

## **Windpark Jacobahaven**

Onderzoek geluid en slagschaduw

**Opdrachtgever**

E-Connection Project BV

**Contactpersoon**

de heer E. Hol

**Kenmerk**

R068380ad.198CMPR.dv

**Versie**

03\_001

**Datum**

27 juni 2019

**Auteur**

ing. D. (David) Vrolijk

## Inhoudsopgave

|          |                                                   |           |
|----------|---------------------------------------------------|-----------|
| <b>1</b> | <b>Inleiding en samenvatting .....</b>            | <b>3</b>  |
| <b>2</b> | <b>Uitgangspunten .....</b>                       | <b>4</b>  |
| 2.1      | Situatie .....                                    | 4         |
| 2.2      | Turbines .....                                    | 5         |
| 2.3      | Wettelijk kader.....                              | 5         |
| <b>3</b> | <b>Geluid windturbines .....</b>                  | <b>6</b>  |
| 3.1      | Modellering omgeving en geluidoverdracht .....    | 6         |
| 3.2      | Resultaten windturbinegeluid .....                | 7         |
| 3.3      | Maatregelen .....                                 | 8         |
| 3.4      | Resultaten windturbinegeluid met maatregelen..... | 9         |
| <b>4</b> | <b>Slagschaduw .....</b>                          | <b>10</b> |
| 4.1      | Rekenmethode .....                                | 10        |
| 4.2      | Resultaten slagschaduw .....                      | 11        |
| <b>5</b> | <b>Conclusie .....</b>                            | <b>12</b> |

## Bijlagen

|             |                                       |
|-------------|---------------------------------------|
| Bijlage I   | Figuren                               |
| Bijlage II  | Berekening jaargemiddelde bronsterkte |
| Bijlage III | Invoergegevens rekenmodel geluid      |
| Bijlage IV  | Rekenresultaten geluid                |
| Bijlage V   | Invoer en resultaten slagschaduw      |

## **1 Inleiding en samenvatting**

In opdracht van E-Connection BV, contactpersoon de heer E. Hol, hebben we een geluid en slagschaduw onderzoek uitgevoerd voor het windpark Jacobahaven. Het windpark ligt in de gemeente Noord-Beverland. Het onderzoek is verricht in het kader van de aanvraag omgevingsvergunning en melding Activiteitenbesluit.

### **Het windpark**

Windpark Jacobahaven bestaat uit drie turbines in een clusteropstelling. Deze turbines worden vervangen door drie nieuwe turbines. In het onderzoek zijn voor geluid twee potentiële turbinetypes en voor slagschaduw één worst-case turbinetype onderzocht. Voor slagschaduw is, ter vergelijking, ook de bestaande turbine meegenomen in het onderzoek.

### **Het onderzoek richt zich op de volgende twee onderdelen**

- De jaargemiddelde geluidbelasting door windpark Jacobahaven ter plaatse van de omliggende woningen en enkele recreatiepunten. De geluidbelasting bij de woningen is getoetst aan de grenswaarden voor geluid uit het Activiteitenbesluit.
- Slagschaduw door het windpark op de omliggende woningen en enkele recreatiepunten. Voor slagschaduw is het uitgangspunt dat in de nieuwe situatie niet meer slagschaduw optreedt dan in de bestaande situatie. Dit is dan ook de reden dat de bestaande situatie ook is meegenomen in dit onderzoek.

### **Uit het onderzoek blijkt het volgende**

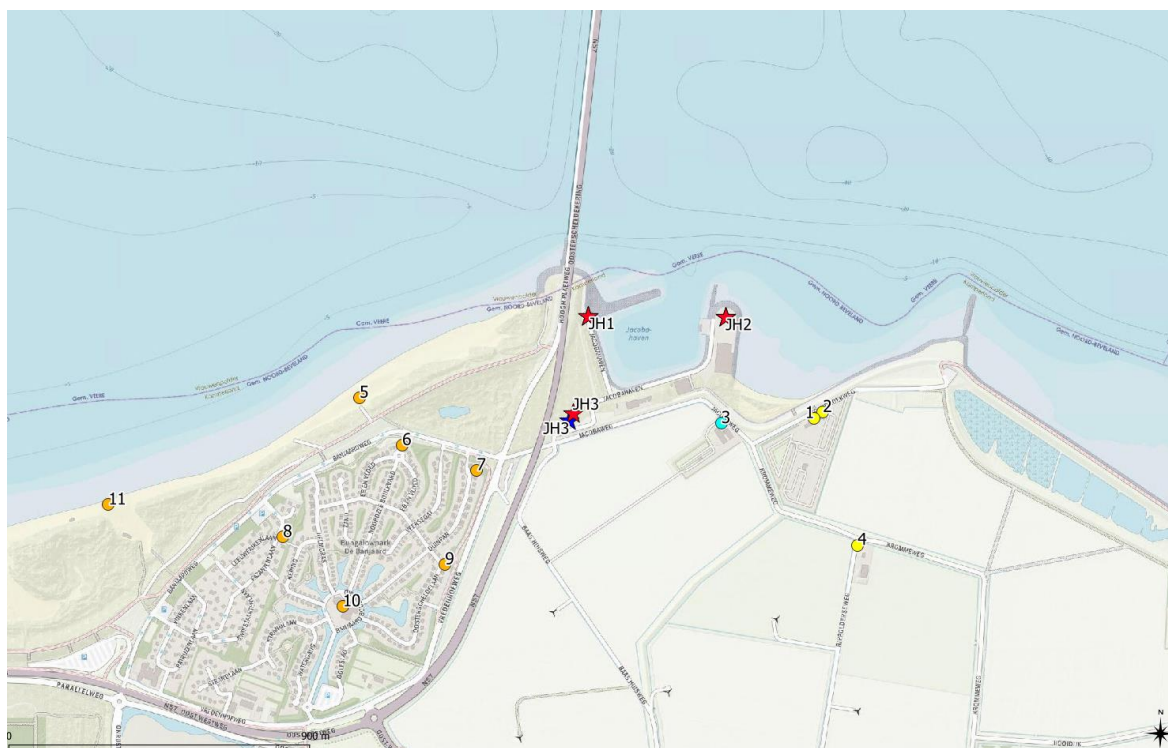
- De jaargemiddelde geluidbelasting in de nieuwe situatie voldoet voor beide potentiële turbinetypes, met maatregelen, aan de grenswaarden van  $L_{den}$  47 dB en  $L_{night}$  41 dB. De maatregelen zijn beschreven in paragraaf 3.3.
- Het aantal slagschaduwuren in de nieuwe situatie is hoger dan in de bestaande situatie. Bij de uiteindelijke selectie van het nieuwe turbinetype moet ook een nieuwe stilstandsregeling bepaald worden.

## 2 Uitgangspunten

### 2.1 Situatie

Het bestaande windpark bestaat uit drie turbines van het type Vestas V90. Het windpark ligt op de damaanzet aan de zuidzijde van de Oosterscheldekering bij de Jacobahaven in de gemeente Noord-Beverland. De drie nieuwe turbines komen ongeveer op dezelfde locaties als de bestaande turbines. Alleen turbine 3 is in de nieuwe situatie enkele meters verschoven.

In de directe omgeving van het windpark liggen woningen en recreatieparken. Door de opdrachtgever zijn een tiental locaties aangegeven die wij in dit onderzoek meegenomen hebben. Ten zuidoosten van het windpark ligt een bedrijfswoning (BW) die hoort bij het windpark (Jacobaweg 1). In figuur 2.1 hebben we de nieuwe situatie weergegeven, inclusief de opgegeven locaties. Enkele van de opgegeven locaties zijn woningen en daarmee geluidgevoelige objecten waar we toetsen aan de grenswaarden voor geluid. Deze woningen bleken kritisch op basis van de M.E.R. Een aantal locaties zijn niet geluidgevoelig (recreatie(woningen) en strand). Deze locaties zijn alleen ter informatie meegenomen in dit onderzoek.



**Figuur 2.1**

Situatie. Rode ster = nieuwe windturbine; blauwe ster = bestaande windturbines; Gevoelige objecten = gele bolletjes; Bedrijfswoning = blauw bolletje; Recreatie = oranje bolletjes. (bron achtergrond: Opentopo)

## 2.2 Turbines

Het turbinetype staat nog niet vast. We hebben de volgende selectie van turbines onderzocht.

### Geluid

- Vestas V117 STE HWO 4.2MW op 91,5 meter ashoogte.
- Enercon E115 EP3 4 MW op 92 meter ashoogte.

### Slagschaduw

- Bestaande situatie: de Vestas V90 3MW 78 meter ashoogte. Met en zonder stilstandsregeling.
- Vestas V117 op 91,5 meter ashoogte.

Voor slagschaduw is door ons alleen de worst-case turbine V117 beschouwd. De E115 heeft een kleinere rotorafmeting en nagenoeg gelijke ashoogte. Daardoor is de impact kleiner.

## 2.3 Wettelijk kader

### **Geluid**

Voor windturbines gelden de grenswaarden uit het Activiteitenbesluit milieubeheer. Volgens dit besluit geldt voor geluid een jaargemiddelde norm van 47 dB  $L_{den}$  en 41 dB  $L_{night}$  ter plaatse van woningen van derden en andere gevoelige objecten.

We hebben de geluidbelasting ter plaatse van de woningen van derden getoetst aan deze grenswaarden, zie hiervoor hoofdstuk 3. Waar nodig is aangegeven welke maatregelen (noise-modes) nodig zijn om te voldoen aan de grenswaarden.

### **Slagschaduw**

Voor slagschaduw is in artikel 3.12 lid 1 van de Activiteitenregeling het volgende opgenomen:

*“Ten behoeve van het voorkomen of beperken van slagschaduw en lichtschittering is de windturbine voorzien van een automatische stilstandvoorziening die de windturbine afschakelt indien slagschaduw optreedt ter plaatse van gevoelige objecten voor zover de afstand tussen de windturbine en de gevoelige objecten minder dan 12 maal de rotordiameter bedraagt en gemiddeld meer dan 17 dagen per jaar gedurende meer dan 20 minuten per dag slagschaduw kan optreden en voor zover zich in de door de slagschaduw getroffen uitwendige scheidingsconstructie van gevoelige gebouwen of woonwagens ramen bevinden. De afstand geldt van een punt op ashoogte van de windturbine tot de gevel van het gevoelige object.”*

Binnen een afstand van 12 maal de rotordiameter van alle beschouwde turbinetypes zijn gevoelige objecten gelegen, waardoor onderzoek nodig is. De huidige turbine zijn al voorzien van een stilstandsregeling. Uitgangspunt voor windpark Jacobahaven is dat in de nieuwe situatie niet meer slagschaduw optreedt dan in de bestaande situatie. Om die reden is niet getoetst aan de norm voor slagschaduw, maar is een vergelijking gemaakt tussen de bestaande situatie met en zonder stilstandsregeling en de nieuwe situatie, zonder stilstandsregeling. Dit om een indicatie te geven van de benodigde stilstand.

### 3 Geluid windturbines

De berekening van de jaargemiddelde geluidbelasting ter plaatse van de omliggende geluidgevoelige objecten hebben we uitgevoerd volgens het reken- en meetvoorschrift windturbines. Deze is opgenomen in de ministeriële regeling bij het Activiteitenbesluit; de Activiteitenregeling.

#### 3.1 Modellerings omgeving en geluidoverdracht

##### Rekenmodel

Voor het berekenen van de geluidbelasting naar de omgeving is een rekenmodel opgesteld met de volgende kenmerken:

- De windturbines zijn ingevoerd als puntbron op ashoogte.
- De rekenpunten zijn gemodelleerd op een hoogte van 5 meter.
- Bodemdemping:
  - Standaard: een half harde, half reflecterende, bodem (bodemfactor 0,5).
  - Wegen en water: een harde reflecterende bodem (factor 0).

In de omgeving zijn enkele gebouwen gelegen met zonnepanelen. Hiermee is rekening gehouden door ook daar een bodemreflectie met een factor 0 aan te houden (harde, reflecterende bodem). In figuur I.1 in bijlage I is een verbeelding van het rekenmodel opgenomen.

##### Jaargemiddelde bronsterkte

Voor het bepalen van de jaargemiddelde bronsterkte van de verschillende windturbintypes is gebruikgemaakt van fabrikantgegevens en de KNMI windsnelheidsverdeling op ashoogte. In bijlage 4 van de Activiteitenregeling is deze windsnelheidsverdeling voorgeschreven. In dit onderzoek is gebruik gemaakt van de meest recente dataset 2004-2013 van het KNMI<sup>1</sup>. De turbines hebben een maaiveld wat hoger is dan het plaatselijke maaiveld in de omgeving. Hier hebben we rekening mee gehouden door bij de ashoogte 5 meter op te tellen voor het bepalen van het windprofiel wat gebruikt is voor de berekeningen.

De berekening van de jaargemiddelde bronsterkte is per turbintype opgenomen in bijlage II. De invoergegevens van het geluidmodel zijn opgenomen in bijlage III.

In tabel 3.1 zijn ter vergelijking de maximale bronsterkte gegeven. Ter vergelijking is ook de maximale bronsterkte opgenomen van de bestaande turbine Vestas V90<sup>2</sup>.

1 Beschikbaar per november 2018 via <https://www.mp.nl/rekentool>

2 Noise report V90-3.0MW mode 0 ref. 0005-9597

**Tabel 3.1**

Maximale bronsterktes van de onderzochte turbinetypes en de bestaande turbine [dB(A)]

| Turbine                          | Maximale bronsterkte |
|----------------------------------|----------------------|
| V117 4.2 MW STE <sup>3</sup> HWO | 106,0                |
| E115 4 MW STE                    | 106,0                |
| V90 3 MW (bestaand)              | 109,4                |

### Coördinaten

De volgende opgegeven coördinaten zijn aangehouden in dit onderzoek

**Tabel 3.2**

Opgegeven coördinaten

| New wind turbines |       |        |
|-------------------|-------|--------|
| Wind turbine      | X-co  | Y-co   |
| JH1               | 36943 | 402577 |
| JH2               | 37353 | 402574 |
| JH3               | 36896 | 402286 |

| Existing wind turbines |       |        |
|------------------------|-------|--------|
| Wind turbine           | X-co  | Y-co   |
| JH1                    | 36943 | 402577 |
| JH2                    | 37353 | 402574 |
| JH3                    | 36885 | 402263 |

## 3.2 Resultaten windturbinegeluid

De geluidcontouren ( $L_{den}$  47 dB) zijn opgenomen in de figuren in bijlage I. In aanvulling op de  $L_{den}$  47 dB contouren zijn apart de  $L_{den}$  35, 40, 47, 50 en 52 dB contouren gegeven.

De rekenresultaten in tabelvorm zijn opgenomen in bijlage IV. In tabel 3.3 is de geluidbelasting samengevat. Overschrijdingen van de norm zijn vetgedrukt. Bepalend zijn de gevoelig objecten (woning ID 1, 2 en 4).

3 \*STE staat voor Serrated Trailing Edge. Hierbij wordt een gekartelde rand op de bladen toegepast wat een positief effect heeft op de geluidemissie.

**Tabel 3.3**

Samenvatting jaargemiddelde geluidbelasting [dB]

| ID   | Omschrijving             | V117      |           | E115   |           |
|------|--------------------------|-----------|-----------|--------|-----------|
|      |                          | Lnight    | Lden      | Lnight | Lden      |
| 01_A | Strandhoekweg 1          | <b>42</b> | <b>48</b> | 41     | <b>48</b> |
| 02_A | Strandhoekweg 3          | <b>42</b> | <b>48</b> | 41     | <b>48</b> |
| 03_A | Jacobaweg 1 (BW)         | 45        | 51        | 44     | 50        |
| 04_A | Rippolderseweg 1         | 37        | 43        | 36     | 42        |
| 05_A | Banjaard Strand          | 38        | 44        | 37     | 44        |
| 06_A | Banjaard Noord           | 40        | 46        | 39     | 45        |
| 07_A | Banjaard Noord-Oost      | 43        | 49        | 42     | 49        |
| 08_A | Banjaard West            | 34        | 40        | 33     | 39        |
| 09_A | Banjaard Oost            | 38        | 44        | 38     | 44        |
| 10_A | Banjaard Centraal        | 34        | 40        | 33     | 40        |
| 11_A | Banjaard strandpaviljoen | 28        | 34        | 27     | 34        |

Punt 4, Jacobaweg 1, valt onder een molenaarsovereenkomst. Hier wordt niet getoetst aan de grenswaarden.

Uit tabel 3.3 blijkt dat de Vestas V117 en de Enercon E115 turbines ter plaatse van een tweetal woningen niet voldoen aan de grenswaarden van  $L_{den}$  47 dB en  $L_{night}$  41 dB. Maatregelen zijn nodig. Deze zijn voor de nieuwe situatie bepaald in paragraaf 3.3.

### 3.3 Maatregelen

Voor de V117 en E115 turbines hebben we bepaald met welke noise-modes<sup>4</sup> de turbines voldoen aan de grenswaarden uit het Activiteitenbesluit.

De benodigde noise-modes en resulterende reducties op de geluidemissie zijn opgenomen in tabel 3.4 voor de benodigde tijdvakken. Voor de Enercon E115 turbine zijn momenteel nog geen noisemodes bekend. Daarom is voor de E115 alleen bepaald hoeveel dB reductie nodig op de geluidemissie. Bij selectie van deze turbine kunnen in een later stadium de noise-modes bepaald worden voor de benodigde reductie<sup>5</sup>.

Het gaat voor beide turbintypes alleen om noise-modes voor turbine JH2.

**Tabel 3.4**

Benodigde maatregelen (noise-modes en reductie op geluidemissie)

| Turbintype   | Turbine | Dag (07:00 – 19:00 uur) | Avond (19:00 – 23:00 uur) | Nacht (23:00 – 07:00 uur)      |
|--------------|---------|-------------------------|---------------------------|--------------------------------|
| Vestas V117  | JH2     | --                      | --                        | S03 (HWO)<br>(reductie 3,6 dB) |
| Enercon E115 | JH2     | --                      | --                        | Onbekend<br>(reductie: 1,6 dB) |

4 Noise-mode-instellingen zijn maatregelen aan rotatiesnelheid van de rotor van de turbine waarmee de geluidsemmissie van de windturbine naar de omgeving wordt verminderd. Dit is van invloed op de vermogensopbrengst van de windturbine.

5 Alle ons bekende Enercon-turbines beschikken uiteindelijk allemaal over noise-modes. De gehanteerde reductie is haalbaar.

### 3.4 Resultaten windturbinegeluid met maatregelen

De geluidcontouren met maatregelen ( $L_{den}$  47 dB) zijn opgenomen in de figuren van de V117 en E115 in bijlage I. De rekenresultaten in tabelvorm zijn opgenomen in bijlage IV. In tabel 3.5 is de geluidbelasting samengevat.

**Tabel 3.5**

Samenvatting jaargemiddelde geluidbelasting - met maatregelen [dB]

| ID   | Omschrijving             | V117        |           | E115        |           |
|------|--------------------------|-------------|-----------|-------------|-----------|
|      |                          | $L_{night}$ | $L_{den}$ | $L_{night}$ | $L_{den}$ |
| 01_A | Strandhoekweg 1          | 40          | 47        | 40          | 47        |
| 02_A | Strandhoekweg 3          | 40          | 47        | 40          | 47        |
| 03_A | Jacobaweg 1 (BW)         | 43          | 50        | 43          | 50        |
| 04_A | Rippolderseweg 1         | 35          | 42        | 35          | 42        |
| 05_A | Banjaard Strand          | 38          | 44        | 37          | 44        |
| 06_A | Banjaard Noord           | 39          | 46        | 39          | 45        |
| 07_A | Banjaard Noord-Oost      | 43          | 49        | 42          | 49        |
| 08_A | Banjaard West            | 33          | 40        | 33          | 39        |
| 09_A | Banjaard Oost            | 38          | 44        | 37          | 44        |
| 10_A | Banjaard Centraal        | 34          | 40        | 33          | 40        |
| 11_A | Banjaard strandpaviljoen | 27          | 34        | 27          | 33        |

Uit tabel 3.5 blijkt dat met maatregelen voldaan wordt aan de grenswaarden  $L_{den}$  47 dB en  $L_{night}$  41 dB.

## 4 Slagschaduw

De ronddraaiende wieken van een windturbine werpen schaduw op de omgeving. Dat wordt slagschaduw genoemd. Die schaduw reikt het verst als de zon laag staat ('s winters, 's ochtends en 's avonds). Als slagschaduw op het raam van bijvoorbeeld een woning valt kan de afwisseling van donker en licht als hinderlijk ervaren worden. De frequentie, de intensiteit en de duur van dergelijke slagschaduw bij een locatie bepalen de mate van hinder.

Een automatische stilstandvoorziening moet ervoor zorgen dat de slagschaduwduur binnen de wettelijke norm blijft. Deze schakelt de windturbine uit gedurende de tijd dat er meer slagschaduw optreedt dan volgens de wettelijke norm is toegestaan. In de bestaande situatie is reeds een stilstandsregeling actief. Deze stilstandsregeling voor de bestaande V90 turbine is meegenomen in de vergelijking met de worst-case turbine, zonder stilstandsregeling.

### 4.1 Rekenmethode

Slagschaduw is voor de bestaande turbine Vestas V90 en de worst-case Vestas V117 turbine berekend met behulp van het softwarepakket Windpro, versie 3.3. De verwachte slagschaduwduur is daarbij afgeleid van de potentiële duur door rekening te houden met de gemiddelde zonuren per dag en de gemiddelde windrichtingverdeling voor het KNMI-meetstation in Vlissingen.

Bij de slagschaduwberekening zijn geen afscherpende objecten, zoals bomen of bebouwing, meegenomen. Ook is slagschaduw niet meegenomen wanneer de zon lager dan 3 graden boven de horizon staat.

Slagschaduwreceptoren zijn gemodelleerd als 'greenhouse'. De raamhoogte en raambreedte verschilt per receptor.

Voor de gevoelige objecten en de bedrijfswoning zijn de volgende afmetingen aangehouden:

- Strandhoekweg 1: 4 meter hoog, 14 meter breed vanaf 1 m boven maaiveld.
- Strandhoekweg 3: 1,5 meter hoog, 10 meter breed vanaf 1 m boven maaiveld.
- Jacobaweg 1 (BW): 1,5 meter hoog, 18 meter breed vanaf 1 m boven maaiveld.
- Rippolderseweg 1: 4 meter hoog, 14 meter breed vanaf 1 m boven maaiveld.

De receptoren voor Jacobaweg 1 (BW) en Rippolderseweg 1 zijn enigszins verschoven ten opzichte van de ontvangen posities om deze beter te matchen met de daadwerkelijke woning. Voor de overige receptoren op de recreatieposities is een receptor van 3 meter hoog en 8 meter breed aangehouden.

#### Stilstandsregeling

In de bestaande situatie zijn de Vestas V90 turbines voorzien van een stilstandsregeling. Hier is in dit onderzoek rekening mee gehouden.

## 4.2 Resultaten slagschaduw

In bijlage I zijn de contouren opgenomen van de verwachte 1, 3, 6 en 12 uur slagschaduw. De contouren van de bestaande Vestas V90 zijn **zonder** de bestaande stilstandsregeling<sup>6</sup>. In bijlage V zijn de invoer en resultaten opgenomen voor beide situaties. Voor de worst-case Vestas V117 turbine zijn ook de tekstuele en grafische kalender gegeven. Uit de grafische kalender is het mogelijk de slagschaduwmomenten af te leiden.

Hieronder hebben we een samenvatting gegeven:

- Recreatie zuidwestzijde van de turbines: De slagschaduw treedt bij de recreatiepunten op in de ochtendperiode voor 9:00 uur. De maanden tussen april en september zijn daarbij bepalend.
- Woningen zuidoostzijde van de turbines: De slagschaduw treedt bij deze woningen op in de avondperiode tussen circa 18:00 en 21:00 uur. Hier zijn de maanden tussen eind maart en september bepalend.

Tabel 4.1 geeft de rekenresultaten bij de verschillende receptoren. In de tabel zijn de resultaten voor de bestaande Vestas V90 en de worst-case Vestas V117 naast elkaar opgenomen. De resultaten voor de bestaande situatie zijn **met en zonder** stilstandsregeling. De resultaten voor nieuwe situatie met de worst-case turbine Vestas V117 zijn **zonder** stilstandsregeling.

**Tabel 4.1**

Rekenresultaten slagschaduw ter plaatse van de omliggende receptoren in de bestaande en nieuwe (worst-case) situatie. Slagschaduwuren in uren en minuten [uu:mm]

| ID | Omschrijving             | Zonder stilstandsregeling<br>Vestas V90 bestaand |          | Met stilstandsregeling<br>Vestas V90 bestaand |          | Zonder stilstandsregeling<br>Vestas V117 STE HWO |          |
|----|--------------------------|--------------------------------------------------|----------|-----------------------------------------------|----------|--------------------------------------------------|----------|
|    |                          | worst-case                                       | verwacht | worst-case                                    | verwacht | worst-case                                       | verwacht |
| 1  | Strandhoekweg 1          | 46:41                                            | 11:30    | 1:32                                          | 0:23     | 85:57                                            | 21:18    |
| 2  | Strandhoekweg 3          | 36:41                                            | 8:59     | 1:18                                          | 0:18     | 67:09                                            | 16:35    |
| 3  | Jacobaweg 1 (BW)         | 46:44                                            | 12:06    | 26:50                                         | 7:11     | 85:32                                            | 22:30    |
| 4  | Rippolderseweg 1         | 14:09                                            | 3:31     | 14:09                                         | 3:31     | 30:58                                            | 7:41     |
| 5  | Banjaard Strand          | 50:41                                            | 13:24    | 50:41                                         | 13:24    | 90:58                                            | 24:38    |
| 6  | Banjaard Noord           | 54:21                                            | 15:24    | 26:59                                         | 7:43     | 97:09                                            | 27:31    |
| 7  | Banjaard Noord-Oost      | 56:58                                            | 16:58    | 0:00                                          | 0:00     | 47:52                                            | 14:19    |
| 8  | Banjaard West            | 19:20                                            | 5:44     | 0:49                                          | 0:14     | 36:18                                            | 10:45    |
| 9  | Banjaard Oost            | 0:00                                             | 0:00     | 0:00                                          | 0:00     | 0:00                                             | 0:00     |
| 10 | Banjaard Centraal        | 0:00                                             | 0:00     | 0:00                                          | 0:00     | 0:00                                             | 0:00     |
| 11 | Banjaard Strandpaviljoen | 2:47                                             | 0:46     | 2:47                                          | 0:46     | 10:38                                            | 3:03     |

Uit tabel 4.1 blijkt dat de slagschaduwreceptoren in de nieuwe (worst-case) situatie meer slagschaduwuren ontvangen dan in de bestaande situatie. Een nieuwe stilstandsregeling is daarom noodzakelijk. Het bepalen van een nieuwe stilstandsregeling valt buiten het kader van dit onderzoek. Bij de uiteindelijke turbinesselectie moet de nieuwe stilstandsregeling bepaald worden.

<sup>6</sup> Het is niet mogelijk met de beschikbare software een slagschaduwcontour te berekenen waarbij rekening wordt gehouden met de stilstandsregeling

## 5 Conclusie

De jaargemiddelde geluidbelasting en het aantal slagschaduwen zijn door ons berekend voor het windpark Jacobahaven. Uit het onderzoek blijkt het volgende.

### *Windturbinegeluid*

Het windpark voldoet met maatregelen, zoals omschreven in tabel 3.3, aan de grenswaarden voor geluid van  $L_{den}$  47 dB en  $L_{night}$  41 dB.

### *Slagschaduw*

Het aantal slagschaduwuren in de nieuwe situatie is hoger dan in de bestaande situatie. Bij de uiteindelijke selectie van het nieuwe turbinetype moet een nieuwe stilstandsregeling bepaald worden.

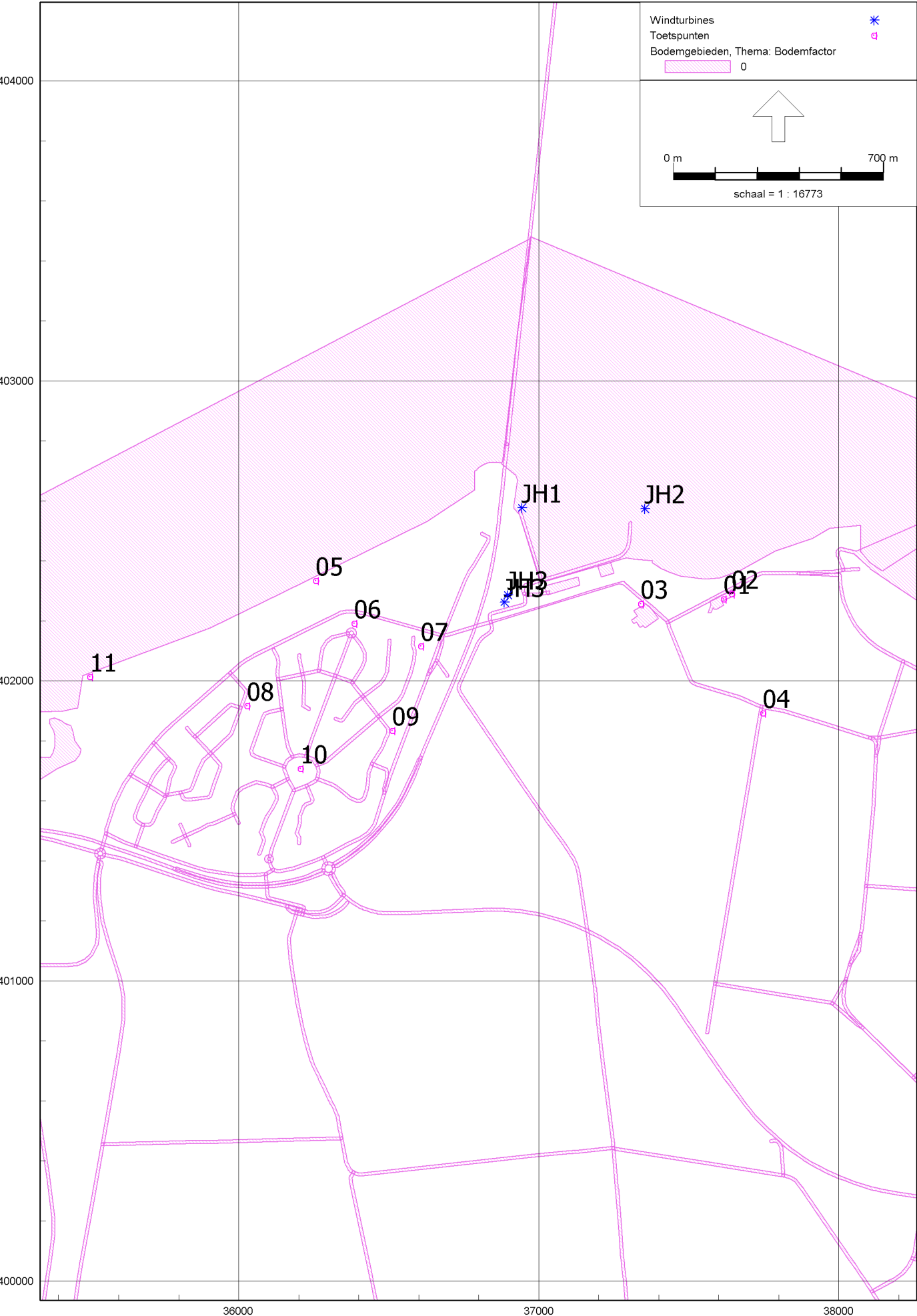
LBP|SIGHT BV



ing. D. (David) Vrolijk

## **Bijlage I**

### **Figuren**

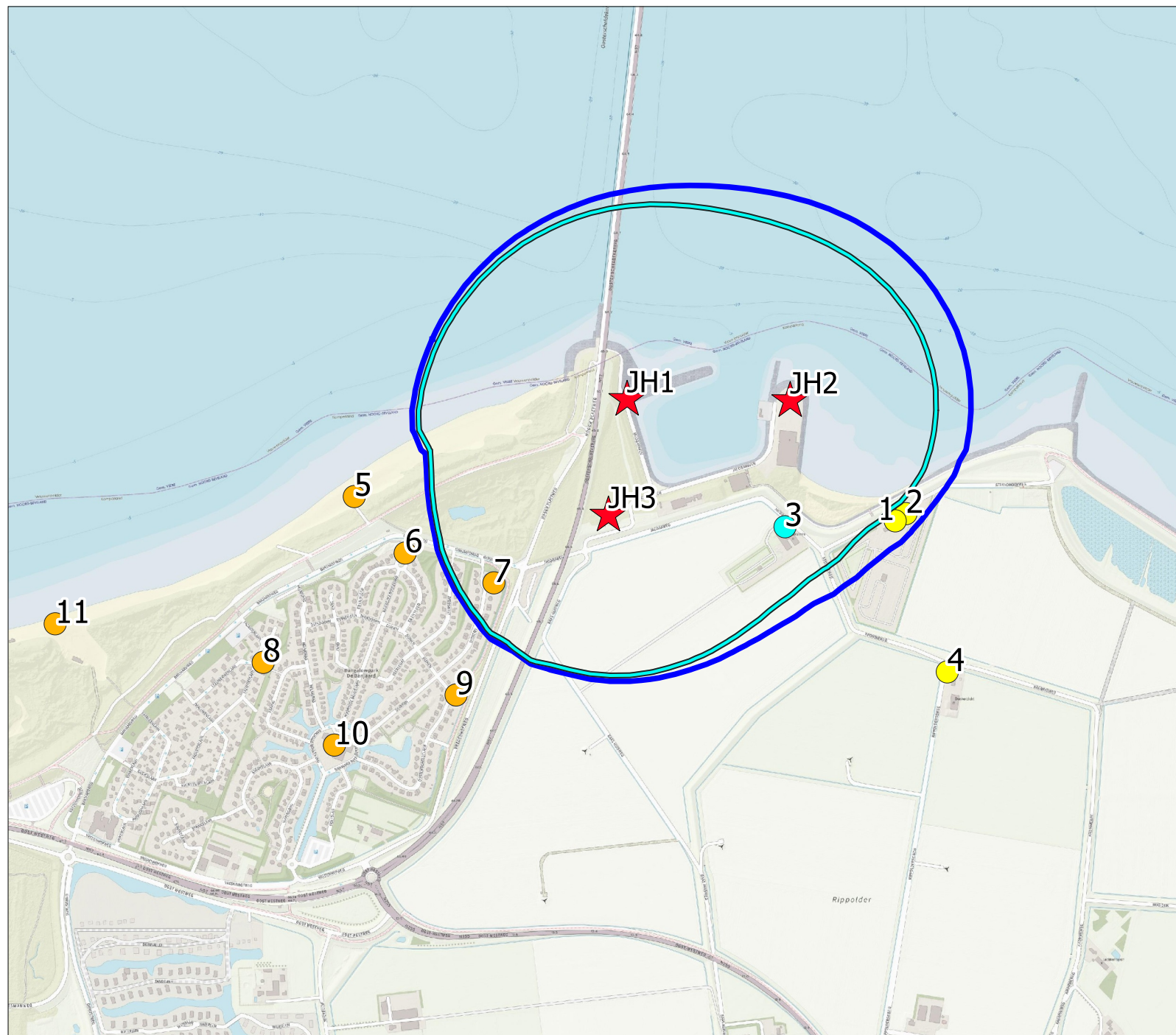


## WP Jacobahaven

Lden 47 dB contour  
Vestas V117

### Legenda

-  Turbines
-  Bedrijfswoningen
-  Recreatie
-  Woningen
-  Lden 47 dB - V117
-  Lden 47 dB - V117 - maatregelen



Bron: Opentopo via PDOK

0 400 m



Referentie:  
068380ad

Datum figuur:  
13-06-2019

Versie figuur:  
01

Auteur:  
D. Vrolijk

Reviewer:

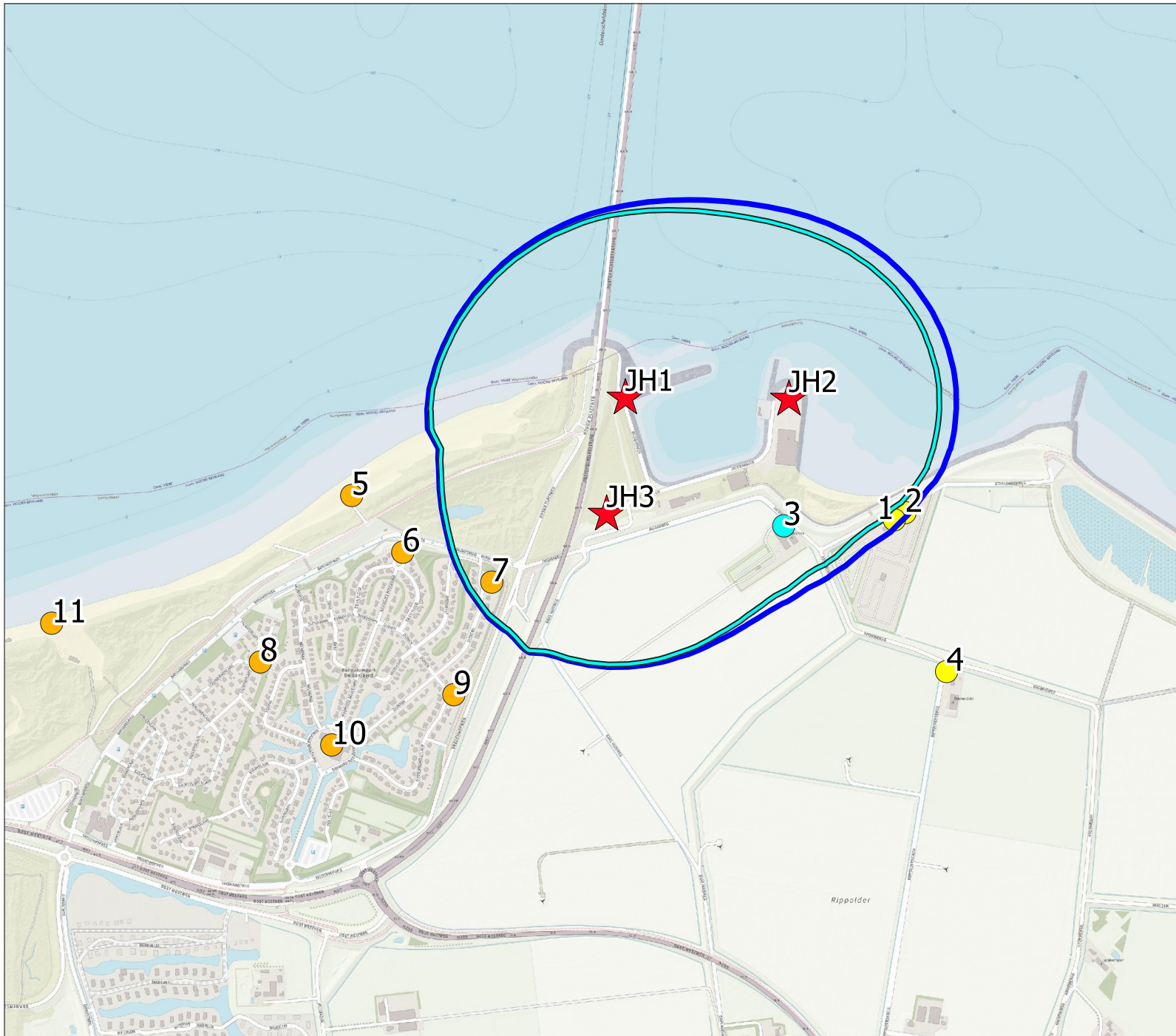
Opdrachtgever:  
E-Connection

## WP Jacobahaven

Lden 47 dB contour  
Enercon E115

### Legenda

-  Turbines
-  Bedrijfswoningen
-  Recreatie
-  Woningen
-  Lden 47 dB - E115
-  Lden 47 dB - E115 - maatregelen



Bron: Opentopo via PDOK

0 400 m



Referentie:  
068380ad

Datum figuur:  
13-06-2019

Versie figuur:  
01

Auteur:  
D. Vrolijk

Reviewer:

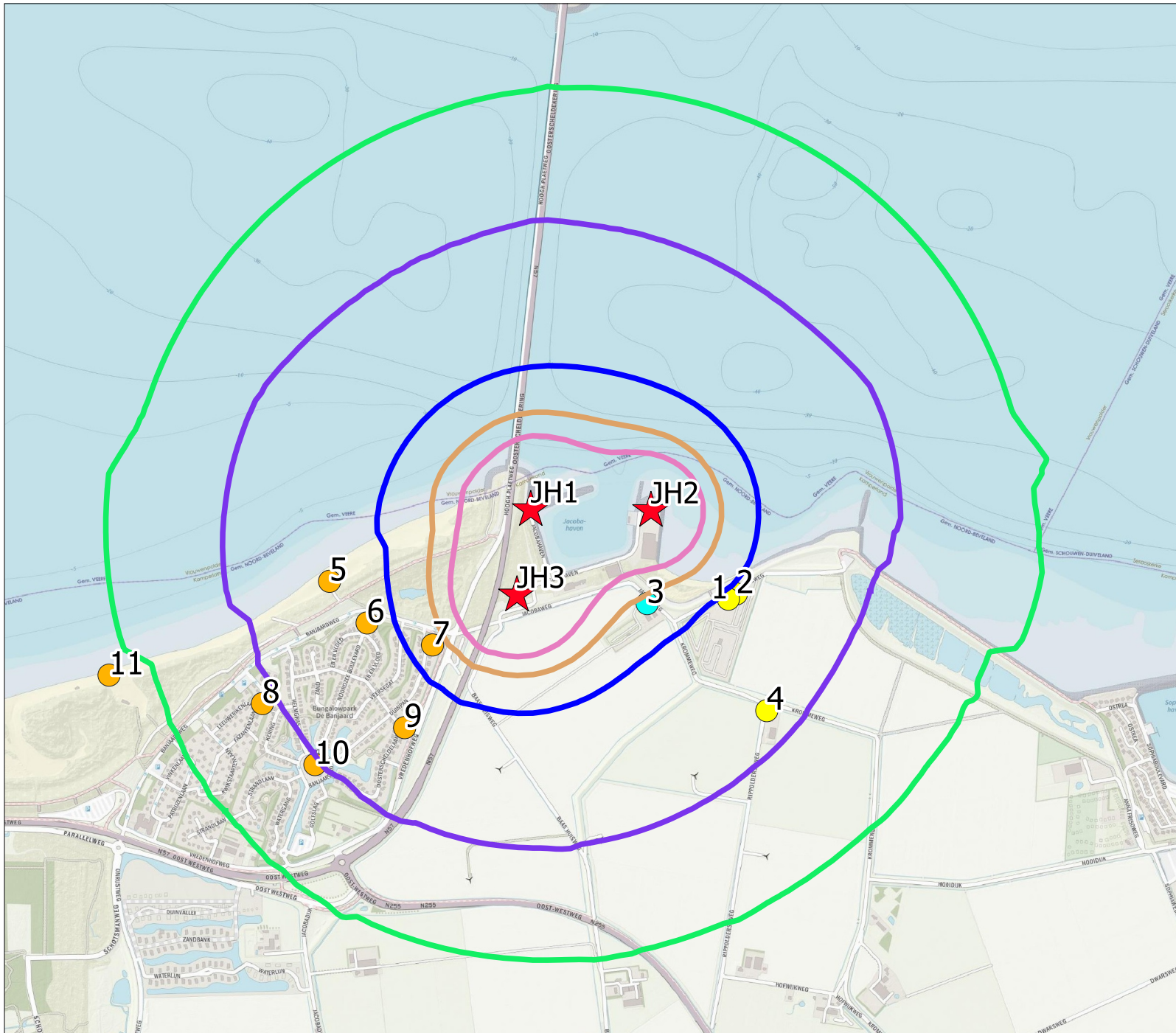
Opdrachtgever:  
E-Connection

## WP Jacobahaven

Lden contouren  
Vestas V117 - met maatregelen

### Legenda

-  Turbines
-  Bedrijfswoningen
-  Recreatie
-  Woningen
-  35 dB Lden
-  40 dB Lden
-  47 dB Lden
-  50 dB Lden
-  52 dB Lden



Bron: OpenTopo via PDOK

0 600 m



Referentie:  
068380ad

Datum figuur:  
20-06-2019

Versie figuur:  
01

Auteur:  
D. Vrolijk

Reviewer:

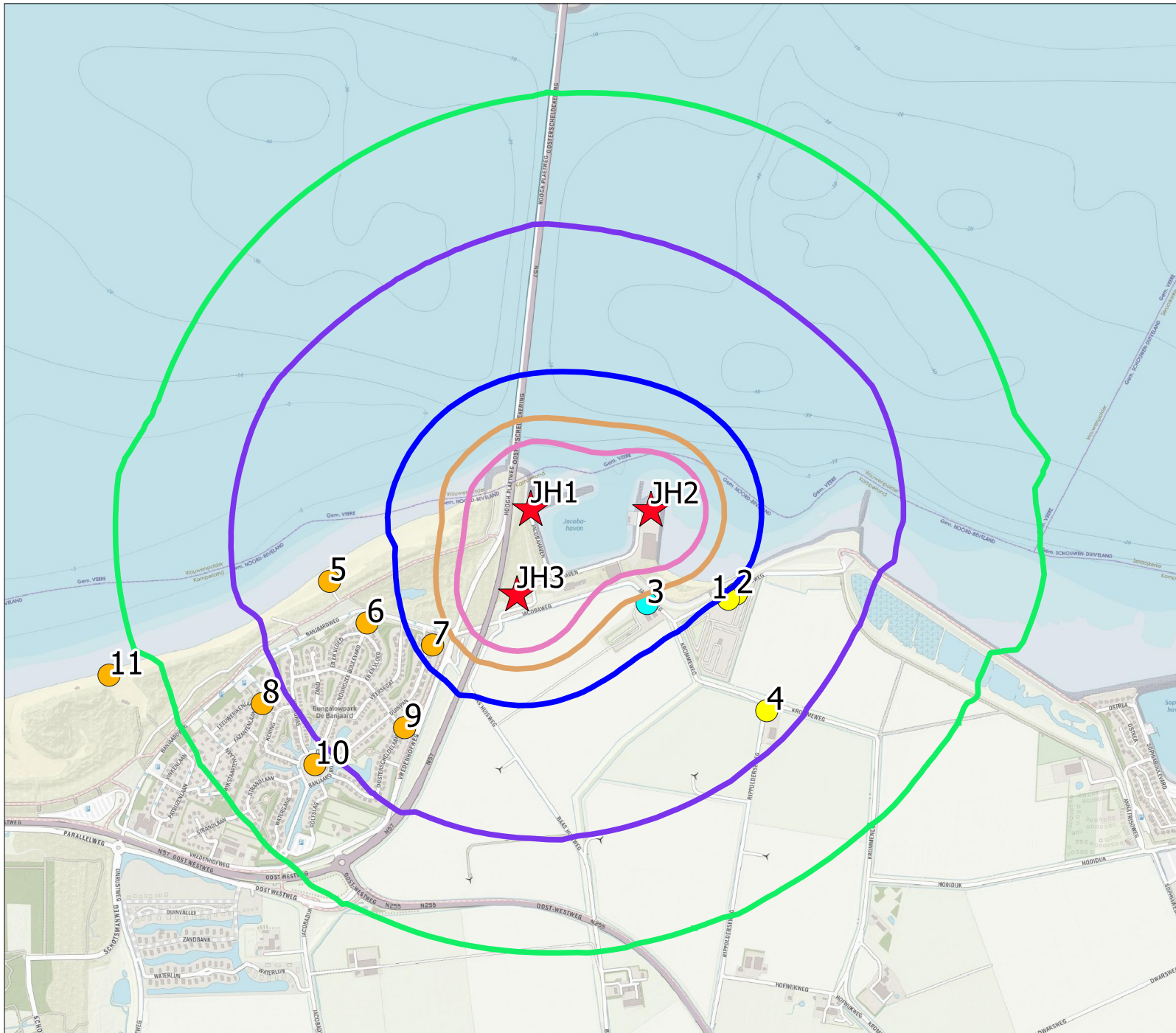
Opdrachtgever:  
E-Connection

## WP Jacobahaven

Lden contouren  
Enercon E115 - met maatregelen

### Legenda

-  Turbines
-  Bedrijfswoningen
-  Recreatie
-  Woningen
-  35 dB Lden
-  40 dB Lden
-  47 dB Lden
-  50 dB Lden
-  52 dB Lden



Bron: OpenTopo via PDOK

0 600 m



Referentie:  
068380ad

Datum figuur:  
20-06-2019

Versie figuur:  
01

Auteur:  
D. Vrolijk

Reviewer:

Opdrachtgever:  
E-Connection

## WP Jacobahaven

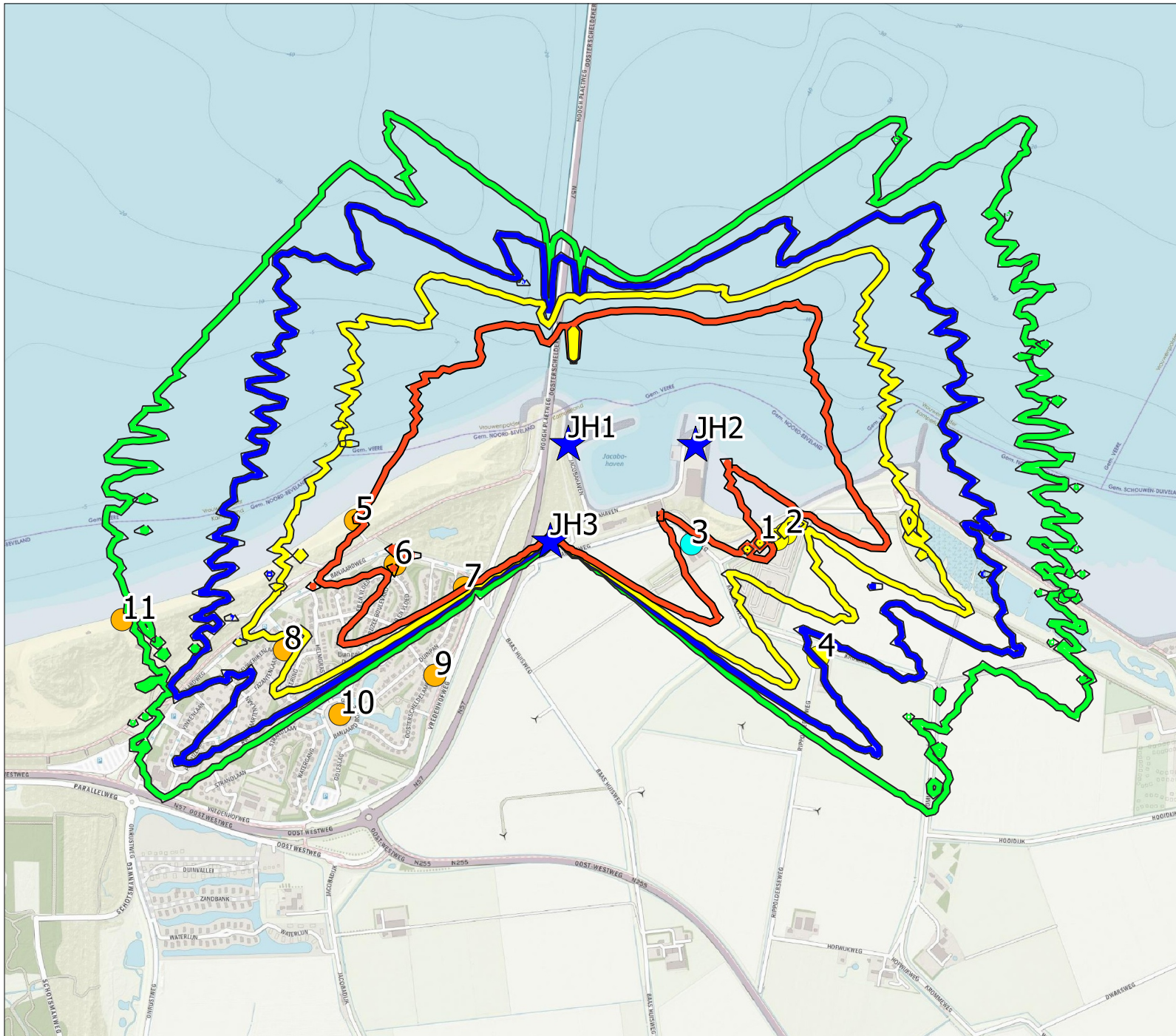
Slagschaduwcontouren  
Bestaand - Vestas V90  
Exclusief stilstandregeling

### Legenda

- ★ Bestaande turbines
- Bedrijfswoningen
- Recreatie
- Woningen

Verwachte slagschaduwuren:

- 1 uur
- 3 uur
- 6 uur
- 12 uur



Bron: OpenTopo via PDOK

0 500 m



Referentie:  
068380ad

Datum figuur:  
20-06-2019

Versie figuur:  
02

Auteur:  
D. Vrolijk

Reviewer:

Opdrachtgever:  
E-Connection

## WP Jacobahaven

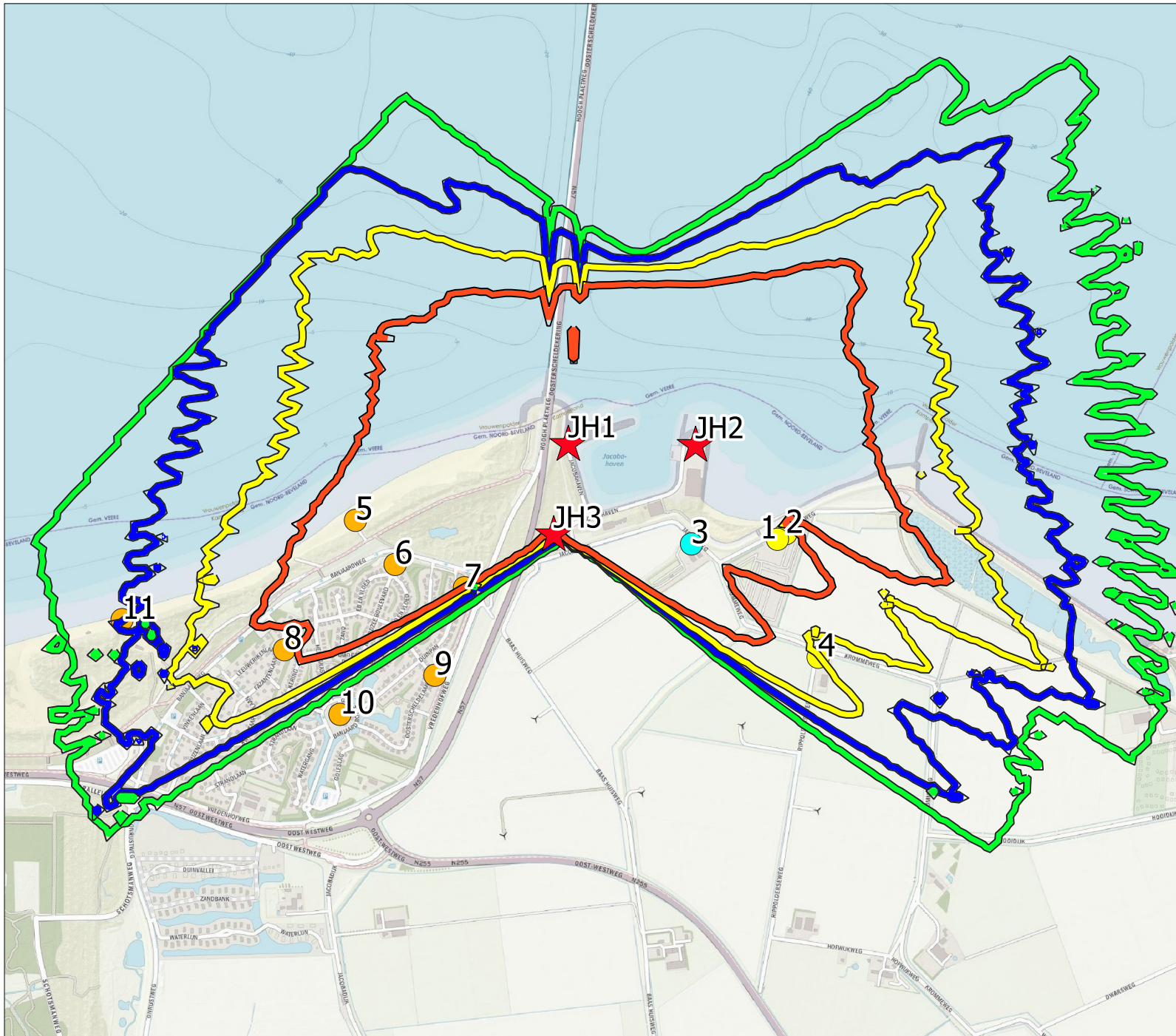
### Slagschaduwcontouren Nieuw - V117

#### Legenda

- ★ Turbines
- Bedrijfswoningen
- Recreatie
- Woningen

#### Verwachte slagschaduwuren:

- 1 uur
- 3 uur
- 6 uur
- 12 uur



Bron: OpenTopo via PDOK

0 500 m



Referentie:  
068380ad

Datum figuur:  
13-06-2019

Versie figuur:  
01

Auteur:  
D. Vrolijk

Reviewer:

Opdrachtgever:  
E-Connection

## **Bijlage II**

### **Berekening jaargemiddelde bronsterkte**

|                 |      |                          |       |           |          |          |          |       |       |       |
|-----------------|------|--------------------------|-------|-----------|----------|----------|----------|-------|-------|-------|
| RD coords:      |      | 37082 402441             |       |           |          |          |          |       |       |       |
| Windprofiel:    |      | 96,5 m                   |       |           |          |          |          |       |       |       |
| Turbine type:   |      | Vestas V117 HWO with STE |       |           | Ashoogte |          | 91,5 m   |       |       |       |
| Modeinstelling: |      | Mode P01/P01-0S          |       |           | Lw+Cb    |          |          |       |       |       |
| wind (ashoogte) | dag  | avond                    | nacht |           |          |          |          |       |       |       |
| m/s             | %    | %                        | %     | Lw as     | LE dag   | LE avond | LE nacht |       |       |       |
|                 |      |                          |       | [dB(A)]   | [db(A)]  | [db(A)]  | [db(A)]  |       |       |       |
| 1               | 1,8  | 1,7                      | 1,8   |           |          |          |          |       |       |       |
| 2               | 3,7  | 3,5                      | 3,0   |           |          |          |          |       |       |       |
| 3               | 6,1  | 5,4                      | 4,5   | 92,2      | 80,1     | 79,5     | 78,7     |       |       |       |
| 4               | 8,4  | 7,5                      | 5,9   | 92,8      | 82,0     | 81,5     | 80,5     |       |       |       |
| 5               | 9,8  | 9,2                      | 7,4   | 94,0      | 83,9     | 83,6     | 82,7     |       |       |       |
| 6               | 10,9 | 10,7                     | 10,2  | 97,0      | 87,4     | 87,3     | 87,1     |       |       |       |
| 7               | 11,5 | 10,9                     | 13,0  | 100,0     | 90,6     | 90,4     | 91,1     |       |       |       |
| 8               | 10,7 | 11,4                     | 13,1  | 102,8     | 93,1     | 93,4     | 94,0     |       |       |       |
| 9               | 8,8  | 9,8                      | 10,9  | 105,1     | 94,6     | 95,0     | 95,5     |       |       |       |
| 10              | 7,1  | 8,1                      | 8,5   | 106,0     | 94,5     | 95,1     | 95,3     |       |       |       |
| 11              | 5,7  | 5,9                      | 6,1   | 106,0     | 93,6     | 93,7     | 93,8     |       |       |       |
| 12              | 4,5  | 4,3                      | 4,2   | 106,0     | 92,6     | 92,3     | 92,3     |       |       |       |
| 13              | 3,3  | 3,4                      | 3,4   | 106,0     | 91,2     | 91,3     | 91,3     |       |       |       |
| 14              | 2,2  | 2,6                      | 2,5   | 106,0     | 89,4     | 90,2     | 89,9     |       |       |       |
| 15              | 1,6  | 1,8                      | 1,7   | 106,0     | 88,1     | 88,4     | 88,3     |       |       |       |
| 16              | 1,3  | 1,3                      | 1,2   | 106,0     | 87,1     | 87,2     | 86,8     |       |       |       |
| 17              | 0,9  | 0,9                      | 0,9   | 106,0     | 85,7     | 85,7     | 85,7     |       |       |       |
| 18              | 0,6  | 0,5                      | 0,7   | 106,0     | 83,8     | 83,4     | 84,5     |       |       |       |
| 19              | 0,4  | 0,4                      | 0,4   | 106,0     | 81,9     | 82,2     | 81,9     |       |       |       |
| 20              | 0,3  | 0,3                      | 0,3   | 106,0     | 80,3     | 80,7     | 80,3     |       |       |       |
| 21              | 0,2  | 0,2                      | 0,2   | 106,0     | 78,6     | 77,8     | 78,1     |       |       |       |
| 22              | 0,1  | 0,1                      | 0,1   | 106,0     | 77,0     | 74,5     | 76,2     |       |       |       |
| 23              | 0,1  | 0,1                      | 0,1   | 106,0     | 73,6     | 73,5     | 73,1     |       |       |       |
| 24              | 0,0  | 0,0                      | 0,0   | 106,0     | 70,1     | 69,7     | 71,5     |       |       |       |
| 25              | 0,0  | 0,0                      | 0,0   | 106,0     | 72,8     | 72,7     | 71,0     |       |       |       |
|                 |      |                          |       | Lden [dB] | 109,4    | 102,6    | 102,9    | 103,1 |       |       |
|                 |      | 31,5 Hz                  | 63 Hz | 125 Hz    | 250 Hz   | 500 Hz   | 1 kHz    | 2 kHz | 4 kHz | 8 kHz |
| SPECTRUM        |      | -29,3                    | -19,7 | -12,5     | -7,8     | -5,5     | -5,6     | -8,2  | -13,1 | -20,6 |
| Ldag            |      | 73,3                     | 83,0  | 90,1      | 94,8     | 97,2     | 97,0     | 94,5  | 89,5  | 82,1  |
| Levening        |      | 73,5                     | 83,2  | 90,3      | 95,0     | 97,4     | 97,3     | 94,7  | 89,7  | 82,3  |
| Lnicht          |      | 73,7                     | 83,4  | 90,5      | 95,2     | 97,6     | 97,5     | 94,9  | 89,9  | 82,5  |

|                 |      |                          |        |          |         |         |          |          |
|-----------------|------|--------------------------|--------|----------|---------|---------|----------|----------|
| RD coords:      |      | 37082                    | 402441 |          |         |         |          |          |
| Windprofiel:    |      | 96,5 m                   |        |          |         |         |          |          |
| Turbine type:   |      | Vestas V117 HWO with STE |        | Ashoogte | 91,5 m  |         |          |          |
| Modeinstelling: |      | S03 HWO                  |        | Lw+Cb    |         |         |          |          |
| wind (ashoogte) | dag  | avond                    | nacht  |          | Lw as   | LE dag  | LE avond | LE nacht |
| m/s             | %    | %                        | %      |          | [dB(A)] | [db(A)] | [db(A)]  | [db(A)]  |
| 1               | 1,8  | 1,7                      | 1,8    |          |         |         |          |          |
| 2               | 3,7  | 3,5                      | 3,0    |          |         |         |          |          |
| 3               | 6,1  | 5,4                      | 4,5    |          | 92,2    | 80,1    | 79,5     | 78,7     |
| 4               | 8,4  | 7,5                      | 5,9    |          | 92,8    | 82,0    | 81,5     | 80,5     |
| 5               | 9,8  | 9,2                      | 7,4    |          | 94,0    | 83,9    | 83,6     | 82,7     |
| 6               | 10,9 | 10,7                     | 10,2   |          | 97,0    | 87,4    | 87,3     | 87,1     |
| 7               | 11,5 | 10,9                     | 13,0   |          | 99,8    | 90,4    | 90,2     | 90,9     |
| 8               | 10,7 | 11,4                     | 13,1   |          | 100,8   | 91,1    | 91,4     | 92,0     |
| 9               | 8,8  | 9,8                      | 10,9   |          | 101,0   | 90,5    | 90,9     | 91,4     |
| 10              | 7,1  | 8,1                      | 8,5    |          | 101,0   | 89,5    | 90,1     | 90,3     |
| 11              | 5,7  | 5,9                      | 6,1    |          | 101,0   | 88,6    | 88,7     | 88,8     |
| 12              | 4,5  | 4,3                      | 4,2    |          | 101,0   | 87,6    | 87,3     | 87,3     |
| 13              | 3,3  | 3,4                      | 3,4    |          | 101,0   | 86,2    | 86,3     | 86,3     |
| 14              | 2,2  | 2,6                      | 2,5    |          | 101,0   | 84,4    | 85,2     | 84,9     |
| 15              | 1,6  | 1,8                      | 1,7    |          | 101,0   | 83,1    | 83,4     | 83,3     |
| 16              | 1,3  | 1,3                      | 1,2    |          | 101,0   | 82,1    | 82,2     | 81,8     |
| 17              | 0,9  | 0,9                      | 0,9    |          | 101,0   | 80,7    | 80,7     | 80,7     |
| 18              | 0,6  | 0,5                      | 0,7    |          | 101,0   | 78,8    | 78,4     | 79,5     |
| 19              | 0,4  | 0,4                      | 0,4    |          | 101,0   | 76,9    | 77,2     | 76,9     |
| 20              | 0,3  | 0,3                      | 0,3    |          | 101,0   | 75,3    | 75,7     | 75,3     |
| 21              | 0,2  | 0,2                      | 0,2    |          | 101,0   | 73,6    | 72,8     | 73,1     |
| 22              | 0,1  | 0,1                      | 0,1    |          | 101,0   | 72,0    | 69,5     | 71,2     |
| 23              | 0,1  | 0,1                      | 0,1    |          | 101,0   | 68,6    | 68,5     | 68,1     |
| 24              | 0,0  | 0,0                      | 0,0    |          | 101,0   | 65,1    | 64,7     | 66,5     |
| 25              | 0,0  | 0,0                      | 0,0    |          | 101,0   | 67,8    | 67,7     | 66,0     |
| Lden [dB]       |      |                          |        |          | 105,8   | 99,1    | 99,2     | 99,5     |

Gebruikte gegevens:

- Geluidcurve: V117-4.0\_4.2MW Strong Wind 0067-7063\_V05 - Performance Specification.pdf
- Spectrum: 0067-7587\_V00 - V117-4\_0MW Third Octaves.pdf

### 8.3 Sound Curves, Power Optimized Mode PO1/PO1-0S

| Sound Power Level at Hub Height   |                                                                                                                                                                     |                                                                                                                 |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Conditions for Sound Power Level: | Measurement standard IEC 61400-11 ed. 3<br>Maximum turbulence at hub height: 30%<br>Inflow angle (vertical): $0 \pm 2^\circ$<br>Air density: $1.225 \text{ kg/m}^3$ |                                                                                                                 |
| Wind speed at hub height [m/s]    | Sound Power Level at Hub Height [dBA]<br>Power Optimized Mode PO1<br>(Blades with serrated trailing edge)                                                           | Sound Power Level at Hub Height [dBA]<br>Power Optimized Mode PO1-0S<br>(Blades without serrated trailing edge) |
| 3                                 | 92.2                                                                                                                                                                | 94.5                                                                                                            |
| 4                                 | 92.8                                                                                                                                                                | 95.4                                                                                                            |
| 5                                 | 94.0                                                                                                                                                                | 97.1                                                                                                            |
| 6                                 | 97.0                                                                                                                                                                | 100.2                                                                                                           |
| 7                                 | 100.0                                                                                                                                                               | 103.1                                                                                                           |
| 8                                 | 102.8                                                                                                                                                               | 105.6                                                                                                           |
| 9                                 | 105.1                                                                                                                                                               | 107.7                                                                                                           |
| 10                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 11                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 12                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 13                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 14                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 15                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 16                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 17                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 18                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 19                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |
| 20                                | 106.0                                                                                                                                                               | 108.5                                                                                                           |

Table 8-3: Sound curves, Power Optimized Mode PO1/PO1-0S

### 15.3 Sound Curves, SO3 (HWO)

| Sound Power Level at Hub Height   |                                                                                                                                                                     |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conditions for Sound Power Level: | Measurement standard IEC 61400-11 ed. 3<br>Maximum turbulence at hub height: 30%<br>Inflow angle (vertical): $0 \pm 2^\circ$<br>Air density: $1.225 \text{ kg/m}^3$ |
| Wind speed at hub height [m/s]    | Sound Power Level at Hub Height [dBA]<br>SO3 (HWO) (Blades with serrated trailing edge)                                                                             |
| 3                                 | 92.2                                                                                                                                                                |
| 4                                 | 92.8                                                                                                                                                                |
| 5                                 | 94.0                                                                                                                                                                |
| 6                                 | 97.0                                                                                                                                                                |
| 7                                 | 99.8                                                                                                                                                                |
| 8                                 | 100.8                                                                                                                                                               |
| 9                                 | 101.0                                                                                                                                                               |
| 10                                | 101.0                                                                                                                                                               |
| 11                                | 101.0                                                                                                                                                               |
| 12                                | 101.0                                                                                                                                                               |
| 13                                | 101.0                                                                                                                                                               |
| 14                                | 101.0                                                                                                                                                               |
| 15                                | 101.0                                                                                                                                                               |
| 16                                | 101.0                                                                                                                                                               |
| 17                                | 101.0                                                                                                                                                               |
| 18                                | 101.0                                                                                                                                                               |
| 19                                | 101.0                                                                                                                                                               |
| 20                                | 101.0                                                                                                                                                               |

Table 15-3: Sound curves, SO3 (HWO)

|                 |      |                      |       |           |          |          |          |       |       |       |
|-----------------|------|----------------------|-------|-----------|----------|----------|----------|-------|-------|-------|
| RD coords:      |      | 37082 402441         |       |           |          |          |          |       |       |       |
| Windprofiel:    |      | 97,0 m               |       |           |          |          |          |       |       |       |
| Turbine type:   |      | Enercon E115 4.0 STE |       |           | Ashoogte |          | 92 m     |       |       |       |
| Modeinstelling: |      | Mode 0s              |       |           | Lw+Cb    |          |          |       |       |       |
| wind (ashoogte) | dag  | avond                | nacht |           |          |          |          |       |       |       |
| m/s             | %    | %                    | %     | Lw as     | LE dag   | LE avond | LE nacht |       |       |       |
|                 |      |                      |       | [dB(A)]   | [db(A)]  | [db(A)]  | [db(A)]  |       |       |       |
| 1               | 1,8  | 1,7                  | 1,8   |           |          |          |          |       |       |       |
| 2               | 3,7  | 3,5                  | 3,0   |           |          |          |          |       |       |       |
| 3               | 6,1  | 5,4                  | 4,5   | 91,1      | 79,0     | 78,4     | 77,6     |       |       |       |
| 4               | 8,3  | 7,4                  | 5,9   | 91,1      | 80,3     | 79,8     | 78,8     |       |       |       |
| 5               | 9,8  | 9,2                  | 7,4   | 91,1      | 81,0     | 80,7     | 79,8     |       |       |       |
| 6               | 10,8 | 10,6                 | 10,2  | 95,0      | 85,4     | 85,3     | 85,1     |       |       |       |
| 7               | 11,4 | 10,9                 | 12,9  | 98,3      | 88,9     | 88,7     | 89,4     |       |       |       |
| 8               | 10,7 | 11,4                 | 13,1  | 101,3     | 91,6     | 91,9     | 92,5     |       |       |       |
| 9               | 8,9  | 9,8                  | 11,0  | 103,9     | 93,4     | 93,8     | 94,3     |       |       |       |
| 10              | 7,1  | 8,1                  | 8,6   | 104,7     | 93,2     | 93,8     | 94,0     |       |       |       |
| 11              | 5,7  | 5,9                  | 6,1   | 105,2     | 92,8     | 92,9     | 93,0     |       |       |       |
| 12              | 4,5  | 4,3                  | 4,2   | 105,5     | 92,1     | 91,8     | 91,8     |       |       |       |
| 13              | 3,3  | 3,4                  | 3,4   | 106,0     | 91,2     | 91,3     | 91,3     |       |       |       |
| 14              | 2,2  | 2,7                  | 2,5   | 106,0     | 89,4     | 90,2     | 89,9     |       |       |       |
| 15              | 1,6  | 1,8                  | 1,7   | 106,0     | 88,1     | 88,5     | 88,3     |       |       |       |
| 16              | 1,3  | 1,3                  | 1,2   | 106,0     | 87,1     | 87,3     | 86,8     |       |       |       |
| 17              | 0,9  | 0,9                  | 0,9   | 106,0     | 85,7     | 85,7     | 85,7     |       |       |       |
| 18              | 0,6  | 0,5                  | 0,7   | 106,0     | 83,8     | 83,4     | 84,5     |       |       |       |
| 19              | 0,4  | 0,4                  | 0,4   | 106,0     | 81,9     | 82,2     | 81,9     |       |       |       |
| 20              | 0,3  | 0,3                  | 0,3   | 106,0     | 80,3     | 80,8     | 80,3     |       |       |       |
| 21              | 0,2  | 0,2                  | 0,2   | 106,0     | 78,6     | 77,9     | 78,1     |       |       |       |
| 22              | 0,1  | 0,1                  | 0,1   | 106,0     | 77,1     | 74,5     | 76,2     |       |       |       |
| 23              | 0,1  | 0,1                  | 0,1   | 106,0     | 73,6     | 73,5     | 73,1     |       |       |       |
| 24              | 0,0  | 0,0                  | 0,0   | 106,0     | 70,1     | 69,7     | 71,5     |       |       |       |
| 25              | 0,0  | 0,0                  | 0,0   | 106,0     | 72,9     | 72,7     | 71,0     |       |       |       |
|                 |      |                      |       | Lden [dB] | 108,5    | 101,8    | 102,0    | 102,2 |       |       |
|                 |      | 31,5 Hz              | 63 Hz | 125 Hz    | 250 Hz   | 500 Hz   | 1 kHz    | 2 kHz | 4 kHz | 8 kHz |
| SPECTRUM        |      | -28,2                | -16,7 | -10,8     | -7,8     | -5,6     | -5,7     | -7,9  | -15,4 | -32,3 |
| Ldag            |      | 73,5                 | 85,0  | 90,9      | 93,9     | 96,1     | 96,0     | 93,8  | 86,3  | 69,4  |
| Levening        |      | 73,8                 | 85,3  | 91,2      | 94,2     | 96,4     | 96,3     | 94,1  | 86,6  | 69,7  |
| Lnight          |      | 73,9                 | 85,4  | 91,3      | 94,3     | 96,5     | 96,4     | 94,2  | 86,7  | 69,8  |

Gebruikte gegevens:

- Geluidcurve en spectrum: E115 EP3 TES\_Data Sheet power curve new.pdf

Tab. 6: Calculated sound power level in dB(A), based on wind speed at hub height

| Wind speed at hub height ( $v_{HH}$ ) | Sound power level in dB(A) |
|---------------------------------------|----------------------------|
| 5 m/s                                 | 91.1                       |
| 5.5 m/s                               | 93.0                       |
| 6 m/s                                 | 95.0                       |
| 6.5 m/s                               | 96.7                       |
| 7 m/s                                 | 98.3                       |
| 7.5 m/s                               | 99.8                       |
| 8 m/s                                 | 101.3                      |
| 8.5 m/s                               | 102.6                      |
| 9 m/s                                 | 103.9                      |
| 9.5 m/s                               | 104.4                      |
| 10 m/s                                | 104.7                      |
| 10.5 m/s                              | 105.0                      |
| 11 m/s                                | 105.2                      |
| 11.5 m/s                              | 105.4                      |
| 12 m/s                                | 105.5                      |
| 12.5 m/s                              | 105.9                      |
| 13 m/s                                | 106.0                      |
| 13.5 m/s                              | 106.0                      |
| 14 m/s                                | 106.0                      |
| 14.5 m/s                              | 106.0                      |
| 15 m/s                                | 106.0                      |

## **Bijlage III**

### **Invoergegevens rekenmodel geluid**

Invoer rekenmodel geluid

Model: tweede model - v2  
 R068380ad.198CMPR.dv - Oosterschelde  
 Groep: (hoofdgroep)  
 Lijst van Toetspunten, voor rekenmethode Industrielawaai - WT

| Naam | Omschr.                  | X        | Y         | Maaiveld | Hoogte A | Hoogte B | Hoogte C | Hoogte D | Hoogte E | Hoogte F | Gevel |
|------|--------------------------|----------|-----------|----------|----------|----------|----------|----------|----------|----------|-------|
| 01   | Strandhoekweg 1          | 37617,00 | 402272,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 02   | Strandhoekweg 3          | 37644,00 | 402290,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 03   | Jacobaweg 1 (BW)         | 37340,00 | 402257,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 04   | Rippolderseweg 1         | 37748,00 | 401892,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 05   | Banjaard Strand          | 36257,00 | 402333,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 06   | Banjaard Noord           | 36385,00 | 402191,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 07   | Banjaard Noord-Oost      | 36608,00 | 402116,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 08   | Banjaard West            | 36028,00 | 401916,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 09   | Banjaard Oost            | 36513,00 | 401834,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 10   | Banjaard Centraal        | 36207,00 | 401708,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |
| 11   | Banjaard strandpaviljoen | 35505,00 | 402013,00 | 1,00     | 5,00     | --       | --       | --       | --       | --       | Ja    |

## Invoer rekenmodel geluid

---

Model: tweede model - v2

R068380ad.198CMPR.dv - Oosterschelde

Groep: Vestas V117 4.2 STE

Lijst van Windturbines, voor rekenmethode Industrielawaai - WT

| Naam | Omschr.     | X        | Y         | Maaiveld | Hoogte | LE (D) Totaal | LE (A) Totaal | LE (N) Totaal |
|------|-------------|----------|-----------|----------|--------|---------------|---------------|---------------|
| JH1  | Vestas V117 | 36943,00 | 402577,00 | 5,10     | 91,50  | 102,65        | 102,87        | 103,07        |
| JH2  | Vestas V117 | 37353,00 | 402574,00 | 4,90     | 91,50  | 102,65        | 102,87        | 103,07        |
| JH3  | Vestas V117 | 36896,00 | 402286,00 | 7,70     | 91,50  | 102,65        | 102,87        | 103,07        |

Invoer rekenmodel geluid

Model: tweede model - v2  
R068380ad.198CMPR.dv - Oosterschelde  
Groep: E115 4.0 STE  
Lijst van Windturbines, voor rekenmethode Industrielawaai - WT

| Naam | Omschr.      | X        | Y         | Maaiveld | Hoogte | LE (D) Totaal | LE (A) Totaal | LE (N) Totaal |
|------|--------------|----------|-----------|----------|--------|---------------|---------------|---------------|
| JH1  | Enercon E115 | 36943,00 | 402577,00 | 5,10     | 92,00  | 101,79        | 102,01        | 102,18        |
| JH2  | Enercon E115 | 37353,00 | 402574,00 | 4,90     | 92,00  | 101,79        | 102,01        | 102,18        |
| JH3  | Enercon E115 | 36896,00 | 402286,00 | 7,70     | 92,00  | 101,79        | 102,01        | 102,18        |

# Invoer rekenmodel geluid

Model: tweede model - v2  
R068380ad.198CMPR.dv - Oosterschelde  
Groep: Vestas V117 4.2 STE  
Lijst van Windturbines, voor rekenmethode Industrielawaai - WT

| Naam | Omschr.     | LE (D) 63 | LE (D) 125 | LE (D) 250 | LE (D) 500 | LE (D) 1k | LE (D) 2k | LE (D) 4k | LE (D) 8k | LE (A) 63 | LE (A) 125 | LE (A) 250 | LE (A) 500 | LE (A) 1k |
|------|-------------|-----------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|-----------|
| JH1  | Vestas V117 | 82,95     | 90,11      | 94,83      | 97,17      | 97,04     | 94,46     | 89,52     | 82,08     | 83,17     | 90,33      | 95,04      | 97,39      | 97,26     |
| JH2  | Vestas V117 | 82,95     | 90,11      | 94,83      | 97,17      | 97,04     | 94,46     | 89,52     | 82,08     | 83,17     | 90,33      | 95,04      | 97,39      | 97,26     |
| JH3  | Vestas V117 | 82,95     | 90,11      | 94,83      | 97,17      | 97,04     | 94,46     | 89,52     | 82,08     | 83,17     | 90,33      | 95,04      | 97,39      | 97,26     |

## Invoer rekenmodel geluid

---

Model: tweede model - v2  
R068380ad.198CMPR.dv - Oosterschelde  
Groep: Vestas V117 4.2 STE  
Lijst van Windturbines, voor rekenmethode Industrielawaai - WT

| Naam | LE (A) 2k | LE (A) 4k | LE (A) 8k | LE (N) 63 | LE (N) 125 | LE (N) 250 | LE (N) 500 | LE (N) 1k | LE (N) 2k | LE (N) 4k | LE (N) 8k |
|------|-----------|-----------|-----------|-----------|------------|------------|------------|-----------|-----------|-----------|-----------|
| JH1  | 94,68     | 89,73     | 82,30     | 83,37     | 90,53      | 95,25      | 97,59      | 97,46     | 94,88     | 89,94     | 82,50     |
| JH2  | 94,68     | 89,73     | 82,30     | 83,37     | 90,53      | 95,25      | 97,59      | 97,46     | 94,88     | 89,94     | 82,50     |
| JH3  | 94,68     | 89,73     | 82,30     | 83,37     | 90,53      | 95,25      | 97,59      | 97,46     | 94,88     | 89,94     | 82,50     |

Invoer rekenmodel geluid

Model: tweede model - v2  
R068380ad.198CMPR.dv - Oosterschelde  
Groep: E115 4.0 STE  
Lijst van Windturbines, voor rekenmethode Industrielawaai - WT

| Naam | Omschr.      | LE (D) 63 | LE (D) 125 | LE (D) 250 | LE (D) 500 | LE (D) 1k | LE (D) 2k | LE (D) 4k | LE (D) 8k | LE (A) 63 | LE (A) 125 | LE (A) 250 | LE (A) 500 | LE (A) 1k |
|------|--------------|-----------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|-----------|
| JH1  | Enercon E115 | 85,05     | 90,95      | 93,95      | 96,15      | 96,05     | 93,85     | 86,35     | 69,45     | 85,27     | 91,17      | 94,17      | 96,37      | 96,27     |
| JH2  | Enercon E115 | 85,05     | 90,95      | 93,95      | 96,15      | 96,05     | 93,85     | 86,35     | 69,45     | 85,27     | 91,17      | 94,17      | 96,37      | 96,27     |
| JH3  | Enercon E115 | 85,05     | 90,95      | 93,95      | 96,15      | 96,05     | 93,85     | 86,35     | 69,45     | 85,27     | 91,17      | 94,17      | 96,37      | 96,27     |

Invoer rekenmodel geluid

Model: tweede model - v2  
R068380ad.198CMPR.dv - Oosterschelde  
Groep: E115 4.0 STE  
Lijst van Windturbines, voor rekenmethode Industrielawaai - WT

| Naam | LE (A) 2k | LE (A) 4k | LE (A) 8k | LE (N) 63 | LE (N) 125 | LE (N) 250 | LE (N) 500 | LE (N) 1k | LE (N) 2k | LE (N) 4k | LE (N) 8k |
|------|-----------|-----------|-----------|-----------|------------|------------|------------|-----------|-----------|-----------|-----------|
| JH1  | 94,07     | 86,57     | 69,67     | 85,44     | 91,34      | 94,34      | 96,54      | 96,44     | 94,24     | 86,74     | 69,84     |
| JH2  | 94,07     | 86,57     | 69,67     | 85,44     | 91,34      | 94,34      | 96,54      | 96,44     | 94,24     | 86,74     | 69,84     |
| JH3  | 94,07     | 86,57     | 69,67     | 85,44     | 91,34      | 94,34      | 96,54      | 96,44     | 94,24     | 86,74     | 69,84     |

## **Bijlage IV**

### **Rekenresultaten geluid**

---

Rapport: Resultatentabel  
Model: Eerste model  
Groep: LAeq totaalresultaten voor toetspunten  
Groepsreductie: Vestas V117 4.2 STE  
Nee

| Naam<br>Toetspunt | Omschrijving             | Hoogte | Dag  | Avond | Nacht | Lden |
|-------------------|--------------------------|--------|------|-------|-------|------|
| 01_A              | Strandhoekweg 1          | 5,00   | 41,7 | 41,9  | 42,1  | 48,4 |
| 02_A              | Strandhoekweg 3          | 5,00   | 41,5 | 41,8  | 42,0  | 48,3 |
| 03_A              | Jacobaweg 1 (BW)         | 5,00   | 44,2 | 44,5  | 44,7  | 51,0 |
| 04_A              | Rippolderseweg 1         | 5,00   | 36,2 | 36,4  | 36,6  | 42,9 |
| 05_A              | Banjaard Strand          | 5,00   | 37,7 | 37,9  | 38,1  | 44,4 |
| 06_A              | Banjaard Noord           | 5,00   | 39,3 | 39,5  | 39,7  | 46,0 |
| 07_A              | Banjaard Noord-Oost      | 5,00   | 42,6 | 42,8  | 43,0  | 49,3 |
| 08_A              | Banjaard West            | 5,00   | 33,2 | 33,4  | 33,6  | 39,9 |
| 09_A              | Banjaard Oost            | 5,00   | 37,7 | 37,9  | 38,1  | 44,5 |
| 10_A              | Banjaard Centraal        | 5,00   | 33,5 | 33,7  | 33,9  | 40,3 |
| 11_A              | Banjaard strandpaviljoen | 5,00   | 27,3 | 27,5  | 27,7  | 34,1 |

Alle getoonde dB-waarden zijn A-gewogen

---

Rapport: Resultatentabel  
Model: Eerste model  
Groep: LAeq totaalresultaten voor toetspunten  
Groepsreductie: E115 4.0 STE  
Nee

| Naam<br>Toetspunt | Omschrijving             | Hoogte | Dag  | Avond | Nacht | Lden |
|-------------------|--------------------------|--------|------|-------|-------|------|
| 01_A              | Strandhoekweg 1          | 5,00   | 41,0 | 41,2  | 41,4  | 47,7 |
| 02_A              | Strandhoekweg 3          | 5,00   | 40,9 | 41,1  | 41,3  | 47,6 |
| 03_A              | Jacobaweg 1 (BW)         | 5,00   | 43,6 | 43,8  | 44,0  | 50,3 |
| 04_A              | Rippolderseweg 1         | 5,00   | 35,6 | 35,8  | 36,0  | 42,3 |
| 05_A              | Banjaard Strand          | 5,00   | 37,1 | 37,3  | 37,5  | 43,8 |
| 06_A              | Banjaard Noord           | 5,00   | 38,6 | 38,9  | 39,0  | 45,4 |
| 07_A              | Banjaard Noord-Oost      | 5,00   | 41,9 | 42,1  | 42,3  | 48,6 |
| 08_A              | Banjaard West            | 5,00   | 32,6 | 32,9  | 33,0  | 39,4 |
| 09_A              | Banjaard Oost            | 5,00   | 37,1 | 37,3  | 37,5  | 43,8 |
| 10_A              | Banjaard Centraal        | 5,00   | 33,0 | 33,2  | 33,3  | 39,7 |
| 11_A              | Banjaard strandpaviljoen | 5,00   | 26,9 | 27,1  | 27,2  | 33,6 |

Alle getoonde dB-waarden zijn A-gewogen

Maatregelen

Rapport: Resultatentabel  
Model: Eerste model  
Groep: LAeq totaalresultaten voor toetspunten  
Groepsreductie: Vestas V117 4.2 STE  
Ja

| Naam      |                          |        |      |       |       |      |
|-----------|--------------------------|--------|------|-------|-------|------|
| Toetspunt | Omschrijving             | Hoogte | Dag  | Avond | Nacht | Lden |
| 01_A      | Strandhoekweg 1          | 5,00   | 41,7 | 41,9  | 40,0  | 46,9 |
| 02_A      | Strandhoekweg 3          | 5,00   | 41,5 | 41,8  | 39,9  | 46,7 |
| 03_A      | Jacobaweg 1 (BW)         | 5,00   | 44,2 | 44,5  | 43,1  | 49,8 |
| 04_A      | Rippolderseweg 1         | 5,00   | 36,2 | 36,4  | 35,2  | 41,9 |
| 05_A      | Banjaard Strand          | 5,00   | 37,7 | 37,9  | 37,8  | 44,2 |
| 06_A      | Banjaard Noord           | 5,00   | 39,3 | 39,5  | 39,4  | 45,8 |
| 07_A      | Banjaard Noord-Oost      | 5,00   | 42,6 | 42,8  | 42,8  | 49,2 |
| 08_A      | Banjaard West            | 5,00   | 33,2 | 33,4  | 33,3  | 39,7 |
| 09_A      | Banjaard Oost            | 5,00   | 37,7 | 37,9  | 37,9  | 44,2 |
| 10_A      | Banjaard Centraal        | 5,00   | 33,5 | 33,7  | 33,6  | 40,0 |
| 11_A      | Banjaard strandpaviljoen | 5,00   | 27,3 | 27,5  | 27,3  | 33,7 |

Alle getoonde dB-waarden zijn A-gewogen

## Maatregelen

Rapport: Resultatentabel  
Model: Eerste model  
Groep: LAeq totaalresultaten voor toetspunten  
Groepsreductie: E115 4.0 STE  
Ja

| Naam<br>Toetspunt | Omschrijving             | Hoogte | Dag  | Avond | Nacht | Lden |
|-------------------|--------------------------|--------|------|-------|-------|------|
| 01_A              | Strandhoekweg 1          | 5,00   | 41,0 | 41,2  | 40,4  | 47,0 |
| 02_A              | Strandhoekweg 3          | 5,00   | 40,9 | 41,1  | 40,3  | 46,8 |
| 03_A              | Jacobaweg 1 (BW)         | 5,00   | 43,6 | 43,8  | 43,2  | 49,7 |
| 04_A              | Rippolderseweg 1         | 5,00   | 35,6 | 35,8  | 35,3  | 41,8 |
| 05_A              | Banjaard Strand          | 5,00   | 37,1 | 37,3  | 37,3  | 43,7 |
| 06_A              | Banjaard Noord           | 5,00   | 38,6 | 38,9  | 38,9  | 45,2 |
| 07_A              | Banjaard Noord-Oost      | 5,00   | 41,9 | 42,1  | 42,2  | 48,6 |
| 08_A              | Banjaard West            | 5,00   | 32,6 | 32,9  | 32,9  | 39,2 |
| 09_A              | Banjaard Oost            | 5,00   | 37,1 | 37,3  | 37,3  | 43,7 |
| 10_A              | Banjaard Centraal        | 5,00   | 33,0 | 33,2  | 33,2  | 39,6 |
| 11_A              | Banjaard strandpaviljoen | 5,00   | 26,9 | 27,1  | 27,0  | 33,4 |

Alle getoonde dB-waarden zijn A-gewogen

## **Bijlage V**

### **Invoer en resultaten slagschaduw**

## SHADOW - Main Result

Calculation: Bestand V90 - Alle turbines - V90 als new turbine

### Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

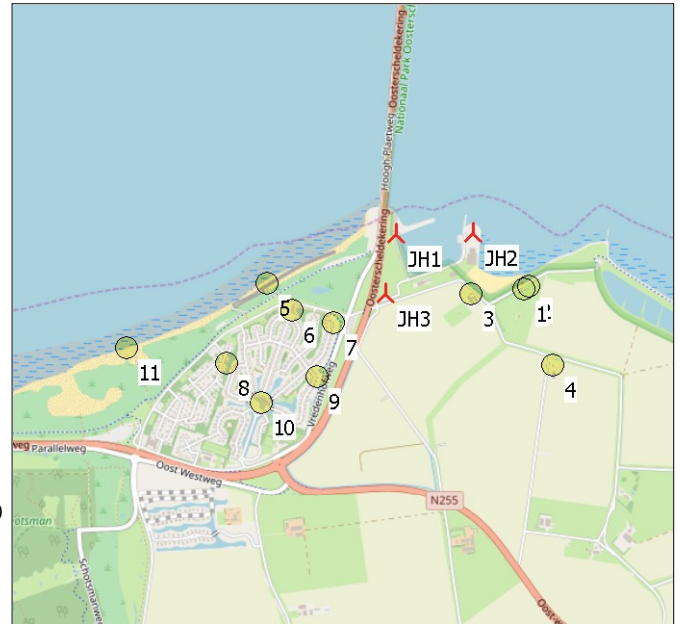
Height contours used: Height Contours: CONTOURLINE\_068380ac WP32 v90  
Obstacles not used in calculation

Eye height for map: 1,5 m

Grid resolution: 1,0 m

All coordinates are in

Dutch Stereo-RD/NAP 2008



New WTG

Scale 1:40.000

Shadow receptor

### WTGs

|     | X<br>(east) | Y<br>(north) | Z<br>[m] | Row data/Description                   | WTG type |           |                | Shadow data             |                          |                      |                                |      |
|-----|-------------|--------------|----------|----------------------------------------|----------|-----------|----------------|-------------------------|--------------------------|----------------------|--------------------------------|------|
|     |             |              |          |                                        | Valid    | Manufact. | Type-generator | Power,<br>rated<br>[kW] | Rotor<br>diameter<br>[m] | Hub<br>height<br>[m] | Calculation<br>distance<br>[m] | RPM  |
|     |             |              |          |                                        |          |           |                |                         |                          |                      |                                |      |
| JH1 | 36.943      | 402.577      | 5,1      | VESTAS V90 3000 90.0 !O! hub: 78,0 ... | Yes      | VESTAS    | V90-3.000      | 3.000                   | 90,0                     | 78,0                 | 1.507                          | 16,1 |
| JH2 | 37.353      | 402.574      | 4,9      | VESTAS V90 3000 90.0 !O! hub: 78,0 ... | Yes      | VESTAS    | V90-3.000      | 3.000                   | 90,0                     | 78,0                 | 1.507                          | 16,1 |
| JH3 | 36.885      | 402.263      | 7,7      | VESTAS V90 3000 90.0 !O! hub: 78,0 ... | Yes      | VESTAS    | V90-3.000      | 3.000                   | 90,0                     | 78,0                 | 1.507                          | 16,1 |

### Shadow receptor-Input

| No. | Name                     | X (east) | Y (north) | Z   | Width | Height | Elevation<br>a.g.l. | Slope of<br>window | Direction mode     | Eye height<br>(ZVI) a.g.l. |
|-----|--------------------------|----------|-----------|-----|-------|--------|---------------------|--------------------|--------------------|----------------------------|
|     |                          |          |           | [m] | [m]   | [m]    | [m]                 | [°]                |                    | [m]                        |
| 1   | Strandhoekweg 1          | 37.617   | 402.272   | 1,0 | 14,0  | 4,0    | 1,0                 | 90,0               | "Green house mode" | 5,0                        |
| 2   | Strandhoekweg 3          | 37.644   | 402.290   | 1,0 | 10,0  | 1,5    | 1,0                 | 90,0               | "Green house mode" | 2,5                        |
| 3   | Jacobaweg 1 (BW)         | 37.334   | 402.255   | 1,3 | 18,0  | 1,5    | 1,0                 | 90,0               | "Green house mode" | 2,5                        |
| 4   | Rippolderseweg 1         | 37.762   | 401.866   | 1,0 | 14,0  | 4,0    | 1,0                 | 90,0               | "Green house mode" | 5,0                        |
| 5   | Banjaard Strand          | 36.257   | 402.333   | 3,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 6   | Banjaard Noord           | 36.385   | 402.191   | 2,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 7   | Banjaard Noord-Oost      | 36.608   | 402.116   | 1,6 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 8   | Banjaard West            | 36.028   | 401.916   | 1,2 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 9   | Banjaard Oost            | 36.513   | 401.834   | 1,5 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 10  | Banjaard Centraal        | 36.207   | 401.708   | 1,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 11  | Banjaard Strandpaviljoen | 35.505   | 402.013   | 2,8 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |

### Calculation Results

#### Shadow receptor

| No. | Name             | Shadow, worst case                   |                                        |                                        | Shadow, expected values              |  |
|-----|------------------|--------------------------------------|----------------------------------------|----------------------------------------|--------------------------------------|--|
|     |                  | Shadow hours<br>per year<br>[h/year] | Shadow days<br>per year<br>[days/year] | Max shadow<br>hours per day<br>[h/day] | Shadow hours<br>per year<br>[h/year] |  |
| 1   | Strandhoekweg 1  | 46:41                                | 118                                    | 0:34                                   | 11:30                                |  |
| 2   | Strandhoekweg 3  | 36:41                                | 97                                     | 0:31                                   | 8:59                                 |  |
| 3   | Jacobaweg 1 (BW) | 46:44                                | 70                                     | 0:52                                   | 12:06                                |  |
| 4   | Rippolderseweg 1 | 14:09                                | 48                                     | 0:26                                   | 3:31                                 |  |
| 5   | Banjaard Strand  | 50:41                                | 134                                    | 0:35                                   | 13:24                                |  |

To be continued on next page...

## SHADOW - Main Result

Calculation: Bestaand V90 - Alle turbines - V90 als new turbine

...continued from previous page

| No. | Name                     | Shadow, worst case                   |                                        | Shadow, expected values                |                                      |
|-----|--------------------------|--------------------------------------|----------------------------------------|----------------------------------------|--------------------------------------|
|     |                          | Shadow hours<br>per year<br>[h/year] | Shadow days<br>per year<br>[days/year] | Max shadow<br>hours per day<br>[h/day] | Shadow hours<br>per year<br>[h/year] |
| 6   | Banjaard Noord           | 54:21                                | 109                                    | 0:48                                   | 15:24                                |
| 7   | Banjaard Noord-Oost      | 56:58                                | 56                                     | 1:19                                   | 16:58                                |
| 8   | Banjaard West            | 19:20                                | 59                                     | 0:34                                   | 5:44                                 |
| 9   | Banjaard Oost            | 0:00                                 | 0                                      | 0:00                                   | 0:00                                 |
| 10  | Banjaard Centraal        | 0:00                                 | 0                                      | 0:00                                   | 0:00                                 |
| 11  | Banjaard Strandpaviljoen | 2:47                                 | 18                                     | 0:14                                   | 0:46                                 |

Total amount of flickering on the shadow receptors caused by each WTG

| No. | Name                                                    | Worst case<br>[h/year] | Expected<br>[h/year] |
|-----|---------------------------------------------------------|------------------------|----------------------|
| JH1 | VESTAS V90 3000 90.0 !O! hub: 78,0 m (TOT: 123,0 m) (7) | 65:31                  | 17:35                |
| JH2 | VESTAS V90 3000 90.0 !O! hub: 78,0 m (TOT: 123,0 m) (8) | 37:30                  | 11:05                |
| JH3 | VESTAS V90 3000 90.0 !O! hub: 78,0 m (TOT: 123,0 m) (9) | 182:33                 | 49:13                |

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

## SHADOW - Main Result

Calculation: Bestand V90 - Alle turbines - V90 als new turbine - mitigatie

### Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

Flicker curtailment according to specified plan

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: CONTOURLINE\_068380ac WP32 v90

Obstacles not used in calculation

Eye height for map: 1,5 m

Grid resolution: 1,0 m

All coordinates are in

Dutch Stereo-RD/NAP 2008



New WTG

Shadow receptor

### WTGs

|     | X<br>(east) | Y<br>(north) | Z<br>[m] | Row data/Description                   | WTG type |           |                | Power,<br>rated<br>[kW] | Rotor<br>diameter<br>[m] | Hub<br>height<br>[m] | Shadow data                    |      |
|-----|-------------|--------------|----------|----------------------------------------|----------|-----------|----------------|-------------------------|--------------------------|----------------------|--------------------------------|------|
|     |             |              |          |                                        | Valid    | Manufact. | Type-generator |                         |                          |                      | Calculation<br>distance<br>[m] | RPM  |
| JH1 | 36.943      | 402.577      | 5,1      | VESTAS V90 3000 90.0 !O! hub: 78,0 ... | Yes      | VESTAS    | V90-3.000      | 3.000                   | 90,0                     | 78,0                 | 1.507                          | 16,1 |
| JH2 | 37.353      | 402.574      | 4,9      | VESTAS V90 3000 90.0 !O! hub: 78,0 ... | Yes      | VESTAS    | V90-3.000      | 3.000                   | 90,0                     | 78,0                 | 1.507                          | 16,1 |
| JH3 | 36.885      | 402.263      | 7,7      | VESTAS V90 3000 90.0 !O! hub: 78,0 ... | Yes      | VESTAS    | V90-3.000      | 3.000                   | 90,0                     | 78,0                 | 1.507                          | 16,1 |

### Shadow receptor-Input

| No. | Name                     | X (east) | Y (north) | Z   | Width | Height | Elevation<br>a.g.l. | Slope of<br>window | Direction mode     | Eye height<br>(ZVI) a.g.l. |
|-----|--------------------------|----------|-----------|-----|-------|--------|---------------------|--------------------|--------------------|----------------------------|
|     |                          |          |           | [m] | [m]   | [m]    | [m]                 | [°]                |                    | [m]                        |
| 1   | Strandhoekweg 1          | 37.617   | 402.272   | 1,0 | 14,0  | 4,0    | 1,0                 | 90,0               | "Green house mode" | 5,0                        |
| 2   | Strandhoekweg 3          | 37.644   | 402.290   | 1,0 | 10,0  | 1,5    | 1,0                 | 90,0               | "Green house mode" | 2,5                        |
| 3   | Jacobaweg 1 (BW)         | 37.334   | 402.255   | 1,3 | 18,0  | 1,5    | 1,0                 | 90,0               | "Green house mode" | 2,5                        |
| 4   | Rippolderseweg 1         | 37.762   | 401.866   | 1,0 | 14,0  | 4,0    | 1,0                 | 90,0               | "Green house mode" | 5,0                        |
| 5   | Banjaard Strand          | 36.257   | 402.333   | 3,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 6   | Banjaard Noord           | 36.385   | 402.191   | 2,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 7   | Banjaard Noord-Oost      | 36.608   | 402.116   | 1,6 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 8   | Banjaard West            | 36.028   | 401.916   | 1,2 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 9   | Banjaard Oost            | 36.513   | 401.834   | 1,5 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 10  | Banjaard Centraal        | 36.207   | 401.708   | 1,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 11  | Banjaard Strandpaviljoen | 35.505   | 402.013   | 2,8 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |

### Calculation Results

Shadow receptor

| No. | Name                     | Shadow, worst case                   |                                        |                                        | Shadow, expected values               |                                         |                                      |
|-----|--------------------------|--------------------------------------|----------------------------------------|----------------------------------------|---------------------------------------|-----------------------------------------|--------------------------------------|
|     |                          | Shadow hours<br>per year<br>[h/year] | Shadow days<br>per year<br>[days/year] | Max shadow<br>hours per day<br>[h/day] | Avoided hours<br>per year<br>[h/year] | Avoided days<br>per year<br>[days/year] | Shadow hours<br>per year<br>[h/year] |
| 1*  | Strandhoekweg 1          | 1:32                                 | 25                                     | 0:11                                   | 45:09                                 | 93                                      | 0:23                                 |
| 10  | Banjaard Centraal        | 0:00                                 | 0                                      | 0:00                                   |                                       |                                         | 0:00                                 |
| 11  | Banjaard Strandpaviljoen | 2:47                                 | 18                                     | 0:14                                   |                                       |                                         | 0:46                                 |

To be continued on next page...

## SHADOW - Main Result

Calculation: Bestand V90 - Alle turbines - V90 als new turbine - mitigatie

...continued from previous page

| No. | Name                | Shadow, worst case   |                         |                          |                      | Shadow, expected values |                      |
|-----|---------------------|----------------------|-------------------------|--------------------------|----------------------|-------------------------|----------------------|
|     |                     | Shadow hours         | Shadow days             | Max shadow               | Avoided hours        | Avoided days            | Shadow hours         |
|     |                     | per year<br>[h/year] | per year<br>[days/year] | hours per day<br>[h/day] | per year<br>[h/year] | per year<br>[days/year] | per year<br>[h/year] |
| 2*  | Strandhoekweg 3     | 1:18                 | 17                      | 0:15                     | 35:23                | 80                      | 0:18                 |
| 3*  | Jacobaweg 1 (BW)    | 26:50                | 62                      | 0:52                     | 19:54                | 8                       | 7:11                 |
| 4   | Rippolderseweg 1    | 14:09                | 48                      | 0:26                     |                      |                         | 3:31                 |
| 5   | Banjaard Strand     | 50:41                | 134                     | 0:35                     |                      |                         | 13:24                |
| 6*  | Banjaard Noord      | 26:59                | 99                      | 0:44                     | 27:22                | 10                      | 7:43                 |
| 7*  | Banjaard Noord-Oost | 0:00                 | 0                       | 0:00                     | 56:58                | 56                      | 0:00                 |
| 8*  | Banjaard West       | 0:49                 | 22                      | 0:05                     | 18:31                | 37                      | 0:14                 |
| 9   | Banjaard Oost       | 0:00                 | 0                       | 0:00                     |                      |                         | 0:00                 |

\* Receptors where shadow flicker is reduced by curtailment

Total amount of flickering on the shadow receptors caused by each WTG

| No. | Name                                                    | Worst case | Stopped due to flicker curtailment | Expected |
|-----|---------------------------------------------------------|------------|------------------------------------|----------|
|     |                                                         | [h/year]   | [h/year]                           | [h/year] |
| JH1 | VESTAS V90 3000 90.0 !O! hub: 78,0 m (TOT: 123,0 m) (7) | 31:08      | 34:23                              | 9:04     |
| JH2 | VESTAS V90 3000 90.0 !O! hub: 78,0 m (TOT: 123,0 m) (8) | 12:00      | 25:30                              | 3:27     |
| JH3 | VESTAS V90 3000 90.0 !O! hub: 78,0 m (TOT: 123,0 m) (9) | 79:37      | 102:56                             | 20:27    |

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

## SHADOW - Main Result

Calculation: V117 - Alle turbines

### Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: CONTOURLINE\_068380ac WP32 v90

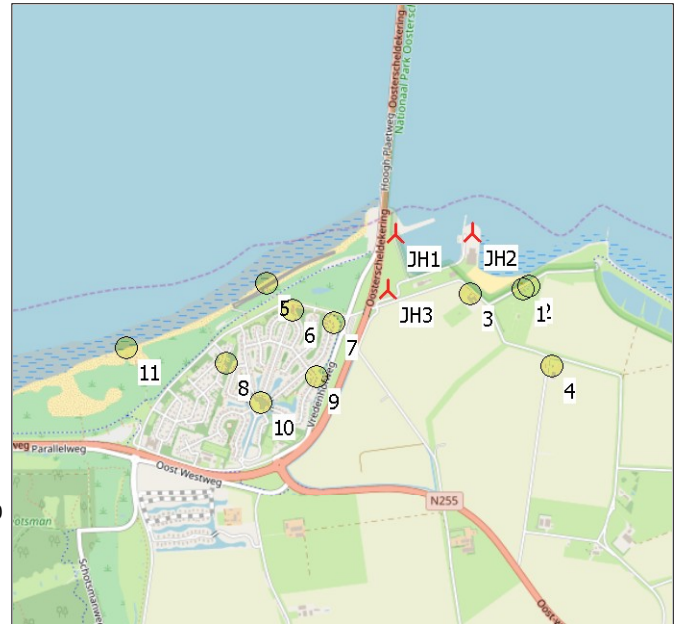
Obstacles not used in calculation

Eye height for map: 1,5 m

Grid resolution: 1,0 m

All coordinates are in

Dutch Stereo-RD/NAP 2008



New WTG

Scale 1:40.000

Shadow receptor

### WTGs

|     | X<br>(east) | Y<br>(north) | Z<br>[m] | Row data/Description                  | WTG type |           |                | Power,<br>rated<br>[kW] | Rotor<br>diameter<br>[m] | Hub<br>height<br>[m] | Shadow data                    |      |
|-----|-------------|--------------|----------|---------------------------------------|----------|-----------|----------------|-------------------------|--------------------------|----------------------|--------------------------------|------|
|     |             |              |          |                                       | Valid    | Manufact. | Type-generator |                         |                          |                      | Calculation<br>distance<br>[m] | RPM  |
| JH1 | 36.943      | 402.577      | 5,1      | VESTAS V117-4.2 4200 117.0 !O! hub... | Yes      | VESTAS    | V117-4.2-4.200 | 4.200                   | 117,0                    | 91,5                 | 1.735                          | 13,6 |
| JH2 | 37.353      | 402.574      | 4,9      | VESTAS V117-4.2 4200 117.0 !O! hub... | Yes      | VESTAS    | V117-4.2-4.200 | 4.200                   | 117,0                    | 91,5                 | 1.735                          | 13,6 |
| JH3 | 36.896      | 402.286      | 7,7      | VESTAS V117-4.2 4200 117.0 !O! hub... | Yes      | VESTAS    | V117-4.2-4.200 | 4.200                   | 117,0                    | 91,5                 | 1.735                          | 13,6 |

### Shadow receptor-Input

| No. | Name                     | X (east) | Y (north) | Z   | Width | Height | Elevation<br>a.g.l. | Slope of<br>window | Direction mode     | Eye height<br>(ZVI) a.g.l. |
|-----|--------------------------|----------|-----------|-----|-------|--------|---------------------|--------------------|--------------------|----------------------------|
|     |                          |          |           | [m] | [m]   | [m]    | [m]                 | [°]                |                    | [m]                        |
| 1   | Strandhoekweg 1          | 37.617   | 402.272   | 1,0 | 14,0  | 4,0    | 1,0                 | 90,0               | "Green house mode" | 5,0                        |
| 2   | Strandhoekweg 3          | 37.644   | 402.290   | 1,0 | 10,0  | 1,5    | 1,0                 | 90,0               | "Green house mode" | 2,5                        |
| 3   | Jacobaweg 1 (BW)         | 37.334   | 402.255   | 1,3 | 18,0  | 1,5    | 1,0                 | 90,0               | "Green house mode" | 2,5                        |
| 4   | Rippolderseweg 1         | 37.762   | 401.866   | 1,0 | 14,0  | 4,0    | 1,0                 | 90,0               | "Green house mode" | 5,0                        |
| 5   | Banjaard Strand          | 36.257   | 402.333   | 3,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 6   | Banjaard Noord           | 36.385   | 402.191   | 2,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 7   | Banjaard Noord-Oost      | 36.608   | 402.116   | 1,6 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 8   | Banjaard West            | 36.028   | 401.916   | 1,2 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 9   | Banjaard Oost            | 36.513   | 401.834   | 1,5 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 10  | Banjaard Centraal        | 36.207   | 401.708   | 1,0 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |
| 11  | Banjaard Strandpaviljoen | 35.505   | 402.013   | 2,8 | 8,0   | 3,0    | 1,0                 | 90,0               | "Green house mode" | 4,0                        |

### Calculation Results

#### Shadow receptor

| No. | Name             | Shadow, worst case                   |                                        |                                        | Shadow, expected values              |  |
|-----|------------------|--------------------------------------|----------------------------------------|----------------------------------------|--------------------------------------|--|
|     |                  | Shadow hours<br>per year<br>[h/year] | Shadow days<br>per year<br>[days/year] | Max shadow<br>hours per day<br>[h/day] | Shadow hours<br>per year<br>[h/year] |  |
| 1   | Strandhoekweg 1  | 85:57                                | 157                                    | 0:43                                   | 21:18                                |  |
| 2   | Strandhoekweg 3  | 67:09                                | 140                                    | 0:40                                   | 16:35                                |  |
| 3   | Jacobaweg 1 (BW) | 85:32                                | 100                                    | 1:08                                   | 22:30                                |  |
| 4   | Rippolderseweg 1 | 30:58                                | 85                                     | 0:33                                   | 7:41                                 |  |
| 5   | Banjaard Strand  | 90:58                                | 178                                    | 0:45                                   | 24:38                                |  |

To be continued on next page...

## SHADOW - Main Result

Calculation: V117 - Alle turbines

...continued from previous page

| No. | Name                     | Shadow, worst case   |                         | Max shadow<br>hours per day<br>[h/day] | Shadow, expected values |  |
|-----|--------------------------|----------------------|-------------------------|----------------------------------------|-------------------------|--|
|     |                          | Shadow hours         | Shadow days             |                                        | Shadow hours            |  |
|     |                          | per year<br>[h/year] | per year<br>[days/year] |                                        | per year<br>[h/year]    |  |
| 6   | Banjaard Noord           | 97:09                | 130                     | 1:20                                   | 27:31                   |  |
| 7   | Banjaard Noord-Oost      | 47:52                | 57                      | 1:12                                   | 14:19                   |  |
| 8   | Banjaard West            | 36:18                | 98                      | 0:42                                   | 10:45                   |  |
| 9   | Banjaard Oost            | 0:00                 | 0                       | 0:00                                   | 0:00                    |  |
| 10  | Banjaard Centraal        | 0:00                 | 0                       | 0:00                                   | 0:00                    |  |
| 11  | Banjaard Strandpaviljoen | 10:38                | 57                      | 0:19                                   | 3:03                    |  |

Total amount of flickering on the shadow receptors caused by each WTG

| No. | Name                           |                                | Worst case<br>[h/year] | Expected<br>[h/year] |
|-----|--------------------------------|--------------------------------|------------------------|----------------------|
|     |                                |                                |                        |                      |
| JH1 | VESTAS V117-4.2 4200 117.0 !O! | hub: 91,5 m (TOT: 150,0 m) (1) | 122:14                 | 32:42                |
| JH2 | VESTAS V117-4.2 4200 117.0 !O! | hub: 91,5 m (TOT: 150,0 m) (2) | 57:52                  | 17:04                |
| JH3 | VESTAS V117-4.2 4200 117.0 !O! | hub: 91,5 m (TOT: 150,0 m) (6) | 283:28                 | 76:00                |

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 1 - Strandhoekweg 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|    | January | February | March |  | April | May            |       | June           |       | July           |       | August         |       | September      |                | October        | November | December |       |
|----|---------|----------|-------|--|-------|----------------|-------|----------------|-------|----------------|-------|----------------|-------|----------------|----------------|----------------|----------|----------|-------|
| 1  | 08:52   | 08:26    | 07:33 |  | 07:23 | 19:10 (JH3)    | 06:19 | 20:30 (JH1)    | 05:34 | 20:20 (JH1)    | 05:32 | 20:31 (JH1)    | 06:08 | 20:27 (JH1)    | 06:57          | 19:09 (JH3)    | 07:45    | 07:38    | 08:28 |
|    | 16:46   | 17:33    | 18:24 |  | 20:18 | 40 19:50 (JH3) | 21:08 | 9 20:39 (JH1)  | 21:53 | 37 20:57 (JH1) | 22:07 | 29 21:00 (JH1) | 21:36 | 39 21:06 (JH1) | 20:34          | 34 19:43 (JH3) | 19:25    | 17:20    | 16:40 |
| 2  | 08:52   | 08:24    | 07:31 |  | 07:21 | 19:09 (JH3)    | 06:17 | 20:26 (JH1)    | 05:34 | 20:21 (JH1)    | 05:32 | 20:31 (JH1)    | 06:09 | 20:28 (JH1)    | 06:58          | 19:08 (JH3)    | 07:47    | 07:40    | 08:30 |
|    | 16:47   | 17:35    | 18:26 |  | 20:19 | 40 19:49 (JH3) | 21:10 | 15 20:41 (JH1) | 21:54 | 36 20:57 (JH1) | 22:07 | 30 21:01 (JH1) | 21:34 | 37 21:05 (JH1) | 20:32          | 36 19:44 (JH3) | 19:23    | 17:18    | 16:40 |
| 3  | 08:52   | 08:23    | 07:29 |  | 07:19 | 19:08 (JH3)    | 06:15 | 20:25 (JH1)    | 05:33 | 20:21 (JH1)    | 05:33 | 20:30 (JH1)    | 06:11 | 20:28 (JH1)    | 07:00          | 19:07 (JH3)    | 07:48    | 07:42    | 08:31 |
|    | 16:48   | 17:37    | 18:28 |  | 20:21 | 41 19:49 (JH3) | 21:11 | 18 20:43 (JH1) | 21:55 | 35 20:56 (JH1) | 22:06 | 31 21:01 (JH1) | 21:32 | 35 21:03 (JH1) | 20:30          | 38 19:45 (JH3) | 19:21    | 17:16    | 16:39 |
| 4  | 08:52   | 08:21    | 07:27 |  | 07:16 | 19:08 (JH3)    | 06:13 | 20:23 (JH1)    | 05:32 | 20:22 (JH1)    | 05:34 | 20:30 (JH1)    | 06:12 | 20:28 (JH1)    | 07:01          | 19:06 (JH3)    | 07:50    | 07:43    | 08:32 |
|    | 16:50   | 17:39    | 18:30 |  | 20:23 | 42 19:50 (JH3) | 21:13 | 21 20:44 (JH1) | 21:56 | 35 20:57 (JH1) | 22:06 | 31 21:01 (JH1) | 21:31 | 33 21:01 (JH1) | 20:28          | 39 19:45 (JH3) | 19:19    | 17:15    | 16:39 |
| 5  | 08:51   | 08:19    | 07:24 |  | 07:14 | 19:08 (JH3)    | 06:12 | 20:22 (JH1)    | 05:32 | 20:22 (JH1)    | 05:35 | 20:30 (JH1)    | 06:14 | 20:29 (JH1)    | 07:03          | 19:05 (JH3)    | 07:52    | 07:45    | 08:34 |
|    | 16:51   | 17:41    | 18:32 |  | 20:24 | 41 19:49 (JH3) | 21:14 | 23 20:45 (JH1) | 21:57 | 34 20:56 (JH1) | 22:05 | 32 21:02 (JH1) | 21:29 | 31 21:00 (JH1) | 20:25          | 40 19:45 (JH3) | 19:16    | 17:13    | 16:38 |
| 6  | 08:51   | 08:18    | 07:22 |  | 07:12 | 19:08 (JH3)    | 06:10 | 20:21 (JH1)    | 05:31 | 20:23 (JH1)    | 05:35 | 20:30 (JH1)    | 06:15 | 20:30 (JH1)    | 07:05          | 19:04 (JH3)    | 07:53    | 07:47    | 08:35 |
|    | 16:52   | 17:43    | 18:33 |  | 20:26 | 40 19:48 (JH3) | 21:16 | 27 20:48 (JH1) | 21:58 | 34 20:57 (JH1) | 22:05 | 33 21:03 (JH1) | 21:27 | 28 20:58 (JH1) | 20:23          | 40 19:44 (JH3) | 19:14    | 17:11    | 16:38 |
| 7  | 08:51   | 08:16    | 07:20 |  | 07:10 | 19:08 (JH3)    | 06:08 | 20:20 (JH1)    | 05:30 | 20:23 (JH1)    | 05:36 | 20:30 (JH1)    | 06:17 | 20:31 (JH1)    | 07:06          | 19:04 (JH3)    | 07:55    | 07:49    | 08:36 |
|    | 16:53   | 17:44    | 18:35 |  | 20:28 | 40 19:48 (JH3) | 21:18 | 29 20:49 (JH1) | 21:59 | 33 20:56 (JH1) | 22:04 | 33 21:03 (JH1) | 21:25 | 26 20:57 (JH1) | 20:21          | 41 19:45 (JH3) | 19:12    | 17:10    | 16:37 |
| 8  | 08:50   | 08:14    | 07:18 |  | 07:07 | 19:08 (JH3)    | 06:06 | 20:18 (JH1)    | 05:30 | 20:24 (JH1)    | 05:37 | 20:28 (JH1)    | 06:18 | 20:31 (JH1)    | 07:08          | 19:03 (JH3)    | 07:56    | 07:50    | 08:37 |
|    | 16:54   | 17:46    | 18:37 |  | 20:29 | 40 19:48 (JH3) | 21:19 | 32 20:50 (JH1) | 22:00 | 32 20:56 (JH1) | 22:04 | 35 21:03 (JH1) | 21:24 | 23 20:54 (JH1) | 20:18          | 41 19:44 (JH3) | 19:10    | 17:08    | 16:37 |
| 9  | 08:50   | 08:13    | 07:16 |  | 07:05 | 19:09 (JH3)    | 06:05 | 20:18 (JH1)    | 05:29 | 20:25 (JH1)    | 05:38 | 20:28 (JH1)    | 06:20 | 20:33 (JH1)    | 07:09          | 19:03 (JH3)    | 07:58    | 07:52    | 08:39 |
|    | 16:56   | 17:48    | 18:39 |  | 20:31 | 38 19:47 (JH3) | 21:21 | 34 20:52 (JH1) | 22:01 | 32 20:57 (JH1) | 22:03 | 36 21:04 (JH1) | 21:22 | 20 20:53 (JH1) | 20:16          | 41 19:44 (JH3) | 19:07    | 17:06    | 16:37 |
| 10 | 08:49   | 08:11    | 07:13 |  | 07:03 | 19:10 (JH3)    | 06:03 | 20:17 (JH1)    | 05:29 | 20:25 (JH1)    | 05:39 | 20:28 (JH1)    | 06:22 | 20:34 (JH1)    | 07:11          | 19:02 (JH3)    | 08:00    | 07:54    | 08:40 |
|    | 16:57   | 17:50    | 18:40 |  | 20:33 | 36 19:46 (JH3) | 21:22 | 36 20:53 (JH1) | 22:02 | 31 20:56 (JH1) | 22:02 | 36 21:04 (JH1) | 21:20 | 17 20:51 (JH1) | 20:14          | 40 19:42 (JH3) | 19:05    | 17:05    | 16:36 |
| 11 | 08:49   | 08:09    | 07:11 |  | 07:01 | 19:10 (JH3)    | 06:01 | 20:17 (JH1)    | 05:29 | 20:26 (JH1)    | 05:40 | 20:28 (JH1)    | 06:23 | 20:37 (JH1)    | 07:13          | 19:02 (JH3)    | 08:02    | 07:56    | 08:41 |
|    | 16:59   | 17:52    | 18:42 |  | 20:35 | 34 19:44 (JH3) | 21:24 | 38 20:58 (JH1) | 22:02 | 30 20:56 (JH1) | 22:01 | 37 21:05 (JH1) | 21:18 | 13 20:50 (JH1) | 20:12          | 40 19:42 (JH3) | 19:03    | 17:03    | 16:36 |
| 12 | 08:48   | 08:07    | 07:09 |  | 06:58 | 19:11 (JH3)    | 06:00 | 20:16 (JH1)    | 05:28 | 20:27 (JH1)    | 05:41 | 20:28 (JH1)    | 06:25 | 20:39 (JH1)    | 07:14          | 19:02 (JH3)    | 08:03    | 07:57    | 08:42 |
|    | 17:00   | 17:54    | 18:44 |  | 20:36 | 32 19:43 (JH3) | 21:26 | 40 20:56 (JH1) | 22:03 | 29 20:56 (JH1) | 22:01 | 37 21:05 (JH1) | 21:16 | 9 20:48 (JH1)  | 20:09          | 39 19:41 (JH3) | 19:01    | 17:02    | 16:36 |
| 13 | 08:47   | 08:05    | 07:07 |  | 06:56 | 19:13 (JH3)    | 05:58 | 20:16 (JH1)    | 05:28 | 20:28 (JH1)    | 05:42 | 20:27 (JH1)    | 06:26 | 20:38 (JH1)    | 07:16          | 19:02 (JH3)    | 08:05    | 07:59    | 08:43 |
|    | 17:01   | 17:55    | 18:45 |  | 20:38 | 29 19:42 (JH3) | 21:27 | 41 20:57 (JH1) | 22:04 | 28 20:56 (JH1) | 22:00 | 39 21:06 (JH1) | 21:14 | 21 20:57 (JH1) | 20:07          | 38 19:40 (JH3) | 18:59    | 17:00    | 16:36 |
| 14 | 08:47   | 08:03    | 07:04 |  | 06:54 | 19:14 (JH3)    | 05:56 | 20:16 (JH1)    | 05:28 | 20:27 (JH1)    | 05:43 | 20:27 (JH1)    | 06:28 | 20:39 (JH1)    | 07:17          | 19:03 (JH3)    | 08:07    | 08:01    | 08:44 |
|    | 17:03   | 17:57    | 18:47 |  | 20:40 | 27 19:41 (JH3) | 21:29 | 41 20:57 (JH1) | 22:04 | 29 20:56 (JH1) | 21:59 | 39 21:06 (JH1) | 21:12 | 20:05          | 35 19:38 (JH3) | 18:56          | 16:59    | 16:36    |       |
| 15 | 08:46   | 08:02    | 07:02 |  | 06:52 | 19:16 (JH3)    | 05:55 | 20:16 (JH1)    | 05:28 | 20:28 (JH1)    | 05:45 | 20:27 (JH1)    | 06:29 | 20:39 (JH1)    | 07:19          | 19:03 (JH3)    | 08:08    | 08:03    | 08:45 |
|    | 17:05   | 17:59    | 18:49 |  | 20:41 | 23 19:39 (JH3) | 21:30 | 41 20:57 (JH1) | 22:05 | 28 20:56 (JH1) | 21:58 | 39 21:06 (JH1) | 21:10 | 20:02          | 33 19:36 (JH3) | 18:54          | 16:57    | 16:36    |       |
| 16 | 08:45   | 08:00    | 07:00 |  | 06:50 | 19:18 (JH3)    | 05:53 | 20:15 (JH1)    | 05:27 | 20:28 (JH1)    | 05:46 | 20:26 (JH1)    | 06:31 | 20:39 (JH1)    | 07:21          | 19:04 (JH3)    | 08:10    | 08:04    | 08:46 |
|    | 17:06   | 18:01    | 18:51 |  | 20:43 | 19 19:37 (JH3) | 21:32 | 42 20:57 (JH1) | 22:05 | 28 20:56 (JH1) | 21:57 | 40 21:06 (JH1) | 21:08 | 20:00          | 30 19:34 (JH3) | 18:52          | 16:56    | 16:36    |       |
| 17 | 08:44   | 07:58    | 06:57 |  | 06:48 | 19:21 (JH3)    | 05:52 | 20:15 (JH1)    | 05:27 | 20:29 (JH1)    | 05:47 | 20:27 (JH1)    | 06:33 | 20:72          | 27 19:04 (JH3) | 08:12          | 08:06    | 08:46    |       |
|    | 17:08   | 18:03    | 18:52 |  | 20:45 | 13 19:34 (JH3) | 21:33 | 43 20:58 (JH1) | 22:06 | 27 20:56 (JH1) | 21:56 | 41 21:08 (JH1) | 21:06 | 19:58          | 27 19:31 (JH3) | 18:50          | 16:55    | 16:37    |       |
| 18 | 08:43   | 07:56    | 06:55 |  | 06:45 | 19:26 (JH3)    | 05:51 | 20:16 (JH1)    | 05:27 | 20:29 (JH1)    | 05:48 | 20:27 (JH1)    | 06:34 | 20:72          | 24 19:06 (JH3) | 08:13          | 08:08    | 08:47    |       |
|    | 17:09   | 18:05    | 18:54 |  | 20:46 | 19:28 (JH3)    | 05:54 | 20:16 (JH1)    | 05:27 | 20:29 (JH1)    | 05:49 | 20:26 (JH1)    | 06:36 | 20:75          | 23 19:07 (JH3) | 08:15          | 08:09    | 08:48    |       |
| 19 | 08:42   | 07:54    | 06:53 |  | 06:43 | 19:30 (JH3)    | 05:53 | 20:16 (JH1)    | 05:27 | 20:29 (JH1)    | 05:49 | 20:26 (JH1)    | 06:36 | 20:75          | 19 19:07 (JH3) | 08:15          | 08:09    | 08:48    |       |
|    | 17:11   | 18:06    | 18:56 |  | 20:48 | 19:32 (JH3)    | 05:55 | 20:16 (JH1)    | 05:27 | 20:29 (JH1)    | 05:49 | 20:26 (JH1)    | 06:36 | 20:75          | 19 19:07 (JH3) | 08:15          | 08:09    | 08:48    |       |
| 20 | 08:41   | 07:52    | 06:51 |  | 06:41 | 19:34 (JH3)    | 05:56 | 20:16 (JH1)    | 05:27 | 20:29 (JH1)    | 05:49 | 20:26 (JH1)    | 06:37 | 20:76          | 19 19:08 (JH3) | 08:16          | 08:10    | 08:49    |       |
|    | 17:13   | 18:08    | 18:57 |  | 20:50 | 19:36 (JH3)    | 05:57 | 20:16 (JH1)    | 05:28 | 20:29 (JH1)    | 05:50 | 20:26 (JH1)    | 06:38 | 20:77          | 14 19:15 (JH3) | 08:17          | 08:11    | 08:49    |       |
| 21 | 08:40   | 07:50    | 06:48 |  | 06:39 | 19:38 (JH3)    | 05:58 | 20:16 (JH1)    | 05:28 | 20:30 (JH1)    | 05:52 | 20:26 (JH1)    | 06:39 | 20:79          | 14 19:16 (JH3) | 08:18          | 08:12    | 08:50    |       |
|    | 17:14   | 18:10    | 18:59 |  | 20:51 | 19:40 (JH3)    | 05:59 | 20:16 (JH1)    | 05:29 | 20:30 (JH1)    | 05:53 | 20:26 (JH1)    | 06:40 | 20:80          | 14 19:17 (JH3) | 08:19          | 08:13    | 08:50    |       |
| 22 | 08:39   | 07:48    | 06:46 |  | 06:37 | 19:42 (JH3)    | 05:59 | 20:16 (JH1)    | 05:29 | 20:30 (JH1)    | 05:53 | 20:26 (JH1)    | 06:41 | 20:81          | 14 19:18 (JH3) | 08:20          | 08:14    | 08:50    |       |
|    | 17:16   | 18:12    | 19:01 |  | 20:53 | 19:44 (JH3)    | 06:00 | 20:16 (JH1)    | 05:30 | 20:30 (JH1)    | 05:54 | 20:26 (JH1)    | 06:42 | 20:82          | 14 19:19 (JH3) | 08:21          | 08:15    | 08:51    |       |
| 23 | 08:38   | 07:46    | 06:44 |  | 06:35 | 18:24 (JH3)    | 06:35 | 20:16 (JH1)    | 05:28 | 20:30 (JH1)    | 05:55 | 20:26 (JH1)    | 06:42 | 20:83          | 14 19:20 (JH3) | 08:22          | 08:16    | 08:50    |       |
|    | 17:18   | 18:14    | 19:03 |  | 20:55 | 18:26 (JH3)    | 06:36 | 20:16 (JH1)    | 05:29 | 20:30 (JH1)    | 05:56 | 20:26 (JH1)    | 06:43 | 20:84          | 14 19:21 (JH3) | 08:23          | 08:17    | 08:51    |       |
| 24 | 08:37   | 07:44    | 06:41 |  | 06:33 | 18:28 (JH3)    | 06:36 | 20:16 (JH1)    | 05:29 | 20:30 (JH1)    | 05:56 | 20:26 (JH1)    | 06:44 | 20:85          | 14 19:22 (JH3) | 08:24          | 08:18    | 08:51    |       |
|    | 17:19   | 18:16    | 19:04 |  | 20:56 | 18:30 (JH3)    | 06:37 | 20:16 (JH1)    | 05:30 | 20:30 (JH1)    | 05:57 | 20:26 (JH1)    | 06:45 | 20:86          | 14 19:23 (JH3) | 08:25          | 08:19    | 08:52    |       |
| 25 | 08:36   | 07:42    | 06:39 |  | 06:31 | 18:32 (JH3)    | 06:37 | 20:16 (JH1)    | 05:30 | 20:30 (JH1)    | 05:57 | 20:26 (JH1)    | 06:45 | 20:87          | 14 19:24 (JH3) | 08:26          | 08:20    | 08:52    |       |
|    | 17:21   | 18:17    | 19:06 |  | 20:58 | 18:34 (JH3)    | 06:38 | 20:16 (JH1)    | 05:31 | 20:30 (JH1)    | 05:58 | 20:26 (JH1)    | 06:46 | 20:88          | 14 19:25 (JH3) | 08:27          | 08:21    | 08:53    |       |
| 26 | 08:34   | 07:39    | 06:37 |  | 06:29 | 18:36 (JH3)    | 06:39 | 20:16 (JH1)    | 05:31 | 20:30 (JH1)    | 05:59 | 20:26 (JH1)    | 06:47 | 20:89          | 14 19:26 (JH3) | 08:28          | 08:22    | 08:54    |       |
|    | 17:23   | 18:19    | 19:08 |  | 20:59 | 18:38 (JH3)    | 06:40 | 20:16 (JH1)    | 05:32 | 20:30 (JH1)    | 06:00 | 20:26 (JH1)    | 06:48 | 20:90          | 14 19:27 (JH3) | 08:29          | 08:23    | 08:55    |       |
| 27 | 08:33   | 07:37    | 06:35 |  | 06:27 | 18:38 (JH3)    | 06:39 | 20:18 (JH1)    | 05:29 | 20:31 (JH1)    | 05:46 | 20:26 (JH1)    | 06:49 | 20:91          | 19 19:23 (JH3) | 08:30          | 08:24    | 08:56    |       |
|    | 17:25   | 18:21    | 19:09 |  | 20:59 | 18:40 (JH3)    | 06:41 | 20:18 (JH1)    | 05:30 | 20:31 (JH1)    | 05:47 | 20:26 (JH1)    | 06:50 | 20:92          | 19 19:24 (JH3) | 08:31          | 08:25    | 08:57    |       |
| 28 | 08:32   | 07:35    | 06:32 |  | 06:28 | 18:44 (JH3)    | 06:25 | 20:18 (JH1)    | 05:28 | 20:31 (JH1)    | 05:42 | 20:26 (JH1)    | 06:50 | 20:93          | 19 19:25 (JH3) |                |          |          |       |

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 2 - Strandhoekweg 3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|    | January |       |       | February |             |       | March |  |       | April         |             |       | May |  |             | June  |    |             | July  |    |    | August      |             |             | September   |             |             | October     |             |             | November |       |       | December |  |  |
|----|---------|-------|-------|----------|-------------|-------|-------|--|-------|---------------|-------------|-------|-----|--|-------------|-------|----|-------------|-------|----|----|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|----------|-------|-------|----------|--|--|
| 1  | 08:52   | 08:26 | 07:33 |          |             |       |       |  | 07:23 | 19:07 (JH3)   | 06:19       |       |     |  | 20:16 (JH1) | 05:34 |    | 20:21 (JH1) | 05:32 |    |    | 06:08       |             | 20:20 (JH1) | 06:57       |             | 19:11 (JH3) | 07:45       |             | 07:38       |          | 08:28 |       |          |  |  |
|    | 16:46   | 17:33 | 18:24 |          |             |       |       |  | 20:18 | 19:45 (JH3)   | 21:08       | 23    |     |  | 20:39 (JH1) | 21:53 | 24 | 20:45 (JH1) | 22:07 |    |    | 21:36       | 40          |             | 21:00 (JH1) | 20:34       | 23          |             | 19:34 (JH3) | 19:25       | 17:20    | 16:40 |       |          |  |  |
| 2  | 08:52   | 08:24 | 07:31 |          |             |       |       |  | 07:21 | 19:06 (JH3)   | 06:17       |       |     |  | 20:15 (JH1) | 05:34 |    | 20:21 (JH1) | 05:32 |    |    | 20:37 (JH1) | 06:09       |             | 20:21 (JH1) | 06:58       |             | 19:09 (JH3) | 07:47       |             | 07:40    | 08:30 |       |          |  |  |
|    | 16:47   | 17:35 | 18:26 |          |             |       |       |  | 20:19 | 19:44 (JH3)   | 21:10       | 26    |     |  | 20:41 (JH1) | 21:54 | 23 | 20:44 (JH1) | 22:07 | 5  |    | 20:42 (JH1) | 21:34       | 39          | 21:00 (JH1) | 20:32       | 27          |             | 19:36 (JH3) | 19:23       | 17:18    | 16:40 |       |          |  |  |
| 3  | 08:52   | 08:23 | 07:29 |          |             |       |       |  | 07:19 | 19:06 (JH3)   | 06:15       |       |     |  | 20:15 (JH1) | 05:33 |    | 20:22 (JH1) | 05:33 |    |    | 20:34 (JH1) | 06:11       |             | 20:21 (JH1) | 07:00       |             | 19:08 (JH3) | 07:48       |             | 07:42    | 08:31 |       |          |  |  |
|    | 16:48   | 17:37 | 18:28 |          |             |       |       |  | 20:21 | 19:44 (JH3)   | 21:11       | 28    |     |  | 20:43 (JH1) | 21:55 | 21 | 20:43 (JH1) | 22:06 | 9  |    | 20:43 (JH1) | 21:32       | 38          | 20:59 (JH1) | 20:30       | 29          |             | 19:37 (JH3) | 19:21       | 17:16    | 16:39 |       |          |  |  |
| 4  | 08:52   | 08:21 | 07:27 |          |             |       |       |  | 07:16 | 19:07 (JH3)   | 06:13       |       |     |  | 20:13 (JH1) | 05:32 |    | 20:23 (JH1) | 05:34 |    |    | 20:34 (JH1) | 06:12       |             | 20:20 (JH1) | 07:01       |             | 19:05 (JH3) | 07:50       |             | 07:43    | 08:32 |       |          |  |  |
|    | 16:50   | 17:39 | 18:30 |          |             |       |       |  | 20:23 | 19:44 (JH3)   | 21:13       | 31    |     |  | 20:44 (JH1) | 21:56 | 20 | 20:43 (JH1) | 22:06 | 11 |    | 20:45 (JH1) | 21:31       | 39          | 20:59 (JH1) | 20:28       | 32          |             | 19:37 (JH3) | 19:19       | 17:15    | 16:39 |       |          |  |  |
| 5  | 08:51   | 08:19 | 07:24 |          |             |       |       |  | 07:14 | 19:07 (JH3)   | 06:12       |       |     |  | 20:12 (JH1) | 05:32 |    | 20:24 (JH1) | 05:35 |    |    | 20:33 (JH1) | 06:14       |             | 20:21 (JH1) | 07:03       |             | 19:04 (JH3) | 07:52       |             | 07:45    | 08:34 |       |          |  |  |
|    | 16:51   | 17:41 | 18:32 |          |             |       |       |  | 20:24 | 19:43 (JH3)   | 21:14       | 33    |     |  | 20:45 (JH1) | 21:57 | 18 | 20:42 (JH1) | 22:05 | 13 |    | 20:46 (JH1) | 21:29       | 38          | 20:59 (JH1) | 20:25       | 34          |             | 19:38 (JH3) | 19:16       | 17:13    | 16:38 |       |          |  |  |
| 6  | 08:51   | 08:18 | 07:22 |          |             |       |       |  | 07:12 | 19:07 (JH3)   | 06:10       |       |     |  | 20:12 (JH1) | 05:31 |    | 20:26 (JH1) | 05:35 |    |    | 20:32 (JH1) | 06:15       |             | 20:21 (JH1) | 07:05       |             | 19:03 (JH3) | 07:53       |             | 07:47    | 08:35 |       |          |  |  |
|    | 16:52   | 17:43 | 18:33 |          |             |       |       |  | 20:26 | 19:42 (JH3)   | 21:16       | 36    |     |  | 20:48 (JH1) | 21:58 | 16 | 20:42 (JH1) | 22:05 | 16 |    | 20:32 (JH1) | 06:17       | 37          | 20:58 (JH1) | 20:23       | 35          |             | 19:38 (JH3) | 19:14       | 17:11    | 16:38 |       |          |  |  |
| 7  | 08:51   | 08:16 | 07:20 |          |             |       |       |  | 07:10 | 19:07 (JH3)   | 06:08       |       |     |  | 20:11 (JH1) | 05:30 |    | 20:26 (JH1) | 05:36 |    |    | 20:32 (JH1) | 06:17       |             | 20:22 (JH1) | 07:06       |             | 19:02 (JH3) | 07:55       |             | 07:49    | 08:36 |       |          |  |  |
|    | 16:53   | 17:44 | 18:35 |          |             |       |       |  | 20:28 | 19:41 (JH3)   | 21:18       | 37    |     |  | 20:48 (JH1) | 21:59 | 14 | 20:40 (JH1) | 22:04 | 17 |    | 20:49 (JH1) | 21:25       | 35          | 20:57 (JH1) | 20:21       | 37          |             | 19:39 (JH3) | 19:12       | 17:10    | 16:37 |       |          |  |  |
| 8  | 08:50   | 08:14 | 07:18 |          |             |       |       |  | 07:07 | 19:08 (JH3)   | 06:06       |       |     |  | 20:11 (JH1) | 05:30 |    | 20:28 (JH1) | 05:37 |    |    | 20:30 (JH1) | 06:18       |             | 20:22 (JH1) | 07:08       |             | 19:01 (JH3) | 07:56       |             | 07:50    | 08:37 |       |          |  |  |
|    | 16:54   | 17:46 | 18:37 |          |             |       |       |  | 20:29 | 19:40 (JH3)   | 21:19       | 37    |     |  | 20:48 (JH1) | 22:00 | 12 | 20:40 (JH1) | 22:04 | 19 |    | 20:49 (JH1) | 21:24       | 32          | 20:54 (JH1) | 20:18       | 37          |             | 19:38 (JH3) | 19:10       | 17:08    | 16:37 |       |          |  |  |
| 9  | 08:50   | 08:13 | 07:16 |          |             |       |       |  | 07:05 | 19:10 (JH3)   | 06:05       |       |     |  | 20:11 (JH1) | 05:29 |    | 20:30 (JH1) | 05:38 |    |    | 20:30 (JH1) | 06:20       |             | 20:23 (JH1) | 07:09       |             | 19:00 (JH3) | 07:58       |             | 07:52    | 08:39 |       |          |  |  |
|    | 16:56   | 17:48 | 18:39 |          |             |       |       |  | 20:31 | 19:39 (JH3)   | 21:21       | 38    |     |  | 20:49 (JH1) | 22:01 | 9  | 20:39 (JH1) | 22:03 |    |    | 20:50 (JH1) | 21:22       | 30          | 20:53 (JH1) | 20:16       | 38          |             | 19:38 (JH3) | 19:07       | 17:06    | 16:37 |       |          |  |  |
| 10 | 08:49   | 08:11 | 07:13 |          |             |       |       |  | 07:03 | 19:11 (JH3)   | 06:03       |       |     |  | 20:10 (JH1) | 05:29 |    | 20:31 (JH1) | 05:39 |    |    | 20:29 (JH1) | 06:22       |             | 20:23 (JH1) | 07:11       |             | 18:59 (JH3) | 08:00       |             | 07:54    | 08:40 |       |          |  |  |
|    | 16:57   | 17:50 | 18:40 |          |             |       |       |  | 20:33 | 19:38 (JH3)   | 21:22       | 39    |     |  | 20:49 (JH1) | 22:02 | 6  | 20:37 (JH1) | 22:02 | 22 |    | 20:51 (JH1) | 21:20       | 28          | 20:54 (JH1) | 20:14       | 38          |             | 19:37 (JH3) | 19:05       | 17:05    | 16:36 |       |          |  |  |
| 11 | 08:49   | 08:09 | 07:11 |          |             |       |       |  | 07:01 | 19:12 (JH3)   | 06:01       |       |     |  | 20:11 (JH1) | 05:29 |    | 20:32 (JH1) | 05:40 |    |    | 20:28 (JH1) | 06:23       |             | 20:25 (JH1) | 07:13       |             | 18:59 (JH3) | 08:02       |             | 07:56    | 08:41 |       |          |  |  |
|    | 16:59   | 17:52 | 18:42 |          |             |       |       |  | 20:35 | 19:35 (JH3)   | 21:24       | 39    |     |  | 20:50 (JH1) | 22:02 |    | 22:01       |       |    | 24 |             | 20:52 (JH1) | 21:18       | 25          | 20:50 (JH1) | 20:12       | 38          |             | 19:37 (JH3) | 19:03    | 17:03 | 16:36 |          |  |  |
| 12 | 08:48   | 08:07 | 07:09 |          |             |       |       |  | 06:58 | 19:14 (JH3)   | 06:00       |       |     |  | 20:10 (JH1) | 05:28 |    | 20:33 (JH1) | 05:41 |    |    | 20:28 (JH1) | 06:25       |             | 20:25 (JH1) | 07:14       |             | 18:58 (JH3) | 08:03       |             | 07:57    | 08:42 |       |          |  |  |
|    | 17:00   | 17:54 | 18:44 |          |             |       |       |  | 20:36 | 19:33 (JH3)   | 21:26       | 40    |     |  | 20:50 (JH1) | 22:03 |    | 22:01       |       |    | 25 |             | 20:53 (JH1) | 21:16       | 23          | 20:48 (JH1) | 20:09       | 38          |             | 19:36 (JH3) | 19:01    | 17:02 | 16:36 |          |  |  |
| 13 | 08:47   | 08:05 | 07:07 |          |             |       |       |  | 06:56 | 19:16 (JH3)   | 05:58       |       |     |  | 20:10 (JH1) | 05:28 |    | 20:34 (JH1) | 05:42 |    |    | 20:27 (JH1) | 06:26       |             | 20:27 (JH1) | 07:16       |             | 18:59 (JH3) | 08:05       |             | 07:59    | 08:43 |       |          |  |  |
|    | 17:01   | 17:55 | 18:45 |          |             |       |       |  | 20:38 | 19:31 (JH3)   | 21:27       | 40    |     |  | 20:50 (JH1) | 22:04 |    | 22:00       |       |    | 26 |             | 20:53 (JH1) | 21:14       | 19          | 20:46 (JH1) | 20:07       | 37          |             | 19:36 (JH3) | 18:59    | 17:00 | 16:36 |          |  |  |
| 14 | 08:47   | 08:03 | 07:04 |          |             |       |       |  | 06:54 | 19:21 (JH3)   | 05:56       |       |     |  | 20:10 (JH1) | 05:28 |    | 20:35 (JH1) | 05:43 |    |    | 20:27 (JH1) | 06:28       |             | 20:28 (JH1) | 07:17       |             | 18:59 (JH3) | 08:07       |             | 08:01    | 08:44 |       |          |  |  |
|    | 17:03   | 17:57 | 18:47 |          |             |       |       |  | 20:40 | 4 19:25 (JH3) | 21:29       | 40    |     |  | 20:50 (JH1) | 22:04 |    | 21:59       |       |    | 27 |             | 20:54 (JH1) | 21:12       | 16          | 20:44 (JH1) | 20:05       | 37          |             | 19:36 (JH3) | 18:56    | 16:59 | 16:36 |          |  |  |
| 15 | 08:46   | 08:02 | 07:02 |          |             |       |       |  | 06:52 |               | 05:55       |       |     |  | 20:10 (JH1) | 05:28 |    | 20:36 (JH1) | 05:45 |    |    | 20:26 (JH1) | 06:29       |             | 20:32 (JH1) | 07:19       |             | 18:59 (JH3) | 08:08       |             | 08:03    | 08:45 |       |          |  |  |
|    | 17:05   | 17:59 | 18:49 |          |             |       |       |  | 20:41 |               | 21:30       | 40    |     |  | 20:50 (JH1) | 22:05 |    | 21:58       |       |    | 29 |             | 20:55 (JH1) | 21:10       |             | 20:43 (JH1) | 20:02       | 35          |             | 19:34 (JH3) | 18:54    | 16:57 | 16:36 |          |  |  |
| 16 | 08:45   | 08:00 | 07:00 |          |             |       |       |  | 06:50 |               | 05:53       |       |     |  | 20:10 (JH1) | 05:27 |    | 20:37 (JH1) | 05:46 |    |    | 20:25 (JH1) | 06:31       |             | 20:25 (JH1) | 07:21       |             | 18:59 (JH3) | 08:10       |             | 08:04    | 08:46 |       |          |  |  |
|    | 17:06   | 18:01 | 18:51 |          |             |       |       |  | 20:43 |               | 21:32       | 39    |     |  | 20:49 (JH1) | 22:05 |    | 21:57       |       |    | 30 |             | 20:55 (JH1) | 21:08       |             | 20:00       |             | 34          |             | 19:33 (JH3) | 18:52    | 16:56 | 16:36 |          |  |  |
| 17 | 08:44   | 07:58 | 06:57 |          |             |       |       |  | 06:48 |               | 05:52       |       |     |  | 20:10 (JH1) | 05:27 |    | 20:38 (JH1) | 05:47 |    |    | 20:25 (JH1) | 06:33       |             | 07:22       |             | 18:59 (JH3) | 08:12       |             | 08:06       | 08:46    |       |       |          |  |  |
|    | 17:08   | 18:03 | 18:52 |          |             |       |       |  | 20:45 |               | 21:33       | 39    |     |  | 20:49 (JH1) | 22:06 |    | 21:56       |       |    | 32 |             | 20:57 (JH1) | 21:06       |             | 19:58       |             | 32          |             | 19:31 (JH3) | 18:50    | 16:55 | 16:37 |          |  |  |
| 18 | 08:43   | 07:56 | 06:55 |          |             |       |       |  | 06:45 |               | 05:51       |       |     |  | 20:11 (JH1) | 05:27 |    | 20:39 (JH1) | 05:48 |    |    | 20:25 (JH1) | 06:34       |             | 07:24       |             | 19:00 (JH3) | 08:13       |             | 08:08       | 08:47    |       |       |          |  |  |
|    | 17:09   | 18:05 | 18:54 |          |             |       |       |  | 20:46 |               | 21:35       | 39    |     |  | 20:50 (JH1) | 22:06 |    | 21:55       |       |    | 32 |             | 20:57 (JH1) | 21:04       |             | 19:55       |             | 29          |             | 19:29 (JH3) | 18:48    | 16:53 | 16:37 |          |  |  |
| 19 | 08:42   | 07:54 | 06:53 |          |             |       |       |  | 06:43 |               | 05:49       |       |     |  | 20:12 (JH1) | 05:27 |    | 20:40 (JH1) | 05:49 |    |    | 20:24 (JH1) | 06:36       |             | 07:25       |             | 19:00 (JH3) | 08:15       |             | 08:09       | 08:48    |       |       |          |  |  |
|    | 17:11   | 18:06 | 18:56 |          |             |       |       |  | 20:48 |               | 21:36       | 38    |     |  | 20:50 (JH1) | 22:07 |    | 21:54       |       |    | 34 |             | 20:58 (JH1) | 21:02       |             | 19:53       |             | 26          |             | 19:26 (JH3) | 18:46    | 16:52 | 16:37 |          |  |  |
| 20 | 08:41   | 07:52 | 06:51 |          |             |       |       |  | 06:41 |               | 05:48       |       |     |  | 20:11 (JH1) | 05:27 |    | 20:35 (JH1) | 05:51 |    |    | 20:23 (JH1) | 06:37       |             | 07:27       |             | 19:02 (JH3) | 08:17       |             | 08:11       | 08:48    |       |       |          |  |  |
|    | 17:13   | 18:08 | 18:57 |          |             |       |       |  | 20:50 |               | 21:38       | 38    |     |  | 20:49 (JH1) | 22:07 |    | 21:53       |       |    | 35 |             | 20:58 (JH1) | 21:00       |             | 19:51       |             | 22          |             | 19:24 (JH3) | 18:44    | 16:51 | 16:37 |          |  |  |
| 21 | 08:40   | 07:50 | 06:48 |          |             |       |       |  | 06:48 |               | 05:46       |       |     |  | 20:12 (JH1) | 05:28 |    | 20:36 (JH1) | 05:47 |    |    | 20:25 (JH1) | 06:39       |             | 07:29       |             | 19:04 (JH3) | 08:19       |             | 08:13       | 08:49    |       |       |          |  |  |
|    | 17:14   | 18:10 | 18:59 | 11       | 18:23 (JH3) | 06:51 |       |  | 21:39 | 37            | 20:49 (JH1) | 22:07 |     |  | 20:35 (JH1) | 05:28 |    | 21:51       |       |    | 35 |             | 20:58 (JH1) | 20:58       |             | 19:49       | 18          | 19:22 (JH3) | 18:42       | 16:50       | 16:38    |       |       |          |  |  |
| 22 | 08:39   | 07:57 | 06:46 |          |             |       |       |  | 06:46 |               | 05:47       |       |     |  | 20:13 (JH1) | 05:28 |    | 20:37 (JH1) | 05:49 |    |    | 20:26 (JH1) | 06:41       |             | 07:30       |             | 19:06 (JH3) | 08:20       |             | 08:14       | 08:50    |       |       |          |  |  |
|    | 17:16   | 18:12 | 19:01 | 17       | 18:16 (JH3) | 06:53 |       |  | 21:40 | 36            | 20:49 (JH1) | 22:07 |     |  | 20:36 (JH1) | 05:29 |    | 21:50       |       |    | 36 |             | 20:59 (JH1) | 20:56       |             | 19:46       | 13          | 19:19 (JH3) | 18:40       | 16:48       | 16:38    |       |       |          |  |  |
| 23 | 08:38   | 07:46 | 06:44 |          |             |       |       |  | 06:44 |               | 05:44       |       |     |  | 20:13 (JH1) | 05:28 |    | 20:35 (JH1) | 05:48 |    |    | 20:22 (JH1) | 06:42       |             | 07:32       |             |             |             | 18:22       | 16:06       | 16:50    |       |       |          |  |  |
|    | 17:18   | 18:14 | 19:03 | 21       | 18:17 (JH3) | 06:55 |       |  | 21:42 | 35            | 20:48 (JH1) | 22:07 |     |  | 20:34 (JH1) |       |    |             |       |    |    |             |             |             |             |             |             |             |             |             |          |       |       |          |  |  |

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 3 - Jacobaweg 1 (BW)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|    | January | February | March |  | April |    | May         |       | June | July        |       | August |  | September |             | October     | November    | December |             |       |       |       |
|----|---------|----------|-------|--|-------|----|-------------|-------|------|-------------|-------|--------|--|-----------|-------------|-------------|-------------|----------|-------------|-------|-------|-------|
| 1  | 08:52   | 08:26    | 07:33 |  | 07:23 |    | 19:06 (JH3) | 06:19 |      | 18:52 (JH3) | 05:35 | 05:32  |  | 06:08     | 19:16 (JH3) | 06:57       | 18:50 (JH3) | 07:45    | 07:38       | 08:28 |       |       |
|    | 16:46   | 17:34    | 18:24 |  | 20:18 | 35 | 19:41 (JH3) | 21:08 | 59   | 19:51 (JH3) | 21:53 | 22:07  |  | 21:36     | 35          | 19:15 (JH3) | 20:34       | 62       | 19:52 (JH3) | 19:26 | 17:20 | 16:40 |
| 2  | 08:52   | 08:24    | 07:31 |  | 07:21 |    | 19:03 (JH3) | 06:17 |      | 18:53 (JH3) | 05:34 | 05:32  |  | 06:09     |             | 19:13 (JH3) | 06:58       |          | 18:50 (JH3) | 07:47 | 07:40 | 08:30 |
|    | 16:47   | 17:35    | 18:26 |  | 20:19 | 39 | 19:42 (JH3) | 21:10 | 57   | 19:50 (JH3) | 21:54 | 22:07  |  | 21:34     | 38          | 19:53 (JH3) | 20:32       | 62       | 19:52 (JH3) | 19:23 | 17:18 | 16:40 |
| 3  | 08:52   | 08:23    | 07:29 |  | 07:19 |    | 19:01 (JH3) | 06:15 |      | 18:55 (JH3) | 05:33 | 05:33  |  | 06:11     |             | 19:13 (JH3) | 07:00       |          | 18:51 (JH3) | 07:48 | 07:42 | 08:31 |
|    | 16:48   | 17:37    | 18:28 |  | 20:21 | 43 | 19:44 (JH3) | 21:11 | 55   | 19:50 (JH3) | 21:55 | 22:06  |  | 21:32     | 41          | 19:54 (JH3) | 20:30       | 60       | 19:51 (JH3) | 19:21 | 17:17 | 16:39 |
| 4  | 08:52   | 08:21    | 07:27 |  | 07:16 |    | 19:00 (JH3) | 06:13 |      | 18:56 (JH3) | 05:32 | 05:34  |  | 06:12     |             | 19:11 (JH3) | 07:01       |          | 18:51 (JH3) | 07:50 | 07:43 | 08:32 |
|    | 16:50   | 17:39    | 18:30 |  | 20:23 | 46 | 19:46 (JH3) | 21:13 | 53   | 19:49 (JH3) | 21:56 | 22:06  |  | 21:31     | 43          | 19:54 (JH3) | 20:28       | 58       | 19:49 (JH3) | 19:19 | 17:15 | 16:39 |
| 5  | 08:51   | 08:19    | 07:24 |  | 07:14 |    | 18:58 (JH3) | 06:12 |      | 18:58 (JH3) | 05:35 | 05:34  |  | 06:14     |             | 19:11 (JH3) | 07:03       |          | 18:52 (JH3) | 07:52 | 07:45 | 08:34 |
|    | 16:51   | 17:41    | 18:32 |  | 20:24 | 50 | 19:48 (JH3) | 21:14 | 51   | 19:48 (JH3) | 21:57 | 22:05  |  | 21:29     | 45          | 19:56 (JH3) | 20:25       | 55       | 19:47 (JH3) | 19:16 | 17:13 | 16:38 |
| 6  | 08:51   | 08:18    | 07:22 |  | 07:12 |    | 18:56 (JH3) | 06:10 |      | 18:59 (JH3) | 05:31 | 05:35  |  | 06:15     |             | 19:09 (JH3) | 07:05       |          | 18:52 (JH3) | 07:53 | 07:47 | 08:35 |
|    | 16:52   | 17:43    | 18:33 |  | 20:26 | 53 | 19:49 (JH3) | 21:16 | 49   | 19:48 (JH3) | 21:58 | 22:05  |  | 21:27     | 47          | 19:56 (JH3) | 20:23       | 53       | 19:45 (JH3) | 19:14 | 17:11 | 16:38 |
| 7  | 08:51   | 08:16    | 07:20 |  | 07:10 |    | 18:55 (JH3) | 06:08 |      | 19:00 (JH3) | 05:30 | 05:36  |  | 06:17     |             | 19:08 (JH3) | 07:06       |          | 18:53 (JH3) | 07:55 | 07:49 | 08:36 |
|    | 16:53   | 17:44    | 18:35 |  | 20:28 | 55 | 19:50 (JH3) | 21:18 | 46   | 19:46 (JH3) | 21:59 | 22:04  |  | 21:25     | 49          | 19:57 (JH3) | 20:21       | 50       | 19:43 (JH3) | 19:12 | 17:10 | 16:37 |
| 8  | 08:50   | 08:14    | 07:18 |  | 07:07 |    | 18:54 (JH3) | 06:06 |      | 19:01 (JH3) | 05:30 | 05:37  |  | 06:18     |             | 19:06 (JH3) | 07:08       |          | 18:54 (JH3) | 07:57 | 07:50 | 08:37 |
|    | 16:54   | 17:46    | 18:37 |  | 20:29 | 58 | 19:52 (JH3) | 21:19 | 44   | 19:45 (JH3) | 22:00 | 22:04  |  | 21:24     | 52          | 19:58 (JH3) | 20:18       | 46       | 19:40 (JH3) | 19:10 | 17:08 | 16:37 |
| 9  | 08:50   | 08:13    | 07:16 |  | 07:05 |    | 18:53 (JH3) | 06:05 |      | 19:03 (JH3) | 05:29 | 05:38  |  | 06:20     |             | 19:05 (JH3) | 07:09       |          | 18:55 (JH3) | 07:58 | 07:52 | 08:39 |
|    | 16:56   | 17:48    | 18:39 |  | 20:31 | 60 | 19:53 (JH3) | 21:21 | 41   | 19:44 (JH3) | 22:01 | 22:03  |  | 21:22     | 54          | 19:59 (JH3) | 20:16       | 44       | 19:39 (JH3) | 19:07 | 17:06 | 16:37 |
| 10 | 08:49   | 08:11    | 07:13 |  | 07:03 |    | 18:53 (JH3) | 06:03 |      | 19:03 (JH3) | 05:29 | 05:39  |  | 06:22     |             | 19:03 (JH3) | 07:11       |          | 18:56 (JH3) | 08:00 | 07:54 | 08:40 |
|    | 16:57   | 17:50    | 18:40 |  | 20:33 | 61 | 19:54 (JH3) | 21:23 | 40   | 19:43 (JH3) | 22:02 | 22:02  |  | 21:20     | 56          | 19:59 (JH3) | 20:14       | 40       | 19:36 (JH3) | 19:05 | 17:05 | 16:36 |
| 11 | 08:49   | 08:09    | 07:11 |  | 07:01 |    | 18:51 (JH3) | 06:01 |      | 19:05 (JH3) | 05:29 | 05:40  |  | 06:23     |             | 19:02 (JH3) | 07:13       |          | 18:58 (JH3) | 08:02 | 07:56 | 08:41 |
|    | 16:59   | 17:52    | 18:42 |  | 20:35 | 62 | 19:53 (JH3) | 21:24 | 37   | 19:42 (JH3) | 22:02 | 22:01  |  | 21:18     | 58          | 20:00 (JH3) | 20:12       | 36       | 19:34 (JH3) | 19:03 | 17:03 | 16:36 |
| 12 | 08:48   | 08:07    | 07:09 |  | 06:58 |    | 18:50 (JH3) | 06:00 |      | 19:06 (JH3) | 05:28 | 05:41  |  | 06:25     |             | 19:01 (JH3) | 07:14       |          | 18:59 (JH3) | 08:03 | 07:57 | 08:42 |
|    | 17:00   | 17:54    | 18:44 |  | 20:36 | 64 | 19:54 (JH3) | 21:26 | 34   | 19:40 (JH3) | 22:03 | 22:01  |  | 21:16     | 59          | 20:00 (JH3) | 20:09       | 32       | 19:31 (JH3) | 19:01 | 17:02 | 16:36 |
| 13 | 08:47   | 08:05    | 07:07 |  | 06:56 |    | 18:50 (JH3) | 05:58 |      | 19:08 (JH3) | 05:28 | 05:42  |  | 06:26     |             | 19:00 (JH3) | 07:16       |          | 19:02 (JH3) | 08:05 | 07:59 | 08:43 |
|    | 17:02   | 17:56    | 18:45 |  | 20:38 | 65 | 19:55 (JH3) | 21:27 | 31   | 19:39 (JH3) | 22:04 | 22:00  |  | 21:14     | 60          | 20:00 (JH3) | 20:07       | 26       | 19:28 (JH3) | 18:59 | 17:00 | 16:36 |
| 14 | 08:47   | 08:04    | 07:04 |  | 06:54 |    | 18:49 (JH3) | 05:56 |      | 19:10 (JH3) | 05:28 | 05:43  |  | 06:28     |             | 18:59 (JH3) | 07:17       |          | 19:06 (JH3) | 08:07 | 08:01 | 08:44 |
|    | 17:03   | 17:57    | 18:47 |  | 20:40 | 66 | 19:55 (JH3) | 21:29 | 27   | 19:37 (JH3) | 22:04 | 21:59  |  | 21:12     | 61          | 20:00 (JH3) | 20:05       | 18       | 19:24 (JH3) | 18:56 | 16:59 | 16:36 |
| 15 | 08:46   | 08:02    | 07:02 |  | 06:52 |    | 18:49 (JH3) | 05:55 |      | 19:12 (JH3) | 05:28 | 05:45  |  | 06:29     |             | 18:58 (JH3) | 07:19       |          | 18:08       | 08:03 | 08:45 |       |
|    | 17:05   | 17:59    | 18:49 |  | 20:41 | 67 | 19:56 (JH3) | 21:30 | 23   | 19:35 (JH3) | 22:05 | 21:58  |  | 21:10     | 63          | 20:01 (JH3) | 20:02       |          | 18:54       | 16:57 | 16:36 |       |
| 16 | 08:45   | 08:00    | 07:00 |  | 06:50 |    | 18:49 (JH3) | 05:53 |      | 19:14 (JH3) | 05:27 | 05:46  |  | 06:31     |             | 18:57 (JH3) | 07:21       |          | 08:10       | 08:04 | 08:46 |       |
|    | 17:06   | 18:01    | 18:51 |  | 20:43 | 67 | 19:56 (JH3) | 21:32 | 18   | 19:32 (JH3) | 22:05 | 21:57  |  | 21:08     | 63          | 20:00 (JH3) | 20:00       |          | 18:52       | 16:56 | 16:36 |       |
| 17 | 08:44   | 07:58    | 06:57 |  | 06:48 |    | 18:49 (JH3) | 05:52 |      | 19:19 (JH3) | 05:27 | 05:47  |  | 06:33     |             | 18:56 (JH3) | 07:22       |          | 08:12       | 08:06 | 08:46 |       |
|    | 17:08   | 18:03    | 18:52 |  | 20:45 | 67 | 19:56 (JH3) | 21:33 | 9    | 19:28 (JH3) | 22:06 | 21:56  |  | 21:06     | 65          | 20:01 (JH3) | 19:58       |          | 18:50       | 16:55 | 16:37 |       |
| 18 | 08:43   | 07:56    | 06:55 |  | 06:45 |    | 18:49 (JH3) | 05:51 |      | 19:22 (JH3) | 05:27 | 05:48  |  | 06:34     |             | 18:55 (JH3) | 07:24       |          | 08:13       | 08:08 | 08:47 |       |
|    | 17:09   | 18:05    | 18:54 |  | 20:46 | 67 | 19:56 (JH3) | 21:35 |      | 19:26 (JH3) | 21:55 | 21:55  |  | 21:04     | 66          | 20:01 (JH3) | 20:00       |          | 18:48       | 16:53 | 16:37 |       |
| 19 | 08:42   | 07:54    | 06:53 |  | 06:43 |    | 18:48 (JH3) | 05:49 |      | 19:27 (JH3) | 05:27 | 05:49  |  | 06:36     |             | 18:55 (JH3) | 07:25       |          | 08:15       | 08:09 | 08:48 |       |
|    | 17:11   | 18:06    | 18:56 |  | 20:48 | 67 | 19:55 (JH3) | 21:36 |      | 19:29 (JH3) | 21:54 | 21:54  |  | 21:02     | 66          | 20:01 (JH3) | 19:53       |          | 18:46       | 16:52 | 16:37 |       |
| 20 | 08:41   | 07:52    | 06:51 |  | 06:41 |    | 18:48 (JH3) | 05:48 |      | 19:30 (JH3) | 05:27 | 05:51  |  | 06:37     |             | 18:54 (JH3) | 07:27       |          | 08:17       | 08:11 | 08:48 |       |
|    | 17:13   | 18:08    | 18:57 |  | 20:50 | 67 | 19:55 (JH3) | 21:38 |      | 19:32 (JH3) | 21:53 | 21:53  |  | 21:00     | 66          | 20:00 (JH3) | 19:51       |          | 18:44       | 16:51 | 16:37 |       |
| 21 | 08:40   | 07:50    | 06:48 |  | 06:39 |    | 18:48 (JH3) | 05:46 |      | 19:33 (JH3) | 05:28 | 05:52  |  | 06:39     |             | 18:53 (JH3) | 07:29       |          | 08:19       | 08:13 | 08:49 |       |
|    | 17:14   | 18:10    | 18:59 |  | 20:51 | 67 | 19:55 (JH3) | 21:39 |      | 19:34 (JH3) | 21:54 | 21:54  |  | 20:58     | 68          | 20:01 (JH3) | 19:49       |          | 18:42       | 16:50 | 16:38 |       |
| 22 | 08:39   | 07:48    | 06:46 |  | 06:37 |    | 18:48 (JH3) | 05:45 |      | 19:35 (JH3) | 05:28 | 05:53  |  | 06:41     |             | 18:52 (JH3) | 07:30       |          | 08:20       | 08:14 | 08:50 |       |
|    | 17:16   | 18:12    | 19:01 |  | 20:53 | 67 | 19:55 (JH3) | 21:40 |      | 19:36 (JH3) | 21:55 | 21:55  |  | 20:56     | 68          | 20:00 (JH3) | 19:46       |          | 18:40       | 16:48 | 16:38 |       |
| 23 | 08:38   | 07:46    | 06:44 |  | 06:35 |    | 18:48 (JH3) | 05:44 |      | 19:37 (JH3) | 05:28 | 05:55  |  | 06:42     |             | 18:52 (JH3) | 07:32       |          | 08:22       | 08:16 | 08:50 |       |
|    | 17:18   | 18:14    | 19:03 |  | 20:55 | 67 | 19:55 (JH3) | 21:42 |      | 19:38 (JH3) | 21:57 | 21:57  |  | 20:54     | 68          | 20:00 (JH3) | 19:44       |          | 18:38       | 16:47 | 16:39 |       |
| 24 | 08:37   | 07:44    | 06:41 |  | 06:33 |    | 18:48 (JH3) | 05:43 |      | 19:39 (JH3) | 05:28 | 05:56  |  | 06:44     |             | 18:51 (JH3) | 07:34       |          | 08:24       | 08:18 | 08:51 |       |
|    | 17:19   | 18:16    | 19:04 |  | 20:56 | 66 | 19:54 (JH3) | 21:43 |      | 19:40 (JH3) | 21:58 | 21:58  |  | 20:52     | 68          | 19:59 (JH3) | 19:42       |          | 18:36       | 16:46 | 16:39 |       |
| 25 | 08:36   | 07:42    | 06:39 |  | 06:31 |    | 18:48 (JH3) | 05:42 |      | 19:41 (JH3) | 05:27 | 05:57  |  | 06:45     |             | 18:51 (JH3) | 07:35       |          | 08:26       | 08:19 | 08:51 |       |
|    | 17:21   | 18:17    | 19:06 |  | 20:58 | 66 | 19:54 (JH3) | 21:45 |      | 19:42 (JH3) | 21:59 | 21:59  |  | 20:50     | 68          | 19:59 (JH3) | 19:39       |          | 17:34       | 16:45 | 16:40 |       |
| 26 | 08:34   | 07:39    | 06:37 |  | 06:29 |    | 18:50 (JH3) | 05:40 |      | 19:43 (JH3) | 05:29 | 05:59  |  | 06:47     |             | 18:51 (JH3) | 07:37       |          | 08:27       | 08:21 | 08:51 |       |
|    | 17:23   | 18:19    | 19:08 |  | 21:00 | 64 | 19:54 (JH3) | 21:46 |      | 19:44 (JH3) | 21:58 | 21:58  |  | 20:47     | 67          | 19:59 (JH3) | 20:00       |          | 17:32       | 16:44 | 16:41 |       |
| 27 | 08:33   | 07:37    | 06:35 |  | 06:27 |    | 18:50 (JH3) | 05:39 |      | 19:45 (JH3) | 05:29 | 06:00  |  | 06:49     |             | 18:51 (JH3) | 07:38       |          | 08:29       | 08:22 | 08:52 |       |
|    | 17:25   | 18:21    | 19:09 |  | 21:01 | 64 | 19:54 (JH3) | 21:47 |      | 19:46 (JH3) | 21:59 | 21:59  |  | 20:45     | 67          | 19:58 (JH3) | 19:35       |          | 17:30       | 16:44 | 16:41 |       |
| 28 | 08:32   | 07:35    | 06:32 |  | 06:25 |    | 18:51 (JH3) | 05:38 |      | 19:47 (JH3) | 05:30 | 06:02  |  | 06:50     |             | 18:50 (JH3) | 07:40       |          | 08:31       | 08:24 | 08:52 |       |
|    | 17:26   | 18:23    | 19:11 |  | 21:03 | 62 | 19:53 (JH3) | 21:48 |      | 19:48 (JH3) | 21:59 | 21:59  |  | 20:43     | 66          | 19:56 (JH3) | 19:32       |          | 17:28       | 16:43 | 16:42 |       |
| 29 | 08:30   |          | 07:30 |  | 06:23 |    | 18:51 (JH3) | 05:37 |      | 19:49 (JH3) | 05:30 | 06:03  |  | 06:52     |             | 18:50 (JH3) | 07:42       |          | 08:1        |       |       |       |

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 4 - Rippolderseweg 1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|                     | January        | February       | March          | April          | May            | June           | July                       | August         | September         | October        | November          | December       |                |                |                |
|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------------------|----------------|-------------------|----------------|-------------------|----------------|----------------|----------------|----------------|
| 1                   | 08:52<br>16:46 | 08:26<br>17:33 | 07:33<br>18:24 | 07:23<br>20:18 | 06:19<br>21:08 | 05:35<br>21:53 | 20:36 (JH3)<br>21:00 (JH3) | 05:32<br>22:07 | 10<br>20:49 (JH3) | 06:08<br>21:36 | 25<br>20:41 (JH3) | 06:57<br>20:34 | 07:45<br>19:25 | 07:38<br>17:20 | 08:28<br>16:40 |
| 2                   | 08:52<br>16:47 | 08:24<br>17:35 | 07:31<br>18:26 | 07:21<br>20:19 | 06:17<br>21:10 | 05:34<br>21:54 | 20:37 (JH3)<br>20:59 (JH3) | 05:32<br>22:07 | 11<br>21:00 (JH3) | 06:09<br>21:34 | 23<br>21:02 (JH3) | 06:58<br>20:32 | 07:47<br>19:23 | 07:40<br>17:18 | 08:30<br>16:40 |
| 3                   | 08:52<br>16:48 | 08:23<br>17:37 | 07:29<br>18:28 | 07:19<br>20:21 | 06:15<br>21:11 | 05:33<br>21:55 | 20:38 (JH3)<br>20:58 (JH3) | 05:33<br>22:06 | 12<br>21:00 (JH3) | 06:11<br>21:32 | 21<br>21:03 (JH3) | 07:00<br>20:30 | 07:48<br>19:21 | 07:41<br>17:16 | 08:31<br>16:39 |
| 4                   | 08:52<br>16:50 | 08:21<br>17:39 | 07:27<br>18:30 | 07:16<br>20:23 | 06:13<br>21:13 | 05:32<br>21:56 | 20:39 (JH3)<br>20:58 (JH3) | 05:32<br>22:06 | 14<br>21:02 (JH3) | 06:12<br>21:31 | 21<br>21:01 (JH3) | 07:01<br>20:28 | 07:50<br>19:19 | 07:43<br>17:15 | 08:32<br>16:39 |
| 5                   | 08:51<br>16:51 | 08:19<br>17:41 | 07:24<br>18:32 | 07:14<br>20:24 | 06:12<br>21:14 | 05:32<br>21:54 | 20:39 (JH3)<br>20:58 (JH3) | 05:35<br>22:05 | 16<br>21:03 (JH3) | 06:14<br>21:29 | 17<br>21:00 (JH3) | 07:03<br>20:25 | 07:51<br>19:16 | 07:45<br>17:13 | 08:34<br>16:38 |
| 6                   | 08:51<br>16:52 | 08:18<br>17:43 | 07:22<br>18:33 | 07:12<br>20:26 | 06:10<br>21:16 | 05:31<br>21:58 | 20:36 (JH3)<br>20:58 (JH3) | 05:35<br>22:05 | 17<br>21:04 (JH3) | 06:15<br>21:27 | 14<br>20:58 (JH3) | 07:05<br>20:23 | 07:53<br>19:14 | 07:47<br>17:11 | 08:35<br>16:38 |
| 7                   | 08:51<br>16:53 | 08:16<br>17:44 | 07:20<br>18:35 | 07:10<br>20:28 | 06:08<br>21:18 | 05:30<br>21:59 | 20:34 (JH3)<br>20:49 (JH3) | 05:36<br>22:04 | 17<br>21:05 (JH3) | 06:17<br>21:25 | 14<br>20:56 (JH3) | 07:06<br>20:21 | 07:55<br>19:12 | 07:49<br>17:10 | 08:36<br>16:37 |
| 8                   | 08:50<br>16:54 | 08:14<br>17:46 | 07:18<br>18:37 | 07:07<br>20:29 | 06:06<br>21:19 | 05:30<br>22:00 | 20:33 (JH3)<br>20:50 (JH3) | 05:37<br>22:04 | 18<br>21:05 (JH3) | 06:18<br>21:24 | 11<br>20:57 (JH3) | 07:08<br>20:18 | 07:56<br>19:10 | 07:50<br>17:08 | 08:37<br>16:39 |
| 9                   | 08:50<br>16:56 | 08:13<br>17:48 | 07:15<br>18:39 | 07:05<br>20:31 | 06:05<br>21:21 | 05:29<br>22:01 | 20:32 (JH3)<br>20:52 (JH3) | 05:29<br>22:03 | 20<br>21:05 (JH3) | 06:20<br>21:22 | 7<br>20:50 (JH3)  | 07:09<br>20:16 | 07:58<br>19:07 | 07:52<br>17:06 | 08:39<br>16:37 |
| 10                  | 08:49<br>16:57 | 08:11<br>17:50 | 07:13<br>18:40 | 07:03<br>20:33 | 06:03<br>21:22 | 05:29<br>22:02 | 20:31 (JH3)<br>20:53 (JH3) | 05:29<br>22:02 | 21<br>21:06 (JH3) | 06:22<br>21:20 | 3<br>20:53 (JH3)  | 07:11<br>20:14 | 08:00<br>19:05 | 07:54<br>17:05 | 08:40<br>16:36 |
| 11                  | 08:49<br>16:59 | 08:09<br>17:52 | 07:11<br>18:42 | 07:01<br>20:34 | 06:01<br>21:24 | 05:29<br>22:02 | 20:31 (JH3)<br>20:55 (JH3) | 05:29<br>22:02 | 21<br>21:04 (JH3) | 06:23<br>21:18 |                   | 07:13<br>20:12 | 08:02<br>19:03 | 07:56<br>17:03 | 08:41<br>16:36 |
| 12                  | 08:48<br>17:08 | 08:07<br>17:54 | 07:09<br>18:44 | 06:58<br>20:36 | 06:00<br>21:26 | 05:28<br>22:04 | 20:30 (JH3)<br>20:56 (JH3) | 05:28<br>22:01 | 23<br>21:07 (JH3) | 06:25<br>21:16 |                   | 07:14<br>20:13 | 08:03<br>19:01 | 07:57<br>17:04 | 08:42<br>16:38 |
| 13                  | 08:47<br>17:01 | 08:05<br>17:55 | 07:07<br>18:47 | 06:56<br>20:38 | 05:56<br>21:27 | 05:28<br>22:04 | 20:30 (JH3)<br>20:58 (JH3) | 05:28<br>22:00 | 9<br>21:04 (JH3)  | 06:26<br>21:14 |                   | 07:16<br>20:07 | 08:05<br>18:59 | 07:59<br>17:00 | 08:43<br>16:36 |
| 14                  | 08:47<br>17:03 | 08:03<br>17:57 | 07:04<br>18:47 | 06:54<br>20:40 | 05:56<br>21:29 | 05:28<br>22:04 | 20:29 (JH3)<br>20:59 (JH3) | 05:28<br>22:04 | 26<br>21:08 (JH3) | 06:28<br>21:12 |                   | 07:17<br>20:05 | 08:07<br>18:56 | 08:01<br>16:59 | 08:44<br>16:36 |
| 15                  | 08:46<br>17:05 | 08:02<br>17:59 | 07:02<br>18:49 | 06:52<br>20:41 | 05:55<br>21:30 | 05:28<br>22:05 | 20:29 (JH3)<br>21:00 (JH3) | 05:28<br>22:05 | 27<br>21:09 (JH3) | 06:29<br>21:10 |                   | 07:19<br>20:12 | 08:08<br>18:54 | 08:03<br>16:57 | 08:45<br>16:36 |
| 16                  | 08:45<br>17:06 | 08:00<br>18:01 | 07:00<br>18:51 | 06:50<br>20:43 | 05:53<br>21:32 | 05:27<br>22:05 | 20:29 (JH3)<br>21:01 (JH3) | 05:27<br>22:05 | 28<br>21:10 (JH3) | 06:31<br>21:08 |                   | 07:21<br>20:00 | 08:10<br>18:52 | 08:04<br>16:56 | 08:46<br>16:36 |
| 17                  | 08:44<br>17:08 | 07:58<br>18:03 | 06:57<br>18:52 | 06:48<br>20:45 | 05:52<br>21:33 | 05:27<br>22:06 | 20:29 (JH3)<br>21:02 (JH3) | 05:27<br>22:06 | 29<br>21:11 (JH3) | 06:33<br>21:06 |                   | 07:22<br>19:58 | 08:12<br>18:50 | 08:06<br>16:55 | 08:46<br>16:37 |
| 18                  | 08:43<br>17:09 | 07:56<br>18:05 | 06:55<br>18:54 | 06:45<br>20:46 | 05:51<br>21:35 | 05:27<br>22:06 | 20:29 (JH3)<br>21:02 (JH3) | 05:27<br>22:06 | 30<br>21:11 (JH3) | 06:34<br>21:04 |                   | 07:24<br>19:55 | 08:13<br>18:48 | 08:08<br>16:53 | 08:47<br>16:37 |
| 19                  | 08:43<br>17:11 | 07:55<br>18:06 | 06:54<br>18:56 | 06:43<br>20:48 | 05:49<br>21:36 | 05:26<br>22:07 | 20:30 (JH3)<br>21:02 (JH3) | 05:26<br>22:07 | 31<br>21:12 (JH3) | 06:36<br>21:02 |                   | 07:25<br>19:53 | 08:15<br>18:46 | 08:09<br>16:52 | 08:48<br>16:37 |
| 20                  | 08:41<br>17:13 | 07:52<br>18:08 | 06:51<br>18:57 | 06:41<br>20:50 | 05:48<br>21:38 | 05:27<br>22:07 | 20:29 (JH3)<br>21:02 (JH3) | 05:27<br>22:07 | 31<br>21:11 (JH3) | 06:37<br>21:00 |                   | 07:27<br>19:51 | 08:17<br>18:44 | 08:11<br>16:51 | 08:48<br>16:37 |
| 21                  | 08:40<br>17:14 | 07:50<br>18:10 | 06:48<br>18:59 | 06:39<br>20:51 | 05:46<br>21:39 | 05:28<br>22:07 | 20:30 (JH3)<br>21:02 (JH3) | 05:28<br>22:07 | 31<br>21:11 (JH3) | 06:39<br>20:58 |                   | 07:29<br>19:49 | 08:19<br>18:42 | 08:13<br>16:50 | 08:49<br>16:38 |
| 22                  | 08:39<br>17:17 | 07:48<br>18:12 | 06:46<br>19:01 | 06:37<br>20:53 | 05:45<br>21:40 | 05:28<br>22:07 | 20:30 (JH3)<br>21:02 (JH3) | 05:28<br>22:07 | 31<br>21:12 (JH3) | 06:41<br>20:56 |                   | 07:30<br>19:46 | 08:20<br>18:40 | 08:14<br>16:48 | 08:50<br>16:38 |
| 23                  | 08:38<br>17:18 | 07:46<br>18:14 | 06:44<br>19:03 | 06:35<br>20:55 | 05:44<br>21:42 | 05:28<br>22:07 | 20:30 (JH3)<br>21:02 (JH3) | 05:28<br>22:07 | 32<br>21:12 (JH3) | 06:42<br>20:54 |                   | 07:32<br>19:44 | 08:22<br>18:38 | 08:16<br>16:47 | 08:50<br>16:39 |
| 24                  | 08:37<br>17:19 | 07:44<br>18:16 | 06:41<br>19:04 | 06:33<br>20:56 | 05:43<br>21:43 | 05:28<br>22:08 | 20:31 (JH3)<br>21:02 (JH3) | 05:28<br>22:08 | 32<br>21:12 (JH3) | 06:44<br>20:52 |                   | 07:33<br>19:42 | 08:24<br>18:35 | 08:18<br>16:46 | 08:51<br>16:39 |
| 25                  | 08:35<br>17:21 | 07:42<br>18:17 | 06:39<br>19:06 | 06:31<br>20:58 | 05:41<br>21:44 | 05:29<br>22:08 | 20:31 (JH3)<br>21:02 (JH3) | 05:29<br>22:08 | 33<br>21:13 (JH3) | 06:45<br>20:50 |                   | 07:35<br>19:39 | 07:26<br>17:33 | 08:19<br>16:45 | 08:51<br>16:40 |
| 26                  | 08:34<br>17:23 | 07:39<br>18:19 | 06:37<br>19:08 | 06:29<br>21:00 | 05:40<br>21:46 | 05:29<br>22:08 | 20:32 (JH3)<br>21:01 (JH3) | 05:29<br>22:08 | 33<br>21:13 (JH3) | 06:47<br>20:47 |                   | 07:37<br>19:37 | 07:27<br>17:32 | 08:21<br>16:44 | 08:51<br>16:41 |
| 27                  | 08:33<br>17:25 | 07:37<br>18:21 | 06:35<br>19:09 | 06:27<br>21:01 | 05:39<br>21:47 | 05:29<br>22:08 | 20:33 (JH3)<br>21:01 (JH3) | 05:29<br>22:08 | 33<br>21:12 (JH3) | 06:49<br>20:45 |                   | 07:38<br>19:35 | 07:29<br>17:30 | 08:22<br>16:44 | 08:51<br>16:41 |
| 28                  | 08:32<br>17:26 | 07:35<br>18:23 | 06:32<br>19:11 | 06:25<br>21:03 | 05:38<br>21:48 | 05:30<br>22:07 | 20:33 (JH3)<br>21:01 (JH3) | 05:30<br>22:07 | 32<br>21:12 (JH3) | 06:50<br>20:43 |                   | 07:40<br>19:32 | 07:31<br>17:28 | 08:24<br>16:43 | 08:52<br>16:42 |
| 29                  | 08:30<br>17:28 | 07:30<br>18:23 | 06:23<br>19:13 | 06:23<br>21:05 | 05:37<br>21:50 | 05:30<br>22:07 | 20:34 (JH3)<br>21:00 (JH3) | 05:30<br>22:07 | 30<br>21:10 (JH3) | 06:52<br>20:41 |                   | 07:42<br>19:30 | 07:33<br>17:26 | 08:25<br>16:42 | 08:52<br>16:43 |
| 30                  | 08:29<br>17:30 | 07:28<br>18:24 | 06:21<br>19:14 | 06:21<br>21:06 | 05:36<br>21:51 | 05:31<br>22:07 | 20:34 (JH3)<br>21:00 (JH3) | 05:31<br>22:07 | 28<br>21:08 (JH3) | 06:53<br>20:39 |                   | 07:43<br>19:28 | 07:34<br>17:24 | 08:27<br>16:41 | 08:52<br>16:44 |
| 31                  | 08:27<br>17:32 | 07:25<br>18:26 | 06:20<br>19:16 | 06:19<br>21:06 | 05:35<br>21:52 | 05:32<br>22:08 | 20:36 (JH3)<br>21:00 (JH3) | 05:32<br>22:08 | 27<br>21:08 (JH3) | 06:55<br>20:36 |                   | 07:45<br>19:26 | 07:36<br>17:22 | 08:28<br>16:41 | 08:52<br>16:45 |
| Potential sun hours | 260            | 278            | 367            | 415            | 484            | 497            | 222                        | 776            | 453               | 381            | 332               | 267            | 245            |                |                |
| Total, worst case   |                |                |                |                | 720            | 0,45           | 0,43                       | 0,46           |                   |                |                   |                |                |                |                |
| Oper. time red.     |                |                |                |                | 0,99           | 0,99           | 0,99                       | 0,99           |                   |                |                   |                |                |                |                |
| Wind dir. red.      |                |                |                |                | 0,56           | 0,56           | 0,56                       | 0,56           |                   |                |                   |                |                |                |                |
| Total reduction     |                |                |                |                | 0,25           | 0,24           | 0,25                       | 0,25           |                   |                |                   |                |                |                |                |
| Total, real         |                |                |                |                | 179            | 54             | 192                        | 36             |                   |                |                   |                |                |                |                |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | First time (hh:mm) with flicker | (WTG causing flicker first time) |
|--------------|------------------|---------------------------------|----------------------------------|
|              | Sun set (hh:mm)  | Last time (hh:mm) with flicker  | (WTG causing flicker last time)  |

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 5 - Banjaard Strand

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|    | January |       |       | February |  |  | March |  |       | April |             |       | May |  |             | June        |       |             | July  |             |             | August |    |             | September |    |             | October     |       |             | November    |       |       | December |  |  |
|----|---------|-------|-------|----------|--|--|-------|--|-------|-------|-------------|-------|-----|--|-------------|-------------|-------|-------------|-------|-------------|-------------|--------|----|-------------|-----------|----|-------------|-------------|-------|-------------|-------------|-------|-------|----------|--|--|
| 1  | 08:52   | 17:24 | 18:26 | 07:33    |  |  |       |  | 07:23 |       | 07:57 (JH3) | 06:19 |     |  | 06:43 (JH1) | 05:35       |       | 06:39 (JH1) | 05:32 |             | 06:52 (JH1) | 06:08  |    | 06:42 (JH1) | 06:57     |    | 07:58 (JH3) | 07:45       |       | 07:38       |             | 08:28 |       |          |  |  |
|    | 16:46   | 17:34 | 18:25 |          |  |  |       |  | 20:18 | 44    | 08:41 (JH3) | 21:08 |     |  | 31          | 07:14 (JH2) | 21:53 |             | 27    | 07:06 (JH1) | 22:07       |        | 12 | 07:04 (JH1) | 21:36     | 41 |             | 08:31 (JH3) | 19:26 |             | 17:20       |       | 16:40 |          |  |  |
| 2  | 08:52   | 08:24 | 07:31 |          |  |  |       |  | 07:21 |       | 07:56 (JH3) | 06:17 |     |  |             | 06:42 (JH1) | 05:34 |             |       | 06:39 (JH1) | 05:32       |        |    | 06:43 (JH1) | 06:09     |    | 06:43 (JH1) | 06:58       |       | 07:40       |             | 08:30 |       |          |  |  |
|    | 16:47   | 17:35 | 18:26 |          |  |  |       |  | 20:19 | 44    | 08:40 (JH3) | 21:10 |     |  | 27          | 07:09 (JH1) | 21:54 |             | 26    | 07:05 (JH1) | 22:07       |        | 13 | 07:05 (JH1) | 21:34     | 40 |             | 07:23 (JH1) | 20:32 | 35          | 08:31 (JH3) | 19:23 | 17:18 | 16:40    |  |  |
| 3  | 08:52   | 08:23 | 07:29 |          |  |  |       |  | 07:19 |       | 07:56 (JH3) | 06:15 |     |  |             | 06:40 (JH1) | 05:33 |             |       | 06:41 (JH1) | 05:33       |        |    | 06:42 (JH1) | 06:11     |    | 06:42 (JH1) | 07:00       |       | 07:55 (JH3) | 07:48       | 17:42 | 08:31 |          |  |  |
|    | 16:48   | 17:37 | 18:28 |          |  |  |       |  | 20:21 | 44    | 08:40 (JH3) | 21:11 |     |  | 30          | 07:10 (JH1) | 21:55 |             | 24    | 07:05 (JH1) | 22:06       |        | 15 | 07:06 (JH1) | 21:32     | 40 |             | 07:22 (JH1) | 20:30 | 38          | 08:33 (JH3) | 19:21 | 17:17 | 16:39    |  |  |
| 4  | 08:52   | 08:21 | 07:27 |          |  |  |       |  | 07:16 |       | 07:56 (JH3) | 06:14 |     |  |             | 06:38 (JH1) | 05:32 |             |       | 06:41 (JH1) | 05:34       |        |    | 06:50 (JH1) | 06:12     |    | 06:42 (JH1) | 07:02       |       | 07:54 (JH3) | 07:50       | 17:43 | 08:33 |          |  |  |
|    | 16:50   | 17:39 | 18:30 |          |  |  |       |  | 20:23 | 44    | 08:40 (JH3) | 21:13 |     |  | 32          | 07:10 (JH1) | 21:56 |             | 23    | 07:04 (JH1) | 22:06       |        | 17 | 07:07 (JH1) | 21:31     | 40 |             | 07:22 (JH1) | 20:28 | 39          | 08:33 (JH3) | 19:19 | 17:15 | 16:39    |  |  |
| 5  | 08:51   | 08:20 | 07:24 |          |  |  |       |  | 07:14 |       | 07:56 (JH3) | 06:12 |     |  |             | 06:36 (JH1) | 05:32 |             |       | 06:42 (JH1) | 05:35       |        |    | 06:50 (JH1) | 06:14     |    | 06:43 (JH1) | 07:03       |       | 07:53 (JH3) | 07:52       | 17:45 | 08:34 |          |  |  |
|    | 16:51   | 17:41 | 18:32 |          |  |  |       |  | 20:25 | 43    | 08:39 (JH3) | 21:15 |     |  | 34          | 07:10 (JH1) | 21:57 |             | 21    | 07:03 (JH1) | 22:05       |        | 18 | 07:08 (JH1) | 21:29     | 39 |             | 07:22 (JH1) | 20:25 | 41          | 08:34 (JH3) | 19:16 | 17:13 | 16:38    |  |  |
| 6  | 08:51   | 08:18 | 07:22 |          |  |  |       |  | 07:12 |       | 07:56 (JH3) | 06:10 |     |  |             | 06:35 (JH1) | 05:31 |             |       | 06:43 (JH1) | 05:35       |        |    | 06:50 (JH1) | 06:15     |    | 06:43 (JH1) | 07:05       |       | 07:52 (JH3) | 07:53       | 17:47 | 08:35 |          |  |  |
|    | 16:52   | 17:43 | 18:33 |          |  |  |       |  | 20:26 | 41    | 08:37 (JH3) | 21:16 |     |  | 37          | 07:12 (JH1) | 21:58 |             | 20    | 07:03 (JH1) | 22:05       |        | 19 | 07:09 (JH1) | 21:27     | 38 |             | 07:21 (JH1) | 20:23 | 41          | 08:33 (JH3) | 19:14 | 17:11 | 16:38    |  |  |
| 7  | 08:51   | 08:16 | 07:20 |          |  |  |       |  | 07:10 |       | 07:56 (JH3) | 06:08 |     |  |             | 06:33 (JH1) | 05:30 |             |       | 06:43 (JH1) | 05:36       |        |    | 06:49 (JH1) | 06:17     |    | 06:45 (JH1) | 07:06       |       | 07:51 (JH3) | 07:55       | 17:49 | 08:36 |          |  |  |
|    | 16:53   | 17:45 | 18:35 |          |  |  |       |  | 20:28 | 41    | 08:37 (JH3) | 21:18 |     |  | 39          | 07:12 (JH1) | 21:59 |             | 19    | 07:02 (JH1) | 22:04       |        | 21 | 07:10 (JH1) | 21:25     | 36 |             | 07:21 (JH1) | 20:21 | 43          | 08:34 (JH3) | 19:12 | 17:10 | 16:37    |  |  |
| 8  | 08:50   | 08:14 | 07:18 |          |  |  |       |  | 07:07 |       | 07:57 (JH3) | 06:06 |     |  |             | 06:32 (JH1) | 05:30 |             |       | 06:45 (JH1) | 05:37       |        |    | 06:48 (JH1) | 06:18     |    | 06:46 (JH1) | 07:08       |       | 07:50 (JH3) | 07:57       | 17:50 | 08:38 |          |  |  |
|    | 16:55   | 17:46 | 18:37 |          |  |  |       |  | 20:30 | 39    | 08:36 (JH3) | 21:19 |     |  | 40          | 07:12 (JH1) | 22:00 |             | 17    | 07:02 (JH1) | 22:04       |        | 22 | 07:10 (JH1) | 21:24     | 34 |             | 07:09 (JH1) | 20:19 | 44          | 08:34 (JH3) | 19:10 | 17:08 | 16:37    |  |  |
| 9  | 08:50   | 08:13 | 07:16 |          |  |  |       |  | 07:05 |       | 07:57 (JH3) | 06:05 |     |  |             | 06:33 (JH1) | 05:29 |             |       | 06:46 (JH1) | 05:38       |        |    | 06:48 (JH1) | 06:20     |    | 06:48 (JH1) | 07:10       |       | 07:50 (JH3) | 07:58       | 17:52 | 08:39 |          |  |  |
|    | 16:56   | 17:48 | 18:39 |          |  |  |       |  | 20:31 | 38    | 08:35 (JH3) | 21:21 |     |  | 39          | 07:12 (JH1) | 22:01 |             | 16    | 07:02 (JH1) | 22:03       |        | 23 | 07:11 (JH1) | 21:22     | 31 |             | 07:19 (JH1) | 20:16 | 44          | 08:34 (JH3) | 19:08 | 17:06 | 16:37    |  |  |
| 10 | 08:49   | 08:11 | 07:13 |          |  |  |       |  | 07:03 |       | 07:58 (JH3) | 06:03 |     |  |             | 06:32 (JH1) | 05:29 |             |       | 06:46 (JH1) | 05:39       |        |    | 06:47 (JH1) | 06:22     |    | 06:49 (JH1) | 07:11       |       | 07:49 (JH3) | 08:00       | 17:54 | 08:40 |          |  |  |
|    | 16:57   | 17:50 | 18:40 |          |  |  |       |  | 20:33 | 35    | 08:33 (JH3) | 21:23 |     |  | 40          | 07:12 (JH1) | 22:02 |             | 25    | 07:01 (JH1) | 22:02       |        | 29 | 07:12 (JH1) | 21:20     | 29 |             | 07:18 (JH1) | 20:14 | 44          | 08:33 (JH3) | 19:05 | 17:05 | 16:37    |  |  |
| 11 | 08:49   | 08:09 | 07:11 |          |  |  |       |  | 07:01 |       | 07:58 (JH3) | 06:01 |     |  |             | 06:32 (JH1) | 05:29 |             |       | 06:48 (JH1) | 05:40       |        |    | 06:47 (JH1) | 06:23     |    | 06:51 (JH1) | 07:13       |       | 07:49 (JH3) | 08:02       | 17:56 | 08:41 |          |  |  |
|    | 16:59   | 17:52 | 18:42 |          |  |  |       |  | 20:35 | 33    | 08:31 (JH3) | 21:24 |     |  | 41          | 07:13 (JH1) | 22:02 |             | 12    | 07:00 (JH1) | 22:02       |        | 26 | 07:13 (JH1) | 21:18     | 29 |             | 07:20 (JH1) | 20:12 | 44          | 08:33 (JH3) | 19:03 | 17:03 | 16:36    |  |  |
| 12 | 08:48   | 08:07 | 07:09 |          |  |  |       |  | 06:59 |       | 07:59 (JH3) | 06:00 |     |  |             | 06:31 (JH1) | 05:28 |             |       | 06:49 (JH1) | 05:41       |        |    | 06:46 (JH1) | 06:25     |    | 06:52 (JH1) | 07:14       |       | 07:49 (JH3) | 08:03       | 17:57 | 08:42 |          |  |  |
|    | 17:00   | 17:54 | 18:44 |          |  |  |       |  | 20:36 | 30    | 08:29 (JH3) | 21:26 |     |  | 41          | 07:12 (JH1) | 22:03 |             | 11    | 07:00 (JH1) | 22:01       |        | 28 | 07:14 (JH1) | 21:16     | 31 |             | 07:23 (JH1) | 20:09 | 45          | 08:34 (JH3) | 19:01 | 17:02 | 16:36    |  |  |
| 13 | 08:48   | 08:05 | 07:07 |          |  |  |       |  | 06:56 |       | 08:01 (JH3) | 05:58 |     |  |             | 06:32 (JH1) | 05:28 |             |       | 06:54 (JH1) | 05:42       |        |    | 06:46 (JH1) | 06:26     |    | 06:54 (JH1) | 07:16       |       | 07:49 (JH3) | 08:05       | 17:59 | 08:43 |          |  |  |
|    | 17:02   | 17:56 | 18:46 |          |  |  |       |  | 20:38 | 26    | 08:27 (JH3) | 21:27 |     |  | 41          | 07:13 (JH1) | 22:04 |             | 8     | 06:59 (JH1) | 22:00       |        | 29 | 07:15 (JH1) | 21:14     | 31 |             | 07:25 (JH1) | 20:07 | 43          | 08:32 (JH3) | 18:59 | 17:00 | 16:36    |  |  |
| 14 | 08:47   | 08:04 | 07:04 |          |  |  |       |  | 06:54 |       | 07:17 (JH2) | 05:57 |     |  |             | 06:31 (JH1) | 05:28 |             |       | 06:51 (JH1) | 05:43       |        |    | 06:45 (JH1) | 06:28     |    | 06:55 (JH1) | 07:18       |       | 07:49 (JH3) | 08:07       | 18:01 | 08:44 |          |  |  |
|    | 17:03   | 17:57 | 18:47 |          |  |  |       |  | 20:40 | 25    | 08:25 (JH3) | 21:29 |     |  | 41          | 07:12 (JH1) | 22:04 |             | 6     | 06:57 (JH1) | 21:59       |        | 31 | 07:16 (JH1) | 21:12     | 31 |             | 07:26 (JH1) | 20:05 | 43          | 08:32 (JH3) | 18:57 | 16:59 | 16:36    |  |  |
| 15 | 08:46   | 08:02 | 07:02 |          |  |  |       |  | 06:52 |       | 07:15 (JH2) | 05:55 |     |  |             | 06:31 (JH1) | 05:28 |             |       | 06:53 (JH1) | 05:45       |        |    | 06:45 (JH1) | 06:29     |    | 06:57 (JH1) | 07:19       |       | 07:49 (JH3) | 08:08       | 18:03 | 08:45 |          |  |  |
|    | 17:05   | 17:59 | 18:49 |          |  |  |       |  | 20:41 | 24    | 08:22 (JH3) | 21:30 |     |  | 42          | 07:13 (JH1) | 22:05 |             | 3     | 06:56 (JH1) | 21:58       |        | 31 | 07:16 (JH1) | 21:10     | 31 |             | 07:28 (JH1) | 20:02 | 42          | 08:31 (JH3) | 18:54 | 16:57 | 16:36    |  |  |
| 16 | 08:45   | 08:00 | 07:00 |          |  |  |       |  | 06:50 |       | 07:13 (JH2) | 05:53 |     |  |             | 06:32 (JH1) | 05:27 |             |       | 06:45 (JH1) | 05:31       |        |    | 06:45 (JH1) | 06:31     |    | 06:58 (JH1) | 07:21       |       | 07:50 (JH3) | 08:10       | 18:04 | 08:46 |          |  |  |
|    | 17:06   | 18:01 | 18:51 |          |  |  |       |  | 20:43 | 17    | 08:17 (JH3) | 21:32 |     |  | 41          | 07:13 (JH1) | 22:05 |             |       | 06:47 (JH1) | 21:57       |        | 33 | 07:18 (JH1) | 21:08     | 29 |             | 07:28 (JH1) | 20:00 | 40          | 08:30 (JH3) | 18:52 | 16:56 | 16:36    |  |  |
| 17 | 08:44   | 07:58 | 06:58 |          |  |  |       |  | 06:48 |       | 07:11 (JH2) | 05:52 |     |  |             | 06:31 (JH1) | 05:27 |             |       | 06:47 (JH1) | 05:47       |        |    | 06:45 (JH1) | 06:33     |    | 07:06 (JH2) | 07:22       |       | 07:49 (JH3) | 08:12       | 18:06 | 08:46 |          |  |  |
|    | 17:08   | 18:03 | 18:52 |          |  |  |       |  | 20:45 | 13    | 07:24 (JH2) | 21:33 |     |  | 41          | 07:12 (JH1) | 22:06 |             |       | 06:48 (JH1) | 21:56       |        | 34 | 07:19 (JH1) | 21:06     | 23 |             | 07:29 (JH1) | 19:58 | 40          | 08:29 (JH3) | 18:50 | 16:55 | 16:37    |  |  |
| 18 | 08:43   | 07:56 | 06:55 |          |  |  |       |  | 06:46 |       | 07:09 (JH2) | 05:51 |     |  |             | 06:32 (JH1) | 05:27 |             |       | 06:48 (JH1) | 05:48       |        |    | 06:44 (JH1) | 06:34     |    | 07:05 (JH2) | 07:24       |       | 07:50 (JH3) | 08:14       | 18:08 | 08:47 |          |  |  |
|    | 17:09   | 18:05 | 18:54 |          |  |  |       |  | 20:46 | 16    | 07:25 (JH2) | 21:35 |     |  | 40          | 07:12 (JH1) | 22:06 |             |       | 06:49 (JH1) | 21:55       |        | 35 | 07:19 (JH1) | 21:04     | 24 |             | 07:29 (JH1) | 19:56 | 38          | 08:28 (JH3) | 18:48 | 16:53 | 16:37    |  |  |
| 19 | 08:42   | 07:54 | 06:53 |          |  |  |       |  | 06:43 |       | 07:07 (JH2) | 05:49 |     |  |             | 06:32 (JH1) | 05:27 |             |       | 06:50 (JH1) | 05:50       |        |    | 06:44 (JH1) | 06:36     |    | 07:04 (JH2) | 07:26       |       | 07:51 (JH3) | 08:15       | 18:10 | 08:48 |          |  |  |
|    | 17:11   | 18:07 | 18:56 |          |  |  |       |  | 20:48 | 18    | 07:25 (JH2) | 21:36 |     |  | 40          | 07:12 (JH1) | 22:07 |             |       | 06:51 (JH1) | 21:54       |        | 35 | 07:19 (JH1) | 21:02     | 26 |             | 07:30 (JH1) | 19:53 | 35          | 08:26 (JH3) | 18:46 | 16:52 | 16:37    |  |  |
| 20 | 08:41   | 07:52 | 06:51 |          |  |  |       |  | 06:41 |       | 07:04 (JH2) | 05:48 |     |  |             | 06:32 (JH1) | 05:26 |             |       | 06:51 (JH1) | 05:51       |        |    | 06:43 (JH1) | 06:37     |    | 07:05 (JH2) | 07:24       |       | 07:52 (JH3) | 08:14       | 18:08 | 08:47 |          |  |  |
|    | 17:13   | 18:08 | 18:58 |          |  |  |       |  | 20:50 | 20    | 07:24 (JH2) | 21:38 |     |  | 39          | 07:11 (JH1) | 22:07 |             |       | 06:52 (JH1) | 21:57       |        | 37 | 07:20 (JH1) | 21:00     | 25 |             | 07:29 (JH1) | 19:51 | 33          | 08:25 (JH3) | 18:44 | 16:51 | 16:38    |  |  |
| 21 | 08:40   | 07:50 | 06:48 |          |  |  |       |  | 06:39 |       | 07:02 (JH2) | 05:46 |     |  |             | 06:32 (JH1) | 05:28 |             |       | 06:52 (JH1) | 05:52       |        |    | 06:44 (JH1) | 06:39     |    | 07:06 (JH2) | 07:29       |       | 07:54 (JH3) | 08:19       | 18:13 | 08:49 |          |  |  |
|    | 17:14   | 18:10 | 18:59 |          |  |  |       |  | 20:51 | 22    | 07:24 (JH2) | 21:39 |     |  | 39          | 07:11 (JH1) | 22:07 |             |       | 06:53 (JH1) | 21:57       |        | 37 | 07:21 (JH1) | 21:08     | 24 |             | 07:30 (JH1) | 19:49 | 29          | 08:23 (JH3) | 18:42 | 16:50 | 16:38    |  |  |
| 22 | 08:39   | 07:48 | 06:37 |          |  |  |       |  | 06:37 |       | 07:00 (JH2) | 05:45 |     |  |             | 06:33 (JH1) | 05:28 |             |       | 06:53 (JH1) | 05:48       |        |    | 06:43 (JH1) | 06:30     |    | 07:07 (JH2) | 07:30       |       | 07:55 (JH3) | 08:20       | 18:14 |       |          |  |  |

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 6 - Banjaard Noord

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|                     | January        | February       | March          | April          | May            | June                          | July           | August                        | September                     | October                       | November                      | December                      |                |                |                |                |
|---------------------|----------------|----------------|----------------|----------------|----------------|-------------------------------|----------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|----------------|----------------|----------------|----------------|
| 1                   | 08:52<br>16:46 | 08:26<br>17:34 | 07:33<br>18:25 | 07:23<br>20:18 | 06:19<br>21:08 | 61 06:43 (JH2)<br>07:58 (JH3) | 05:35<br>21:53 | 4 07:27 (JH3)<br>07:31 (JH3)  | 05:32<br>22:07                | 16 06:02 (JH1)<br>06:18 (JH1) | 06:08<br>21:36                | 80 06:36 (JH2)<br>08:06 (JH3) | 06:57<br>20:34 | 07:45<br>19:26 | 07:38<br>17:20 | 08:28<br>16:40 |
| 2                   | 08:52<br>16:47 | 08:24<br>17:35 | 07:31<br>18:26 | 07:21<br>20:19 | 06:17<br>21:10 | 64 06:42 (JH2)<br>07:59 (JH3) | 05:34<br>21:54 | 05:32<br>22:07                | 15 06:03 (JH1)<br>06:18 (JH1) | 06:09<br>21:34                | 79 06:38 (JH2)<br>08:06 (JH3) | 06:58<br>20:32                | 07:47<br>19:23 | 07:40<br>17:18 | 08:30<br>16:40 |                |
| 3                   | 08:52<br>16:48 | 08:23<br>17:37 | 07:29<br>18:28 | 07:19<br>20:21 | 06:15<br>21:11 | 67 06:40 (JH2)<br>07:58 (JH3) | 05:33<br>21:55 | 05:33<br>22:06                | 14 06:03 (JH1)<br>06:17 (JH1) | 06:11<br>21:32                | 79 06:39 (JH2)<br>08:06 (JH3) | 07:00<br>20:30                | 07:48<br>19:21 | 07:42<br>17:17 | 08:31<br>16:39 |                |
| 4                   | 08:52<br>16:50 | 08:21<br>17:39 | 07:27<br>18:30 | 07:16<br>20:23 | 06:14<br>21:13 | 70 06:38 (JH2)<br>07:58 (JH3) | 05:32<br>21:56 | 05:34<br>22:06                | 12 06:04 (JH1)<br>06:16 (JH1) | 06:12<br>21:31                | 78 06:40 (JH2)<br>08:06 (JH3) | 07:02<br>20:28                | 07:50<br>19:19 | 07:43<br>17:15 | 08:33<br>16:39 |                |
| 5                   | 08:51<br>16:51 | 08:20<br>17:41 | 07:24<br>18:32 | 07:14<br>20:24 | 06:12<br>21:15 | 71 06:36 (JH2)<br>07:57 (JH3) | 05:32<br>21:57 | 05:35<br>22:05                | 9 06:06 (JH1)<br>06:15 (JH1)  | 06:14<br>21:29                | 77 06:42 (JH2)<br>08:07 (JH3) | 07:03<br>20:25                | 07:52<br>19:16 | 07:45<br>17:13 | 08:34<br>16:38 |                |
| 6                   | 08:51<br>16:52 | 08:18<br>17:43 | 07:22<br>18:33 | 07:12<br>20:26 | 06:10<br>21:16 | 74 06:35 (JH2)<br>07:57 (JH3) | 05:31<br>21:58 | 05:35<br>22:05                | 3 06:09 (JH1)<br>06:12 (JH1)  | 06:15<br>21:27                | 74 06:43 (JH2)<br>08:06 (JH3) | 07:05<br>20:23                | 07:53<br>19:14 | 07:47<br>17:11 | 08:35<br>16:38 |                |
| 7                   | 08:51<br>16:53 | 08:16<br>17:45 | 07:20<br>18:35 | 07:10<br>20:28 | 06:08<br>21:18 | 76 06:33 (JH2)<br>07:57 (JH3) | 05:30<br>21:59 | 06:00 (JH1)<br>06:08 (JH1)    | 05:36<br>22:04                | 06:17<br>21:25                | 73 06:45 (JH2)<br>08:07 (JH3) | 07:06<br>20:21                | 07:55<br>19:12 | 07:49<br>17:10 | 08:36<br>16:37 |                |
| 8                   | 08:50<br>16:55 | 08:14<br>17:46 | 07:18<br>18:37 | 07:07<br>20:30 | 06:06<br>21:19 | 77 06:31 (JH2)<br>07:56 (JH3) | 05:30<br>22:00 | 8 06:09 (JH1)<br>06:18 (JH1)  | 05:37<br>22:04                | 06:18<br>21:24                | 72 06:46 (JH2)<br>08:07 (JH3) | 07:08<br>20:19                | 07:57<br>19:10 | 07:50<br>17:08 | 08:38<br>16:37 |                |
| 9                   | 08:50<br>16:56 | 08:13<br>17:48 | 07:16<br>18:39 | 07:05<br>20:31 | 06:05<br>21:21 | 77 06:30 (JH2)<br>07:56 (JH3) | 05:29<br>22:01 | 11 06:09 (JH1)<br>06:18 (JH1) | 05:43<br>22:03                | 06:21<br>21:22                | 72 06:48 (JH2)<br>08:07 (JH3) | 07:10<br>20:16                | 07:58<br>19:08 | 07:52<br>17:06 | 08:39<br>16:37 |                |
| 10                  | 08:49<br>16:57 | 08:11<br>17:50 | 07:13<br>18:40 | 07:03<br>20:33 | 06:03<br>21:23 | 78 06:28 (JH2)<br>07:55 (JH3) | 05:29<br>22:02 | 06:08 (JH1)<br>06:18 (JH1)    | 05:39<br>22:02                | 06:22<br>21:20                | 72 06:58 (JH2)<br>08:07 (JH3) | 07:11<br>20:14                | 08:00<br>19:05 | 07:54<br>17:05 | 08:40<br>16:37 |                |
| 11                  | 08:49<br>16:59 | 08:09<br>17:52 | 07:11<br>18:42 | 07:01<br>20:35 | 06:01<br>21:24 | 80 06:27 (JH2)<br>07:55 (JH3) | 05:29<br>22:02 | 16 06:08 (JH1)<br>06:18 (JH1) | 05:40<br>22:02                | 06:23<br>21:18                | 63 06:51 (JH2)<br>08:07 (JH3) | 07:13<br>20:12                | 08:02<br>19:03 | 07:56<br>17:03 | 08:41<br>16:36 |                |
| 12                  | 08:48<br>17:00 | 08:07<br>17:54 | 07:09<br>18:44 | 06:59<br>20:36 | 06:00<br>21:26 | 80 06:25 (JH2)<br>07:54 (JH3) | 05:28<br>22:03 | 16 06:08 (JH1)<br>06:18 (JH1) | 05:41<br>22:01                | 06:25<br>21:16                | 63 06:52 (JH2)<br>08:07 (JH3) | 07:14<br>20:09                | 08:03<br>19:01 | 07:57<br>17:02 | 08:42<br>16:36 |                |
| 13                  | 08:47<br>17:02 | 08:05<br>17:56 | 07:07<br>18:46 | 06:56<br>20:38 | 06:00<br>21:27 | 80 06:24 (JH2)<br>07:54 (JH3) | 05:28<br>22:04 | 16 06:08 (JH1)<br>06:18 (JH1) | 05:42<br>22:03                | 06:26<br>21:14                | 60 06:52 (JH2)<br>08:07 (JH3) | 07:16<br>20:07                | 08:05<br>19:00 | 07:59<br>17:00 | 08:43<br>16:36 |                |
| 14                  | 08:47<br>17:03 | 08:04<br>17:57 | 07:04<br>18:47 | 06:54<br>20:40 | 06:00<br>21:28 | 80 06:23 (JH2)<br>07:53 (JH3) | 05:28<br>22:04 | 18 06:08 (JH1)<br>06:18 (JH1) | 05:43<br>21:59                | 06:27<br>21:12                | 56 06:52 (JH2)<br>08:07 (JH3) | 07:18<br>20:05                | 08:07<br>19:00 | 08:01<br>17:00 | 08:44<br>16:36 |                |
| 15                  | 08:46<br>17:05 | 08:02<br>17:59 | 07:02<br>18:49 | 06:52<br>20:41 | 06:00<br>21:28 | 80 06:22 (JH2)<br>07:52 (JH3) | 05:28<br>22:05 | 21 06:09 (JH1)<br>06:18 (JH1) | 05:45<br>21:58                | 06:29<br>21:10                | 55 06:53 (JH2)<br>08:07 (JH3) | 07:19<br>20:02                | 08:08<br>19:00 | 08:03<br>17:00 | 08:45<br>16:36 |                |
| 16                  | 08:45<br>17:06 | 08:00<br>18:01 | 07:00<br>18:51 | 06:50<br>20:43 | 06:00<br>21:29 | 80 06:21 (JH2)<br>07:51 (JH3) | 05:27<br>22:05 | 30 06:09 (JH1)<br>06:18 (JH1) | 05:46<br>21:57                | 06:31<br>21:08                | 54 06:54 (JH2)<br>08:07 (JH3) | 07:21<br>20:00                | 08:10<br>19:00 | 08:04<br>17:00 | 08:46<br>16:36 |                |
| 17                  | 08:44<br>17:08 | 07:58<br>18:03 | 06:58<br>18:52 | 06:48<br>20:45 | 06:00<br>21:30 | 80 06:20 (JH2)<br>07:53 (JH3) | 05:27<br>22:06 | 30 06:10 (JH1)<br>06:18 (JH1) | 05:47<br>21:56                | 06:33<br>21:06                | 54 06:55 (JH2)<br>08:07 (JH3) | 07:22<br>20:00                | 08:12<br>19:00 | 08:06<br>17:00 | 08:46<br>16:37 |                |
| 18                  | 08:43<br>17:09 | 07:56<br>18:05 | 06:55<br>18:54 | 06:46<br>20:46 | 06:00<br>21:31 | 80 06:19 (JH2)<br>07:54 (JH3) | 05:27<br>22:06 | 37 06:11 (JH1)<br>06:18 (JH1) | 05:48<br>21:55                | 06:34<br>21:04                | 53 06:56 (JH2)<br>08:07 (JH3) | 07:24<br>20:00                | 08:13<br>19:00 | 08:08<br>17:00 | 08:47<br>16:37 |                |
| 19                  | 08:42<br>17:11 | 07:54<br>18:07 | 06:53<br>18:56 | 06:43<br>20:48 | 06:00<br>21:32 | 80 06:18 (JH2)<br>07:53 (JH3) | 05:27<br>22:07 | 42 06:12 (JH1)<br>06:18 (JH1) | 05:48<br>21:54                | 06:36<br>21:02                | 52 06:57 (JH2)<br>08:07 (JH3) | 07:26<br>20:00                | 08:15<br>19:00 | 08:09<br>17:00 | 08:48<br>16:37 |                |
| 20                  | 08:41<br>17:13 | 07:52<br>18:08 | 06:51<br>18:58 | 06:41<br>20:50 | 06:00<br>21:33 | 80 06:17 (JH2)<br>07:52 (JH3) | 05:27<br>22:08 | 51 06:13 (JH1)<br>06:18 (JH1) | 05:51<br>21:53                | 06:37<br>21:00                | 49 06:58 (JH2)<br>08:07 (JH3) | 07:27<br>20:00                | 08:16<br>19:00 | 08:11<br>17:00 | 08:49<br>16:38 |                |
| 21                  | 08:40<br>17:14 | 07:50<br>18:10 | 06:48<br>18:59 | 06:39<br>20:51 | 06:00<br>21:34 | 80 06:16 (JH2)<br>07:51 (JH3) | 05:28<br>22:07 | 55 06:14 (JH1)<br>06:18 (JH1) | 05:52<br>21:51                | 06:39<br>20:58                | 48 06:59 (JH2)<br>08:07 (JH3) | 07:29<br>20:00                | 08:19<br>19:00 | 08:13<br>17:00 | 08:49<br>16:38 |                |
| 22                  | 08:39<br>17:16 | 07:48<br>18:12 | 06:46<br>19:01 | 06:37<br>20:53 | 06:00<br>21:35 | 80 06:15 (JH2)<br>07:50 (JH3) | 05:28<br>22:07 | 58 06:15 (JH1)<br>06:18 (JH1) | 05:53<br>21:50                | 06:40<br>20:56                | 48 06:60 (JH2)<br>08:07 (JH3) | 07:30<br>20:00                | 08:20<br>19:00 | 08:14<br>17:00 | 08:50<br>16:38 |                |
| 23                  | 08:38<br>17:18 | 07:46<br>18:14 | 06:44<br>19:03 | 06:35<br>20:55 | 06:00<br>21:36 | 80 06:14 (JH2)<br>07:49 (JH3) | 05:28<br>22:08 | 61 06:16 (JH1)<br>06:18 (JH1) | 05:55<br>21:49                | 06:42<br>20:54                | 44 06:61 (JH2)<br>08:07 (JH3) | 07:32<br>20:00                | 08:22<br>19:00 | 08:16<br>17:00 | 08:50<br>16:39 |                |
| 24                  | 08:37<br>17:19 | 07:44<br>18:16 | 06:42<br>19:04 | 06:33<br>20:56 | 06:00<br>21:37 | 80 06:13 (JH2)<br>07:48 (JH3) | 05:28<br>22:09 | 64 06:17 (JH1)<br>06:18 (JH1) | 05:56<br>21:48                | 06:44<br>20:52                | 44 06:62 (JH2)<br>08:07 (JH3) | 07:33<br>20:00                | 08:23<br>19:00 | 08:17<br>17:00 | 08:51<br>16:40 |                |
| 25                  | 08:36<br>17:21 | 07:42<br>18:17 | 06:39<br>19:06 | 06:31<br>20:58 | 06:00<br>21:38 | 80 06:12 (JH2)<br>07:47 (JH3) | 05:29<br>22:10 | 67 06:18 (JH1)<br>06:18 (JH1) | 05:58<br>21:46                | 06:45<br>20:50                | 40 06:63 (JH2)<br>08:07 (JH3) | 07:35<br>20:00                | 08:24<br>19:00 | 08:18<br>17:00 | 08:52<br>16:41 |                |
| 26                  | 08:34<br>17:23 | 07:39<br>18:19 | 06:37<br>19:08 | 06:29<br>21:00 | 06:00<br>21:39 | 80 06:11 (JH2)<br>07:46 (JH3) | 05:29<br>22:11 | 70 06:19 (JH1)<br>06:18 (JH1) | 05:59<br>21:45                | 06:47<br>20:47                | 36 06:64 (JH2)<br>08:07 (JH3) | 07:37<br>20:00                | 08:25<br>19:00 | 08:19<br>17:00 | 08:53<br>16:42 |                |
| 27                  | 08:33<br>17:25 | 07:37<br>18:21 | 06:35<br>19:09 | 06:27<br>21:01 | 06:00<br>21:40 | 80 06:10 (JH2)<br>07:45 (JH3) | 05:30<br>22:12 | 72 06:20 (JH1)<br>06:18 (JH1) | 06:00<br>21:43                | 06:49<br>20:43                | 33 06:65 (JH2)<br>08:07 (JH3) | 07:38<br>20:00                | 08:26<br>19:00 | 08:20<br>17:00 | 08:54<br>16:43 |                |
| 28                  | 08:32<br>17:26 | 07:35<br>18:23 | 06:32<br>19:11 | 06:25<br>21:03 | 06:00<br>21:41 | 80 06:09 (JH2)<br>07:44 (JH3) | 05:30<br>22:13 | 75 06:21 (JH1)<br>06:18 (JH1) | 06:02<br>21:42                | 06:50<br>20:40                | 28 06:66 (JH2)<br>08:07 (JH3) | 07:39<br>20:00                | 08:27<br>19:00 | 08:21<br>17:00 | 08:55<br>16:44 |                |
| 29                  | 08:30<br>17:28 | 07:30<br>18:20 | 06:23<br>19:03 | 06:23<br>21:05 | 06:00<br>21:42 | 80 06:08 (JH2)<br>07:43 (JH3) | 05:31<br>22:14 | 77 06:22 (JH1)<br>06:18 (JH1) | 06:03<br>21:43                | 06:52<br>20:38                | 24 06:67 (JH2)<br>08:07 (JH3) | 07:40<br>20:00                | 08:28<br>19:00 | 08:22<br>17:00 | 08:56<br>16:45 |                |
| 30                  | 08:29<br>17:30 | 07:28<br>18:14 | 06:21<br>19:01 | 06:21<br>21:06 | 06:00<br>21:43 | 80 06:07 (JH2)<br>07:42 (JH3) | 05:31<br>22:15 | 77 06:23 (JH1)<br>06:18 (JH1) | 06:05<br>21:39                | 06:53<br>20:39                | 16 06:68 (JH2)<br>08:07 (JH3) | 07:43<br>20:00                | 08:29<br>19:00 | 08:23<br>17:00 | 08:57<br>16:46 |                |
| 31                  | 08:27<br>17:32 | 07:26<br>18:13 | 06:20<br>19:00 | 06:20<br>21:07 | 06:00<br>21:44 | 80 06:06 (JH2)<br>07:41 (JH3) | 05:32<br>22:16 | 80 06:09 (JH1)<br>06:18 (JH1) | 06:06<br>21:37                | 06:56<br>20:35                | 16 06:69 (JH2)<br>08:07 (JH3) | 07:44<br>20:00                | 08:30<br>19:00 | 08:24<br>17:00 | 08:58<br>16:47 |                |
| Potential sun hours | 260            | 278            | 367            | 415            | 484            | 523                           | 497            | 500                           | 453                           | 381                           | 332                           | 267                           | 245            |                |                |                |
| Total, worst case   |                |                |                |                |                |                               |                |                               |                               |                               |                               |                               |                |                |                |                |
| Sun reduction       |                |                |                | 789            | 1856           | 439                           | 1093           |                               | 1652                          |                               |                               |                               |                |                |                |                |
| Oper. time red.     |                |                |                | 0,45           | 0,45           | 0,43                          | 0,45           |                               | 0,46                          |                               |                               |                               |                |                |                |                |
| Wind dir. red.      |                |                |                | 0,99           | 0,99           | 0,99                          | 0,99           |                               | 0,99                          |                               |                               |                               |                |                |                |                |
| Total reduction     |                |                |                | 0,62           | 0,63           | 0,69                          | 0,64           |                               | 0,63                          |                               |                               |                               |                |                |                |                |
| Total, real         |                |                |                | 0,28           | 0,28           | 0,30                          | 0,28           |                               | 0,29                          |                               |                               |                               |                |                |                |                |
|                     |                |                |                | 218            | 523            | 131                           | 309            |                               | 471                           |                               |                               |                               |                |                |                |                |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | First time (hh:mm) with flicker | (WTG causing flicker first time) |
|--------------|------------------|---------------------------------|----------------------------------|
|              | Sun set (hh:mm)  | Last time (hh:mm) with flicker  | (WTG causing flicker last time)  |

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 7 - Banjaard Noord-Oost

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|                     | January | February | March | April | May   | June        | July           | August | September      | October | November | December |       |       |
|---------------------|---------|----------|-------|-------|-------|-------------|----------------|--------|----------------|---------|----------|----------|-------|-------|
| 1                   | 08:52   | 08:26    | 07:33 | 07:23 | 06:19 | 05:35       | 06:03 (JH2)    | 05:32  | 06:02 (JH2)    | 06:08   | 06:57    | 07:45    | 07:38 | 08:28 |
|                     | 16:46   | 17:34    | 18:25 | 20:18 | 21:08 | 21:53       | 41 06:52 (JH3) | 22:07  | 68 07:10 (JH3) | 21:36   | 20:34    | 19:26    | 17:20 | 16:40 |
| 2                   | 08:52   | 08:24    | 07:31 | 07:21 | 06:17 | 05:34       | 06:02 (JH2)    | 05:32  | 06:03 (JH2)    | 06:09   | 06:58    | 07:47    | 07:40 | 08:30 |
|                     | 16:47   | 17:35    | 18:26 | 20:19 | 21:10 | 21:54       | 46 06:54 (JH3) | 22:07  | 67 07:10 (JH3) | 21:34   | 20:32    | 19:23    | 17:18 | 16:40 |
| 3                   | 08:52   | 08:23    | 07:29 | 07:19 | 06:15 | 05:33       | 06:02 (JH2)    | 05:33  | 06:03 (JH2)    | 06:11   | 07:00    | 07:48    | 07:42 | 08:31 |
|                     | 16:48   | 17:37    | 18:28 | 20:21 | 21:11 | 21:55       | 51 06:57 (JH3) | 22:06  | 66 07:09 (JH3) | 21:32   | 20:30    | 19:21    | 17:17 | 16:39 |
| 4                   | 08:52   | 08:21    | 07:27 | 07:16 | 06:14 | 05:32       | 06:01 (JH2)    | 05:34  | 06:04 (JH2)    | 06:12   | 07:01    | 07:50    | 07:43 | 08:32 |
|                     | 16:50   | 17:39    | 18:30 | 20:23 | 21:13 | 21:56       | 56 06:58 (JH3) | 22:06  | 64 07:08 (JH3) | 21:31   | 20:28    | 19:19    | 17:15 | 16:39 |
| 5                   | 08:51   | 08:19    | 07:24 | 07:14 | 06:12 | 05:32       | 06:00 (JH2)    | 05:35  | 06:05 (JH2)    | 06:14   | 07:03    | 07:52    | 07:45 | 08:34 |
|                     | 16:51   | 17:41    | 18:32 | 20:24 | 21:15 | 21:57       | 59 06:59 (JH3) | 22:05  | 63 07:08 (JH3) | 21:29   | 20:25    | 19:16    | 17:13 | 16:38 |
| 6                   | 08:51   | 08:18    | 07:22 | 07:12 | 06:10 | 05:31       | 06:00 (JH2)    | 05:35  | 06:06 (JH2)    | 06:15   | 07:05    | 07:53    | 07:47 | 08:35 |
|                     | 16:52   | 17:43    | 18:33 | 20:26 | 21:16 | 21:58       | 61 07:01 (JH3) | 22:05  | 61 07:07 (JH3) | 21:27   | 20:23    | 19:14    | 17:11 | 16:38 |
| 7                   | 08:51   | 08:16    | 07:20 | 07:10 | 06:08 | 05:30       | 05:59 (JH2)    | 05:36  | 06:07 (JH2)    | 06:17   | 07:06    | 07:55    | 07:49 | 08:36 |
|                     | 16:53   | 17:45    | 18:35 | 20:28 | 21:18 | 21:59       | 62 07:01 (JH3) | 22:04  | 60 07:07 (JH3) | 21:25   | 20:21    | 19:12    | 17:10 | 16:37 |
| 8                   | 08:50   | 08:14    | 07:18 | 07:07 | 06:06 | 05:30       | 05:59 (JH2)    | 05:37  | 06:07 (JH2)    | 06:18   | 07:08    | 07:57    | 07:50 | 08:38 |
|                     | 16:55   | 17:46    | 18:37 | 20:30 | 21:19 | 22:00       | 64 07:03 (JH3) | 22:04  | 57 07:05 (JH3) | 21:24   | 20:19    | 19:10    | 17:08 | 16:37 |
| 9                   | 08:50   | 08:13    | 07:16 | 07:05 | 06:05 | 05:29       | 05:59 (JH2)    | 05:38  | 06:08 (JH2)    | 06:20   | 07:09    | 07:58    | 07:52 | 08:39 |
|                     | 16:56   | 17:48    | 18:39 | 20:31 | 21:21 | 22:01       | 65 07:04 (JH3) | 22:03  | 53 07:04 (JH3) | 21:22   | 20:16    | 19:07    | 17:06 | 16:37 |
| 10                  | 08:49   | 08:11    | 07:13 | 07:03 | 06:03 | 05:29       | 05:58 (JH2)    | 05:39  | 06:09 (JH2)    | 06:22   | 07:11    | 08:00    | 07:54 | 08:40 |
|                     | 16:57   | 17:50    | 18:40 | 20:33 | 21:23 | 22:02       | 66 07:04 (JH3) | 22:02  | 49 07:02 (JH3) | 21:20   | 20:14    | 19:05    | 17:05 | 16:37 |
| 11                  | 08:49   | 08:09    | 07:11 | 07:01 | 06:01 | 05:29       | 05:58 (JH2)    | 05:40  | 43 07:00 (JH3) | 21:18   | 20:12    | 19:03    | 17:03 | 16:36 |
|                     | 16:59   | 17:52    | 18:42 | 20:35 | 21:24 | 22:02       | 67 07:05 (JH3) | 22:02  | 43 07:05 (JH3) | 21:18   | 20:12    | 19:03    | 17:03 | 16:36 |
| 12                  | 08:48   | 08:07    | 07:09 | 06:59 | 06:00 | 05:28       | 05:58 (JH2)    | 05:41  | 37 06:11 (JH2) | 06:25   | 07:14    | 08:03    | 07:57 | 08:42 |
|                     | 17:00   | 17:54    | 18:44 | 20:36 | 21:26 | 22:03       | 68 07:06 (JH3) | 22:01  | 37 06:58 (JH3) | 21:16   | 20:09    | 19:01    | 17:02 | 16:36 |
| 13                  | 08:47   | 08:05    | 07:07 | 06:56 | 05:58 | 05:28       | 05:58 (JH2)    | 05:42  | 28 06:12 (JH2) | 06:26   | 07:16    | 08:05    | 07:59 | 08:43 |
|                     | 17:02   | 17:56    | 18:46 | 20:38 | 21:27 | 22:04       | 69 07:07 (JH3) | 22:00  | 28 06:54 (JH3) | 21:14   | 20:07    | 18:59    | 17:00 | 16:36 |
| 14                  | 08:47   | 08:04    | 07:04 | 06:54 | 05:57 | 05:28       | 05:57 (JH2)    | 05:43  | 16 06:13 (JH2) | 06:28   | 07:17    | 08:07    | 08:01 | 08:44 |
|                     | 17:03   | 17:57    | 18:47 | 20:40 | 21:29 | 22:04       | 70 07:07 (JH3) | 21:59  | 16 06:29 (JH2) | 21:12   | 20:05    | 18:57    | 16:59 | 16:36 |
| 15                  | 08:46   | 08:02    | 07:02 | 06:52 | 05:55 | 05:28       | 05:57 (JH2)    | 05:45  | 14 06:14 (JH2) | 06:29   | 07:19    | 08:08    | 08:03 | 08:45 |
|                     | 17:05   | 17:59    | 18:49 | 20:41 | 21:30 | 22:05       | 71 07:08 (JH3) | 21:58  | 14 06:28 (JH2) | 21:10   | 20:02    | 18:54    | 16:57 | 16:36 |
| 16                  | 08:45   | 08:00    | 07:00 | 06:50 | 05:53 | 05:27       | 05:57 (JH2)    | 05:46  | 12 06:16 (JH2) | 06:31   | 07:21    | 08:10    | 08:04 | 08:46 |
|                     | 17:06   | 18:01    | 18:51 | 20:43 | 21:32 | 22:05       | 71 07:08 (JH3) | 21:57  | 12 06:28 (JH2) | 21:08   | 20:00    | 18:52    | 16:56 | 16:36 |
| 17                  | 08:44   | 07:58    | 06:58 | 06:48 | 05:52 | 05:27       | 05:57 (JH2)    | 05:47  | 10 06:17 (JH2) | 06:33   | 07:22    | 08:12    | 08:06 | 08:46 |
|                     | 17:08   | 18:03    | 18:52 | 20:45 | 21:33 | 22:06       | 71 07:08 (JH3) | 21:56  | 10 06:27 (JH2) | 21:06   | 19:58    | 18:50    | 16:55 | 16:37 |
| 18                  | 08:43   | 07:56    | 06:55 | 06:46 | 05:51 | 05:27       | 05:57 (JH2)    | 05:48  | 8 06:18 (JH2)  | 06:34   | 07:24    | 08:13    | 08:08 | 08:47 |
|                     | 17:09   | 18:05    | 18:54 | 20:46 | 21:35 | 22:06       | 72 07:09 (JH3) | 21:55  | 8 06:26 (JH2)  | 21:04   | 19:56    | 18:48    | 16:53 | 16:37 |
| 19                  | 08:42   | 07:54    | 06:53 | 06:43 | 05:49 | 05:27       | 05:57 (JH2)    | 05:49  | 5 06:19 (JH2)  | 06:36   | 07:25    | 08:15    | 08:09 | 08:48 |
|                     | 17:11   | 18:07    | 18:56 | 20:48 | 21:36 | 22:07       | 72 07:09 (JH3) | 21:54  | 5 06:24 (JH2)  | 21:02   | 19:53    | 18:46    | 16:52 | 16:37 |
| 20                  | 08:41   | 07:52    | 06:51 | 06:41 | 05:48 | 05:28       | 05:58 (JH2)    | 05:51  | 06:20 (JH2)    | 06:37   | 07:27    | 08:17    | 08:11 | 08:49 |
|                     | 17:13   | 18:08    | 18:57 | 20:50 | 21:38 | 22:07       | 72 07:10 (JH3) | 21:53  | 06:21 (JH2)    | 21:00   | 19:51    | 18:44    | 16:51 | 16:38 |
| 21                  | 08:40   | 07:50    | 06:48 | 06:39 | 05:46 | 05:28       | 05:58 (JH2)    | 05:52  | 06:22 (JH2)    | 06:38   | 07:29    | 08:19    | 08:13 | 08:49 |
|                     | 17:14   | 18:10    | 18:59 | 20:51 | 21:39 | 22:07       | 72 07:10 (JH3) | 21:51  | 06:23 (JH2)    | 21:00   | 19:50    | 18:42    | 16:50 | 16:38 |
| 22                  | 08:39   | 07:48    | 06:46 | 06:37 | 05:45 | 05:28       | 05:58 (JH2)    | 05:53  | 06:24 (JH2)    | 06:39   | 07:30    | 08:20    | 08:14 | 08:50 |
|                     | 17:16   | 18:12    | 19:01 | 20:53 | 21:40 | 22:07       | 72 07:10 (JH3) | 21:50  | 06:25 (JH2)    | 21:00   | 19:50    | 18:42    | 16:49 | 16:38 |
| 23                  | 08:38   | 07:46    | 06:44 | 06:35 | 05:44 | 05:28       | 05:58 (JH2)    | 05:55  | 06:26 (JH2)    | 06:40   | 07:32    | 08:22    | 08:16 | 08:50 |
|                     | 17:18   | 18:14    | 19:03 | 20:55 | 21:42 | 22:08       | 72 07:10 (JH3) | 21:49  | 06:27 (JH2)    | 21:00   | 19:50    | 18:42    | 16:47 | 16:39 |
| 24                  | 08:37   | 07:44    | 06:42 | 06:33 | 05:43 | 05:28       | 05:59 (JH2)    | 05:56  | 06:28 (JH2)    | 06:41   | 07:34    | 08:24    | 08:18 | 08:51 |
|                     | 17:19   | 18:16    | 19:04 | 20:56 | 21:43 | 22:08       | 72 07:11 (JH3) | 21:48  | 06:29 (JH2)    | 21:00   | 19:50    | 18:42    | 16:46 | 16:39 |
| 25                  | 08:36   | 07:42    | 06:39 | 06:31 | 05:42 | 05:29       | 06:09 (JH2)    | 05:59  | 06:30 (JH2)    | 06:42   | 07:35    | 08:26    | 08:19 | 08:51 |
|                     | 17:21   | 18:17    | 19:06 | 20:58 | 21:45 | 22:08       | 72 07:11 (JH3) | 21:46  | 06:31 (JH2)    | 21:00   | 19:50    | 18:42    | 16:45 | 16:40 |
| 26                  | 08:34   | 07:39    | 06:37 | 06:29 | 05:40 | 05:29       | 06:08 (JH2)    | 05:59  | 06:32 (JH2)    | 06:43   | 07:37    | 08:27    | 08:21 | 08:51 |
|                     | 17:23   | 18:19    | 19:08 | 21:00 | 21:46 | 22:08       | 71 07:10 (JH3) | 21:45  | 06:33 (JH2)    | 21:00   | 19:50    | 18:42    | 16:44 | 16:41 |
| 27                  | 08:33   | 07:37    | 06:35 | 06:27 | 05:39 | 05:30       | 06:07 (JH2)    | 06:00  | 06:34 (JH2)    | 06:44   | 07:38    | 08:29    | 08:22 | 08:52 |
|                     | 17:25   | 18:21    | 19:09 | 21:01 | 21:47 | 22:08       | 71 07:11 (JH3) | 21:43  | 06:35 (JH2)    | 21:00   | 19:50    | 18:42    | 16:44 | 16:42 |
| 28                  | 08:32   | 07:35    | 06:32 | 06:25 | 05:38 | 05:30       | 06:06 (JH2)    | 06:02  | 06:35 (JH2)    | 06:45   | 07:40    | 08:31    | 08:24 | 08:52 |
|                     | 17:26   | 18:23    | 19:11 | 21:03 | 21:48 | 22:08       | 70 07:10 (JH3) | 21:42  | 06:36 (JH2)    | 21:00   | 19:50    | 18:42    | 16:43 | 16:42 |
| 29                  | 08:30   |          | 07:30 | 06:23 | 05:37 | 05:31       | 06:05 (JH2)    | 06:03  | 06:36 (JH2)    | 06:46   | 07:42    | 08:33    | 08:25 | 08:52 |
|                     | 17:28   |          | 20:13 | 21:05 | 21:50 | 22:07       | 69 07:10 (JH3) | 21:40  | 06:37 (JH2)    | 21:00   | 19:50    | 18:42    | 16:42 | 16:43 |
| 30                  | 08:29   |          | 07:28 | 06:21 | 05:36 | 05:31       | 06:04 (JH2)    | 06:05  | 06:38 (JH2)    | 06:47   | 07:43    | 08:34    | 08:27 | 08:52 |
|                     | 17:30   |          | 20:14 | 21:06 | 21:51 | 22:07       | 69 07:10 (JH3) | 21:39  | 06:39 (JH2)    | 21:00   | 19:50    | 18:42    | 16:41 | 16:44 |
| 31                  | 08:27   |          | 07:25 |       | 05:35 | 06:04 (JH2) |                | 06:06  | 06:40 (JH2)    | 21:00   | 19:50    | 18:42    | 16:41 | 16:44 |
|                     | 17:32   |          | 20:16 |       | 21:52 | 06:49 (JH3) |                | 06:07  | 06:41 (JH2)    | 21:00   | 19:50    | 18:42    | 16:41 | 16:44 |
| Potential sun hours | 260     | 278      | 367   | 415   | 484   | 497         | 500            | 453    | 381            | 332     | 267      | 245      |       |       |
| Total, worst case   |         |          |       |       | 107   | 1984        | 781            |        |                |         |          |          |       |       |
| Sun reduction       |         |          |       |       | 0,45  | 0,43        | 0,45           |        |                |         |          |          |       |       |
| Oper. time red.     |         |          |       |       | 0,99  | 0,99        | 0,99           |        |                |         |          |          |       |       |
| Wind dir. red.      |         |          |       |       | 0,69  | 0,69        | 0,69           |        |                |         |          |          |       |       |
| Total reduction     |         |          |       |       | 0,31  | 0,30        | 0,30           |        |                |         |          |          |       |       |
| Total, real         |         |          |       |       | 33    | 589         | 238            |        |                |         |          |          |       |       |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | Sun set (hh:mm) | Minutes with flicker | First time (hh:mm) with flicker | Last time (hh:mm) with flicker | (WTG causing flicker first time) | (WTG causing flicker last time) |
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|

Project:

068380ad WP Jacobahaven

Licensed user:

LBP SIGHT

Kelvinbaan 40, PO box 1475

NL-3430BL Nieuwegein

+31 3023 11377

D. Vrolijk / d.vrolijk@lbpsight.nl

Calculated:

18-6-2019 10:07/3.3.247

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 8 - Banjaard West

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|                     | January        | February       | March          | April          | May            | June           | July                       | August         | September                  | October        | November                   | December       |                |                |                |
|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------------------|----------------|----------------------------|----------------|----------------------------|----------------|----------------|----------------|----------------|
| 1                   | 08:52<br>16:46 | 08:26<br>17:34 | 07:33<br>18:25 | 07:23<br>20:18 | 06:19<br>21:08 | 05:35<br>21:53 | 06:18 (JH2)<br>06:49 (JH3) | 05:32<br>22:07 | 06:39 (JH3)<br>06:48 (JH3) | 06:08<br>21:36 | 06:36 (JH2)<br>07:02 (JH3) | 06:57<br>20:34 | 07:45<br>19:26 | 07:38<br>17:20 | 08:28<br>16:40 |
| 2                   | 08:52<br>16:47 | 08:24<br>17:35 | 07:31<br>18:26 | 07:21<br>20:19 | 06:17<br>21:10 | 05:34<br>21:54 | 06:26 (JH3)<br>06:49 (JH3) | 05:32<br>22:07 | 06:38 (JH3)<br>06:49 (JH3) | 06:09<br>21:34 | 06:38 (JH3)<br>07:02 (JH3) | 06:58<br>20:32 | 07:47<br>19:23 | 07:40<br>17:18 | 08:30<br>16:40 |
| 3                   | 08:52<br>16:48 | 08:23<br>17:37 | 07:29<br>18:28 | 07:19<br>20:21 | 06:15<br>21:11 | 05:33<br>21:55 | 06:28 (JH3)<br>06:49 (JH3) | 05:33<br>22:06 | 06:37 (JH3)<br>06:50 (JH3) | 06:11<br>21:32 | 06:39 (JH3)<br>07:01 (JH3) | 07:00<br>20:30 | 07:48<br>19:21 | 07:42<br>17:17 | 08:31<br>16:39 |
| 4                   | 08:52<br>16:50 | 08:21<br>17:39 | 07:27<br>18:30 | 07:16<br>20:23 | 06:14<br>21:13 | 05:32<br>21:56 | 06:28 (JH3)<br>06:48 (JH3) | 05:34<br>22:06 | 06:37 (JH3)<br>06:51 (JH3) | 06:12<br>21:31 | 06:40 (JH3)<br>06:59 (JH3) | 07:02<br>20:28 | 07:50<br>19:19 | 07:43<br>17:15 | 08:33<br>16:39 |
| 5                   | 08:51<br>16:51 | 08:20<br>17:41 | 07:24<br>18:32 | 07:14<br>20:25 | 06:12<br>21:15 | 05:32<br>21:57 | 06:28 (JH3)<br>06:45 (JH3) | 05:35<br>22:05 | 06:37 (JH3)<br>06:52 (JH3) | 06:14<br>21:29 | 06:42 (JH3)<br>06:59 (JH3) | 07:03<br>20:25 | 07:52<br>19:16 | 07:45<br>17:13 | 08:34<br>16:38 |
| 6                   | 08:51<br>16:52 | 08:18<br>17:43 | 07:22<br>18:33 | 07:12<br>20:26 | 06:10<br>21:16 | 05:31<br>21:58 | 06:30 (JH3)<br>06:47 (JH3) | 05:36<br>22:05 | 06:36 (JH3)<br>06:53 (JH3) | 06:15<br>21:27 | 06:43 (JH3)<br>06:57 (JH3) | 07:05<br>20:23 | 07:53<br>19:14 | 07:47<br>17:11 | 08:35<br>16:38 |
| 7                   | 08:51<br>16:53 | 08:16<br>17:45 | 07:20<br>18:35 | 07:10<br>20:28 | 06:08<br>21:18 | 05:30<br>21:59 | 06:33 (JH3)<br>06:48 (JH3) | 05:36<br>22:04 | 06:36 (JH3)<br>06:54 (JH3) | 06:17<br>21:25 | 06:45 (JH3)<br>06:56 (JH3) | 07:06<br>20:21 | 07:55<br>19:12 | 07:49<br>17:10 | 08:36<br>16:37 |
| 8                   | 08:50<br>16:55 | 08:14<br>17:46 | 07:18<br>18:37 | 07:07<br>20:30 | 06:06<br>21:19 | 05:30<br>21:58 | 06:31 (JH3)<br>06:49 (JH3) | 05:37<br>22:00 | 06:35 (JH3)<br>06:46 (JH3) | 06:18<br>21:24 | 06:46 (JH3)<br>06:53 (JH3) | 07:08<br>20:19 | 07:57<br>19:10 | 07:50<br>17:08 | 08:38<br>16:37 |
| 9                   | 08:50<br>16:56 | 08:13<br>17:48 | 07:16<br>18:39 | 07:05<br>20:31 | 06:05<br>21:21 | 05:29<br>22:01 | 06:30 (JH3)<br>06:50 (JH3) | 05:29<br>22:03 | 06:34 (JH3)<br>06:46 (JH3) | 06:20<br>21:22 | 06:48 (JH3)<br>06:55 (JH3) | 07:10<br>20:16 | 07:58<br>19:08 | 07:52<br>17:06 | 08:39<br>16:37 |
| 10                  | 08:49<br>16:57 | 08:11<br>17:50 | 07:13<br>18:40 | 07:03<br>20:33 | 06:03<br>21:23 | 05:29<br>22:02 | 06:28 (JH3)<br>06:50 (JH3) | 05:29<br>22:02 | 06:33 (JH3)<br>06:44 (JH3) | 05:39<br>22:02 | 06:34 (JH3)<br>06:56 (JH3) | 06:22<br>21:20 | 07:11<br>20:14 | 08:00<br>19:05 | 07:54<br>17:05 |
| 11                  | 08:49<br>16:59 | 08:09<br>17:52 | 07:11<br>18:42 | 07:01<br>20:35 | 06:01<br>21:24 | 05:29<br>22:02 | 06:27 (JH3)<br>06:52 (JH3) | 05:29<br>22:02 | 06:34 (JH3)<br>06:54 (JH3) | 05:40<br>22:02 | 06:27 (JH2)<br>06:57 (JH3) | 06:23<br>21:18 | 07:13<br>20:12 | 08:02<br>19:03 | 07:56<br>17:03 |
| 12                  | 08:48<br>17:00 | 08:07<br>17:54 | 07:09<br>18:44 | 06:59<br>20:36 | 06:00<br>21:26 | 05:28<br>22:01 | 06:25 (JH2)<br>06:51 (JH3) | 05:28<br>22:01 | 06:44 (JH3)<br>06:57 (JH3) | 05:41<br>21:16 | 06:25 (JH2)<br>06:44 (JH3) | 06:25<br>21:16 | 07:14<br>20:09 | 08:03<br>19:01 | 07:57<br>17:01 |
| 13                  | 08:48<br>17:02 | 08:05<br>17:56 | 07:07<br>18:46 | 06:56<br>20:38 | 05:54<br>21:27 | 05:28<br>22:04 | 06:24 (JH2)<br>06:52 (JH3) | 05:28<br>22:04 | 06:44 (JH3)<br>06:57 (JH3) | 05:42<br>21:14 | 06:24 (JH2)<br>06:58 (JH3) | 06:26<br>21:14 | 07:16<br>20:07 | 08:05<br>18:59 | 07:59<br>17:00 |
| 14                  | 08:47<br>17:03 | 08:04<br>17:57 | 07:04<br>18:47 | 06:54<br>20:40 | 05:57<br>21:29 | 05:28<br>22:04 | 06:22 (JH2)<br>06:52 (JH3) | 05:28<br>22:04 | 06:41 (JH3)<br>06:59 (JH3) | 05:44<br>21:59 | 06:23 (JH2)<br>06:59 (JH3) | 06:28<br>21:12 | 07:18<br>20:05 | 08:07<br>18:57 | 08:01<br>16:59 |
| 15                  | 08:46<br>17:05 | 08:02<br>17:59 | 07:02<br>18:49 | 06:52<br>20:41 | 05:55<br>21:30 | 05:28<br>22:05 | 06:21 (JH2)<br>06:53 (JH3) | 05:28<br>22:05 | 06:41 (JH3)<br>06:59 (JH3) | 05:45<br>21:58 | 06:22 (JH2)<br>06:59 (JH3) | 06:30<br>21:10 | 07:19<br>20:02 | 08:08<br>18:54 | 08:03<br>16:57 |
| 16                  | 08:45<br>17:06 | 08:00<br>18:01 | 07:00<br>18:51 | 06:50<br>20:43 | 05:54<br>21:32 | 05:28<br>22:06 | 06:20 (JH2)<br>06:53 (JH3) | 05:28<br>22:06 | 06:41 (JH3)<br>07:01 (JH3) | 05:46<br>21:57 | 06:23 (JH2)<br>07:01 (JH3) | 06:31<br>21:08 | 07:21<br>20:00 | 08:10<br>18:52 | 08:04<br>16:56 |
| 17                  | 08:44<br>17:08 | 07:58<br>18:03 | 06:58<br>18:52 | 06:48<br>20:45 | 05:52<br>21:33 | 05:27<br>22:06 | 06:18 (JH2)<br>06:53 (JH3) | 05:27<br>22:06 | 06:41 (JH3)<br>07:01 (JH3) | 05:47<br>21:56 | 06:22 (JH2)<br>07:01 (JH3) | 06:36<br>21:03 | 07:22<br>19:58 | 08:12<br>18:50 | 08:06<br>16:55 |
| 18                  | 08:43<br>17:09 | 07:56<br>18:05 | 06:55<br>18:54 | 06:46<br>20:46 | 05:51<br>21:35 | 05:27<br>22:06 | 06:17 (JH2)<br>06:53 (JH3) | 05:27<br>22:06 | 06:41 (JH3)<br>07:01 (JH3) | 05:48<br>21:55 | 06:21 (JH2)<br>07:01 (JH3) | 06:34<br>21:04 | 07:24<br>19:56 | 08:14<br>18:48 | 08:08<br>16:53 |
| 19                  | 08:42<br>17:11 | 07:54<br>18:07 | 06:53<br>18:56 | 06:43<br>20:48 | 05:50<br>21:36 | 05:26<br>22:07 | 06:16 (JH2)<br>06:53 (JH3) | 05:26<br>22:07 | 06:41 (JH3)<br>07:01 (JH3) | 05:50<br>21:54 | 06:21 (JH2)<br>07:02 (JH3) | 06:36<br>21:02 | 07:25<br>19:53 | 08:13<br>18:46 | 08:09<br>16:52 |
| 20                  | 08:41<br>17:13 | 07:52<br>18:08 | 06:51<br>18:58 | 06:41<br>20:50 | 05:48<br>21:38 | 05:26<br>22:07 | 06:14 (JH2)<br>06:52 (JH3) | 05:26<br>22:07 | 06:41 (JH3)<br>07:02 (JH3) | 05:51<br>21:53 | 06:20 (JH2)<br>07:02 (JH3) | 06:37<br>21:00 | 07:27<br>19:51 | 08:17<br>18:44 | 08:11<br>16:51 |
| 21                  | 08:40<br>17:14 | 07:50<br>18:10 | 06:48<br>18:59 | 06:39<br>20:51 | 05:47<br>21:39 | 05:28<br>22:07 | 06:13 (JH2)<br>06:52 (JH3) | 05:28<br>22:07 | 06:41 (JH3)<br>07:03 (JH3) | 05:52<br>21:51 | 06:22 (JH2)<br>07:03 (JH3) | 06:39<br>20:58 | 07:29<br>19:49 | 08:19<br>18:42 | 08:13<br>16:50 |
| 22                  | 08:39<br>17:16 | 07:48<br>18:12 | 06:46<br>19:01 | 06:37<br>20:53 | 05:45<br>21:41 | 05:28<br>22:07 | 06:12 (JH2)<br>06:52 (JH3) | 05:28<br>22:07 | 06:41 (JH3)<br>07:03 (JH3) | 05:53<br>21:50 | 06:23 (JH2)<br>07:03 (JH3) | 06:41<br>20:56 | 07:30<br>19:46 | 08:20<br>18:40 | 08:14<br>16:49 |
| 23                  | 08:38<br>17:18 | 07:46<br>18:14 | 06:44<br>19:03 | 06:35<br>20:55 | 05:44<br>21:42 | 05:28<br>22:08 | 06:11 (JH2)<br>06:52 (JH3) | 05:28<br>22:08 | 06:41 (JH3)<br>07:03 (JH3) | 05:55<br>21:49 | 06:24 (JH2)<br>07:03 (JH3) | 06:42<br>20:54 | 07:32<br>19:44 | 08:22<br>18:38 | 08:16<br>16:47 |
| 24                  | 08:37<br>17:19 | 07:44<br>18:16 | 06:42<br>19:04 | 06:33<br>20:56 | 05:43<br>21:43 | 05:28<br>22:08 | 06:11 (JH2)<br>06:52 (JH3) | 05:28<br>22:08 | 06:41 (JH3)<br>07:03 (JH3) | 05:56<br>21:48 | 06:25 (JH2)<br>07:03 (JH3) | 06:44<br>20:52 | 07:34<br>19:42 | 08:24<br>18:36 | 08:18<br>16:46 |
| 25                  | 08:36<br>17:21 | 07:42<br>18:17 | 06:39<br>19:06 | 06:31<br>20:58 | 05:42<br>21:45 | 05:29<br>22:08 | 06:12 (JH2)<br>06:52 (JH3) | 05:29<br>22:08 | 06:41 (JH3)<br>07:04 (JH3) | 05:58<br>21:46 | 06:27 (JH2)<br>07:04 (JH3) | 06:45<br>20:50 | 07:35<br>19:39 | 07:26<br>18:34 | 08:19<br>16:45 |
| 26                  | 08:34<br>17:23 | 07:40<br>18:19 | 06:37<br>19:08 | 06:29<br>21:00 | 05:40<br>21:46 | 05:29<br>22:08 | 06:12 (JH2)<br>06:52 (JH3) | 05:29<br>22:08 | 06:41 (JH3)<br>07:03 (JH3) | 05:59<br>21:45 | 06:28 (JH2)<br>07:03 (JH3) | 06:47<br>20:48 | 07:37<br>19:37 | 07:27<br>18:32 | 08:21<br>16:45 |
| 27                  | 08:33<br>17:25 | 07:37<br>18:21 | 06:35<br>19:09 | 06:27<br>21:01 | 05:39<br>21:47 | 05:30<br>22:08 | 06:13 (JH2)<br>06:51 (JH3) | 05:30<br>22:08 | 06:40 (JH3)<br>07:03 (JH3) | 06:00<br>21:43 | 06:29 (JH2)<br>07:03 (JH3) | 06:49<br>20:45 | 07:38<br>19:35 | 07:29<br>18:30 | 08:22<br>16:44 |
| 28                  | 08:32<br>17:26 | 07:35<br>18:23 | 06:32<br>19:11 | 06:25<br>21:03 | 05:38<br>21:48 | 05:30<br>22:08 | 06:13 (JH2)<br>06:51 (JH3) | 05:30<br>22:08 | 06:40 (JH3)<br>07:04 (JH3) | 06:02<br>21:42 | 06:31 (JH2)<br>07:04 (JH3) | 06:50<br>20:43 | 07:40<br>19:32 | 07:31<br>18:28 | 08:24<br>16:43 |
| 29                  | 08:30<br>17:28 | 07:30<br>18:25 | 06:30<br>19:13 | 06:23<br>21:05 | 05:37<br>21:50 | 05:31<br>22:07 | 06:14 (JH2)<br>06:50 (JH3) | 05:31<br>22:07 | 06:01 (JH3)<br>07:03 (JH3) | 06:03<br>21:40 | 06:32 (JH2)<br>07:03 (JH3) | 06:52<br>20:41 | 07:42<br>19:30 | 07:33<br>18:26 | 08:25<br>16:43 |
| 30                  | 08:29<br>17:30 | 07:28<br>18:24 | 06:21<br>19:14 | 06:21<br>21:06 | 05:36<br>21:51 | 05:31<br>22:07 | 06:15 (JH2)<br>06:50 (JH3) | 05:31<br>22:07 | 06:01 (JH3)<br>07:02 (JH3) | 06:05<br>21:39 | 06:33 (JH2)<br>07:02 (JH3) | 06:54<br>20:39 | 07:43<br>19:28 | 07:34<br>18:24 | 08:27<br>16:41 |
| 31                  | 08:27<br>17:32 | 07:26<br>18:26 | 06:20<br>19:16 | 06:15<br>21:06 | 05:35<br>21:52 | 05:32<br>22:08 | 06:17 (JH2)<br>06:50 (JH3) | 05:32<br>22:08 | 06:06<br>07:03 (JH3)       | 06:06<br>21:37 | 06:35 (JH2)<br>07:03 (JH3) | 06:55<br>20:37 | 07:42<br>19:32 | 07:36<br>18:22 | 08:28<br>16:45 |
| Potential sun hours | 260            | 278            | 367            | 415            | 484            | 497            | 288                        | 300            | 308                        | 318            | 328                        | 338            | 348            | 358            | 368            |
| Total, worst case   |                |                |                |                | 840            | 840            | 288                        | 300            | 308                        | 318            | 328                        | 338            | 348            | 358            | 368            |
| Sun reduction       |                |                |                |                | 0,45           | 0,45           | 0,45                       | 0,45           | 0,45                       | 0,45           | 0,45                       | 0,45           | 0,45           | 0,45           | 0,45           |
| Oper. time red.     |                |                |                |                | 0,99           | 0,99           | 0,99                       | 0,99           | 0,99                       | 0,99           | 0,99                       | 0,99           | 0,99           | 0,99           | 0,99           |
| Wind dir. red.      |                |                |                |                | 0,67           | 0,67           | 0,67                       | 0,67           | 0,67                       | 0,67           | 0,67                       | 0,67           | 0,67           | 0,67           | 0,67           |
| Total reduction     |                |                |                |                | 0,30           | 0,30           | 0,29                       | 0,30           | 0,30                       | 0,30           | 0,30                       | 0,30           | 0,30           | 0,30           | 0,30           |
| Total, real         |                |                |                |                | 250            | 250            | 84                         | 269            | 288                        | 300            | 318                        | 338            | 358            | 378            | 398            |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | First time (hh:mm) with flicker | (WTG causing flicker first time) |
|--------------|------------------|---------------------------------|----------------------------------|
|              | Sun set (hh:mm)  | Last time (hh:mm) with flicker  | (WTG causing flicker last time)  |

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 9 - Banjaard Oost

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|                     | January | February | March | April | May   | June  | July  | August | September | October | November | December |
|---------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|
| 1                   | 08:52   | 08:26    | 07:33 | 07:23 | 06:19 | 05:35 | 05:32 | 06:08  | 06:57     | 07:45   | 07:38    | 08:28    |
|                     | 16:46   | 17:34    | 18:25 | 20:18 | 21:08 | 21:53 | 22:07 | 21:36  | 20:34     | 19:26   | 17:20    | 16:40    |
| 2                   | 08:52   | 08:24    | 07:31 | 07:21 | 06:17 | 05:34 | 05:32 | 06:09  | 06:58     | 07:47   | 07:40    | 08:30    |
|                     | 16:47   | 17:35    | 18:26 | 20:19 | 21:10 | 21:54 | 22:07 | 21:34  | 20:32     | 19:23   | 17:18    | 16:40    |
| 3                   | 08:52   | 08:23    | 07:29 | 07:19 | 06:15 | 05:33 | 05:33 | 06:11  | 07:00     | 07:48   | 07:42    | 08:31    |
|                     | 16:48   | 17:37    | 18:28 | 20:21 | 21:11 | 21:55 | 22:06 | 21:32  | 20:30     | 19:21   | 17:17    | 16:39    |
| 4                   | 08:52   | 08:21    | 07:27 | 07:16 | 06:14 | 05:32 | 05:34 | 06:12  | 07:02     | 07:50   | 07:43    | 08:32    |
|                     | 16:50   | 17:39    | 18:30 | 20:23 | 21:13 | 21:56 | 22:06 | 21:31  | 20:28     | 19:19   | 17:15    | 16:39    |
| 5                   | 08:51   | 08:19    | 07:24 | 07:14 | 06:12 | 05:32 | 05:35 | 06:14  | 07:03     | 07:52   | 07:45    | 08:34    |
|                     | 16:51   | 17:41    | 18:32 | 20:24 | 21:15 | 21:57 | 22:05 | 21:29  | 20:25     | 19:16   | 17:13    | 16:38    |
| 6                   | 08:51   | 08:18    | 07:22 | 07:12 | 06:10 | 05:31 | 05:36 | 06:15  | 07:05     | 07:53   | 07:47    | 08:35    |
|                     | 16:52   | 17:43    | 18:33 | 20:26 | 21:16 | 21:58 | 22:05 | 21:27  | 20:23     | 19:14   | 17:11    | 16:38    |
| 7                   | 08:51   | 08:16    | 07:20 | 07:10 | 06:08 | 05:30 | 05:36 | 06:17  | 07:06     | 07:55   | 07:49    | 08:36    |
|                     | 16:53   | 17:45    | 18:35 | 20:28 | 21:18 | 21:59 | 22:04 | 21:25  | 20:21     | 19:12   | 17:10    | 16:37    |
| 8                   | 08:50   | 08:14    | 07:18 | 07:07 | 06:06 | 05:30 | 05:37 | 06:18  | 07:08     | 07:57   | 07:50    | 08:38    |
|                     | 16:55   | 17:46    | 18:37 | 20:30 | 21:19 | 22:00 | 22:04 | 21:24  | 20:19     | 19:10   | 17:08    | 16:37    |
| 9                   | 08:50   | 08:13    | 07:16 | 07:05 | 06:05 | 05:29 | 05:38 | 06:20  | 07:10     | 07:58   | 07:52    | 08:39    |
|                     | 16:56   | 17:48    | 18:39 | 20:31 | 21:21 | 22:01 | 22:03 | 21:22  | 20:16     | 19:08   | 17:06    | 16:37    |
| 10                  | 08:49   | 08:11    | 07:13 | 07:03 | 06:03 | 05:29 | 05:39 | 06:22  | 07:11     | 08:00   | 07:54    | 08:40    |
|                     | 16:57   | 17:50    | 18:40 | 20:33 | 21:23 | 22:02 | 22:02 | 21:20  | 20:14     | 19:05   | 17:05    | 16:37    |
| 11                  | 08:49   | 08:09    | 07:11 | 07:01 | 06:01 | 05:29 | 05:40 | 06:23  | 07:13     | 08:02   | 07:56    | 08:41    |
|                     | 16:59   | 17:52    | 18:42 | 20:35 | 21:24 | 22:02 | 22:02 | 21:18  | 20:12     | 19:03   | 17:03    | 16:36    |
| 12                  | 08:48   | 08:07    | 07:09 | 06:59 | 06:00 | 05:28 | 05:41 | 06:25  | 07:14     | 08:03   | 07:57    | 08:42    |
|                     | 17:00   | 17:54    | 18:44 | 20:36 | 21:26 | 22:03 | 22:01 | 21:16  | 20:09     | 19:01   | 17:02    | 16:36    |
| 13                  | 08:47   | 08:05    | 07:07 | 06:56 | 05:58 | 05:28 | 05:42 | 06:26  | 07:16     | 08:05   | 07:59    | 08:43    |
|                     | 17:02   | 17:56    | 18:46 | 20:38 | 21:27 | 22:04 | 22:00 | 21:14  | 20:07     | 18:59   | 17:00    | 16:36    |
| 14                  | 08:47   | 08:04    | 07:04 | 06:54 | 05:57 | 05:28 | 05:43 | 06:28  | 07:17     | 08:07   | 08:01    | 08:44    |
|                     | 17:03   | 17:57    | 18:47 | 20:40 | 21:29 | 22:04 | 21:59 | 21:12  | 20:05     | 18:57   | 16:59    | 16:36    |
| 15                  | 08:46   | 08:02    | 07:02 | 06:52 | 05:55 | 05:28 | 05:45 | 06:29  | 07:19     | 08:08   | 08:03    | 08:45    |
|                     | 17:05   | 17:59    | 18:49 | 20:41 | 21:30 | 22:05 | 21:58 | 21:10  | 20:02     | 18:54   | 16:57    | 16:36    |
| 16                  | 08:45   | 08:00    | 07:00 | 06:50 | 05:53 | 05:27 | 05:46 | 06:31  | 07:21     | 08:10   | 08:04    | 08:46    |
|                     | 17:06   | 18:01    | 18:51 | 20:43 | 21:32 | 22:05 | 21:57 | 21:08  | 20:00     | 18:52   | 16:56    | 16:36    |
| 17                  | 08:44   | 07:58    | 06:58 | 06:48 | 05:52 | 05:27 | 05:47 | 06:33  | 07:22     | 08:12   | 08:06    | 08:46    |
|                     | 17:08   | 18:03    | 18:52 | 20:45 | 21:33 | 22:06 | 21:56 | 21:06  | 19:58     | 18:50   | 16:55    | 16:37    |
| 18                  | 08:43   | 07:56    | 06:55 | 06:46 | 05:51 | 05:27 | 05:48 | 06:34  | 07:24     | 08:13   | 08:08    | 08:47    |
|                     | 17:09   | 18:05    | 18:54 | 20:46 | 21:35 | 22:06 | 21:55 | 21:04  | 19:56     | 18:48   | 16:53    | 16:37    |
| 19                  | 08:42   | 07:54    | 06:53 | 06:43 | 05:49 | 05:27 | 05:50 | 06:36  | 07:26     | 08:15   | 08:09    | 08:48    |
|                     | 17:11   | 18:07    | 18:56 | 20:48 | 21:36 | 22:07 | 21:54 | 21:02  | 19:53     | 18:46   | 16:52    | 16:37    |
| 20                  | 08:41   | 07:52    | 06:51 | 06:41 | 05:48 | 05:28 | 05:51 | 06:37  | 07:27     | 08:17   | 08:11    | 08:49    |
|                     | 17:13   | 18:08    | 18:58 | 20:50 | 21:38 | 22:07 | 21:53 | 21:00  | 19:51     | 18:44   | 16:51    | 16:38    |
| 21                  | 08:40   | 07:50    | 06:48 | 06:39 | 05:46 | 05:28 | 05:52 | 06:39  | 07:29     | 08:19   | 08:13    | 08:49    |
|                     | 17:14   | 18:10    | 18:59 | 20:51 | 21:39 | 22:07 | 21:51 | 20:58  | 19:49     | 18:42   | 16:50    | 16:38    |
| 22                  | 08:39   | 07:48    | 06:46 | 06:37 | 05:45 | 05:28 | 05:53 | 06:41  | 07:30     | 08:20   | 08:14    | 08:50    |
|                     | 17:16   | 18:12    | 19:01 | 20:53 | 21:40 | 22:07 | 21:50 | 20:56  | 19:46     | 18:40   | 16:49    | 16:38    |
| 23                  | 08:38   | 07:46    | 06:44 | 06:35 | 05:44 | 05:28 | 05:55 | 06:42  | 07:32     | 08:22   | 08:16    | 08:50    |
|                     | 17:18   | 18:14    | 19:03 | 20:55 | 21:42 | 22:08 | 21:49 | 20:54  | 19:44     | 18:38   | 16:47    | 16:39    |
| 24                  | 08:37   | 07:44    | 06:42 | 06:33 | 05:43 | 05:28 | 05:56 | 06:44  | 07:34     | 08:24   | 08:18    | 08:51    |
|                     | 17:19   | 18:16    | 19:04 | 20:56 | 21:43 | 22:08 | 21:48 | 20:52  | 19:42     | 18:36   | 16:46    | 16:40    |
| 25                  | 08:36   | 07:42    | 06:39 | 06:31 | 05:42 | 05:29 | 05:58 | 06:45  | 07:35     | 07:26   | 08:19    | 08:51    |
|                     | 17:21   | 18:17    | 19:06 | 20:58 | 21:45 | 22:08 | 21:46 | 20:50  | 19:39     | 17:34   | 16:45    | 16:40    |
| 26                  | 08:34   | 07:39    | 06:37 | 06:29 | 05:40 | 05:29 | 05:59 | 06:47  | 07:37     | 07:27   | 08:21    | 08:51    |
|                     | 17:23   | 18:19    | 19:08 | 21:00 | 21:46 | 22:08 | 21:45 | 20:47  | 19:37     | 17:32   | 16:44    | 16:41    |
| 27                  | 08:33   | 07:37    | 06:35 | 06:27 | 05:39 | 05:30 | 06:00 | 06:49  | 07:38     | 07:29   | 08:22    | 08:52    |
|                     | 17:25   | 18:21    | 19:09 | 21:01 | 21:47 | 22:08 | 21:43 | 20:45  | 19:35     | 17:30   | 16:44    | 16:42    |
| 28                  | 08:32   | 07:35    | 06:32 | 06:25 | 05:38 | 05:30 | 06:02 | 06:50  | 07:40     | 07:31   | 08:24    | 08:52    |
|                     | 17:26   | 18:23    | 19:11 | 21:03 | 21:48 | 22:08 | 21:42 | 20:43  | 19:32     | 17:28   | 16:43    | 16:42    |
| 29                  | 08:30   |          | 07:30 | 06:23 | 05:37 | 05:31 | 06:03 | 06:52  | 07:42     | 07:33   | 08:25    | 08:52    |
|                     | 17:28   |          | 20:13 | 21:05 | 21:50 | 22:07 | 21:40 | 20:41  | 19:30     | 17:26   | 16:42    | 16:43    |
| 30                  | 08:29   |          | 07:28 | 06:21 | 05:36 | 05:31 | 06:05 | 06:53  | 07:43     | 07:34   | 08:27    | 08:52    |
|                     | 17:30   |          | 20:14 | 21:06 | 21:51 | 22:07 | 21:39 | 20:39  | 19:28     | 17:24   | 16:41    | 16:44    |
| 31                  | 08:27   |          | 07:26 |       | 05:35 |       | 06:06 | 06:55  |           | 07:36   |          | 08:52    |
|                     | 17:32   |          | 20:16 |       | 21:52 |       | 21:37 | 20:37  |           | 17:22   |          | 16:45    |
| Potential sun hours | 260     | 278      | 367   | 415   | 484   | 497   | 500   | 453    | 381       | 332     | 267      | 245      |
| Total, worst case   |         |          |       |       |       |       |       |        |           |         |          |          |
| Sun reduction       |         |          |       |       |       |       |       |        |           |         |          |          |
| Oper. time red.     |         |          |       |       |       |       |       |        |           |         |          |          |
| Wind dir. red.      |         |          |       |       |       |       |       |        |           |         |          |          |
| Total reduction     |         |          |       |       |       |       |       |        |           |         |          |          |
| Total, real         |         |          |       |       |       |       |       |        |           |         |          |          |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | Sun set (hh:mm) | Minutes with flicker | First time (hh:mm) with flicker | Last time (hh:mm) with flicker | (WTG causing flicker first time) | (WTG causing flicker last time) |
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 10 - Banjaard Centraal

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

|                     | January | February | March | April | May   | June  | July  | August | September | October | November | December |
|---------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|
| 1                   | 08:52   | 08:26    | 07:33 | 07:23 | 06:19 | 05:35 | 05:32 | 06:08  | 06:57     | 07:45   | 07:38    | 08:28    |
|                     | 16:46   | 17:34    | 18:25 | 20:18 | 21:08 | 21:53 | 22:07 | 21:36  | 20:34     | 19:26   | 17:20    | 16:40    |
| 2                   | 08:52   | 08:24    | 07:31 | 07:21 | 06:17 | 05:34 | 05:32 | 06:09  | 06:58     | 07:47   | 07:40    | 08:30    |
|                     | 16:47   | 17:35    | 18:26 | 20:19 | 21:10 | 21:54 | 22:07 | 21:34  | 20:32     | 19:23   | 17:18    | 16:40    |
| 3                   | 08:52   | 08:23    | 07:29 | 07:19 | 06:15 | 05:33 | 05:33 | 06:11  | 07:00     | 07:48   | 07:42    | 08:31    |
|                     | 16:48   | 17:37    | 18:28 | 20:21 | 21:11 | 21:55 | 22:06 | 21:32  | 20:30     | 19:21   | 17:17    | 16:39    |
| 4                   | 08:52   | 08:21    | 07:27 | 07:16 | 06:14 | 05:32 | 05:34 | 06:12  | 07:02     | 07:50   | 07:43    | 08:32    |
|                     | 16:50   | 17:39    | 18:30 | 20:23 | 21:13 | 21:56 | 22:06 | 21:31  | 20:28     | 19:19   | 17:15    | 16:39    |
| 5                   | 08:51   | 08:20    | 07:24 | 07:14 | 06:12 | 05:32 | 05:35 | 06:14  | 07:03     | 07:52   | 07:45    | 08:34    |
|                     | 16:51   | 17:41    | 18:32 | 20:25 | 21:15 | 21:57 | 22:05 | 21:29  | 20:25     | 19:16   | 17:13    | 16:38    |
| 6                   | 08:51   | 08:18    | 07:22 | 07:12 | 06:10 | 05:31 | 05:36 | 06:15  | 07:05     | 07:53   | 07:47    | 08:35    |
|                     | 16:52   | 17:43    | 18:33 | 20:26 | 21:16 | 21:58 | 22:05 | 21:27  | 20:23     | 19:14   | 17:11    | 16:38    |
| 7                   | 08:51   | 08:16    | 07:20 | 07:10 | 06:08 | 05:30 | 05:36 | 06:17  | 07:06     | 07:55   | 07:49    | 08:36    |
|                     | 16:53   | 17:45    | 18:35 | 20:28 | 21:18 | 21:59 | 22:04 | 21:25  | 20:21     | 19:12   | 17:10    | 16:37    |
| 8                   | 08:50   | 08:14    | 07:18 | 07:07 | 06:06 | 05:30 | 05:37 | 06:18  | 07:08     | 07:57   | 07:50    | 08:38    |
|                     | 16:55   | 17:46    | 18:37 | 20:30 | 21:19 | 22:00 | 22:04 | 21:24  | 20:19     | 19:10   | 17:08    | 16:37    |
| 9                   | 08:50   | 08:13    | 07:16 | 07:05 | 06:05 | 05:29 | 05:38 | 06:20  | 07:10     | 07:58   | 07:52    | 08:39    |
|                     | 16:56   | 17:48    | 18:39 | 20:31 | 21:21 | 22:01 | 22:03 | 21:22  | 20:16     | 19:08   | 17:06    | 16:37    |
| 10                  | 08:49   | 08:11    | 07:13 | 07:03 | 06:03 | 05:29 | 05:39 | 06:22  | 07:11     | 08:00   | 07:54    | 08:40    |
|                     | 16:57   | 17:50    | 18:40 | 20:33 | 21:23 | 22:02 | 22:02 | 21:20  | 20:14     | 19:05   | 17:05    | 16:37    |
| 11                  | 08:49   | 08:09    | 07:11 | 07:01 | 06:01 | 05:29 | 05:40 | 06:23  | 07:13     | 08:02   | 07:56    | 08:41    |
|                     | 16:59   | 17:52    | 18:42 | 20:35 | 21:24 | 22:02 | 22:02 | 21:18  | 20:12     | 19:03   | 17:03    | 16:36    |
| 12                  | 08:48   | 08:07    | 07:09 | 06:59 | 06:00 | 05:28 | 05:41 | 06:25  | 07:14     | 08:03   | 07:57    | 08:42    |
|                     | 17:00   | 17:54    | 18:44 | 20:36 | 21:26 | 22:03 | 22:01 | 21:16  | 20:09     | 19:01   | 17:02    | 16:36    |
| 13                  | 08:47   | 08:05    | 07:07 | 06:56 | 05:58 | 05:28 | 05:42 | 06:26  | 07:16     | 08:05   | 07:59    | 08:43    |
|                     | 17:02   | 17:56    | 18:46 | 20:38 | 21:27 | 22:04 | 22:00 | 21:14  | 20:07     | 18:59   | 17:00    | 16:36    |
| 14                  | 08:47   | 08:04    | 07:04 | 06:54 | 05:57 | 05:28 | 05:44 | 06:28  | 07:18     | 08:07   | 08:01    | 08:44    |
|                     | 17:03   | 17:57    | 18:47 | 20:40 | 21:29 | 22:04 | 21:59 | 21:12  | 20:05     | 18:57   | 16:59    | 16:36    |
| 15                  | 08:46   | 08:02    | 07:02 | 06:52 | 05:55 | 05:28 | 05:45 | 06:30  | 07:19     | 08:08   | 08:03    | 08:45    |
|                     | 17:05   | 17:59    | 18:49 | 20:41 | 21:30 | 22:05 | 21:58 | 21:10  | 20:02     | 18:54   | 16:57    | 16:36    |
| 16                  | 08:45   | 08:00    | 07:00 | 06:50 | 05:54 | 05:28 | 05:46 | 06:31  | 07:21     | 08:10   | 08:04    | 08:46    |
|                     | 17:06   | 18:01    | 18:51 | 20:43 | 21:32 | 22:05 | 21:57 | 21:08  | 20:00     | 18:52   | 16:56    | 16:36    |
| 17                  | 08:44   | 07:58    | 06:58 | 06:48 | 05:52 | 05:27 | 05:47 | 06:33  | 07:22     | 08:12   | 08:06    | 08:46    |
|                     | 17:08   | 18:03    | 18:52 | 20:45 | 21:33 | 22:06 | 21:56 | 21:06  | 19:58     | 18:50   | 16:55    | 16:37    |
| 18                  | 08:43   | 07:56    | 06:55 | 06:46 | 05:51 | 05:27 | 05:48 | 06:34  | 07:24     | 08:14   | 08:08    | 08:47    |
|                     | 17:09   | 18:05    | 18:54 | 20:46 | 21:35 | 22:06 | 21:55 | 21:04  | 19:56     | 18:48   | 16:53    | 16:37    |
| 19                  | 08:42   | 07:54    | 06:53 | 06:43 | 05:49 | 05:27 | 05:50 | 06:36  | 07:26     | 08:15   | 08:09    | 08:48    |
|                     | 17:11   | 18:07    | 18:56 | 20:48 | 21:36 | 22:07 | 21:54 | 21:02  | 19:53     | 18:46   | 16:52    | 16:37    |
| 20                  | 08:41   | 07:52    | 06:51 | 06:41 | 05:48 | 05:28 | 05:51 | 06:37  | 07:27     | 08:17   | 08:11    | 08:49    |
|                     | 17:13   | 18:08    | 18:58 | 20:50 | 21:38 | 22:07 | 21:53 | 21:00  | 19:51     | 18:44   | 16:51    | 16:38    |
| 21                  | 08:40   | 07:50    | 06:48 | 06:39 | 05:47 | 05:28 | 05:52 | 06:39  | 07:29     | 08:19   | 08:13    | 08:49    |
|                     | 17:14   | 18:10    | 18:59 | 20:51 | 21:39 | 22:07 | 21:51 | 20:58  | 19:49     | 18:42   | 16:50    | 16:38    |
| 22                  | 08:39   | 07:48    | 06:46 | 06:37 | 05:45 | 05:28 | 05:53 | 06:41  | 07:30     | 08:20   | 08:14    | 08:50    |
|                     | 17:16   | 18:12    | 19:01 | 20:53 | 21:40 | 22:07 | 21:50 | 20:56  | 19:46     | 18:40   | 16:49    | 16:38    |
| 23                  | 08:38   | 07:46    | 06:44 | 06:35 | 05:44 | 05:28 | 05:55 | 06:42  | 07:32     | 08:22   | 08:16    | 08:50    |
|                     | 17:18   | 18:14    | 19:03 | 20:55 | 21:42 | 22:08 | 21:49 | 20:54  | 19:44     | 18:38   | 16:47    | 16:39    |
| 24                  | 08:37   | 07:44    | 06:42 | 06:33 | 05:43 | 05:28 | 05:56 | 06:44  | 07:34     | 08:24   | 08:18    | 08:51    |
|                     | 17:19   | 18:16    | 19:04 | 20:56 | 21:43 | 22:08 | 21:48 | 20:52  | 19:42     | 18:36   | 16:46    | 16:40    |
| 25                  | 08:36   | 07:42    | 06:39 | 06:31 | 05:42 | 05:29 | 05:58 | 06:45  | 07:35     | 07:26   | 08:19    | 08:51    |
|                     | 17:21   | 18:17    | 19:06 | 20:58 | 21:45 | 22:08 | 21:46 | 20:50  | 19:39     | 17:34   | 16:45    | 16:40    |
| 26                  | 08:34   | 07:39    | 06:37 | 06:29 | 05:40 | 05:29 | 05:59 | 06:47  | 07:37     | 07:27   | 08:21    | 08:51    |
|                     | 17:23   | 18:19    | 19:08 | 21:00 | 21:46 | 22:08 | 21:45 | 20:47  | 19:37     | 17:32   | 16:45    | 16:41    |
| 27                  | 08:33   | 07:37    | 06:35 | 06:27 | 05:39 | 05:30 | 06:00 | 06:49  | 07:38     | 07:29   | 08:22    | 08:52    |
|                     | 17:25   | 18:21    | 19:09 | 21:01 | 21:47 | 22:08 | 21:43 | 20:45  | 19:35     | 17:30   | 16:44    | 16:42    |
| 28                  | 08:32   | 07:35    | 06:32 | 06:25 | 05:38 | 05:30 | 06:02 | 06:50  | 07:40     | 07:31   | 08:24    | 08:52    |
|                     | 17:26   | 18:23    | 19:11 | 21:03 | 21:48 | 22:08 | 21:42 | 20:43  | 19:32     | 17:28   | 16:43    | 16:42    |
| 29                  | 08:30   |          | 07:30 | 06:23 | 05:37 | 05:31 | 06:03 | 06:52  | 07:42     | 07:33   | 08:25    | 08:52    |
|                     | 17:28   |          | 20:13 | 21:05 | 21:50 | 22:07 | 21:40 | 20:41  | 19:30     | 17:26   | 16:42    | 16:43    |
| 30                  | 08:29   |          | 07:28 | 06:21 | 05:36 | 05:31 | 06:05 | 06:54  | 07:43     | 07:34   | 08:27    | 08:52    |
|                     | 17:30   |          | 20:14 | 21:06 | 21:51 | 22:07 | 21:39 | 20:39  | 19:28     | 17:24   | 16:41    | 16:44    |
| 31                  | 08:27   |          | 07:26 |       | 05:35 |       | 06:06 | 06:55  |           | 07:36   |          | 08:52    |
|                     | 17:32   |          | 20:16 |       | 21:52 |       | 21:37 | 20:37  |           | 17:22   |          | 16:45    |
| Potential sun hours | 260     | 278      | 367   | 415   | 484   | 497   | 500   | 453    | 381       | 332     | 267      | 245      |
| Total, worst case   |         |          |       |       |       |       |       |        |           |         |          |          |
| Sun reduction       |         |          |       |       |       |       |       |        |           |         |          |          |
| Oper. time red.     |         |          |       |       |       |       |       |        |           |         |          |          |
| Wind dir. red.      |         |          |       |       |       |       |       |        |           |         |          |          |
| Total reduction     |         |          |       |       |       |       |       |        |           |         |          |          |
| Total, real         |         |          |       |       |       |       |       |        |           |         |          |          |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | Sun set (hh:mm) | Minutes with flicker | First time (hh:mm) with flicker | Last time (hh:mm) with flicker | (WTG causing flicker first time) | (WTG causing flicker last time) |
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|

## SHADOW - Calendar

Calculation: V117 - Alle turbinesShadow receptor: 11 - Banjaard Strandpaviljoen

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

| Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 2,20 | 3,20 | 4,30 | 6,20 | 7,00 | 7,20 | 7,20 | 6,70 | 5,10 | 3,80 | 2,30 | 1,70 |

Operational time

| N   | NNE | ENE | E   | ESE | SSE | S   | SSW   | WSW   | W   | WNW | NNW | Sum   |
|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|-----|-------|
| 563 | 673 | 737 | 507 | 350 | 394 | 853 | 1.312 | 1.152 | 974 | 554 | 619 | 8.688 |

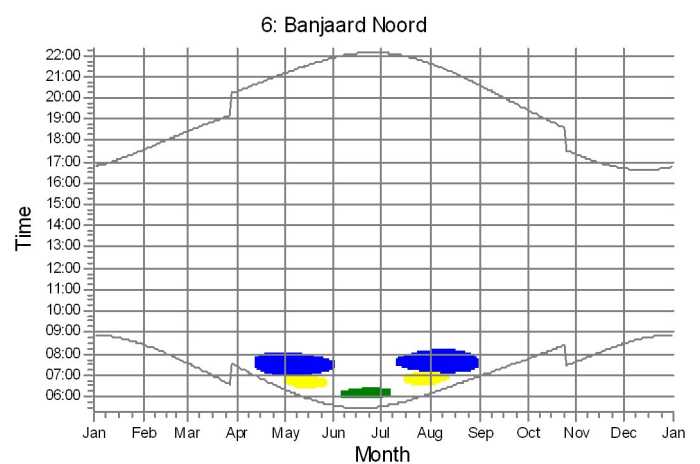
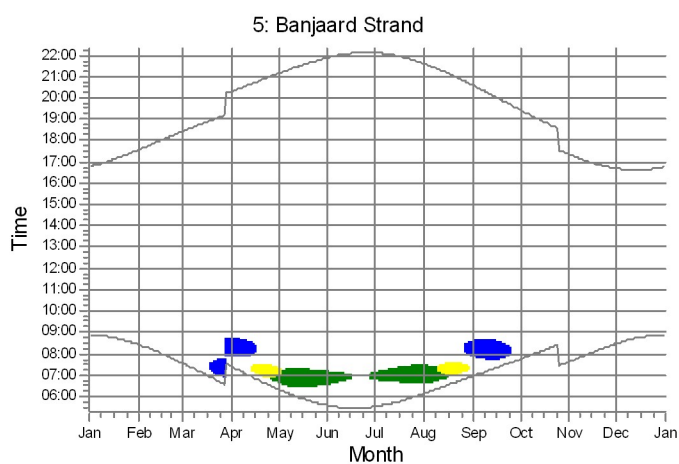
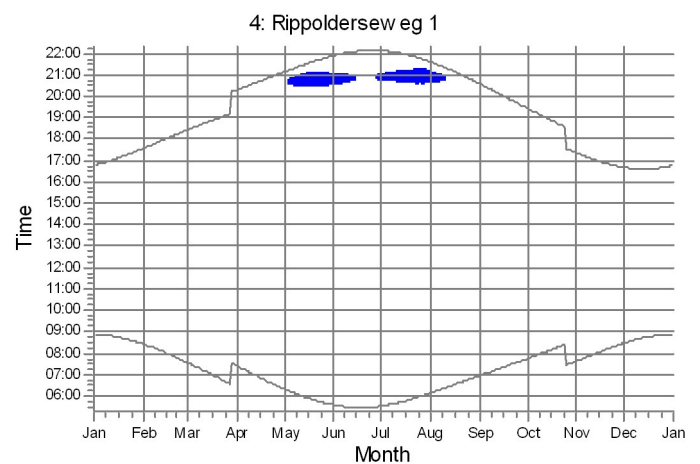
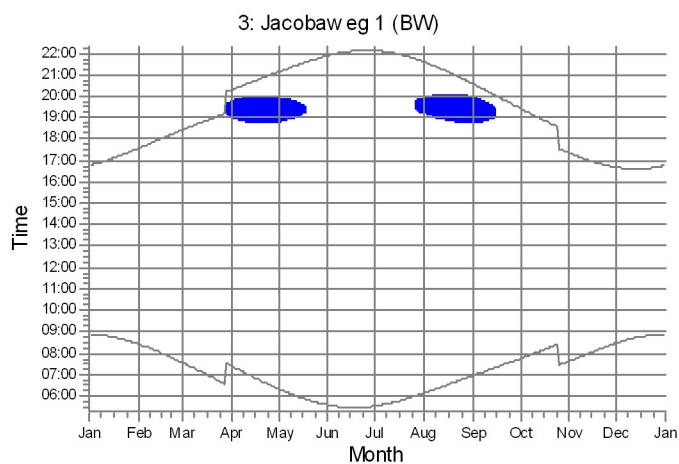
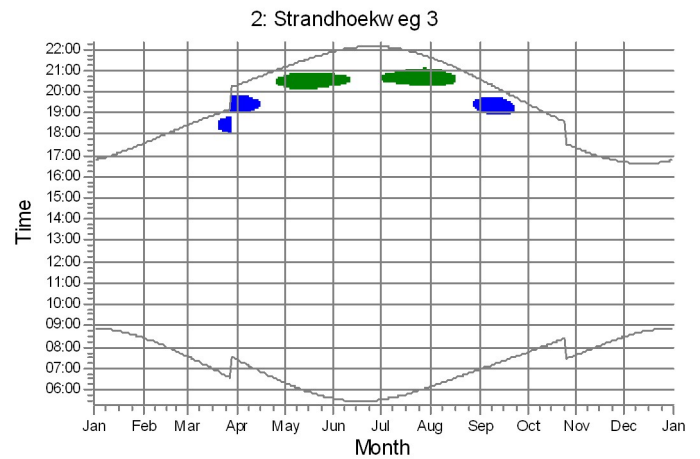
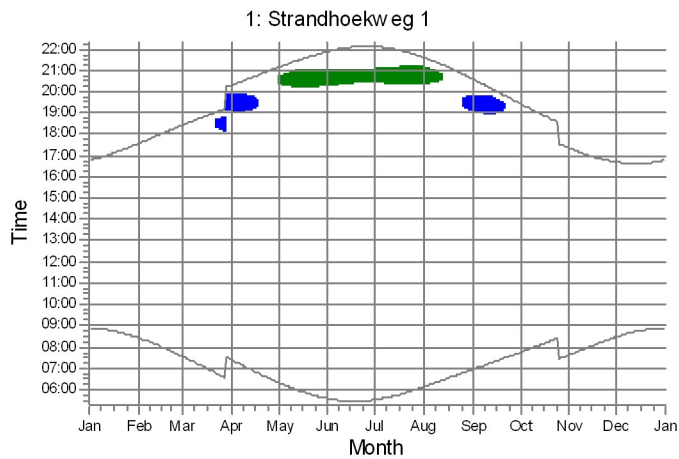
|                     | January        | February       | March          | April          | May                  | June                 | July           | August         | September            | October        | November       | December       |
|---------------------|----------------|----------------|----------------|----------------|----------------------|----------------------|----------------|----------------|----------------------|----------------|----------------|----------------|
| 1                   | 08:52<br>16:46 | 08:26<br>17:34 | 07:33<br>18:25 | 07:23<br>20:18 | 06:19<br>21:08       | 06:43 (JH1)<br>21:53 | 05:35<br>22:07 | 06:08<br>21:36 | 06:39 (JH1)<br>20:34 | 06:57<br>19:26 | 07:45<br>17:20 | 08:28<br>16:41 |
| 2                   | 08:52<br>16:47 | 08:24<br>17:35 | 07:31<br>18:26 | 07:21<br>20:20 | 06:17<br>21:10       | 06:42 (JH1)<br>21:54 | 05:32<br>22:07 | 06:09<br>21:34 | 06:39 (JH1)<br>20:32 | 06:58<br>19:23 | 07:47<br>17:18 | 08:30<br>16:40 |
| 3                   | 08:52<br>16:49 | 08:23<br>17:37 | 07:29<br>18:28 | 07:19<br>20:21 | 06:15<br>21:11       | 06:40 (JH1)<br>21:55 | 05:33<br>22:06 | 06:11<br>21:32 | 06:39 (JH1)<br>20:30 | 07:00<br>19:21 | 07:48<br>17:17 | 08:31<br>16:39 |
| 4                   | 08:52<br>16:50 | 08:21<br>17:39 | 07:27<br>18:30 | 07:16<br>20:23 | 06:14<br>21:13       | 06:46 (JH1)<br>21:56 | 05:34<br>22:06 | 06:12<br>21:31 | 06:41 (JH1)<br>20:28 | 07:02<br>19:19 | 07:50<br>17:15 | 08:33<br>16:39 |
| 5                   | 08:52<br>16:51 | 08:20<br>17:41 | 07:24<br>18:32 | 07:14<br>20:25 | 06:12<br>21:15       | 06:36 (JH1)<br>21:57 | 05:35<br>22:05 | 06:14<br>21:29 | 06:42 (JH1)<br>20:25 | 07:03<br>19:17 | 07:52<br>17:13 | 08:34<br>16:38 |
| 6                   | 08:51<br>16:52 | 08:18<br>17:43 | 07:22<br>18:33 | 07:12<br>20:26 | 06:10<br>21:16       | 06:35 (JH1)<br>21:58 | 05:36<br>22:05 | 06:15<br>21:27 | 06:43 (JH1)<br>20:23 | 07:05<br>19:14 | 07:53<br>17:11 | 08:35<br>16:38 |
| 7                   | 08:51<br>16:53 | 08:16<br>17:45 | 07:20<br>18:35 | 07:10<br>20:28 | 06:08<br>21:18       | 06:33 (JH1)<br>21:59 | 05:36<br>22:04 | 06:17<br>21:25 | 06:45 (JH1)<br>20:21 | 07:06<br>19:12 | 07:55<br>17:10 | 08:36<br>16:37 |
| 8                   | 08:50<br>16:55 | 08:14<br>17:46 | 07:18<br>18:37 | 07:07<br>20:30 | 06:06<br>21:19       | 06:31 (JH1)<br>22:00 | 05:37<br>22:04 | 06:19<br>21:24 | 06:46 (JH1)<br>20:19 | 07:08<br>19:10 | 07:57<br>17:08 | 08:38<br>16:37 |
| 9                   | 08:50<br>16:56 | 08:13<br>17:48 | 07:16<br>18:39 | 07:05<br>20:31 | 06:05<br>21:21       | 06:30 (JH1)<br>22:01 | 05:38<br>22:03 | 06:20<br>21:22 | 06:48 (JH1)<br>20:16 | 07:10<br>19:08 | 07:58<br>17:06 | 08:39<br>16:37 |
| 10                  | 08:49<br>16:57 | 08:11<br>17:50 | 07:13<br>18:40 | 07:03<br>20:33 | 06:03<br>21:23       | 06:28 (JH1)<br>22:02 | 05:39<br>22:02 | 06:22<br>21:20 | 06:56 (JH1)<br>20:14 | 07:11<br>19:05 | 08:00<br>17:05 | 08:40<br>16:37 |
| 11                  | 08:49<br>16:59 | 08:09<br>17:52 | 07:11<br>18:42 | 07:01<br>20:35 | 06:01<br>21:24       | 06:45 (JH1)<br>22:02 | 05:40<br>22:02 | 06:23<br>21:18 | 07:13 (JH1)<br>20:12 | 07:13<br>19:03 | 08:02<br>17:03 | 08:41<br>16:36 |
| 12                  | 08:48<br>17:00 | 08:07<br>17:54 | 07:09<br>18:44 | 06:59<br>20:36 | 07:21 (JH3)<br>21:26 | 06:45 (JH1)<br>22:03 | 05:41<br>22:01 | 06:25<br>21:16 | 07:14 (JH3)<br>20:09 | 08:03<br>19:01 | 07:58<br>17:02 | 08:42<br>16:36 |
| 13                  | 08:48<br>17:02 | 08:05<br>17:56 | 07:07<br>18:46 | 06:56<br>20:38 | 07:19 (JH3)<br>21:27 | 06:30 (JH1)<br>22:04 | 05:42<br>22:00 | 06:26<br>21:14 | 07:16 (JH3)<br>20:07 | 08:05<br>18:59 | 07:59<br>17:00 | 08:43<br>16:36 |
| 14                  | 08:47<br>17:03 | 08:04<br>17:57 | 07:04<br>18:47 | 06:54<br>20:40 | 07:17 (JH3)<br>21:29 | 06:31 (JH1)<br>22:04 | 05:44<br>21:59 | 06:28<br>21:12 | 07:18 (JH3)<br>20:05 | 08:07<br>18:57 | 08:01<br>16:59 | 08:44<br>16:36 |
| 15                  | 08:46<br>17:05 | 08:02<br>17:59 | 07:02<br>18:49 | 06:52<br>20:41 | 07:15 (JH3)<br>21:30 | 06:34 (JH1)<br>22:05 | 05:45<br>21:58 | 06:30<br>21:10 | 07:19 (JH3)<br>20:03 | 08:08<br>18:54 | 08:03<br>16:57 | 08:45<br>16:36 |
| 16                  | 08:45<br>17:06 | 08:00<br>18:01 | 07:00<br>18:51 | 06:50<br>20:43 | 07:13 (JH3)<br>21:32 | 06:38 (JH1)<br>22:05 | 05:46<br>21:57 | 06:31<br>21:08 | 07:21 (JH3)<br>20:00 | 08:10<br>18:52 | 08:04<br>16:56 | 08:46<br>16:36 |
| 17                  | 08:44<br>17:08 | 07:58<br>18:03 | 06:58<br>18:52 | 06:48<br>20:45 | 07:11 (JH3)<br>21:33 | 06:27 (JH1)<br>22:06 | 05:47<br>21:56 | 06:33<br>21:06 | 07:22 (JH3)<br>19:58 | 08:12<br>18:50 | 08:06<br>16:55 | 08:46<br>16:37 |
| 18                  | 08:43<br>17:09 | 07:56<br>18:05 | 06:55<br>18:54 | 06:46<br>20:46 | 07:09 (JH3)<br>21:35 | 06:26 (JH1)<br>22:06 | 05:48<br>21:55 | 06:34<br>21:04 | 07:16 (JH3)<br>19:56 | 08:14<br>18:48 | 08:08<br>16:53 | 08:47<br>16:37 |
| 19                  | 08:42<br>17:11 | 07:54<br>18:07 | 06:53<br>18:56 | 06:43<br>20:48 | 07:07 (JH3)<br>21:36 | 06:27 (JH1)<br>22:07 | 05:50<br>21:54 | 06:36<br>21:02 | 07:13 (JH3)<br>19:53 | 08:15<br>18:46 | 08:10<br>16:52 | 08:48<br>16:37 |
| 20                  | 08:41<br>17:13 | 07:52<br>18:08 | 06:51<br>18:58 | 06:41<br>20:50 | 07:05 (JH3)<br>21:38 | 06:28 (JH1)<br>22:07 | 05:51<br>21:53 | 06:38<br>21:00 | 07:11 (JH3)<br>19:51 | 08:17<br>18:44 | 08:11<br>16:51 | 08:49<br>16:38 |
| 21                  | 08:40<br>17:14 | 07:50<br>18:10 | 06:48<br>18:59 | 06:39<br>20:51 | 07:04 (JH3)<br>21:39 | 06:29 (JH1)<br>22:07 | 05:52<br>21:51 | 06:39<br>20:58 | 07:10 (JH3)<br>19:49 | 08:19<br>18:42 | 08:13<br>16:50 | 08:49<br>16:38 |
| 22                  | 08:39<br>17:16 | 07:48<br>18:12 | 06:46<br>19:01 | 06:37<br>20:53 | 07:03 (JH3)<br>21:41 | 06:28 (JH1)<br>22:07 | 05:53<br>21:50 | 06:41<br>20:56 | 07:09 (JH3)<br>19:46 | 08:20<br>18:40 | 08:15<br>16:49 | 08:50<br>16:38 |
| 23                  | 08:38<br>17:18 | 07:46<br>18:14 | 06:44<br>19:03 | 06:35<br>20:55 | 07:02 (JH3)<br>21:42 | 06:27 (JH1)<br>22:08 | 05:54<br>21:49 | 06:42<br>20:54 | 07:09 (JH3)<br>19:44 | 08:22<br>18:38 | 08:16<br>16:48 | 08:50<br>16:39 |
| 24                  | 08:37<br>17:19 | 07:44<br>18:16 | 06:42<br>19:04 | 06:33<br>20:56 | 07:08 (JH3)<br>21:43 | 06:28 (JH1)<br>22:08 | 05:56<br>21:48 | 06:44<br>20:52 | 07:10 (JH3)<br>19:42 | 08:24<br>18:36 | 08:18<br>16:46 | 08:51<br>16:40 |
| 25                  | 08:36<br>17:21 | 07:42<br>18:17 | 06:39<br>19:06 | 06:31<br>20:58 | 07:12 (JH3)<br>21:45 | 06:29 (JH1)<br>22:08 | 05:58<br>21:46 | 06:46<br>20:50 | 07:12 (JH3)<br>19:39 | 08:26<br>17:34 | 08:19<br>16:45 | 08:51<br>16:40 |
| 26                  | 08:34<br>17:23 | 07:40<br>18:19 | 06:37<br>19:08 | 06:29<br>21:00 | 07:14 (JH3)<br>21:46 | 06:29 (JH1)<br>22:08 | 05:59<br>21:45 | 06:47<br>20:48 | 07:13 (JH3)<br>19:37 | 08:27<br>17:32 | 08:21<br>16:45 | 08:51<br>16:41 |
| 27                  | 08:33<br>17:25 | 07:37<br>18:21 | 06:35<br>19:09 | 06:27<br>21:01 | 07:15 (JH3)<br>21:47 | 06:30 (JH1)<br>22:08 | 06:00<br>21:43 | 06:49<br>20:45 | 07:15 (JH3)<br>19:35 | 08:28<br>17:30 | 08:22<br>16:44 | 08:52<br>16:42 |
| 28                  | 08:32<br>17:26 | 07:35<br>18:23 | 06:32<br>19:11 | 06:25<br>21:03 | 07:16 (JH3)<br>21:48 | 06:31 (JH1)<br>22:08 | 06:02<br>21:42 | 06:50<br>20:43 | 07:16 (JH3)<br>19:32 | 08:29<br>17:28 | 08:24<br>16:43 | 08:52<br>16:42 |
| 29                  | 08:30<br>17:28 | 07:30<br>18:20 | 06:30<br>19:03 | 06:23<br>21:05 | 07:17 (JH3)<br>21:49 | 06:32 (JH1)<br>22:07 | 06:03<br>21:40 | 06:52<br>20:41 | 07:18 (JH3)<br>19:30 | 08:30<br>17:26 | 08:25<br>16:42 | 08:52<br>16:43 |
| 30                  | 08:29<br>17:30 | 07:28<br>18:14 | 06:28<br>19:01 | 06:21<br>21:06 | 07:18 (JH3)<br>21:50 | 06:33 (JH1)<br>22:07 | 06:05<br>21:39 | 06:54<br>20:40 | 07:20 (JH3)<br>19:28 | 08:31<br>17:24 | 08:27<br>16:41 | 08:52<br>16:44 |
| 31                  | 08:27<br>17:32 | 07:26<br>18:16 | 06:26<br>19:06 | 06:21<br>21:06 | 07:19 (JH3)<br>21:51 | 06:34 (JH1)<br>22:07 | 06:06<br>21:39 | 06:55<br>20:37 | 07:21 (JH3)<br>19:22 | 08:32<br>17:22 | 08:28<br>16:41 | 08:52<br>16:45 |
| Potential sun hours | 260            | 278            | 367            | 415            | 484                  | 497                  | 500            | 453            | 381                  | 332            | 267            | 245            |
| Total, worst case   |                |                |                | 160            | 157                  |                      | 30             |                | 291                  |                |                |                |
| Sun reduction       |                |                |                | 0.45           | 0.45                 |                      | 0.45           |                | 0.46                 |                |                |                |
| Oper. time red.     |                |                |                | 0.99           | 0.99                 |                      | 0.99           |                | 0.99                 |                |                |                |
| Wind dir. red.      |                |                |                | 0.62           | 0.66                 |                      | 0.66           |                | 0.64                 |                |                |                |
| Total reduction     |                |                |                | 0.28           | 0.29                 |                      | 0.29           |                | 0.29                 |                |                |                |
| Total, real         |                |                |                | 44             | 46                   |                      | 9              |                | 84                   |                |                |                |

Table layout: For each day in each month the following matrix apply

| Day in month | Sun rise (hh:mm) | Sun set (hh:mm) | Minutes with flicker | First time (hh:mm) with flicker | Last time (hh:mm) with flicker | (WTG causing flicker first time) | (WTG causing flicker last time) |
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|
|--------------|------------------|-----------------|----------------------|---------------------------------|--------------------------------|----------------------------------|---------------------------------|

## SHADOW - Calendar, graphical

Calculation: V117 - Alle turbines

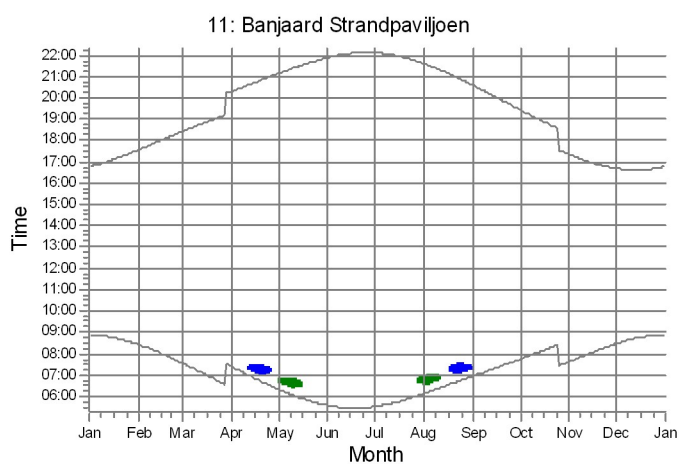
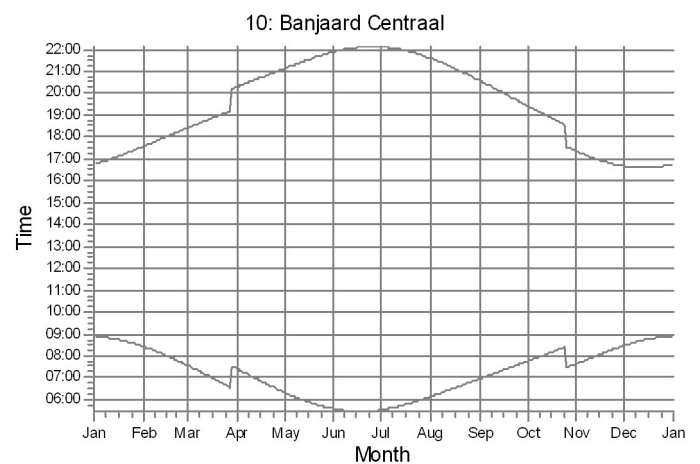
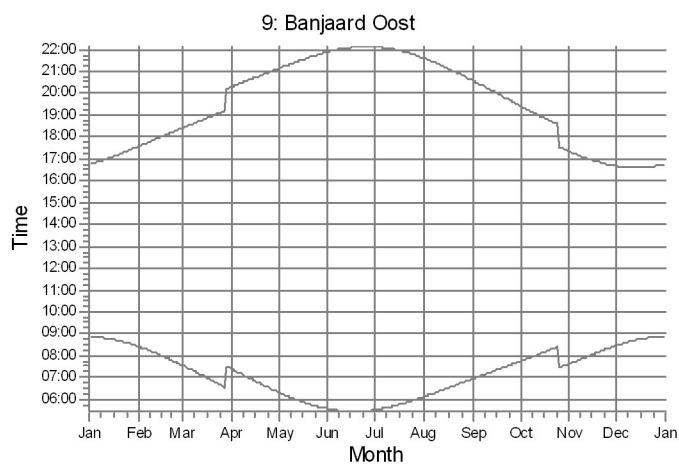
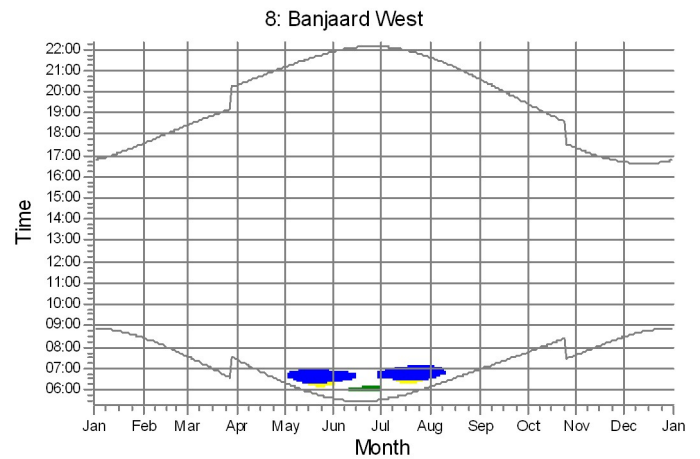
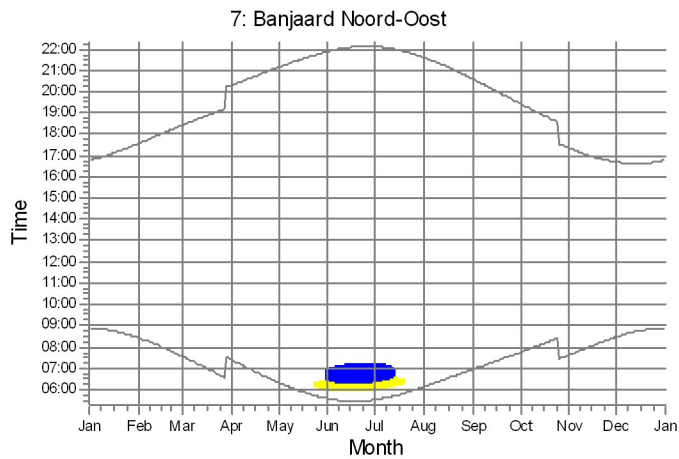


## WTGs

- JH1: VESTAS V117-4.2 4200 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (1)
- JH2: VESTAS V117-4.2 4200 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (2)
- JH3: VESTAS V117-4.2 4200 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (6)

## SHADOW - Calendar, graphical

Calculation: V117 - Alle turbines



## WTGs

- JH1: VESTAS V117-4.2 4200 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (1)
- JH2: VESTAS V117-4.2 4200 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (2)
- JH3: VESTAS V117-4.2 4200 117.0 !O! hub: 91,5 m (TOT: 150,0 m) (6)