

11th August 2022

Ms Jennifer Green
WSP in Africa
The Pavilion, 1st Floor
Corner Portwood and Beach Rd
Waterfront, Cape Town

Dear Ms Green

RE-MODELLING OF NOISE IMPACT ASSESSMENT – KARREEBOSCH WIND FARM RF (PTY) LTD.

As per our recent correspondence, please find attached the re-modelling report for the Karreebosch Wind Energy Project near Laingsburg in the Western Cape.

This report is to be viewed as an addendum to the main Noise Impact Report that was issued by Jongens Keet Associates in 2015 (EA Ref: 14/12/16/3/3/2/807) in addition to the two amendment reports compiled in 2016 (EA Ref: 14/12/16/3/3/2/2018/AM1) and 2018 (EA Ref: 14/12/16/3/3/2/807/AM2). The methodologies used to conduct the remodelling, identification of noise sensitive areas and the project description is described in the main report and is not repeated here.

The purpose of this report is to determine if the final project layout will comply with the noise emission limits as contained in the most recent Department of Environmental Affairs - Environmental Authorisation (EA Ref: 14/12/16/3/3/2/807/AM3) issued in 2019. The wind turbine specifications as authorised, are proposed to be amended, however. The proposed amendments include the following:

- The total generation capacity will remain 140MW, however the number of turbines has decreased from 65 to up to 40 turbines. The individual power output of each turbine has increased from 5.5MW to up to 7.5MW.
- Increase in the rotor diameter from 160m to, up to 170m; and
- Increase in hub height from 125m to, up to 140m.

This report pertains only to the Karreebosch Wind Energy Project and excludes Noise Impacts from the associated Karreebosch Grid Infrastructure as these impacts are expected to be negligible, from a noise perspective.

The proposed amendments described above has necessitated a remodelling of the layout. The results of the modelling are presented below.

Yours sincerely



Dr Brett Williams

1. Noise Sensitive Areas (NSA)

The following noise sensitive areas have been used in the remodelling:

Table 1 – Noise Sensitive Areas

Description	East	South	Type
NSA 1	20°30'17.97"	32°57'10.38"	Farmhouse
NSA 2	20°32'52.95"	32°59'17.08"	Farmhouse
NSA 3	20°33'46.34"	32°59'14.38"	Farmhouse
NSA 4	20°32'50.34"	32°57'02.30"	Farmhouse
NSA 5	20°35'33.01"	33°04'25.20"	Farmhouse
NSA 6	20°36'03.35"	32°58'22.40"	Farmhouse
NSA 7	20°32'05.40"	33°06'21.24"	Farmhouse
NSA 8	20°28'42.36"	33°05'39.20"	Farmhouse
NSA 9	20°23'38.49"	33°10'03.50"	Farmhouse
NSA 10	20°21'09.92"	33°08'30.25"	Farmhouse
NSA 11	20°23'36.36"	33°04'12.19"	Farmhouse
NSA 12	20°25'16.19"	33°04'42.76"	Farmhouse
NSA 13	20°25'12.35"	33°04'05.63"	Farmhouse
NSA 14	20°27'42.38"	33°02'14.53"	Farmhouse
NSA 15	20°33'09.67"	32°54'52.62"	Farmhouse
NSA 16	20°22'49.18"	33°07'02.68"	Farmhouse
NSA 17	20°23'36.67"	33°05'09.53"	Farmhouse
NSA 18	20°29'22.71"	33°03'29.96"	Farmhouse
NSA 19	20°25'51.24"	33°06'16.52"	Farmhouse
NSA 20	20°28'51.51"	33°10'20.42"	Farmhouse
NSA 21	20°25'54.65"	33°10'25.14"	Farmhouse
NSA 22	20°21'25.27"	32°57'21.98"	Farmhouse
NSA 23	20°22'07.76"	32°58'30.41"	Farmhouse
NSA 24	20°16'15.80"	32°57'29.92"	Farmhouse
NSA 25	20°19'48.45"	32°53'44.68"	Farmhouse
NSA 26	20°27'23.34"	32°52'42.16"	Farmhouse
NSA 27	20°28'03.60"	32°49'35.62"	Farmhouse
NSA 28	20°26'46.16"	33°00'14.10"	Farmhouse
NSA 29	20°19'04.31"	33°00'15.87"	Farmhouse
NSA 30	20°24'54.14"	32°52'02.62"	Farmhouse
NSA 31	20°32'07.95"	32°49'19.83"	Farmhouse
NSA 32	20°28'41.48"	32°45'52.81"	Farmhouse
NSA 33	20°21'48.77"	32°45'14.37"	Farmhouse

These NSAs are shown in Figure 1 below.

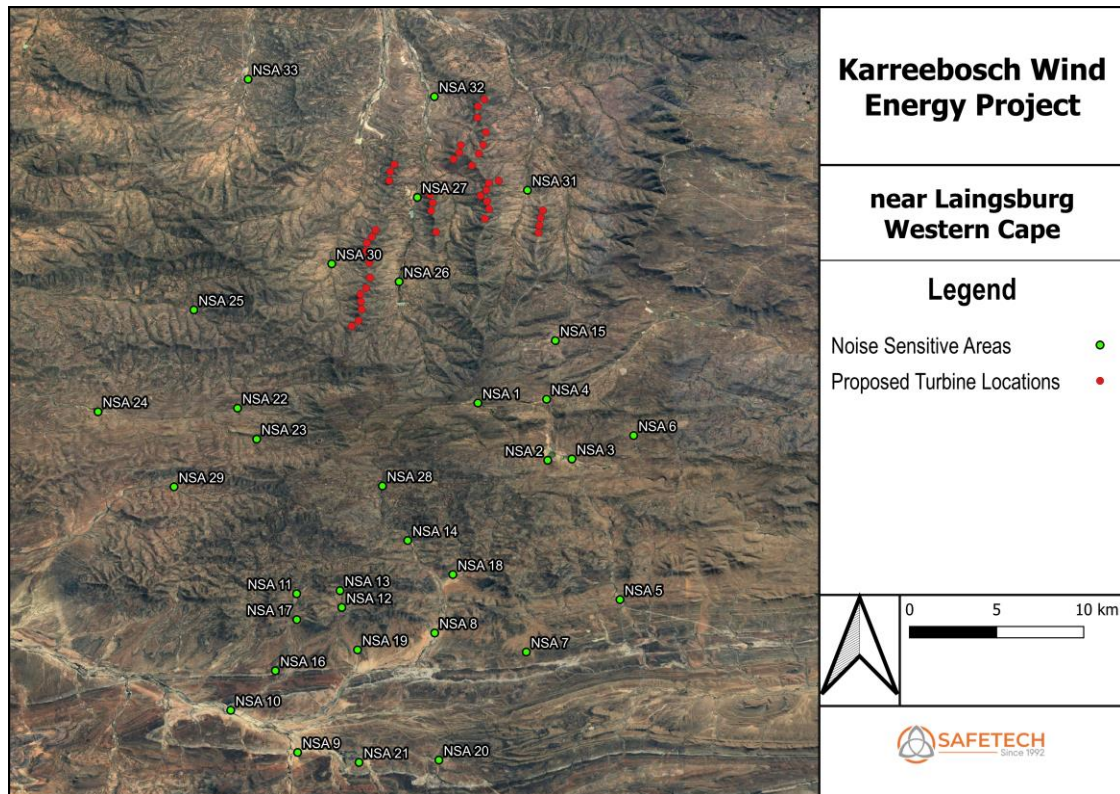


Figure 1: Noise Sensitive Areas and Proposed Wind Turbines Locations

2. Wind Turbine Generators (WTG)

The wind turbine generator that was modelled is described in Table 2 below. This turbine was chosen to represent the worst-case scenario of a wind turbine up to 7.5 MW and 140m hub height. This model of turbine was chosen based on the client's feedback. The modelled hub height (140m) is the same as the amendments proposed by the developer.

Table 2 - Proposed Turbine Specifications

Manufacturer	Goldwind
Type / Version	GW165- 6.0MW
Rated Power	Up to 7.5 MW
Rotor Diameter	Up to 170m
Tower	Tubular
Grid Connection	50/60 Hz
Maximum Sound Power Level	Up to 113.0 dB
Hub Height	140m

The sound power levels at lower and higher wind speeds as stated above were interpolated from the developer's (Goldwind) acoustic performance report provided by the client. The stated sound power level provided in the acoustic report is 111.0dB(A) for a 6.0MW Wind Turbine. Should the developer wish to increase this rated power output to 7.5MW, it would be difficult to determine the exact sound power level as there is little precise information on turbines of this power rating. Therefore, an increase to 113.0dB(A) was also modelled to draw comparison on the noise impacts. The actual sound power levels may thus be less than those stated when the final turbine is selected. The levels used in the re-modelling are thus a worst-case scenario.

The turbine positions are recorded in Annexure A and shown in Figure 1 above.

3. Cumulative Impacts

The proposed windfarm is located adjacent to several other windfarms. The Roggeveld, Karusa and Soetwater Wind Energy Facilities are currently operational.

Due to technical constraints of the modelling software, only the nearest wind turbines were analysed. Other projects in the area will have less impact due to the distance from the noise sensitive areas and the noise attenuation. The details of the modelled turbines are as follows:

- Rietkloof – 60 wind turbines*
- Witberg – 28 wind turbines
- Brandvalley – 58 wind turbines*
- Esizayo – 55 wind turbines
- Roggeveld – 47 wind turbines

The locations of these turbines are recorded in Annexure A. The same turbine data as described in Table 2 was used to model the cumulative impacts from all the adjacent windfarms. This is thus a worst-case scenario, as it is unlikely that all the turbines will be operational simultaneously and if all the sites obtain the required regulatory approval.

**Note: the turbine numbers for the Rietkloof and Brandvalley developments are lower than that modelled (32 Turbines per development), it can therefore be inferred that the cumulative impacts of these two developments will be lower than that which was modelled.*

Modelling Results

The masking effect of the wind noise will mitigate the noise impact. The results are based on NO wind noise masking, which in reality rarely occurs when the turbines are operational. The maximum noise rating limit as per the DEA Environmental Authorisation is 45 dB(A). The noise impacts were modelled in WindPro Version 3.2.669 using the above data. The results area as follows:

Table 3 - Modelling Results

Environmental Authorisation Limit = 45dB(A) at 111.0dB(A)

Noise Sensitive Area	Noise Levels from Karreebosch (dBA)	Cumulative Noise Levels (dBA)
NSA 1	10,3	44,6
NSA 2	0.0	37,4
NSA 3	0.0	37,7
NSA 4	5,2	40,0
NSA 5	0.0	27,5
NSA 6	0.0	43,7
NSA 7	0.0	30,9
NSA 8	0.0	37,0
NSA 9	0.0	7,9
NSA 10	0.0	6,2
NSA 11	0.0	26,8
NSA 12	0.0	35,3
NSA 13	0.0	36,7
NSA 14	0.0	38,3
NSA 15	13,5	36,0
NSA 16	0.0	16,6
NSA 17	0.0	24,8
NSA 18	0.0	38,4
NSA 19	0.0	31,6
NSA 20	0.0	11,5
NSA 21	0.0	9,7
NSA 22	8,5	27,1
NSA 23	6,0	32,8
NSA 24	0.0	5,6
NSA 25	9,9	13,7
NSA 26	37,8	38,4
NSA 27	45,2	45,2
NSA 28	2,1	39,4

Noise Sensitive Area	Noise Levels from Karreebosch (dBA)	Cumulative Noise Levels (dBA)
NSA 29	0,0	17,8
NSA 30	36,4	36,5
NSA 31	39,1	39,4
NSA 32	32,2	32,2
NSA 33	6,1	6,2

Should the rated power of the Wind Turbines increase to 7.5MW, a maximum sound power level of 113.0dB(A) was chosen to represent a worst-case scenario, the modelling results indicate that NSA 27 will experience noise levels of 47.2dB(A). This is 2.2dB(A) over the authorized limit of 45.0dB(A). It has been confirmed by the client that this NSA is a farm dwelling that is currently occupied.

According to Table 4 below, provided by SANS 10103:2008 sporadic complaints may be expected. This, however, does not consider that the wind noise masking will affect the receiver and therefore mitigate the impact. Additionally, the model places the receiver outdoors and the noise levels inside the dwelling at NSA 27 will likely be lower than that modelled.

Table 4 - Expected community response to excess noise levels

Excess ($\Delta L_{Req,T}$)	Estimated community/group response	
	Category	Description
0 - 10	Little	Sporadic complaints
5 - 15	Medium	Widespread complaints
10 - 20	Strong	Threats of community / group action
> 15	Very Strong	Vigorous community / group action

NOTE: Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.

The $\Delta L_{Req,T}$ should be calculated from the appropriate of the following options:

- 1) $\Delta L_{Req,T} = L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation);
- 2) $\Delta L_{Req,T} = L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1 of SANS 10103:2008;
- 3) $\Delta L_{Req,T} = L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2 of SANS 10103:2008; or
- 4) $\Delta L_{Req,T} =$ Expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.

Discussion

Karreebosch Wind Energy Farm

The modelling results indicate that the Environmental Authorisation Limit and IFC Guideline of 45 dB(A) will be exceeded at NSA 27 for sound power levels of the turbines at 111.0dB(A) and 113.0dB(A). It must however be noted that the wind noise will provide a masking effect and the exceedance is only marginal (0.2 dBA and 2.2dBA). It is therefore unlikely that the receiver will be negatively impacted. Furthermore, the modelling assumes the receiver is outdoors at all times and therefore the indoor noise levels are likely to be lower.

Cumulative Impacts

The cumulative impact modelling results indicate that the Environmental Authorisation Limit of 45 dB(A) limit will be exceeded at NSA 27 by 0.2 dB(A). If the 113.0dB(A) sound power level is applied, the limit will be exceeded at NSA 27 by 2.2dB(A) due to the Kareebosch Wind Energy Project. This includes the cumulative impacts from the other windfarms.

It is highly likely that the wind noise will provide a masking effect and the exceedance will therefore be negligible. Furthermore, the modelling assumes the receiver is outdoors at all times and therefore the indoor noise levels are likely to be lower.

4. Impact Statement

A description of the Impact Assessment Methodology has been provided by the client and is recorded in Annexure C. Table 4 and Table 5 provide the impact rating for Wind Turbines at 111.0dB(A) and 113.0dB(A) respectively.

Table 4 – Impact Rating Table at 111.0dB(A) sound power levels

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Noise Impacts									
Without Mitigation	1	2	1	4	2	16	Low	(-)	High
With Mitigation	1	2	1	4	2	16	Low	(-)	High
Mitigation and Management Measures	<ul style="list-style-type: none"> — Conduct Noise Monitoring at NSA 27 if complaints arise. — Ensure all wind turbines are placed at least 500m from the nearest Noise Sensitive Area. 								

Table 5 – Impact Rating Table at 113.0dB(A) sound power levels

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence	
Noise Impacts									
Without Mitigation	1	2	1	4	2	16	Low	(-)	High
With Mitigation	1	2	1	4	2	16	Low	(-)	High
Mitigation and Management Measures	<ul style="list-style-type: none"> — Conduct Noise Monitoring at NSA 27 during the operational phase. — Ensure all wind turbines are placed at least 500m from the nearest Noise Sensitive Area. 								

The overall environmental impact of the changes made to the project scope is rated as low and has not changed from the original noise impact assessment.

5. Conclusion

The overall environmental noise impact significance remains low considering the changes to the turbine specifications. The proposed amendments will only slightly exceed the current Environmental Authorisation limit and IFC night-time limit of 45 dB(A) at NSA 27.

A maximum sound power level threshold of 113.0dB(A) will exceed the Environmental authorization limit of 45.0dB(A) by 2.2dB(A) at NSA 27. Sporadic complaints may be expected but is unlikely as the wind masking effect will mitigate the noise impacts and the model considers the receiver to be outdoors at all times, which, in reality, will not be the case. This is the worst-case scenario based on the data that was modelled.

It is my recommendation that, based on the results and information presented here, the amendment to the Environmental Authorisation with respect to the noise impacts should be granted.

Please feel free to contact us should you have any further requirements. Assuring you of our best attention at all times.

Yours sincerely



Dr Brett Williams

Annexure A – 2022 Karreebosch Amended 40 WTG Positions

Longitude	Latitude	Elevation [m]
20° 32' 32.28" E	32° 50' 54.23" S	1082
20° 32' 34.07" E	32° 50' 37.31" S	1100
20° 32' 37.68" E	32° 50' 20.76" S	1078
20° 32' 42.00" E	32° 50' 04.56" S	1067
20° 30' 33.47" E	32° 50' 22.92" S	1145
20° 30' 43.20" E	32° 50' 01.32" S	1124
20° 30' 38.16" E	32° 49' 44.75" S	1110
20° 30' 23.75" E	32° 49' 32.16" S	1126
20° 30' 37.08" E	32° 49' 19.55" S	1115
20° 30' 42.48" E	32° 49' 03.72" S	1067
20° 31' 04.08" E	32° 48' 58.67" S	1019
20° 30' 04.68" E	32° 48' 25.20" S	1020
20° 29' 23.99" E	32° 48' 11.16" S	990
20° 29' 36.60" E	32° 47' 56.76" S	1038
20° 29' 40.19" E	32° 47' 40.19" S	980
20° 30' 20.16" E	32° 47' 58.92" S	1018
20° 30' 29.51" E	32° 47' 39.47" S	970
20° 30' 35.63" E	32° 47' 12.12" S	934
20° 30' 17.27" E	32° 46' 39.00" S	960
20° 30' 17.99" E	32° 46' 14.51" S	991
20° 30' 32.04" E	32° 45' 59.03" S	945
20° 28' 45.47" E	32° 50' 52.44" S	1043
20° 28' 34.31" E	32° 50' 05.28" S	1085
20° 28' 37.91" E	32° 49' 47.64" S	1020
20° 28' 31.80" E	32° 49' 29.63" S	982
20° 27' 01.43" E	32° 48' 59.04" S	965
20° 27' 03.96" E	32° 48' 38.51" S	977
20° 27' 12.96" E	32° 48' 22.31" S	990
20° 25' 38.27" E	32° 54' 20.52" S	1159
20° 25' 53.39" E	32° 54' 08.64" S	1167
20° 26' 00.59" E	32° 53' 43.44" S	1240
20° 25' 59.15" E	32° 53' 26.15" S	1230
20° 25' 57.36" E	32° 53' 09.60" S	1215
20° 26' 09.95" E	32° 52' 56.28" S	1151
20° 26' 19.32" E	32° 52' 33.24" S	1154
20° 26' 17.51" E	32° 52' 00.47" S	1075
20° 26' 10.67" E	32° 51' 34.91" S	1076
20° 26' 11.75" E	32° 51' 16.55" S	1115
20° 26' 23.28" E	32° 51' 02.87" S	1101
20° 26' 31.55" E	32° 50' 48.11" S	1069

Annexure B – Cumulative WTG Positions

Rietkloof				Brandvalley			
Longitude	Latitude	Elevation [m]		Longitude	Latitude	Elevation [m]	
20°26'24.18"	33°04'57.38"	1198		20°23'36.20"	33°01'11.11"	1322	
20°26'47.81"	33°04'48.70"	1200		20°23'37.82"	33°00'58.26"	1321	
20°26'44.27"	33°04'27.49"	1180		20°23'45.84"	33°00'47.17"	1289	
20°27'13.28"	33°04'47.13"	1240		20°23'50.44"	32°58'20.63"	1190	
20°27'23.56"	33°04'38.07"	1211		20°24'00.40"	32°59'35.37"	1280	
20°27'42.27"	33°04'52.59"	1210		20°24'11.92"	33°01'09.07"	1309	
20°28'06.39"	33°04'55.28"	1182		20°24'25.27"	32°58'16.83"	1210	
20°26'12.35"	33°03'50.84"	1203		20°24'24.81"	33°01'01.27"	1300	
20°26'23.02"	33°03'41.61"	1230		20°24'33.36"	32°57'59.95"	1308	
20°26'31.96"	33°03'31.15"	1216		20°24'33.87"	32°57'47.06"	1320	
20°27'16.77"	33°03'36.50"	1180		20°24'35.10"	32°57'21.60"	1369	
20°30'05.02"	33°05'08.34"	1205		20°24'37.58"	32°57'34.56"	1320	
20°30'29.33"	33°05'02.09"	1219		20°24'42.25"	32°57'10.20"	1345	
20°30'38.06"	33°04'37.14"	1211		20°24'57.51"	32°55'29.35"	1420	
20°30'43.65"	33°04'50.27"	1258		20°24'59.69"	32°55'51.45"	1378	
20°31'30.21"	33°04'31.37"	1228		20°25'19.74"	33°01'12.67"	1220	
20°31'27.45"	33°03'35.42"	1226		20°25'23.79"	32°55'32.32"	1400	
20°31'19.84"	33°03'19.55"	1250		20°25'33.17"	33°01'04.80"	1210	
20°31'30.90"	33°03'02.63"	1220		20°25'44.10"	32°59'03.38"	1280	
20°31'38.99"	33°02'51.75"	1240		20°26'03.36"	32°56'43.86"	1340	
20°31'50.02"	33°02'42.32"	1210		20°26'17.05"	32°56'23.90"	1390	
20°31'45.25"	33°02'25.62"	1210		20°26'43.07"	32°55'44.03"	1405	
20°31'41.31"	33°02'13.06"	1238		20°26'46.09"	32°56'11.32"	1410	
20°31'53.12"	33°02'04.89"	1250		20°27'06.33"	32°55'54.69"	1416	
20°32'03.71"	33°01'55.61"	1260		20°27'24.88"	32°59'06.20"	1290	
20°32'17.02"	33°01'49.29"	1290		20°27'50.99"	32°58'55.95"	1363	
20°32'25.08"	33°01'38.36"	1320		20°28'03.52"	32°58'48.59"	1386	
20°32'20.27"	33°01'21.93"	1320		20°28'24.33"	32°59'27.91"	1308	
20°32'19.90"	33°01'09.03"	1330		20°28'24.15"	32°59'49.80"	1288	
20°32'31.75"	33°01'00.93"	1318		20°28'39.12"	32°58'36.92"	1427	
20°31'58.05"	33°00'40.83"	1328		20°28'54.42"	32°58'01.90"	1510	
20°32'08.84"	33°00'31.66"	1316		20°29'05.61"	32°58'50.45"	1409	
20°31'11.16"	32°59'46.78"	1351		20°29'06.72"	32°57'54.29"	1478	
20°30'45.54"	32°59'46.97"	1380		20°29'11.42"	32°58'17.90"	1455	
20°30'20.05"	32°59'45.72"	1369		20°29'32.94"	32°57'53.95"	1409	
20°29'46.43"	32°59'42.49"	1350		20°30'20.44"	32°57'48.80"	1380	
20°30'08.70"	33°00'14.48"	1288		20°30'41.46"	32°58'10.73"	1394	
20°30'01.91"	33°00'26.02"	1297		20°30'54.18"	32°58'03.59"	1369	
20°29'55.99"	33°00'38.00"	1260		20°31'44.49"	32°57'55.13"	1355	
20°29'50.86"	33°00'50.12"	1260		20°31'56.28"	32°57'46.89"	1400	
20°29'53.20"	33°01'02.82"	1246		20°32'08.84"	32°57'39.50"	1366	
20°29'57.14"	33°01'15.29"	1221		20°24'24.73"	32°59'41.10"	1270	
20°30'04.93"	33°01'37.92"	1200		20°24'29.38"	32°59'28.86"	1280	

Rietkloof			Brandvalley		
Longitude	Latitude	Elevation [m]	Longitude	Latitude	Elevation [m]
20°30'11.58"	33°02'15.16"	1170	20°24'41.92"	32°59'21.55"	1270
20°30'11.14"	33°02'33.92"	1147	20°24'53.56"	32°59'11.12"	1266
20°29'01.92"	33°02'22.86"	1156	20°25'17.86"	32°59'04.74"	1286
20°28'23.90"	33°01'15.40"	1280	20°28'30.60"	32°58'47.67"	1420
20°28'29.59"	33°01'03.43"	1231	20°28'46.68"	32°58'13.03"	1453
20°28'23.60"	33°00'44.44"	1280	20°28'51.75"	32°58'29.66"	1450
20°28'32.36"	33°00'33.88"	1260	20°24'36.81"	33°00'53.24"	1243
20°29'00.01"	33°02'42.77"	1120	20°23'48.07"	32°59'42.92"	1282
20°33'02.47"	33°03'28.28"	1205	20°24'06.86"	32°59'23.72"	1240
20°33'05.59"	33°03'15.57"	1199	20°25'19.90"	32°58'21.05"	1270
20°33'01.45"	33°03'01.41"	1209	20°28'21.75"	32°58'17.34"	1394
20°32'59.88"	33°02'48.54"	1204	20°29'27.48"	32°58'07.75"	1423
20°33'03.34"	33°02'35.90"	1215	20°28'50.03"	32°59'24.72"	1336
20°27'57.12"	33°00'36.62"	1242	20°28'36.43"	32°59'06.60"	1370
20°32'19.70"	33°00'21.35"	1290	20°25'44.81"	33°00'55.98"	1184
20°31'28.69"	33°04'54.31"	1184			
20°28'27.72"	33°01'27.87"	1226			

Witberg			Esizayo			Roggeveld		
Longitude	Latitude	Elevation [m]	Longitude	Latitude	Elevation [m]	Longitude	Latitude	Elevation [m]
20°28'56.27"	33°16'59.10"	1410	20°33'40.64"	32°57'30.35"	1380	20°29'48.80"	32°56'31.84"	1392
20°28'43.31"	33°17'01.43"	1400	20°35'09.27"	32°57'22.54"	1335	20°29'59.40"	32°56'24.35"	1423
20°28'30.29"	33°17'03.75"	1410	20°33'59.92"	32°57'25.55"	1370	20°30'12.40"	32°56'18.53"	1410
20°28'11.31"	33°16'59.19"	1443	20°38'07.36"	33°01'29.88"	1200	20°30'19.68"	32°56'08.68"	1383
20°28'12.58"	33°17'07.96"	1450	20°37'22.97"	33°01'44.37"	1201	20°30'26.37"	32°55'58.45"	1370
20°27'59.57"	33°17'09.64"	1450	20°38'24.73"	33°01'23.44"	1180	20°30'20.28"	32°55'44.74"	1401
20°27'58.88"	33°17'19.92"	1428	20°34'50.00"	32°57'24.09"	1333	20°30'25.43"	32°55'34.16"	1420
20°27'45.46"	33°17'21.19"	1435	20°38'28.65"	33°01'07.22"	1140	20°30'30.49"	32°55'23.53"	1418
20°27'31.16"	33°17'22.85"	1415	20°38'47.93"	33°01'05.65"	1120	20°30'34.79"	32°55'12.02"	1387
20°27'18.07"	33°17'24.15"	1410	20°38'52.28"	32°59'00.64"	1218	20°30'49.65"	32°55'24.78"	1375
20°27'02.33"	33°17'21.48"	1400	20°35'28.53"	32°57'22.60"	1294	20°31'00.62"	32°55'17.37"	1350
20°26'49.47"	33°17'20.23"	1384	20°36'31.06"	33°01'13.36"	1222	20°31'08.87"	32°55'08.31"	1310
20°26'51.87"	33°17'30.93"	1400	20°37'48.06"	33°01'36.33"	1190	20°30'31.77"	32°54'58.90"	1328
20°26'38.83"	33°17'31.88"	1380	20°34'28.82"	32°57'22.40"	1328	20°30'33.25"	32°54'45.24"	1340
20°27'07.29"	33°17'36.05"	1380	20°38'34.92"	32°59'07.08"	1205	20°30'47.32"	32°54'40.94"	1340
20°26'28.02"	33°17'32.85"	1352	20°36'17.80"	33°00'21.36"	1170	20°30'59.89"	32°54'34.73"	1320
20°26'15.98"	33°17'45.06"	1346	20°35'08.37"	33°00'34.12"	1199	20°31'07.55"	32°54'25.18"	1320

Witberg			Esizayo			Roggeveld		
Longitude	Latitude	Elevation [m]	Longitude	Latitude	Elevation [m]	Longitude	Latitude	Elevation [m]
20°26'38.92"	33°18'01.66"	1346	20°36'54.18"	33°01'16.68"	1199	20°31'20.88"	32°54'19.25"	1301
20°26'19.12"	33°17'58.05"	1352	20°38'07.45"	33°01'08.78"	1139	20°31'29.89"	32°54'10.58"	1291
20°26'05.34"	33°17'55.46"	1370	20°39'15.22"	32°59'47.79"	1120	20°31'30.66"	32°53'56.88"	1260
20°25'51.36"	33°17'56.94"	1343	20°35'41.12"	33°00'37.48"	1180	20°31'35.77"	32°53'45.18"	1230
20°27'28.41"	33°16'59.33"	1379	20°38'32.57"	33°00'50.99"	1077	20°31'41.21"	32°53'34.61"	1194
20°27'14.18"	33°17'00.46"	1387	20°35'58.51"	33°00'26.17"	1160	20°31'47.35"	32°53'24.44"	1200
20°26'59.96"	33°17'00.88"	1369	20°37'46.52"	33°00'03.77"	1100	20°31'55.36"	32°53'15.25"	1230
20°22'22.34"	33°17'49.96"	1230	20°37'03.75"	33°01'31.32"	1190	20°32'04.80"	32°53'06.84"	1218
20°21'59.66"	33°17'54.29"	1220	20°38'09.70"	32°59'49.23"	1120	20°32'14.43"	32°52'57.72"	1173
20°21'45.50"	33°17'54.78"	1220	20°39'11.54"	32°59'02.32"	1200	20°32'23.56"	32°52'49.13"	1180
20°21'31.88"	33°17'54.92"	1220	20°38'21.34"	32°59'29.78"	1128	20°32'29.26"	32°52'38.65"	1188
			20°37'05.80"	33°01'03.72"	1145	20°32'48.91"	32°52'22.79"	1230
			20°38'32.85"	32°59'42.80"	1119	20°32'57.06"	32°52'13.58"	1205
			20°39'48.11"	32°59'12.16"	1180	20°32'36.70"	32°52'27.87"	1240
			20°36'45.10"	32°59'08.38"	1165	20°30'05.26"	32°54'21.85"	1304
			20°40'51.63"	32°59'26.94"	1174	20°29'51.83"	32°54'06.01"	1298
			20°35'08.94"	32°58'32.35"	1196	20°30'03.85"	32°54'00.56"	1313
			20°38'15.65"	32°59'07.03"	1179	20°30'10.80"	32°53'50.33"	1286
			20°37'19.56"	32°59'58.82"	1105	20°30'13.89"	32°53'38.86"	1270
			20°35'05.32"	32°57'42.00"	1251	20°30'21.01"	32°53'26.18"	1270
			20°37'21.71"	32°59'06.87"	1158	20°30'25.68"	32°53'15.42"	1261
			20°36'35.18"	33°00'14.92"	1120	20°30'24.66"	32°53'04.04"	1236
			20°35'40.16"	32°57'06.40"	1197	20°30'18.27"	32°52'44.60"	1270
			20°35'24.40"	32°58'22.66"	1210	20°32'25.36"	32°51'34.69"	1100
			20°36'56.46"	32°59'53.88"	1111	20°32'28.27"	32°51'23.15"	1089
			20°35'07.17"	32°57'58.25"	1221	20°32'33.48"	32°51'12.61"	1087
			20°35'21.92"	33°00'22.80"	1161	20°30'34.11"	32°52'41.54"	1240
			20°36'40.63"	33°01'28.00"	1160	20°30'05.02"	32°52'46.81"	1230
			20°39'40.12"	33°00'25.20"	1060	20°29'29.70"	32°56'43.50"	1410
			20°39'28.85"	32°59'08.86"	1182	20°29'30.70"	32°56'58.59"	1419
			20°37'21.56"	32°59'42.59"	1118			
			20°36'58.31"	33°00'11.74"	1104			
			20°34'53.49"	32°58'42.04"	1171			
			20°38'11.37"	33°00'52.55"	1083			
			20°36'27.28"	33°00'57.11"	1142			
			20°35'34.50"	32°56'40.40"	1141			
			20°34'46.05"	32°57'45.19"	1246			
			20°35'31.94"	32°58'58.40"	1160			

Annexure C – Impact Rating Methodology Table

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ <i>Significance = (Extent + Duration + Reversibility + Magnitude) × Probability</i>				
IMPACT SIGNIFICANCE RATING					
Total Score	0 – 30		31 to 60		61 – 100
Environmental Significance Rating (Negative (-))	Low (-)		Moderate (-)		High (-)
Environmental Significance Rating (Positive (+))	Low (+)		Moderate (+)		High (+)