Orsted Onshore Ireland Midco Limited

8: MEMORANDUM RESPONSE TO SUBMISSIONS RECEIVED

SHADOW FLICKER

Proposed Oatfield Wind Farm Project, Co. Clare: ABP Case No. ABP-318782-24

June 2024

CONTENTS

TABLES

1 SHADOW FLICKER

1.1 Introduction

The following memorandum has been prepared to address submissions received during the observations and submissions period associated with the Oatfield Wind Farm Planning Application. The planning application for the aforementioned Proposed Development was submitted to An Bord Pleanála on 22nd December 2023 (ABP Case Number: ABP-318782-24). The period for 3rd party submissions and observations was 22nd December 2023 to 19th February 2024.

This is memorandum number 8 in the Oatfield Wind Farm submission response documentation, which addresses common themes identified within the discipline of Shadow Flicker (corresponding to **Chapter 12 of the EIAR**, submitted as part of the planning application made to An Bord Pleanála).

Responses to submissions received from regulatory & prescribed bodies are presented in Section 2 and responses to common themes in submissions received from the general public are presented in Section 3.

Where relevant, additional information is included in Appendix 1.

1.2 Statement of authority

This memorandum has been prepared by Dr Thomas Burke and reviewed by Ben Hockridge, both of RSK ADAS Ltd. Thomas Burke is a GIS (Geographic Information Systems) Consultant with expertise in the evaluation, analysis, and visualisation of geospatial data to investigate and solve environmental management issues. Thomas uses these skills and experience to manage and deliver projects for a range of clients, particularly in the area of onshore renewables development. Thomas joined ADAS in 2022, prior to which he spent four years as a graduate researcher in geography and GIS following completion of his MSci in Earth and Environmental Science.

Ben Hockridge is Principal GIS and Remote Sensing Consultant at RSK ADAS. He has over 10 years' experience in providing GIS and Remote Sensing expertise in a range of projects and services. Ben first joined ADAS in 2012 following his studies in Physical Geography (BSc) and Environmental Monitoring, Modelling and Management (MSc). Ben returned to work for RSK ADAS in 2017 after spending a year providing GIS solutions for the Ministry for Primary Industries in New Zealand. This range of experience has provided him with an in depth understanding on the use of GIS and Remote Sensing and their application in environmental management.

2 REGULATORY & PRESCRIBED BODIES

2.1 Clare County Council

Comments were submitted by Clare County Council regarding the implementation of measures to mitigate potential cumulative shadow flicker effects arising from the Proposed Development with the potential Knockshanvo development.

The Applicant will adhere to the mitigation measures noted within the EIAR. For shadow flicker, mitigation measures to be implemented and operated as part of the Proposed Development are fully detailed in **EIAR Chapter 12 Shadow Flicker** (hereafter referred to as **EIAR Chapter 12**), Section 12.7.1 and Section 12.9.1.3. As described, this is a shadow flicker control system, in which specialist software calculates the position of the sun and uses light sensors to measure the intensity of sunlight. When the conditions for shadow flicker to occur at a sensitive receptor within the study area are detected, responsible turbine(s) can be curtailed, and come to a stop. Through the implementation and operation of this system, the Proposed Development will adhere to currently adopted Wind Energy Development Guidelines (2006) thresholds of 30 minutes per day, or 30 hours per year.

2.1.1 Cumulative effects

As noted in **EIAR Chapter 20 Impact Interactions and Cumulative Effects,** the EIA Directive requires consideration of cumulative effects with existing and/or approved projects. Nonetheless, potential cumulative effects were also considered for (i) projects that are currently going through the planning application system; and (ii) projects that may be envisaged through a plan/programme although there has not been any application submitted yet (*i.e.*, consideration of future development). However, it is important to note that the level of detail available per project will reflect the stage within which it sits in the planning application process. Crucially, therefore, it follows that the level of detail of cumulative assessment is reflective of the level of detail of information available at time of assessment.

To this end, at the time the shadow flicker assessment was undertaken, the planning application for the Knockshanvo Wind Farm had not been submitted for planning, and no finalised detailed information is yet available. However, the planning application for Knockshanvo Wind Farm will likely consider the cumulative impacts from the Proposed Development, for which all relevant information has been submitted in the planning system. Nonetheless, **EIAR Chapter 12** for the Proposed Development presented an assessment of potential cumulative shadow flicker effects, using the latest known project details for Knockshanvo Wind Farm available at the time. As mentioned, it will be the responsibility of the Knockshanvo Wind Farm to demonstrate how it considers that Wind Energy Development Guidelines thresholds for shadow flicker can be achieved in practice through the cumulative operation of both sites.

Should it be necessary, the shadow flicker control system can be operated to curtail Oatfield turbines should they, in combination with Knockshanvo turbines, result in exceedances of adopted Wind Energy Development Guidelines (2006) thresholds of 30 minutes per day, or 30 hours per year. Through the implementation and operation of this

system, the Proposed Development will adhere to currently adopted Wind Energy Development Guidelines (2006) thresholds.

3 GENERAL PUBLIC

3.1 Theme 1: Shadow flicker resulting from the Proposed Development

Submissions were received regarding levels and incidence of shadow flicker resulting from operation of the Proposed Development. It is highlighted that predicted levels of shadow flicker (maximum hours per day, and total hours per year) reported in the assessment (refer to **EIAR Chapter 12**, Section 12.6, Section 12.9.1.1 and Section 12.9.1.2) are for a "worst-case" scenario, and in the absence of any mitigation measures. As detailed in **EIAR Chapter 12**, Section 12.4.6, the analysis assumes that:

- The sun is shining from sunrise to sunset (cloudless sky);
- The turbine blades are turning 100% of the time;
- The turbine rotor is oriented directly between the sun and the sensitive receptor; and
- There is no screening (such as trees) between the turbine and the receptor (excluding topography).

In real life conditions, therefore, the actual shadow flicker durations will be **less than the theoretical levels from the model.**

As shadow flicker can only occur when the sun is shining, a more "likely" prediction of potential annual shadow flicker duration is also presented in **EIAR Chapter 12**, Section 12.6, using historical weather data to account for the frequency of clear skies when shadows may be cast. This "likely" scenario, however, still uses other conservative assumptions listed above, i.e., that the turbine blades are turning 100% of the time, that the turbine rotor is oriented directly between the sun and sensitive receptor, and that there is no screening excluding topography. Predicted "likely" annual shadow flicker durations are therefore still likely to be overestimated in the assessment.

It is further highlighted that both the "worst-case" and "likely" scenario results present potential shadow flicker effects should no mitigation measures be implemented or operated. However, as detailed in **EIAR Chapter 12**, Section 12.7.1 and **EIAR Chapter 12**, Section 12.9.1.3, the Applicant will install and operate a shadow flicker control system as part of the Proposed Development. In this system, specialist software calculates the position of the sun and uses light sensors to measure the intensity of sunlight. When the conditions for shadow flicker to occur at a sensitive receptor within the study area are detected, responsible turbine(s) can be curtailed, and come to a stop. Through the implementation and operation of this system, the Proposed Development will adhere to currently adopted Wind Energy Development Guidelines (2006) thresholds of 30 minutes per day, or 30 hours per year.

Residual effects (those experienced once mitigation has been applied) are described in **EIAR Chapter 12**, Section 12.8 and Section 12.9.1.4. As this accounts for the implementation of mitigation, it is these effects that will arise from the Proposed Development, rather than the unmitigated effects described in **EIAR Chapter 12** Section 12.6, Section 12.9.1.1 and Section 12.9.1.2. As mitigation will be applied to adhere to current Wind Energy Development Guidelines (2006) thresholds of 30 minutes per day,

or 30 hours per year, it is considered that there would be no significant residual effects related to shadow flicker from the Proposed Development.

3.2 Theme 2: Implementation and operation of mitigation measures

Submissions were received regarding the implementation of mitigation measures for shadow flicker effects at the Proposed Development.

The Applicant will adhere to the mitigation measures noted within the EIAR. For shadow flicker, mitigation measures to be implemented and operated as part of the Proposed Development are fully detailed in **EIAR Chapter 12** Section 12.7 and 12.9.1.3. As described above, this is a shadow flicker control system, in which specialist software calculates the position of the sun and uses light sensors to measure the intensity of sunlight. When the conditions for shadow flicker to occur at a sensitive receptor within the study area are detected, responsible turbine(s) can be curtailed, and come to a stop. Through the implementation and operation of this system, the Proposed Development will adhere to currently adopted Wind Energy Development Guidelines (2006) thresholds of 30 minutes per day, or 30 hours per year. A shadow flicker monitoring programme will ensure the effective functioning of the shadow flicker control system.

3.3 Theme 3: Wind energy development guidelines

Submissions were received regarding the Wind Energy guidelines used in preparing the shadow flicker assessment, and to which version the Proposed Development will adhere to during operation.

The shadow flicker assessment has been undertaken following current guidelines and best practice. These are detailed fully in **EIAR Chapter 12** Section 12.3. Further details regarding the legislation and guidance documents considered and applied in preparation of the EIAR are also detailed in **EIAR Chapter 2 EIA Methodology**.

As detailed in **EIAR Chapter 12**, Section 12.3, the shadow flicker assessment adheres to both the Wind Energy Development Guidelines (2006), and the Clare County Development Plan 2023 – 2029 (2023).

The Wind Energy Development Guidelines (2006), provided by the DoEHLG, are the current guidance. The DoEHLG undertook a consultation on the Draft Revised Wind Energy Guidelines (2019) following a targeted review of the 2006 Guidelines. Consultation on the Draft Revised Guidelines concluded in February 2020. To date the Department has not issued replacement Wind Energy Guidelines.

The Wind Energy Development Guidelines (2006) state that:

“Careful site selection, design and planning, and good use of relevant software, can help avoid the possibility of shadow flicker in the first instance. It is recommended that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day.”

“At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Where shadow flicker could be a problem, developers should provide

calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect, such as by turning off a particular turbine at certain times."

The Clare County Development Plan 2023-2029 was adopted by the Elected Members of Clare County Council at a Special Meeting on 9th March 2023. An Interim Version of the Plan is currently available for viewing. Regarding shadow flicker, Annex A: Best Practice and General Considerations for wind energy developments in County Clare, Section 6.7 (Population and Human Health) states that:

"Applications must have regard to the thresholds, limits and buffer zone in the Planning Guidelines for Wind Energy Development for Planning Authorities 2006 in order to mitigate against potential impacts on human health in terms of shadow flicker, visual impact and noise."

EIAR Chapter 12 Section 12.7 and **EIAR Chapter 12** Section 12.9.1.3 detail the proposed mitigation measures i.e., the shadow flicker control system that will be installed and operated as part of the Proposed Development, such that it will adhere to currently adopted Wind Energy Development Guidelines (2006). The control system described can be used to detect and mitigate instances of shadow flicker at any sensitive receptor if required. Should guidelines with revised limitations on shadow flicker be adopted during the planning application process for this Development, the technical solutions described can be adapted and applied to adhere to these (allowing for a short period for shadow conditions to be confirmed and for the turbines to come to a stop).

3.4 Theme 4: Identification of sensitive receptors

A study area of 10 times the rotor diameter was used in the shadow flicker assessment. This is based upon current Wind Energy Development Guidelines (2006), which state that at distances greater than 10 rotor diameter from a turbine, the potential for shadow flicker is very low.

As described in **EIAR Chapter 12**, Section 12.4.1, three shadow flicker assessments were performed, one for each candidate turbine model. As noted in **EIAR Chapter 12**, Section 12.4.2 and **EIAR Chapter 12**, Section 12.4.3, for each assessment, potential shadow flicker was assessed at all sensitive receptors within a distance equal to 10x the rotor diameter around all proposed turbine locations. This corresponds to 1,550 m for candidate turbine model 1; 1,490 m for candidate turbine model 2; and 1,330 m for candidate turbine model 3.

In preparing the EIAR, a database containing a list of potential sensitive receptors within 2.1km of the proposed turbines was first produced. This EIAR receptor database was produced through both desktop study and field survey, with a full description of the methodology employed in identifying the sensitive receptors being provided in **EIAR Volume III Appendix 2.1**. Receptors identified include occupied dwellings, unoccupied dwellings, planning permission sites (validated and granted up to 4th of December 2023), community buildings, schools, and places of worship. The EIAR receptor database is provided in **EIAR Volume III Appendix 2.2**.

From this EIAR receptor database, subsets of sensitive receptors within the 10 rotor diameter shadow flicker study areas for each of the three candidate turbine models were identified. Sensitive receptors within these study areas are listed in **EIAR Volume III**

Appendix 12.1 (Candidate Turbine 1), **EIAR Volume III Appendix 12.2** (Candidate Turbine 2) and **EIAR Volume III Appendix 12.3** (Candidate Turbine 3).

Submissions were received regarding the Sunyatta Buddhist Centre. The Centre is recorded in the EIAR receptor database (**EIAR Volume III Appendix 2.2**) as receptor 177. The closest proposed turbine to the Centre is Turbine 1, located approximately 1,810 m away. The Sunyatta Buddhist Centre is therefore located outside the 10 rotor diameter study area for all turbine models. Outside this area, current Wind Energy Development Guidelines (2006) state that the potential for shadow flicker is very low.

Submissions were also received regarding Broadford National School. The school is recorded in the EIAR receptor database (**EIAR Volume III Appendix 2.2**) as receptor 576. The closest proposed turbine to the school is Turbine 10, located approximately 1,671 m away. Broadford National School is therefore located outside the 10 rotor diameter study area for all turbine models. Outside this area, current Wind Energy Development Guidelines (2006) state that the potential for shadow flicker is very low.

3.5 Theme 5: Classification of associated dwellings

Submissions were received regarding the labelling of some receptors as associated dwellings.

A list of sensitive receptors within 2.1km of the proposed turbines was produced for use in the EIAR through both desktop study and field survey. A full description of the methodology employed in producing this receptor list is provided in **EIAR Volume III Appendix 2.1**. Within this receptor list, some sites are labelled as Associated Dwellings.

Subsequent to the shadow flicker assessment being carried out, the following amendments have been made to the list of Associated Dwellings:

- Receptor 4: Not an involved landowner. Label amended from Associated Dwelling to Residential Dwelling.
- Receptor 520: Involved landowner. Label amended from Dilapidated Dwelling / Potential Replacement Opportunity to Associated Dwelling.
- Receptor 606: Not an involved landowner. Label amended from Associated Dwelling to Residential Dwelling.

Shadow flicker was assessed at all sensitive receptors within the shadow flicker study area, including those labelled as Associated Dwellings in the list of sensitive receptors. This change in labelling therefore does not change the levels of shadow flicker predicted at these receptors, the number of sensitive receptors within the study areas, or the total levels of predicted shadow flicker reported in the assessment. It does, however, impact how these are described within the chapter text and labelled within tables and figures.

The above changes to labelling should therefore be noted when interpreting:

- **EIAR Chapter 12,** Figures: 12.1 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 12.10
- **EIAR Chapter 12,** Tables: 12.2, 12.3, 12.4, 12.5, 12.6

Textual amendments to how these receptors are described are fully detailed in Appendix 1 Table A1.

3.6 Theme 6: Assessment methodology and scope of assessment

Submissions were received regarding the methodology used in carrying out the shadow flicker assessment, and the scope of the shadow flicker assessment.

Prediction of shadow flicker effects associated with the Proposed Development was carried out using ReSoft WindFarm 4.2.2.2[1]. The Shadow Flicker module of WindFarm is one of the most used computer models in the industry for predicting and quantifying shadow flicker effects[2]. It has been used in a large number of assessments, including assessments of shadow flicker effects from turbines with comparable turbine dimensions to those proposed at the Proposed Development.

The Shadow Flicker module of WindFarm calculates potential shadow flicker occurrences throughout a year. The assessment therefore considers shadow flicker over a full 12-month period. As described in the Wind Energy Development Guidelines (2006), shadow flicker refers to the effect where the blades of a wind turbine cast a shadow over a window in a nearby house, and the rotation of the blades causes the shadow to flick on and off. All instances of shadow flicker at input sensitive receptors (refer to **EIAR Volume III Appendix 12.1**, **Appendix 12.2** and **Appendix 12.3**) by the WindFarm software are reported in the assessment. Where results of the assessment predict no shadow flicker at a point in time, this does not mean that data is missing for this time period, or that shadows are not predicted to be cast during this time. It means that any shadows cast are not predicted to be cast over windows of a sensitive receptor, and therefore no shadow flicker effects are predicted to occur.

As described in **EIAR Chapter 12**, Section 12.4.6, each receptor was assigned a North, South, East and West facing window placed at the centroid of the property, 1m x 1m in dimension, and with a height of 2m above the ground. This allows for shadow flicker from all directions to be assessed, with the assumption that every wall of each receptor contains a window, which will not necessarily be the case. This is a commonly adopted methodology in shadow flicker assessments. Changes to input window sizes can be expected to impact results in a marginal way. For example, doubling the window size from 1m x 1m to 2m x 2m at receptor 1 changes total predicted hours of shadow flicker per year from 70.8 to 71.5 (for candidate turbine 1), a difference of 0.98%.

As detailed in **EIAR Chapter 12**, Section 12.4.6, the analysis further assumes that:

- The sun is shining from sunrise to sunset (cloudless sky);
- The turbine blades are turning 100% of the time;
- The turbine rotor is oriented directly between the sun and the sensitive receptor; and
- There is no screening (such as trees) between the turbine and the receptor (excluding topography).

[1] https://www.windfarm.co.uk/html/rel_4222.html

[2] UK Department of Energy and Climate Change, 2010. Update of UK Shadow Flicker Evidence Base.

In real life conditions, therefore, the actual shadow flicker durations will be less than the theoretical levels from the model.

As shadow flicker can only occur when the sun is shining, a more "likely" prediction of potential annual shadow flicker duration is also presented in **EIAR Chapter 12**, Section 12.6, using historical weather data to account for the frequency of clear skies when shadows may be cast. This "likely" scenario however still uses other conservative assumptions listed above: That the turbine blades are turning 100% of the time, the turbine rotor is oriented directly between the sun and sensitive receptor, and there is no screening excluding topography. Predicted "likely" annual shadow flicker durations are therefore still likely to be overestimated in the assessment. Because of these assumptions, we refer to results presented in the assessment as 'potential' shadow flicker effects.

3.7 Theme 7: Interpretation of results

Submissions were received regarding the results of the assessment, and their accuracy.

Results of the shadow flicker assessment are presented in **EIAR Chapter 12**, Table 12.2 (candidate turbine 1), Table 12.3 (candidate turbine 2), Table 12.4 (candidate turbine 3), Table 12.5 (cumulative scenario 1) and Table 12.6 (cumulative scenario 2). These tables detail the maximum hours per day and total hours per year of predicted shadow flicker effects ('worst case' scenario), and more 'likely' hours per year incorporating average annual sunshine data. Further detailed results are presented in the appendices (**EIAR Volume III Appendix 12.4** to **Appendix 12.9**). These are direct outputs from the Wind Farm software, and shadow flicker values and instances within these have not been modified.

As described in the Wind Energy Development Guidelines (2006), shadow flicker refers to the effect where the blades of a wind turbine cast a shadow over a window in a nearby house, and the rotation of the blades causes the shadow to flick on and off. All instances of shadow flicker at input sensitive receptors (**EIAR Volume III Appendix 12.1**, **Appendix 12.2** and **Appendix 12.3**) by the WindFarm software are reported in the assessment.

EIAR Volume III Appendix 12.4, **Appendix 12.5** and **Appendix 12.6** detail theoretical shadow times per turbine. This lists, for each turbine, time periods during which turbine blades have the potential to cast shadows on the windows of one or more sensitive receptors within the study area. This does not mean that during these time periods the turbine blades will be casting shadows on every receptor within the study area.

Similarly, **EIAR Volume III Appendix 12.7**, **Appendix 12.8** and **Appendix 12.9** detail theoretical shadow times per sensitive receptor. This lists, for each receptor, time periods during which shadows may be cast by the blades of one or more turbines onto one or more of the receptor's windows.

The location where these shadows are cast depends on the location of the sun in relation to the turbines. This position varies throughout the day and year. Consequently, there will be instances where for example the sun is situated east of a turbine in the sky, and therefore potentially casting shadows on receptors positioned to the west of the turbine, but not on those to the north, south or east. Thus, there will be instances where a turbine is recorded as causing shadow flicker in the theoretical shadow times per turbine listing,

but a nearby receptor experiences no such effect according to the theoretical shadow times per sensitive receptor listing during the same period, because it is outside the area where shadows are being cast.

The Shadow Flicker module of the Wind Farm software used in this assessment calculates potential timing of shadow flicker throughout a year. The assessment therefore considers shadow flicker over a full 12-month period. Where the results of the assessment predict no shadow flicker, this does not mean that data is missing for this time period and does not mean that shadows are not predicted to be cast during this time. It does, however, mean that these shadows are not predicted to be cast over windows of a sensitive receptor, and therefore no shadow flicker effects are predicted to occur.

3.8 Theme 8: Potential cumulative effects

A full assessment of potential cumulative effects was carried out as part of the shadow flicker assessment (**EIAR Chapter 12**, Section 12.9.1). Submissions were received regarding the potential for cumulative effects from Ballycar Wind Farm and Knockshanvo Wind Farm.

As noted in **EIAR Chapter 20 Impact Interactions and Cumulative Effects,** the EIA Directive requires consideration of cumulative effects with existing and/or approved projects. Nonetheless, potential cumulative effects were also considered for (i) projects that are currently going through the planning application system; and (ii) projects that may be envisaged through a plan/programme although there has not been any application submitted yet (*i.e.*, consideration of future development). However, it is important to note that the level of detail available per project will reflect the stage within which it sits in the planning application process. Crucially, therefore, it follows that the level of detail of cumulative assessment is reflective of the level of detail of information available at time of assessment.

At the time the shadow flicker assessment was undertaken, Ballycar Wind Farm was in pre-planning, and proposed turbine locations and specifications were not publicly available. The planning application for Ballycar Wind Farm has now been submitted. Examination of the shadow flicker assessment carried out as part of this indicates that the 10 rotor diameter shadow flicker study area for Ballycar Wind Farm does not overlap with that of the Proposed Development. There is therefore no potential for cumulative effects.

At the time the shadow flicker assessment was undertaken, the planning application for the Knockshanvo Wind Farm had not been submitted for planning, and no finalised detailed information is yet available. However, the planning application for Knockshanvo Wind Farm will likely consider the cumulative impacts from the Proposed Development, for which all relevant information has been submitted in the planning system. Nonetheless, **EIAR Chapter 12** for the Proposed Development presented an assessment of potential cumulative shadow flicker effects, using the latest known project details for Knockshanvo Wind Farm available at the time. As mentioned, it will be the responsibility of the Knockshanvo Wind Farm to demonstrate how it considers that Wind Energy Development Guidelines thresholds for shadow flicker can be achieved in practice through the cumulative operation of both sites.

Should it be necessary, the shadow flicker control system can be operated to curtail Oatfield turbines should they, in combination with Knockshanvo turbines, result in exceedances of adopted Wind Energy Development Guidelines (2006) thresholds of 30 minutes per day, or 30 hours per year. Through the implementation and operation of this system, the Proposed Development will adhere to currently adopted Wind Energy Development Guidelines (2006) thresholds.

APPENDIX 1 - AMENDMENTS TO LABELLING OF ASSOCIATED DWELLINGS

Table A1: Textual amendments to labelling of associated dwellings.

Section	Previous Description	Amended Description
EIAR Chapter 12, Section 12.5.1	There are no sensitive receptors within 500m of the proposed turbines. There are 101 sensitive receptors within the 10 rotor diameter (1,500 m) study area for candidate turbine 1. These consist of: • 82 residential dwellings; • 5 associated dwellings; • 1 place of worship; • 3 sites with planning permission; and • 10 dilapidated dwellings / potential replacement opportunities.	There are no sensitive receptors within 500m of the proposed turbines. There are 101 sensitive receptors within the 10 rotor diameter (1,500 m) study area for candidate turbine 1. These consist of: • 84 residential dwellings; • 4 associated dwellings; • 1 place of worship; • 3 sites with planning permission; and • 9 dilapidated dwellings / potential replacement opportunities.

EIAR Chapter 12, Section 12.5.2	There are no sensitive receptors within 500m of the proposed turbines. There are 98 sensitive receptors within the 10 rotor diameter (1,490 m) study area for candidate turbine 1. These consist of: • 79 residential dwellings; • 5 associated dwellings; • 1 place of worship; • 3 sites with planning permission; and • 10 dilapidated dwellings / potential replacement opportunities.	There are no sensitive receptors within 500m of the proposed turbines. There are 98 sensitive receptors within the 10 rotor diameter (1,490 m) study area for candidate turbine 1. These consist of: • 81 residential dwellings; • 4 associated dwellings; • 1 place of worship; • 3 sites with planning permission; and • 9 dilapidated dwellings / potential replacement opportunities.
EIAR Chapter 12, Section 12.5.3	There are no sensitive receptors within 500m of the proposed turbines. There are 69 sensitive receptors within the 10 rotor diameter (1,3300 m) study area for candidate turbine 1. These consist of: • 55 residential dwellings; • 5 associated dwellings; • 1 place of worship; • 2 sites with planning permission; and • 6 dilapidated dwellings / potential replacement opportunities.	There are no sensitive receptors within 500m of the proposed turbines. There are 69 sensitive receptors within the 10 rotor diameter (1,3300 m) study area for candidate turbine 1. These consist of: • 57 residential dwellings; • 4 associated dwellings; • 1 place of worship; • 2 sites with planning permission; and • 5 dilapidated dwellings / potential replacement opportunities.

EIAR Chapter 12, Section 12.6.4	The results of the analysis for the 'worst-case' scenario for candidate turbine 1 show that of the 101 receptors within the (1,500m) study area, 45 are predicted to experience no shadow flicker, while it is predicted that 56 may experience some shadow flicker. Of these, 40 may potentially exceed the Wind Energy Development Guidelines (2006) thresholds of 30 hours per year or 30 minutes per day. These consist of: • 4 associated dwellings; • 4 dilapidated dwellings / potential replacement opportunities; • 31 residential dwellings; and • 1 site with planning permission.	The results of the analysis for the 'worst-case' scenario for candidate turbine 1 show that of the 101 receptors within the (1,500m) study area, 45 are predicted to experience no shadow flicker, while it is predicted that 56 may experience some shadow flicker. Of these, 40 may potentially exceed the Wind Energy Development Guidelines (2006) thresholds of 30 hours per year or 30 minutes per day. These consist of: • 2 associated dwellings; • 4 dilapidated dwellings / potential replacement opportunities; • 33 residential dwellings; and • 1 site with planning permission.
EIAR Chapter 12, Section 12.6.5	The results of the analysis for the 'worst-case' scenario for candidate turbine 2 show that of the 98 receptors within the (1,490m) study area, 43 are predicted to experience no shadow flicker, while it is predicted that 55 may experience some shadow flicker. Of these, 40 may potentially exceed the Wind Energy Development Guidelines (2006) thresholds of 30 hours per year or 30 minutes per day. These consist of: • 4 associated dwellings; • 4 dilapidated dwellings / potential replacement opportunities; • 31 residential dwellings; and • 1 site with planning permission.	The results of the analysis for the 'worst-case' scenario for candidate turbine 1 show that of the 101 receptors within the (1,500m) study area, 45 are predicted to experience no shadow flicker, while it is predicted that 56 may experience some shadow flicker. Of these, 40 may potentially exceed the Wind Energy Development Guidelines (2006) thresholds of 30 hours per year or 30 minutes per day. These consist of: • 2 associated dwellings; • 4 dilapidated dwellings / potential replacement opportunities; • 33 residential dwellings; and • 1 site with planning permission.

EIAR Chapter 12, Section 12.6.6	The results of the analysis for the 'worst-case' scenario for candidate turbine 3 show that of the 69 receptors within the (1330m) study area, 26 are predicted to experience no shadow flicker, while it is predicted that 43 may experience some shadow flicker. Of these, 31 may potentially exceed the Wind Energy Development Guidelines (2006) thresholds of 30 hours per year or 30 minutes per day. These consist of: • 4 associated dwellings; • 2 dilapidated dwellings / potential replacement opportunities; • 24 residential dwellings; and • 1 site with planning permission.	The results of the analysis for the 'worst-case' scenario for candidate turbine 3 show that of the 69 receptors within the (1330m) study area, 26 are predicted to experience no shadow flicker, while it is predicted that 43 may experience some shadow flicker. Of these, 31 may potentially exceed the Wind Energy Development Guidelines (2006) thresholds of 30 hours per year or 30 minutes per day. These consist of: • 2 associated dwellings; • 2 dilapidated dwellings / potential replacement opportunities; • 26 residential dwellings; and • 1 site with planning permission.