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Date:	**Our reference:**	**Your reference:**
23/11/2018	PP173871-AUME-L-01-B	

Re: Alberton Shadow Flicker Assessment

Dear Coralie Spitzner,

DNV GL has been commissioned by Synergy Wind Pty Ltd (the "Customer") to independently assess the expected annual shadow flicker duration at a single structure near the proposed Alberton Wind Farm (the "Structure").

DNV GL have previously conducted a shadow flicker assessment for the Alberton Wind Farm, considering a layout of 34 turbines, and a list of 102 dwellings located in the vicinity of the project. The outcomes of that assessment, along with information regarding planning guidelines, model inputs, and methodology, are detailed in DNV GL report PP173871-AUME-R-01-H dated 15 September 2017 [1] (the "Report).

The Customer has advised that the Structure had not received a certificate of occupancy and was not inhabited, nor habitable, at the time the Report was completed and the planning application was submitted [2].

The current assessment was undertaken to establish whether shadow flicker durations would remain within relevant limits should the Structure ever be inhabited. It was also proposed that should shadow flicker durations predicted at the Structure exceed relevant limits, turbine micro-siting would be undertaken to reduce shadow flicker durations to be within relevant limits, while also attempting to maintain compliant noise levels at dwellings.

The current assessment has used the same methodology as proposed in the Report, and is intended to be read in conjunction with the Report. However it is noted that there has been a revision to the planning guidelines [3] in the period since the Report was issued.

ASSESSMENT OF IMPACT FROM CURRENT LAYOUT

The location of the Structure has been provided by the Customer as detailed in Table 1 [2].

Table 1: Location of the Structure

Receptor ID	Easting [m]	Northing [m]
Structure	467322	5722563

DNV GL have modelled shadow flicker durations at 2 m and 6 m to predict shadow flicker durations at heights representative of single and double storey windows.

The modelling shows that shadow flicker durations at the Structure (using the methodology, turbine layout and configuration as detailed in [1]) will exceed the limit of 30 hrs/year. Shadow flicker calculation results prior to micro-siting are shown below in Table 2.

Table 2: Pre-microsited theoretical and predicted annual shadow flicker duration

House ID[1]	Easting[2] [m]	Northing[2] [m]	Contributing turbines	Theoretical annual				Predicted actual annual[3]			
				At dwelling [hr/yr]		Max within 50 m of dwelling [hr/yr]		At dwelling [hr/yr]		Max within 50 m of dwelling [hr/yr]	
				SF at 2 m	SF at 6 m	SF at 2 m	SF at 6 m	SF at 2 m	SF at 6 m	SF at 2m	SF at 6 m
Structure	467322	5722563	T18 T19	18.3	18.3	**40.5**	**39.6**	4.3	4.3	8.6	8.4
	Annual duration limits			***30***		***30***		***10***		***10***	

ASSESSMENT OF IMPACT FROM MICRO-SITED LAYOUT

To reduce shadow flicker impact at the Structure it will be necessary to relocate the turbines contributing to shadow flicker at the Structure.

DNV GL has investigated options for micro-siting to reduce shadow flicker impacts at the Structure. The outcome of this investigation was that relocating turbine T18 approximately 50 m to the north is expected to reduce the theoretical shadow flicker durations at the Structure to acceptable levels. The predicted shadow flicker durations at the Structure after micro-siting can be found in Table 3. Shadow flicker durations at the remaining dwellings after micro-siting are expected to be less than or equal to shadow flicker durations detailed in [1].

Table 3: Theoretical and predicted annual shadow flicker duration after micro-siting

House ID[1]	Easting[2] [m]	Northing[2] [m]	Contributing turbines	Theoretical annual				Predicted actual annual[3]			
				At dwelling [hr/yr]		Max within 50 m of dwelling [hr/yr]		At dwelling [hr/yr]		Max within 50 m of dwelling [hr/yr]	
				SF at 2 m	SF at 6 m	SF at 2 m	SF at 6 m	SF at 2 m	SF at 6 m	SF at 2m	SF at 6 m
Structure	467322	5722563	T18 T19	18.3	18.3	23.0	21.6	4.3	4.3	5.0	4.8
		Annual duration limits		***30***		***30***		***10***		***10***	

Table 4 tabulates the final set of turbine coordinates after micro-siting.

Table 4: Proposed turbine layout for the Alberton Wind Farm site

WTG ID	Easting[1] [m]	Northing[1] [m]	WTG ID	Easting[1] [m]	Northing[1] [m]
T01	458853	5721594	T18	466216	5723487
T02	458685	5722082	T19	466293	5722824
T03	458756	5722567	T20	466711	5729705
T04	459518	5721714	T21	466771	5730287
T05	459584	5722157	T22	466804	5723380
T06	459637	5722587	T23	466912	5730979
T07	459708	5723054	T24	466630	5726724
T08	462198	5723499	T25	467223	5726089
T09	462340	5724695	T26	467278	5724773
T10	462791	5723439	T27	467403	5723331
T11	463408	5723282	T28	467323	5729252
T12	465069	5723430	T29	467662	5725331
T13	465102	5722990	T30	467551	5730153
T14	465248	5723919	T31	467683	5724225
T15	465606	5723479	T32	467964	5723825
T16	465616	5722934	T33	468258	5723514
T17	466758	5726258	T34	468632	5724068

[1] Coordinate system: UTM zone 55 South, WGS84 datum.

Although the impact of the proposed re-location of turbine T18 on overall noise emission of the project is expected to be negligible, it is recommended that noise assessments previously conducted for the Alberton Wind Farm are updated to consider the micro-sited layout.

REFERENCES

[1] DNV GL, PP173871-AUME-R-01-H Synergy Alberton Wind Farm Shadow Flicker.pdf, shadow flicker assessment, 15 Sep 2017.

[2] Synergy Wind, email from C. Spitzner (Synergy Wind) to T. Gilbert (DNV GL), dated 24 Oct 2018.

[3] "Policy and planning guidelines: Development of wind energy facilities in Victoria," Victoria State Government: Department of Environment, Land, Water and Planning, October 2018.

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