Issue	Construction & decommissioning could result in the loss of drainage systems that are fully functional and provide ecosystem services within the site especially where new crossing are made or large hard engineered surfaces are placed within these systems (including their proposed buffers). Loss can also include a functional loss, through change in vegetation type via alien encroachment for example. This includes the N1 Bypass and the identified watercourse crossings outside the site.	
Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Long-term	Short-term
Extent	Local	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -

Degree to which impact can be reversed	Yes, with a significant amount of rehabilitation
Degree to which impact may cause irreplaceable loss of resources	Medium
Degree to which impact can be mitigated	High
Mitigation actions	
The following measures are recommended:	<p>A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout.</p> <p>Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc).</p> <p>Furthermore, the following applies to watercourse crossing upgrades:</p> <ul style="list-style-type: none"> • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. • River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc.). • A detailed monitoring plan must be developed in the pre-construction phase by an aquatic specialist, where any delineated wetlands occur within 50 m of existing crossings.
Monitoring	
The following monitoring is recommended:	All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.

Table 7-71: Construction, Operation and Decommissioning: Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function during the construction and into the operational phase, i.e., changes to the hydrological regime

Issue	<p>Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.</p> <p>This includes the N1 Bypass and the identified watercourse crossings outside the site.</p>
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Description of Impact		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction, into the Operational phase / Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil.	
Monitoring		
The following monitoring is recommended:	This stormwater control systems must be inspected on an annual basis to ensure these are functional	

Table 7-72: Construction and Operation: Changes to hydrological regimes that could also lead to sedimentation and erosion

Issue	Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.	
Description of Impact		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction into the Operational phase	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	

Mitigation actions	
The following measures are recommended:	A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil.
Monitoring	
The following monitoring is recommended:	This stormwater control systems must be inspected on an annual basis to ensure these are functional

Table 7-73: Construction and Decommissioning: Potential impacts on localised surface water quality

Issue	During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the fuel storage facility must be given. Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), if the Redox Flow technology is selected, namely with regard to safe handling during the construction phase. This is to avoid any spills or leaks from this system.	
Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction / Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Long-term	Short-term
Extent	Local	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	Yes, with a significant amount of rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely. Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment). Mechanical plant and bowsers must not be refueled or serviced within 100m of a river channel. 	

	<ul style="list-style-type: none"> All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses. Littering and contamination associated with construction activity must be avoided through effective construction camp management. No stockpiling should take place within or near a water course. All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.
Monitoring	
The following monitoring is recommended:	ESO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.

Table 7-74: Construction and Operation: Groundwater abstraction

Issue	The proposed project will require water for the construction and operations of the proposed Wind Farms, with anticipated demands being met by the local groundwater resources, but would not exceed the General Authorisation limits per farm portion of 40 000m ³ Per Annum per farm portion (assuming that farm portions selected meet the thresholds listed in the GA).	
Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction & Operations	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> The legal status of groundwater use at each property should be confirmed. This will inform the need for future water use authorisations. Every effort should be made to visit all boreholes and undertake yield and quality tests at boreholes that could be considered for future supply (based on their relative proximity to Wind Farm infrastructure). The information obtained from the NGA database would be a useful starting point in determining which of the boreholes should be tested for their yields. Further, the relative sizes, GA volumes (and cap volumes) of the respective farm portions should also be considered when planning scientific yield testing. Groundwater exploration via geological and geophysical methods is recommended for Wind Farms, should existing boreholes not be sufficient. 	

	<ul style="list-style-type: none"> All boreholes planned for use will require scientific yield and quality testing and analysis. Water abstracted will be used for, <i>inter alia</i>, dust suppression on the wearing course of the proposed gravel roads that are to service the Wind Farms. In an effort to limit the groundwater abstraction volumes, consideration should be given to the application of a stabilization compound to the <i>in-situ</i> materials. A series of basic laboratory tests on natural material can determine the appropriate dosage to that is to be applied to <i>in-situ</i> materials. Further, these tests would also aid in the determination of the feasibility of adopting such an approach. This method of road construction would limit the evaporative losses of groundwater on surface. This is of significance as the proposed wind energy facility is located in a water-stressed area.
Monitoring	
The following monitoring is recommended:	Monitoring of groundwater (abstraction volumes and water levels) will be required, but the exact requirements will be determined during the physical surveys of the boreholes

7.7.4 Cumulative Impacts

The following cumulative impacts have been identified and rated by EnviroSci (2022).

Table 7-75: Cumulative impact: Damage or loss of riparian systems and disturbance of waterbodies

Issue	Construction and decommissioning could result in the loss of drainage systems that are fully functional and provide ecosystem services within the site especially where new crossing are made or large hard engineered surfaces are placed within these systems (including their proposed buffers). Loss can also include a functional loss, through change in vegetation type.. This includes the N1 Bypass and the identified watercourse crossings outside the site.	
Nature of cumulative impacts	The cumulative assessment considers the various proposed renewable projects that occur within a 30km radius of this site, namely the proposed Hoogland Southern Wind Farm Cluster and adjacent Nuweveld Wind Farms. The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Very Low -

Table 7-76: Cumulative impact: Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function

Issue	<p>Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.</p> <p>This includes the N1 Bypass and the identified watercourse crossings outside the site.</p>
Nature of cumulative impacts	The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations

	proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-77: Cumulative impact: Changes to hydrological regimes that could also lead to sedimentation and erosion

Issue	Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.	
Nature of cumulative impacts	The rating below is based on the premise that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-78: Table 7-79: Cumulative impact: Potential impacts on localised surface water quality

Issue	During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the fuel storage facility must be given. Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), if the Redox Flow technology is selected, namely with regard to safe handling during the construction phase. This is to avoid any spills or leaks from this system.	
Nature of cumulative impacts	Although most of the project components are linear in fashion, while being spread over a wide area, most of the projects are spread over various catchments. However, spills and water quality issues remain localised due to the ephemeral nature of the aquatic systems	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Very Low -

Table 7-80: Cumulative impact: Groundwater abstraction

Issue	The proposed project will require water for the construction and operations of the proposed Wind Farms, with anticipated demands being met by the local groundwater resources, but would not exceed the General Authorisation limits per farm portion of 40 000m ³ Per Annum per farm portion (assuming that farm portions selected meet the thresholds listed in the GA).	
Nature of cumulative impacts	This can only be assessed in detail prior to construction when modelling, pump and yield testing is undertaken.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

7.7.5 No-Go Alternative

The overall impact of the status quo activities would be Very Low (-) over time mostly related to road and track access within the aquatic environment and does have a marginal impact on the landscape. However, the intensity, which is Low, limits any significant degradation these systems.

7.7.6 Conclusion and Recommendations

To summarise, various aquatic features, mostly ephemeral in nature were observed within the study area for Hoogland 1 and Hoogland 2 Wind Farms respectively, and with adherence to the constraints, the overall impact on the aquatic environment would be Low (-).

Specific areas that should be avoided are the valley bottom wetlands and the endorheic pans which have been avoided by all infrastructure in the layouts assessed. The valley bottom wetlands have been mapped and it is recommended that only existing crossings be used or upgraded, and these have also been avoided by all infrastructure in the layout except in the case of existing crossings. These together with some of the mainstem alluvial systems were rated Very High in the DFFE screening tool results and have been avoided by the larger structures (turbines, O&M buildings etc.). These too have been also avoided by all infrastructure in the layout except in the case of roads.

Furthermore, the potential water sources for the project, will focus mainly on groundwater resources. The desktop assessment (refer to *Appendix C18: Geohydrology* of the EIR) has indicated that water is available and in sufficient quantities, but this will be supported at later stage with pump/yield tests. As this is a significant factor in wind farm construction, a detailed ground water investigation will be conducted as part of the Water Use License Application. Estimates for wind farm construction projects have been around 50 – 60 000m³ per year, but actual figures from wind farm monitoring data indicate that between 80 – 90 000m³ of water is required per year over the 24-month construction period, particularly if concrete towers for the turbines are used.

In summary the current layout for each wind farm has, avoided key sensitive features and buffer areas, greatly reducing the potential overall impact and risk to Aquatic resources, which includes any Critical Biodiversity Areas and Ecological Support Areas. The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the aquatic environment would be Low (-).

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented.

7.8 Visual

This section provides a short summary of the visual specialist report compiled by Quinton Lawson and Bernard Oberholzer (2022) which is available in *Appendix C11: Visual*.

7.8.1 Baseline Description

The proposed Hoogland Northern Cluster Wind Farms (Hoogland 1 Wind Farm and Hoogland 2 Wind Farm) are located on the Nuweveld plateau in the Great Karoo. Both Wind Farms straddle the R381 Provincial Main Road between Beaufort West and Loxton, a gravel road for most of this stretch, which includes several passes and *poorts* along the Route.

According to Lawson and Oberholzer (2022), it is an expansive semi-arid landscape, with widely scattered farmsteads nestled among tree copses, usually near sources of water or boreholes, many of the farm names ending with the term 'fontein'. The large farms support mainly merino sheep, and occasionally dorper sheep and cattle, as well as game, such as springbok and other small antelope. The Nuweveld escarpment and plateau is characterised by horizontal sills

of erosion-resistant dolerite forming steep cliffs in places, boulder-strewn mesas or plateaus and flat-topped koppies while the gentler, lower hillslopes and plains consist of more easily weathered mudstone, with occasional narrow ledges of harder sandstone. The flattish plains are at around 1400m elevation, and the dolerite ridges and mesas are 1500-1600m elevation.

The landscape and scenic features of the site and surrounding area are made up of landscape setting, geology and landforms, vegetation cover, land use and sense of place (Figure 7-68).



Figure 7-68: The expansive Karoo landscape (top left), vegetation cover (middle left), Merino sheep farmland use (middle right) and a rubble stone wall adding to sense of place (bottom)

Landscape features of visual or scenic value, along with potential sensitive receptors in the surroundings, are described in below. These provide a visual baseline for the study area.

Table 7-81: Landscape features within or adjacent the proposed site

SCENIC RESOURCE	LANDSCAPE FEATURES WITHIN OR ADJACENT TO THE DEVELOPMENT SITE
Topographic features	Characteristic landforms include the <i>mesas</i> and <i>koppies</i> formed from horizontal dolerite sills. Vertical dolerite dykes form long knobbly ridges and rock outcrops. Landscape features in the area contribute to scenic and natural heritage value, providing visual interest or contrast in the open Karoo landscape.
Water Features	In the dry landscape, drainage features and the larger dams provide scenic and amenity value.
Cultural landscapes	Green patches of cultivated land and tree copses in alluvial valleys form part of the cultural landscape. The Heritage Assessment includes archaeological and historical features, which have visual implications.
SCENIC RESOURCE	RECEPTORS ADJACENT TO THE SITE OR IN THE LOCAL SURROUNDINGS.
Protected Areas	The Karoo National Park, about 40km from the site, has wilderness and scenic value in addition to its biological conservation role, serving as an important visitor / tourist destination (Figure 1-1). Visual significance is increased by its protection status.
Game farms	Private game farms and guest accommodation in the area are important for the local tourism economy, and tend to be sensitive to loss or degradation of scenic quality.
Human settlements, farmsteads	Loxton is about 13km north of the site and would potentially be within the zone of visual influence of the proposed Hoogland Northern Cluster. Surrounding farmsteads, particularly those within 10km of the project, could be sensitive to the visual intrusion of wind turbines in the landscape. It is assumed that farms that form part of the development are less visually sensitive.
Scenic routes and arterial roads	The R381 Route between Beaufort West and Loxton, which includes a number of small passes and poorts, has scenic value in places. This route, and primary district roads, used by residents and visitors to the area, are therefore visually sensitive.

7.8.2 Site Sensitivity

The Hoogland Northern Cluster Wind Farms have been classified by the DFFE National Screening tool as being sensitive due landscape features of visual or scenic value, along with potential sensitive receptors in the surroundings, as described in Table 7-81 above and shown in Figure 7-69.

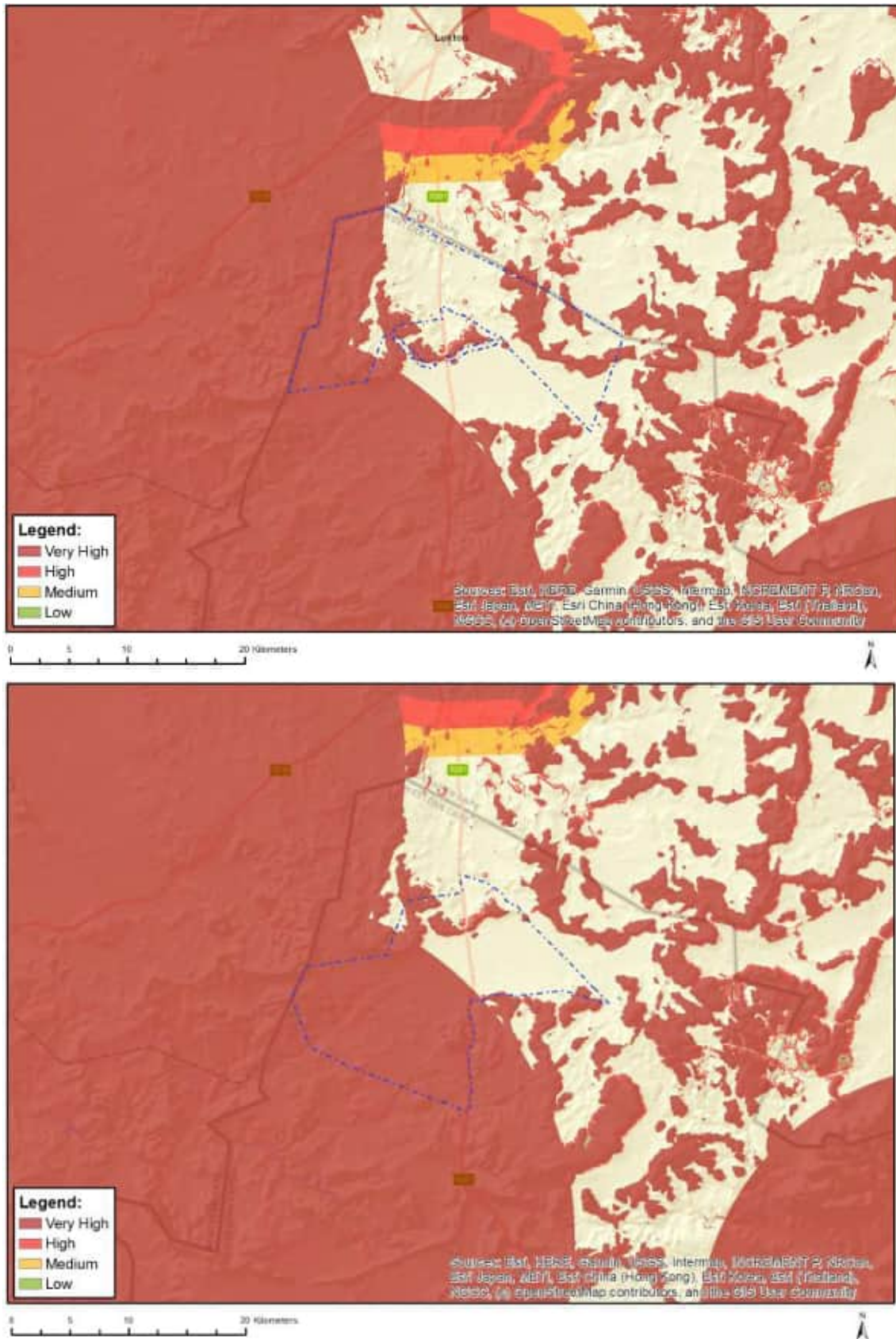


Figure 7-69: Map of relative landscape theme sensitivity for Hoogland 1 Wind Farm (top) and Hoogland 2 Wind Farm (bottom). High sensitivity shown in red.

7.8.2.1 Viewsheds and Viewpoints

During the site assessment the specialist identified viewpoints based on selected potentially sensitive receptors, mainly surrounding farmsteads (some of which are guest accommodation), as well as road corridors, particularly where these have scenic attributes, such the small passes and *poorts*. Viewpoints were selected to represent a range of distances to give an idea of their relative visibility.

Viewsheds of the wind turbine layouts are indicated on Figure 7-70 and Figure 7-71 being the zone of visual influence of the wind farms for both Hoogland Northern Wind Farms²⁸. Figure 7-70 indicates the number of turbines that would be visible within 5km, based on the tip height of the turbines. Figure 7-71 indicates the number of turbines that would be visible from 5 to 25km, based on the hub height of the turbines. The colours denote how many turbines are visible from each location, while the 'clear' areas are in a view shadow and therefore not visually affected. These maps show that in some cases only a few turbines would be visible, even from nearby receptors. Table 7-82 below defines visibility in terms of distance.

Table 7-82: Definitions of visibility

Distance	Visibility	Notes
0-2.5km	Very high visibility	Prominent feature within the observer's frame
2.5-5km	High visibility	Relatively prominent feature within the observer's frame
5-10km	Moderate visibility	Only prominent with clear visibility as part of the wider landscape
10-20km	Marginal visibility	Seen in very clear visibility as a minor element in the landscape

It is important to note that for the purposes of this report, the term 'visibility' relates to geographic distance from the proposed wind turbines, while the term 'sensitivity' involves a range of additional visual criteria.

²⁸ The Northern Cluster Wind Farms have been assessed cumulatively so as to represent a worst-case scenario for the purpose of the EIA report.

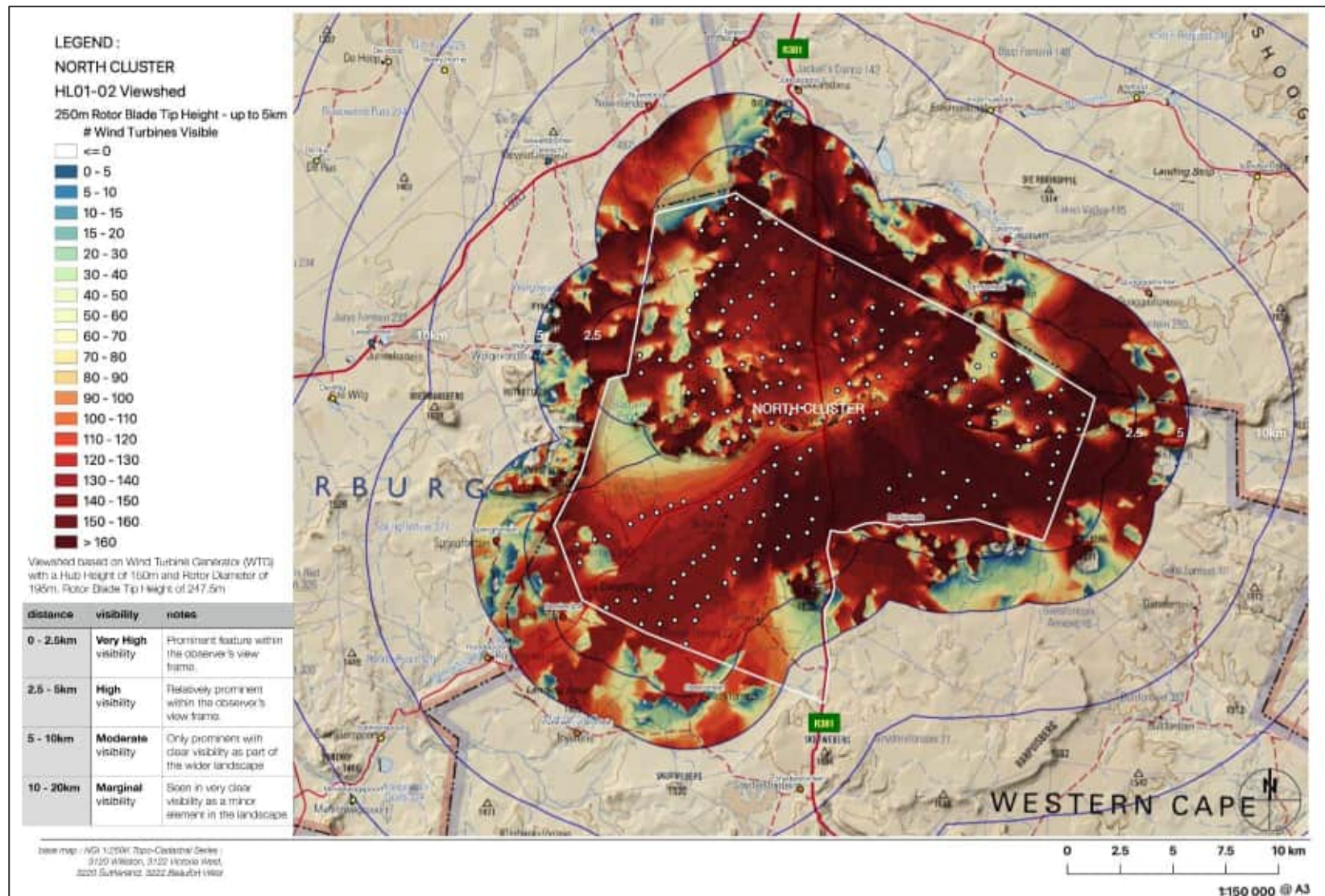


Figure 7-70: Viewshed indicates the number of turbines that would be visible within 5km, based on the tip height of the turbines of the current wind turbine layouts for both Hoogland 1 and Hoogland 2 Wind Farms clear areas are in a view shadow.

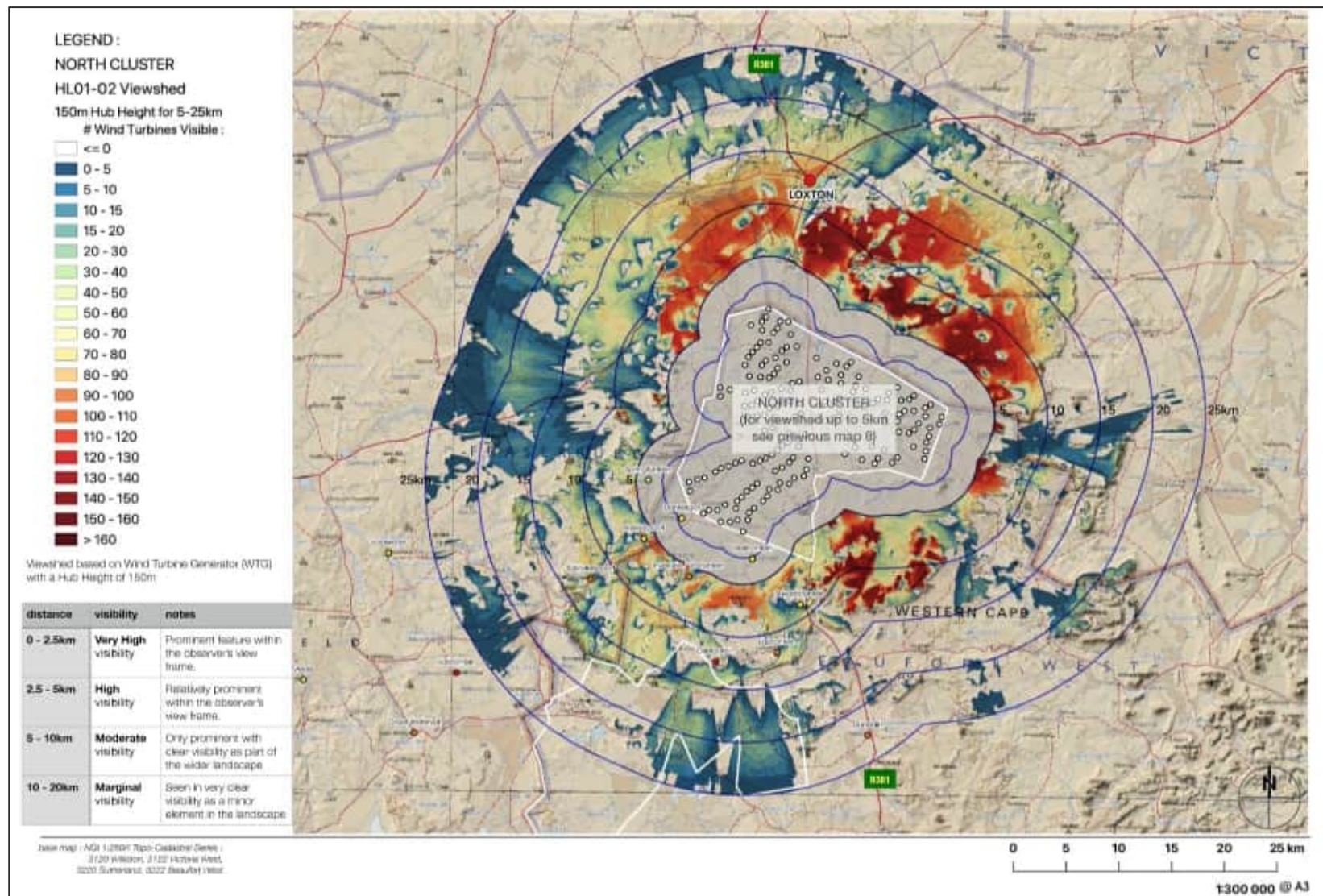


Figure 7-71: Viewshed indicates the number of turbines that would be visible from 5 to 25km, based on the hub height of the turbines. The colours denote how many turbines are visible from each location, while the 'clear' areas are in a view shadow and therefore not visually affected.

7.8.2.2 Visual sensitivity mapping criteria

The visual assessments of the proposed Hoogland Northern Wind Farms are based on several quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance, including the considerations described below.

7.8.2.2.1 Visual Exposure

As described above, viewsheds of the proposed Wind Farms are indicated on Figure 7-70 and Figure 7-71, being the potential zone of visual influence of the Northern Cluster development based on the current layout of wind turbines (representing a theoretical 'worst case scenario'). Figure 7-70 indicates the number of turbines that would be visible within 5km, based on the tip height of the turbines. Figure 7-71 indicates the number of turbines that would be visible from 5 to 25km, based on the hub height of the turbines. These maps show that in some cases only a few turbines would be visible, even from nearby receptors.

7.8.2.2.2 Visibility

A number of significant viewpoints have been identified, together with their relative distances and anticipated visibility of the proposed Wind Farms (shown on Figure 7-70 and Figure 7-71 and listed in the VIA). The viewpoints were selected based on proximity to the Wind Farms and the potential sensitivity of identified receptors, including users of arterial routes along with guest farms and farmsteads.

Degrees of visibility would depend on the number of turbines in the view field and their position in the landscape (e.g., on ridgelines), as well as on foreground screening provided by topography or trees.

7.8.2.2.3 Visual Absorption Capacity (VAC)

This relates to the potential of the landscape to screen the proposed Wind Farms from view. Wind turbines tend to be more obscured from view in broken mountainous topography and more exposed in the open plains. Turbines located on ridgelines or *koppies* tend to be more visible in the landscape, particularly when seen in silhouette. The sparse Karoo vegetation provides little screening effect. However dense clumps of trees around farmsteads tend to reduce visibility by receptors.

7.8.2.2.4 Landscape Integrity

Landscape integrity tends to be enhanced by scenic or rural quality and intactness of the landscape, as well as absence of other visual intrusions. Natural or pristine landscapes tend to have higher visual quality and therefore higher value. Cultural landscapes, such as rural or farming scenes also have visual or scenic value. On the other hand, industrial activity and visual 'clutter', including substations and power lines, detract from these scenes.

Most of the site for the proposed Wind Farms has an uncluttered, expansive landscape with pastoral scenes, for which the Karoo is renowned.

7.8.2.2.5 Visually Sensitive Resources

Natural and cultural landscapes, or scenic resources, form part of the 'National Estate' and may have local, regional or even national significance, usually, but not only, of tourism importance. Within the study area, the dolerite dykes, koppies and other outcrops tend to be the main features of scenic and geological interest.

7.8.2.2.6 Visual Impact Intensity

The overall potential visual impact intensity is determined in Table 7-83 below by combining all the factors above, namely visual exposure, visibility, visual absorption capacity, landscape integrity and visually sensitive resources. Visual impact intensity is in turn used to assess visual impact consequence of the two proposed Wind Farms and related infrastructure, such as the substation (including associated battery facilities), buildings, internal overhead powerlines and access roads.

Table 7-83: Visual Impact Intensity

VISUAL CRITERIA	COMMENTS	WIND TURBINES	RELATED INFRASTRUCTURE
Visual exposure	Extensive viewshed relating to large scale and number of wind turbines.	High	Low
Visibility	Visible from parts of the R381 Route, main district roads, and a number of farmsteads and guest farms.	High	Low
Visual absorption capacity (VAC)	Visually exposed plain and ridges (in places), and therefore low VAC.	High	Medium
Landscape integrity / intactness	Effect on rural farming character and Karoo landscape.	High	Medium
Landscape / scenic sensitivity	Effect on scenic resources / dolerite outcrops.	High	Low
Impact intensity	Summary	High	Medium

Scenic resources and sensitive receptors within the study area have been identified and categorised into no-go, high sensitivity, medium sensitivity and low visual sensitivity zones at a more detailed local scale. Visual sensitivity maps have been created for turbines, buildings and substations (including associated battery storage facilities), internal roads and cables, internal overhead powerlines and the N1 bypass. The sensitivity mapping provides some indication of the level of acceptable change in visual terms and has informed the project layout. The sensitivity maps are included in the figures below (Figure 7-72 - Figure 7-76) and the criteria are included in Table 9-1.

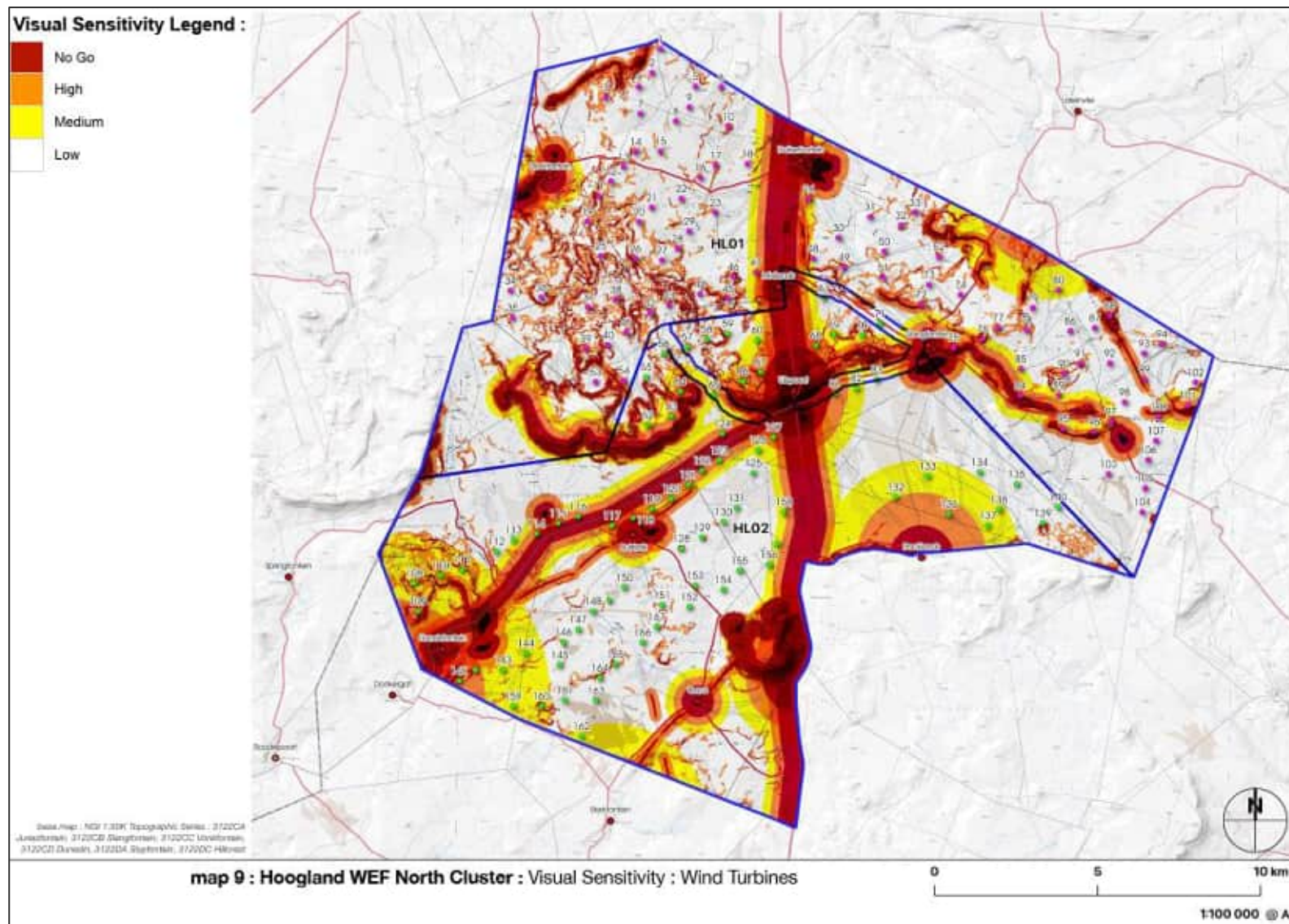


Figure 7-72: Wind turbine visual sensitivity map

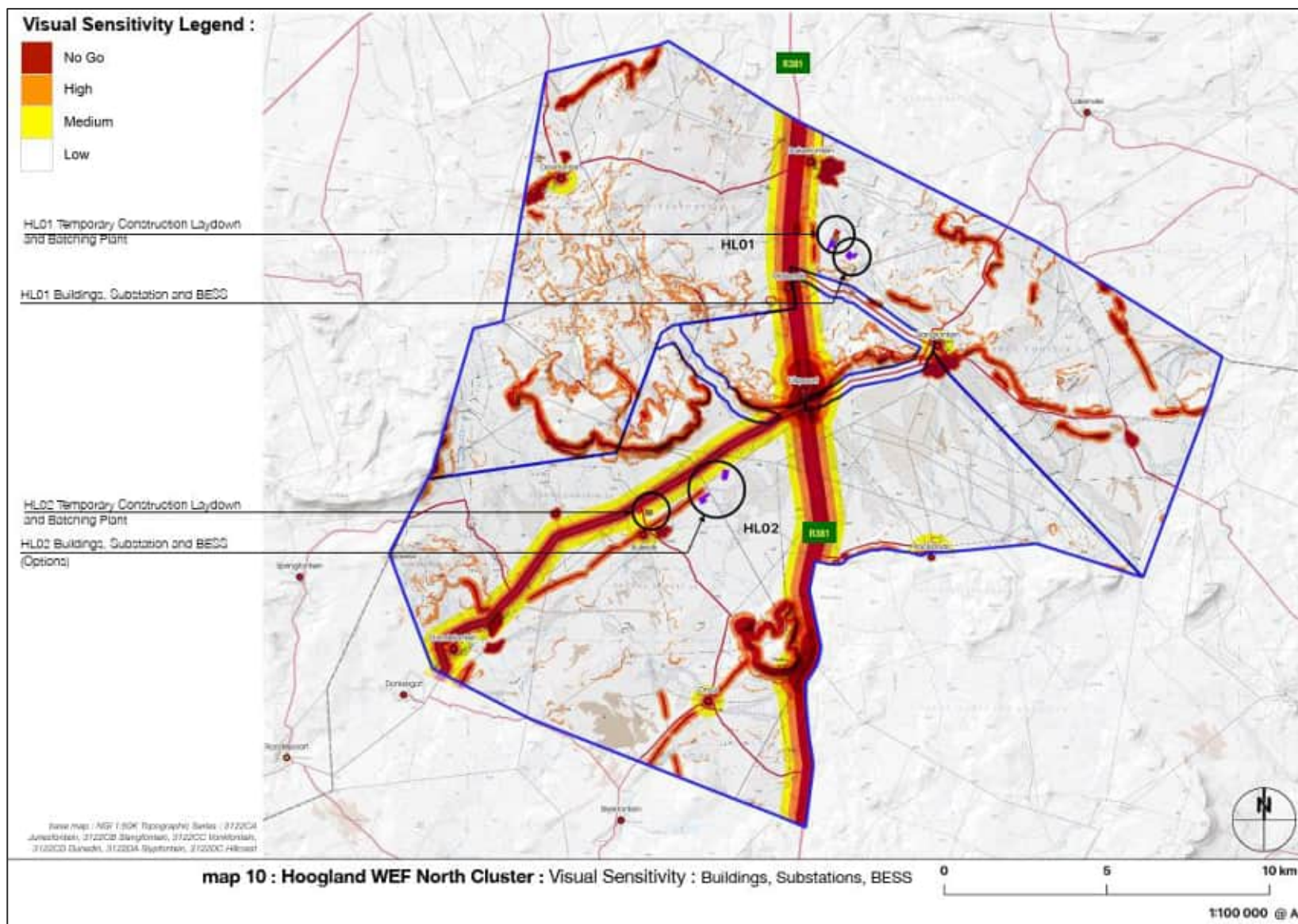


Figure 7-73: Buildings, substation and BESS visual sensitivity map

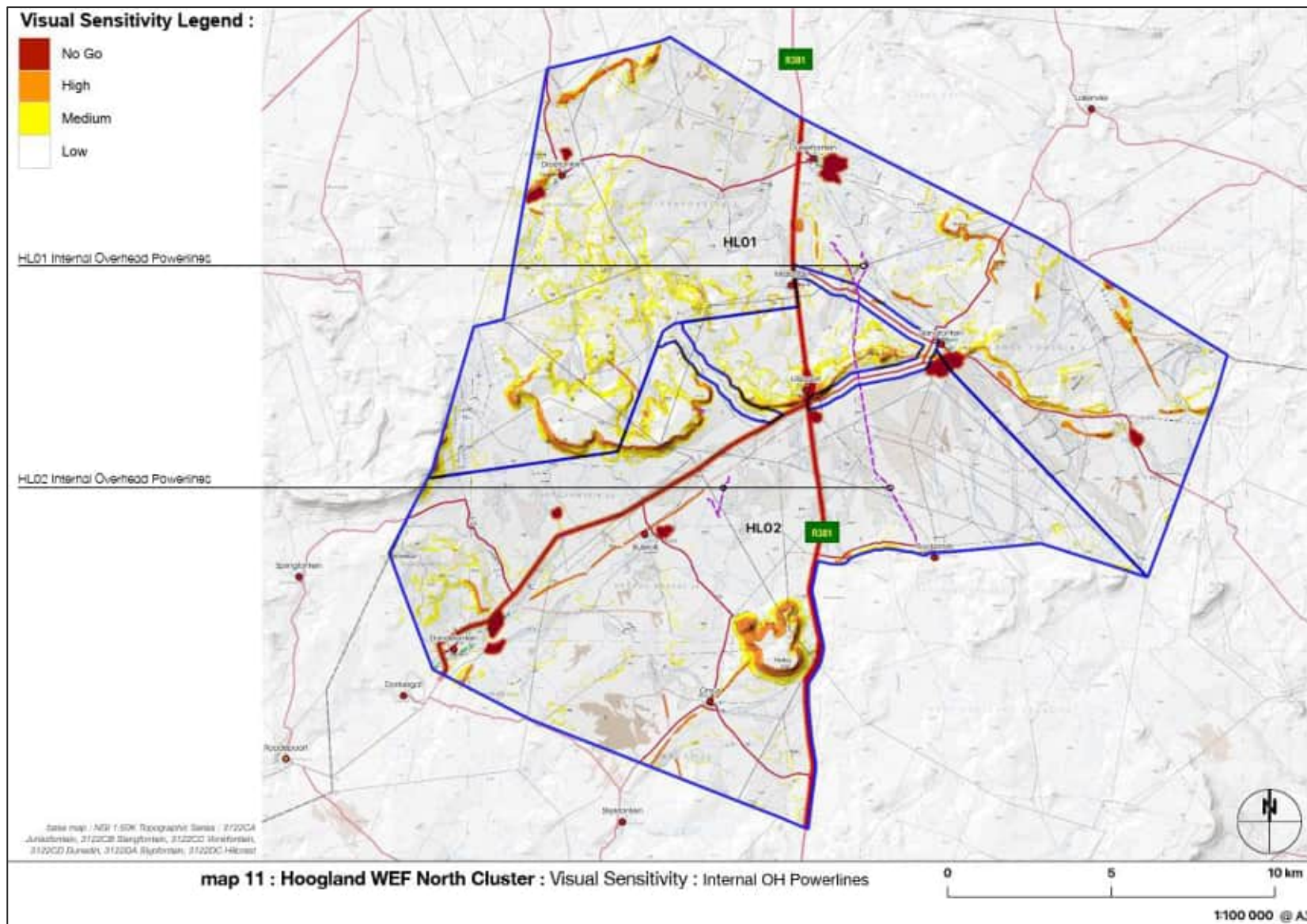


Figure 7-74:Overhead powerline visual sensitivity map

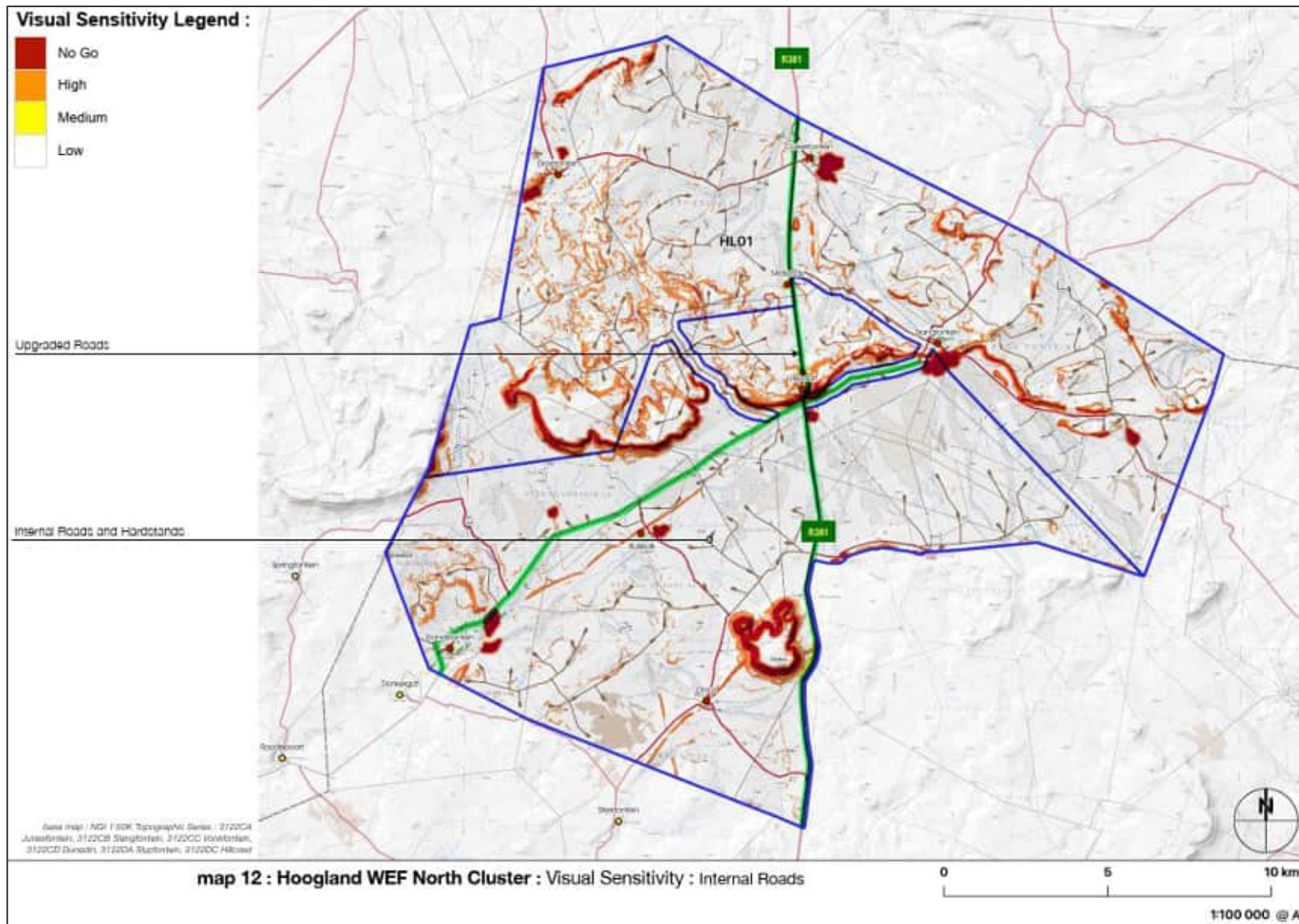


Figure 7-75: Internal roads visual sensitivity map

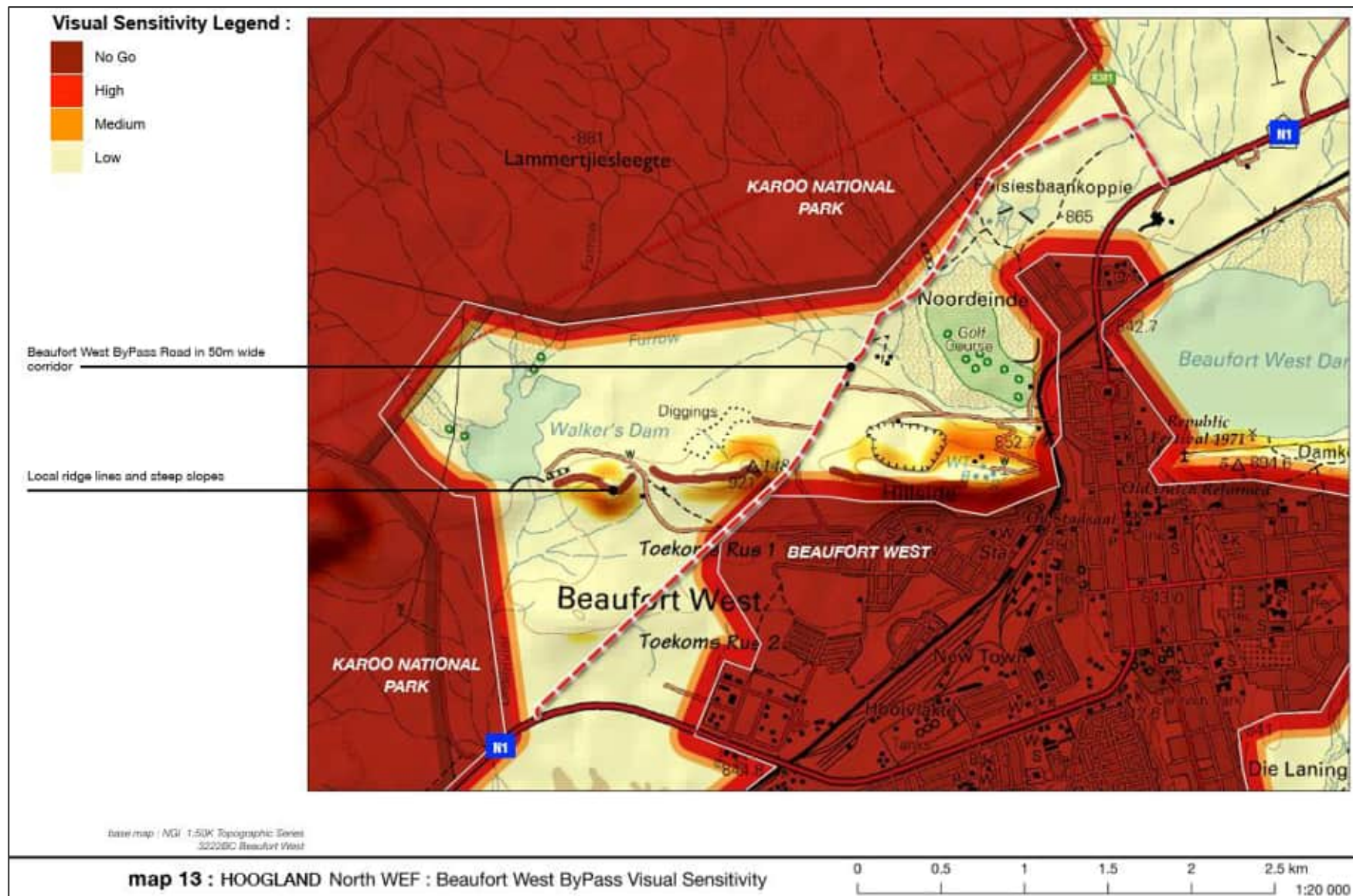


Figure 7-76: Beaufort West N1 Bypass visual sensitivity map

7.8.3 Impact Assessment and Mitigation

The following visual impacts have been identified and rated by Lawson and Oberholzer (2022).

Potential visual impacts associated with the proposed Wind Farms will occur where turbine positions and associated infrastructure types conflict with identified scenic resources and sensitive receptors, as indicated in the sensitivity mapping. Scenic resources at the site are mainly prominent topographic and water features. Sensitive receptors include game farms, especially those with tourism facilities, as well as individual farmsteads within the site and in the surroundings.

A number of quantitative and qualitative criteria may affect the potential visual impacts, as well as their relative significance, including: visual exposure, visibility, visual absorption capacity, landscape integrity, visually sensitive resources and visual impact intensity (as outlined in the previous section).

7.8.3.1 Construction Phase

Table 7-84: Construction: Visual intrusion of construction activities

Issue: Visual intrusion of construction activities on the Karoo landscape.		
Description of Impact		
<ul style="list-style-type: none"> Visual intrusion of cranes, heavy vehicles and construction activities required for the erection of wind turbines, and related infrastructure. Temporary construction areas e.g., camps and batching plants Visual scarring from earthworks for assembly platforms. Soil/ rubble stockpiles from earthworks. Litter generated from construction site. Noise and dust from construction activity affecting the Karoo's sense of place. 		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Probable
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact is reversible by means of site rehabilitation after construction and removal of construction equipment.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	<ul style="list-style-type: none"> There is some scope for mitigation as per the recommended mitigation measures below: Visually sensitive skylines, such as dolerite ridges, koppies, rock outcrops and slopes steeper than 1:4 or 1:10 gradient, avoided in the layout design. The EIA layout meets these requirements Disturbed areas rehabilitated / revegetated as soon as possible during the construction phase. Temporary laydown and areas and batching plants to be located away from arterial or district roads unless approved by the visual 	

	<p>specialists. This current layout is acceptable in this regard, where a visual buffer of 50m would be provided.</p> <ul style="list-style-type: none"> • Stockpiles to be demarcated and located within approved construction footprints. • Recycling and refuse bins to be provided to eliminate litter from the site.
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7.8.3.2 Operational Phase

Table 7-85: Operation: Visual intrusion of wind turbines

Issue: Visual intrusion of wind turbines on the Karoo landscape.		
Description of Impact		
Potential visual intrusion of the tall wind turbines on the rural landscape, scenic resources and sensitive receptors. Change in the pastoral Karoo character and sense of place of the local area.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	High
Probability	Definite/ Continuous	Definite/ Continuous
Significance	High -	High -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of dismantling the turbines and site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	Mitigation only achievable by means of avoidance in the siting of turbines. No potential for screening of the tall turbines. Further potential design recommendations in relation to cumulative impacts are shown in Section 7.8.4.	

Table 7-86: Operation: Visual intrusion of associated infrastructure

Issue: Visual intrusion of infrastructure on the Karoo landscape.		
Description of Impact		
Visual effect of industrial-type substations and BESS on the rural Karoo landscape. Visual intrusion of internal overhead powerlines, including silhouette effect on skylines of ridges / koppies. Visual intrusion of internal access roads and hardstands in the local area.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Definite/ Continuous

Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of dismantling the infrastructure and implementing site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	<p>Some mitigation is achievable through careful siting and screening of infrastructure. These are as follows:</p> <ul style="list-style-type: none"> Substations and O&M Buildings to be located in unobtrusive low-lying areas away from provincial and district roads where possible. The current location shown in Map 8 meet these requirements. On-site signage to be discrete, and billboards prohibited. Signage to be fixed as low as possible, preferably against a backdrop to avoid intrusion on the skyline. Security and other outdoor lighting to be fitted with reflectors to conceal the light source. 	

Table 7-87: Operation: Visual intrusion of lighting at night

Issue: Visual intrusion of lighting at night.		
Description of Impact		
Visual effect on the dark skies of the Karoo created by lights on turbines for aircraft navigation. Visual intrusion of area and security lighting around the substations and O&M buildings.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Definite/ Continuous
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of dismantling the turbines and other infrastructure and site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	<p>Some mitigation achievable for navigation lights by means of technological advances. Security and other outdoor lighting can be fitted with reflectors. These are as follows:</p> <ul style="list-style-type: none"> Use of available technology to minimise the visual effect of navigation lights, conforming with CAA requirements. Use of reflectors on area and security lighting to conceal light sources. 	

Table 7-88: Operation: Visual impact of the N1 Bypass Road

Issue: Visual impact of the N1 Bypass road on the Karoo National Park, Beaufort West town and the golf course
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Description of Impact		
Visual and noise intrusion of the roadway and related truck traffic on adjacent sensitive visual receptors.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	High	Medium
Probability	Definite/ Continuous	Definite/ Continuous
Significance	High -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	The resource is damaged irreparably but is represented elsewhere	
Degree to which impact can be mitigated	<ul style="list-style-type: none"> • Earth berms and planting to be used to visually screen the roadway in places of close proximity to residential areas. • Traffic and other signage to be limited to only that which is essential. • Where lighting is required, these are to have reflectors to avoid light spillage on adjacent areas. 	

7.8.3.3 Decommissioning Phase

Table 7-89: Decommissioning: Visual intrusion of decommissioning activities

Description of Impact		
Issue: Visual intrusion of activities to remove infrastructure.		
Visual effect of construction activities to remove infrastructure at the end of the life of the project, including wind turbines, substation, buildings, internal overhead powerlines and access roads.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Very short-term	Very short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Probable
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact is reversible by means of site rehabilitation after construction and removal of construction equipment.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	There is some scope for mitigation as per the recommended mitigation measures below:	

	<ul style="list-style-type: none"> • Disturbed areas rehabilitated / revegetated as soon as possible after the decommissioning phase. • Wind turbines and building structures removed at the end of the life of the project. • Hardstands and access roads no longer required to be ripped and regraded. • Exposed or disturbed areas revegetated and returned to grazing pasture or natural veld to blend with the surroundings.
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7.8.4 Cumulative Impact

The proximity of the Hoogland Northern and the Nuweveld North Wind Farms to each other could particularly increase cumulative visual impacts, especially when seen from the R381 Provincial Route and there would be a change to the largely rural character and sense of place of the area. However, the nature of the topography would result in some screening between the above-mentioned Wind Farms, and these would therefore seldom be seen fully in combination. The Hoogland Northern and Southern Clusters are also spaced more than 10 km apart from each other which ensures a visual separation of the two clusters. Similarly, the Hoogland Wind Farms have a number of smaller natural gaps, derived from the various specialist sensitivity mapping, which helps to provide a clustering effect.

Potential cumulative visual impacts of the combination of the above Wind Farms would be high (-). In terms of mitigation, it is proposed that where a choice exists between turbines to be dropped and all other factors being equal, priority should be given to removing or relocating those within 1km of the R381, as well as widening any other gaps to improve the visual clustering effect. Removing turbines in the “high” visual sensitivity category and outlier turbines could also be considered. The residual impact can therefore only be quantified once the layout of the 60 turbines is finalised.

Table 7-90: Cumulative impact: Visual impact of turbines

Issue: Cumulative visual intrusion of wind turbines on the Karoo landscape.		
Nature of cumulative impacts	The cumulative assessment considers the various proposed renewable projects that occur within a 30km radius of this site, namely the proposed Hoogland Southern Wind Farm Cluster, Hoogland Northern Wind Farm Cluster and adjacent Nuweveld Wind Farms. The rating below is based on the premise that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	High -

7.8.5 No-Go Alternative

The no-go alternative would mean that there would be no additional visual intrusion on the rural landscape and on farmsteads in the area by wind turbines and related infrastructure. Scenic features and the overall sense of place would therefore remain intact.

It is envisaged that the potential visual impact significance of the no-go alternative would be neutral as the status quo would likely continue and there would be no further visual impacts.

7.8.6 Conclusion and Recommendations

The layouts of the Hoogland Northern Wind Farms have followed an iterative planning process during the Screening Phase, based on the various specialist findings, including the mapping of scenic resources and sensitive receptors. The proposed layout for construction and operational infrastructure succeeds in avoiding most visual 'no-go' areas indicated on the visual sensitivity maps and is acceptable.

To reduce the impacts, further refinement of the layout has been recommended where a choice exists between turbines to be dropped to reach the reduce the layout to a maximum of 60 turbines, and all other factors are equal. This includes outlier turbines (that extend the zone of visual influence and detract from the visual cohesion of the proposed WEFs); those in the 'high' visual sensitivity areas; those within 1km of the R381 and those when removed widen gaps that could improve the clustering effect.

Given the relatively large number and large scale of the wind turbines, the potential visual impact of the Wind Farm was calculated to be high (-) before mitigation. The VIA considered the visual impact of 87 and 80 turbines for each of the Wind Farms respectively, while acknowledging that a maximum of 60 turbines for each could be developed (as per the application), potentially reducing the visual impact. This assessment, however, considers the worst-case scenario in terms of the visual impacts associated with the two proposed Hoogland Northern Cluster Wind Farms.

It is the opinion of the Visual Specialists that while the Hoogland 1 Wind Farm and Hoogland 2 Wind Farm layouts would each respectively have a significant visual impact, the layouts have avoided most of the scenic resources and visual receptors of the area and provided the recommended mitigation measures are implemented, would not present a potential fatal flaw in visual terms. The project, with mitigations, may therefore be authorised from a visual perspective.

7.9 Heritage

This section provides a short summary of the heritage specialist report compiled by Jayson Orton of ASHA Consulting which is available in *Appendix C12: Heritage*.

7.9.1 Baseline Description

The baseline description is based on available literature, mapping and field work undertaken between April 2021 and March 2022 the aim of which was to record as many heritage resources in the study area as possible.

The Wind Farm sites are in a rural/natural context used for livestock (sheep and cattle) and game rearing. All local roads are gravel and farm complexes are few and far between. Human modification of the environment, aside from roads and occasional farm complexes, some of which have associated agricultural lands, is limited to wind pumps, reservoirs, dams and farm fences.

Large parts of the overall study area lie on extensive flat, silty plains and these are bounded variably by dolerite dykes that form small or large ridges or hills and low sandstone scarps. In places shale is visible on the surface but this is largely limited to riverbeds. It is generally very hilly and rocky, although the majority of the rocks do not form cliffs but break into pieces through erosion and weathering. The exception is the bands of sandstone that occur in places and are more resistant to weathering. These create low cliffs (in the order to 1 to 5 m high and sometimes result in the formation of rock shelters. Narrow, incised valleys with well-defined rivers are rare. Vegetation tends to be relatively sparse due variably to the elevation and exposure, limited rainfall and sometimes very rocky substrates (Figure 7-77).



Figure 7-77: View towards the south in a river valley in the eastern part of HL01 (top left), View towards the southeast across the extensive silty plains in the eastern part of HL02 (top right)

Heritage resources at the site can be divided into five main categories namely: Palaeontology, archaeology, graves, built environment and cultural landscape. This section provides a summary of the baseline heritage resources associated with these five categories.

Note: Visual and palaeontology resources are not included in this baseline description as they are covered in more detail Section 7.8 and Section 7.10 respectively.

7.9.1.1 Archaeology

According to ASHA (2022), The study area has been found to be rich in archaeology dating back to the 18th and 19th centuries but evidence of occupation of these sites into the early 20th century was also found in a few instances, but with sites being in clusters that are often quite far apart. The vast majority of the recorded archaeology dates to the colonial period but Stone Age sites were also present. Appendix 2 of the HIA (*Appendix C12: Heritage*) lists and describes all the finds with the highlights being presented and illustrated in this section.

The vast majority of the Stone Age finds were from the Late Stone Age (LSA), although occasional finds of older stone artefacts were also noted. One such scatter was near a dolerite scarp with the heavy patination on the artefacts indicating their relatively great age – the artefacts are no doubt from the MSA (waypoint 059; Figure 7-78). Background scatter artefacts (essentially precolonial litter) were generally uncommon, but when such artefacts were found they tended to be in areas with a light gravel covering and were very ephemeral. These materials are all likely to be of Pleistocene age and, because of their small numbers, are of no consequence. No Early Stone Age (ESA) material was seen.



Figure 7-78: Collection of very well-patinated hornfels flaked stone artefacts dating to the MSA (waypoint 059 in HL01). Scale = 5 cm

A few proper LSA occupation sites were found, but all were surface scatters. One was an extensive artefact scatter on the southern side of a river in HL02 (but also HL01 due to shared infrastructure; waypoint 1703; Figure 7-79).

Most artefacts are in hornfels but some are in wacke. There are also many ostrich eggshell fragments. An unusual occurrence was a small enclosure or 'clearing' amongst dolerite boulders with a few stone artefacts, some ostrich eggshell, a burnt bone and a fragment of refined white earthenware in it in HL01 (waypoint 1723; Figure 7-79). The site may have been used as a location from which to survey the plains for game. Another significant site lies in the far east of HL01 and comprises of an extensive but relatively low-density artefact scatter that includes some grindstones (waypoint 1731; Figure 7-79). Also present are ostrich eggshell fragments and a piece of pottery. Single fragments of refined white earthenware and glass may indicate a late date for the site or could have been dropped there later. One site in Hoogland 2 Wind Farm (HL02) located close to the point where a stream cut through a dolerite dyke had pottery, an unfinished bead, a lower grindstone and various flaked stone artefacts (waypoint 079; Figure 7-80). Many other LSA sites occurred but most were ephemeral to light scatters of stone artefacts, sometimes including ostrich eggshell fragments.



Figure 7-79: Finds located in the 'clearing' at waypoint 1723 in HL01. (Left), Stone artefacts and ostrich eggshell at waypoint 1703 in HL01 and HL02 (Middle) and Surface appearance showing a lower grindstone and flaked artefacts among gravel at waypoint 1731 in HL01 (right). Scale in cm



Figure 7-80: Stone artefacts, ostrich eggshell fragments, an unfinished bead and a potsherd from waypoint 079 in HL02. Scale in 1 and 5 cm intervals (left) and A lower grindstone at waypoint 079 in HL02. Scale in 1 and 5 cm intervals (right). Scale in cm

LSA engraved sites also occur but just one has been found in the present study area. It lies in the northeast of HL01 on the same ridge as the small 'clearing' described above. It is an engraved boulder bearing two animals, one of which is clearly an eland due to the presence of a hump. The other animal is less clear, although it has far larger forequarters than hindquarters which might suggest a hyena (Figure 7-81).



Figure 7-81: Dolerite boulder with two LSA engraved animals on it (waypoint 512 in HL01)

One rock painting site is known from the study area thus far on HL01. It is a very faded finger-painted geometric painting in a rock shelter that also contains much scratched historical graffiti (waypoint 1676; Figure 7-82). A few stone artefacts, ostrich eggshell and bone fragments occur in and around the shelter.



Figure 7-82: The rock shelter containing painting and graffiti (waypoint 1676 in HL01); and close up of the remnant paint showing horizontal finger smears. Scale in cm

The colonial period archaeological sites would have been made by the trekboers who colonised this area during the 18th and 19th centuries but evidence of occupation of these sites into the early 20th century was also found in a few instances. These sites are stone-built farm complexes with livestock enclosures (kraals), houses, cooking shelters (kookskerms), rare threshing floors (trapvloere), various other unidentifiable stone structures and graves. Importantly, they sometimes have associated ash and rubbish dumps which contain extensive material evidence relating to day-to-day life during occupation of these sites. These sites are invariably located along rivers and, for this reason, should largely be protected from harm. Figure 7-83 shows an example of a stone-built house photographed in the early 20th century while still in use. The roof would have been of poles, branches, sacking,

sheepskins, or other suitable materials. This is probably what many of the less formal stone houses in the area looked like. More formal rectangular houses would have had flat roofs, brakkdak during earlier times with corrugated iron coming later.



Figure 7-83: A shepherd's hut photographed near Beaufort West in the early 20th century. Note the low, narrow doorway and informal roof structure. Source: Schoeman (2013:48)

One such complex is at Bulskolk located in the centre of the HL02 study area at waypoints 98 to 112 and serves well to illustrate a number of the types of features expected on these sites. This complex contains older, derelict, and ruined 19th century (or possibly older) components as well as more recent components dating to the early and mid-20th century and that, although derelict, can still be regarded as built structures. Figure 7-84 show views of what seems to have been the main house. It was added to many times with different materials and, even included sun dried bricks made from what must have been riverbank mud that had an LSA site on it – the bricks contain stone artefacts, ostrich eggshell fragments and bones. Figure 7-85 shows a kraal complex probably used to house young animals and/or their mothers (waypoint 110). A further large kraal also occurs in the complex (waypoint 099; Figure 7-86) as does a threshing floor which is probably fairly recent (waypoint 108; Figure 7-87). Related features include an extensive stone wall stretching towards the south and then turning west and which was not examined or mapped in detail and infrastructure related to the control and distribution of water. A large stone-lined farm dam occurs at waypoint 100 and smaller leiwater features lie below the dam wall (Figure 7-88). The dam shows the continuation of traditional building methods, no doubt to save money.



Figure 7-84: Part of a house at waypoint 112 in HL02 (left) showing sun-dried bricks, stone walls and a filled in doorway (middle) and showing stone walling and a remnant of a brakdak



Figure 7-85: A stone-walled structure that looks to have been a set of kraals (waypoint 110 in HL02)



Figure 7-86: A large stone kraal, undoubtedly the primary kraal for the farm (waypoint 099 in HL02)



Figure 7-87: The threshing floor and 20th century ruined structure at waypoint 108 in HL02



Figure 7-88: View of the large dam at waypoint 100 in HL02 with the insets showing the outlet valve and associated leivater

A particularly important part of the farm complex described above is the ash and rubbish dumps that occur at waypoints 105, 107 and 111. The first is the largest (Figure 7-89) and contains a multitude of historical glass and ceramic artefacts. Most artefacts seem to be of the types expected for mid-late 19th century occupations.



Figure 7-89: An enormous stone-lined ash and rubbish dump (middle ground) with an associated small stone feature (foreground) at waypoint 105 in HL02

Another aspect of historical archaeology is the many scratched engravings found in clusters in various places. The main subject matter is horses. This is not unexpected; Morris (1988:116) notes that “recently incised engravings, including distinctive horse motifs, are found in great numbers in the Karoo and areas just north of the Orange River.” Figure 7-90 shows a site in the HL02 study area which depicts five animals presumed to be horses and one image in the centre that looks like a bird. The panel is signed by ‘MANUS’ and looks, from the lack of patination, to be quite recent. Another engraving was unusual in its placement on an exposed section of dolerite bedrock on the

side of a hill rather than on a ridge-top outcrop or boulder. It too is recent and bears initials and a date (Figure 7-91). Although the year is given as “34”, it is fairly safe to assume from the lack of patination that this means 1934 rather than an earlier century. It lies in HL01. Only one other historical engraving was found in the area, at waypoint 550 in HL02.



Figure 7-90: Historical scratched engraving of five (presumably) horses, one bird-like creature and the name 'MANUS' at waypoint 077 in HL02. Scale bar = 15 cm



Figure 7-91: Historical scratched engraving spread over a single section of exposed dolerite at waypoint 073 in HL01. Left: a human portrait, centre: a horse and other scratches, right: date '30.7.34' and initials 'EdV'. Scale bar in each case is 10 cm

7.9.1.2 Graves

Many graves were seen throughout the study area. Some of them are formal graveyards associated with currently occupied farm complexes. Examples include waypoint 1746 on HL01 (Figure 7-92) on the farm Slangfontein which has family graves within the walled enclosure with other graves located immediately outside the wall as well as

clusters further away to the northeast and southwest (waypoints 703 & 706) likely to be those of farm workers. The dated burials extend from 1852 to 1966. Another somewhat less formal graveyard in HL02 appears to be associated with a farmstead located on the other side of a dolerite dyke. Most graves are informal but two have formal headstones and grave surrounds. There is no surrounding wall or fence, but one grave has its own fence. Only one bears a date (1934; waypoint 076; Figure 7-93).

Many other graves are located in remote areas, sometimes very close to historical sites such as the graveyard at waypoint 097 in HL02 (Figure 7-94) and a single grave at waypoint 1711, in HL01 and HL02 (Figure 7-95). Two very clear graves were found at waypoint 1696 in HL01 but they were located in a very remote location far from any structures or ruins (Figure 7-95). At waypoint 1733 in HL01, a set of three poorly marked probable graves was also associated with a farm complex and each had only a single standing stone. Although the stones were aligned north-south (suggesting the graves, if parallel as expected, to run east-west), two of the stones had their faces pointing north and south (Figure 7-96).



Figure 7-92: The formal Minnaar family graveyard at waypoint 1746 in HL01 (left) Graves located outside of the walled graveyard at waypoint 1746 (right)



Figure 7-93: Graveyard at waypoint 076 in HL02



Figure 7-94: A poorly preserved, informal graveyard at waypoint 097 in HL02 in a farm complex.



Figure 7-95: Single grave at waypoint 1711 in HL01/2. (Left) and two fairly clear graves at waypoint 1696 in HL01 (right), refer to ASHA (2022) for further detail (Appendix C9: Heritage).



Figure 7-96: Set of three probable graves at waypoint 1733 in HL01. They are marked by single standing stones, refer to ASHA (2022) for further detail (Appendix C12: Heritage).

7.9.1.3 Historical aspects and the built environment

Several historical buildings occur in the study area. Some are occupied and others are not. A few examples are presented here. In the north-eastern part of HL01 at waypoints 1691 and 1692 there is an abandoned farm complex with standing buildings, gardens and many trees (Figure 7-97). The house appears to date to the first half of the 20th century and is still in fair condition, despite having been abandoned for perhaps 40 years (Figure 7-99 to Figure 7-98). Also of heritage value is the cultivated landscape of trees and now unused gardens that surrounds the house and stretches towards the northeast. The trees include fruit trees and a tree-lined avenue along the access road.



Figure 7-97: View of the farmstead at waypoint 1692 in HL01 and showing the many trees that surround the house



Figure 7-98: The main house at waypoint 1692 in HL01 as seen from the north



Figure 7-99: The stoep and front door of the main house at waypoint 1692 in HL01

The Slangfontein farmstead in HL01 is still in use and contains several structures. Many are modern but a few late 19th or early 20th century buildings in good condition also occur (Figure 7-100 and Figure 7-101). The houses are also surrounded by a substantial planted landscape, all of which is enclosed by a stone werf wall. Another house (part of the modern Bulskolk farmstead) seemingly in good condition but also probably unoccupied lies close to waypoint 113 in HL02 but was not visited. It is likely early 20th century in age (Figure 7-102).



Figure 7-100: Historical structure at Slangfontein (waypoint 1747 in HL01)



Figure 7-101: Historical structure at Slangfontein (waypoint 1747 in HL01)



Figure 7-102: An unvisited house close to waypoint 113 in HL02

In addition to these structures, at least one bridge on the R381 in Northern Cape is historical in that it is dated 1952. It is essentially a modern concrete bridge which is not in very good condition. It and the other existing watercourse crossing structures in both Northern and Western Cape are considered to have very low cultural significance and require no further study.

7.9.1.4 Cultural landscapes and scenic routes

Cultural landscapes are the product of the interactions between humans and nature in a particular area. The site is characterised as a relatively undisturbed wilderness with a sense of wide-open space. The three aspects that make up the cultural landscape of the site are summarised in Table 7-91.

Table 7-91: Summary of the aspects of the cultural landscape of the Hoogland Northern Wind Farms site

CULTURAL LANDSCAPE	DESCRIPTION
Natural / Primeval Landscape	Inhabited by the indigenous Bushmen hunter-gatherers who left little trace of their passing but did mark the landscape with engravings and rock gongs.
Trekboer Landscape	Characterised by more permanent traces in the form of stone-built residential and farming structures (now in ruin), graves and threshing floors. The earliest trekboers left very little trace at all since they would have lived in their ox wagons before eventually settling down and building the stone structures that characterise this aspect of the cultural landscape. Grey poplar (<i>Populus x canescens</i>) is typical of trekboer farm structures who grew these fast-growing trees for construction purposes.
Modern Landscape	Characterised by livestock and game farming, widely spaced farm complexes, farm fences and tracks. Farm complexes are generally marked by the presence of many trees. They often contain different layers of heritage and can be thought of as areas of higher density of heritage resources. Examples include the Slangfontein (mostly in HL01) and Elandsfontein (HL02) werfs (Figure 7-103 and Figure 7-104).

Part of all described above is the relatively undisturbed wilderness atmosphere that pervades the region – this includes the darkness of the night-time sky. Driving its main roads, in this case the R381 which passes through the study area, leaves one marvelling at the tremendous sense of wide-open space and, away from the hills of the escarpment, the endless Karoo plains. Winter and Oberholzer (2013) have rated the Molteno Pass section of the R381 which goes up the escarpment as being a locally significant route. This rating can certainly be extended to the rest of this road for its scenic value, although it must be noted that parts of the R381 pass through the Beaufort West REDZ, and three other Wind Farms have been approved by Heritage Western Cape (HWC) in the area. The KNP lies some 49 km and 39 km south of HL01 and HL02 respectively. It is a significant landscape and offers formal protection to a section of the highly scenic escarpment. The KNP and escarpment are both too far south to be affected by the proposed Wind Farms.



Figure 7-103: Historical aerial view of the Slangfontein werf (mostly on HL01) and associated agricultural landscape from 1959 showing the landscape at that time (left). Modern aerial view of the Slangfontein werf (mostly on HL01) showing that structures have been added and that there are more and larger trees. Source: CapeFarmMapper



Figure 7-104: Historical aerial view of the Elandsfontein werf on HL02 and associated agricultural landscape from 1960 showing the landscape at that time (left). Modern aerial view of the Elandsfontein werf on HL02 showing that structures have been added and that the amount of arable land has slightly increased. Source: CapeFarmMapper (right)

7.9.1.5 Places associated with living heritage

As noted above, the historical engravings of the area demonstrate continuity in the tradition of engraving. This signature is minimal in the study area with just one site known in Hoogland 1 and two sites in Hoogland 2. What is perhaps of greatest interest is that the engraving tradition appears to have continued even longer than expected as evidenced by the dated example described above.

7.9.1.6 Visual impact assessment

Lawson and Oberholzer (2022) summarised in Section 7.8, note the project setting to be an expansive semi-arid landscape. Flat-topped hills are seen as a characteristic feature of what is an otherwise fairly featureless landscape. Refer to Figure 7-70 and Figure 7-71 which show viewshed maps for HL01 and HL02 Wind Farms together. Figure 7-70 shows a zoomed in viewshed and is based on blade tip height for the turbine positions as seen from within 5km and Figure 7-71 is based on hub height for the turbine positions as seen from further than 5km (the towers are used in this instance as distance mitigates the visibility of the blades), and where after 10km visibility in general becomes marginal. The colours denote how many turbines are visible from each location. It is notable that with more open plains to the north of the study area the visual exposure is greater there than is the case to the south and especially the east where the land is more mountainous.

7.9.2 Site Sensitivity

The DFFE National Screening tool indicates that the Archeological and Cultural Heritage theme for the Hoogland Northern Cluster Wind Farms is classified as not being sensitive (Figure 7-105).

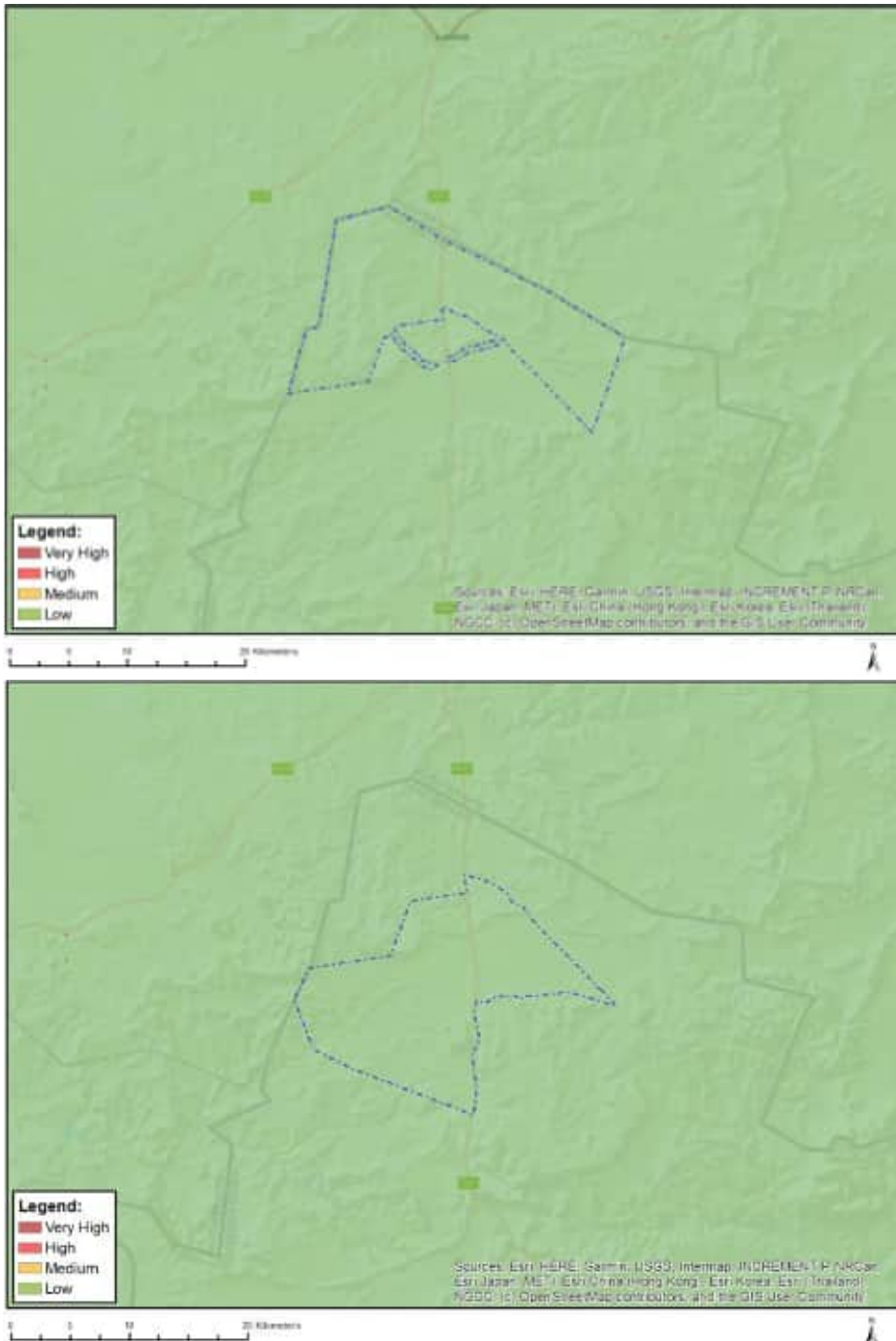


Figure 7-105: Map of relative Archaeological and Cultural Heritage theme sensitivity for Hoogland 1 Wind Farm (top) and Hoogland 2 Wind Farm (bottom)

7.9.2.1 Sensitive features and buffers

The development footprint contains various sensitivities that were identified following the undertaking of several site visits and spatial input considerations. A detailed list of inventory finds, their locations and associated heritage grading are included in Appendix 3 of the Heritage report (included in *Appendix C12: Heritage* of this report).

The sensitivity of these findings and the respective buffers was classified according to their grading, which differed for the various infrastructure types. Refer to Table 7-92. They are shown graphically in Figure 7-106 and more detailed maps can be found in the Heritage report (*Appendix C12: Heritage*).

Table 7-92: Relationship between heritage grades, sensitivity ratings and project components as developed during the early part of the project

PROJECT COMPONENT	IIIA		IIIB		IIIC		NCW
	FEATURE	BUFFER	FEATURE	BUFFER	FEATURE	BUFFER	FEATURE
Turbines	No-go	No-go	High	Medium	Medium	Low	Neutral
Substations, buildings	No-go	No-go	High	Medium	Medium	Low	Neutral
New roads and jeep tracks for upgrade	No-go	No-go	High	Medium	Medium	Low	Neutral
Existing proper gravel roads (not jeep tracks) for upgrade	No-go	High	Medium	Low	Low	Low	Neutral
Pylons	No-go	No-go	High	Medium	Medium	Low	Neutral
Overhead lines (spanning)	No-go	High	Medium	Low	Low	Low	Neutral

• Sensitivity classes are designed to be in line with the HWC grading scheme, since the gradings MUST be used in all HIAs. Although NCW is low sensitivity (the lowest rating in the Red Cap scheme), they are coloured black and called ‘neutral’ to distinguish low heritage sensitivity from NCW.

• Note that existing roads would obviously not go over point sites, but they may pass through larger multi-component sites.

- Existing roads to be widened/upgraded get a lower level of sensitivity as they are already present and it is more desirable to upgrade than to build a second road nearby.
- Occasionally very small ‘twee-spoor’ jeep tracks can pass very close to heritage sites and create minimal existing impacts. For this reason, their upgrades are best treated like building new roads.

 Overhead lines spanning over sites also get lower ratings because there would be no physical damage. BUT there is still a chance of damage during construction, so spanning lines are only one sensitivity level lower.

Allocation of protective buffers is as follows:

- Scenic passes, roads and cultural landscapes
 - Buffer to be determined by visual specialist for Grade IIIB linear features.
 - Buffer 50 m around Grades IIIA and IIIB cultural landscapes. Agricultural landscapes were delineated by including all arable lands clearly visible on aerial photography. Note that these are really visual issues and hence different buffers may be proposed by the visual practitioners. The 50 m buffer suggested here should be treated as a minimum.
- Archaeology, Built environment, Graves
 - Buffer 50 m around waypoints for small, single component sites (Grades IIIA to IIIC)
 - Buffer 50 m around outer edge of larger, multi-component sites (Grades IIIA to IIIC)
 - Note that, in line with the relevant heritage indicator and although it may not always be possible due to the multitude of other limitations on turbine layout, buffers of up to 200 m are encouraged for IIIA rock art sites

Note that, in line with the relevant heritage indicator and although it may not always be possible due to the multitude of other limitations on turbine layout, buffers of up to 200 m are encouraged for IIIA rock art sites.

The implications of the mapped sensitivities are discussed in the conclusions. There are no highly significant concerns requiring major adjustment to the layout as these have mostly been addressed through avoidance.

The entire area is regarded as a cultural landscape, although the Karoo National Park²⁹ and escarpment are the most important parts. These are too far from the study area to require mapping in relation to the potential impacts. The R381 in this area is a local route with lesser significance due to being away from the major topographic landscape

²⁹ Noting that the project infrastructure is located outside the Karoo National Park and its respective buffer and expansion areas.

features. At Beaufort West there is one area of low sensitivity that has been avoided by the proposed bypass road (but does fall partly within the studied corridor), although the majority of the alignment has not been specifically surveyed.

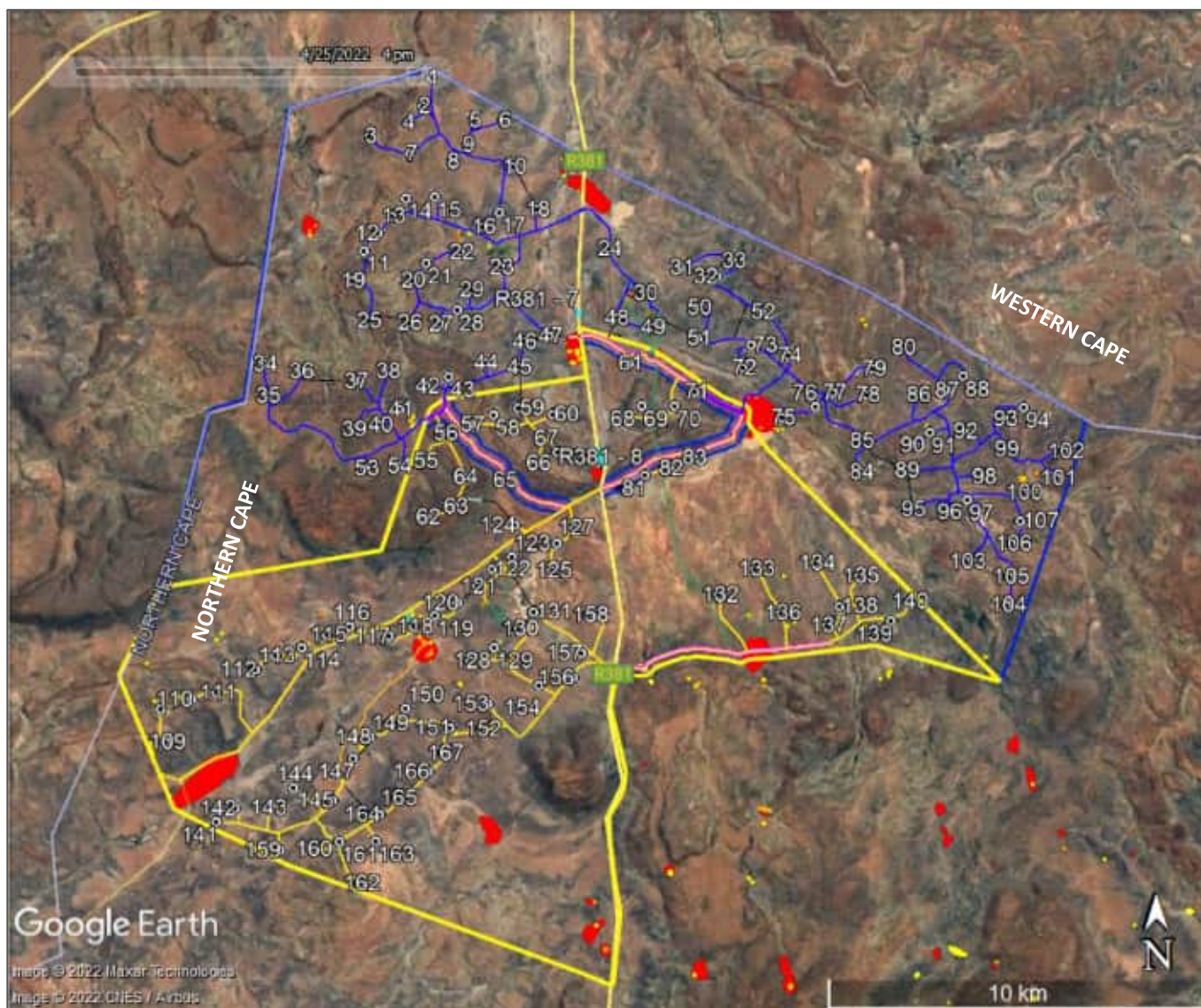


Figure 7-106: Sensitivity map for the entire HL01 (blue layout) and HL02 (yellow layout) area. Red, orange and yellow shaded areas are high, medium and low sensitivity respectively

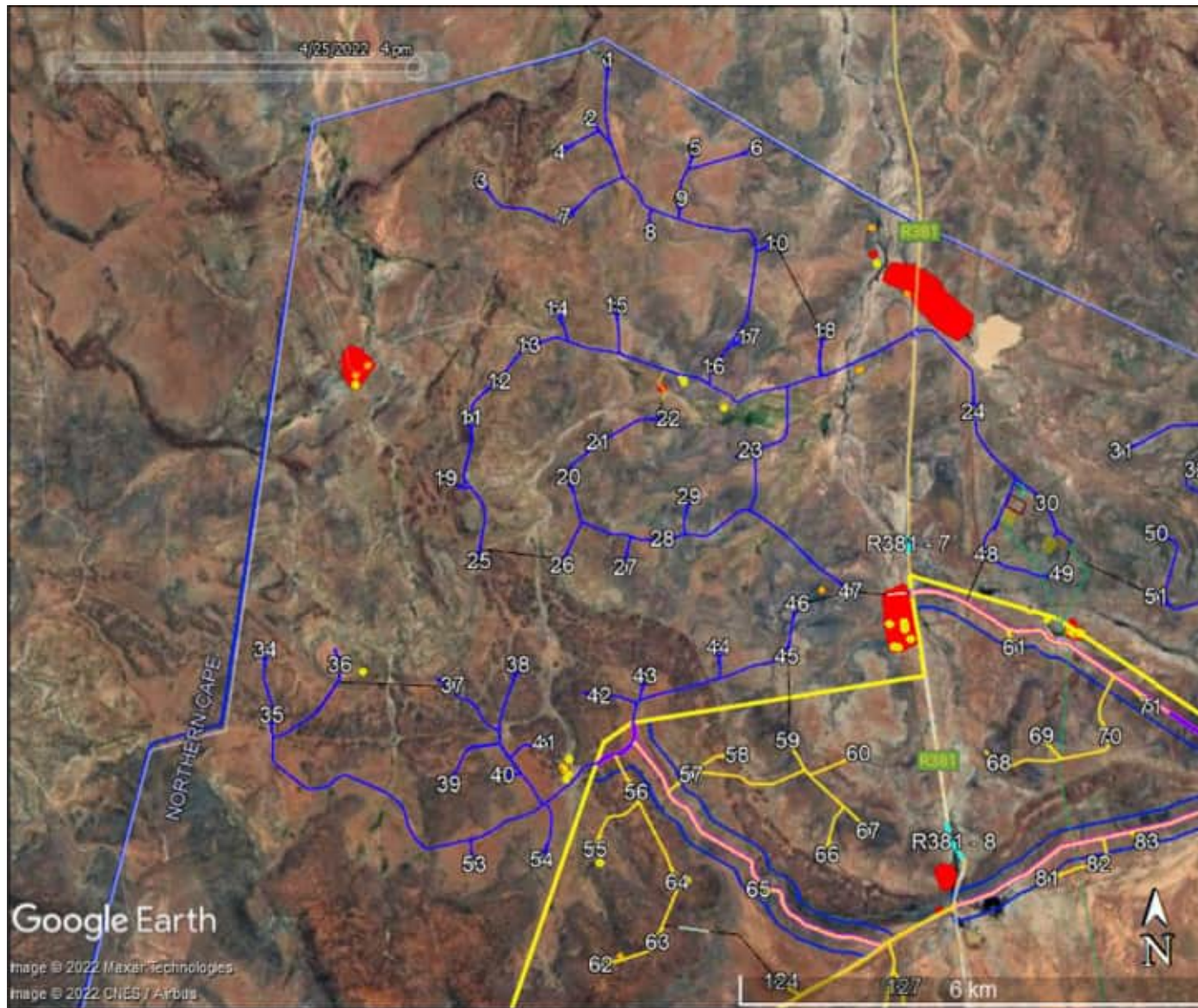


Figure 7-107: Enlarged sensitivity map showing the north-western part of Figure 7-106. Key as per Figure 7-106.

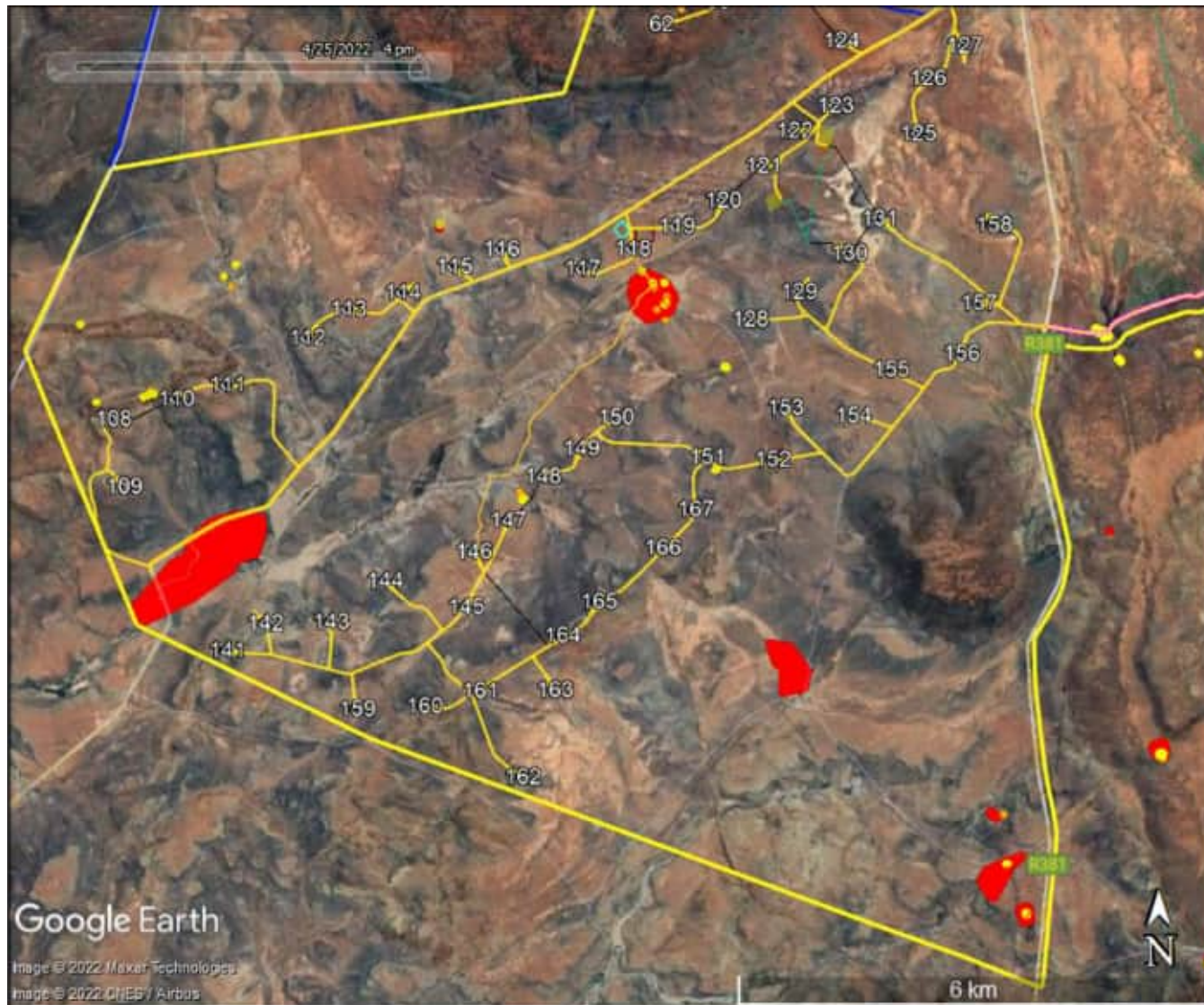


Figure 7-108: Enlarged sensitivity map showing the south-western part of Figure 7-106. Key as per Figure 7-106.

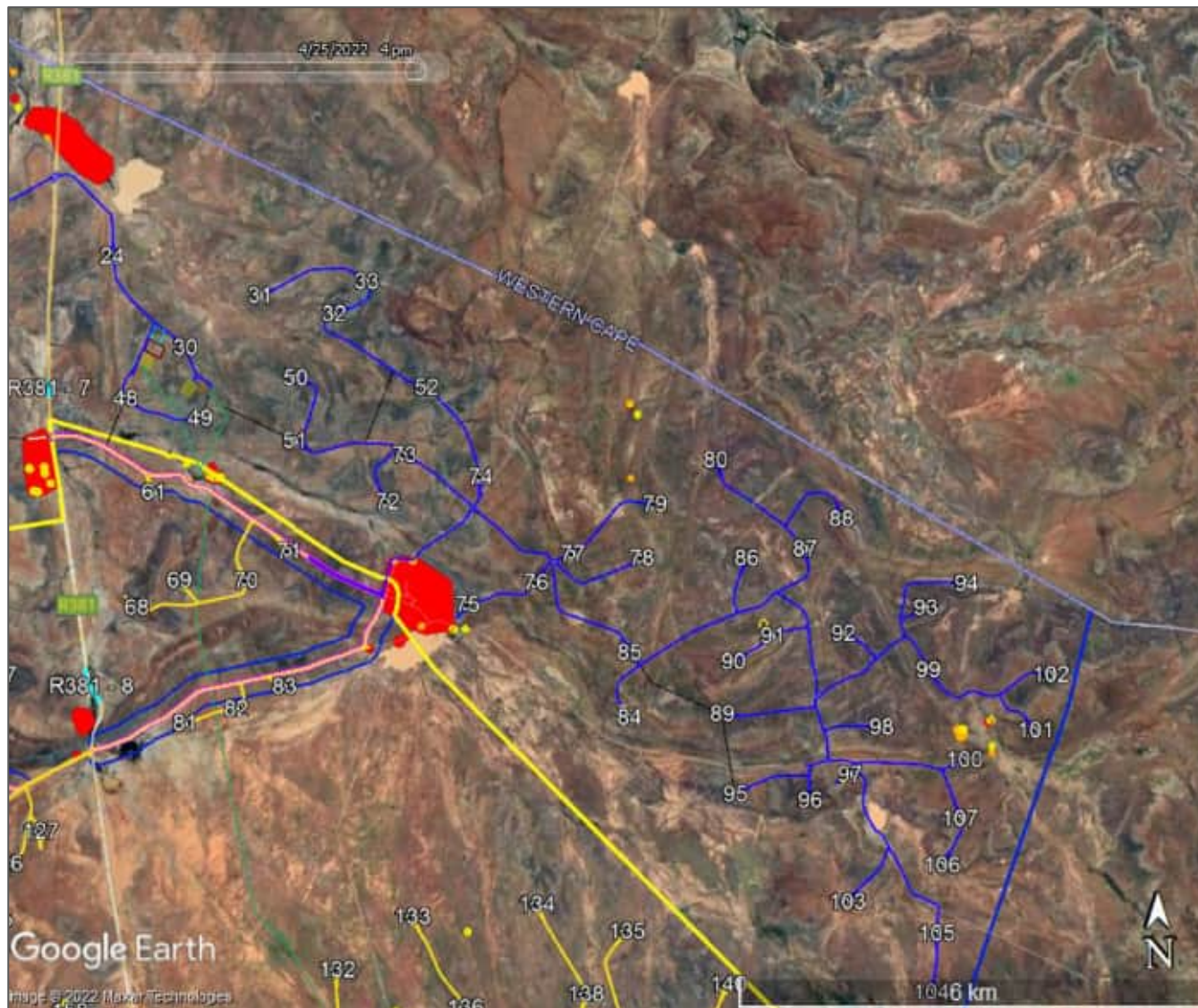


Figure 7-109: Enlarged sensitivity map showing the north-eastern part of Figure 7-106. Key as per Figure 7-106.

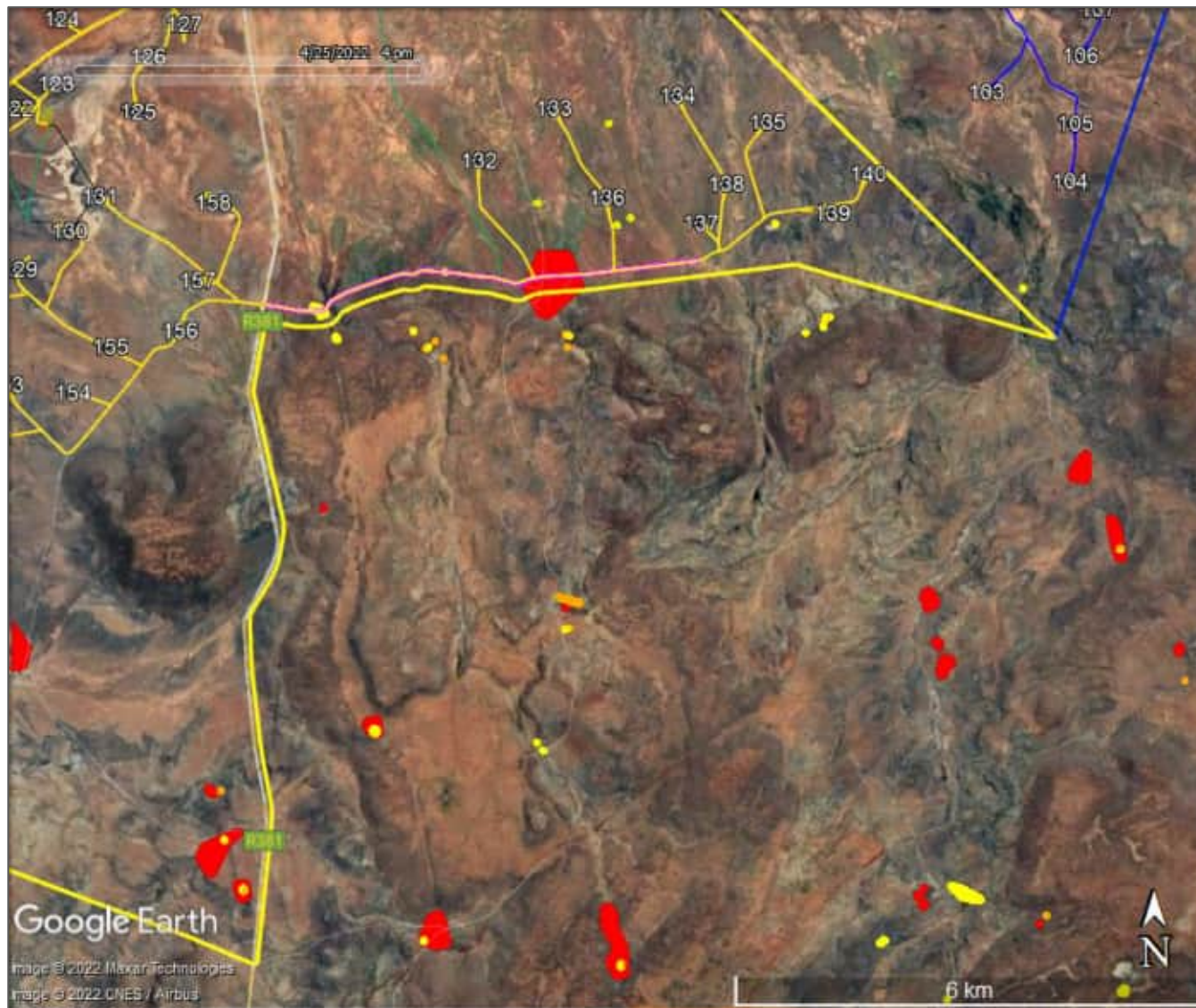


Figure 7-110: Enlarged sensitivity map showing the south-eastern part of Figure 7-106. Key as per Figure 7-106.

7.9.2.2 Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Any uncontrolled impacts to standing heritage structures are unacceptable. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many publicly accessible vantage points is undesirable.

7.9.3 Impact Assessment and Mitigation

In summary, heritage resources are highly likely to be impacted by the proposed Wind Farm, as is the cultural landscape. All will be impacted during the construction phase but impacts to the cultural landscape will continue throughout the lifetime of the project.

These impacts have been identified and rated by ASHA (2022) in the following tables, per phase, noting that the construction phase impacts differ between Hoogland 1 and Hoogland 2.

7.9.3.1 Construction Phase: Hoogland 1

Table 7-93: Construction: Hoogland 1 - Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Description of Impact		
Archaeological materials can be damaged or destroyed during grubbing and excavation of foundations and trenches.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	High	Low
Probability	Definite / Continuous	Conceivable
Significance	High -	Very Low -
Degree to which impact can be reversed	Low. Heritage resources cannot be replaced or recreated.	
Degree to which impact may cause irreplaceable loss of resources	High. Heritage resources are unique and irreplaceable.	
Degree to which impact can be mitigated	High. Archaeological heritage can very easily be sampled and/or mapped as needed, although in the case of historical sites this can be more time-consuming.	
Mitigation actions		
The following measures are recommended:	Pre-construction survey of the layout followed by micrositing or mitigation as appropriate or possible. Sampling of the stone artefact scatter at waypoint 1703.	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint and that mitigation at waypoint 1703 has been completed.	

Table 7-94: Construction: Hoogland 1 - Damage to or destruction of built heritage resources

Issue	Damage to or destruction of built heritage resources	
Description of Impact		
Built heritage resources can be physically harmed during construction, either to make way for development or accidentally.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Low	Low
Probability	Unlikely / improbable	Unlikely / improbable
Significance	Insignificant	Insignificant
Degree to which impact can be reversed	Low. Heritage resources are unique and cannot be replaced, although repairs can be made in the event of minor damage.	
Degree to which impact may cause irreplaceable loss of resources	High. Heritage resources are unique and cannot be replaced.	
Degree to which impact can be mitigated	High. Road footprints can be adjusted to avoid sensitive features.	
Mitigation actions		
The following measures are recommended:	None required	
Monitoring		
The following monitoring is recommended:	ECO to ensure that enough space exists between roads and built structures.	

Table 7-95: Construction: Hoogland 1 - Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial equipment and structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	Medium. Once construction is complete all the equipment would be removed but the turbines and related structures would remain present. However, almost all noise and activity would cease.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Keep construction duration as short as possible. • Minimise landscape scarring. 	

	<ul style="list-style-type: none"> Rehabilitate any areas not required during operation. Where road surfacing is required use low contrast materials where possible.
Monitoring	
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint.

7.9.3.2 Construction Phase: Hoogland 2

Table 7-96: Construction: Hoogland 2 - Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Description of Impact		
Archaeological materials can be damaged or destroyed during grubbing and excavation of foundations and trenches.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	High	Low
Probability	Definite / Continuous	Conceivable
Significance	High -	Very Low -
Degree to which impact can be reversed	Low. Heritage resources cannot be replaced or recreated.	
Degree to which impact may cause irreplaceable loss of resources	High. Heritage resources are unique and irreplaceable.	
Degree to which impact can be mitigated	High. Archaeological heritage can very easily be sampled and/or mapped as needed, although in the case of historical sites this can be more time-consuming.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Pre-construction survey of the layout followed by micrositing or mitigation as appropriate or possible. Sampling of the stone artefact scatter at waypoint 1703. 	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint and that mitigation at waypoint 1703 has been completed.	

Table 7-97: Construction: Hoogland 2 - Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial equipment and structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous

Significance	Medium -	Medium -
Degree to which impact can be reversed	Medium. Once construction is complete all the equipment would be removed but the turbines and related structures would remain present. However, almost all noise and activity would cease.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Keep construction duration as short as possible. • Minimise landscape scarring. • Rehabilitate any areas not required during operation. • Where road surfacing is required use low contrast materials where possible. 	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint.	

7.9.3.3 Operational Phase: Hoogland 1 and 2

Table 7-98: Operation: Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	High. Once the facility is decommissioned and the land rehabilitated, the impacts would be almost entirely gone.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa. With decommissioning the landscape could be restored.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • No maintenance activities to take place outside of the authorised footprint and all vehicles to remain on authorised roads and tracks. • Make use of a warning system in which the aviation lights stay off at night until needed. 	
Monitoring		
The following monitoring is recommended:	No specific monitoring other than to ensure the above measure is complied with.	

7.9.3.4 Decommissioning Phase: Hoogland 1 and 2

Table 7-99: Decommissioning: Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial equipment and structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	Medium. Once decommissioning is complete all the equipment would be removed, and the site would be rehabilitated. Although it would likely take hundreds of years for the landscape to fully recover, the general pre-construction sense of place would be restored.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Keep decommissioning duration as short as possible. • Ensure effective rehabilitation of all areas. 	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint.	

7.9.4 Cumulative Impact

The following cumulative impacts have been identified and rated by ASHA (2022).

7.9.4.1 Construction Phase: Hoogland 1

Table 7-100: Cumulative impact: Hoogland 1 - Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

Table 7-101: Cumulative impact: Hoogland 1 - Damage to or destruction of built heritage resources

Issue	Damage to or destruction of built heritage resources	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Very Low -	Very Low -

Table 7-102: Cumulative impact: Hoogland 1 - Construction phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.9.4.2 Construction Phase: Hoogland 2

Table 7-103: Cumulative impact: Hoogland 2 - Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

Table 7-104: Cumulative impact: Hoogland 2 - Construction phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.9.4.3 Operational Phase: Hoogland 1 and 2

Table 7-105: Cumulative impact: Operational phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.9.4.4 Decommissioning Phase: Hoogland 1 and 2

Table 7-106: Cumulative impact: Decommissioning phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.9.5 No-Go Alternative

Aside from the natural degradation, weathering and erosion that will affect fossils, archaeological materials and buildings, the only obvious threat to heritage resources on the site is the robbing and reuse of stones and possibly bricks from historical sites. Trampling from grazing animals and/or farm/other vehicles could also occur. Some of the buildings are unoccupied and unmaintained which is also resulting in accelerated natural degradation.

Not constructing the facilities means that the study area would remain undeveloped, and the status quo would be retained. The impacts that would occur would be as per the existing impacts described above in the paragraph above. Importantly, electricity generation would not take place, which means that this benefit would be lost to society.

Although the heritage impacts with implementation would be greater than the existing impacts, the loss of socio-economic benefits is more significant and suggests that the No-Go option is less desirable.

7.9.6 Conclusion and Recommendations

The Hoogland Wind Farm Projects study area contains many heritage resources, the vast majority of which are archaeological. In general, the iterative process followed in the development of the Hoogland 1 and Hoogland 2 Wind Farm layouts has meant that, aside from the unavoidable impacts to the wider cultural landscape, impacts to heritage resources are minimal. On Hoogland 1, there are no significant concerns, and in most instances, where the project will impinge on heritage buffers these are found to be acceptable, while mitigation measures have been suggested to mitigate impacts in two cases (a Grade IIIB stone artefact scatter and a Grade IIIC large LSA hornfels scatter) and prevent direct impacts in a third case (to two graves). On Hoogland 2 the only concern is a IIIB stone artefact scatter that is crossed by a proposed wind farm road and cannot be deviated due to ecological impacts, and mitigation is required in this instance. Other key recommendations are included in Section 8.3.

Given that the site lies just outside of a REDZ, and that other Wind Farms have been approved in the area, the proposed land use is deemed acceptable because renewable energy facilities are to be expected in the future. The various other individual impacts highlighted in Section 7.9.3 above can easily be dealt with through micro-siting or archaeological mitigation as appropriate. It is therefore the opinion of the heritage specialist that the proposed Hoogland 1 Wind Farm and Hoogland 2 Wind Farm should both be authorised in full, but subject to the mitigation recommendations.

7.10 Palaeontology

This section provides a short summary of the palaeontology specialist report compiled by John Almond of Natura Viva which is available in *Appendix C13: Palaeontology*. Noting that a supplementary specialist report was compiled by Elize Butler of Banzai Environmental to provide a field-based assessment of the watercourse road crossing upgrades proposed on Northern Cape roads as shared offsite infrastructure for the Hoogland Northern Wind Farm Projects (Table 2-3 and Figure 2-17). This report was commissioned due to comments received from SAHRA during the scoping phase (*Appendix D2: Scoping Phase*).

7.10.1 Baseline Description

As reported by Natura Viva (2022), the country here is semi-arid with sparse *bossieveld* vegetation and few trees, except along larger water courses (Figure 7-111). Rugged, rocky upland areas are largely centered on major dolerite intrusions and associated tough-weathering, baked country rocks within their metamorphic aureoles. Examples include the Beesberg – Uilspoor – Kambrokop range (1530-1570 m amsl) that runs west-east across the central sector of the combined project area, the Onrusberg and Die Berg cluster of *koppies* (c. 1600-1625 m amsl) in the south, the Rooiplaat region in the northeast and the Blinkpoort se Rante and Bontberg range (c. 1600 m amsl) to the southeast. Extensive, low-lying, sandy to gravelly *vlaktes* at around 1435-1470 m with very little bedrock exposure make up most of the remainder of the project area. These areas are drained by a network of shallow, intermittent-flowing water courses that feed into more deeply-incised river systems such as the Slangfontein se Rivier towards the north, the Sakrivier to the south and the Elandsfontein se Rivier to the southwest. Between the two topographic subregions is found distinctive, highly dissected, stepped terrain where exposure of potentially fossiliferous sedimentary bedrocks is above average. Resistant-weathering, yellowish sandstone bodies here build low rocky *kranzes* with aprons of slabby rock rubble, while darker-hued mudrocks are locally well-exposed in riverbanks, stream gullies, steeper hillslopes and occasional low hills.

Banzai Environmental reported that the watercourse road crossing upgrade sites required on Northern Cape roads are specifically underlain by the Abrahamskraal Formation as well as the Poortjie Member of the Teekloof Formation.



Figure 7-111: Typical rocky doleritic terrain in the Beesberg range (Duikerfontein RE/5, HL01). Exposure of sedimentary bedrocks in such areas is minimal but thick sandy alluvial deposits here are potentially fossiliferous. The Karoo dolerites themselves are unfossiliferous but may compromise fossil preservation within adjacent country rocks (Left). Low relief terrain mantled by alluvial sands and surface gravels with very limited bedrock exposure occurs in larger portions of the project area, as seen here on Elandsfontein 1/24 (HL01 and HL02) looking towards the SE (right)

The geology of the combined Hoogland 1 Wind Farm and Hoogland 2 Wind Farm project area is covered by 1: 250 000 geology sheet 3122 Victoria West (Council for Geoscience, Pretoria), with a short sheet explanation by Le Roux & Keyser (1988) (Figure 7-112). Large portions of the combined project area are underlain by continental (fluvial, lacustrine) sediments of the Lower Beaufort Group (Karoo Supergroup) of late Middle Permian to early Late Permian age. Only the uppermost portion of the Abrahamskraal Formation is represented within the project area, underlying the northern margins of the Hoogland 1 Wind Farm project area.

The sandstone-rich Poortjie Member of the Teekloof Formation dominates the rest of Hoogland 1 Wind Farm as well as almost all of the Hoogland 2 Wind Farm project areas. The overlying mudrock-dominated Hoedemaker Member of the Teekloof Formation only crops out over a small area along the southern margins of the major Beesberg – Uilspoor dolerite body whose intrusion may have preferentially occurred at this stratigraphic level. A large portion of the Hoedemaker country rocks have therefore been baked and otherwise altered by Karoo-age magmatism. This igneous activity has resulted regionally in an extensive network of dolerite sills and dykes assigned to the Karoo Dolerite Suite of Early Jurassic age.

Substantial thicknesses of gravelly and sandy to silty Late Caenozoic alluvium are associated with major drainage lines within the combined Hoogland Wind Farm project area (pale yellow areas in Figure 7-112) and also cover large portions of lower-lying terrain here. Older alluvial deposits, especially in areas overlying dolerite, have often been partially calcretised. In turn, gravelly colluvial and eluvial deposits dominated by sandstone, hornfels, quartzite and dolerite rubble mantle plateau areas and most hillslopes. In general, topographic relief is subdued within most of the project area and exposure levels of potentially-fossiliferous Beaufort Group sediments, with few local exceptions, are correspondingly low to very low.

Representative exposures of the main rock units occurring within the site can be found in the specialist report in *Appendix C13: Palaeontology*.

The main geological units represented on the geological map include:

- Middle Permian Abrahamskraal Formation (Lower Beaufort Group) – pale blue (Pa).
- Middle to Late Permian Teekloof Formation (Lower Beaufort Group) – green / blue-green. On the Victoria West sheet this formation (Pt) is differentiated into the Ptp = Poortjie Member (Pt, stippled), Hoedemaker Member (Pth) and Oukloof Member (Pto, dark green) (Note the outcrop areas of these members are probably in need of revision). Small black symbols refer to historical fossil sites, very few of which are recorded within the Hoogland project areas.

- Early Jurassic Karoo Dolerite Suite – red (Jd)
- Late Caenozoic alluvium – yellow with “flying bird” symbol
- *N.B.* Most younger superficial deposits are not mapped at 1: 250 000 scale but these obscure the older bedrocks over most of the WEF and grid project area.

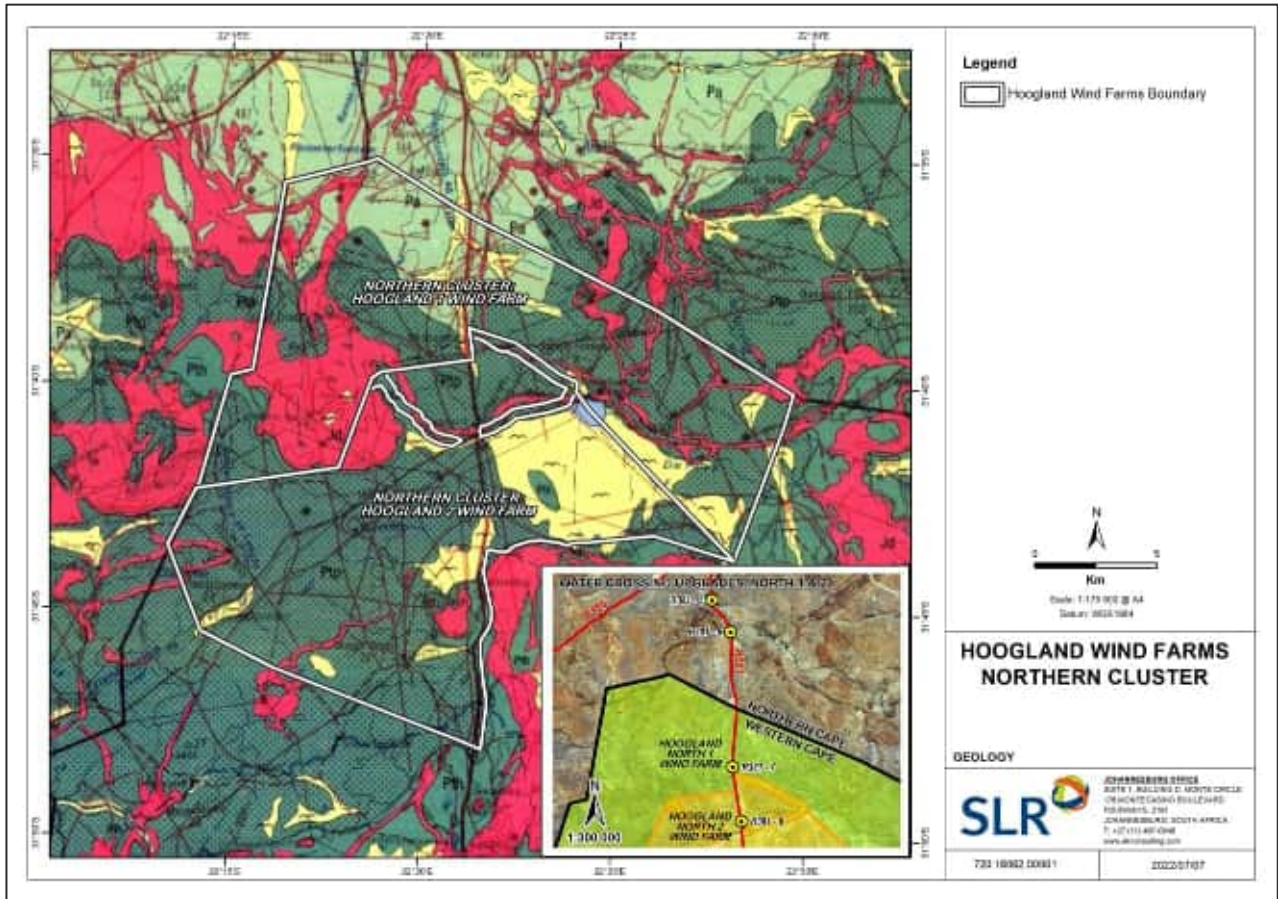


Figure 7-112: Extract from adjoining 1: 250 000 geology sheets 3122 Victoria West (above) and 3222 Beaufort West (below) (Council for Geoscience, Pretoria) showing the location of the Hoogland 1 and 2 Wind Farm project areas (white polygons). Scale bar = 5 km

7.10.2 Site Sensitivity

The project is rated as of Very High Palaeosensitivity (SAHRIS website, DFFE Screening Tool) due to the rich Permian fossil assemblages recorded from the Lower Beaufort Group in the Main Karoo Basin. A three-week reconnaissance-level palaeontological heritage survey by Dr John Almond from NaturaViva between April and May 2021, showed few well-preserved fossils of scientific and conservation interest within the Hoogland Northern Cluster Project Area. This is due to:

- poor levels of bedrock exposure associated with generally low relief and pervasive cover by largely unfossiliferous superficial sediments;
- a high intensity of dolerite intrusion which has “sterilized” large volumes of potentially fossiliferous bedrocks through thermal metamorphism, leaching and secondary mineralisation, while the large dolerite outcrop areas in the uplands are completely fossil-free; and
- highly impoverished fossil biotas associated with the catastrophic end Middle Permian Mass Extinction Event of 260 million years ago.

Noting that the proposed layouts of the Hoogland 1 Wind Farm and Hoogland 2 Wind Farm do not directly or indirectly threaten any of the known fossil sites which all lie > 20 m outside the project footprints.

- The **Hoogland Fossil Site 3** on the eastern margins of Slangefontein RE6 (Hoogland 1 Wind Farm project area) comprises a concentration of fossil skeletons and burrows of small-bodied therapsids. It is associated with stream bank exposures just east of a farm dam and will therefore be protected within the standard riverine ecological buffer zone. It lies > 750 m *outside* the proposed WEF infrastructure footprint and no mitigation of the site is therefore required (Figure 7-114).
- The **Hoogland Fossil Site 4** on Elandsfontein 1/24 (Hoogland 2 Wind Farm project area) encloses several good exposures of intensely-burrowed (but otherwise fossil-poor) mudrocks on gullied hillslopes. Fieldwork suggests that this zone extends onto adjoining land parcels, and it does not represent a unique or very limited heritage resource. The known fossil burrow sites here lie 300 m or more *outside* the proposed WEF infrastructure footprint and no mitigation of these sites is therefore required (Figure 7-115). Potential additional sites within the broader burrowed zone can be mitigated, if necessary, through the proposed pre-construction palaeontological walkdown of the final authorized footprint.

Two small areas or sites of higher palaeontological heritage interest were recorded, one of these in Hoogland 1 occur along drainage lines and are likely to be protected within the standard riverine ecological buffers (Figure 7-114). The second, larger area in Hoogland 2 includes several good exposures of a paleontologically interesting zone of floodplain mudrocks that have been intensely burrowed by small tetrapods in possible response to challenging climates during or following the end Middle Permian Mass Extinction - but are otherwise unfossiliferous (Figure 7-115).

Potential additional sites within the broader burrowed zone can be mitigated, if necessary, through the proposed pre-construction palaeontological walkdown of the final authorized footprint.

Furthermore, as requested by SAHRA, Banzai Environmental undertook a two day-site-specific field survey on 25 and 26 June 2022 to assess the offsite watercourse road crossing upgrades proposed on Northern Cape roads. A few fossiliferous sites were identified in the vicinity of some of the watercourse crossings, including the following:

- Crossing R381-6: Fragmented fossils as well as trace fossils were detected in this section and thus the area has a High Palaeontological Sensitivity (Figure 7-116).
- Crossing DR02314-2&3: A well-preserved tetrapod skull and skeleton were found here and thus the area has a Very High Palaeontological Sensitivity (Figure 7-117).



Figure 7-114: Hoogland Fossil Site (red polygon) on the eastern margins of Slangefontein RE6 (Hoogland 1 Wind Farm project area) lies > 750 m outside the proposed Wind Farm footprint



Figure 7-115: Hoogland Fossil Site (red polygon) on Elandsfontein 1/24 (Hoogland 2 Wind Farm project area). Known fossil burrow sites here lie 300 m or more outside the proposed Wind Farm footprint and at a lower stratigraphic level



Figure 7-116: Fossiliferous area in the R381-6 watercourse crossing .



Figure 7-117: Fossiliferous area in the DR02314 watercourse crossing.

7.10.3 Impact Assessment and Mitigation

The following palaeontological impacts have been identified and rated by Natura Viva (2022) and Banzai Environmental (2022) respectively.

Given the similar geological (and hence palaeontological) setting for both developments, the results of their separate impact assessments are also very similar. Fossils of some sort occur widely within almost all sedimentary rocks, but most of them are low scientific or conservation value or are very widely distributed (e.g., many microfossils, trace fossils). This assessment therefore focuses on fossil heritage that is of potentially high scientific and / or conservation interest and on the construction phase of the developments where impacts are potentially most damaging.

7.10.3.1 Construction Phase

Table 7-107: Construction: Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value within the Hoogland Northern Wind Farm sites in the Western Cape

Issue: Loss or degradation of local palaeontological heritage resources of scientific and / or conservation value		
Description of Impact		
Damage, disturbance, destruction or sealing-in of legally protected, scientifically valuable fossil heritage at or beneath the ground surface within the Wind Farm project footprint, mainly due to ground clearance and excavations for wind turbines, hard standing areas, access / service roads, underground cabling and pylon footings.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Possible
Significance	Low -	Very Low -
Mitigation actions		
Degree to which impact can be reversed	Impacts to palaeontological heritage are generally irreversible.	
Degree to which impact may cause irreplaceable loss of resources	Low. Most fossils recorded from the project area are of widely occurring forms within the outcrop areas of the formations concerned.	
Degree to which impact can be mitigated	Moderate. Most recorded fossil sites can be effectively mitigated by a professional palaeontologist in the pre-construction phase (recording / collection). Newly exposed fossils can be mitigated through a Chance Fossil Finds Procedure. However, residual impacts following mitigation may be locally high, given the unavoidable difficulties of identifying and sampling fossils from on-going construction phase excavations and site clearance.	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> The Environmental Control Officer (ECO) / Environmental Site Officer (ESO) responsible for the development should be made aware of the possibility of important fossil remains (vertebrate bones, teeth, burrows, petrified wood, plant-rich horizons etc., such as those illustrated in this report) being found or unearthed during the construction phase of the development. Monitoring for fossil material of all major surface clearance and deeper (>1m) excavations by the ECO/ESO on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape for recording and sampling by a professional palaeontologist (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za). 	

	<ul style="list-style-type: none"> An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work. Minimum Standards for palaeontological heritage reports and fieldwork have been specified by SAHRA (2013) and Heritage Western Cape (2021).
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Table 7-108: Construction: Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value of the Northern Cape watercourse crossing road upgrades

Issue: Loss or degradation of local palaeontological heritage resources of scientific and / or conservation value		
Description of Impact		
Damage, disturbance, destruction or sealing-in of legally-protected, scientifically valuable fossil heritage at or beneath the ground surface within the road footprint, mainly due to ground clearance and excavations.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	High	Medium
Probability	Probable	Probable
Significance	High -	Medium -
Mitigation actions		
Degree to which impact can be reversed	Impacts to palaeontological heritage are generally irreversible.	
Degree to which impact may cause irreplaceable loss of resources	Medium, however if mitigation is properly implemented. New fossils would be accessible for research.	
Degree to which impact can be mitigated	Medium. Most recorded fossil sites can be effectively mitigated by a professional palaeontologist in the pre-construction phase (recording / collection). Newly exposed fossils can be mitigated through a Chance Fossil Finds Procedure. However, residual impacts following mitigation may be locally high, given the unavoidable difficulties of identifying and sampling fossils from on-going construction phase excavations and site clearance.	
Monitoring		
The following monitoring is recommended:	<ul style="list-style-type: none"> The Environmental Control Officer (ECO) for this project must be informed that sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) have a Very High Palaeontological Sensitivity. Training of accountable supervisory personnel by a qualified palaeontologist in the recognition of fossil heritage is very important and necessary. If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out. A well-preserved tetrapod skull and skeleton were observed near crossing DR02314-2&3. Mitigation of this specimen is recommended. 	

	<ul style="list-style-type: none"> Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
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7.10.4 Cumulative Impacts

The following cumulative impact has been identified and rated by both Natura Viva (2022) and Banzai Environmental (2022) and considers the contribution of the Western Cape Hoogland Northern Wind Farm sites as well as the offsite watercourse crossings in the Northern Cape as a whole to cumulative impacts in the area.

Table 7-109: Cumulative impact: Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value

Issue: Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value		
Nature of cumulative impacts	Potential loss of a significant fraction of scientifically important, rare or unique, fossil heritage within the Palaeozoic bedrocks and Late Caenozoic superficial sediments in the Upper Karoo south of Loxton.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.10.5 No-Go Alternative

The impact significance of the No-Go Alternative considers that even without development fossils would still be destroyed by natural weathering and erosion. Other factors such as current farming activities within the project area (viz. small stock farming) as well as potential illegal fossil collection are considered to have a negligible effect on local palaeontological resources. In the case of the No-Go Alternative (i.e., no Wind Farm development), the likely loss of local heritage resources through construction activities (negative impact) would be avoided while potential improvements in palaeontological understanding through professional mitigation - i.e., recording and collection of palaeontological material and data (positive impacts) - would be lost. The slow destruction of fossils exposed at the surface through natural weathering and erosion would continue, while new fossils would be revealed and prepared-out for scientific study. It is concluded that the No-Go alternative would have a neutral impact on palaeontological heritage.

7.10.6 Conclusion and Recommendations

According to Natura Viva (2022), despite the Very High provisional palaeosensitivity assigned to large parts of the combined project area for the proposed Hoogland 1 and Hoogland 2 Wind Farms, desktop and field data suggest that, in practice, the area is of low palaeosensitivity overall, with only a sparse, and largely unpredictable, scatter of fossil sites of scientific and / or conservation value. However, according to the supplementary assessment of the offsite watercourse road crossing upgrades proposed in the Northern Cape (undertaken by Elize Butler of Banzai Environmental) there are some higher conservation value fossil sites at the offsite watercourse crossings on the DR02314 and R381.

In terms of palaeontological heritage resources, the proposed Hoogland 1 and Hoogland 2 Wind Farm developments are assigned a similar overall impact significance rating (Construction Phase), with the offsite watercourse crossings having higher sensitivity and therefore higher ratings. No significant further impacts on fossil heritage resources are anticipated in the planning, operational and decommissioning phases. The No-Go Alternative will probably have a neutral impact.

The proposed Hoogland Wind Farms developments are thus not fatally flawed from a palaeontological perspective. On condition that the recommended mitigation measures are included within the EMPr and implemented in full during the construction phase, there are no objections on palaeontological heritage grounds to their authorisation. These mitigation measures include cross-checking of the final, authorised layout of the projects against the available fossil database and other relevant resources (e.g. satellite imagery, geological maps) by the palaeontological specialist who should make recommendations for pre-construction phase mitigation, if any proves necessary; and inclusion of a Chance Fossil Finds Protocol as detailed in the Specialist reports (Appendix 4 of Natura Viva, 2022 and Section 13 of Banzai Environmental, 2022) which can be found in *Appendix C13: Palaeontology* of this report).

7.11 Noise

This section provides a short summary of the noise specialist report compiled by Morné de Jager of Enviro-Acoustic Research (EARES) which is available in *Appendix C14: Noise*.

7.11.1 Baseline Description

According to EARES (2022), and of relevance to the noise study, the natural veldt has been impacted due to anthropogenic activities related to sheep farming, with significant changes to the natural veldt closer to the farm dwellings and structures. Most of the surface area is well vegetated with shrubs, succulent shrubs, grasses and sedges associated with the Karoo, with a number of significant trees closer to the farm dwellings. The topography of the site is characterised by undulating hills and the Regional Route R381 runs north / south through the site. The project is situated at approximately 1,400 to 1,500 meters above sea level (mamsl). There are little natural features that could act as noise barriers considering practical distances at which sound propagates from turbines. Most dwellings featuring in the vicinity of the project focus area are scattered in a heterogeneous fashion, typical of a sub-urban/rural area. Most of the surrounding areas can be considered wilderness with tourism (and game farming) as well as agricultural activities (sheep farming).

EARES (2022) notes that certain conditions may influence sound propagation, these include natural sounds characteristic to rural areas such as those from insects and birds, with noises such as wind flowing through vegetation increasing as wind speed increases. In addition, factors such as the season (e.g., dry or no leaves versus green leaves), the type of vegetation (e.g., grass, deciduous trees), the vegetation density and the total vegetation surface all determine both the sound level as well as spectral characteristics. In addition, this type of noise has a broad frequency spectrum and is of natural origin, and therefore a good candidate to mask wind turbine noise. Other, environmental factors that impact on sound propagation includes wind, temperature and humidity. The noise monitoring undertaken in September 2021 therefore measured sound levels and the types of noise heard when on site, as well as temperature and humidity both on and off the site; the findings are reported in the specialist report in *Appendix C14: Noise*.

The noise sensitive receptors identified for the site are described in Section 7.11.2 below.

7.11.2 Site Sensitivity

The DFFE National Screening tool indicates that the Noise theme for the Hoogland Northern Cluster Wind Farms is classified by the as being sensitive (Figure 7-113).

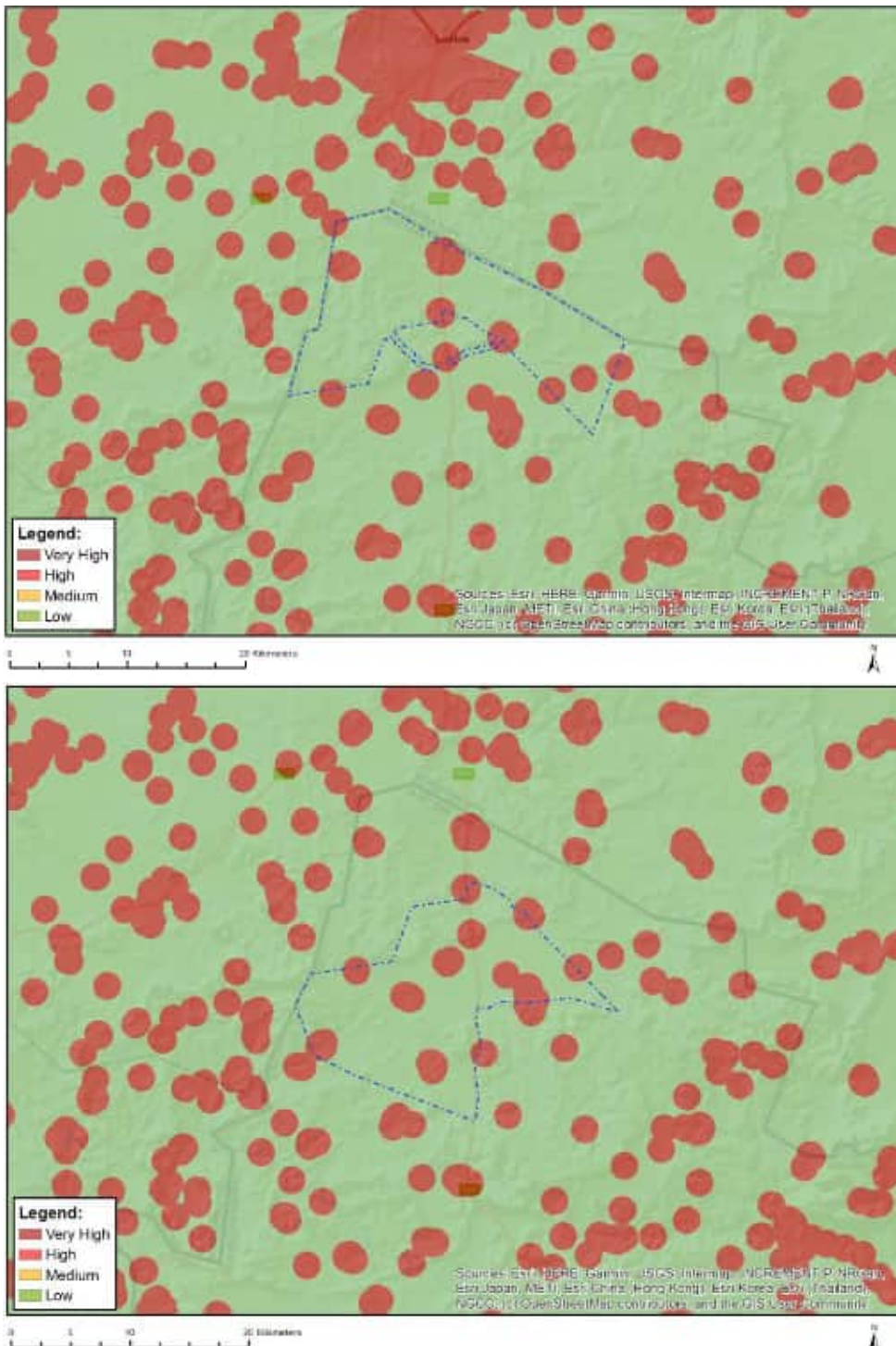


Figure 7-118: Map of relative Noise theme sensitivity for Hoogland 1 Wind Farm (top) and Hoogland 2 Wind Farm (bottom). High sensitivity shown in red.

Potential noise-sensitive developments, receptors and communities (NSRs) were identified using tools such as Google Earth® up to a distance of 2,000m (recommendation SANS 10328:2008) from turbine locations, with the statuses of the NSRs defined during the site visit. These receptors are highlighted in Figure 7-119 and Figure 7-120.

Generally, noises from wind turbines:

- Could be significant within 500m, with receptors³⁰ staying within 500m from operational wind turbines subject to noises at a potentially sufficient level to be considered disturbing;
- Are normally limited to a distance of approximately 1,000m from operational wind turbines (subject to turbine layout, as the turbines cumulatively contribute to noise levels with 2,000m from each turbine). Night-time ambient sound levels could be elevated and the potential noise impact measurable;
- Likely to be audible up to a distance of 2,000m at night; and
- Are of a low concern at distances greater than 2,000m. During certain meteorological phenomena the sound of the turbines may be audible, but the sound level will be low.

Note from the EAP: As a precautionary approach, the developer applied a 500m buffer from each NSR to ensure that noise impacts were limited from the outset.

It should be noted that the sensitive receptors based on proximity to proposed infrastructure as discussed in Section 7.11.3 below are NSR 18 and NSR 23 (farm Slangfontein on Hoogland 1), NSR 19 (farm Midlands on Hoogland 1) and NSR 32 (farm Duikerfontein on Hoogland 1). Based on information gained during the site visit the dwelling at NSR 19 (farm Midlands on Hoogland 1) is only used on a temporary basis (reported less than two months during the shearing season).

As described in Section 6.4 of the specialist report (*Appendix C14: Noise*), setting noise limits relative to the background noise level is relatively straightforward when the prevailing background noise level and source level are constant. However, wind turbines emit noise that is related to wind speed, and the ambient sound levels in the environment within which they are heard will probably also be dependent on the strength of the wind and the noise associated with its effects. It is therefore necessary to derive a background noise level that is indicative of the noise environment at the receiving property for different wind speeds so that the turbine noise level at any particular wind speed can be compared with the background noise level in the same wind conditions. On this basis, the specialist has proposed the following acceptable rating levels based on international guidelines and local regulations (noting that exceeding the noise limit does not immediately prevent a project from continuing):

Table 7-110: Proposed ambient sound levels and acceptable rating levels

10 METER WIND SPEED (m/s)	ESTIMATED AMBIENT SOUND LEVELS (NIGHT-TIME) (dBA)	MoE SOUND LEVEL LIMITS OF CLASS 3 (RURAL) AREAS (dBA)	ETSU-R97 LIMIT FOR PROJECT PARTICIPANTS (dBA)	NIGHT-TIME ZONE SOUND LEVEL (SANS 10103:2008) (dBA)	PROPOSED NIGHT RATING LEVEL (dBA)
4	37.6	40	45	35 (at low wind speeds, this will increase as wind speeds increase)	40
5	38.6	40	45		40
6	39.5	40	45		40
7	40.5	43	45		43
8	41.5	45	45		45
9	42.5	49	45		45

³⁰ Depending on the layout as well as the specific sound power emission levels of the selected wind turbine.

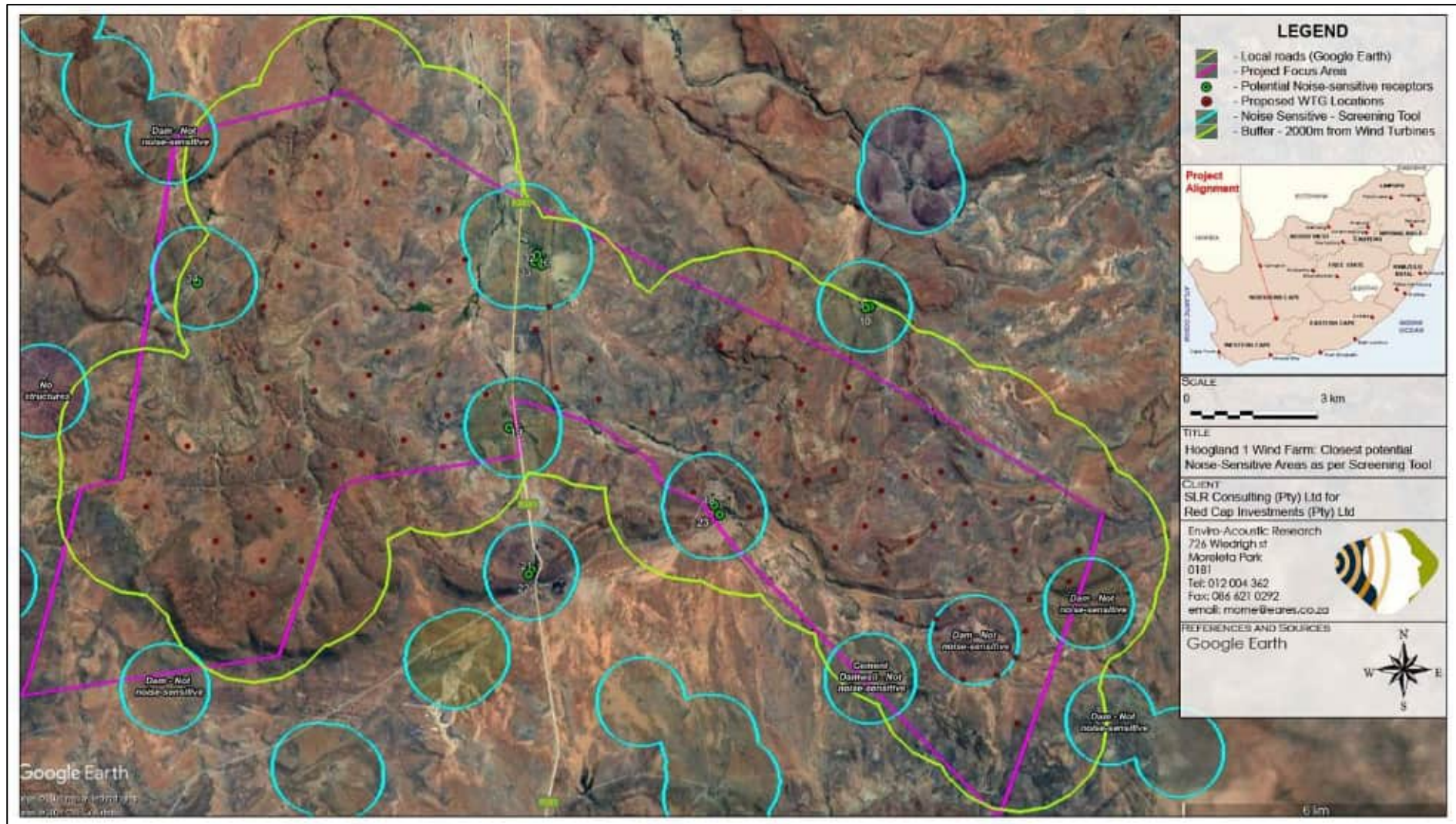


Figure 7-119: Hoogland 1 Wind Farm study area and potential noise-sensitive areas identified by the online screening tool

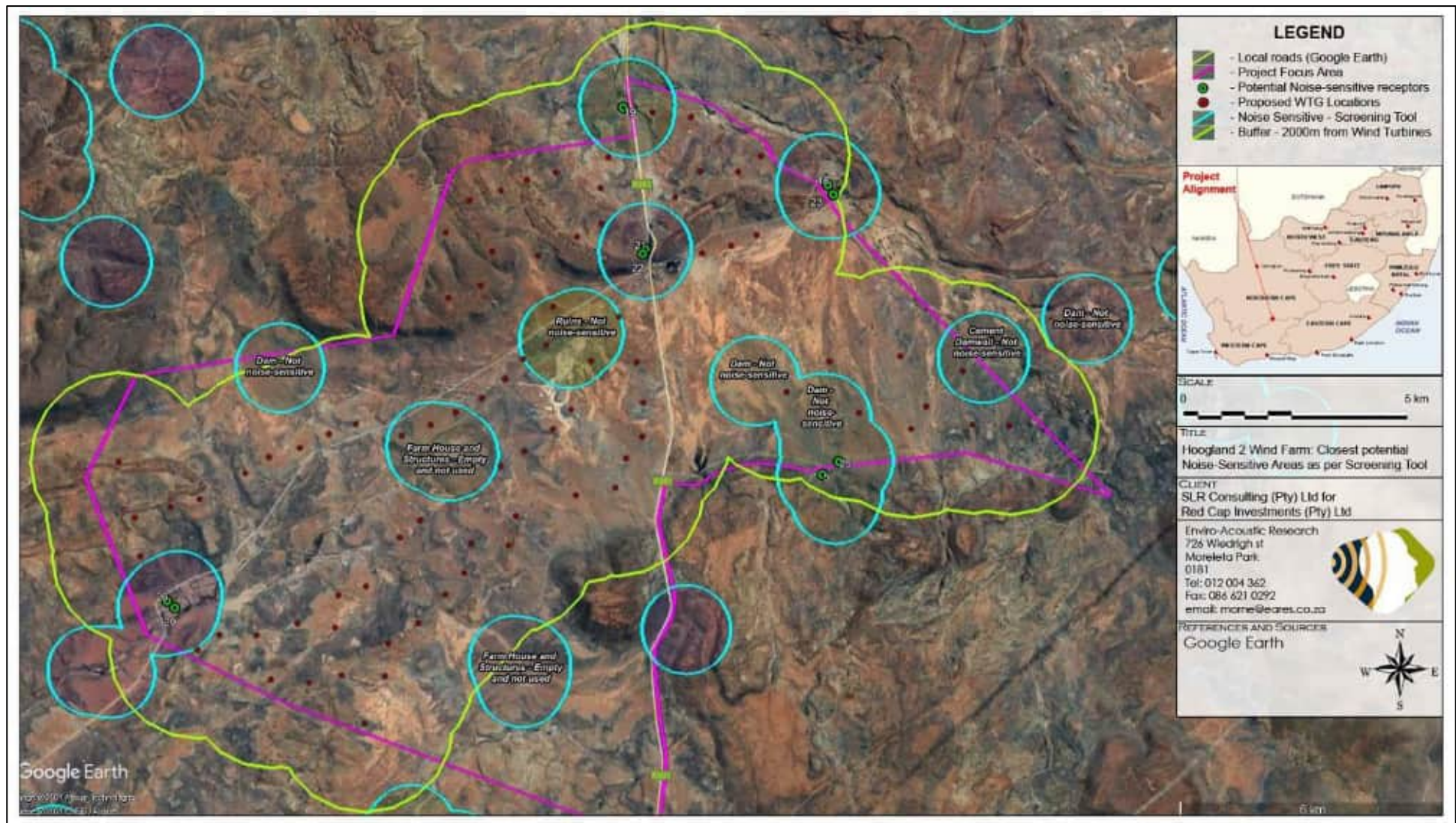


Figure 7-120: Hoogland 2 Wind Farm study area and potential noise-sensitive areas identified by the online screening tool

7.11.3 Impact Assessment and Mitigation

The following noise impacts have been identified and rated by EARES (2022). The potential for a noise impact to occur during the decommissioning and closure phases of the Wind Farms will be much lower than that of the construction and/or operational phases and if required, the noise levels for decommissioning can be compared with the construction phase noise level, and the noise impact will be similar or less. Therefore, impact tables for decommissioning have not been prepared.

7.11.3.1 Construction Phase: Hoogland 1

Table 7-111: Construction: Hoogland 1 - Daytime Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities during the day raising ambient sound levels at the Hoogland 1 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements.		
Daytime construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit – 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Site	Site
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	Insignificant (All NSR)	Insignificant (All NSR)
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for daytime construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-112: Construction: Hoogland 1 - Night-time Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities at night raising ambient sound levels at the Hoogland 1 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, night-time sound levels could range between 40.4 (arithmetic average impulse-weighted equivalent value) and 26.7 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 55.0 dBA when considering the 10-minute measurements. Night-time construction activities should not change the existing ambient sound levels by more than 7 dB, or exceed the acceptable rating level (the noise limit– 35 dBA for a rural noise district at night).		
Type of Impact	Direct	

Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium (for NSRs 18, 19 & 23)	Medium (for NSRs 18, 19 & 23)
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Local	Local
Consequence	Medium	Medium
Probability	Conceivable	Unlikely / Improbable
Significance of Impact	Low -	Very Low -
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for night-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is low and no specific mitigation measures are required. Minimizing the night-time noise-generating activities (construction activities at only one WTG location) when doing construction activities closer than 1,000 m from NSRs 18, 19 and 23 would reduce the noise levels and the potential significance of the noise impact, minimizing the risk of annoyance developing with the project.	
Monitoring		
The following monitoring is recommended:	No routine noise monitoring is recommended.	

Table 7-113: Construction: Hoogland 1 - Daytime road construction activities

Issue	Numerous simultaneous road construction activities during the day raising ambient sound levels at the Hoogland 1 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements.		
Daytime road construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low (for NSRs 19 and 32)	Low (for NSRs 19 and 32)
Duration	Very Short term	Very Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Site	Site
Consequence	Very Low	Very Low
Probability	Conceivable	Conceivable
Significance of Impact	Insignificant (All NSR)	Insignificant (All NSR)
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	

Mitigation actions	
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.
Monitoring	
The following monitoring is recommended:	No additional noise monitoring is recommended.

Table 7-114: Construction: Hoogland 1 - Daytime road traffic from construction vehicles

Issue	Road traffic passing NSR during the day raising ambient sound levels at the Hoogland 1 WF and surrounds (along access roads)	
Description of Impact		
<p>Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements.</p> <p>Daytime construction traffic should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).</p>		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Site	Site
Consequence	Very Low	Very Low
Probability	Improbable (all NSR)	Improbable (all NSR)
Significance of Impact	Insignificant (All NSR)	Insignificant (All NSR)
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

7.11.3.2 Construction Phase: Hoogland 2

Table 7-115: Construction: Hoogland 2 - Daytime Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities during the day raising ambient sound levels at the Hoogland 2 WF
Description of Impact	
<p>Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements.</p>	

Daytime construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit – 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Very Low (for all NSR)	Very Low (for all NSR)
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Site	Site
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	Insignificant (All NSR)	Insignificant (All NSR)
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-116: Construction: Hoogland 2 - Night-time Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities at night raising ambient sound levels at the Hoogland 2 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, night-time sound levels could range between 40.4 (arithmetic average impulse-weighted equivalent value) and 26.7 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 55.0 dBA when considering the 10-minute measurements.		
Night-time construction activities should not change the existing ambient sound levels by more than 7 dB, or exceed the acceptable rating level (the noise limit– 35 dBA for a rural noise district at night).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Local	Local
Consequence	Low	Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	Insignificant	Insignificant
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for night-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		

The following monitoring is recommended:	No additional noise monitoring is recommended.
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Table 7-117: Construction: Hoogland 2 - Daytime road construction activities

Issue	Numerous simultaneous road construction activities during the day raising ambient sound levels at the Hoogland 2 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements.		
Daytime road construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Very Short term	Very Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Site	Site
Consequence	Low	Low
Probability	Conceivable	Conceivable
Significance of Impact	Very Low -	Very Low -
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is very low and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-118: Construction: Hoogland 2 - Daytime road traffic from construction vehicles

Issue	Road traffic passing NSR during the day raising ambient sound levels at the Hoogland 2 WF and surrounds (along access roads)	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements.		
Daytime construction traffic should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Site	Site
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable

Significance of Impact	Insignificant (All NSR)	Insignificant (All NSR)
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

7.11.3.3 Operational Phase: Hoogland 1

Table 7-119: Operation Hoogland 1: Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 1 WF operating simultaneously during the day raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Local	Local
Consequence	Medium	Medium
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	Very Low	Very Low
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low (loss of natural environment that may be quiet during the day)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is Very Low (for the daytime scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA and additional mitigation is not required.	
Monitoring		
The following monitoring is recommended:	Based on daytime noise levels, no additional noise monitoring is recommended.	

Table 7-120: Operation Hoogland 1: Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 1 WF operating simultaneously at night raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR (using the unmitigated WTG) and (using the mitigated WTG) and summarized in this table.		

Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Local	Local
Consequence	Medium	Medium
Probability	Conceivable / Probable	Conceivable / Probable
Significance of Impact	Low	Low
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium (loss of natural night-time quiet environment)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is Low (for the night-time scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA. While not required, the use of a quieter WTG would reduce the significance of the noise impact to very low.	
Monitoring		
The following monitoring is recommended:	Based on night-time noise levels, no additional noise monitoring is recommended.	

7.11.3.4 Operational Phase: Hoogland 2

Table 7-121: Operation Hoogland 2: Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 2 WF operating simultaneously during the day raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR and summarized in this table.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Local	Local
Consequence	Medium	Medium
Probability	Unlikely / Improbable (all NSR)	Unlikely / Improbable (all NSR)
Significance of Impact	Very Low -	Very Low -
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low (loss of natural environment that may be quiet during the day)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		

The following measures are recommended:	The potential significance of the noise impact is very low (for the daytime scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA.
Monitoring	
The following monitoring is recommended:	Based on day-time noise levels, no additional noise monitoring is recommended.

Table 7-122: Operation Hoogland 2: Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 2 WF operating simultaneously at night raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR (using the unmitigated WTG) and (using the mitigated WTG) and summarized in this table.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D} > 7\text{dBA}$)	Local	Local
Consequence	Medium	Medium
Probability	Conceivable	Unlikely / Improbable
Significance of Impact	Low -	Very Low -
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium (loss of natural night-time quiet environment)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is low (for the night-time scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA. While not required, the use of a quieter WTG would reduce the significance of the noise impact to very low.	
Monitoring		
The following monitoring is recommended:	Based on night-time noise levels, no additional noise monitoring is recommended.	

7.11.4 Cumulative Impact

The following cumulative impacts have been identified and rated by EARES (2022). The following impacts were considered insignificant and not repeated here:

- Hoogland 1: Daytime WTG construction activities
- Hoogland 1: Daytime road construction activities
- Hoogland 1: Daytime road traffic from construction vehicles
- Hoogland 2: Daytime WTG construction activities
- Hoogland 2: Night-time WTG construction activities
- Hoogland 2: Daytime road traffic from construction vehicles

7.11.4.1 Construction Phase: Hoogland 1

Table 7-123: Cumulative impact: Hoogland 1 - Night-time Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities at night raising ambient sound levels at the Hoogland 1 WF	
Nature of cumulative impacts	The noise impact assessment did consider the cumulative noise impact, with numerous worst-case construction activities cumulatively raising the noise levels	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

7.11.4.2 Construction Phase: Hoogland 2

Table 7-124: Cumulative impact: Hoogland 2 - Daytime road construction activities

Issue	Numerous simultaneous road construction activities during the day raising ambient sound levels at the Hoogland 2 WF	
Nature of cumulative impacts	The noise impact assessment did consider the cumulative noise impact, with numerous worst-case construction activities cumulatively raising the noise levels	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Very Low -	Very Low -

7.11.4.3 Operational Phase: Hoogland 1

Table 7-125: Cumulative Hoogland 1: Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 1 WF operating simultaneously during the day raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 1 and 2 WF will not result in cumulative noise levels.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Very Low -	Very Low -

Table 7-126: Cumulative Hoogland 1: Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 1 WF operating simultaneously at night raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 1 and 2 WF will not result in cumulative noise levels.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Low -

7.11.4.4 Operational Phase: Hoogland 2

Table 7-127: Cumulative Hoogland 2: Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 2 WF operating simultaneously during the day raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 1 and 2 WF will not result in cumulative noise levels.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Very Low -	Very Low -

Table 7-128: Cumulative Hoogland 2: Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 2 WF operating simultaneously at night raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 1 and 2 WF will not result in cumulative noise levels.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

7.11.5 No-Go Alternative

The ‘no-go’ alternative is the option of not constructing the Project where the status quo of the current farming activities would prevail. The ambient sound levels will remain as is and the area would keep the rural noise character.

7.11.6 Conclusion and Recommendations

Considering the potential noise impacts (inclusive of cumulative impacts) for the proposed Wind Farms and associated infrastructure, it is recommended that the Hoogland Northern Cluster Wind Farms (Hoogland 1 and 2) be authorised, subject to the implementation of the mitigation measures as recommended in the specialist report.

Some mitigation measures are included in this report are for the applicant to consider, as the implementation of these mitigation measures would reduce the probability of annoyance developing with the project.

No additional noise assessment studies are recommended, though noise monitoring is recommended at NSR (18 and 19 for the current layout) that may be exposed to noise levels exceeding 42dBA.

7.12 Shadow Flicker

This section provides a summary of the shadow flicker specialist report compiled by Emma Lewis and Martin Stevenson of Arcus Consultancy Services Limited is available in *Appendix C15: Shadow Flicker*.

7.12.1 Baseline Description

The topography of the site is characterised by undulating hills and has been described in more detail elsewhere in this report however of most relevance is 7.8.1. A number of buildings are located sporadically within the site and the sensitive receptors are described in more detail in the section below.

7.12.2 Site Sensitivity

Sensitive receptors were identified in conjunction with the Noise study (Section 7.11) and a study area around each proposed turbine location within a distance of 10 x rotor diameter was mapped (1,950 m) as shown in Figure 7-121 and Figure 7-122. Seven potentially sensitive receptors with the potential to experience shadow flicker effects were identified within Hoogland 1 and nine respectively in Hoogland 2. The notable receptors on Hoogland 1 are 5 N (Slangfontein), 6 N (Midlands) and 10 N (Slangfontein); on Hoogland 2 are 8 N (Uilspoort) and 9 N (Uilspoort). With respect to cumulative in relation to Nuweveld North Wind Farm, 2 N and 11 N (both Rocklands).

Potential shadow flicker-sensitive receptors located more than 10 x rotor diameter of the turbines have been excluded from investigation, on the basis that shadow flicker effects are unlikely to be experienced beyond 10 x rotor diameter of the turbines.

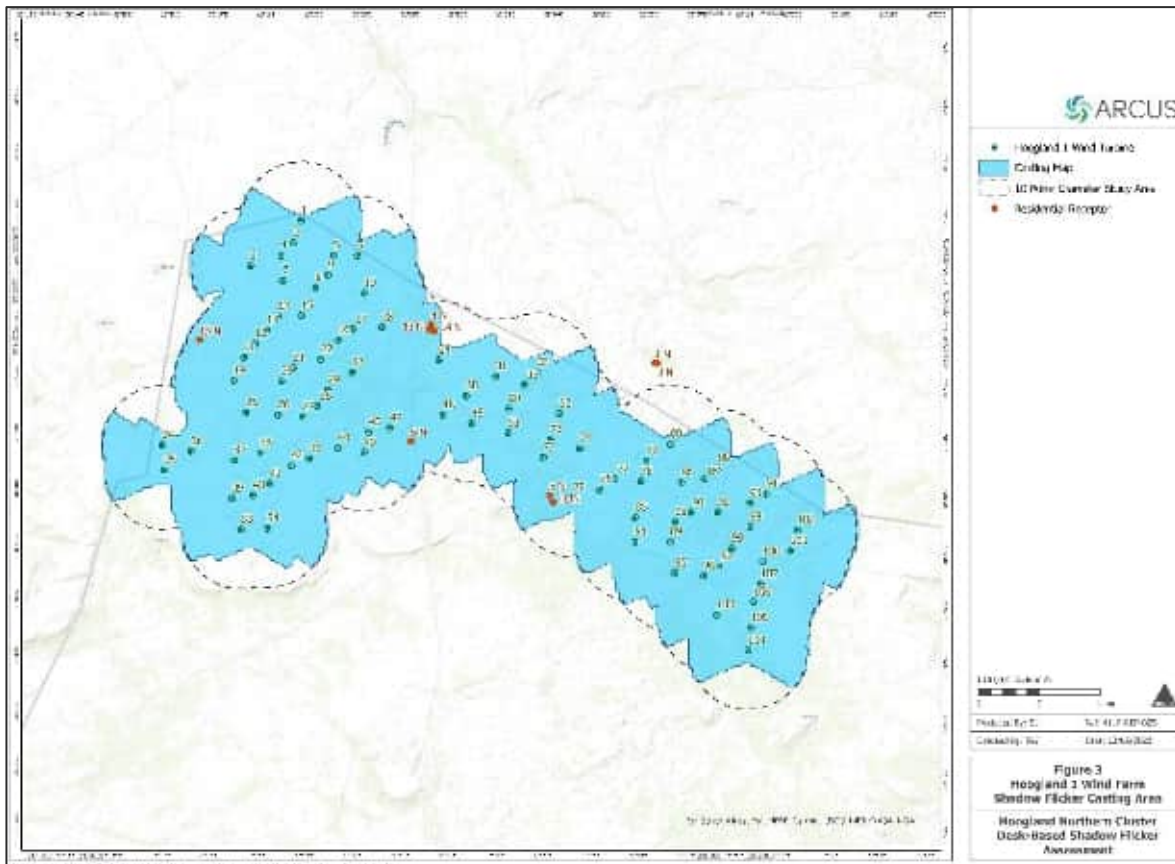


Figure 7-121: Hoogland 1 study area around each proposed turbine location within a distance 1,950m

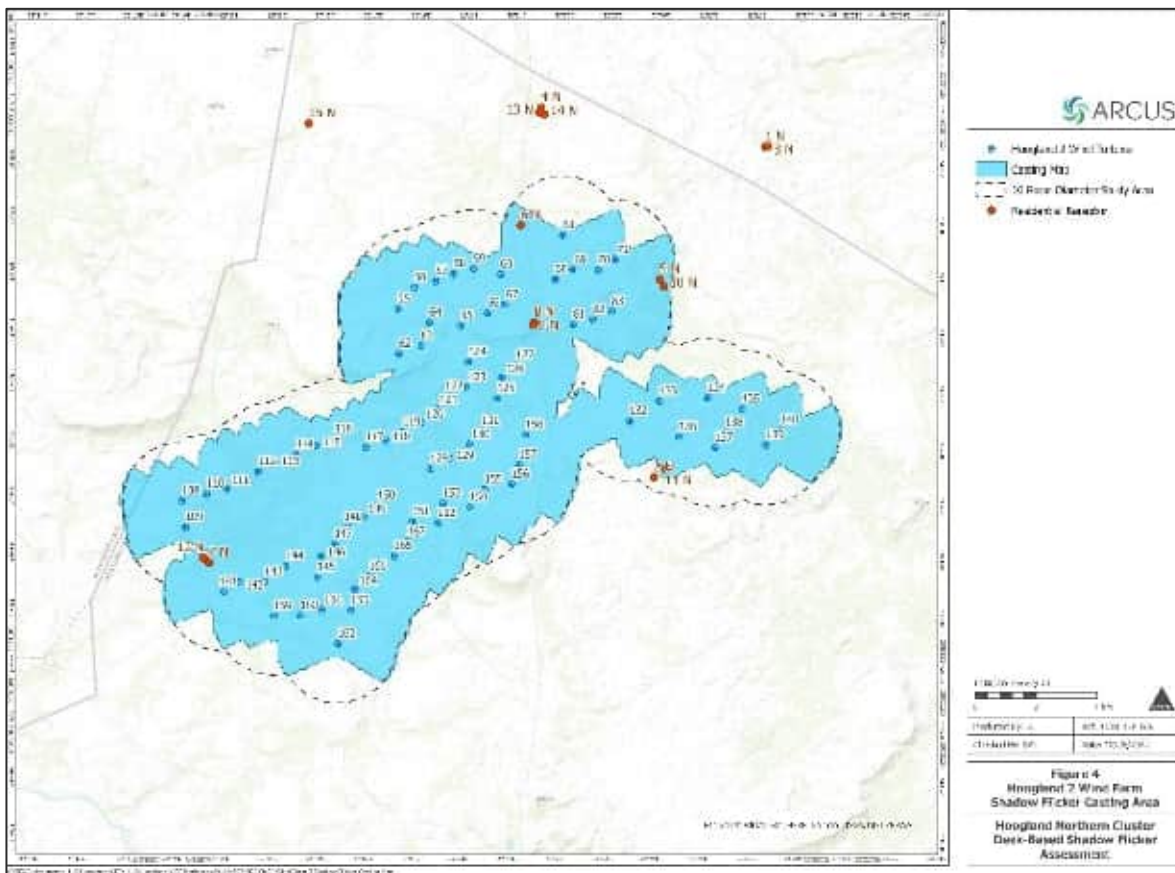


Figure 7-122: Hoogland 2 study area around each proposed turbine location within a distance 1,950m

Shadow flicker is a phenomenon that only occurs once turbines are installed and operational and thus no shadow flicker effects are anticipated (or assessed) during the construction phase of Hoogland 1 Wind Farm or Hoogland 2 Wind Farm.

It has been calculated that shadow flicker could potentially occur at all seven potentially sensitive receptors identified within the Study Area for Hoogland 1 and seven of the nine identified for Hoogland 2 Wind Farm respectively (Table 7-129 and Table 7-130, also see Figure 7-119 and Figure 7-120 above).

The theoretical maximum number of hours per annum predicted to be experienced at each receptor account for any overlap where effects may be experienced at different windows or from different turbines simultaneously. However, based upon weather conditions required to facilitate shadow flicker occurring for 76 % of the time (i.e., no cloud, sufficient wind for the turbines to operate, and a wind direction such that the turbines are not side-on to the receptor in question), the likely number of hours per year where shadow flicker could potentially occur is usually reduced (Table 7-129 and Table 7-130).

Table 7-129: Hoogland 1 Hours of Shadow Flicker at Modelled Receptors

RECEPTOR	X COORDINATE	Y COORDINATE	THEORETICAL MAXIMUM NUMBER OF HOURS PER ANNUM	LIKELY NUMBER OF HOURS PER ANNUM	TURBINES AFFECTING RECEPTOR
4 N	628883	6501282	16	12	18
5 N	632798	6495625	74	56	75,76
6 N	628203	6497419	138	105	45,46,47
10 N	632921	6495403	89	68	75,76
13 N	628819	6501124	16	12	18
14 N	628990	6501058	13	10	18
15 N	621216	6500763	35	27	11, 12

Table 7-130: Hoogland 2 Hours of Shadow Flicker at Modelled Receptors

RECEPTOR	X COORDINATE	Y COORDINATE	THEORETICAL MAXIMUM NUMBER OF HOURS PER ANNUM	LIKELY NUMBER OF HOURS PER ANNUM	TURBINES AFFECTING RECEPTOR
5 N	632798	6495625	19	14	17
6 N	628202.6	6497419	21	16	71
7 N	617927.2	6486307	22	17	55,56
8 N	628660.8	6494224	94	71	66,67,81,82
9 N	628599.9	6494125	90	68	66,67,81
10 N	632920.9	6495403	21	16	71
11 N	632968	6489392	28	21	137
12 N	617751	6486462	0	0	0

It should be noted that the predicted likely number of hours in which shadow flicker is to occur is above the annual 30-hour threshold for three of the receptors on Hoogland 1 Wind Farm (5 N, 6 N, and 10 N) and two of the receptors on Hoogland 2 Wind Farm (8 N and 9 N). However, due to the numerous worst-case assumptions made as part of this assessment it is likely that the results over-estimate of actual effects. In addition, considering that none of the turbines are proposed within 500 m of any receptor, a worst-case study area for exceedance has been considered.

7.12.3 Impact Assessment and Mitigation

The following shadow flicker impacts have been identified and rated by Arcus (2022) and are only relevant to the operational phase as such impacts do not occur during construction and decommissioning.

As a worst case, the impact assessment assesses the impact on those receptors predicted to receive shadow flicker effects which exceed 30 hours per year, i.e., receptors 5 N, 6 N, 10 N, 8 N and 9 N, as detailed in Table 7-129 and Table 7-130 above. No impact assessment tables have been provided for receptors predicted to receive less than 30 hours per annum. Properties predicted to experience no shadow flicker effects are deemed to be insignificant.

7.12.3.1 Operational Phase: Hoogland 1

Table 7-131: Operation: Hoogland 1 - Shadow Flicker Impact

Issue	Shadow Flicker	
Description of Impact		
Shadow Flicker effects on identified receptors (5 N, 6 N and 10 N)		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Low
Probability	Probable	Unlikely / improbable
Significance	Medium -	Insignificant
Degree to which impact can be reversed	Any potential impact would be completely reversed with the implementation of the proposed mitigation as below.	
Degree to which impact may cause irreplaceable loss of resources	Low - the resource is not damaged irreparably or is not scarce.	
Degree to which impact can be mitigated	The Applicant could assist the affected receptor with shielding (blind, shutters, curtains, or screening with vegetation) or moving the affected window, or any other measure found acceptable to the affected party. Compensation may also be considered. As a last resort, a shut-down calendar could be implemented on turbines directly causing shadow flicker to receptors found to result in an adverse impact. Depending on the mitigation implemented, shadow flicker effects can be mitigated.	

7.12.3.2 Operational Phase: Hoogland 2

Table 7-132: Operation: Hoogland 2 - Shadow Flicker Impact

Issue	Shadow Flicker	
Description of Impact		
Shadow Flicker effects on identified receptors (8 N and 9N)		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local

Consequence	Medium	Low
Probability	Probable	Unlikely / improbable
Significance	Medium -	Insignificant
Degree to which impact can be reversed	Any potential impact would be completely reversed with the implementation of the proposed mitigation as below.	
Degree to which impact may cause irreplaceable loss of resources	Low - the resource is not damaged irreparably or is not scarce.	
Degree to which impact can be mitigated	The Applicant could assist the affected receptor with shielding (blind, shutters, curtains, or screening with vegetation) or moving the affected window, or any other measure found acceptable to the affected party. Compensation may also be considered. As a last resort, a shut-down calendar could be implemented on turbines directly causing shadow flicker to receptors found to result in an adverse impact. Depending on the mitigation implemented, shadow flicker effects can be mitigated.	

7.12.4 Cumulative Impact

The following cumulative impacts have been identified and rated where necessary by Arcus (2022).

7.12.4.1 Operational Phase: Hoogland 1

Three receptors (5 N, 10 N and 6 N) were identified as falling within 10 x rotor diameters of Hoogland 1 Wind Farm and Hoogland 2 Wind Farm.

The theoretical maximum number of hours per annum, are for all windows and account for any overlap where effects may be experienced at different windows or from different turbines simultaneously. As such, shadow flicker effects are calculated as being possible for up to a theoretical maximum of 158 hours per year at receptor 6 N, a theoretical maximum of 110 hours per year at receptor 10 N and a theoretical maximum of 93 hours per year at receptor 5 N.

Based upon weather conditions required to facilitate shadow flicker occurring for 76 % of the time (i.e., no cloud, sufficient wind for the turbines to operate, and a wind direction such that the turbines are not side-on to the receptor in question), the likely number of hours per year where shadow flicker could potentially occur is reduced to 120 hours per annum at receptor 6 N, 84 hours per annum at receptor 10 N and 71 hours per annum at receptor 5 N. This is also not taking into account the presence of windows and their sizes and positioning, and any screening from vegetation or other intervening topography, and is therefore assuming the conditions allow for a worst-case shadow flicker scenario. Upon refinement of the shadow flicker model by establishing window sizes and aspects to replace worst-case assumptions, the theoretical and therefore likely number of hours cumulative shadow flicker at modelled receptors should reduce.

Table 7-133: Hoogland 1 Cumulative Hours of Shadow Flicker at Modelled Receptors

RECEPTOR	X COORDINATE	Y COORDINATE	THEORETICAL MAXIMUM NUMBER OF HOURS PER ANNUM	LIKELY NUMBER OF HOURS PER ANNUM	TURBINES AFFECTING RECEPTOR
5 N	632798	6495625	93	71	75,76,71
6 N	628202.6	6497419	158	120	45,46,47,61
10 N	632920.9	6495403	110	84	75,76,71
2N	632595	6489111	51	34	Nuweveld 05, Nuweveld 22
11N	632968	6489392	43	33	137, Nuweveld 05

As can be seen from Table 7-133 the predicted number of hours in which shadow flicker is to occur is above the 30-hour threshold. However, it is likely to comprise an over-estimate of actual effects, given the other conservative aspects of the assessment as set out in the assessment methodology described in the specialist report (*Appendix C15: Shadow Flicker*). Without mitigation the significance of effects would be medium however, with mitigation the significance should decrease to insignificant.

Table 7-134: Cumulative impact: Operation: Hoogland 1 and 2 – Shadow flicker

Nature of cumulative impacts	Shadow Flicker effects on identified receptors (5 N, 6 N and 10 N)	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium	Insignificant

7.12.4.2 Operational Phase: Hoogland 2

Two receptors (2 N and 11 N) were identified as falling within the 10 x rotor diameter Study Areas of Hoogland 2 Wind Farm and Nuweveld North Wind Farm.

The theoretical maximum number of hours per annum, are for all windows and account for any overlap where effects may be experienced at different windows or from different turbines simultaneously. As such, shadow flicker effects are calculated as being possible for up to a theoretical maximum of 25 hours per year at the receptor 2 N and 31 hours at receptor 11 N.

Table 7-135: Hoogland 2 Cumulative Hours of Shadow Flicker at Modelled Receptors

RECEPTOR	X COORDINATE	Y COORDINATE	THEORETICAL MAXIMUM NUMBER OF HOURS PER ANNUM	LIKELY NUMBER OF HOURS PER ANNUM	TURBINES AFFECTING RECEPTOR
5 N	632798	6495625	184	140	75,86,87,74
6 N	628202.6	6497419	128	97	44,45,63,64
10 N	632920.9	6495403	189	144	75,86,87,74
2N	632595	6489111	25	19	151, Nuweveld North 05
11N	632968	6489392	31	24	Nuweveld North 05, Nuweveld North 22

Based upon weather conditions required to facilitate shadow flicker occurring for 76 % of the time (i.e., no cloud, sufficient wind for the turbines to operate, and a wind direction such that the turbines are not side-on to the receptor in question), the likely number of hours per year where shadow flicker could potentially occur is reduced to 34 hours per annum at receptor 2 N and 33 hours per annum at receptor 11 N. However, it is likely to comprise an over-estimate of actual effects, given the other conservative aspects of this assessment as set out in the assessment methodology in Section 2. Without mitigation the significance of effects would be medium however, with mitigation the significance should decrease to insignificant.

As detailed in Section 7.12.4.1, three potentially sensitive receptors (5 N, 10 N and 6 N) were identified as falling within the 10-x rotor diameter Study Areas of both Hoogland 1 Wind Farm and Hoogland 2 Wind Farm. The cumulative effects on these receptors were previously assessed with the likely number of hours per year where shadow flicker would potentially occur reaching 120 hours per annum at receptor 6 N, 84 hours per annum at receptor 10 N and 71 hours per annum at receptor 5 N. As such, the Hoogland 1 Wind Farm impact assessment conclusions for these receptors are also applicable for Hoogland 2 Wind Farm, refer to Table 7-133.

Table 7-136: Cumulative impact: Operation: Hoogland 1 and 2 – Shadow flicker

Nature of cumulative impacts	Shadow Flicker effects on identified receptors (2N, 5 N, 6 N 10N and 11 N)	
Description of Impact		
Shadow Flicker effects on identified receptors (2N, 5 N, 6 N, 10N and 11 N)		
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium	Insignificant

7.12.5 No-Go Alternative

The ‘no-go’ alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail. In the event of a No-Go alternative, there will be no shadow flicker impact and as such, the No-Go alternative impact is assessed as insignificant.

7.12.6 Conclusion and Recommendations

The effect of shadow flicker during the operational phase has been assessed using international guidance considered to be appropriate, and effects are considered to be of medium (-) significance prior to mitigation, which applies to both Hoogland 1 and Hoogland 2 Wind Farms.

Mitigation measures include (Section 8 of the specialist report in *Appendix C15: Shadow Flicker* of this report):

- Control at Receptor: The provision of blinds, shutters or curtains to affected receptors;
- Control on Pathway: for example, screening planting close to an affected receptor; and
- Control at Source: for example, shutdown of turbines at times when effects occur.

Following appropriate mitigation, no significant impacts are anticipated on either Hoogland 1 or Hoogland 2 Wind Farms, and as such, it is the opinion of the author that the Projects may be authorised in terms of shadow flicker.

7.13 Traffic

This section provides a short summary of the traffic specialist report compiled by Athol Schwarz which is available in *Appendix C16: Traffic*.

7.13.1 Baseline Description

According to Shwarz (2022), the existing road network adjacent to the proposed developments is well established, refer to Figure 7-123. Consisting of a combination of national roads, first, second and third-order roads, which provides the proposed development accessibility to local towns and the major commercial centres within South Africa. The access to the site is off the R381 (main route between Loxton and Beaufort West) which is mostly a gravel (unpaved) road with several tarred (paved) sections (Figure 7-124) and can be reached via several public roads as shown in Figure 7-123.

The majority of the roads in the study area are gravel roads. Some of the roads are in better condition than others. There is a higher level of maintenance on the roads in the Western Cape than there is in the Northern Cape. All roads adjacent to the proposed development are expected to deteriorate due to the increased traffic volumes.



Figure 7-123: Road Network



Figure 7-124: Paved and gravel sections of the R381 which will provide the main access to the site via Beaufort West

7.13.1.1 Transportation Routes

7.13.1.1.1 Commuter Routes

In light of the REIPPPP requirements, it is assumed that the workforce will be drawn from surrounding communities. There are several towns within a 150 km radius of the proposed development. The most relevant include Beaufort West, Carnarvon, Fraserburg, Loxton, Nelspoort, and Victoria West. The proposed development can only be approached from the following directions:

- All abnormal and heavy transportation, including busses and mini-buses, will be via TR05801 (R381) and DR02315;
- Personnel travelling to the proposed development from Carnarvon, Loxton and Victoria West, will be via the TR05801 (R381) and DR02315;
- Personnel travelling to the proposed development from Fraserburg, will be via the DR02315;
- Personnel and light transportation (less than 10 tons) travelling to the proposed development from Beaufort West, will be via the TR05801 (R381) and DR02315; and
- Personnel travelling to the proposed development from Nelspoort, will be via the DR02317, TR05801 (R381) and DR02315.

The distance from the proposed developments to the surrounding towns and the estimated travelling time and “working age” population in the various towns are shown in Table 7-137.

Table 7-137: Distance to surrounding towns

Town	Travel Distance*	Estimated Time**	Travel	Population
Beaufort West	105 km	1:47		21 608
Carnarvon	88 km	1:05		4 107
Fraserburg	100 km	1:45		1 854
Loxton	25 km	0:25		604
Nelspoort	108 km	1:42		1 212
Victoria West	106 km	1:13		4 978
* Distance from the intersection at TR05801/DR02315 to the main intersection in the Town				
** Obtained using Garmin Software				

7.13.1.1.2 Freight Routes

Container Terminals:

The port of entry into South Africa for all import WTG components is limited to Ngqura (located close to Gqeberha) or Saldanha Terminals (Table 7-138).

Table 7-138: Distance from port terminals

Container Terminals	Distance
Ngqura	537 km
Saldanha	770 km

The length and weight of the various turbine components will only be available once the turbine supplier has been appointed. There is a strong possibility that the length of the blades for the turbine units could exceed 95 m.

The following have been considered for the transportation of turbine components for this project:

- In Beaufort West, the traffic circle in Donkin Street poses a significant challenge for the transportation of the blades. However, a potential by-pass route to the north of Beaufort West, as shown in red in Figure 7-125, has been identified for the possible transportation of the turbine components through Beaufort West if the

components are imported into South Africa via one of the ports in the Western Cape. Sections of the existing track along the identified by-pass route would need to be upgraded, and new sections would have to be constructed to complete the route. From a traffic impact perspective, this by-pass route is an acceptable route that will help reduce potential traffic impacts for the proposed transportation of the turbine components as it will ensure that the abnormal loads can bypass the centre of the town. This bypass has therefore been included in the applications for the Hoogland 1 and Hoogland 2 Wind Farms.

- The trio of passes on the TR05801 (R381) between Beaufort West and the proposed developments pose constraints that will not easily be overcome with the current transportation equipment available in South Africa without significant intervention;
- Transporting the components through towns is always a challenge. Most are conquered with a bit of ingenuity. At Loxton, the TR016 (R63)/TR05801 intersection will have to be redesigned and upgraded. However, this may have already been undertaken as part of the Nuweveld Wind Farm Project. The route through the town should avoid the commercial centre of town if possible, however, will need to be identified by the appointed logistics company transporting the turbine components.
- The route from Ngqura Container Terminal to the proposed development via Loxton is feasible. This route has been used to transport turbine components for Noblesfontein, Loeriesfontein and Khobab Wind Farms. Construction of Noblesfontein Wind Farm commenced in March 2013.

The turbine components were transported from the Ngqura Container Terminal to the site. Loeriesfontein and Khobab Wind Farms commenced with the transportation of wind turbine tower components on 20 June 2016. Over 300 wind turbine tower sections, which were fabricated in Atlantis, were transported on the N1 (via Worcester, Laingsburg and Beaufort West), N12 (to Victoria West), R63 (to Carnarvon, Williston and Calvinia) to the site.

The 53 m long wind turbine blades, nacelles and hubs were transported via Uitenhage, Graaff-Reinet, Beaufort West, Three Sisters, Victoria West and Carnarvon onto Loeriesfontein.

- The geometric design and gradient of the Theekloofpas on the TR07301 (R353) could pose constraints that would inhibit the use of this road with the current transportation equipment available in South Africa, and this route is not recommended at this point.



Figure 7-125: Potential By-Pass of Beaufort West

The preferred transportation route would ultimately be identified by the logistic company appointed to transport the various turbine components from the port of entry to the proposed development.

Commercial Centres:

The most likely transportation routes for domestically supplied and manufactured components from the major commercial centres to the proposed developments are either Cape Town or Johannesburg (or any supplier along these routes). The distances from the proposed developments to the major commercial centres in South Africa are shown in Table 7-139.

Table 7-139: Distance from major commercial centres

Commercial Centres	Distance
Cape Town	696 km
Johannesburg (via N1)	1003 km
Johannesburg (via N12)	968 km

7.13.1.2 Traffic Volumes

The baseline traffic volumes for the road network adjacent to the proposed developments are based on the Average Annual Daily Traffic (AADT) values obtained from the various counting stations. The values used are the average values between intersections, which have been adjusted by a growth factor relevant to the road. The adjusted AADT values used in this assessment are provided in Figure 7-126.



Figure 7-126: Baseline AADT

7.13.2 Site Sensitivity

7.13.2.1 Road Network

The N1 is a Class 1 road, generally consisting of a single paved carriageway, with one lane in each direction and paved shoulders. Climbing lanes are provided along various sections of the road, and there are turning lanes at major intersections. In many cases, the shoulder is wide enough to allow yellow-line driving. The road is in good condition with a speed limit of 120 km/h.

The Trunk Roads in the area are very diverse, from the first world paved roads to third world gravel roads. The R353 is a Minor Arterial providing mobility between provinces, regions, and towns. The paved sections of the R353 consist of a single paved carriageway, with one lane in each direction and unpaved shoulders. There is a noticeable difference in the condition of the roads in the Northern Cape and Western Cape.

Of particular concern are several sections of the unpaved road through the Molteno Pass (R381) that are extremely treacherous, with no barriers and steep drop-offs, very tight corners, negative banking and loose gravel. At a distance of 19.5 km from Beaufort West, there is a sharp bend in the road, a very tight bend with poor sighting distance, and is the site of numerous fatalities. A mirror has been installed to mitigate collision at this point. However, the mirror does not prevent single-vehicle incidents.

The main road of relevance, (R356) is the Access Collector providing mobility between Beaufort West and Loxton towns. The road consists of a gravel carriageway within a 30 m wide servitude. The condition of the road is good and allows for dual-directional traffic at speed.

The district roads in the area are level 4 roads and are classified as Resident Access Collector roads, providing accessibility to nearby towns and main roads. Most of these roads consist of a gravel carriageway, approximately 7 m wide, within a 20 m wide servitude. As a result of the width, road users have to reduce speed when passing oncoming vehicles. Although most of these roads are suitable for light vehicles, the use of these roads by heavy vehicles is not recommended. The most relevant district road that will be used to access the site is the DR02315 (off the R381).

7.13.3 Impact Assessment and Mitigation

7.13.3.1 Traffic Volumes expected from the Project

The most significant impact on traffic volumes is because of commuting personnel to and from the site in the morning and in the afternoon, and delivery of equipment and material. At no point during the construction or operational phases does the traffic volume on the various roads exceed fifty trips per hour, which is the threshold for a detailed Traffic Impact Assessment (TIA).

A project duration of 30 months is expected for both Hoogland 1 and Hoogland 2 Wind Farms assuming they are constructed simultaneously. However, an active construction phase of 24 months has been assumed, providing six months for site establishment and final commissioning of the proposed developments.

The envisaged timeframes of traffic activities (as adopted in the specialist report) are:

- Morning Peak Traffic - between 6:30 to 7:30.
- Diurnal Traffic - between 7:30 to 16:30.
- Afternoon Peak Traffic - between 16:30 to 17:30.

The traffic volume generated during the peak construction phase of the development is in the order of:

- Peak Traffic: The maximum number of vehicles on the public road network during the Peak Traffic is in the order of 28 vph. The most significant expected Peak Traffic increase is on R318.

- Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 19.7 vph. Which equates to approximately 158 vehicles, over an eight-hour period.

The traffic volume generated during the operational phase of the proposed developments is in the order of:

- Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 9 vph. The most significant expected Peak Traffic increase is on R318 and the DR02317.
- Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 4.25 vph. Which equates to approximately 34 vehicles, over an eight-hour period.

The minimum required level of service for gravel roads is LOS C. For the worst-case scenario, the additional traffic volume of the proposed developments results in a LOS A. Thus, the additional traffic volume does not compromise the level of service of the roads.

The following traffic impacts have been identified and rated by Schwarz (2022). Noting that the impacts for construction and operation have been identified, and for decommissioning, a separate traffic impact assessment should be undertaken since many of the characteristics related to the traffic impact assessment, i.e., access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the development. Thus, the impact assessment for the decommissioning phase has not been provided.

7.13.3.2 Construction Phase

Table 7-140: Construction: Increased Road Incidents

Issue: Increased Road Incidents		
Description of Impact		
The increased traffic volumes on the public roads will increase the potential of incidents on the road network within the study area		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Very High
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Conceivable
Significance	Medium -	Low-
Degree to which impact can be reversed	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist, or mitigation will slightly reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Post relevant road signage along affected routes; • Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes; • Transport Management Plan (TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process are known. The TMP needs to address, inter alia: <ul style="list-style-type: none"> - clearly defined route/s to the site for specific vehicles needed to transport equipment and materials - scheduled deliveries to avoid local congestion; 	

	<ul style="list-style-type: none"> Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.
Monitoring	
The following monitoring is recommended:	Incident register and ongoing road safety awareness training

Table 7-141: Construction: Road Degradation

Issue: Road Degradation		
Description of Impact		
The increased traffic volumes on the public roads will increase the potential for localised road network degradation within the study area.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will be able to recover from the impact	
Degree to which impact may cause irreplaceable loss of resources	The resource is not damaged irreparably or is not scarce	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Create a local WhatsApp Group for local community and post notices of road conditions and proposed alternatives. Developer to contribute to the maintenance of the public roads in the area during construction phase of the development/s. A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective view from road users. Upgrade unpaved roads to a suitable condition for proposed construction vehicles. Ensure that the roads are left in the same or better condition, post-construction. 	
Monitoring		
The following monitoring is recommended:	Weekly inspection	

Table 7-142: Construction: Dust

Issue: Dust		
Description of Impact		
The increased traffic volumes on the unpaved public roads will generate more dust. The larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view for over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation

Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will not be able to recover from the impact - permanently modified	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist, or mitigation will slightly reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Reduce travel speed for construction vehicles on the gravel road to reduce dust. • Dust suppression of the roads in the immediate vicinity of the site where feasible. • Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period. 	
Monitoring		
The following monitoring is recommended:	Continues observation, remedial action needs to be taken as and when required.	

Table 7-143: Construction: Intersection Safety

Issue: Intersection Safety		
Description of Impact		
The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	The affected environment will not be able to recover from the impact - permanently modified	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		

The following measures are recommended:	<ul style="list-style-type: none"> • Compile TMP, refer to Section 11 of the Traffic Report. Reduce speed at intersections and use appropriate traffic warning signs. • Identify alternative routes where possible. • Request the assistance of local law enforcement. • Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.
Monitoring	
The following monitoring is recommended:	Incident register and ongoing road safety awareness training

7.13.3.3 Operational Phase

Table 7-144: Operation: Intersection Safety

Issue: Intersection Safety		
Description of Impact		
The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	High	High
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	The affected environment will not be able to recover from the impact - permanently modified	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Compile TMP, refer to Section 11 of the Traffic Report (<i>Appendix C16: Traffic</i>). • Reduce speed at intersections and use appropriate traffic warning signs. • Identify alternative routes where possible. • Request the assistance of local law enforcement. • Ensure that all site vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licensed operator. 	
Monitoring		
The following monitoring is recommended:	Incident register and ongoing road safety awareness training	

7.13.4 Cumulative Impact

The following cumulative impacts have been identified and rated by Schwarz (2022).

7.13.4.1 Construction Phase

Table 7-145: Cumulative impact: Construction Phase - Increased Road Incidents

Issue: Increased Road Incidents		
Nature of cumulative impacts	The cumulative impact resulting from the traffic volumes on the road network	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-146: Cumulative impact: Construction Phase - Road Degradation

Issue: Road Degradation		
Nature of cumulative impacts	The cumulative impact resulting from the traffic volumes on the road network	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-147: Cumulative impact: Construction Phase – Dust

Issue: Dust		
Nature of cumulative impacts	The cumulative impact resulting from the traffic volumes on the road network	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-148: Cumulative impact: Construction Phase - Intersection Safety

Issue: Intersection Safety		
Nature of cumulative impacts	The cumulative impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.13.4.2 Operational Phase

Table 7-149: Cumulative impact: Operational Phase - Intersection Safety

Issue: Intersection Safety		
Nature of cumulative impacts	The cumulative impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.13.5 No-Go Alternative

If the proposed development does not materialise, the increase in the traffic volume will not transpire, resulting in the following impacts:

- Road Degradation - Less traffic on the roads means that the rate of degradation to the roads will be less. However, the maintenance of the roads will not be augmented by the proposed development. Improved maintenance of the roads will improve the quality of life for the road users and could increase the economic opportunities in the area. The status quo is therefore rated as of low negative significance.
- Road Safety - Less traffic on the roads means less probability of an incident, reducing the likelihood of a fatality. Therefore, the impact is neutral.

The improved road maintenance counteracts the negative impacts on the road network due to the development and economic prospects the development will bring to the local community and the impact the development has on a national scale.

7.13.6 Conclusion and Recommendations

It can be concluded that the development of the Northern Cluster of the Hoogland Wind Farm Project (Hoogland 1 Wind Farm and Hoogland 2 Wind Farm) will have a notable increase in traffic volumes on the road network during the peak construction phase of the proposed developments. However, the specialist report has assessed the impact of these additional traffic volumes on the surrounding road network will be well within the acceptable level of service. Noting that the road network is not well maintained due to budgetary constraints within various spheres of government. The increase in traffic volumes will lead to greater wear and tear, especially during construction, but will not have an undue detrimental impact on the road network within the study area if the mitigation measures are undertaken.

It is the reasoned opinion of the author that the proposed development of the Northern Cluster of the Hoogland Wind Farm Project (Hoogland 1 Wind Farm and Hoogland 2 Wind Farm) can be approved from a traffic and transportation perspective as there are no constraints or notable impacts that would jeopardise the implementation of the development, subject to the specific requirements included within this report. It is recommended that a separate traffic impact assessment be conducted for the decommissioning phase of the development as the traffic characteristics of the area will likely change over the lifespan of the Wind Farm.

7.14 Socio-economic

This section provides a short summary of the socio-economic specialist report compiled by Hugo van Zyl and James Kinghorn of Independent Economic Researchers (IER) which is available in *Appendix C17: Socio-Economic*. From a socio-economic perspective, the project was investigated in terms of its compatibility with South African energy policy and strategic spatial planning, as well as with socio-economic development planning with a focus on local and regional planning.

7.14.1 Baseline Description

The proposed Wind Farm sites are situated within Ward 7 of the Beaufort West Municipality which forms part of the Central Karoo District Municipality of the Western Cape Province (note that Ward 7 covers a particularly large area of 8,175m² and extends as far as the town of Merweville which is over 100km from the sites). The towns nearest the sites are Beaufort West, Loxton and Fraserburg. Loxton is in the Ubuntu Local Municipality which forms part of the Pixley ka Seme District Municipality, while Fraserburg is in the Karoo Hoogland Local Municipality within the Namakwa District Municipality, both in the Northern Cape Province.

7.14.1.1 Land uses

Current land uses in the wider rural area, where the Wind Farm and majority of the Wind Farm infrastructure would be located, are focused on extensive agriculture with small stock primarily in the form of sheep, game farming, some tourism and conservation primarily in the form of the Karoo National Park. According to IER (2022) Although generally tourism facilities and attractions in the areas surrounding the project site are very limited and sparsely distributed, with the exception of Khulu Umzi Self-catering Lodge, on Donkergat Farm, 2.05km from the nearest planned wind

turbine. The farms are large, and homesteads are few and far between to maintain economically viable farm units. Small communities are housed on the farms and work as farm labourers or in associated tourism ventures. Away from the towns there are few other sources of enterprise or employment. For more details on agricultural land uses, see the Agricultural Specialist Study (Section 7.3).

Drought has been experienced to varying degrees in different parts of the study area, with many of the farms surrounding Loxton having received little to no rain over the past ten years. The financial sustainability of farming in this area has been severely compromised, and many farmers have removed all livestock from their farms or have resorted to other coping strategies given the persistently low forage levels available to livestock in the area. Some farm labourers have been retrenched as a result of the drought and have been forced to relocate to urban centres in search of employment.

The town of Beaufort West is a regional hub. Typical urban land uses can be found on the urban periphery of Beaufort West where the temporary N1 bypass would be situated (to be used in the construction of the Northern Wind Farm Cluster). These include residential areas, recreation / tourism ventures and accommodations, industrial areas, major infrastructure (such as existing electricity transmission infrastructure, the N1 road and railway line) some mining (in the form of a quarry in the northern part of the town) and recreational uses (including the golf course in the northern part of the town).

7.14.1.2 Demographics

The demographics of the study area are presented in detail in *Appendix C17: Socio-Economic* however some key points are included here for context. Beaufort West Local Municipality (BWLM) had a population of 51 074 in 2019, up from 49 586 in 2011, which translates to a population growth rate of around 0.4% per annum over the eight-year period. This is lower than the annual growth rate for the Central Karoo District Municipality (CKDM), which was 1.2% over the same period. BWLM had an average household size of 3.8 in 2019.

Up-to-date statistics are not available for Ubuntu Local Municipality (ULM). But based on the population growth rate between 2011 and 2016 (average of 0.92% per annum), the 2019 population was estimated to be 20,007. The average growth rate for Pixley ka Seme District Municipality (PkSDM) was estimated to be 0.98% per year over the 2011–2019 period, based on available statistics for these years, which indicate that the PkSDM had a population size of 200,835 in 2019.

Karoo Hoogland Local Municipality (KHLM) had a population of 13 009 in 2016, up from 12 501 in 2011, implying an average growth rate of 0.8%. Up-to-date statistics are not available for KHLM, but assuming that the municipality has grown at a uniform rate since 2011 provides the estimate of a population size of 13,321 in 2019. The average growth rate for NDM over the 2011–2016 period was negative and averaged -0.17% over the same period. However, between 2016 and 2019 NDM's population grew at an average of 7.15% per year. These trends may reflect in-migration to the District, but the statistics should be treated with caution given that they are based on different datasets, one of which is not publicly available and the accuracy of which is therefore difficult to ascertain.

Recent population estimates are not available at the settlement level, but the 2011 census gives some indication of the towns nearby the study site, as outlined in Table 7-150. Beaufort West had a population of 20,053 in 2011, while Loxton had a population of 1,044, Fraserburg 3,029 and Nelspoort 1,696.

Table 7-150: Population groups in the towns surrounding the study site, 2011

POPULATION GROUP	BEAUFORT WEST	LOXTON	FRASERBURG	NELSPOORT
Black African	1 452	28	145	288
Coloured	15 624	895	2 569	1 375
Indian or Asian	107	3	18	14
White	2 741	113	288	13
Other	129	5	9	6
Total	20 053	1 044	3 029	1 696

Source: StatsSA, 2012

Between 2011 and 2016, BWLM's dependency ratio³¹ showed a decreasing trend over time as an ever-larger proportion of the population was falling into the working age group. More recent information suggests that this trend reversed between 2016 and 2019, with an increase in the dependency ratio to a high in recent years of 65. Interviews with municipal representatives indicate that this could be due to higher than anticipated rates of in-migration over the period.

Between 2011 and 2016, the population of the ULM appeared to be following a similar trajectory to that of the BWLM. Post-2016 data are not available to confirm whether this trend has continued or, as in the case of BWLM, reversed. As in BWLM, the dependency ratio in the ULM decreased in 2016, with an increasingly large portion of the younger population falling into the working age category. The dependency ratio in the KHLM decreased from 2011 to 2016, following a similar trend to ULM, although less pronounced. More recent data are not available to determine whether this trend has continued.

7.14.1.3 Employment and Sectors

BWLM's unemployment rate was around 24.2% in 2019, which is the highest unemployment rate in the CKD. The local municipality's trend has for the most part been consistent with that of the district municipality as well as that of the province at least since 2008.

Recent employment data are not available for ULM, PkSDM or KHLM. The 2011 census revealed that in that year the unemployment rate in ULM was 29.1% and in PkSDM, 28.3%. KHLM unemployment rate peaked around 2003 and has been falling since. However, recent data is not available and there is reason to suspect that this trend may not have continued following the impact of the COVID-19 pandemic and lockdown restrictions, which have tended to increase unemployment in other places where the impact has been measured.

The sector which contributes most to employment in BWLM is wholesale and retail trade, catering and accommodation. This sector contributed 3,126 of the total of the area's 12,515 jobs in 2018. The second highest number of jobs was in agriculture, forestry and fisheries which employed 2,421 people in that year.

Most jobs in BWLM fall into the semi-skilled (43.1%) and low-skilled (36.4%) categories with skilled jobs making up only 20.5% of jobs in the area (see *Appendix C17: Socio-Economic*).

7.14.1.4 Educational Levels

The proportion of people over the age of 20 years who have obtained a matric certificate increased in the 2011 to 2016 period at both the local and district municipality scales. This indicates that basic education levels have improved in the study area during this time. The proportion of people who have obtained some form of higher education has however decreased over the same period, at both the local and district municipality scales. This metric, previously published by StatsSA, is not available for either BWLM or CKDM in recent years.

³¹ The dependency ratio expresses the ratio of those typically not in the labour force (being lower than the age of 15 and higher than the age of 64) to those typically in the labour force (people of ages 15 to 64).

Statistics published by the Western Cape Government indicate that learner enrolment has been increasing gradually in recent years (WCPG, 2020a). This is a promising trend. However, while the demand for education has risen, supply has decreased according to the measure of the number of public ordinary schools, which has fallen by one per year over the 2018–2019 period.

According to StatsSA the proportion of people in ULM over the age of 20 years with no schooling fell from 16% to 12% over the 2011–2016 period. For the PkSDM this figure decreased similarly from 15% to 12%. At the same time, the proportion of people who have attained a matric certificate had increased for both ULM and PkSDM during these years. The proportion of people who had attained some form of higher education had meanwhile fallen. More recent data has not been published on the above-reported metrics at either the district or local municipality-level in the Northern Cape.

Education trends in the KHLM and NDM are more or less in line with those in the ULM and PkSDM and the BWLM and CKDM over the 2011–2016 period.

7.14.1.5 Availability of Municipal Services

Access to basic services has improved over time both at the local and district municipality levels, except in the case of water. A greater proportion of households had access to a flush toilet connected to sewerage, weekly refuse removal and electricity and lighting in 2016 as compared to 2011 throughout the local and district municipalities. This progression was somewhat reversed in the 2016–2019 period, with relatively more households not having access to electricity for lighting in recent years. Interviews with municipal representatives suggest that in-migration of poor families has led to the expansion of informal settlements where the provision of service delivery remains relatively low.

According to the Western Cape Government, there are relatively few informal houses in either the BWLM or in the CKDM. In the BWLM, 99.6% of households live in formal dwellings, which is a slightly higher proportion of households than the CKDM with 97.8%.

7.14.1.6 Health

The BWLM supports five primary healthcare centres (PHC) two district hospitals, one specialised hospital, one satellite clinic, one community day centre (CDC) and four mobile clinics. According to the latest available information, the ULM currently has 3 clinics and 2 Community Health Centres, no district hospital, no Mobile Clinics and no Satellite Clinics (HST, no date). The latest available information indicates that the KHM has 3 PHC clinics and 2 Mobile Clinics.

Direct provision of public health services is complemented by service provision more broadly. This is noted in the PkSDM Health Profile, with inadequate provision of basic services such as water and wastewater treatment being stressed as having dire implications for the health status of communities.

Another major concern in the study area is HIV/AIDS and Tuberculosis (TB) treatment and care. BWLM's latest IDP revision notes the importance of providing preventative care to vulnerable communities. This preventative care is provided by government and consists primarily of condom distributions and campaigns to encourage the practice of safe sex. In terms of providing treatment, government provides antiretroviral therapy (ART) to people living with HIV. Similar to the BWLM, communities living in the ULM also face challenges with respect to HIV/AIDS and TB.

Municipalities continue to address health issues facing communities through the provision of health services and through the continued training of Community Health Workers. In addition to treating HIV/AIDS, facilities provide immunisation for children. Other challenges faced by communities include a higher than anticipated neo-natal mortality rate – 13.4 neonatal deaths per 1000 live births for CKDM in 2019, up from 14 in 2016 (the target had been set at 6 or less). The neonatal death rate for BWLM is lower, at 8.4 deaths per live birth.

7.14.1.7 Socio-economic development and spatial planning

Socio-economic development imperatives inform spatial planning imperatives. A critical aspect of socio-economic desirability is thus whether the proposed development complements economic planning as reflected in spatial development planning. Integrated Development Plans (IDPs) and their accompanying Spatial Development Frameworks (SDFs) are particularly important in this regard. SDFs are central to economic development planning and serve to guide overall development in a direction that local and provincial authorities see as desirable. Indeed, the basic purpose of an SDF is to specify the spatial implications of IDPs, with a focus on optimising economic opportunities and other strategic objectives.

Alignment with SDFs, structure plans and other planning documents is a robust way of ensuring economic and social feasibility. Projects that do achieve close alignment are more likely to ensure that positive impacts are optimised, reducing the likelihood of externalities on other stakeholders and productive sectors. Where projects do not achieve alignment with existing planning, there should be clear and compelling reasons why a deviation from planning should be considered.

The following provincial and regional planning documents were found to be of relevance and were consequently reviewed:

- Western Cape SDF 2014
- Northern Cape SDF 2012, updated in 2018
- Central Karoo District Municipality IDP 2021/22
- Central Karoo District Municipality SDF 2014 and draft SDF 2019
- Namakwa District Municipality IDP 2021/22
- Namakwa District Municipality Rural Development Plan 2017
- Beaufort West Local Municipality IDP 2021/22
- Beaufort West Local Municipality SDF 2013
- Ubuntu Local Municipality IDP 2020/21
- Karoo Hoogland Local Municipality IDP 2021/22
- Karoo Hoogland Local Municipality SDF 2019

Considered as a whole, the planning documents reviewed recognise the importance of integrated and diversified economic development that makes optimal use of each area's comparative advantages and creates economic opportunities. The concept of a renewable energy project is therefore broadly supported provided environmental impacts and impacts on other land uses and potentials are acceptable. However, some potentially constraining spatial factors were identified in the documents, including some tension over the kind of development considered appropriate for the Nuweveld Highlands. These findings have been used to guide the remainder of this assessment of socio-economic impacts and in particular those on sense of place and associated tourism.

7.14.2 Site Sensitivity

In spatial terms, site sensitivity in a socio-economic context mainly relates to the sensitivity of the site in terms of tourism. Impacts on tourism would be driven by visual and associated heritage impacts on a relatively isolated area with wilderness quality and limited signs of civilisation. However, tourism facilities and attractions in the areas surrounding the project site are very limited and sparsely distributed, with the exception of Khulu Umzi Self-catering Lodge, on Donkergat Farm, 2.4km from the nearest planned wind turbine (see Figure 7-127). With the exception of this establishment, which is owned by a participant and therefore financial beneficiary of the Wind Farm project, the tourism context itself should limit impacts to a low significance during construction and a medium significance during operations with mitigation.

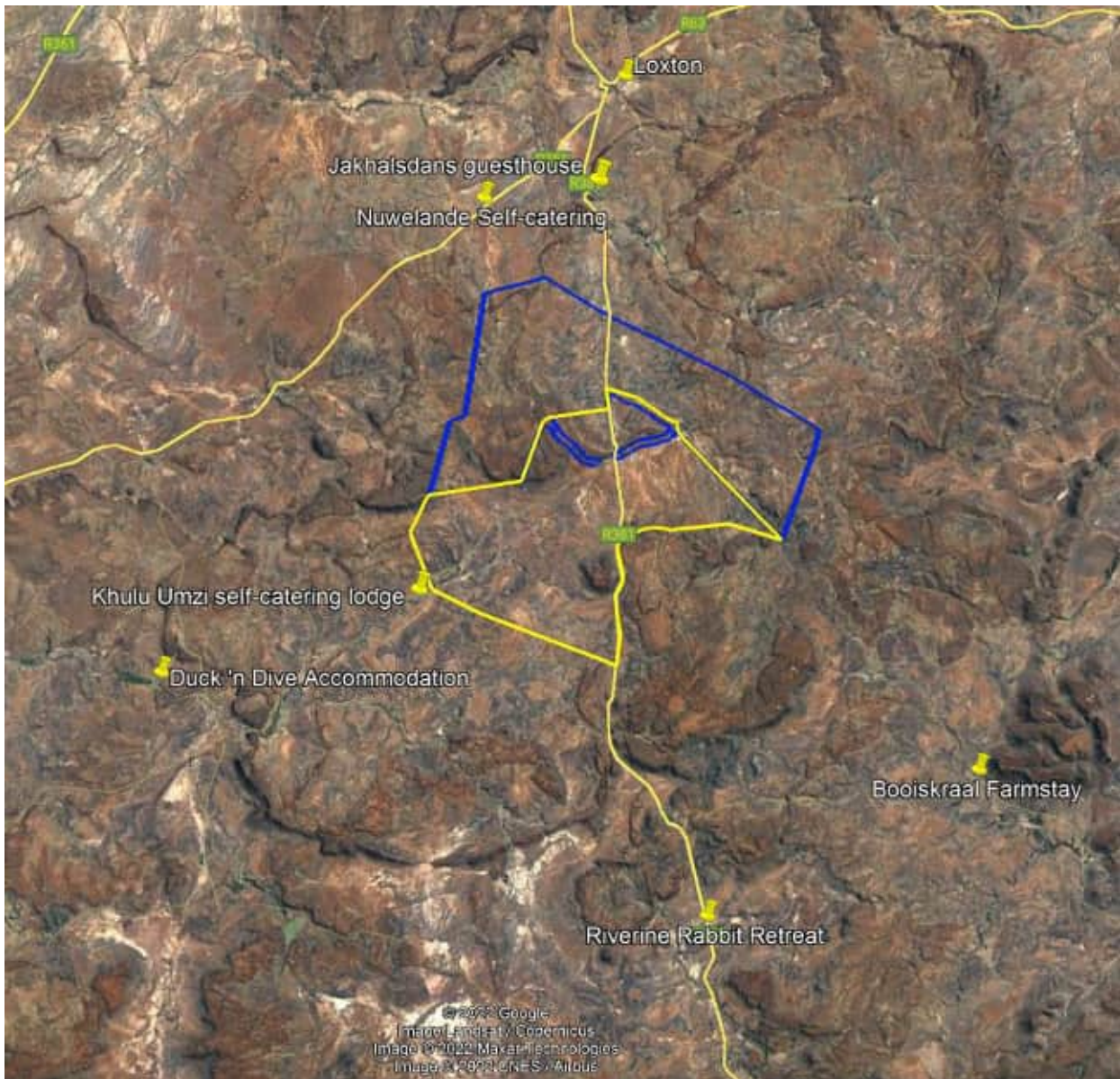


Figure 7-127: Map showing identified prominent tourism establishments in relation to the site.

The distance of such facilities from the proposed projects meant it was not necessary to apply buffers as per on site sensitivities or constraints and therefore no socio-economic features have been included in the consolidated no-go maps in Figure 9-1 - Figure 9-8.

In terms of overall sensitivity, the specialist opinion included in the socio-economic SSSV (Appendix B of *Appendix C17: Socio-Economic*) confirms that no preliminary socio-economic sensitivities or sensitivity rating was identified or provided based on the DFFE Screening Tool. Nevertheless, the specialist report provides all the necessary information and assessment data to provide an opinion on the sensitivity rating of the site. It was therefore found that the site would have a low to medium sensitivity rating based on the following:

- The planning documents relevant to the site do not identify significant or inherent constraints to appropriate development. Considered as a whole, the planning documents reviewed recognise the importance of integrated and diversified economic development that makes optimal use of the area's comparative advantages and creates economic opportunities. The concept of a renewable energy project is therefore broadly supported provided environmental impacts and impacts on other land uses and potentials are acceptable.

- Tourism facilities and attractions in the areas are very limited and sparsely distributed reducing tourism sensitivities. However, it should be recognised that the area is relatively isolated with wilderness quality and limited signs of civilisation which contributes to its tourism potential. It has a remote sense of place which makes it more sensitive to potential impacts on tourism and also on surrounding landowners and communities.
- Given its remote and relatively isolated location, the site would be relatively sensitive to the influx of people, including job seekers, that may be associated with the project. The influx of large numbers of people are not thought likely and these risks should be manageable and are common to most larger projects.
- The area is sensitive, in a positive sense, to increased economic opportunities as they are much needed as reflected in low employment and income levels. Projects that can provide such opportunities are therefore to be encouraged where possible.

7.14.3 Impact Assessment and Mitigation

The following socio-economic impacts have been identified and rated by IER (2022).

7.14.3.1 Construction Phase

Table 7-151: Construction: Impacts from expenditure on the construction of the project

Issue	Impacts from expenditure on the construction of the project	
Description of Impact		
Increased economic activity best measured through changes in expenditure and employment		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	High
Duration	Short-term	Short-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	Medium +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. • Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. • Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. Setting up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made. This can help to ensure fairness and limit potential interference in hiring processes. 	

	<ul style="list-style-type: none"> • An effective employee induction programme is essential to ensuring that new employees, some of whom will be unfamiliar with the responsibilities of maintaining employment, are adequately prepared and motivated to adjust to the lifestyle required of them. This programme should incorporate life skills training as well as basic financial literacy training. • Counselling services should be made available to employees to ensure that they have adequate guidance. Assisting smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects. • Avoiding potential service provider decisions that may lead to abuse or local dissatisfaction. For example, only appointing one accommodating rental agent or one catering supplier may lead to local dissatisfaction regarding the spreading of project benefits. • As far as possible, avoid significant variation in salaries between various contractors for the same types of jobs. When variations are too high, the likelihood of dissatisfaction increases.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-152: Construction: Impacts on tourism

Issue	Impacts on tourism	
Description of Impact		
Reduction in tourism appeal due to construction activities		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-153: Construction: Impacts associated primarily with the influx of people

Issue	Impacts associated primarily with the influx of people	
Description of Impact		
Resulting from influx of workers and job-seekers during the construction phase		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • A 'locals first' policy with regard to construction labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction process. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • The applicant and the contractor should implement a Tuberculosis and HIV/AIDS awareness programme for all workers at the outset of the construction phase. • Arrangements must be made to enable workers from outside the area to return home at reasonably regular intervals. This would reduce the risk posed by non-local construction workers to local family structures and social networks. • Condoms should be freely available to employees and all contractor workers. • The applicant should honour their commitment to spend R 100 000 per year during construction to contribute to security initiatives in the affected areas. • The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. • Close coordination with the municipality is required, including regular meetings. 	

Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-154: Construction: Impacts on surrounding landowners and communities

Issue	Impacts on surrounding landowners and communities	
Description of Impact		
Associated with greater activity nearby and related nuisance and damages		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> No construction workers, with the exception of security personnel, should be allowed to stay on the site overnight. The community should be able to contact the site manager to report any issues which they may have. The site manager should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. The applicant should develop a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. The applicant should honour his commitment to spend R 100 000 per year during construction to contribute to security initiatives. The applicant should implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. 	

	<ul style="list-style-type: none"> The EMPR must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. Mitigation measures proposed by other specialists, in particular those prescribed in the Traffic Impact Assessment, need to be adhered to. The temporary bypass must be gated to prevent use by the public. The applicant should consult community representatives, including relevant people within the local municipality as well as ward councilors, regarding planning for the use of the N1 temporary bypass to ensure that all stakeholders are kept informed as to the timing of project-traffic and potential ways of ensuring the safety of community members in the area.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-155: Construction: Impacts on property values

Issue	Impacts on property values	
Description of Impact		
Changes in property values due to visual and other impacts		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical and socio-economic impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) and in this study would thus also minimise property value impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

7.14.3.2 Operational Phase

Table 7-156: Operation: Impacts from expenditure on the operation of the project

Issue	Impacts from expenditure on the operation of the project
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Description of Impact		
Increased economic activity best measured through changes in expenditure and employment		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	High
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	High
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	High +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. Setting up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made. This can help to ensure fairness and limit potential interference in hiring processes. An effective employee induction programme is essential to ensuring that new employees, some of whom will be unfamiliar with the responsibilities of maintaining employment, are adequately prepared and motivated to adjust to the lifestyle required of them. This programme should incorporate life skills training as well as basic financial literacy training. Counselling services should be made available to employees to ensure that they have adequate guidance. Assisting smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects. Avoiding potential service provider decisions that may lead to abuse or local dissatisfaction. For example, only appointing one accommodating rental agent or one catering supplier may lead to local dissatisfaction regarding the spreading of project benefits. 	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-157: Operation: Impacts associated with the funding of local socio-economic development, enterprise development and shareholding

Issue	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	
Description of Impact		
Economic development resulting from REIPPPP requirements and other Corporate Social Investment (CSI)		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	High
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	High
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	High +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • The project must comply with the requirements of the REIPPPP bidding process which will have stringent requirements with regard to socio-economic development, enterprise development, BBEEE shareholding etc. • The applicant must establish a communications committee early on in the project to ensure inclusive planning and regular feedback from stakeholders. • Community development should be guided by a community needs analysis, drawn up by a third party and based on local socio-economic conditions, a review of planning documents such as the IDP, and discussions with local and district-level government and community representatives. Interventions should be planned in collaboration with other energy developers in the area where relevant. • Close liaison with local and district-level municipal managers, local councilors and other stakeholders involved in socio-economic development is required to ensure that any projects are integrated into wider socio-economic development strategies and plans. 	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-158: Operation: Impacts associated primarily with the influx of people

Issue	Impacts associated primarily with the influx of people	
Description of Impact		
Resulting from influx of workers and other potential movements of people during operations		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation

Intensity	Very Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • A 'locals first' policy with regard to construction and operational labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • Condoms should be freely available to employees and all contractor workers. • Close coordination with the district and local municipalities is encouraged. 	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-159: Operation: Impacts on tourism

Issue	Impacts on tourism	
Description of Impact		
Reduction in tourism appeal due to changes in sense of place, increase in business tourism		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Probable	Probable
Significance	Medium -	Medium -
Degree to which impact can be reversed	Low	

Degree to which impact may cause irreplaceable loss of resources	Low
Degree to which impact can be mitigated	Mitigation will slightly reduce the significance of impacts
Mitigation actions	
The following measures are recommended:	Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-160: Operation: Impacts on surrounding landowners and communities

Issue	Impacts on surrounding landowners and communities	
Description of Impact		
Associated with greater activity nearby and related nuisance and damages		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • A 'locals first' policy with regard to labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • Condoms should be freely available to employees and all contractor workers. • Close coordination with the district and local municipalities is encouraged. 	

Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-161: Operation: Impacts on property values

Issue	Impacts on property values	
Description of Impact		
Changes in property values due to visual and other impacts		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical and socio-economic impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) and in this study would thus also minimise property value impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

7.14.3.3 Decommissioning Phase

Table 7-162: Decommissioning: Impacts from expenditure on the decommissioning of the project

Issue	Impacts from expenditure on the decommissioning of the project	
Description of Impact		
Increased economic activity best measured through changes in expenditure and employment		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	High
Duration	Short-term	Short-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous

Significance	Medium +	Medium +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. Setting up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made. This can help to ensure fairness and limit potential interference in hiring processes. An effective employee induction programme is essential to ensuring that new employees, some of whom will be unfamiliar with the responsibilities of maintaining employment, are adequately prepared and motivated to adjust to the lifestyle required of them. This programme should incorporate life skills training as well as basic financial literacy training. Counselling services should be made available to employees to ensure that they have adequate guidance. Assisting smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects. Avoiding potential service provider decisions that may lead to abuse or local dissatisfaction. For example, only appointing one accommodating rental agent or one catering supplier may lead to local dissatisfaction regarding the spreading of project benefits. As far as possible, avoid significant variation in salaries between various contractors for the same types of jobs. When variations are too high, the likelihood of dissatisfaction increases. 	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-163: Decommissioning: Impacts associated primarily with the influx of people

Issue	Impacts associated primarily with the influx of people	
Description of Impact		
Resulting from influx of workers and job-seekers during the decommissioning phase		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short-term	Short-term

Extent	Local	Local
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> • A 'locals first' policy with regard to decommissioning labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the decommissioning process. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • The applicant and the contractor should implement a Tuberculosis and HIV/AIDS awareness programme for all workers at the outset of the decommissioning phase. • Arrangements must be made to enable workers from outside the area to return home over the weekends or /at regular intervals. This would reduce the risk posed by non-local construction workers to local family structures and social networks. • Condoms should be freely available to employees and all contractor workers. • The applicant should honour their commitment to spend R 100 000 per year during decommissioning to contribute to security initiatives in the affected areas. • The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. • Close coordination with the municipality is required, including regular meetings. 	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-164: Decommissioning: Impacts on tourism

Issue	Impacts on tourism
Description of Impact	
Reduction in tourism appeal due to decommissioning activities	
Type of Impact	Indirect

Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on tourism are dependent on how the site is decommissioned and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-165: Decommissioning: Impacts on surrounding landowners and communities

Issue	Impacts on surrounding landowners and communities	
Description of Impact		
Associated with greater activity nearby and related nuisance and damages		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	<ul style="list-style-type: none"> No decommissioning workers, with the exception of security personnel, should be allowed to stay on the site overnight. The community should be able to contact the site manager to report any issues which they may have. The site manager should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. 	

	<ul style="list-style-type: none"> • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant should develop a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The applicant should honour his commitment to spend R 100 000 per year during construction to contribute to security initiatives. • The applicant should implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • The EMPR must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. • Mitigation measures proposed by other specialists, in particular those prescribed in the Traffic Impact Assessment, need to be adhered to.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-166: Decommissioning: Impacts on property values

Issue	Impacts on property values	
Description of Impact		
Changes in property values due to visual and other impacts		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on property values are dependent on how decommissioning happens, how the site is managed to minimise negative biophysical and socio-economic impacts. The measures recommended in other specialist	

	reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) and in this study would thus also minimise property value impacts.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (<i>Appendix C17: Socio-Economic</i>) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

7.14.4 Cumulative Impact

The following cumulative impacts have been identified and rated by IER (2022).

7.14.4.1 Construction Phase

Table 7-167: Cumulative impact: Impacts from expenditure on the construction of the project

Issue	Impacts from expenditure on the construction of the project	
Nature of cumulative impacts	Increased intensity of positive impact from multiple projects, potential for virtuous cycle of development (economies of scale for supporting industries)	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium +	High +

Table 7-168: Cumulative impact: Impacts associated primarily with the influx of people – construction phase

Issue	Impacts associated primarily with the influx of people	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms and associated gridlines, as well as all three Nuweveld Wind Farms projects and gridline going ahead at the same time would be an increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx particularly during construction.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-169: Cumulative impact: Impacts on tourism during construction

Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms projects and the two associated grid connections going ahead at the same time as the three Nuweveld Wind Farms and their associated gridline would be an increase in tourism risk but also tourism opportunities from business tourism in particular. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that construction would more likely occur in a staggered way so as to spread the effort over the distinct 18–24 months construction period planned for both the Hoogland and Nuweveld projects. Cumulative impacts have therefore been rated medium negative overall bearing in mind the relatively higher levels of uncertainty in making cumulative assessments of this nature.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

Table 7-170: Cumulative impact: Impacts on surrounding landowners and communities during construction

Issue	Impacts on surrounding landowners and communities	
Nature of cumulative impacts	Cumulatively, construction of the Hoogland grid connections alongside the Hoogland Wind Farms as well as the Nuweveld Wind Farms and associated gridline have the potential to substantially change the area's sense of place and impacts on surrounding communities could therefore be noteworthy if all were to go ahead simultaneously. However, it is	

	highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that construction would more likely occur in a staggered way so as to spread the effort over the distinct 18–24 months construction period planned for both the Hoogland and Nuweveld projects. Cumulative impacts associated with these developments are expected to be medium negative both with and without mitigation.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

Table 7-171: Cumulative impact: Impacts on property values during construction

Issue	Impacts on property values	
Nature of cumulative impacts	Cumulative impacts associated with all four Hoogland Wind Farms and associated grid infrastructure, as well as all three Nuweveld Wind Farms and associated gridline, are expected to be low negative with mitigation during construction and operations. This reflects the greater scale of development and the findings of the Visual Impact Assessment that the cumulative impacts could be high given the potential effect on the rural landscape and sense of place. It also recognises that development at this scale will provide a more significant boost to the local economy with the potential to boost property values.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.14.4.2 Operation Phase

Table 7-172: Cumulative impact: Impacts from expenditure on the operation of the project

Issue	Impacts from expenditure on the operation of the project	
Nature of cumulative impacts	Increased intensity of positive impact from multiple projects, potential for virtuous cycle of development (economies of scale for supporting industries)	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High +	High +

Table 7-173: Cumulative impact: Impacts associated primarily with the influx of people – operational phase

Issue	Impacts associated primarily with the influx of people	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms and associated grid connections, as well as all three Nuweveld Wind Farms projects and gridline going ahead at the same time would be an increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx, but relatively less so than during construction.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-174: Cumulative impact: Impacts on tourism during operation

Issue	Impacts on tourism	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms projects and the two associated grid connections going ahead, as well as the three Nuweveld Wind Farms and their associated gridline would be an increase in tourism risk but also tourism opportunities from business tourism. For the operational phase, cumulative impacts are rated as medium negative without and with mitigation.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

	Medium -	Medium -
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Table 7-175: Cumulative impact: Impacts on surrounding landowners and communities during operation

Issue	Impacts on surrounding landowners and communities	
Nature of cumulative impacts	Cumulatively, the Hoogland grid connections considered alongside the Hoogland Wind Farms as well as the Nuweveld Wind Farms and associated gridline have the potential to substantially change the area's sense of place and impacts on surrounding communities could therefore be noteworthy. Cumulative impacts associated with these developments are expected to be medium negative without mitigation and low negative with mitigation during operations.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-176: Cumulative impact: Impacts on property values during operation

Issue	Impacts on property values	
Nature of cumulative impacts	Cumulative impacts associated with all four Hoogland Wind Farms and associated grid infrastructure, as well as all three Nuweveld Wind Farms and associated gridline, are expected to be low negative with mitigation during construction and operations. This reflects the greater scale of development and the findings of the Visual Impact Assessment that the cumulative impacts could be high given the potential effect on the rural landscape and sense of place. It also recognises that development at this scale will provide a more significant boost to the local economy with the potential to boost property values.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-177: Cumulative impact: Impacts associated with the funding of local socio-economic development, enterprise development and shareholding during operation

Issue	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	
Nature of cumulative impacts	The total cumulative funding of local socio-economic and enterprise development associated with all four Hoogland projects as well as all three Nuweveld projects would generate a substantial amount of economic activity. Combined minimum investment would be in the region of between R30.7 million – R34.0 million in the average year during operation.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High +	Very High +

7.14.4.3 Decommissioning Phase

Table 7-178: Cumulative impact: Impacts from expenditure on the decommissioning of the project

Issue	Impacts from expenditure on the decommissioning of the project	
Nature of cumulative impacts	Increased intensity of positive impact from multiple projects, potential for virtuous cycle of development (economies of scale for supporting industries).	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium +	High +

Table 7-179: Cumulative impact: Impacts associated primarily with the influx of people – decommissioning phase

Issue	Impacts associated primarily with the influx of people	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms and associated grid connections, as well as all three Nuweveld Wind	

	Farms projects and gridline being decommissioned at the same time would be an increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx, but relatively less so than during construction.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-180: Cumulative impact: Impacts on tourism during decommissioning

Issue	Impacts on tourism	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms projects and the two associated grid connections going ahead at the same time as the three Nuweveld Wind Farms and their associated gridline would be an increase in tourism risk but also tourism opportunities from business tourism in particular. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that the construction and decommissioning phases would more likely occur in a staggered way so as to spread the effort over the distinct 18–24 months construction period planned for both the Hoogland and Nuweveld projects. Cumulative impacts have therefore been rated medium negative overall bearing in mind the relatively higher levels of uncertainty in making cumulative assessments of this nature.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

Table 7-181: Cumulative impact: Impacts on surrounding landowners and communities during decommissioning

Issue	Impacts on surrounding landowners and communities	
Nature of cumulative impacts	Cumulatively, decommissioning of the Hoogland gridline alongside the Hoogland Wind Farms as well as the Nuweveld Wind Farms and associated gridline have the potential to substantially change the area's sense of place and impacts on surrounding communities could therefore be noteworthy if all were to go ahead simultaneously. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that decommissioning would more likely occur in a staggered way. Cumulative impacts associated with decommissioning are expected to be medium negative without mitigation and low negative with mitigation.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

Table 7-182: Cumulative impact: Impacts on property values during decommissioning

Issue	Impacts on property values	
Nature of cumulative impacts	Cumulative impacts associated with all four Hoogland Wind Farms and associated grid infrastructure, as well as all three Nuweveld Wind Farms and associated gridline, are expected to be low negative with mitigation during decommissioning. This reflects the greater scale of development and the findings of the Visual Impact Assessment that the cumulative impacts could be high given the potential effect on the rural landscape and sense of place. It also recognises that development at this scale will provide a more significant boost to the local economy with the potential to boost property values.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Low -

7.14.5 No-Go Alternative

The no-go alternative is, by definition, the continuation of the status quo the impacts of which can best be described as neutral. In particular, it can be noted that the no-go alternative would result in:

- Neutral impacts linked to project expenditure as this expenditure would not occur.
- Neutral impacts associated with the funding of local socio-economic development initiatives as there would be no additional funding from the project.
- Neutral social impacts associated primarily with the influx of people as there would be no influx.
- Neutral impacts on surrounding landowners and communities as the risk factors associated with the project would be absent.
- Neutral impacts on tourism as the risk factors associated with the project would be absent.
- Neutral impacts on property values as risks associated with factors that might influence property values would be absent.

7.14.6 Conclusion and Recommendations

In term of positive impacts, the project would be largely supportive of local and regional socio-economic development and energy supply planning imperatives including the diversification of the economy and energy sources. The expenditure associated with the project would be about R3 billion to R3.4 billion per Wind Farm (R6 billion–R6.8 billion for both Wind Farms) and R108 million to R119 million would be spent annually during operations per Wind Farm (R216–R238 million for both). Roughly 160 to 200 jobs of 18 to 24-month duration would be associated with construction per Wind Farm (320–400 jobs for both) and between 40 and 60 direct employment opportunities would be created during operations per Wind Farm (80–120 jobs for both), resulting in major benefits. In addition, each Wind Farm would contribute a minimum of R4.3 to R4.7 million per annum if averaged over 20 years to local socio-economic development, local community shareholding and enterprise development (R8.6 million–R9.4 million for both Wind Farms). As these figures are based on the minimum requirements, they represent conservative estimates.

Negative impacts would primarily arise at a local scale. It is anticipated that, with mitigation, the risks posed to the community by the influx of people, including job seekers, would be manageable and of a low significance with mitigation. Impacts on tourism would be driven by visual and associated heritage impacts on a relatively isolated area with wilderness quality and limited signs of civilisation. However, tourism facilities and attractions in the areas surrounding the project site are very limited and sparsely distributed, with a few exceptions. The tourism context itself should limit impacts to a low significance during construction and a medium significance during operations with mitigation. Overall impacts on property values should also remain low with mitigation in keeping with the avoidance of no-go and high visual sensitivity areas and reflecting the findings of the assessment of other socio-economic impacts.

It is considered most likely that the combined positive impacts of the Hoogland 1 and Hoogland 2 Wind Farm projects would exceed the negative impacts resulting in an overall net benefit with mitigation. The projects are therefore deemed acceptable in terms of socio-economic impacts and should be allowed to proceed.

8 SUMMARY OF IMPACT ASSESSMENT

8.1 Summary of Impact Assessment for Hoogland 1 Wind Farm

8.1.1 Summary of Individual Impacts

Table 8-1 provides a summary of the potential environmental impacts that have been identified and assessed for the **Hoogland 1 Wind Farm**. The findings presented in the Final Scoping Report have been re-evaluated as part of the EIR Phase (where required) and are presented in this EIR. The summary of potential environmental impacts for the Hoogland 2 Wind Farm are presented separately in Table 8-3. Noting that the main differences in impact ratings between Hoogland 1 and Hoogland 2 are in relation to terrestrial ecology, heritage and noise.

Table 8-1: Summary of potential impacts assessed pre- and post-mitigation for Hoogland 1 Wind Farm

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
Climate Change	All Phases	Climate change impacts (GHG emissions)	Very High +	N/A
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Geotechnical	Construction	Ground disturbance during construction	High -	Medium -
	Construction	Soil erosion during construction	Medium -	Low -
	Operational	Soil erosion during operational phase	Medium -	Low -
	Decommissioning	Ground disturbance during decommissioning	High -	Medium -
	Decommissioning	Soil erosion during decommissioning stage	Medium -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Agriculture	Construction	Loss of agricultural potential by occupation of land, soil degradation and dust	Very Low -	Very Low -
	Operational	Increased financial security for farming operations	Very Low +	Very Low +
	Decommissioning	Loss of agricultural potential by soil degradation	Very Low -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Terrestrial ecology	Construction	Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Construction	Impact on the Riverine Rabbit	Medium -	Low -
	Construction	Habitat loss and degradation impact on the Karoo Dwarf Tortoise	High -	Low -
	Construction	Karoo Dwarf Tortoise mortalities due to earthworks and roadkill	Medium -	Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Operational	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Operational	Impact on the Riverine Rabbit	Medium -	Low -
	Operational	Karoo Dwarf Tortoise mortalities due to roadkill	High -	Low -
	Operational	Karoo Dwarf Tortoise mortalities due to predation by corvids	High -	Low -
	Decommissioning	Impact on the Riverine Rabbit	Medium -	Low -
	No-go alternative	The impact of the status quo prevailing	Low -	Low -
Bats	Construction	Loss of foraging habitat by clearing of vegetation	Low -	Very Low -
	Construction	Roost destruction during earthworks	Low -	Insignificant
	Operation	Bat mortalities during foraging	High -	Low -
	Operation	Bat mortalities during migration	Medium -	Low -
	Operation	Increased bat mortalities due to light attraction and habitat creation	High -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Avifauna	Construction	Habitat destruction	Medium -	Medium -
	Construction	Disturbance of birds	Low -	Low -
	Operational	Disturbance of birds	Low -	Low -
	Operational	Displacement of birds	Low -	Low -
	Operational	Collision of birds with turbines	High -	Medium -
	Operation	Collision & electrocution of birds on overhead power lines	High -	Low -
	Decommissioning	Disturbance of birds	Low -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Aquatic	Construction	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Construction	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Construction	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Construction	Potential impacts on localised surface water quality	Medium -	Very Low -
	Construction	Groundwater abstraction	Medium -	Very Low -
	Operational	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Operational	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Operational	Groundwater abstraction	Medium -	Very Low -
	Decommissioning	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Decommissioning	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Decommissioning	Potential impacts on localised surface water quality	Medium -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Visual	Construction	Visual intrusion of construction activities on the Karoo landscape.	Medium -	Medium -
	Operational	Visual intrusion of wind turbines on the Karoo landscape.	High -	High -
	Operational	Visual intrusion of infrastructure on the Karoo landscape.	Medium -	Medium -
	Operational	Visual intrusion of lighting at night.	Medium -	Medium -
	Operational	Visual impact of the N1 Bypass road on the Karoo National Park, Beaufort West town and the gold course	High -	Medium -
	Decommissioning	Visual intrusion of activities to remove infrastructure.	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Heritage	Construction	Impacts to archaeological resources	High -	Very Low -
	Construction	Damage to or destruction of built heritage resources	Insignificant	Insignificant
	Construction	Impacts to the cultural landscape	Medium -	Medium -
	Operation	Impacts to the cultural landscape	Medium -	Medium -
	Decommissioning	Impacts to the cultural landscape	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral.
Palaeontology	Construction	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value within the Hoogland Northern Wind Farm sites in the Western Cape	Low -	Very Low -
	Construction	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value of the Northern Cape watercourse crossing road upgrades	High -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Noise	Construction	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Night-time Wind Turbine construction activities (NSR 18, 19 and 23)	Low -	Very Low -
	Construction	Daytime road construction activities	Insignificant	Insignificant

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Construction	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Operation	Daytime Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	Operation	Night time Wind Turbine operation raising ambient sound levels	Low –	Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Shadow flicker	Operation	Shadow Flicker effects on identified receptors	Medium -	Insignificant
	No-Go alternative	The impact of the status quo prevailing	Insignificant	Insignificant
Traffic	Construction	Increased Road Incidents	Medium -	Low -
	Construction	Road Degradation	Medium -	Low -
	Construction	Dust	Medium -	Low -
	Construction	Intersection Safety	Medium -	Medium -
	Operation	Intersection Safety	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Low -	Neutral
Socio-economic	Construction	Impacts from expenditure on the construction of the project	Medium +	Medium +
	Construction	Impacts on tourism	Low -	Low -
	Construction	Impacts associated primarily with the influx of people	Low -	Low -
	Construction	Impacts on surrounding landowners and communities	Low -	Low -
	Construction	Impacts on property value	Low -	Low -
	Operation	Impacts from expenditure on the construction of the project	Medium +	High +
	Operation	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	Medium +	High +
	Operation	Impacts associated primarily with the influx of people	Low -	Low -
	Operation	Impacts on tourism	Medium -	Medium -
	Operation	Impacts on surrounding landowners and communities	Low -	Low -
	Operation	Impacts on property value	Low -	Low -
	Decommissioning	Impacts from expenditure on decommissioning of the project	Medium +	Medium +
	Decommissioning	Impacts associated primarily with the influx of people	Low -	Low -
	Decommissioning	Impacts on tourism	Low -	Low -
Decommissioning	Impacts on surrounding landowners and communities	Low -	Low -	

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Decommissioning	Impacts on property value	Low -	Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral

8.1.2 Summary of Cumulative Impacts

For every impact identified and assessed for the **Hoogland 1 Wind Farm** within the specialist assessments outlined in Section 7 and summarised in Section 8.1, the cumulative impact of the said impact was also considered. The summary of potential cumulative impacts for the Hoogland 2 Wind Farm are presented separately in Table 8-4., noting the main differences are with respect to terrestrial ecology, heritage and noise. As mentioned in Section 6.4, the cumulative impact assessed will be the collective impact of the four Hoogland Wind Farms and Grid Connection applications with the three Nuweveld Wind Farm and Gridline applications¹⁴. Please refer to each specialist assessment's impact assessment tables in Section 7 , as every specialist assessment also includes an assessment of cumulative impacts, pre- and post- mitigation. Please see Table 8-2 below for a summary of these.

Table 8-2: Summary of cumulative impacts assessed pre- and post-mitigation for Hoogland 1 Wind Farm

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
Climate Change	Impact on Climate Change	Very High +	N/A
Geotechnical	Ground disturbance during construction	Medium -	Low -
	Soil erosion during construction	Medium -	Low -
	Soil erosion during operation	Medium -	Low -
	Ground disturbance during decommissioning	Medium -	Low -
	Soil erosion during decommissioning	Medium -	Low -
Agriculture	Loss of agricultural potential	Very Low -	Very Low -
Terrestrial ecology	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes within the site during construction	Low -	Low -
	Impact on the Riverine Rabbit during construction	Medium -	Low -
	Impact on the Karoo Dwarf Tortoise: Habitat loss and degradation during construction	Medium -	Low -
	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes within the site during operational phase	Low -	Low -
	Operational impact on the Riverine Rabbit	Medium -	Low -

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Decommissioning impact on the Riverine Rabbit	Medium -	Low -
	Karoo Dwarf Tortoise mortalities due to earthworks, roadkill and predation by covids.	Medium -	Low -
Bats	Loss of foraging habitat by clearing of vegetation during construction	Low -	Very Low -
	Roost destruction during earthworks during construction	Low -	Very Low -
	Bat mortalities during foraging during construction	High -	Medium -
	Bat mortalities during migration during operation	High -	Medium -
	Increased bat mortalities due to light attraction and habitat creation during operation	High -	Medium -
Avifauna	Habitat destruction during construction	High -	Medium -
	Disturbance of birds during construction	Low -	Low -
	Disturbance of birds during operation	Low -	Low -
	Displacement of birds during operation	Low -	Low -
	Direct mortality of birds through collision with turbines during operation	High -	Medium -
Aquatic	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Low -
	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Low -
	Potential impacts on localised surface water quality	Medium -	Very Low -
	Groundwater abstraction	Low -	Very Low -
Visual	Cumulative visual intrusion of wind turbines on the Karoo landscape	High -	High -
Heritage	Impacts to archaeological resources during construction	Low -	Very Low -
	Damage to or destruction of built heritage resources	Very Low -	Very Low -
	Operational phase impacts to the cultural landscape	Medium -	Medium -
	Decommissioning phase impacts to the cultural landscape	Medium -	Medium -
Palaeontology	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value	Medium -	Low -
Noise	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Night-time Wind Turbine construction activities during construction	Low -	Very Low -
	Daytime road construction activities	Insignificant	Insignificant
	Daytime road traffic from construction vehicles	Insignificant	Insignificant

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Daytime operation of Wind Turbines during operation	Very Low –	Very Low -
	Night-time operation of Wind Turbines during operation	Low -	Low -
Shadow flicker	Shadow Flicker effects on identified receptors during operation	Medium -	Insignificant
Traffic	Increased Road Incidents during construction	Medium -	Low -
	Road Degradation during construction	Medium -	Low -
	Dust during construction	Medium -	Low -
	Intersection safety during construction	Medium -	Medium -
	Intersection safety during operation	Medium -	Medium -
Socio-economic	Impacts from expenditure on construction of the project - construction	Medium +	High +
	Impacts associated primarily with the influx of people - construction	Medium -	Low -
	Impacts on tourism - construction	Medium -	Medium -
	Impacts on surrounding landowners and communities - construction	Medium -	Medium -
	Impacts on property value - construction	Medium -	Low -
	Impacts from expenditure on operation of the project - operation	High +	High +
	Impacts associated with the funding of socio-economic development, enterprise development and shareholding - operation	High +	Very High +
	Impacts associated primarily with the influx of people - operation	Medium -	Low -
	Impacts on tourism - operation	Medium -	Medium -
	Impacts on surrounding landowners and communities- operation	Medium -	Low -
	Impacts on property value - operation	Medium -	Low -
	Impacts from expenditure on decommissioning of the project	Medium +	High +
	Impacts associated primarily with the influx of people - decommissioning	Medium -	Low -
	Impacts on tourism - decommissioning	Medium -	Medium -
	Impacts on surrounding landowners and communities - decommissioning	Medium -	Low -
Impacts on property value - decommissioning	Medium -	Low -	

8.2 Summary of Impact Assessment for Hoogland 2 Wind Farm

8.2.1 Summary of Individual Impacts

Table 8-3 below provides a summary of the potential environmental impacts that have been identified and assessed for the **Hoogland 2 Wind Farm**. The findings presented in the Final Scoping Report have been re-evaluated as part of the EIR Phase (where required) and are presented in this Draft EIR. The summary of potential environmental impacts for the Hoogland 1 Wind Farm are presented in Table 8-1. Noting that the main differences in impact ratings between Hoogland 1 and Hoogland 2 are in relation to ecology, heritage and noise.

Table 8-3: Summary of potential impacts assessed pre- and post-mitigation for Hoogland 2 Wind Farm

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
Climate Change	All Phases	Climate change impacts (GHG emissions)	Very High +	N/A
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Geotechnical	Construction	Ground disturbance during construction	High -	Medium -
	Construction	Soil erosion during construction	Medium -	Low -
	Operational	Soil erosion during operational phase	Medium -	Low -
	Decommissioning	Ground disturbance during decommissioning	High -	Medium -
	Decommissioning	Soil erosion during decommissioning stage	Medium -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Agriculture	Construction	Loss of agricultural potential by occupation of land, soil degradation and dust	Very Low -	Very Low -
	Operational	Increased financial security for farming operations	Very Low +	Very Low +
	Decommissioning	Loss of agricultural potential by soil degradation	Very Low -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Terrestrial Ecology	Construction	Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Low -	Very Low -
	Construction	Impact on the Riverine Rabbit	Medium -	Low -
	Construction	Habitat loss and degradation Impact on the Karoo Dwarf Tortoise	High -	Low -
	Construction	Karoo Dwarf Tortoise mortalities due to earthworks and roadkill.	Medium -	Low -
	Operational	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Operational	Impact on the Riverine Rabbit	Low -	Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Operational	Impact on the Karoo Dwarf Tortoise: Tortoise mortalities due to roadkill.	High -	Low -
	Operational	Impact on the Tortoise mortalities due to predation by corvids.	High -	Low -
	Decommissioning	Impact on the Riverine Rabbit	Low -	Low -
	No-go alternative	The impact of the status quo prevailing	Low -	Low -
Bats	Construction	Loss of foraging habitat by clearing of vegetation	Low -	Very Low -
	Construction	Roost destruction during earthworks	Low -	Insignificant
	Operation	Bat mortalities during foraging	High -	Low -
	Operation	Bat mortalities during migration	Medium -	Low -
	Operation	Increased bat mortalities due to light attraction and habitat creation	High -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral.
Avifauna	Construction	Habitat destruction	Medium -	Medium -
	Construction	Disturbance of birds	Low -	Low -
	Operational	Disturbance of birds	Low -	Low -
	Operational	Displacement of birds	Low -	Low -
	Operational	Collision of birds with turbines	High -	Medium -
	Operation	Collision & electrocution of birds on overhead power lines	High -	Low -
	Decommissioning	Disturbance of birds	Low -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Aquatic	Construction	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Construction	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Construction	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Construction	Potential impacts on localised surface water quality	Medium -	Very Low -
	Construction	Groundwater abstraction	Medium -	Very Low -
	Operational	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Operational	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Operational	Groundwater abstraction	Medium -	Very Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Decommissioning	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Decommissioning	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Decommissioning	Potential impacts on localised surface water quality	Medium -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Visual	Construction	Visual intrusion of construction activities on the Karoo landscape.	Medium -	Medium -
	Operational	Visual intrusion of wind turbines on the Karoo landscape.	High -	High -
	Operational	Visual intrusion of infrastructure on the Karoo landscape.	Medium -	Medium -
	Operational	Visual intrusion of lighting at night.	Medium -	Medium -
	Operational	Visual impact of the N1 Bypass road on the Karoo National Park, Beaufort West town and the gold course	High -	Medium -
	Decommissioning	Visual intrusion of activities to remove infrastructure.	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Heritage	Construction	Impacts to archaeological resources	High -	Very Low -
	Construction	Impacts to the cultural landscape	Medium -	Medium -
	Operation	Impacts to the cultural landscape	Medium -	Medium -
	Decommissioning	Impacts to the cultural landscape	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Palaeontology	Construction	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value within the Hoogland Northern Wind Farm sites in the Western Cape	Low -	Very Low -
	Construction	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value of the Northern Cape water course crossing road upgrades	High -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Noise	Construction	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Night-time Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Daytime road construction activities	Very Low -	Very Low -
	Construction	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Operation	Daytime Wind Turbine operation raising ambient sound levels	Very Low -	Very Low -
	Operation	Night time Wind Turbine operation raising ambient sound levels	Low -	Very Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Shadow flicker	Operation	Shadow Flicker effects on identified receptors	Medium -	Insignificant
	No-Go alternative	The impact of the status quo prevailing	Insignificant	Insignificant
Traffic	Construction	Increased Road Incidents	Medium -	Low -
	Construction	Road Degradation	Medium -	Low -
	Construction	Dust	Medium -	Low -
	Construction	Intersection Safety	Medium -	Medium -
	Operation	Intersection Safety	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Low -	Neutral
Socio-economic	Construction	Impacts from expenditure on the construction of the project	Medium +	Medium +
	Construction	Impacts on tourism	Low -	Low -
	Construction	Impacts associated primarily with the influx of people	Low -	Low -
	Construction	Impacts on surrounding landowners and communities	Low -	Low -
	Construction	Impacts on property value	Low -	Low -
	Operation	Impacts from expenditure on the construction of the project	Medium +	High +
	Operation	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	Medium +	High +
	Operation	Impacts associated primarily with the influx of people	Low -	Low -
	Operation	Impacts on tourism	Medium -	Medium -
	Operation	Impacts on surrounding landowners and communities	Low -	Low -
	Operation	Impacts on property value	Low -	Low -
	Decommissioning	Impacts from expenditure on decommissioning of the project	Medium +	Medium +
	Decommissioning	Impacts associated primarily with the influx of people	Low -	Low -
	Decommissioning	Impacts on tourism	Low -	Low -
	Decommissioning	Impacts on surrounding landowners and communities	Low -	Low -
	Decommissioning	Impacts on property value	Low -	Low -
No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral	

8.2.2 Summary of Cumulative Impacts

For every impact identified and assessed for the **Hoogland 2 Wind Farm** within the specialist assessments outlined in Section 7 and summarised in Section 8.2, the cumulative impact of the said impact was also considered. As mentioned in Section 6.4, the cumulative impact assessed will be the collective impact of the four Hoogland Wind Farms and Grid Connection applications with the three Nuweveld Wind Farm and Gridline applications¹⁴. Please refer to each specialist assessment's impact assessment tables in Section 7 to review this, as every specialist assessment also includes an assessment of cumulative impacts, pre- and post- mitigation. Please see Table 8-4 below for a summary of this.

Table 8-4: Summary of potential cumulative impacts assessed pre- and post-mitigation for Hoogland 2 Wind Farm

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
Climate Change	Impact on Climate Change	Very High +	N/A
Geotechnical	Ground disturbance during construction	Medium -	Low -
	Soil erosion during construction	Medium -	Low -
	Soil erosion during operational phase	Medium -	Low -
	Ground disturbance during decommissioning	Medium -	Low -
	Soil erosion during decommissioning stage	Medium -	Low -
Agriculture	Loss of agricultural potential	Very Low -	Very Low -
Terrestrial ecology	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes during construction	Low -	Low -
	Impact on the Riverine Rabbit during construction	Medium -	Low -
	Impact on the Karoo Dwarf Tortoise: Habitat loss and degradation during construction	Medium -	Low -
	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes during the operational phase	Low -	Low -
	Operational impact on the Riverine Rabbit	Medium -	Low -
	Decommissioning impact on the Riverine Rabbit	Medium -	Low -
	Karoo Dwarf Tortoise mortalities due to earthworks, roadkill and predation by corvids	Medium -	Low -
Bats	Loss of foraging habitat by clearing of vegetation during construction	Low -	Very Low -
	Roost destruction during earthworks during construction	Low -	Very Low -
	Bat mortalities during foraging during operation	High -	Medium -
	Bat mortalities during migration during operation	High -	Medium -
	Increased bat mortalities due to light attraction and habitat creation during operation	High -	Medium -
Avifauna	Habitat destruction during construction	High -	Medium -
	Disturbance of birds during construction	Low -	Low -

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Disturbance of birds during operation	Low -	Low -
	Displacement of birds during operation	Low -	Low -
	Direct mortality of birds through collision with turbines during operation	High -	Medium -
Aquatic	Damage or loss of riparian systems and disturbance of waterbodies during construction and decommissioning	Medium -	Very Low -
	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function during all project phases	Medium -	Low -
	Changes to hydrological regimes that could also lead to sedimentation and erosion during construction and operation	Medium -	Low -
	Potential impacts on localised surface water quality during construction and decommissioning	Medium -	Very Low -
	Groundwater abstraction during construction and operation	Low -	Very Low -
Visual	Cumulative visual intrusion of wind turbines on the Karoo landscape.	High -	High -
Heritage	Impacts to archaeological resources during construction	Low -	Very Low -
	Operational phase impacts to the cultural landscape	Medium -	Medium -
	Decommissioning phase impacts to the cultural landscape	Medium -	Medium -
Palaeontology	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value	Medium -	Low -
Noise	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Night-time Wind Turbine construction activities	Insignificant	Insignificant
	Daytime road construction activities	Very Low -	Very Low -
	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Daytime Wind Turbine operation raising ambient sound levels	Very Low -	Very Low -
	Night time Wind Turbine operation raising ambient sound levels	Low -	Very Low -
Shadow flicker	Shadow Flicker effects on identified receptors during operation	Medium -	Insignificant
Traffic	Increased road incidents during construction	Medium -	Low -
	Road degradation during construction	Medium -	Low -
	Dust during construction	Medium -	Low -
	Intersection safety during construction	Medium -	Medium -
	Intersection safety during operation	Medium -	Medium -
Socio-economic	Impacts from expenditure on construction of the project - construction	Medium +	High +

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Impacts associated primarily with the influx of people - construction	Medium -	Low -
	Impacts on tourism - construction	Medium -	Medium -
	Impacts on surrounding landowners and communities - construction	Medium -	Medium -
	Impacts on property value - construction	Medium -	Low -
	Impacts from expenditure on operation of the project - operation	High +	High +
	Impacts associated with the funding of socio-economic development, enterprise development and shareholding - operation	High +	Very High +
	Impacts associated primarily with the influx of people - operation	Medium -	Low -
	Impacts on tourism - operation	Medium -	Medium -
	Impacts on surrounding landowners and communities- operation	Medium -	Low -
	Impacts on property value - operation	Medium -	Low -
	Impacts from expenditure on decommissioning of the project	Medium +	High +
	Impacts associated primarily with the influx of people - decommissioning	Medium -	Low -
	Impacts on tourism - decommissioning	Medium -	Medium -
	Impacts on surrounding landowners and communities - decommissioning	Medium -	Low -
	Impacts on property value - decommissioning	Medium -	Low -

Key recommendations from the various specialists for consideration are provided in Section 8.3 below.

8.3 Key Recommendations

8.3.1 Key Recommendations for Hoogland 1 Wind Farm

The table below provide a synopsis of the specialist recommendations that are specific for the Hoogland 1 Wind Farm. Noting that visual and heritage are the only disciplines with different recommendations to the Hoogland 2 Wind Farm.

Table 8-5: Specialist Key Recommendations for Hoogland 1 Wind Farm

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
Climate Change	<ul style="list-style-type: none"> The biggest climate change vulnerability of the project lies in the increased number of extremely hot days that could potentially occur. In this respect, it is recommended that the project owners engage with the turbine manufacturers to ensure the operability of the turbines under those conditions.
Geotechnical	<ul style="list-style-type: none"> Formal monitoring during construction should be undertaken on a weekly basis. Routine operational monitoring should form part of the standard operating procedures for each site. Weekly monitoring should be undertaken during the decommissioning stage and thereafter at four monthly intervals until final sign-off.
Agriculture	<ul style="list-style-type: none"> Design and implement an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion. This is included in the stormwater management plan. Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.
Terrestrial Ecology (including Riverine Rabbit and Karoo Dwarf Tortoise)	<ul style="list-style-type: none"> Undertake a pre-construction walk through of the development footprint to refine the layout through micro-siting of turbines, buildings, substation (and associated battery facility), access roads and internal roads where it impacts on SCC. It is recommended that a Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. The details of the monitoring programme should be developed in collaboration with the EWT Dryland Programme and should at minimum include the following components and outcomes: <ul style="list-style-type: none"> Preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site. Matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. It is estimated that each phase of the above monitoring would need to last approximately 1 year (not necessarily continuously, but in order to capture different seasons and different associated activity levels). The monitoring must be conducted in a manner which allows for reliable effect sizes and statistically-backed inferences to be made. Funding to conduct the above monitoring and a feedback mechanism to improve future wind energy development in areas with Riverine Rabbits (i.e., input on guidelines for wind energy development in Riverine Rabbit areas).

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
	<ul style="list-style-type: none"> • All incidents involving Riverine Rabbits should be documented and reported to the local EWT field office in Loxton. If Rabbits are killed, the carcasses should be collected and provided to EWT for the collection of DNA and other samples. • For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. • A Karoo dwarf tortoise Monitoring Plan must be compiled for the construction and operational phases prior to construction, to provide for monitoring of the following components: <ul style="list-style-type: none"> ○ Monitor construction activities aimed at reducing impacts on the Karoo Dwarf Tortoise, i.e., an ECO must oversee the implementation of mitigating measures. ○ Monitor (keep log of) tortoise killed by earthworks and traffic. ○ Conduct annual karoo dwarf tortoise surveys along the powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcasses observed along the powerlines.
Bats	<ul style="list-style-type: none"> • A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed. • Should it be found that the wind farm is in a migration path, the appropriate mitigation measures should be applied to ensure that each facility's bat mortalities are below a sustainable threshold. • At turbine bases (if applicable) and other infrastructure buildings, only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. • During the operational bat mortality monitoring, the bat specialist should visit and make observations on the operational wind farm to determine that no outside lights are installed and positioned in a way where it can increase the probability of bat mortalities from turbines. • Ensure the design does not allow for any entrance holes into any roof cavity.
Avifauna	<ul style="list-style-type: none"> • A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. • Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline), as well as in accordance with the operational monitoring plan.

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
	<ul style="list-style-type: none"> • Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk³²; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer. • Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these. • The safety of the pole design currently proposed, should be improved by using a bird perch at the very top of the pole. • The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins <i>et al.</i>, 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into an Adaptive Management Plan for the facility.
Aquatic Ecology	<ul style="list-style-type: none"> • A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the Stormwater Management Plan and Aquatic Rehabilitation and Monitoring Plan, coupled to micro-siting of the final layout. • A detailed stormwater management plan must be developed in the pre-construction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil. Specific measures relating to watercourse crossing upgrades are detailed in the specialist report (and in the EMPr). These stormwater control systems must be monitored in the first few months of use and then inspected on an annual basis during operation to ensure they are functional. • All alien plants within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed watercourse crossings. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes; as well as for contamination.
Visual	<ul style="list-style-type: none"> • Visually sensitive skylines, such as dolerite ridges, koppies and rock outcrops, avoided in the layout design.

³² Since it will be several years before the proposed wind farm is constructed, there is an opportunity to learn more about these two measures in the interim and make a decision on which option is implemented at that time. Several operational wind farms have just begun observer led shutdown on demand programmes in SA, and two wind farms are about to trial blade painting. There is therefore a high likelihood of having more experience on the effectiveness of such measures a year or two from now.

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
	<ul style="list-style-type: none"> Where a choice exists between turbines to be dropped (when the final 60 turbine positions, or less, are selected), and all other factors are equal, priority should be given to dropping outlier turbines or those in the 'high' visual sensitivity areas including those within 1 km of the R381, and consideration given to removing turbines where widening of gaps improve the clustering effect. Use of available technology to minimise the visual effect of navigation lights conforming with CAA requirements. Note from EAP: The Applicant has committed to adopting on demand aviation warning lights as a condition of the authorisation even though CAA has not yet approved such a system (see Section 10.3).
Heritage	<ul style="list-style-type: none"> A pre-construction survey of the entire authorised footprint must be undertaken in order to determine whether any further archaeological sites may need mitigation or protection through micro-siting (if possible). The archaeological site at waypoint 1703 that will be crossed by a proposed wind farm road must be excavated prior to construction. Excavation should at least cover the area to be disturbed. The archaeological site at waypoints 1978 and 1979 that will be overlapped by a turbine footing must be excavated prior to construction. Excavation must target the densest part(s) of the scatter within or close to the impact zone. The two graves at waypoint 1696 must be fenced with a regular farm-style fence with a pedestrian entrance gate so as to ensure that they are easily identifiable on site. The fence must be placed at least 5 m from the graves and the electrical cable must be placed a minimum of 5 m away from the fence, but preferably further if possible. Trenching within 30 m of waypoint 1696 must be monitored by relevant project staff and/or the ECO. Road construction work around the Slangfontein farm werf must be monitored by relevant project staff and/or the ECO to ensure that the walls remain unharmed. A pre-construction survey of the entire authorised footprint must be undertaken in order to determine whether any further archaeological sites may need mitigation or protection through micro-siting (if possible). A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity must be used to reduce the night-time impacts to the sense of place. If the wind farm is approved and the final layout does not need all approved turbine locations to ensure a maximum of 60 turbines, then where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping turbines in the high visual sensitivity areas and within 1 km of the R381, as well as turbines 72 and 75 due to their proximity to the Slangfontein homestead which is a IIIA cultural landscape. If any archaeological material or human burials are uncovered during the course of development, then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution. Replacement structures for the existing bridges on the local access roads must be designed to have a similar appearance to the current structures.

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
	<ul style="list-style-type: none"> In the Northern Cape, a permit application to NBKB will need to be made on SAHRIS for alteration or demolition of the R381 bridge which is older than 60 years.
Palaeontology	<p><u>Applicable to Wind Farm sites within Western Cape:</u></p> <ul style="list-style-type: none"> The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey. An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work. Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase. <p><u>Applicable to Northern Cape watercourse crossings:</u></p> <ul style="list-style-type: none"> A well-preserved tetrapod skull and skeleton were observed near crossing DR02314-2&3. Mitigation of this specimen is recommended. The ECO must be informed that sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) have a Very High Palaeontological Sensitivity. Training of accountable supervisory personnel by a qualified palaeontologist in the recognition of fossil heritage is very important and necessary. If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) so that mitigation (recording and collection) can be carried out. Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
Noise	<ul style="list-style-type: none"> Once-off noise measurements are recommended at the location of NSRs 18 and 19 before the construction phase start, to establish the existing ambient sound levels. Once the Wind Farms are operational, noise measurements should be repeated to assess the noise levels at these receptors. A complaints register must be kept on site. Should there be a noise complaint, once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint (NSR staying within 2 000 m from construction, operational or decommissioning activities). The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading.
Shadow Flicker	<ul style="list-style-type: none"> In the event of a complaint received, and an appropriate investigation confirms occurrence, then measures such as those outlined below will be explored with the residents or receptor owners to select the most suitable measures to prevent re-occurrence and protect residential amenity: <ul style="list-style-type: none"> Control at Receptor: The provision of blinds, shutters or curtains to affected receptors; Control on Pathway: for example, screening planting close to an affected receptor; and Control at Source: for example, shutdown of turbines at times when effects occur as a last resort.

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
Traffic	<ul style="list-style-type: none"> • The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development. • The access into Loxton from the TR016 (R63) is to be upgraded by the developer to accommodate the expected transportation requirements. This upgrade would need to be implemented to facilitate the delivery of abnormal loads to the proposed development. This is only applicable if this has not already been undertaken as part of the Nuweveld Wind Farm Project. • The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801. • The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete. • The developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development. • A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development. • The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network. • The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road. • The interaction of concrete delivery trucks on the public road network is a serious concern that needs to be mitigated prior to the approval of the proposed development.
Socio-economic / tourism	<ul style="list-style-type: none"> • Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce). • Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REIPPPP local content requirements. • Ensure that employees are adequately prepared to cope with the challenges that come with being employed through the establishment of an employee induction programme. • Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development. • The Project Owner and the contractors should develop a Code of Conduct for the project and all staff, contractors and members of the workforce must be made aware of the Code of Conduct during the recruitment process. • Awareness training must be provided during their induction onsite and prior to commencement of work duties on site.

DISCIPLINE	KEY RECOMMENDATIONS - HOOGLAND 1 WIND FARM
	<ul style="list-style-type: none"> • The Project Owner and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • Establish a Monitoring Programme in collaboration with affected landowners that is specifically designed to provide clarity on impacts and risks. Aspects or risks that should be monitored need to be agreed on with affected landowners. The Contractor/ Project Owner should formally commit to mitigation and potential compensation actions that may arise from REIPPPP monitoring requirements. • The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

8.3.2 Key Recommendations for Hoogland 2 Wind Farm

The table below provide a synopsis of the specialist recommendations that are specific to the Hoogland 2 Wind Farm. As mentioned, visual and heritage are the only disciplines with different recommendations to the Hoogland 1 Wind Farm.

Table 8-6: Specialist Key Recommendations for Hoogland 2 Wind Farm

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
Climate Change	<ul style="list-style-type: none"> • The biggest climate change vulnerability of the project lies in the increased number of extremely hot days that could potentially occur. In this respect, it is recommended that the project owners engage with the turbine manufacturers to ensure the operability of the turbines under those conditions.
Geotechnical	<ul style="list-style-type: none"> • Formal monitoring during construction should be undertaken on a weekly basis. Routine operational monitoring should form part of the standard operating procedures for each site. • Weekly monitoring should be undertaken during the decommissioning stage and thereafter at four monthly intervals until final sign-off.
Agriculture	<ul style="list-style-type: none"> • Design and implement an effective system of stormwater run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion. This is included in the stormwater management plan. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
Terrestrial Ecology (including Riverine Rabbit and Karoo Dwarf Tortoise)	<ul style="list-style-type: none"> • Undertake a pre-construction walk through of the development footprint to refine the layout through micro-siting of turbines, buildings, substation (and associated battery facility), access roads and internal roads where it impacts on SCC. • It is recommended that a Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. • The details of the monitoring programme should be developed in collaboration with the EWT Dryland Programme and should at minimum include the following components and outcomes: <ul style="list-style-type: none"> ○ Preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site. ○ Matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. ○ It is estimated that each phase of the above monitoring would need to last approximately 1 year (not necessarily continuously, but in order to capture different seasons and different associated activity levels). The monitoring must be conducted in a manner which allows for reliable effect sizes and statistically-backed inferences to be made. ○ Funding to conduct the above monitoring and a feedback mechanism to improve future wind energy development in areas with Riverine Rabbits (i.e., input on guidelines for wind energy development in Riverine Rabbit areas). • All incidents involving Riverine Rabbits should be documented and reported to the local EWT field office in Loxton. If Rabbits are killed, the carcasses should be collected and provided to EWT for the collection of DNA and other samples. • For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. • A Karoo dwarf tortoise Monitoring Plan must be compiled for the construction and operational phases prior to construction, to provide for monitoring of the following components: <ul style="list-style-type: none"> ○ Monitor construction activities aimed at reducing impacts on the Karoo Dwarf Tortoise, i.e., an ECO must oversee the implementation of mitigating measures. ○ Monitor (keep log of) tortoise killed by earthworks and traffic. ○ Conduct annual karoo dwarf tortoise surveys along the powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcasses observed along the powerlines.
Bats	<ul style="list-style-type: none"> • A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed. • Should it be found that the wind farm is in a migration path, the appropriate mitigation measures should be applied to ensure that each facility's bat mortalities are below a sustainable threshold.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
	<ul style="list-style-type: none"> At turbine bases (if applicable) and other infrastructure buildings, only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. During the operational bat mortality monitoring, the bat specialist should visit and make observations on the operational wind farm to determine that no outside lights are installed and positioned in a way where it can increase the probability of bat mortalities from turbines. Ensure the design does not allow for any entrance holes into any roof cavity.
Avifauna	<ul style="list-style-type: none"> A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. Monitoring of breeding status of Martial and Verreaux’s Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline), as well as in accordance with the operational monitoring plan. Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk³³; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer. Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these. The safety of the pole design currently proposed, should be improved by using a bird perch at the very top of the pole. The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins <i>et al.</i>, 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into an Adaptive Management Plan for the facility.
Aquatic Ecology	<ul style="list-style-type: none"> A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the Stormwater Management Plan and Aquatic Rehabilitation and Monitoring Plan, coupled to micro-siting of the final layout. A detailed stormwater management plan must be developed in the pre-construction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil. Specific measures relating to watercourse crossing upgrades are detailed in the specialist report (and in the EMPr). These stormwater control systems must be monitored in the first few months of use and then inspected on an annual basis during operation to ensure they are functional.

³³ Since it will be several years before the proposed wind farm is constructed, there is an opportunity to learn more about these two measures in the interim and make a decision on which option is implemented at that time. Several operational wind farms have just begun observer led shutdown on demand programmes in SA, and two wind farms are about to trial blade painting. There is therefore a high likelihood of having more experience on the effectiveness of such measures a year or two from now.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
	<ul style="list-style-type: none"> All alien plants within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed watercourse crossings. Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes; as well as for contamination.
Visual	<ul style="list-style-type: none"> Visually sensitive skylines, such as dolerite ridges, koppies and rock outcrops, avoided in the layout design. Where a choice exists between turbines to be dropped (when the final 60 turbine positions, or less, are selected), and all other factors are equal, priority should be given to dropping outlier turbines or those in the 'high' visual sensitivity areas including those within 1 km of the R381, and consideration given to removing turbines where widening of gaps improve the clustering effect. Use of available technology to minimise the visual effect of navigation lights conforming with CAA requirements. Note from EAP: The Applicant has committed to adopting on demand aviation warning lights as a condition of the authorisation (see Section 10.3).
Heritage	<ul style="list-style-type: none"> A pre-construction survey of the entire authorised footprint must be undertaken in order to determine whether any further archaeological sites may need mitigation or protection through micro-siting (if possible). The archaeological site at waypoint 1703 that will be crossed by a proposed wind farm road must be excavated prior to construction. Excavation should at least cover the area to be disturbed. The two graves at waypoint 702 must be fenced with a regular farm-style fence with a pedestrian entrance gate so as to ensure that they are easily identifiable on site. The cable trench proposed through the historic farm complex of Bulskolk (in the vicinity of waypoint 113) must be sure to avoid impacting any ruined structures or other features in the vicinity. Roadworks within 30 m of the graves at waypoint 702 must be monitored by relevant project staff and/or the ECO. Trenching within the historic werf at Bulskolk (in the vicinity of waypoint 113) must be monitored by relevant project staff and/or the ECO to ensure that the various features remain unharmed. A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity must be used to reduce the night-time impacts to the sense of place. If the wind farm is approved and the final layout does not need all approved turbine locations to ensure a maximum of 60 turbines, then where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping turbines in the high visual sensitivity areas and within 1 km of the R381.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
	<ul style="list-style-type: none"> • If any archaeological material or human burials are uncovered during the course of development, then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution. • Replacement structures for the existing bridges on the local access roads must be designed to have a similar appearance to the current structures. • In the Northern Cape, a permit application to NBKB will need to be made on SAHRIS for alteration or demolition of the R381 bridge which is older than 60 years.
Palaeontology	<p><u>Applicable to Wind Farm sites within Western Cape:</u></p> <ul style="list-style-type: none"> • The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey. • An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work. • Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase <p><u>Applicable to Northern Cape watercourse crossings:</u></p> <ul style="list-style-type: none"> • A well-preserved tetrapod skull and skeleton were observed near crossing DR02314-2&3. Mitigation of this specimen is recommended. • The ECO must be informed that sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) have a Very High Palaeontological Sensitivity. • Training of accountable supervisory personnel by a qualified palaeontologist in the recognition of fossil heritage is very important and necessary. • If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) so that mitigation (recording and collection) can be carried out. • Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
Noise	<ul style="list-style-type: none"> • Once-off noise measurements are recommended at the location of NSRs 18 and 19 (on Hoogland 1 however close to the Hoogland 2 boundary) before the construction phase start, to establish the existing ambient sound levels. Once the Wind Farms are operational, noise measurements should be repeated to assess the noise levels at these receptors. • A complaints register must be kept on site. Should there be a noise complaint, once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint (NSR staying within 2 000 m from construction, operational or decommissioning activities). The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
Shadow Flicker	<ul style="list-style-type: none"> ● In the event of a complaint received by the Developer Site Operator or local municipality, and an appropriate investigation confirms occurrence, then measures such as those outlined below will be explored with the residents or receptor owners to select the most suitable measures to prevent re-occurrence and protect residential amenity. <ul style="list-style-type: none"> ○ Control at Receptor: The provision of blinds, shutters or curtains to affected receptors; ○ Control on Pathway: for example, screening planting close to an affected receptor; and ○ Control at Source: for example, shutdown of turbines at times when effects occur.
Traffic	<ul style="list-style-type: none"> ● The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development. ● The access into Loxton from the TR016 (R63) is to be upgraded by the developer to accommodate the expected transportation requirements. This upgrade would need to be implemented to facilitate the delivery of abnormal loads to the proposed development. This is only applicable if this has not already been undertaken as part of the Nuweveld Wind Farm Project. ● The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801. ● The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete. ● The developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development. ● A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development. ● The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network. ● The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road. ● The interaction of concrete delivery trucks on the public road network is a serious concern that needs to be mitigated prior to the approval of the proposed development.
Socio-economic / tourism	<ul style="list-style-type: none"> ● Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce). ● Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REIPPPP local content requirements.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 2 WIND FARM
	<ul style="list-style-type: none"> • Ensure that employees are adequately prepared to cope with the challenges that come with being employed through the establishment of an employee induction programme. • Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development. • The Project Owner and the contractors should develop a Code of Conduct for the project and all staff, contractors and members of the workforce must be made aware of the Code of Conduct during the recruitment process. • Awareness training must be provided during their induction onsite and prior to commencement of work duties on site. • The Project Owner and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • Establish a Monitoring Programme in collaboration with affected landowners that is specifically designed to provide clarity on impacts and risks. Aspects or risks that should be monitored need to be agreed on with affected landowners. The Contractor/ Project Owner should formally commit to mitigation and potential compensation actions that may arise from REIPPPP monitoring requirements. • The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

9 SENSITIVITY MAPS

As detailed in Section 6.1, the layout and design of the Wind Farms that the specialist assessments considered was determined by inputs from the Screening and Scoping Phases. In the specialist assessments of the layout during the Scoping Phase, some specialists identified additional features/areas that required avoidance by the development. The recommended changes to avoid such features/areas have been implemented in the design of the layouts for the EIA Phase and are detailed in the EIA Report (this report).

Specifically, the specialists identified key features/areas on site pertaining to their respective field of study and developed sensitivity criteria for each of the following infrastructure types: turbines; internal overhead power lines; roads and underground cables; and buildings, see Table 9-1. These outputs were provided spatially and were compiled into the consolidated No-Go maps (which combines the No-Go sensitivities of all specialist fields into one map). The No-Go maps for each infrastructure type are shown in Figure 9-1 - Figure 9-8. Note that all specialist No-Go areas have been avoided in totality, however, due to the scale of the mapping it may appear that some of the infrastructure infringes into these areas.

Table 9-1: No-Go and sensitivity criteria informing the sensitivity mapping

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
Geotech	No-Go • 1:4 slopes with 30 m buffer	None	None	None	None	
Agriculture	No-Go • Very High sensitivity areas (crop boundaries showing arable land)	High Very High sensitivity areas (crop boundaries showing arable land)	No-Go Very High sensitivity areas (crop boundaries showing arable land)	No-Go • Very High sensitivity areas (crop boundaries showing arable land)	None	
Ecology	No-Go • Drainage Lines & Basins • Plains Wash • Dolerite Hills & Outcrops • Slopes (Steep) • Slopes (Other)* • Flat Plains, Calcrete and Plateau areas • Dams • Ridges, Escarpments & Hills • RR Habitat, Connectivity & Buffering ³⁴	No-Go • Drainage Lines & Basins • Plains Wash • Dolerite Hills & Outcrops • Slopes (Steep) • Flat Plains and Plateau areas • Ridges, Escarpments & Hills • RR Habitat, Connectivity & Buffering ³⁴ High • Drainage • Dams • Dolerite Slopes • Slopes (Steep) • Slopes (Other) • Flats • Plains Wash • RR Habitat, Connectivity & Buffering	Same as turbines	No-Go • Drainage Lines & Basins • Plains Wash • Dolerite Hills & Outcrops • Slopes (Steep) • Flat Plains and Plateau areas • Ridges, Escarpments & Hills • RR Habitat, Connectivity & Buffering ³⁴	None	Definition of No-Go: Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas represent no-go areas from a developmental perspective and should be avoided. For roads and cables no-go where these features need to be traversed, existing roads or disturbance footprints should be used. Definition of High: Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution. Where roads are required through these areas, existing access roads should preferably be used as this reduces both the impact and the footprint of any access roads.
Aquatic	No-Go • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines ³⁵ . Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) High • None Medium • None Low	No-Go • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) High • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines ³⁵ . Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) Medium • N/A Low	No-Go • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines ³⁵ . Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) High • None Medium • None Low	No-Go • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) High • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines ³⁵ . Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) Medium • N/A Low	None	No WTG, Hard stands, related buildings, transmission line towers, or new internal roads are allowed within: • Endorheic Pan areas Including their buffers, • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) Only existing roads may be used, and any upgrades may only take place once the proposed designs have been evaluated in the field by the specialist. No WTG, Hard stands, related buildings, or new internal roads are allowed within: • Large Mainstem rivers and alluvial pans, and minor drainage lines. The placement of pylons and new internal roads should avoid these areas but will be evaluated on a case-by-case basis.

³⁴ Riverine Rabbit buffer between 300m-500m depending on topography.

³⁵ Minor watercourse: The feature itself is 20m wide, with additional 10m buffer on either side. Total 40m width.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	<ul style="list-style-type: none"> Artificial - Dams & Reservoirs some with permanent water 	Artificial - Dams & Reservoirs some with permanent water Additional No-Go's for Platforms Only: No-Go <ul style="list-style-type: none"> Large Mainstem rivers and Alluvial pans and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) Minor drainage lines ³⁵ . Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer)	Artificial - Dams & Reservoirs some with permanent water	Artificial - Dams & Reservoirs some with permanent water		<ul style="list-style-type: none"> Minor drainage lines-. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer). The placement of new internal roads should avoid these areas, but will be evaluated on a case by case basis. No constraints are associated with artificial systems, the only restrictions being if these provide bird or bat habitat then they should be avoided / excluded from the development footprint Pylon placement can be evaluated on a case-by-case basis during the planning phase.
Bats	No-Go <ul style="list-style-type: none"> Valley bottom wetlands (200m buffer plus 97.5m blade buffer) Pans and depressions (200m buffer plus 97.5m blade buffer) Dams (200m buffer plus 97.5m blade buffer) Rocky boulder koppies (tors) (200m buffer) Exposed rocky cliff edges (200m buffer plus 97.5m blade buffer) Drainage lines capable of supporting riparian vegetation. (200m buffer plus 97.5m blade buffer) Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds (200m buffer plus 97.5m blade buffer) Medium <ul style="list-style-type: none"> Alluvial plains and washes (150m plus 97.5m blade buffer) Seasonal drainage lines (150m plus 97.5m blade buffer) Small and low exposed rocky cliffs and edges (150m plus 97.5m blade buffer) 	High <ul style="list-style-type: none"> Valley bottom wetlands Pans and depressions Dams Rocky boulder koppies (tors) Exposed rocky cliff edges Drainage lines capable of supporting riparian vegetation. Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds	No-Go <ul style="list-style-type: none"> Valley bottom wetlands Pans and depressions Dams Rocky boulder koppies (tors) Exposed rocky cliff edges Drainage lines capable of supporting riparian vegetation. Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds High <ul style="list-style-type: none"> Valley bottom wetlands (200m buffer) Pans and depressions (200m buffer) Dams (200m buffer) Rocky boulder koppies (tors) (200m buffer) Exposed rocky cliff edges (200m buffer) Drainage lines capable of supporting riparian vegetation. (200m buffer) Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds (200m buffer)	None	None	Roads and Underground Cables & Buildings High: Preferably keep to a minimum within these areas where practically feasible.
Avifauna	No-Go <u>Priority bird species nests:</u> <ul style="list-style-type: none"> Martial Eagle Nest (6km buffer) Verreaux's Eagle VERA High areas Verreaux's Eagle VERA Medium areas³⁶ Secretarybird Nest (2.5km buffer) 	No-Go <u>Priority bird species nests:</u> <ul style="list-style-type: none"> Martial & Verreaux's Eagle & Secretarybird nests (1km buffer)) High <u>Priority bird species nests:</u>	Same as roads and underground cables.	No-Go <u>Priority bird species nests:</u> <ul style="list-style-type: none"> Martial Eagle Nest, Verreaux's Eagle (1.5km buffer) Secretarybird Nest (1km buffer) 	Same as Internal overhead power lines (roads and pylons)	For roads and cables, and buildings, the bird nest buffers take care of disturbance at nests. <u>Restrictions for high areas</u> <ul style="list-style-type: none"> Restriction on new roads, existing roads may be used

³⁶ Noting the specialist had VERA medium categorised as high however the developer has escalated this into a No-go category.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	<ul style="list-style-type: none"> Booted Eagle Nest (2km buffer) Hamerkop Nest (1km buffer) Jackal Buzzard Nest (500m buffer) Corvid Nest (500m buffer) Pale Chanting Goshawk Nest (500m buffer) <p><u>Habitat features:</u></p> <ul style="list-style-type: none"> Selected large dams buffered by 1km from edge of dam when full. Remaining small dams buffered by 300m East-west ridges: Manually delineated & buffered by 300m Pans: Manually delineated – no buffer Rivers: 1km buffer either side of the Sakriver & 300m buffer either side of other rivers Arable lands: Avoid by development but not delineated since Agricultural specialist has delineated based on national ‘field crop boundary’ layers, and arable lands are mostly located adjacent to dams & rivers which have been buffered <p>High</p> <p>N/A</p> <ul style="list-style-type: none"> <p>Medium</p> <p>Remainder of site</p> <p>Low</p> <p>N/A</p>	<ul style="list-style-type: none"> Martial & Verreaux’s Eagle nests (2km buffer) <p>Medium</p> <p>Remainder of site</p> <p>Low</p> <p>N/A</p>		<p><u>Habitat features:</u></p> <ul style="list-style-type: none"> Several large dams buffered by 1km from edge of dam when full. Remaining small dams buffered by 200m Rivers: 1km buffer either side of the Sakriver <p>High</p> <p><u>Priority bird species nests:</u></p> <ul style="list-style-type: none"> Martial Eagle Nest (6km buffer) Verreaux’s Eagle VERA High areas Secretarybird Nest (2.5km buffer) Booted Eagle Nest (2km buffer) Hamerkop Nest (1km buffer) Jackal Buzzard Nest (500m buffer) <p><u>Habitat features:</u></p> <ul style="list-style-type: none"> Rivers: 300m buffer either side of other rivers East-west ridges: Manually delineated & buffered by 300m Pans: Manually delineated – no buffer <p>Medium</p> <p>Remainder of site</p> <p>Low</p> <p>N/A</p>		<ul style="list-style-type: none"> Restriction on total cumulative length of power line in High area
Heritage (including Palaeontology, Archaeology, Graves, Built Environment, Cultural landscape)	<p>No-Go</p> <ul style="list-style-type: none"> GRADE IIIA Features, sites or cultural landscapes (50m buffer) (Points representing the locations of heritage features and sites deemed to have high local heritage significance or cultural landscapes of high heritage significance) <p>High</p> <ul style="list-style-type: none"> GRADE IIIB Feature - Points representing the locations of heritage features deemed to have medium local heritage significance. <p>Medium</p> <ul style="list-style-type: none"> GRADE IIIB Feature 50 m buffer around features. GRADE IIIB Site 50 m buffer around site complexes of medium local heritage significance. GRADE IIIC Feature - Points representing the locations of 	<p>New Roads:</p> <p>Same as turbines</p> <p>Existing Roads:</p> <p>Same as overhead lines (spanning)</p>	Same as turbines	<p>Pylons:</p> <p>Same as turbines</p>	<p>No-Go</p> <ul style="list-style-type: none"> GRADE IIIA Features (Points representing the locations of heritage features deemed to have high local heritage significance or cultural landscapes of high heritage significance) <p>High</p> <ul style="list-style-type: none"> GRADE IIIA Features, sites or cultural landscapes (50m buffer around high resources) <p>Medium</p> <ul style="list-style-type: none"> GRADE IIIB Feature - Points representing the locations of heritage features deemed to have medium local heritage significance. <p>Low</p> <ul style="list-style-type: none"> GRADE IIIB Feature 50 m buffer around medium features. GRADE IIIB Site 50 m buffer around medium site complexes. GRADE IIIC Features - points representing the locations of 	<p>Roads:</p> <p>Note that existing roads would obviously not go over point sites but they may pass through larger multi-component sites.</p> <ul style="list-style-type: none"> Existing roads to be widened/upgraded get a lower level of sensitivity as they are already present, and it is more desirable to upgrade than to build a second road nearby. Occasionally very small ‘twee-spoor’ jeep tracks can pass very close to heritage sites and create minimal existing impacts. For this reason, their upgrades are best treated like building new roads. <p>Overhead lines:</p> <ul style="list-style-type: none"> Overhead lines spanning over sites also get lower ratings because there would be no physical damage. BUT there is still a chance of damage during construction so spanning lines are only one sensitivity level lower.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	<p>heritage features deemed to have low local heritage significance.</p> <p>Low</p> <ul style="list-style-type: none"> GRADE IIIC Feature 50 m buffer around low features. GRADE IIIC Site 50 m buffer around low sites. <p>Neutral</p> <ul style="list-style-type: none"> NCW Features Points representing the locations of heritage features deemed to have very low to no heritage significance. 				<p>heritage features deemed to have low local heritage significance.</p> <ul style="list-style-type: none"> GRADE IIIC Feature 50 m buffer around low features. GRADE IIIC Site 50 m buffer around low sites. <p>Neutral</p> <ul style="list-style-type: none"> NCW Features Points representing the locations of heritage features deemed to have very low to no heritage significance. 	
Visual	<p>No-Go</p> <ul style="list-style-type: none"> Feature - Topographic feature: prominent scarps, peaks and ridges (TOPO Scarp) Feature - Topographic feature: minor ridges, scarps and outcrops (TOPO Minor) Slopes > 1:10 Scenic water features - within buffer 250m National Parks (Karoo NP) -within 5km buffer (<i>none encroaching on site</i>) Private reserves / game farms - within 1,5km buffer Farmsteads outside site – within 1km buffer Farmsteads inside site - within 500m buffer Arterial route R381 - within 750m buffer Scenic Passes/ Poorts (R381) - within 1km buffer Scenic Poorts (District Road) within 500m buffer Main district road - within 250m buffer <p>High</p> <ul style="list-style-type: none"> Topographic feature: prominent scarps, peaks and ridges – within 250 buffer Topographic feature: minor ridges, scarps and outcrops - within 150m buffer Slopes 1:10 - 1:20 Scenic water features - between 250m and 500m buffer National Parks (Karoo NP) -within 10km buffer (<i>none encroaching on site</i>) Private reserves / game farms - within 3km buffer Farmsteads outside site – within 2km buffer Farmsteads inside site - within 750m buffer 	<p>No-Go</p> <ul style="list-style-type: none"> Feature - Topographic feature: prominent scarps, peaks and ridges Slopes > 1:4 Scenic water features - within buffer 50m Farmsteads inside site - within 50m buffer <p>High</p> <ul style="list-style-type: none"> Feature - Topographic feature: prominent scarps, peaks and ridges - 50m buffer Feature - Topographic feature: minor ridges, scarps and outcrops Slopes 1:4 to 1:10 Scenic water features - within buffer 100m Farmsteads inside site - within 100m buffer Scenic Passes/ Poorts (R381) - within 100m buffer <p>Medium</p> <ul style="list-style-type: none"> Farmsteads inside site - within 150m buffer Scenic Passes/ Poorts (R381) - within 150m buffer <p>Low N/A</p>	<p>No-Go</p> <ul style="list-style-type: none"> Topographic feature: prominent scarps, peaks and ridges Minor ridges, scarps and outcrops Steep slopes > 1:4 Scenic water features - within 50m buffer Private reserves / game farms - 250m buffer Farmsteads outside - 250m buffer Farmsteads inside - 150m buffer Scenic routes / Poorts - 500m buffer Arterial route R381 - 250m buffer Main district road - 150m buffer Scenic district road - 250m buffer <p>High</p> <ul style="list-style-type: none"> Topographic feature: prominent scarps, peaks and ridges - within 100m buffer Minor ridges, scarps and outcrops - within 100m buffer Steep slopes > 1:10 Scenic water features - within 100m buffer Private reserves / game farms - 500m buffer Farmsteads outside - 500m buffer Farmsteads inside - 250m buffer Scenic routes / Poorts - 750m buffer Arterial route R381 - 500m buffer Main district road - 250m buffer Scenic district road - 500m buffer <p>Medium</p> <ul style="list-style-type: none"> Private reserves / game farms - 1km buffer Farmsteads outside - 750m buffer Farmsteads inside - 500m buffer Scenic routes / Poorts - 1km buffer Arterial route R381 - 750m buffer Main district road – 500m buffer Scenic district road - 750m buffer <p>Low N/A</p>	<p>No-Go</p> <ul style="list-style-type: none"> Scenic water features (within buffer 50m) Farmsteads inside site (within 50m buffer) Arterial route R381 (within 50m buffer) Scenic Passes/ Poorts (R381) (within 100m buffer) <p>High</p> <ul style="list-style-type: none"> Feature - Topographic feature: prominent scarps, peaks and ridges Feature - Topographic feature: minor ridges, scarps and outcrops Slopes > 1:4 Scenic water features (within buffer 100m) Farmsteads inside site (within 100m buffer) Arterial route R381 (within 100m buffer) Scenic Passes/ Poorts (R381) (within 150m buffer) Main district road (within 50m buffer) <p>Medium</p> <ul style="list-style-type: none"> Slopes > 1:10 <p>Low N/A</p>	<p>None</p>	<p>Cultural landscapes have been determined by heritage specialist.</p> <p>Roads:</p> <ul style="list-style-type: none"> Visual impacts in relation to cultural landscapes have been captured and mapped under the scenic resources such as "topographic features, ridges, peaks, scarps", "scenic water features", "farmsteads", "scenic routes" etc. <p>Internal Overhead Powerlines:</p> <ul style="list-style-type: none"> Exceptions would apply where internal overhead power lines ascend/descend scarps at right angles. The lines should follow valleys and avoid peaks/ridges where possible. The final route of internal lines needs to be reviewed by the specialist/s.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	<ul style="list-style-type: none"> Arterial route R381 - within 1km buffer Scenic Passes/ Poorts (R381) - within 1,5km buffer Scenic Poorts (District Road) within 750m buffer Main district road - within 500m buffer <p>Medium</p> <ul style="list-style-type: none"> Topographic feature: prominent scarps, peaks and ridges - within 500 buffer National Parks (Karoo NP) - within 15km buffer Private reserves / game farms - within 5km buffer Farmsteads outside site – within 3km buffer Farmsteads inside site - within 1km buffer Arterial route R381 - within 1.5km buffer Scenic Passes/ Poorts (R381) - within 2km buffer Scenic Poorts (District Road) within 1km buffer Main district road - within 750m buffer <p>Low N/A</p>					
Noise	<p>No-Go</p> <ul style="list-style-type: none"> 500m buffer from noise sensitive receptors (occupied buildings) 	None	<p>No-Go</p> <ul style="list-style-type: none"> 200m buffer from noise sensitive receptors (occupied buildings) <p>High</p> <ul style="list-style-type: none"> 200-500m buffer from noise sensitive receptors (occupied buildings) 	None	None	Note these buffers have been identified by the developer and are prescribed in the specialist report.

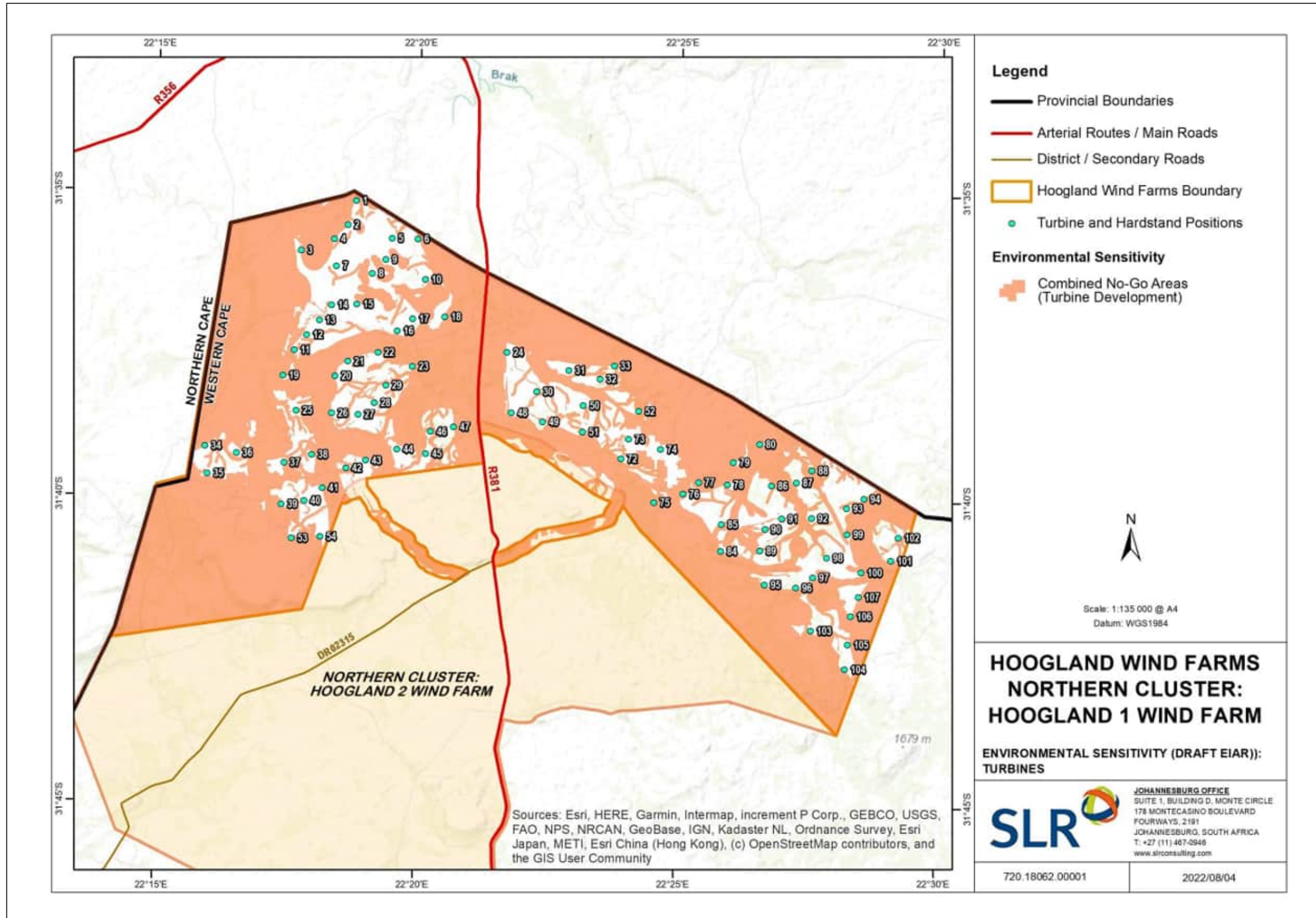


Figure 9-1: Hoogland 1 - EIR Phase Consolidated No-Go map for Turbines

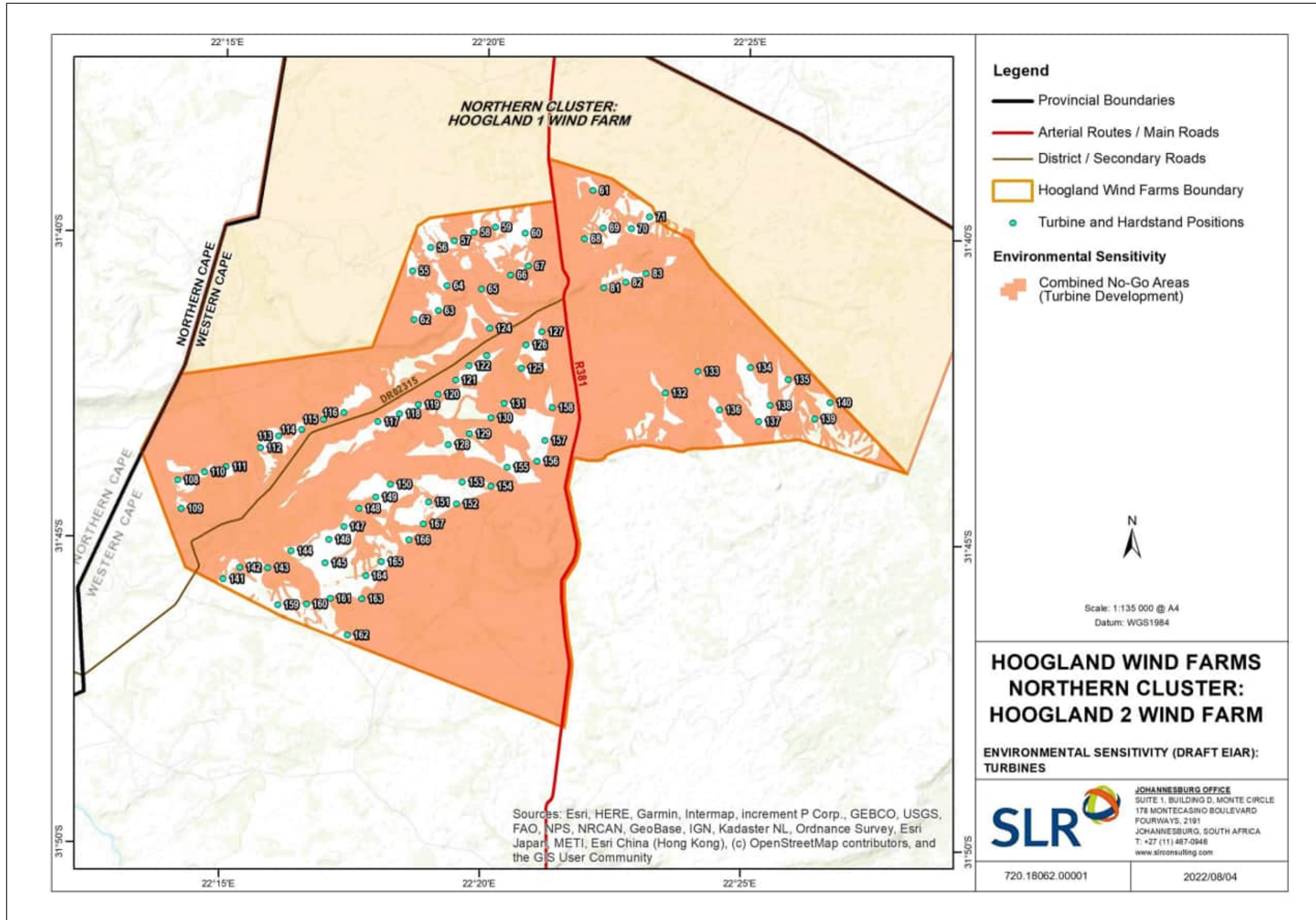


Figure 9-2: Hoogland 2 - EIR Phase Consolidated No-Go map for Turbines

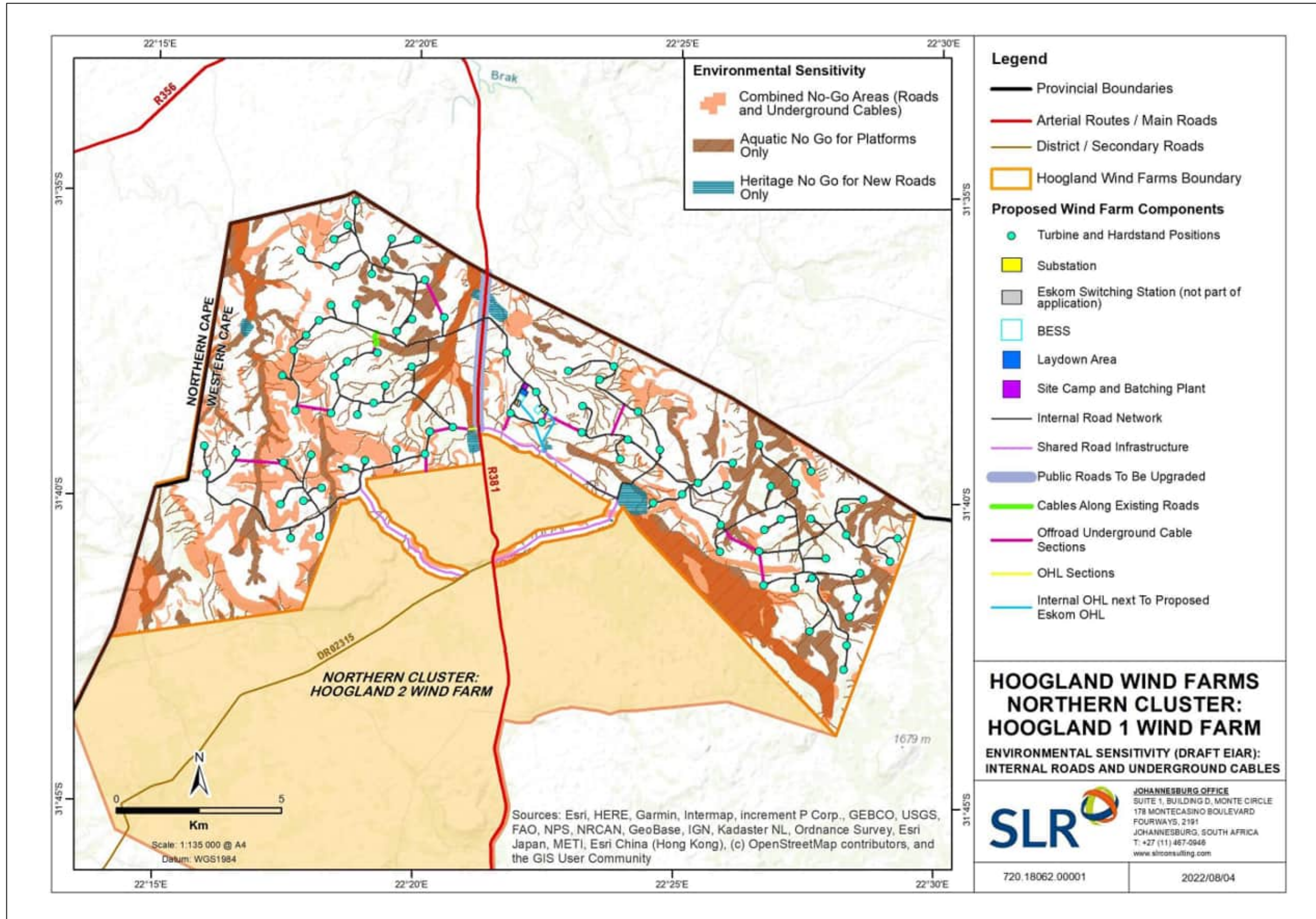


Figure 9-3: Hoogland 1 - EIR Phase Consolidated No-Go map for Roads & Underground Cables

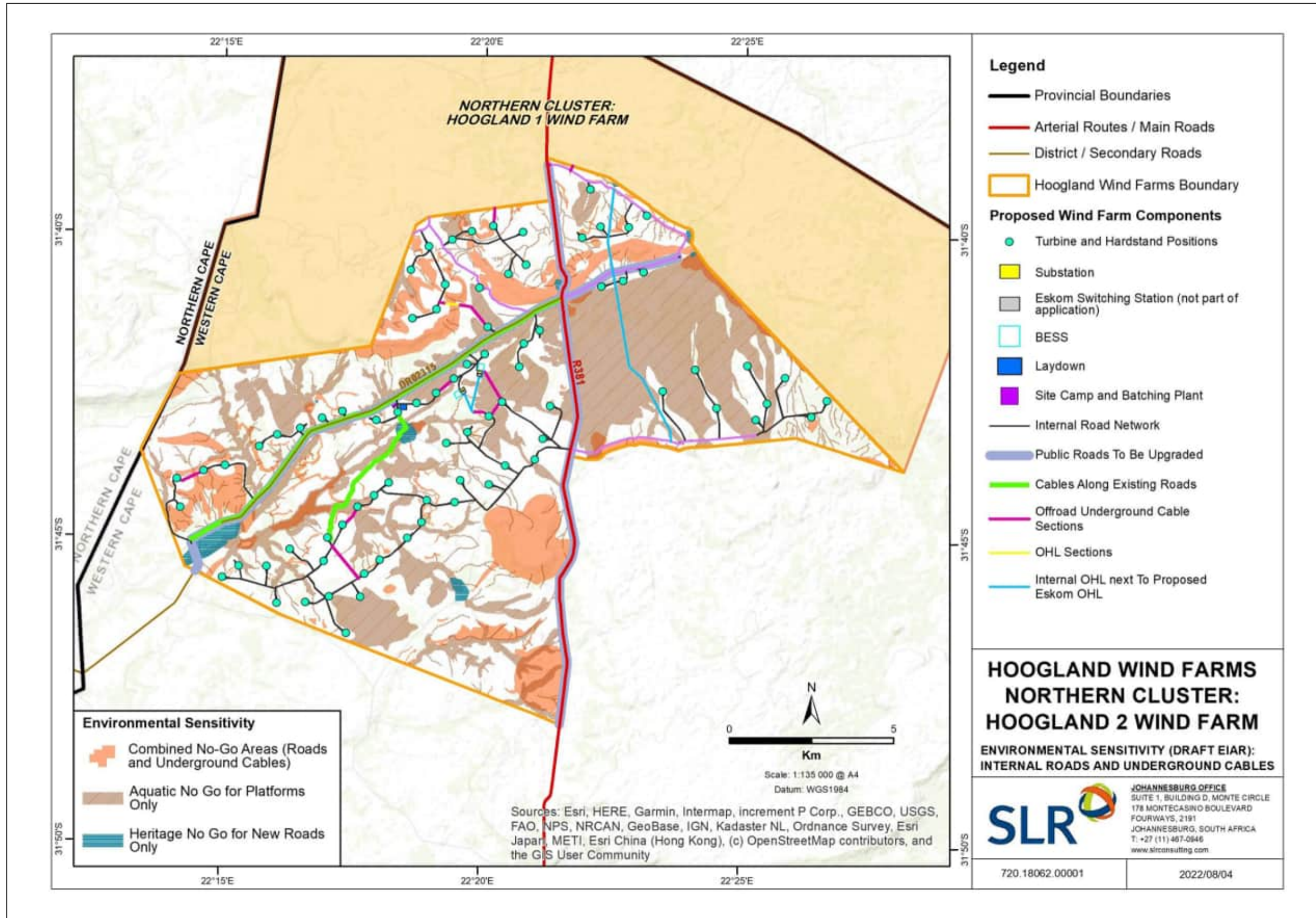


Figure 9-4: Hoogland 2 - EIR Phase Consolidated No-Go map for Roads & Underground Cables

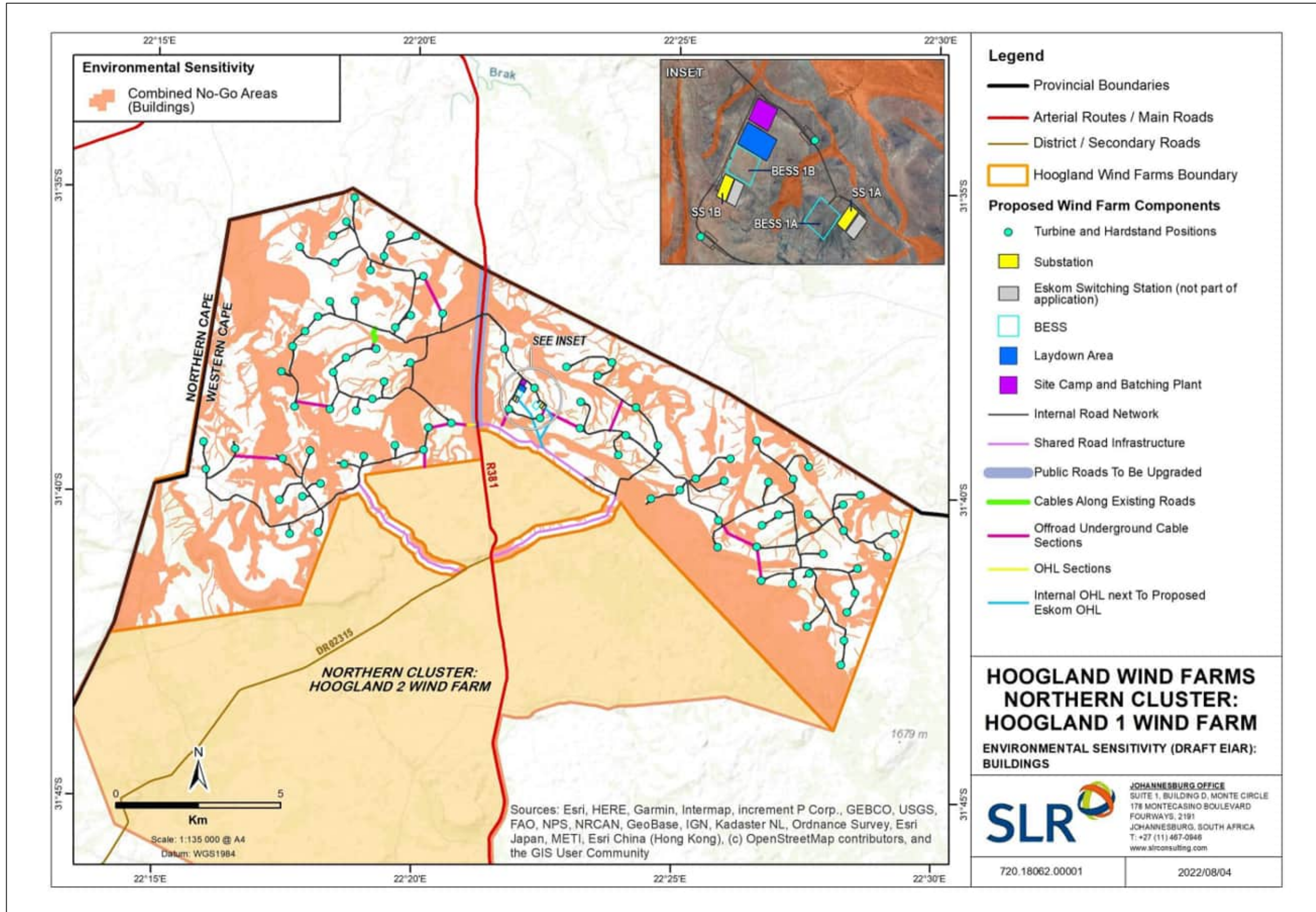


Figure 9-5: Hoogland 1 - EIR Phase Consolidated No-Go map for Buildings

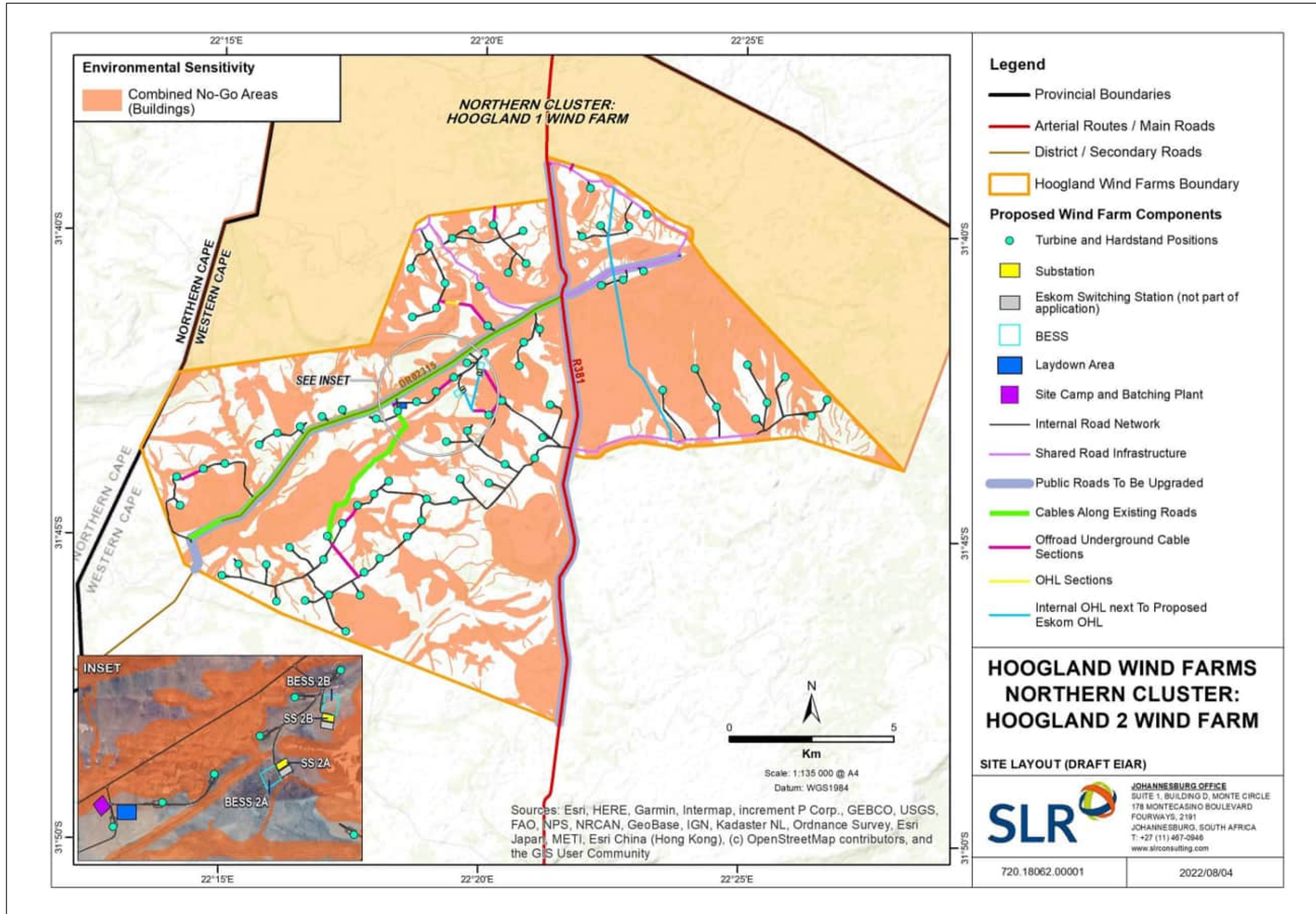


Figure 9-6: Hoogland 2 - EIR Phase Consolidated No-Go map for Buildings

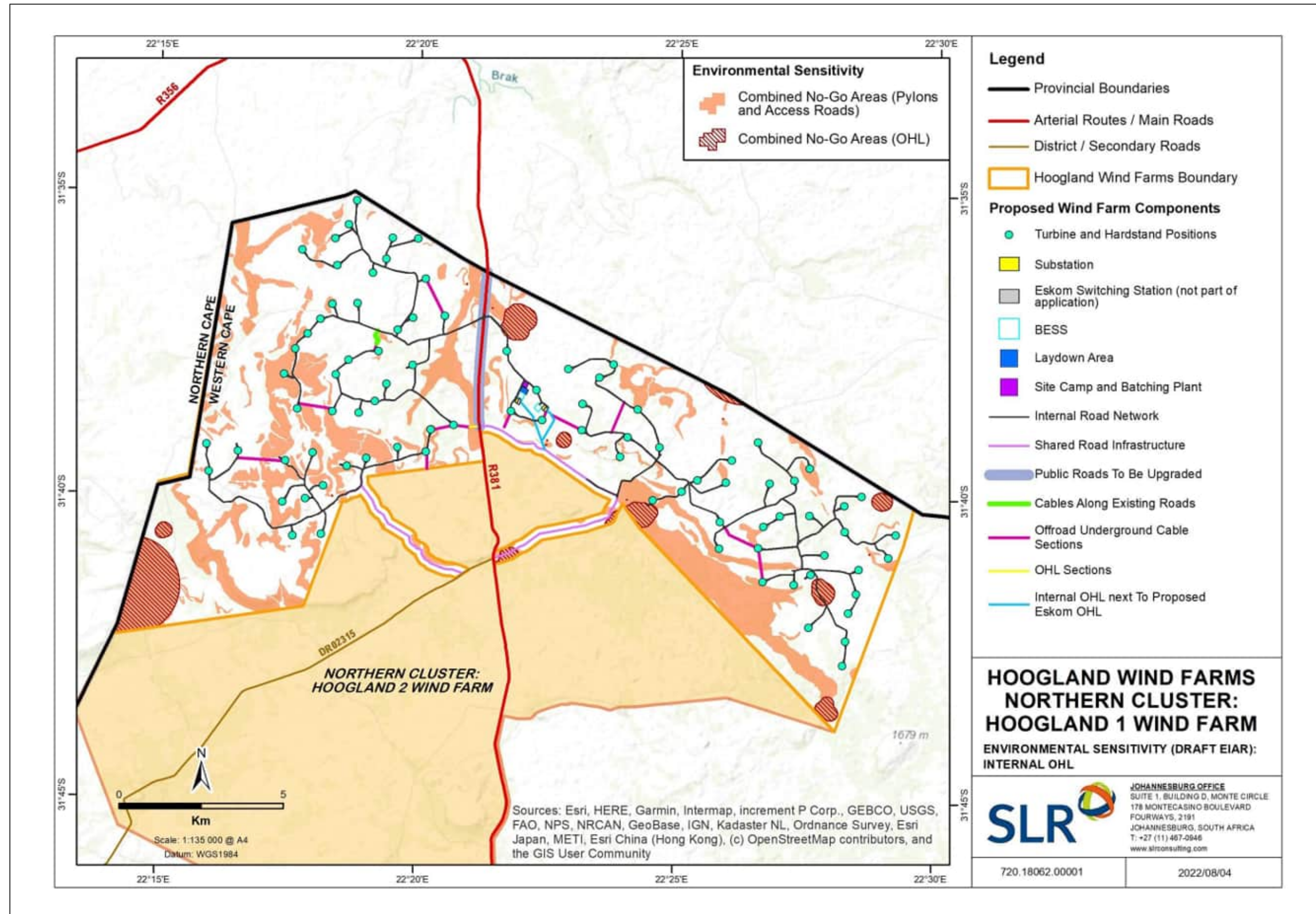


Figure 9-7: Hoogland 1 - EIR Phase Consolidated No-Go map for Internal Overhead Powerlines

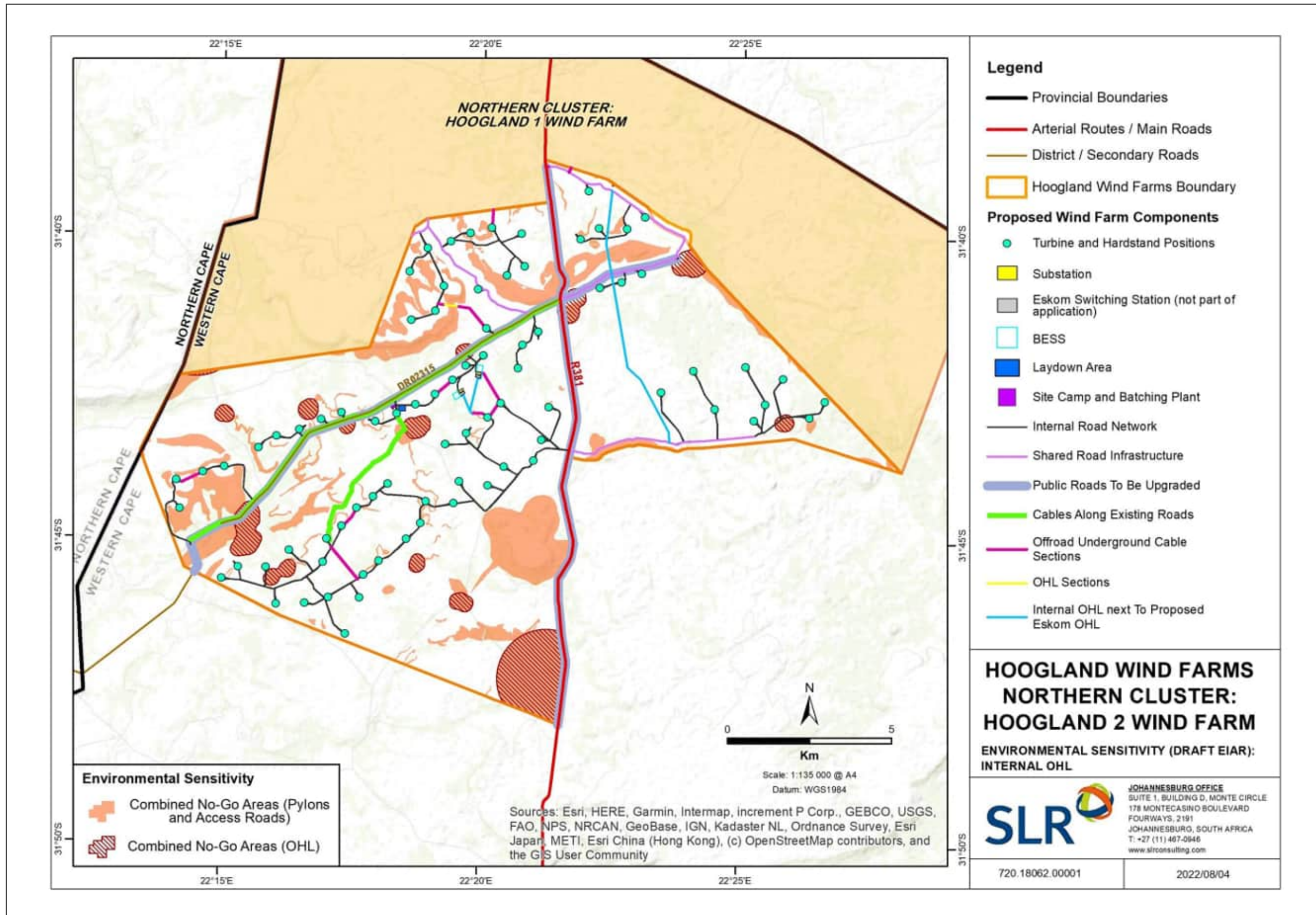


Figure 9-8: Hoogland 2 - EIR Phase Consolidated No-Go map for Internal Overhead Powerlines

10 CONCLUSION

10.1 Summary of the Process

The proposed Hoogland Northern Wind Farm projects (design and layout specifics discussed in Section 2) offer the potential to contribute in part to resolving South Africa's energy crisis and also to the national commitment to transition to a low carbon economy. The project thus stems from a sound needs and desirability basis (detailed in Section 5).

A detailed Screening and Iterative Design process preceded the formal S&EIR process and has informed the project layout that has resulted in 87 potential turbine locations considered as part of this assessment for the Hoogland 1 Wind Farm and 80 potential turbine locations for Hoogland 2 Wind Farm. Section 6 outlines the approach taken to determine the layout and design of the wind farms. Section 3 discusses the motivation for why alternatives have not been assessed and outlines the detailed Screening and Iterative Design approach. The No-Go alternative assumes that the *status-quo* remains and is considered the 'no impact alternative' since in this scenario the wind farms would not be developed. However, the No-Go alternative is also a lost opportunity for socio-economic benefits and sustainable energy production and in most cases has been assessed by the specialists as neutral or insignificant. Given the findings presented in the EIA Report (this report) and input from the various specialist assessments, the No-Go alternative is not considered to be the preferred alternative for either Hoogland 1 or Hoogland 2 Wind Farms.

The EIA Phase has therefore included an assessment of the 'No-Go alternative' against the Hoogland Northern Cluster Wind Farm projects proposed in the preferred location, as detailed in Section 2.4, utilising horizontal axis wind turbines (that are restricted by a defined rotor swept envelop) as the preferred technology and the preferred layout, developed through the iterative design process undertaken for this project.

An array of environmental aspects was identified as having the potential to be impacted by the proposed wind farm projects. The specialists listed in Table 1-3 have undertaken site visits (where required) and compiled their assessment reports based on the preferred layout. The potential impacts expected to occur as a result of the proposed wind farm projects, and any possible mitigation measures to reduce these impacts, are assessed and discussed in Section 7. All the specialist studies found that, should the required mitigation measures be implemented, the impacts associated with the Hoogland 1 Wind Farm (14/12/16/3/3/2/2147) and Hoogland 2 Wind Farm (14/12/16/3/3/2/2146) projects can be mitigated to acceptable levels and the projects are not fatally flawed in terms of their impact on the receiving environment. The cumulative impacts associated with the project have been investigated and assessed in Section 7 (and summarised in Section 8.2.2) and none of the cumulative impacts were deemed to be significant enough to be considered a fatal flaw.

10.2 Environmental Impact Statement

Red Cap have proactively sought to identify the best practical environmental option possible for the identified project site through a rigorous, iterative and multi-disciplinary process, that has involved detailed specialist studies. This approach aligns with the NEMA principles advocating for sustainable development through the adoption of the mitigation hierarchy as set out in section 2 of NEMA. Through application of this hierarchy, 'avoidance' of environmental impacts was then the basis for the approach to the process. The outcome has been a preferred layout for Hoogland 1 (14/12/16/3/3/2/2147) and Hoogland 2 (14/12/16/3/3/2/2146) Wind Farm respectively, which is the subject of this report.

The potential impacts expected to arise from the proposed Hoogland 1 and Hoogland 2 Wind Farms and associated infrastructure are summarised in Table 8-1 and Table 8-3 in Section 8. Various negative and positive impacts were identified and assessed for the construction, operational and decommissioning phases of the respective wind farm projects. The impact significance post-mitigation for the various specialist fields were assessed as ranging mainly from neutral / insignificant to medium negative significance post-mitigation, with one impact of high negative significance being the visual intrusion of wind turbines on the Karoo landscape during the operational phase as well as the high cumulative visual impact associated with this. The high impacts associated with bat, avifauna and Karoo Dwarf Tortoise mortalities can be mitigated to being of medium or low negative significance. Several positive impacts have been identified and are mostly socio-economic, ranging between medium and very high positive post-mitigation, with one very low positive agricultural related impact (namely increased financial security for farming operations) also being identified post-mitigation. Most notable is the very high positive impact on climate change through avoided GHG emissions as well as the post-mitigation high positive impact on the economy from operational expenditure, and the high positive impacts in relation to local socio-economic development, enterprise development and shareholding.

Cumulative impacts associated with the proposed wind farms were found to be acceptable post-mitigation, with the only the high residual cumulative negative impact being the visual intrusion of wind turbines on the Karoo landscape (Table 8-1 and Table 8-3). A number of residual medium negative impacts remain in terms of bats, avifauna, heritage, traffic and socio-economic receptors. Positive residual cumulative impacts are largely socio-economic from expenditure and SED initiatives. However, from a cumulative impact perspective, there are no fatal flaws that would prevent authorisation of either of the wind farms, provided the proposed mitigation measures are adhered to, and the wind farms are therefore considered acceptable in terms of cumulative impacts.

In summary, the specialist studies that informed the EIA Report have not found any fatal flaws or critical issues with the current layouts, with the most notable post-mitigation impacts being the high negative visual impacts in relation to the Karoo landscape, the high positive SED benefits, and very high positive climate change impacts (through avoided emissions), and have all concluded that the development of the wind farms may go ahead, if the proposed mitigation measures are adhered to.

After consideration of the findings presented in the EIA Report and based on the preferred layout presented within this report, it is the reasoned opinion of the EAP that the impacts associated with the proposed Hoogland 1 and Hoogland 2 Wind Farms respectively are acceptable and Environmental Authorisation (EA) (including the conditions stipulated below) should therefore be granted.

10.3 Proposed Conditions of Authorisation

10.3.1 Hoogland 1 Wind Farm Conditions

Validity of the EA

- The formal EIA process typically takes 1 to 2 years to complete and if authorised, it is the intention that the developer / applicant would then prepare the project for submission to the REIPPPP during a forthcoming bidding

window. It is currently unknown when the future bidding windows will be. Should the EA be issued for the Hoogland 1 Wind Farm project, a 10-year validity period is requested. The reason for this is due to the uncertainty regarding when the future REIPPPP bidding rounds may occur, when the Hoogland 1 Wind Farm is bid and if it receives preferred bidder status. A valid EA is one of the requirements for the submission of a project in the REIPPPP.

Micro-Siting

- The expertise of a Terrestrial Ecologist, an Aquatic Ecologist, an Archaeologist, a Palaeontologist, and an Avifaunal Specialist are to be enlisted to conduct post-authorisation micro-siting of the wind farm infrastructure with the design engineers to reduce potential impacts relating to these specialist fields.
- Final adjustments to the layouts shall be made once the specialist micro-siting recommendations from the walkthrough process have been provided. Any No-Go Areas (areas that shall be excluded from any construction activity or general access by the construction team) within the development sites or servitudes shall be clearly indicated on maps and included with the micro-siting reports or attached to the EMPr.

Terrestrial Ecology

- A Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. As there is some potential for noise and disturbance-related impacts on Riverine Rabbits, the development presents a clear opportunity to evaluate the degree to which wind farms are compatible with the maintenance and conservation of Riverine Rabbit populations within their boundaries. The monitoring programme should take account of the following:
 - It should be conducted with input from EWT and should include preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site.
 - This should be followed by matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. The exact duration and frequency of monitoring would need to be determined based on the number of cameras to be used and the desired precision and statistical power to be obtained.
 - The monitoring should include a feedback mechanism to use these findings to improve future wind energy development in Riverine Rabbit areas should be developed.
- For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo, with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. The Applicant should therefore make provision for R250,000 per annum towards this fund during the construction and operational phases of the wind farm commencing at the start of construction. The annual amount of R250,000 is applicable to the year 2022 and should be escalated in accordance with CPI each year after that.
- A Monitoring Plan for the Karoo dwarf tortoise must be compiled for the construction and operational phases prior to construction.

Bats

- A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed.

Avifauna

- The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins *et al.*, 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into the Adaptive Management Plan for the facility.

- Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline), as well as in accordance with the operational monitoring plan.
- Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer.
- Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these.
- If required by the avifaunal specialist after the walkthrough, bird perches at the top of the powerline structures should be fitted at relevant locations.

Aquatic Ecology

- Update the Stormwater Management Plan following micro-siting of the final layout.
- Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes, as well as for contamination.

Visual

- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place.

Heritage

Western Cape:

- The archaeological site at waypoint 1703 that will be crossed by a proposed wind farm road must be excavated prior to construction. Excavation should at least cover the area to be disturbed.
- The archaeological site at waypoints 1978 and 1979 that will be overlapped by a turbine footing must be excavated prior to construction. Excavation must target the densest part(s) of the scatter within or close to the impact zone.
- The two graves at waypoint 1696 must be fenced with a regular farm-style fence with a pedestrian entrance gate so as to ensure that they are easily identifiable on site. The fence must be placed at least 5 m from the graves and the electrical cable must be placed a minimum of 5 m away from the fence, but preferably further if possible.
- Trenching within 30 m of waypoint 1696 must be monitored by relevant project staff and/or the ECO.
- Road construction work around the Slangfontein farm werf must be monitored by relevant project staff and/or the ECO to ensure that the walls remain unharmed.
- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place.
- Replacement structures for the existing bridges on the local access roads must be designed to have a similar appearance to the current structures.
- If any archaeological material or human burials are uncovered during the course of development, then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Northern Cape:

- Replacement structures for the existing bridges on the local access roads must be designed to have a similar appearance to the current structures.
- A permit application will need to be made on SAHRIS to allow for demolition or alteration of the bridge on the R381.

Palaeontology

Western and Northern Cape:

- The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey.
- An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work.
- Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase.

Northern Cape:

- Standard paleontological mitigation (recording and collection) of the well-preserved tetrapod skull and skeleton near crossing DR02314-2&3 (31°49'9.97"S, 22° 5'21.48"E) should be implemented.

Noise

- Implement noise monitoring plan.

Shadow Flicker

- In the event of a complaint received, and an appropriate investigation confirms occurrence, then measures included in the EMPr will be applied.

Traffic

- All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process).
- The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development.
- The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801.
- A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development.

Socio-Economic

- Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce).
- Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REI4P local content requirements.
- Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development.
- The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences.

Radio Interference (RFI)

- Due to the medium risk to the SKA and based on a request from SARAo, a detailed EMC Control Plan must be developed by the renewable energy facility developer should an EA be granted, and development must not commence prior to complying with the AGA Act.

10.3.2 Hoogland 2 Wind Farm Conditions

Validity of the EA

- The formal EIA process typically takes 1 to 2 years to complete and if authorised, it is the intention that the developer / applicant would then prepare the project for submission to the REIPPPP during a forthcoming bidding window. It is currently unknown when the future bidding windows will be. Should the EA be issued for the Hoogland 2 Wind Farm project, a 10-year validity period is requested. The reason for this is due to the uncertainty regarding when the future REIPPPP bidding rounds may occur, when the Hoogland 2 Wind Farm is bid and it receives preferred bidder status. A valid EA is one of the requirements for the submission of a project in the REIPPPP.

Micro-Siting

- The expertise of a Terrestrial Ecologist, an Aquatic Ecologist, an Archaeologist, a Palaeontologist and an Avifaunal Specialist are to be enlisted to conduct post-authorisation micro-siting with the design engineers to reduce potential impacts relating to these specialist fields.
- Final adjustments to the layouts shall be made once the specialist micro-siting recommendations from the walkthrough process have been provided. Any No-Go Areas (areas that shall be excluded from any construction activity or general access by the construction team) within the development sites or servitudes shall be clearly indicated on maps and included with the micro-siting reports or attached to the EMPr.

Terrestrial Ecology

- A Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. As there is some potential for noise and disturbance-related impacts on Riverine Rabbits, the development presents a clear opportunity to evaluate the degree to which wind farms are compatible with the maintenance and conservation of Riverine Rabbit populations within their boundaries. The monitoring programme should take account of the following:
 - It should be conducted with input from EWT and should include preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site.
 - This should be followed by matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. The exact duration and frequency of monitoring would need to be determined based on the number of cameras to be used and the desired precision and statistical power to be obtained.
 - The monitoring should include a feedback mechanism to use these findings to improve future wind energy development in Riverine Rabbit areas should be developed.
- For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo, with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. The Applicant should therefore make provision for R250,000 per annum towards this fund during the construction and operational phases of the wind farm commencing at the start of construction. The annual amount of R250,000 is applicable to the year 2022 and should be escalated in accordance with CPI each year after that.
- A Monitoring Plan for the Karoo dwarf tortoise must be compiled for the construction and operational phases prior to construction.

Bats

- A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed.

Avifauna

- The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins et al., 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into the Adaptive Management Plan for the facility.
- Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline).
- Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer.
- Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these.
- If required by the avifaunal specialist after the walkthrough, bird perches at the top of the powerline structures should be fitted at relevant locations.

Aquatic Ecology

- Update the Stormwater Management Plan following micro-siting of the final layout
- Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes, as well as for contamination.

Visual

- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place.

Heritage

Western Cape:

- The archaeological site at waypoint 1703 that will be crossed by a proposed wind farm road must be excavated prior to construction. Excavation should at least cover the area to be disturbed.
- The two graves at waypoint 702 must be fenced with a regular farm-style fence with a pedestrian entrance gate so as to ensure that they are easily identifiable on site.
- The cable trench proposed through the historic farm complex of Bulskolk (in the vicinity of waypoint 113) must be sure to avoid impacting any ruined structures or other features in the vicinity.
- Roadworks within 30 m of the graves at waypoint 702 must be monitored by relevant project staff and/or the ECO.
- Trenching within the historic werf at Bulskolk (in the vicinity of waypoint 113) must be monitored by relevant project staff and/or the ECO to ensure that the various features remain unharmed.
- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place..
- Replacement structures for the existing bridges on the local access roads must be designed to have a similar appearance to the current structures.
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Northern Cape:

- Replacement structures for the existing bridges on the local access roads must be designed to have a similar appearance to the current structures.
- A permit application will need to be made on SAHRIS to allow for demolition or alteration of the bridge on the R381.

Palaeontology

Western and Northern Cape:

- The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey.
- An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work.
- Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase.

Northern Cape:

- Standard paleontological mitigation (recording and collection) of the well-preserved tetrapod skull and skeleton near crossing DR02314-2&3 (31°49'9.97"S, 22° 5'21.48"E) should be implemented.

Noise

- Implement noise monitoring plan.

Shadow Flicker

- In the event of a complaint received, and an appropriate investigation confirms occurrence, then measures included in the EMPr will be applied.

Traffic

- All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process).
- The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development.
- The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801. This is only applicable if this has not already been undertaken as part of the Nuweveld Wind Farm Project.
- A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development.

Socio-Economic

- Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce).
- Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REI4P local content requirements.
- Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development.

- The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences.

Radio Interference (RFI)

- Due to the medium risk to the SKA and based on a request from SARA0, a detailed EMC Control Plan must be developed by the renewable energy facility developer should an EA be granted, and development must not commence prior to complying with the AGA Act.

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APPENDIX A: EAP DETAILS

APPENDIX B: MAPS

APPENDIX C: SPECIALIST REPORTS

APPENDIX C1: CLIMATE CHANGE

APPENDIX C2: GEOTECHNICAL

APPENDIX C3: AGRICULTURE

APPENDIX C4: TERRESTRIAL ECOLOGY

APPENDIX C5: FLORA

APPENDIX C6: RIVERINE RABBIT

APPENDIX C7: KAROO DWARF TORTOISE

APPENDIX C8: BATS

APPENDIX C9: AVIFAUNA

APPENDIX C10: AQUATIC ECOLOGY

APPENDIX C11: VISUAL

APPENDIX C12: HERITAGE

APPENDIX C13: PALAEOLOGY

APPENDIX C14: NOISE

APPENDIX C15: SHADOW FLICKER

APPENDIX C16: TRAFFIC

APPENDIX C17: SOCIO-ECONOMIC

APPENDIX C18: GEOHYDROLOGY

APPENDIX D: PUBLIC PARTICIPATION

APPENDIX D1: SCREENING PHASE

APPENDIX D2: SCOPING PHASE

APPENDIX D3: EIR PHASE

APPENDIX E: DFFE SCREENING TOOL REPORTS

APPENDIX F: ENVIRONMENTAL MANAGEMENT PROGRAMMES

To be included in next phase

APPENDIX G: BATTERY ENERGY STORAGE RISK ASSESSMENT

APPENDIX H: ADDITIONAL INFORMATION

RECORD OF REPORT DISTRIBUTION

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