Shadow Flicker Assessment to support a planning application for a single wind turbine, up to 135m to tip height.

Imerys Land, Land at Burngullow, St Mewan, Cornwall, PL26 7TE

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## Shadow Flicker Assessment

A shadow flicker assessment has been prepared to support the planning application for a single turbine of 135m to tip on Imerys land, land at Burngullow, Cornwall PL26 7TE.

Under certain combinations of geographical position and time of day, the sun may pass behind the rotor of a wind turbine and cast intermittent shadow over neighbouring properties, an effect known as 'shadow flicker'. It can occur inside buildings where the flicker appears through a narrow window or opening.

Guidance on the potential impact of shadow flicker recommends considering effects up to a distance of ten times the rotor diameter of the turbine. The application is based on a candidate turbine with a rotor diameter of 115m. As such, a distance of 1,150m from the turbine was considered and modelled.

The assessment concludes that 36 properties fall within the test area of 1,150m. Of these 36 properties, 4 would experience shadow flicker annually. Property 28 could experience a theoretical maximum of up to 41.1 hours of flicker a year, with property 29 experiencing a theoretical maximum of 45.7 hours of flicker a year. This is the maximum amount of shadow flicker that could potentially be experienced by the assessed properties.

The model does not consider varied weather conditions - or screening by trees, hedges, or other buildings, which are expected to greatly reduce potential shadow flicker effects to the surrounding properties. Moreover, it models the worst-case scenario whereby the windows of the property are directly facing the wind turbine. Considering common UK winter weather conditions and unmodelled screening effects, the predicted levels of shadow flicker will be greatly reduced.

Research into the effects of shadow flicker has shown that with this wind turbine model, the flicker effect does not occur at frequencies that may cause human health problems[1].

[1] Epilepsy Society: Wind Turbines and photosensitive epilepsy. Accessed via: https://epilepsysociety.org.uk/about-epilepsy/epileptic-seizures/seizure-triggers/photosensitive-epilepsy/wind-turbines-and#:~:text=Photosensitive%20epilepsy%20affects%20up%20to,effect%20of%20'shadow%20flicker' (Accessed 10th February 2022).

## 1. Introduction

CleanEarth (CE) is seeking planning permission from Cornwall Council for a candidate model wind turbine at a tip height of 135m on land at Burngullow, St Mewan, Cornwall, PL26 7TE. This location is surrounded by agricultural land to the east and a mining landscape to the west.

Under certain combinations of geographical position and time of day, the sun may pass behind the rotor of the proposed wind turbine and cast an intermittent shadow over neighbouring properties, known as the 'shadow flicker' effect. The effect can occur inside buildings where the flicker appears through a narrow window or opening.

## 2. Risks and Shadow Flicker Effects

Concerns have been expressed that the stroboscopic effects of shadow flicker may induce epilepsy or similar symptoms. The effects of light flicker on humans concerning shadow flicker from wind turbines has been reviewed by Clarke[2] and more recently by Brinckerhoff[3]. Both references conclude that the frequencies capable of triggering epilepsy and general disturbance lies between 2.5Hz and 3Hz. Epilepsy affects approximately one in every 600,000 people in the UK with only 3% of those having photosensitive epilepsy which can be triggered by flickers as low as 2Hz[4].

The proposed turbine model has a rated speed of 12.3[5] revolutions per minute (rpm). Given the turbine will have three blades, the frequency at which the blade will pass a particular point will be on the order of 36.9 times a minute which equates to 0.615 flashes per second (hertz). This is substantially less than the 2.5 and 3Hz frequency range generally thought to induce photosensitive epilepsy. As a result, the issue of photosensitive epilepsy is not considered further in this assessment as there are no predicted adverse health effects.

[2] Clarke, A. D. A Case of Shadow Flicker/Flashing: Assessment and Solution, British Wind Energy Association Annual Conference 1981

[3] Brinckerhoff, P. Update of UK Shadow Flicker Evidence Base, Department of Energy and Climate Change, 2016.

[4] Epilepsy Society: Wind Turbines and photosensitive epilepsy. Accessed via: https://epilepsysociety.org.uk/about-epilepsy/epileptic-seizures/seizure-triggers/photosensitive-epilepsy/wind-turbines-and#:~:text=Photosensitive%20epilepsy%20affects%20up%20to,effect%20of%20'shadow%20flicker' (Accessed 10th February 2022).

[5] Vensys 115 4.1MW Technical Data. Accessed via: https://www.vensys.de/fileadmin/user_upload/Windkraftanlagen/4.1_MW-Platform/VENSYS_115/DS-Vensys-115_4.1MW_EN-web.pdf (Accessed 10th February 2022)

## 3. Planning and Shadow Flicker

On the 27th March 2012, the UK Government published the new National Planning Policy Framework (NPPF) with the intention of simplifying the planning system and making it more accessible, to protect the environment and promote sustainable growth.

The NPPF replaces most of the existing Planning Policy Statements (PPS's) and Planning Policy Guidance (PPG's) and a number of Planning Circulars with a single policy document. However, whilst the policies in the NPPF are material considerations for the near future, existing policies and guides continue to carry significant weight in their existing form.

Planning for Renewable Energy – A Companion Guide to PPS22 (2004), provided the following guidance on the subject of shadow flicker:

"*Under certain combinations of geographical position and time of day, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the effect is known as 'shadow flicker'. It only occurs inside buildings where the flicker appears through a narrow window or opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the site. Although problems caused by shadow flicker are rare, for sites where existing development may be subject to this problem, applicants for planning permission for wind turbine installations should provide an analysis to quantify the effect. A single window in a single building is likely to be affected for a few minutes at certain times of the day during short periods of the year. The likelihood of this occurring and the duration of such an effect depends upon:*

- *The direction of the residence relative to the turbine(s);*
- *The distance from the turbine(s);*
- *The turbine hub-height and rotor diameter;*
- *The time of year;*
- *The proportion of day-light hours in which the turbines operate;*
- *The frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon); and,*
- *The prevailing wind direction.*

*Only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK – turbines do not cast long shadows on their southern side.*

*The further the observer is from the turbine the less pronounced the effect will be. There are several reasons for this:*

- *There are fewer times when the sun is low enough to cast a long shadow;*
- *When the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and,*
- *The centre of the rotor's shadow passes more quickly over the land reducing the duration of the effect.*

*At a distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow. This effect occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a very weak effect is observed at distance from the turbines.*

*Shadow flicker can be mitigated by siting wind turbines at sufficient distance from residences likely to be affected. Flicker effects have been proven to occur only within ten rotor diameters of a turbine. Therefore, if the turbine has 80m diameter blades, the potential shadow flicker effect could be felt up to 800m from a turbine.*

*Around 0.5% of the population is epileptic and of those around 5% are photo-sensitive. Of photo-sensitive epileptics less than 5% are sensitive to the lowest frequencies of 2.5-3Hz, the remainder are sensitive only to higher frequencies. The flicker caused by wind turbines is equal to the blade passing frequency. A fast moving three-bladed machine will give rise to the highest levels of flicker frequency. These levels are well below 2Hz. The new generation of wind turbines is known to operate at levels below 1Hz.*

*Turbines can also cause flashes of reflected light, which can be visible for some distance. It is possible to ameliorate the flashing but it is not possible to eliminate it. Careful choice of blade colour and surface finish can help reduce the effect. Light grey semi-matt finishes ate often used for this. Other colours and patterns can also be used to reduce the effect further (see "The influence of Colour on the Aesthetics of Wind Turbine Generators" – ETSU W/14/00533/00/00)".*

*"At a distance of 10 rotor diameters a person should not perceive a wind turbine to be chopping through sunlight, but rather as an object with the sun behind it"[6].*

[6] Onshore Wind: Shadow Flicker. Accessed via: https://webarchive.nationalarchives.gov.uk/ukgwa/20090609022927/http://www.berr.gov.uk/energy/sources/renewables/planning/onshore-wind/shadow-flicker/page18736.html (Accessed 10th February 2022).

Further to this, published by the Department of Energy and Climate Change, the Renewable Energy National Planning Policy Statement EN-3, guidance states:

*"The intensity of the shadow of the rotating blades from the turbines at distances from such buildings of 10 rotor diameters and beyond is sufficiently diminished so as to have no significant impact on occupied buildings"*[7]

Another recently published report by the Department of Energy and Climate Change, 'Update of UK Shadow Flicker Evidence Base' states:

"*On health effects and nuisance of the shadow flicker effect, it is considered that the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health. Mitigation measures by which have been employed to operational wind farms such as turbine shut down strategies, have proved very successful, to the extent that shadow flicker cannot be considered to be a major issue in the UK".*

Furthermore, the report also highlights the best practice guidance implemented by the Northern Ireland Department of the Environment (2009) which:

"*Recommends that shadow flickering at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day"*[8]*.*

The guidance references a survey undertaken by Predac, a European Union Sponsored organisation that promotes best practice in energy use and supply.

## 4. Methodology

The seasonal duration of the shadow flicker can be calculated from the geometry of the turbine and the latitude and topography of the potential site[9].

Assessment of the potential shadow flicker from the proposed turbine has been undertaken using Resoft Windfarm®, an industry-standard software package widely used for the design and assessment of wind farms. The software does not take into account any screening between the houses and turbine

[7] Department of Energy & Climate Change: National Policy Statement for Renewable Energy (EN-3). Accessed via: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf (Accessed 10th February 2022).

[8] Department of Energy and Climate Change, Update of UK Shadow Flicker Evidence Base. Accessed via: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf (Accessed 11th February 2022)

[9] Department of Energy and Climate Change: Update of UK Shadow Flicker Evidence Base. Accessed via: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf (Accessed 10th February 2022)

and assumes perfect weather conditions when any possible shadow flicker effects will be at their worst. Furthermore, Resoft Windfarm does not consider daylight savings time, so this should be applied to any listing data within this report.

Shadow strength decreases with distance from the source and is generally accepted that shadow flicker becomes insignificant at distances greater than 10 times the turbine rotor diameter. The candidate turbine selected for this study has a 77m hub height and a rotor diameter of 115m. The shadow flicker effects beyond the distance of 1,150m, can be considered insignificant. In total, 36 properties were identified within the study area.

Ordnance survey 1:10k scale mapping was used to identify buildings in the search area. The theoretical extent of shadow flicker from the proposed wind turbine was then calculated at all properties within 1,150m.

The location of the turbine used for the analysis is given in Table 1 below.

**Table 1: Turbine Location**

| Turbine | Easting | Northing |
|---|---|---|
| 1 | 198378 | 54117 |

As standard industry practice dictates, it has been assumed that each house within the study area has a window of 1m x 1m, located at the nearest point of the house to the turbine and positioned at a height-to-centre of 2m above ground level directly facing the proposed wind turbine. Ordnance Survey and Google Earth software have been used to identify residential addresses and the location of the properties. This will have the effect of creating a worst-case scenario.

## 5. Predicted Impacts

The summarised results of the modelling are presented in Table 2 below.

**Table 2: Summary of the shadow times on each window for the proposed turbine**

| House | Easting | Northing | Degrees | Days per year | Max hours per year | Mean hours per day | Total hours |
|---|---|---|---|---|---|---|---|
| 1 | 197746 | 53245 | 36 | 0 | 0 | 0 | 0 |
| 2 | 197709 | 53228 | 37 | 0 | 0 | 0 | 0 |
| 3 | 197736 | 53224 | 36 | 0 | 0 | 0 | 0 |
| 4 | 197925 | 53251 | 28 | 0 | 0 | 0 | 0 |
| 5 | 197925 | 53228 | 27 | 0 | 0 | 0 | 0 |
| 6 | 197913 | 53177 | 26 | 0 | 0 | 0 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 197940 | 53185 | 25 | 0 | 0 | 0 | 0 |
| 8 | 198913 | 53172 | 330 | 0 | 0 | 0 | 0 |
| 9 | 198917 | 53176 | 330 | 0 | 0 | 0 | 0 |
| 10 | 198916 | 53123 | 332 | 0 | 0 | 0 | 0 |
| 11 | 198924 | 53140 | 331 | 0 | 0 | 0 | 0 |
| 12 | 198923 | 53182 | 330 | 0 | 0 | 0 | 0 |
| 13 | 198942 | 53149 | 330 | 0 | 0 | 0 | 0 |
| 14 | 198957 | 53141 | 329 | 0 | 0 | 0 | 0 |
| 15 | 198893 | 53232 | 330 | 0 | 0 | 0 | 0 |
| 16 | 198917 | 53247 | 328 | 0 | 0 | 0 | 0 |
| 17 | 198836 | 53255 | 332 | 0 | 0 | 0 | 0 |
| 18 | 198806 | 53278 | 333 | 0 | 0 | 0 | 0 |
| 19 | 198798 | 53288 | 333 | 0 | 0 | 0 | 0 |
| 20 | 198783 | 53314 | 333 | 0 | 0 | 0 | 0 |
| 21 | 198766 | 53352 | 333 | 0 | 0 | 0 | 0 |
| 22 | 198806 | 53360 | 331 | 0 | 0 | 0 | 0 |
| 23 | 198840 | 53356 | 329 | 0 | 0 | 0 | 0 |
| 24 | 198872 | 53361 | 327 | 0 | 0 | 0 | 0 |
| 25 | 198877 | 53379 | 326 | 0 | 0 | 0 | 0 |
| 26 | 198738 | 53386 | 334 | 0 | 0 | 0 | 0 |
| 27 | 198903 | 53112 | 332 | 0 | 0 | 0 | 0 |
| 28 | 199210 | 53829 | 289 | 98 | 0.56 | 0.42 | 41.1 |
| 29 | 199175 | 53836 | 289 | 96 | 0.59 | 0.48 | 45.7 |
| 30 | 198935 | 53134 | 330 | 0 | 0 | 0 | 0 |
| 31 | 198947 | 53136 | 330 | 0 | 0 | 0 | 0 |
| 32 | 197942 | 53237 | 26 | 0 | 0 | 0 | 0 |
| 33 | 198894 | 53384 | 325 | 0 | 0 | 0 | 0 |
| 34 | 199079 | 54122 | 270 | 54 | 0.66 | 0.51 | 27.7 |
| 35 | 199256 | 53930 | 282 | 53 | 0.54 | 0.42 | 22.1 |
| 36 | 198391 | 53068 | 359 | 0 | 0 | 0 | 0 |

The theoretical duration of shadow flicker calculated is nil at 32 of the 36 properties considered within this assessment.

Modelling shows that of the 4 properties that may experience shadow flicker, only 2 are in excess of the 30 hours per year threshold. The 4 properties may also experience over 30 minutes on any day of the 96-98 days that the shadow flickering may occur, which equates to less than 1% of shadow flicker for the year. It is to be understood that that the modelling showcases the theoretical maximum shadow flicker without accounting for the common UK winter weather conditions and screening effects experienced by the properties due to the existence of the dense vegetation and developed areas between the turbine and properties. No other properties would encounter over 30 hours of shadow flicker per annum; outside of this test area, any shadow flicker will be sufficiently diminished so that no significant impacts will occur.

These are the maximum amounts of shadow flicker potentially experienced by the assessed properties. However, the instances of shadow flicker will always be less than that predicted by the model as it is based on a worst-case scenario which assumes perfect weather conditions with sunshine all year round and does not take into account any screening between the house and turbine. The occurrence of shadow flicker is only possible during the operation of the wind turbine (i.e., when the rotor blades are turning) and when the sky is clear enough to cast shadows. It is therefore important to consider the following facts when making an assessment:

- Climatic conditions dictate that the sun is not always shining. Cloud cover, mist and fog can obscure the sun and prevent shadow flicker occurrences. It is considered that weather conditions could reduce the actual occurrences of shadow flicker by at least half, compared to calculated levels;
- Objects such as trees or walls may surround windows and obscure the view of the turbine and hence prevent shadow flicker;
- During operation, the turbine rotors automatically orientate themselves to face the prevailing wind direction**.** This means that the turbine rotors will not always be facing the affected window. Very little of the blade movement would be visible during such occurrences and therefore the potential for shadow flicker is reduced;
- The turbine will not operate for 100% of daylight hours. During periods of very low windspeed, very high windspeed or maintenance related shutdowns, the rotors do not turn. During such periods shadow flicker is not possible.

## 6. Mitigation Measures

Minimising any potential effects of shadow flicker on neighbouring properties has been considered in the positioning of the turbine by maximising the distance of the development site from the existing properties. It is considered that the effects of shadow flicker would not be significant however, monitoring, and mitigating measures will be put in place, to address any potential effects that may arise.

Furthermore, a desk study analysis has indicated that dense vegetation present in the vicinity of the affected properties could provide additional screening to limit the potential of shadow flicker occurring. The cluster of vegetation is located between the effected houses and the proposed wind turbine.

A shadow flicker mitigation programme will be installed into the turbines (on commissioning) to ensure that all impacts could be eliminated in the presence of conditions that would cause shadow flicker. The programme will ensure the turbine could be curtailed (switched off) during periods where the conditions optimum for shadow flicker exist. This programme can be initiated at any time during the operational life of the proposed wind turbine.

Further possible mitigation measures also include, but not limited to, the planting of additional trees and shrubs at the affected dwellings to generate more screening.

## 7. Conclusions

Shadow flicker modelling of the houses within 1,150m of the wind turbine has shown that under perfect weather conditions with sunshine all year round and without considering any screening effects between the houses and turbine, 4 of the 36 properties may experience shadow flicker, with 2 of properties experiencing more than the widely recognised 30-hour annual limit. The presence of screening in the form of dense vegetation between the turbine and the affected properties could greatly reduce the occurrence of shadow flicker. These are subject to the stipulations made in the predicted impacts section above. Furthermore, the proposed turbine will have built in software that will allow for the turbine's shutdown immediately if a valid complaint from an impacted receptor is received which would then effectively nullify any shadow impact.

It is important to note that all shadow flicker values given reflect the theoretical maximum shadow flicker per year. The modelling considerations do not take into account varied weather conditions such as cloud cover, wind speed and direction, or screening by trees or hedges, all of which can be expected to greatly reduce potential shadow flicker effects.

The model indicates that the impact of shadow flicker on the 4 affected properties will occur for less than 1% of the year therefore no significant impacts of shadow flicker are expected to occur during the operation of the proposed wind turbine. If any complaints of shadow flicker effects were to be received during the operation of the turbine, several mitigation measures would be employed to diminish them.

## Appendix A – Detailed listing of shadow flicker events for all houses

House 28: Easting 199210, Northing 53829

| Turbine | Easting | Northing | Day | Start Time | End Time | Duration | % Cover |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 123 | 18:46:25 | 18:52:55 | 00:06:30 | 14.56 |
| 1 | 198378 | 54117 | 124 | 18:42:40 | 18:56:32 | 00:13:53 | 68.53 |
| 1 | 198378 | 54117 | 125 | 18:40:27 | 18:58:37 | 00:18:10 | 100 |
| 1 | 198378 | 54117 | 126 | 18:38:49 | 19:00:09 | 00:21:20 | 100 |
| 1 | 198378 | 54117 | 127 | 18:37:31 | 19:01:23 | 00:23:52 | 100 |
| 1 | 198378 | 54117 | 128 | 18:36:28 | 19:02:24 | 00:25:56 | 100 |
| 1 | 198378 | 54117 | 129 | 18:35:36 | 19:03:14 | 00:27:38 | 100 |
| 1 | 198378 | 54117 | 130 | 18:34:52 | 19:03:55 | 00:29:03 | 100 |
| 1 | 198378 | 54117 | 131 | 18:34:17 | 19:04:30 | 00:30:13 | 100 |
| 1 | 198378 | 54117 | 132 | 18:33:47 | 19:04:59 | 00:31:11 | 100 |
| 1 | 198378 | 54117 | 133 | 18:33:24 | 19:05:23 | 00:31:59 | 100 |
| 1 | 198378 | 54117 | 134 | 18:33:06 | 19:05:42 | 00:32:36 | 100 |
| 1 | 198378 | 54117 | 135 | 18:32:53 | 19:05:58 | 00:33:05 | 100 |
| 1 | 198378 | 54117 | 136 | 18:32:44 | 19:06:10 | 00:33:26 | 100 |
| 1 | 198378 | 54117 | 137 | 18:32:40 | 19:06:19 | 00:33:39 | 100 |
| 1 | 198378 | 54117 | 138 | 18:32:39 | 19:06:25 | 00:33:46 | 100 |
| 1 | 198378 | 54117 | 139 | 18:32:41 | 19:06:29 | 00:33:47 | 100 |
| 1 | 198378 | 54117 | 140 | 18:32:47 | 19:06:30 | 00:33:42 | 100 |
| 1 | 198378 | 54117 | 141 | 18:32:56 | 19:06:29 | 00:33:33 | 100 |
| 1 | 198378 | 54117 | 142 | 18:33:07 | 19:06:26 | 00:33:19 | 100 |
| 1 | 198378 | 54117 | 143 | 18:33:21 | 19:06:21 | 00:33:00 | 100 |
| 1 | 198378 | 54117 | 144 | 18:33:37 | 19:06:14 | 00:32:37 | 100 |
| 1 | 198378 | 54117 | 145 | 18:33:56 | 19:06:06 | 00:32:10 | 100 |
| 1 | 198378 | 54117 | 146 | 18:34:17 | 19:05:56 | 00:31:39 | 100 |
| 1 | 198378 | 54117 | 147 | 18:34:41 | 19:05:45 | 00:31:04 | 100 |
| 1 | 198378 | 54117 | 148 | 18:35:06 | 19:05:33 | 00:30:26 | 100 |
| 1 | 198378 | 54117 | 149 | 18:35:34 | 19:05:19 | 00:29:46 | 100 |
| 1 | 198378 | 54117 | 150 | 18:36:03 | 19:05:05 | 00:29:02 | 100 |
| 1 | 198378 | 54117 | 151 | 18:36:34 | 19:04:50 | 00:28:16 | 100 |
| 1 | 198378 | 54117 | 152 | 18:37:07 | 19:04:34 | 00:27:27 | 100 |
| 1 | 198378 | 54117 | 153 | 18:37:40 | 19:04:17 | 00:26:37 | 100 |
| 1 | 198378 | 54117 | 154 | 18:38:16 | 19:04:01 | 00:25:45 | 100 |
| 1 | 198378 | 54117 | 155 | 18:38:52 | 19:03:44 | 00:24:52 | 100 |
| 1 | 198378 | 54117 | 156 | 18:39:29 | 19:03:27 | 00:23:58 | 100 |
| 1 | 198378 | 54117 | 157 | 18:40:07 | 19:03:10 | 00:23:03 | 100 |
| 1 | 198378 | 54117 | 158 | 18:40:45 | 19:02:53 | 00:22:08 | 100 |
| 1 | 198378 | 54117 | 159 | 18:41:24 | 19:02:36 | 00:21:12 | 100 |
| 1 | 198378 | 54117 | 160 | 18:42:03 | 19:02:19 | 00:20:17 | 100 |
| 1 | 198378 | 54117 | 161 | 18:42:41 | 19:02:03 | 00:19:22 | 100 |
| 1 | 198378 | 54117 | 162 | 18:43:20 | 19:01:48 | 00:18:29 | 100 |
| 1 | 198378 | 54117 | 163 | 18:43:57 | 19:01:34 | 00:17:37 | 100 |
| 1 | 198378 | 54117 | 164 | 18:44:34 | 19:01:22 | 00:16:48 | 94.14 |
| 1 | 198378 | 54117 | 165 | 18:45:09 | 19:01:11 | 00:16:02 | 85.17 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 166 | 18:45:42 | 19:01:03 | 00:15:21 | 77.46 |
| 1 | 198378 | 54117 | 167 | 18:46:13 | 19:00:57 | 00:14:44 | 71.01 |
| 1 | 198378 | 54117 | 168 | 18:46:42 | 19:00:54 | 00:14:13 | 65.82 |
| 1 | 198378 | 54117 | 169 | 18:47:07 | 19:00:55 | 00:13:48 | 61.89 |
| 1 | 198378 | 54117 | 170 | 18:47:28 | 19:00:59 | 00:13:31 | 59.23 |
| 1 | 198378 | 54117 | 171 | 18:47:46 | 19:01:08 | 00:13:22 | 57.84 |
| 1 | 198378 | 54117 | 172 | 18:47:59 | 19:01:20 | 00:13:21 | 57.71 |
| 1 | 198378 | 54117 | 173 | 18:48:09 | 19:01:37 | 00:13:29 | 58.85 |
| 1 | 198378 | 54117 | 174 | 18:48:14 | 19:01:58 | 00:13:44 | 61.25 |
| 1 | 198378 | 54117 | 175 | 18:48:16 | 19:02:23 | 00:14:07 | 64.92 |
| 1 | 198378 | 54117 | 176 | 18:48:14 | 19:02:51 | 00:14:37 | 69.85 |
| 1 | 198378 | 54117 | 177 | 18:48:09 | 19:03:22 | 00:15:13 | 76.04 |
| 1 | 198378 | 54117 | 178 | 18:48:01 | 19:03:55 | 00:15:54 | 83.48 |
| 1 | 198378 | 54117 | 179 | 18:47:51 | 19:04:30 | 00:16:39 | 92.18 |
| 1 | 198378 | 54117 | 180 | 18:47:40 | 19:05:07 | 00:17:27 | 100 |
| 1 | 198378 | 54117 | 181 | 18:47:27 | 19:05:45 | 00:18:18 | 100 |
| 1 | 198378 | 54117 | 182 | 18:47:12 | 19:06:24 | 00:19:11 | 100 |
| 1 | 198378 | 54117 | 183 | 18:46:57 | 19:07:03 | 00:20:06 | 100 |
| 1 | 198378 | 54117 | 184 | 18:46:41 | 19:07:42 | 00:21:01 | 100 |
| 1 | 198378 | 54117 | 185 | 18:46:25 | 19:08:21 | 00:21:56 | 100 |
| 1 | 198378 | 54117 | 186 | 18:46:08 | 19:08:59 | 00:22:51 | 100 |
| 1 | 198378 | 54117 | 187 | 18:45:52 | 19:09:38 | 00:23:46 | 100 |
| 1 | 198378 | 54117 | 188 | 18:45:35 | 19:10:15 | 00:24:40 | 100 |
| 1 | 198378 | 54117 | 189 | 18:45:18 | 19:10:52 | 00:25:33 | 100 |
| 1 | 198378 | 54117 | 190 | 18:45:02 | 19:11:27 | 00:26:25 | 100 |
| 1 | 198378 | 54117 | 191 | 18:44:46 | 19:12:02 | 00:27:16 | 100 |
| 1 | 198378 | 54117 | 192 | 18:44:31 | 19:12:35 | 00:28:04 | 100 |
| 1 | 198378 | 54117 | 193 | 18:44:16 | 19:13:07 | 00:28:51 | 100 |
| 1 | 198378 | 54117 | 194 | 18:44:02 | 19:13:37 | 00:29:35 | 100 |
| 1 | 198378 | 54117 | 195 | 18:43:49 | 19:14:05 | 00:30:16 | 100 |
| 1 | 198378 | 54117 | 196 | 18:43:36 | 19:14:31 | 00:30:55 | 100 |
| 1 | 198378 | 54117 | 197 | 18:43:25 | 19:14:55 | 00:31:30 | 100 |
| 1 | 198378 | 54117 | 198 | 18:43:15 | 19:15:16 | 00:32:02 | 100 |
| 1 | 198378 | 54117 | 199 | 18:43:06 | 19:15:36 | 00:32:30 | 100 |
| 1 | 198378 | 54117 | 200 | 18:42:58 | 19:15:52 | 00:32:54 | 100 |
| 1 | 198378 | 54117 | 201 | 18:42:52 | 19:16:06 | 00:33:14 | 100 |
| 1 | 198378 | 54117 | 202 | 18:42:48 | 19:16:18 | 00:33:29 | 100 |
| 1 | 198378 | 54117 | 203 | 18:42:46 | 19:16:26 | 00:33:40 | 100 |
| 1 | 198378 | 54117 | 204 | 18:42:44 | 19:16:31 | 00:33:47 | 100 |
| 1 | 198378 | 54117 | 205 | 18:42:44 | 19:16:32 | 00:33:48 | 100 |
| 1 | 198378 | 54117 | 206 | 18:42:47 | 19:16:30 | 00:33:43 | 100 |
| 1 | 198378 | 54117 | 207 | 18:42:52 | 19:16:24 | 00:33:32 | 100 |
| 1 | 198378 | 54117 | 208 | 18:42:59 | 19:16:14 | 00:33:14 | 100 |
| 1 | 198378 | 54117 | 209 | 18:43:11 | 19:15:59 | 00:32:48 | 100 |
| 1 | 198378 | 54117 | 210 | 18:43:25 | 19:15:40 | 00:32:15 | 100 |
| 1 | 198378 | 54117 | 211 | 18:43:43 | 19:15:15 | 00:31:32 | 100 |
| 1 | 198378 | 54117 | 212 | 18:44:06 | 19:14:44 | 00:30:39 | 100 |
| 1 | 198378 | 54117 | 213 | 18:44:33 | 19:14:07 | 00:29:34 | 100 |
| 1 | 198378 | 54117 | 214 | 18:45:07 | 19:13:23 | 00:28:16 | 100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 215 | 18:45:47 | 19:12:30 | 00:26:43 | 100 |
| 1 | 198378 | 54117 | 216 | 18:46:36 | 19:11:26 | 00:24:50 | 100 |
| 1 | 198378 | 54117 | 217 | 18:47:36 | 19:10:09 | 00:22:33 | 100 |
| 1 | 198378 | 54117 | 218 | 18:48:52 | 19:08:37 | 00:19:45 | 100 |
| 1 | 198378 | 54117 | 219 | 18:50:32 | 19:06:39 | 00:16:07 | 93.41 |
| 1 | 198378 | 54117 | 220 | 18:53:01 | 19:03:51 | 00:10:50 | 40.77 |

House 29: Easting 199175, Northing 53836

| Turbine | Easting | Northing | Day | Start Time | End Time | Duration | % Cover |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 124 | 18:46:15 | 18:53:22 | 00:07:07 | 16.77 |
| 1 | 198378 | 54117 | 125 | 18:42:36 | 18:56:54 | 00:14:19 | 69.9 |
| 1 | 198378 | 54117 | 126 | 18:40:24 | 18:58:59 | 00:18:36 | 100 |
| 1 | 198378 | 54117 | 127 | 18:38:45 | 19:00:33 | 00:21:48 | 100 |
| 1 | 198378 | 54117 | 128 | 18:37:27 | 19:01:49 | 00:24:23 | 100 |
| 1 | 198378 | 54117 | 129 | 18:36:22 | 19:02:52 | 00:26:29 | 100 |
| 1 | 198378 | 54117 | 130 | 18:35:29 | 19:03:44 | 00:28:15 | 100 |
| 1 | 198378 | 54117 | 131 | 18:34:45 | 19:04:28 | 00:29:43 | 100 |
| 1 | 198378 | 54117 | 132 | 18:34:08 | 19:05:05 | 00:30:57 | 100 |
| 1 | 198378 | 54117 | 133 | 18:33:38 | 19:05:37 | 00:31:59 | 100 |
| 1 | 198378 | 54117 | 134 | 18:33:13 | 19:06:03 | 00:32:50 | 100 |
| 1 | 198378 | 54117 | 135 | 18:32:53 | 19:06:26 | 00:33:32 | 100 |
| 1 | 198378 | 54117 | 136 | 18:32:39 | 19:06:44 | 00:34:05 | 100 |
| 1 | 198378 | 54117 | 137 | 18:32:28 | 19:06:59 | 00:34:31 | 100 |
| 1 | 198378 | 54117 | 138 | 18:32:21 | 19:07:11 | 00:34:50 | 100 |
| 1 | 198378 | 54117 | 139 | 18:32:18 | 19:07:21 | 00:35:02 | 100 |
| 1 | 198378 | 54117 | 140 | 18:32:19 | 19:07:28 | 00:35:09 | 100 |
| 1 | 198378 | 54117 | 141 | 18:32:22 | 19:07:33 | 00:35:10 | 100 |
| 1 | 198378 | 54117 | 142 | 18:32:29 | 19:07:36 | 00:35:07 | 100 |
| 1 | 198378 | 54117 | 143 | 18:32:38 | 19:07:37 | 00:34:59 | 100 |
| 1 | 198378 | 54117 | 144 | 18:32:49 | 19:07:36 | 00:34:47 | 100 |
| 1 | 198378 | 54117 | 145 | 18:33:02 | 19:07:34 | 00:34:32 | 100 |
| 1 | 198378 | 54117 | 146 | 18:33:17 | 19:07:30 | 00:34:13 | 100 |
| 1 | 198378 | 54117 | 147 | 18:33:35 | 19:07:26 | 00:33:51 | 100 |
| 1 | 198378 | 54117 | 148 | 18:33:54 | 19:07:20 | 00:33:26 | 100 |
| 1 | 198378 | 54117 | 149 | 18:34:15 | 19:07:13 | 00:32:58 | 100 |
| 1 | 198378 | 54117 | 150 | 18:34:38 | 19:07:06 | 00:32:27 | 100 |
| 1 | 198378 | 54117 | 151 | 18:35:03 | 19:06:57 | 00:31:55 | 100 |
| 1 | 198378 | 54117 | 152 | 18:35:28 | 19:06:49 | 00:31:21 | 100 |
| 1 | 198378 | 54117 | 153 | 18:35:55 | 19:06:40 | 00:30:45 | 100 |
| 1 | 198378 | 54117 | 154 | 18:36:22 | 19:06:30 | 00:30:08 | 100 |
| 1 | 198378 | 54117 | 155 | 18:36:51 | 19:06:21 | 00:29:30 | 100 |
| 1 | 198378 | 54117 | 156 | 18:37:20 | 19:06:11 | 00:28:51 | 100 |
| 1 | 198378 | 54117 | 157 | 18:37:50 | 19:06:02 | 00:28:13 | 100 |
| 1 | 198378 | 54117 | 158 | 18:38:19 | 19:05:53 | 00:27:34 | 100 |
| 1 | 198378 | 54117 | 159 | 18:38:49 | 19:05:45 | 00:26:56 | 100 |
| 1 | 198378 | 54117 | 160 | 18:39:19 | 19:05:38 | 00:26:19 | 100 |
| 1 | 198378 | 54117 | 161 | 18:39:48 | 19:05:32 | 00:25:43 | 100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 162 | 18:40:17 | 19:05:26 | 00:25:09 | 100 |
| 1 | 198378 | 54117 | 163 | 18:40:45 | 19:05:22 | 00:24:37 | 100 |
| 1 | 198378 | 54117 | 164 | 18:41:12 | 19:05:19 | 00:24:07 | 100 |
| 1 | 198378 | 54117 | 165 | 18:41:38 | 19:05:17 | 00:23:39 | 100 |
| 1 | 198378 | 54117 | 166 | 18:42:03 | 19:05:18 | 00:23:15 | 100 |
| 1 | 198378 | 54117 | 167 | 18:42:26 | 19:05:20 | 00:22:54 | 100 |
| 1 | 198378 | 54117 | 168 | 18:42:48 | 19:05:24 | 00:22:36 | 100 |
| 1 | 198378 | 54117 | 169 | 18:43:07 | 19:05:30 | 00:22:23 | 100 |
| 1 | 198378 | 54117 | 170 | 18:43:25 | 19:05:38 | 00:22:14 | 100 |
| 1 | 198378 | 54117 | 171 | 18:43:40 | 19:05:49 | 00:22:09 | 100 |
| 1 | 198378 | 54117 | 172 | 18:43:54 | 19:06:02 | 00:22:08 | 100 |
| 1 | 198378 | 54117 | 173 | 18:44:05 | 19:06:17 | 00:22:12 | 100 |
| 1 | 198378 | 54117 | 174 | 18:44:14 | 19:06:34 | 00:22:21 | 100 |
| 1 | 198378 | 54117 | 175 | 18:44:20 | 19:06:54 | 00:22:33 | 100 |
| 1 | 198378 | 54117 | 176 | 18:44:25 | 19:07:15 | 00:22:50 | 100 |
| 1 | 198378 | 54117 | 177 | 18:44:28 | 19:07:38 | 00:23:10 | 100 |
| 1 | 198378 | 54117 | 178 | 18:44:29 | 19:08:03 | 00:23:34 | 100 |
| 1 | 198378 | 54117 | 179 | 18:44:28 | 19:08:29 | 00:24:01 | 100 |
| 1 | 198378 | 54117 | 180 | 18:44:26 | 19:08:56 | 00:24:31 | 100 |
| 1 | 198378 | 54117 | 181 | 18:44:22 | 19:09:25 | 00:25:03 | 100 |
| 1 | 198378 | 54117 | 182 | 18:44:17 | 19:09:54 | 00:25:36 | 100 |
| 1 | 198378 | 54117 | 183 | 18:44:12 | 19:10:23 | 00:26:12 | 100 |
| 1 | 198378 | 54117 | 184 | 18:44:05 | 19:10:53 | 00:26:49 | 100 |
| 1 | 198378 | 54117 | 185 | 18:43:57 | 19:11:23 | 00:27:26 | 100 |
| 1 | 198378 | 54117 | 186 | 18:43:49 | 19:11:54 | 00:28:04 | 100 |
| 1 | 198378 | 54117 | 187 | 18:43:41 | 19:12:24 | 00:28:43 | 100 |
| 1 | 198378 | 54117 | 188 | 18:43:32 | 19:12:54 | 00:29:22 | 100 |
| 1 | 198378 | 54117 | 189 | 18:43:23 | 19:13:23 | 00:29:59 | 100 |
| 1 | 198378 | 54117 | 190 | 18:43:15 | 19:13:51 | 00:30:37 | 100 |
| 1 | 198378 | 54117 | 191 | 18:43:06 | 19:14:18 | 00:31:13 | 100 |
| 1 | 198378 | 54117 | 192 | 18:42:57 | 19:14:44 | 00:31:47 | 100 |
| 1 | 198378 | 54117 | 193 | 18:42:49 | 19:15:09 | 00:32:20 | 100 |
| 1 | 198378 | 54117 | 194 | 18:42:42 | 19:15:32 | 00:32:50 | 100 |
| 1 | 198378 | 54117 | 195 | 18:42:35 | 19:15:54 | 00:33:19 | 100 |
| 1 | 198378 | 54117 | 196 | 18:42:28 | 19:16:13 | 00:33:45 | 100 |
| 1 | 198378 | 54117 | 197 | 18:42:23 | 19:16:31 | 00:34:08 | 100 |
| 1 | 198378 | 54117 | 198 | 18:42:19 | 19:16:46 | 00:34:27 | 100 |
| 1 | 198378 | 54117 | 199 | 18:42:16 | 19:16:59 | 00:34:44 | 100 |
| 1 | 198378 | 54117 | 200 | 18:42:14 | 19:17:10 | 00:34:56 | 100 |
| 1 | 198378 | 54117 | 201 | 18:42:13 | 19:17:18 | 00:35:05 | 100 |
| 1 | 198378 | 54117 | 202 | 18:42:13 | 19:17:23 | 00:35:10 | 100 |
| 1 | 198378 | 54117 | 203 | 18:42:15 | 19:17:26 | 00:35:11 | 100 |
| 1 | 198378 | 54117 | 204 | 18:42:19 | 19:17:25 | 00:35:06 | 100 |
| 1 | 198378 | 54117 | 205 | 18:42:25 | 19:17:20 | 00:34:55 | 100 |
| 1 | 198378 | 54117 | 206 | 18:42:33 | 19:17:12 | 00:34:39 | 100 |
| 1 | 198378 | 54117 | 207 | 18:42:44 | 19:17:00 | 00:34:16 | 100 |
| 1 | 198378 | 54117 | 208 | 18:42:58 | 19:16:44 | 00:33:46 | 100 |
| 1 | 198378 | 54117 | 209 | 18:43:15 | 19:16:22 | 00:33:07 | 100 |
| 1 | 198378 | 54117 | 210 | 18:43:36 | 19:15:56 | 00:32:20 | 100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 211 | 18:44:01 | 19:15:24 | 00:31:23 | 100 |
| 1 | 198378 | 54117 | 212 | 18:44:31 | 19:14:46 | 00:30:15 | 100 |
| 1 | 198378 | 54117 | 213 | 18:45:06 | 19:13:59 | 00:28:54 | 100 |
| 1 | 198378 | 54117 | 214 | 18:45:49 | 19:13:05 | 00:27:17 | 100 |
| 1 | 198378 | 54117 | 215 | 18:46:40 | 19:12:01 | 00:25:21 | 100 |
| 1 | 198378 | 54117 | 216 | 18:47:42 | 19:10:43 | 00:23:01 | 100 |
| 1 | 198378 | 54117 | 217 | 18:49:00 | 19:09:10 | 00:20:10 | 100 |
| 1 | 198378 | 54117 | 218 | 18:50:42 | 19:07:12 | 00:16:30 | 93.77 |
| 1 | 198378 | 54117 | 219 | 18:53:11 | 19:04:24 | 00:11:13 | 41.93 |

House 34: Easting 199079, Northing 54122

| Turbine | Easting | Northing | Day | Start Time | End Time | Duration | % Cover |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 84 | 17:54:38 | 18:06:20 | 00:11:42 | 42.35 |
| 1 | 198378 | 54117 | 85 | 17:50:41 | 18:09:41 | 00:19:00 | 100 |
| 1 | 198378 | 54117 | 86 | 17:47:59 | 18:11:47 | 00:23:47 | 100 |
| 1 | 198378 | 54117 | 87 | 17:45:53 | 18:13:19 | 00:27:27 | 100 |
| 1 | 198378 | 54117 | 88 | 17:44:08 | 18:14:30 | 00:30:22 | 100 |
| 1 | 198378 | 54117 | 89 | 17:42:40 | 18:15:24 | 00:32:44 | 100 |
| 1 | 198378 | 54117 | 90 | 17:41:26 | 18:16:05 | 00:34:39 | 100 |
| 1 | 198378 | 54117 | 91 | 17:40:22 | 18:16:34 | 00:36:12 | 100 |
| 1 | 198378 | 54117 | 92 | 17:39:28 | 18:16:54 | 00:37:26 | 100 |
| 1 | 198378 | 54117 | 93 | 17:38:43 | 18:17:06 | 00:38:23 | 100 |
| 1 | 198378 | 54117 | 94 | 17:38:05 | 18:17:09 | 00:39:04 | 100 |
| 1 | 198378 | 54117 | 95 | 17:37:36 | 18:17:05 | 00:39:30 | 100 |
| 1 | 198378 | 54117 | 96 | 17:37:14 | 18:16:54 | 00:39:41 | 100 |
| 1 | 198378 | 54117 | 97 | 17:36:58 | 18:16:36 | 00:39:38 | 100 |
| 1 | 198378 | 54117 | 98 | 17:36:50 | 18:16:12 | 00:39:22 | 100 |
| 1 | 198378 | 54117 | 99 | 17:36:47 | 18:15:40 | 00:38:53 | 100 |
| 1 | 198378 | 54117 | 100 | 17:36:52 | 18:15:02 | 00:38:10 | 100 |
| 1 | 198378 | 54117 | 101 | 17:37:04 | 18:14:16 | 00:37:12 | 100 |
| 1 | 198378 | 54117 | 102 | 17:37:24 | 18:13:23 | 00:35:59 | 100 |
| 1 | 198378 | 54117 | 103 | 17:37:54 | 18:12:21 | 00:34:27 | 100 |
| 1 | 198378 | 54117 | 104 | 17:38:33 | 18:11:09 | 00:32:36 | 100 |
| 1 | 198378 | 54117 | 105 | 17:39:24 | 18:09:46 | 00:30:23 | 100 |
| 1 | 198378 | 54117 | 106 | 17:40:29 | 18:08:12 | 00:27:43 | 100 |
| 1 | 198378 | 54117 | 107 | 17:41:52 | 18:06:20 | 00:24:29 | 100 |
| 1 | 198378 | 54117 | 108 | 17:43:42 | 18:04:03 | 00:20:21 | 100 |
| 1 | 198378 | 54117 | 109 | 17:46:19 | 18:00:58 | 00:14:39 | 64.14 |
| 1 | 198378 | 54117 | 110 | 17:53:03 | 17:53:49 | 00:00:46 | 0.17 |
| 1 | 198378 | 54117 | 234 | 17:53:38 | 18:01:16 | 00:07:38 | 16.82 |
| 1 | 198378 | 54117 | 235 | 17:49:03 | 18:05:21 | 00:16:19 | 79.68 |
| 1 | 198378 | 54117 | 236 | 17:46:13 | 18:07:39 | 00:21:26 | 100 |
| 1 | 198378 | 54117 | 237 | 17:44:02 | 18:09:18 | 00:25:16 | 100 |
| 1 | 198378 | 54117 | 238 | 17:42:13 | 18:10:33 | 00:28:20 | 100 |
| 1 | 198378 | 54117 | 239 | 17:40:41 | 18:11:32 | 00:30:51 | 100 |
| 1 | 198378 | 54117 | 240 | 17:39:21 | 18:12:19 | 00:32:59 | 100 |
| 1 | 198378 | 54117 | 241 | 17:38:11 | 18:12:55 | 00:34:45 | 100 |

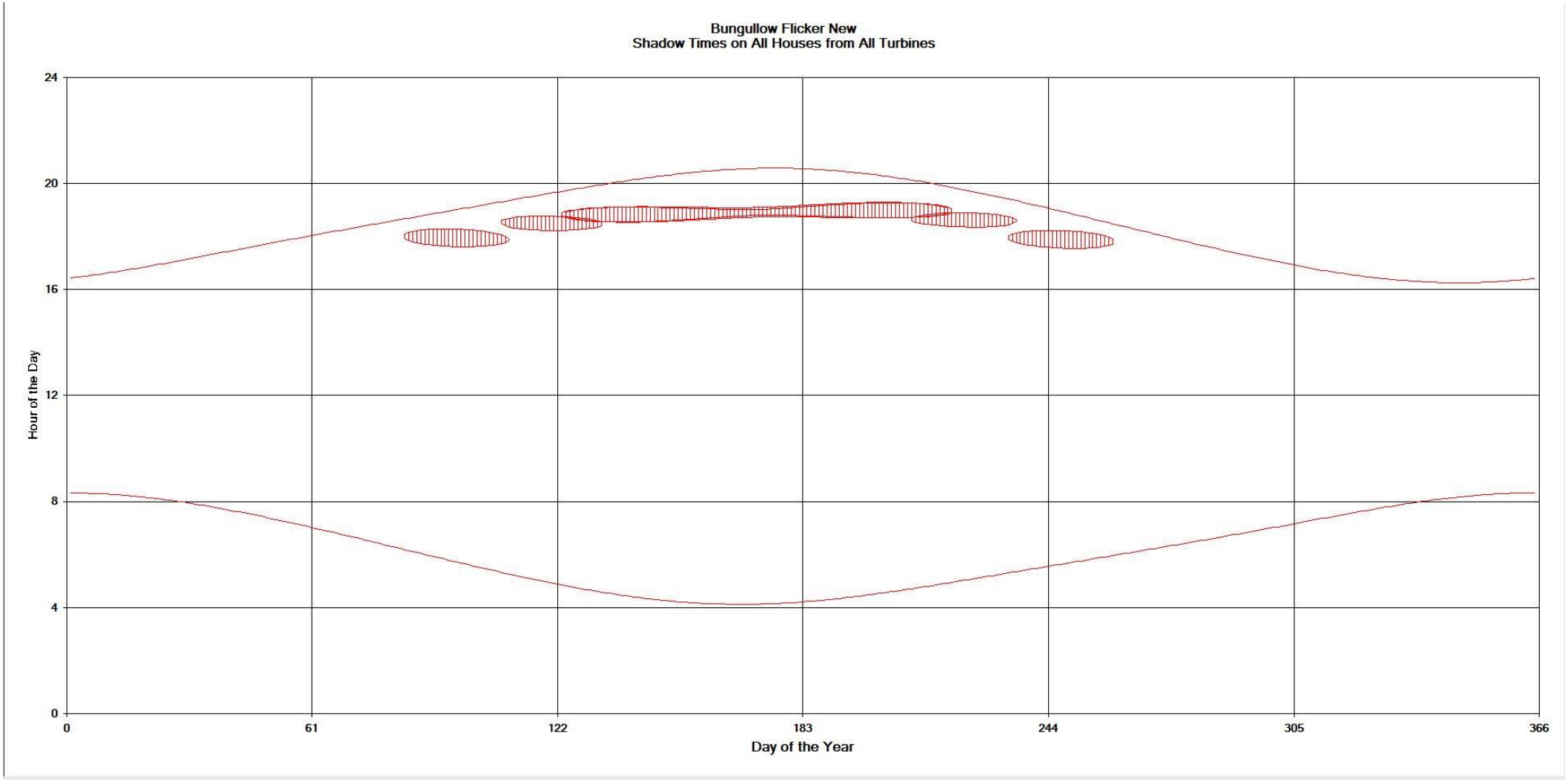
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 242 | 17:37:10 | 18:13:22 | 00:36:12 | 100 |
| 1 | 198378 | 54117 | 243 | 17:36:16 | 18:13:39 | 00:37:22 | 100 |
| 1 | 198378 | 54117 | 244 | 17:35:31 | 18:13:48 | 00:38:18 | 100 |
| 1 | 198378 | 54117 | 245 | 17:34:52 | 18:13:50 | 00:38:58 | 100 |
| 1 | 198378 | 54117 | 246 | 17:34:19 | 18:13:44 | 00:39:25 | 100 |
| 1 | 198378 | 54117 | 247 | 17:33:52 | 18:13:31 | 00:39:40 | 100 |
| 1 | 198378 | 54117 | 248 | 17:33:30 | 18:13:12 | 00:39:41 | 100 |
| 1 | 198378 | 54117 | 249 | 17:33:15 | 18:12:45 | 00:39:29 | 100 |
| 1 | 198378 | 54117 | 250 | 17:33:07 | 18:12:11 | 00:39:04 | 100 |
| 1 | 198378 | 54117 | 251 | 17:33:06 | 18:11:29 | 00:38:23 | 100 |
| 1 | 198378 | 54117 | 252 | 17:33:12 | 18:10:39 | 00:37:27 | 100 |
| 1 | 198378 | 54117 | 253 | 17:33:27 | 18:09:41 | 00:36:14 | 100 |
| 1 | 198378 | 54117 | 254 | 17:33:50 | 18:08:34 | 00:34:43 | 100 |
| 1 | 198378 | 54117 | 255 | 17:34:25 | 18:07:15 | 00:32:50 | 100 |
| 1 | 198378 | 54117 | 256 | 17:35:11 | 18:05:43 | 00:30:32 | 100 |
| 1 | 198378 | 54117 | 257 | 17:36:13 | 18:03:56 | 00:27:43 | 100 |
| 1 | 198378 | 54117 | 258 | 17:37:36 | 18:01:47 | 00:24:11 | 100 |
| 1 | 198378 | 54117 | 259 | 17:39:31 | 17:59:09 | 00:19:38 | 100 |
| 1 | 198378 | 54117 | 260 | 17:42:31 | 17:55:26 | 00:12:56 | 51.46 |

House 35: Easting 199256, Northing 53930

| Turbine | Easting | Northing | Day | Start Time | End Time | Duration | % Cover |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 108 | 18:30:43 | 18:36:28 | 00:05:46 | 34.57 |
| 1 | 198378 | 54117 | 109 | 18:23:56 | 18:39:26 | 00:15:30 | 99.18 |
| 1 | 198378 | 54117 | 110 | 18:21:13 | 18:41:16 | 00:20:03 | 100 |
| 1 | 198378 | 54117 | 111 | 18:19:31 | 18:42:37 | 00:23:06 | 100 |
| 1 | 198378 | 54117 | 112 | 18:18:09 | 18:43:39 | 00:25:30 | 100 |
| 1 | 198378 | 54117 | 113 | 18:17:02 | 18:44:26 | 00:27:24 | 100 |
| 1 | 198378 | 54117 | 114 | 18:16:07 | 18:45:02 | 00:28:55 | 100 |
| 1 | 198378 | 54117 | 115 | 18:15:22 | 18:45:28 | 00:30:06 | 100 |
| 1 | 198378 | 54117 | 116 | 18:14:45 | 18:45:46 | 00:31:01 | 100 |
| 1 | 198378 | 54117 | 117 | 18:14:17 | 18:45:57 | 00:31:40 | 100 |
| 1 | 198378 | 54117 | 118 | 18:13:56 | 18:46:02 | 00:32:06 | 100 |
| 1 | 198378 | 54117 | 119 | 18:13:42 | 18:46:01 | 00:32:19 | 100 |
| 1 | 198378 | 54117 | 120 | 18:13:34 | 18:45:53 | 00:32:19 | 100 |
| 1 | 198378 | 54117 | 121 | 18:13:32 | 18:45:41 | 00:32:09 | 100 |
| 1 | 198378 | 54117 | 122 | 18:13:36 | 18:45:23 | 00:31:47 | 100 |
| 1 | 198378 | 54117 | 123 | 18:13:45 | 18:44:59 | 00:31:15 | 100 |
| 1 | 198378 | 54117 | 124 | 18:14:01 | 18:44:31 | 00:30:30 | 100 |
| 1 | 198378 | 54117 | 125 | 18:14:24 | 18:43:56 | 00:29:33 | 100 |
| 1 | 198378 | 54117 | 126 | 18:14:53 | 18:43:16 | 00:28:23 | 100 |
| 1 | 198378 | 54117 | 127 | 18:15:30 | 18:42:29 | 00:26:59 | 100 |
| 1 | 198378 | 54117 | 128 | 18:16:14 | 18:41:34 | 00:25:20 | 100 |
| 1 | 198378 | 54117 | 129 | 18:17:09 | 18:40:32 | 00:23:24 | 100 |
| 1 | 198378 | 54117 | 130 | 18:18:15 | 18:39:20 | 00:21:05 | 100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 198378 | 54117 | 131 | 18:19:36 | 18:37:54 | 00:18:17 | 100 |
| 1 | 198378 | 54117 | 132 | 18:21:21 | 18:36:05 | 00:14:43 | 77.63 |
| 1 | 198378 | 54117 | 133 | 18:23:53 | 18:33:30 | 00:09:37 | 31.99 |
| 1 | 198378 | 54117 | 210 | 18:35:40 | 18:42:03 | 00:06:23 | 13.8 |
| 1 | 198378 | 54117 | 211 | 18:32:23 | 18:45:17 | 00:12:54 | 58.41 |
| 1 | 198378 | 54117 | 212 | 18:30:21 | 18:47:15 | 00:16:54 | 100 |
| 1 | 198378 | 54117 | 213 | 18:28:46 | 18:48:44 | 00:19:57 | 100 |
| 1 | 198378 | 54117 | 214 | 18:27:29 | 18:49:55 | 00:22:26 | 100 |
| 1 | 198378 | 54117 | 215 | 18:26:22 | 18:50:52 | 00:24:30 | 100 |
| 1 | 198378 | 54117 | 216 | 18:25:25 | 18:51:41 | 00:26:16 | 100 |
| 1 | 198378 | 54117 | 217 | 18:24:36 | 18:52:21 | 00:27:46 | 100 |
| 1 | 198378 | 54117 | 218 | 18:23:52 | 18:52:54 | 00:29:01 | 100 |
| 1 | 198378 | 54117 | 219 | 18:23:15 | 18:53:18 | 00:30:04 | 100 |
| 1 | 198378 | 54117 | 220 | 18:22:43 | 18:53:36 | 00:30:54 | 100 |
| 1 | 198378 | 54117 | 221 | 18:22:15 | 18:53:48 | 00:31:32 | 100 |
| 1 | 198378 | 54117 | 222 | 18:21:53 | 18:53:53 | 00:31:59 | 100 |
| 1 | 198378 | 54117 | 223 | 18:21:36 | 18:53:52 | 00:32:15 | 100 |
| 1 | 198378 | 54117 | 224 | 18:21:23 | 18:53:44 | 00:32:21 | 100 |
| 1 | 198378 | 54117 | 225 | 18:21:14 | 18:53:30 | 00:32:16 | 100 |
| 1 | 198378 | 54117 | 226 | 18:21:11 | 18:53:09 | 00:31:58 | 100 |
| 1 | 198378 | 54117 | 227 | 18:21:14 | 18:52:41 | 00:31:27 | 100 |
| 1 | 198378 | 54117 | 228 | 18:21:23 | 18:52:06 | 00:30:42 | 100 |
| 1 | 198378 | 54117 | 229 | 18:21:39 | 18:51:22 | 00:29:43 | 100 |
| 1 | 198378 | 54117 | 230 | 18:22:03 | 18:50:29 | 00:28:25 | 100 |
| 1 | 198378 | 54117 | 231 | 18:22:37 | 18:49:25 | 00:26:48 | 100 |
| 1 | 198378 | 54117 | 232 | 18:23:22 | 18:48:08 | 00:24:46 | 100 |
| 1 | 198378 | 54117 | 233 | 18:24:22 | 18:46:35 | 00:22:13 | 100 |
| 1 | 198378 | 54117 | 234 | 18:25:43 | 18:44:40 | 00:18:57 | 100 |
| 1 | 198378 | 54117 | 235 | 18:29:00 | 18:42:10 | 00:13:10 | 79.85 |
| 1 | 198378 | 54117 | 236 | 18:35:43 | 18:37:59 | 00:02:16 | 16.35 |

## Appendix B – Graphical output of shadow flicker events for all houses



## Appendix C – Map showing the modelled properties