

SVEVIND OY AB

SANDBACKA VINDKRAFTSPARK **MILJÖKONSEKVENSBESKRIVNING**

BILAGA 3. Skuggbildningsmodelleringar



27.6.2014

ALT 1. N131 x 15 x HH144 (15 vindkraftverk)

Skogens skyddande inverkan inte beaktad

Project:

Svevind Sandbacken

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FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadback / hans.vadback@fcg.fi

Calculated:

15.4.2014 16:46/2.8.579

SHADOW - Main Result

Calculation: Sandbacka N131 x 15 x HH144_ALT 1

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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data 12 sectors; Radius: 20 000 m (3)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
768	494	355	441	467	655	1 123	1 527	1 110	698	338	415	8 390

Idle start wind speed: Cut in wind speed from power curve

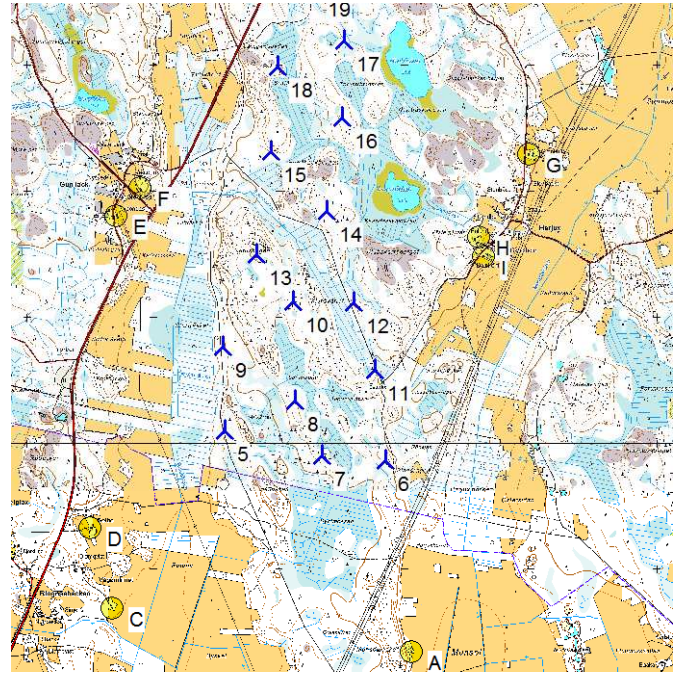
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: Oravais_korkeusk.wpo (1)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:60 000

New WTG

Shadow receptor

WTGs

ETRS 89 Zone: 35

	East	North	Z	Row data/Description	Valid	Manuf.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
			[m]									[RPM]
5	271 574	7 032 104	15,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
6	272 845	7 031 861	22,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
7	272 339	7 031 903	22,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
8	272 131	7 032 340	24,6	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
9	271 558	7 032 764	14,2	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
10	272 114	7 033 125	27,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
11	272 760	7 032 585	24,8	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
12	272 590	7 033 118	27,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
13	271 825	7 033 497	30,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
14	272 381	7 033 839	28,7	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
15	271 935	7 034 312	23,3	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
16	272 502	7 034 584	30,0	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
17	272 518	7 035 190	27,5	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
18	271 991	7 034 984	26,3	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
19	272 287	7 035 624	26,6	NORDEX N131/3000 3000 131.0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	Bostad (Munsolbacken)	273 053	7 030 347	15,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Jeppovägen 264)	271 454	7 029 590	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Bostad (Vägaminn)	270 675	7 030 693	8,9	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Solbackavägen)	270 505	7 031 325	15,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Gunilackvägen 90)	270 712	7 033 804	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Monåvägen 19)	270 899	7 034 022	20,6	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Harjuxvägen 336)	273 981	7 034 287	24,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Harjuxvägen 425)	273 583	7 033 632	28,4	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Harjuxvägen 430)	273 621	7 033 482	23,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"

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FI-00601 Helsinki

+358104095666

Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

15.4.2014 16:46/2.8.579

**SHADOW - Main Result****Calculation:** Sandbacka N131 x 15 x HH144_ALT 1**Calculation Results**

Shadow receptor

No.	Name	Shadow, expected values
		Shadow hours per year [h/year]
A	Bostad (Munsolbacken)	0:00
B	Bostad (Jeppovägen 264)	0:00
C	Bostad (Vägaminnet)	0:00
D	Bostad (Solbackavägen)	7:10
E	Bostad (Gunilackvägen 90)	9:40
F	Bostad (Monåvägen 19)	16:39
G	Bostad (Harjuxvägen 336)	4:06
H	Bostad (Harjuxvägen 425)	14:09
I	Bostad (Harjuxvägen 430)	13:46

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
5	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (475)	25:15	7:10
6	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (476)	0:00	0:00
7	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (477)	0:00	0:00
8	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (478)	0:00	0:00
9	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (479)	21:48	3:37
10	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (480)	27:00	5:03
11	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (481)	24:28	4:45
12	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (482)	26:03	5:06
13	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (483)	25:29	4:27
14	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (484)	41:11	7:49
15	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (485)	33:14	7:39
16	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (486)	52:31	12:34
17	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (487)	7:32	1:37
18	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (488)	14:55	4:24
19	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (489)	0:00	0:00

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FCG Suunnittelu ja tekniikka Oy

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FI-00601 Helsinki

+358104095666

Hans Vadbäck / hans.vadback@fcg.fi

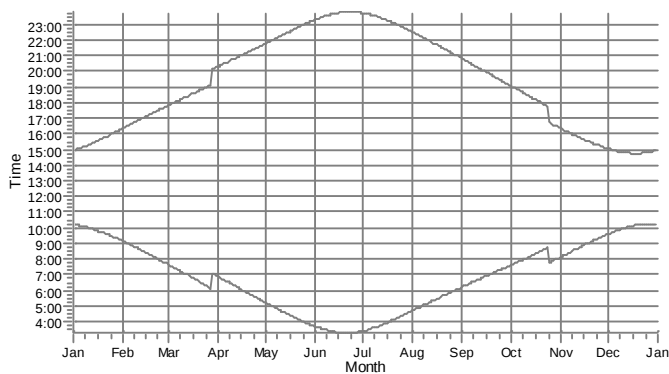
Calculated:

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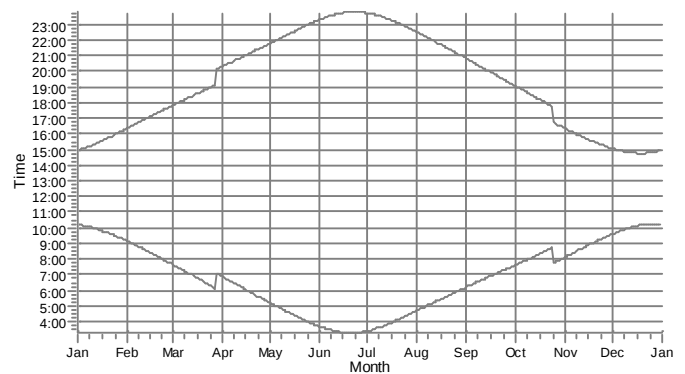
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 15 x HH144 _ALT 1

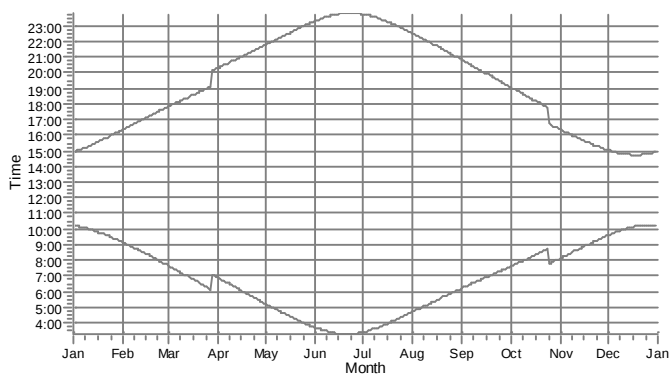
A: Bostad (Munsolbacken)



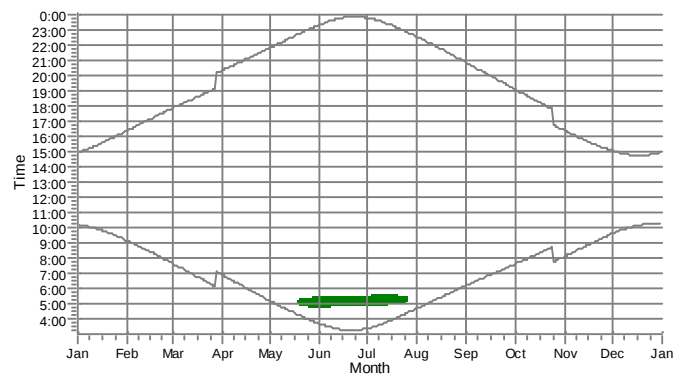
B: Bostad (Jeppovägen 264)



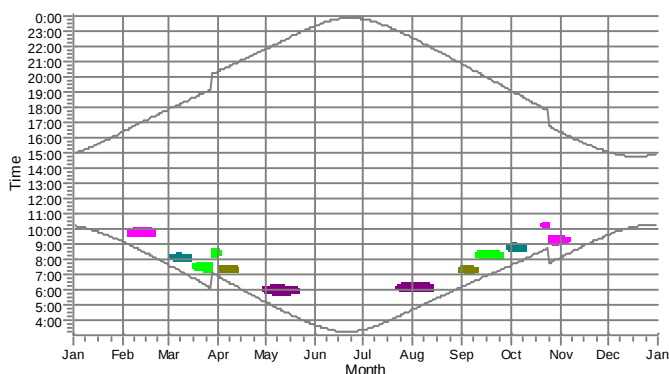
C: Bostad (Vägamnet)



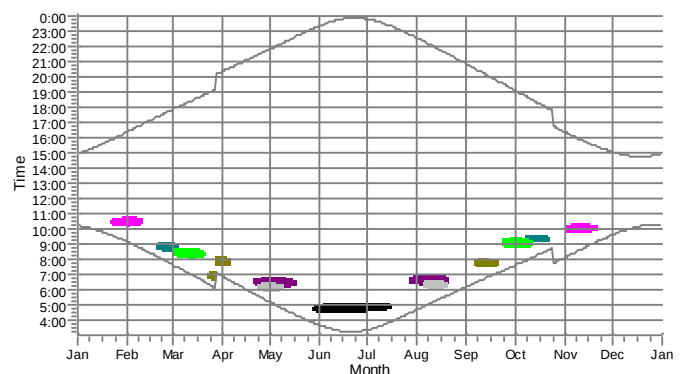
D: Bostad (Solbackavägen)



E: Bostad (Gunilackvägen 90)



F: Bostad (Monåvägen 19)



WTGs

	5: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (475)		14: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (484)
	9: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (479)		15: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (485)
	10: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (480)		16: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (486)
	13: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (483)		18: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (488)

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FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadbäck / hans.vadback@fcg.fi

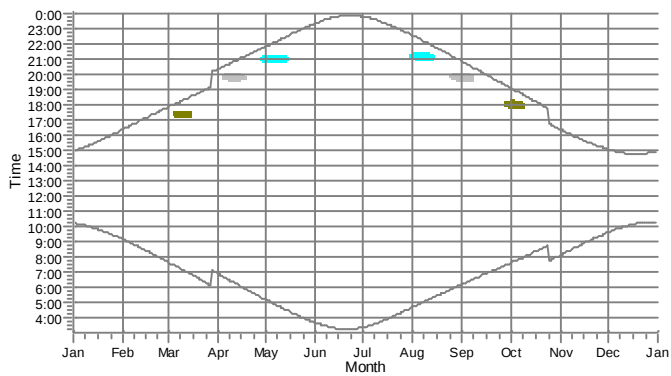
Calculated:

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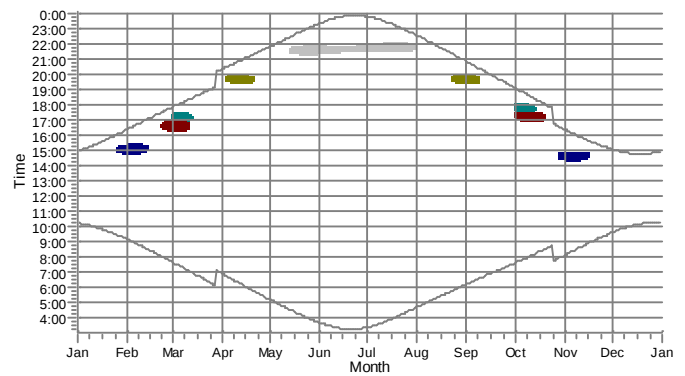
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 15 x HH144 _ALT 1

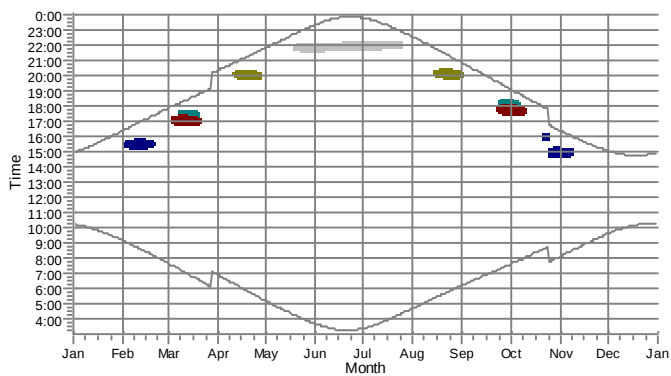
G: Bostad (Harjuxvägen 336)



H: Bostad (Harjuxvägen 425)



I: Bostad (Harjuxvägen 430)



WTGs

10: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (480)
11: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (481)
12: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (482)

14: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (484)
16: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (486)
17: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (487)

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FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

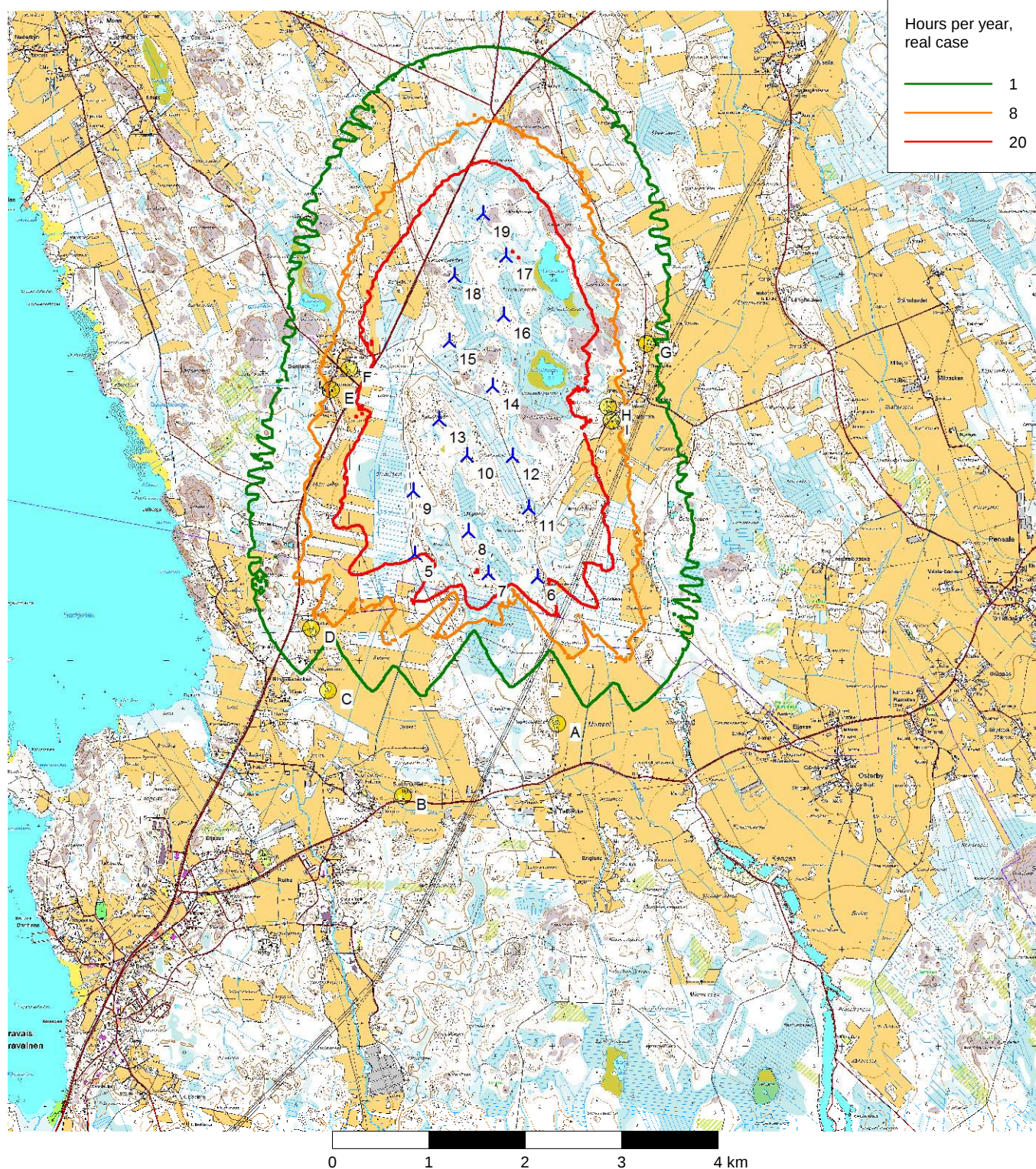
Hans Vadback / hans.vadback@fcg.fi

Calculated:

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SHADOW - Map

Calculation: Sandbacka N131 x 15 x HH144_ALT 1



New WTG

Shadow receptor

Flicker map level: Height Contours: Oravais_korkeusk.wpo (1)

27.6.2014

ALT 1. N131 x 15 x HH144 (15 vindkraftverk)

Skogens skyddande inverkan beaktad

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FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

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+358104095666

Hans Vadback / hans.vadback@fcg.fi

Calculated:

15.4.2014 16:55/2.8.579

SHADOW - Main Result

Calculation: Sandbacka N131 x 15 x HH144_ALT 1 (Skog corine 20-20-15)

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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data 12 sectors; Radius: 20 000 m (3)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
768	494	355	441	467	655	1 123	1 527	1 110	698	338	415	8 390

Idle start wind speed: Cut in wind speed from power curve

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: Oravais_korkeusk.wpo (1)

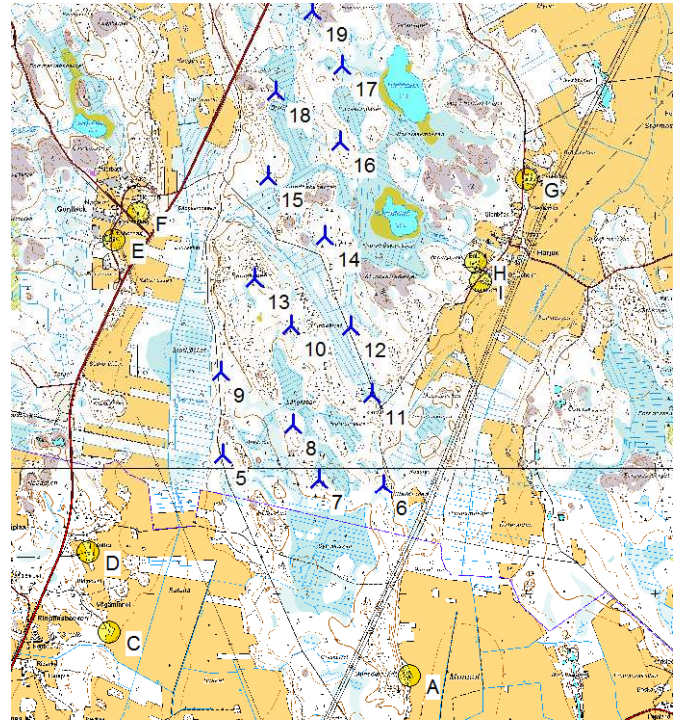
Area object(s) used in calculation:

Area object (Roughness, ZVI): REGIONS_Storbötet_2(1).w2r (14)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



New WTG

Scale 1:60 000

Shadow receptor

WTGs

ETRS 89 Zone: 35				Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
East	North	Z			Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
			[m]									
5	271 574	7 032 104	15,5	NORDEX N131/3000 3000 131,0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
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19	272 287	7 035 624	26,6	NORDEX N131/3000 3000 131,0 ...	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

		ETRS 89 Zone: 35			Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
No.	Name	East	North	Z						
				[m]						
A	Bostad (Munsolbacken)	273 053	7 030 347	15,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Jeppovägen 264)	271 454	7 029 590	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Bostad (Vägamminnet)	270 675	7 030 693	8,9	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Solbackavägen)	270 505	7 031 325	15,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Gunilackvägen 90)	270 712	7 033 804	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Monåvägen 19)	270 899	7 034 022	20,6	5,0	5,0	1,0	0,0	0,0	"Green house mode"

To be continued on next page...

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SHADOW - Main Result

Calculation: Sandbacka N131 x 15 x HH144 ALT 1 (Skog corine 20-20-15)

...continued from previous page

ETRS 89 Zone: 35

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
G	Bostad (Harjuxvägen 336)	273 981	7 034 287	24,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Harjuxvägen 425)	273 583	7 033 632	28,4	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Harjuxvägen 430)	273 621	7 033 482	23,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Name	Shadow hours per year [h/year]
A	Bostad (Munsolbacken)	0:00
B	Bostad (Jeppovägen 264)	0:00
C	Bostad (Vägaminnet)	0:00
D	Bostad (Solbackavägen)	7:10
E	Bostad (Gunilackvägen 90)	9:40
F	Bostad (Monåvägen 19)	5:34
G	Bostad (Harjuxvägen 336)	4:06
H	Bostad (Harjuxvägen 425)	0:00
I	Bostad (Harjuxvägen 430)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
5	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (475)	25:15	7:10
6	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (476)	0:00	0:00
7	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (477)	0:00	0:00
8	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (478)	0:00	0:00
9	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (479)	21:48	3:37
10	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (480)	13:54	2:31
11	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (481)	0:00	0:00
12	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (482)	0:00	0:00
13	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (483)	25:29	4:27
14	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (484)	11:35	2:14
15	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (485)	14:12	3:26
16	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (486)	7:25	1:25
17	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (487)	7:32	1:37
18	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (488)	0:00	0:00
19	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (489)	0:00	0:00

Project:

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FI-00601 Helsinki

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Hans Vadbäck / hans.vadback@fcg.fi

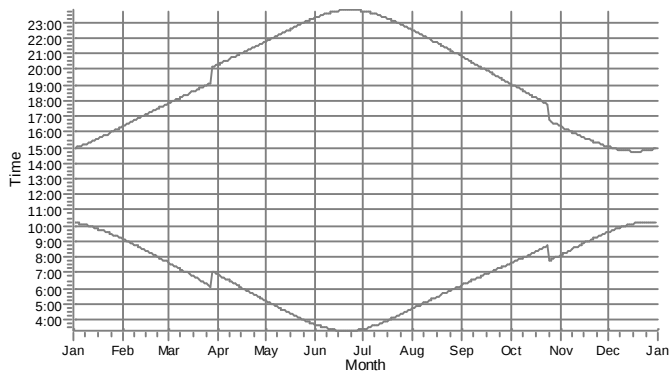
Calculated:

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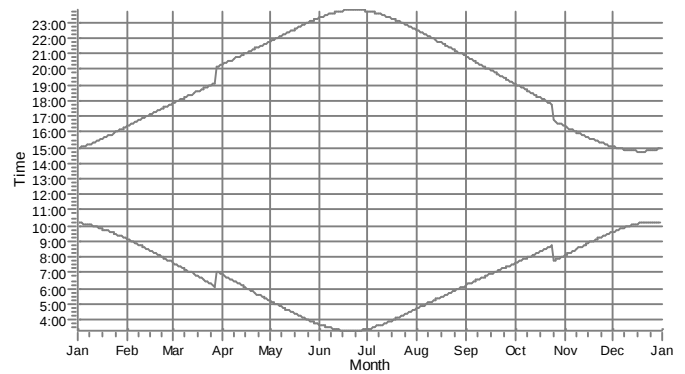
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 15 x HH144 _ALT 1 (Skog corine 20-20-15)

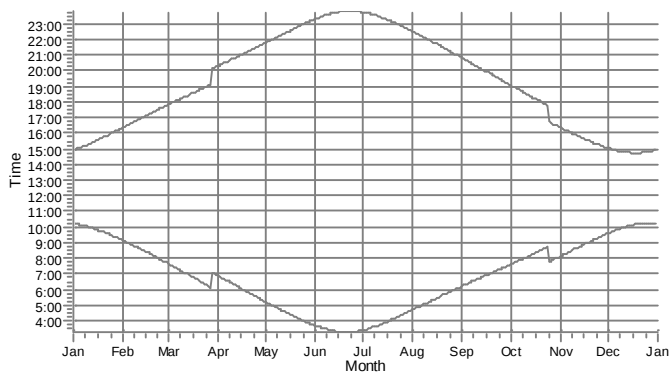
A: Bostad (Munsolbacken)



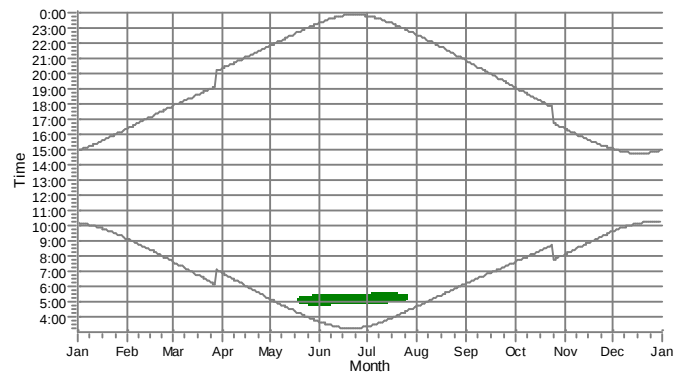
B: Bostad (Jeppovägen 264)



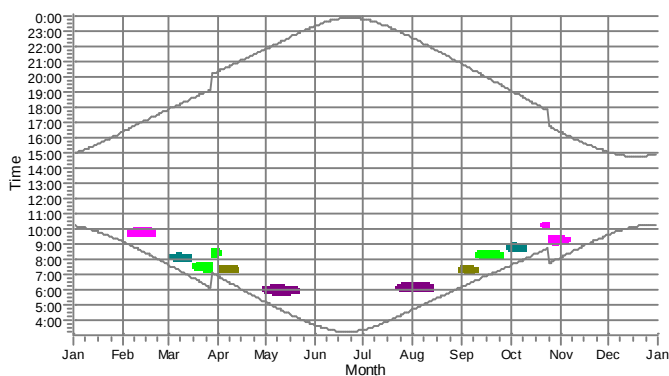
C: Bostad (Vägamnet)



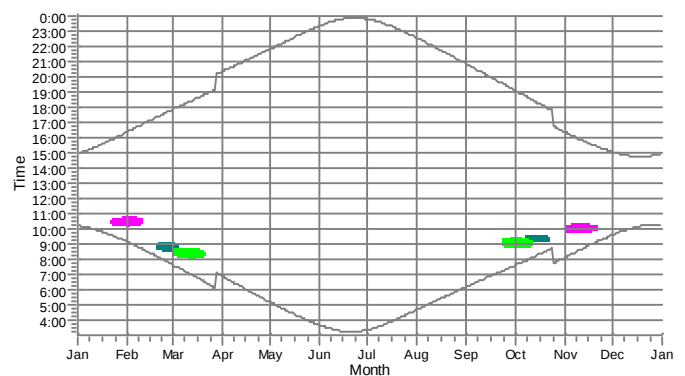
D: Bostad (Solbackavägen)



E: Bostad (Gunilackvägen 90)



F: Bostad (Monåvägen 19)



WTGs

5: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (475)	13: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (483)
9: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (479)	14: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (484)
10: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (480)	15: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (485)

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FI-00601 Helsinki

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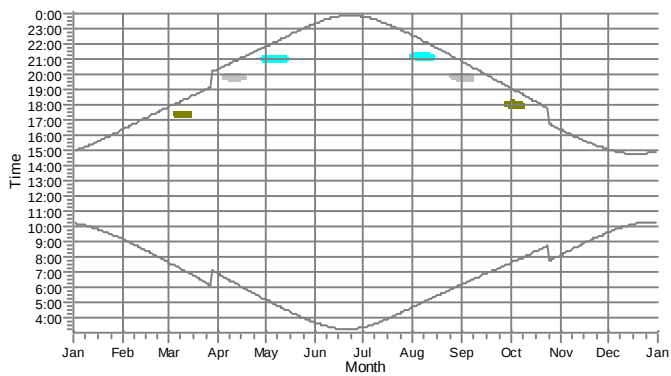
Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

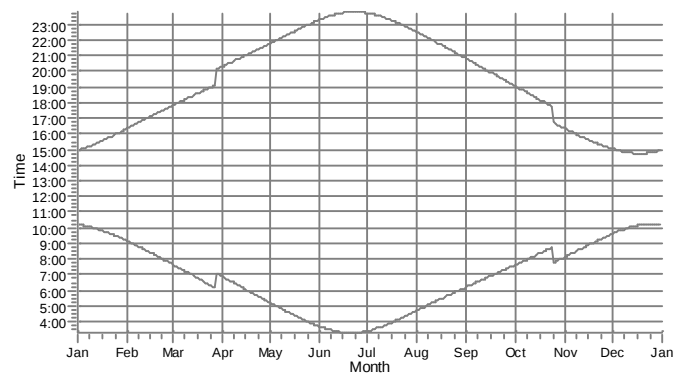
15.4.2014 16:55/2.8.579

SHADOW - Calendar, graphical**Calculation:** Sandbacka N131 x 15 x HH144 _ALT 1 (Skog corine 20-20-15)

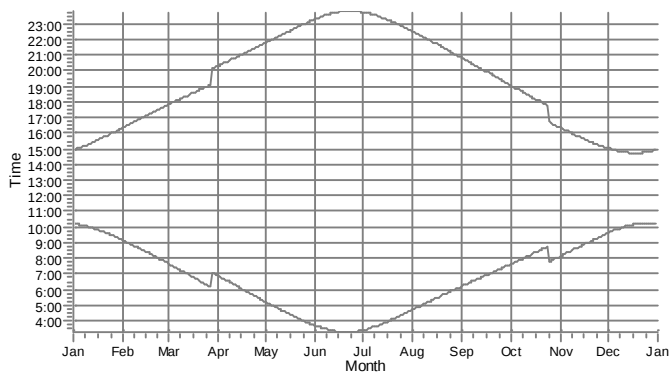
G: Bostad (Harjuxvägen 336)



H: Bostad (Harjuxvägen 425)



I: Bostad (Harjuxvägen 430)



WTGs



14: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (484)

16: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (486)



17: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (487)

Project:

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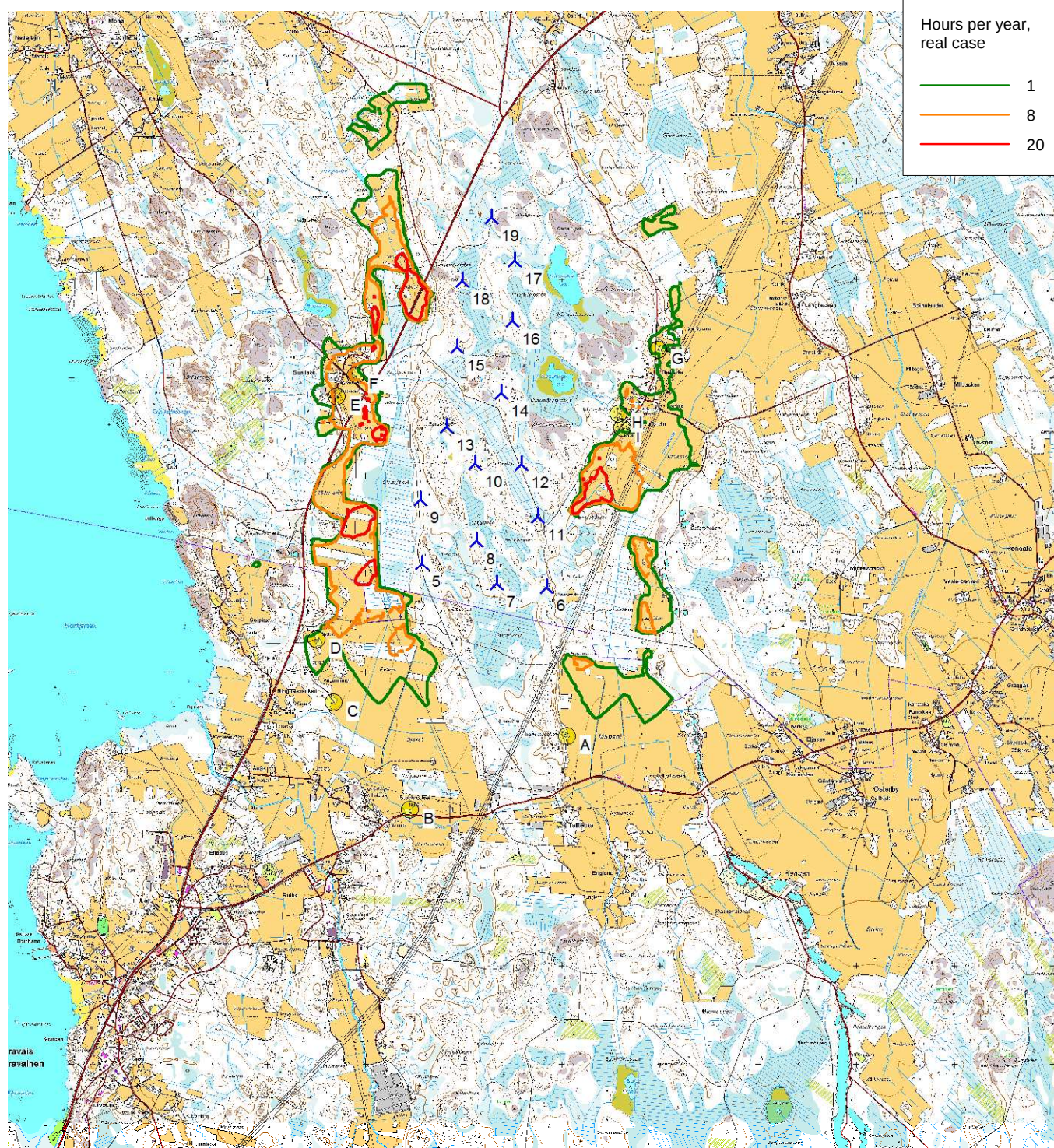
Hans Vadback / hans.vadback@fcg.fi

Calculated:

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SHADOW - Map

Calculation: Sandbacka N131 x 15 x HH144 ALT 1 (Skog corine 20-20-15)

Hours per year,
real case

1
8
20

0 1 2 3 4 km

Map: Peruskarttarasteri, Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 272 160 North: 7 031 440

New WTG

Shadow receptor

Flicker map level: Height Contours: Oravais_korkeusk.wpo (1)

27.6.2014

ALT 2. N131 x 4 x HH144 (4 vindkraftverk)

Skogens skyddande inverkan inte beaktad

Syevind Sandbacken

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Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

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Calculation: Sandbacka N131 x 4 x HH144 ALT 2

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) [UMEA]

Sunshine probability S (Average daily sunshine hours) [CWE2]												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1.02	2.84	3.78	6.14	8.62	9.94	7.42	5.13	4.32	3.43	1.58	0.96	

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data 12 sectors; Radius: 20 000 m (3)

Operational time

Operational time	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
	762	492	355	441	462	661	1 099	1 522	1 108	718	357	411	8 387

Idle start wind speed: Cut in wind speed from power curve

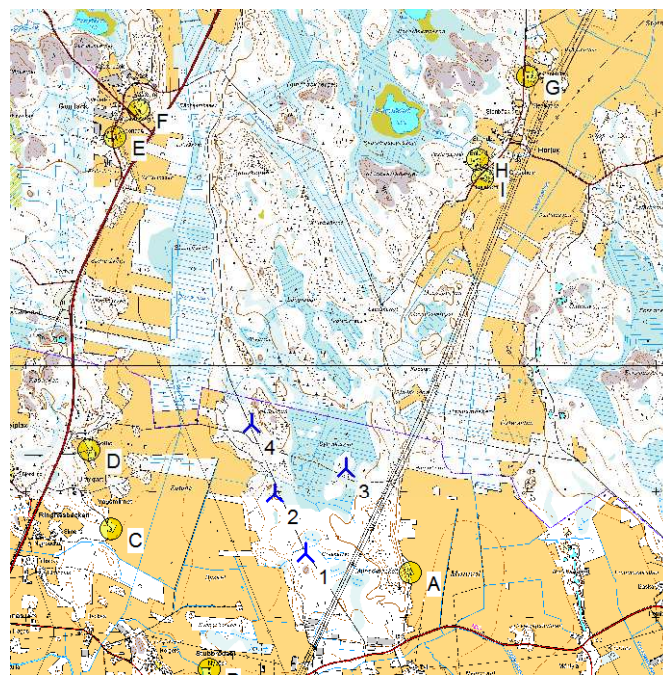
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: Oravais korkeusk.wpo (1)

Obstacles not used in calculation

Eye height: 1.5 m

Grid resolution: 10.0 m



Scale 1:60 000

 New WTG

Shadow receptor

WTGs

ETRS 89 Zone: 35

East	North	Z	Row data/Description
------	-------	---	----------------------

WTG type

Valid Manufact. Type-generator

Power, Rotor

Shadow data

Calculation RPM

					[m]						[kW]	diameter	height	distance					
												[m]	[m]	[m]	[RPM]				
1	272	217	7	030	506	17,5	NORDEX	N131/3000	3000	131.0	!...Yes	NORDEX	N131/3000-3	0 000	3 000	131,0	144,0	1 721	10,3
2	271	975	7	030	974	20,0	NORDEX	N131/3000	3000	131.0	!...Yes	NORDEX	N131/3000-3	0 000	3 000	131,0	144,0	1 721	10,3
3	272	536	7	031	182	18,9	NORDEX	N131/3000	3000	131.0	!...Yes	NORDEX	N131/3000-3	0 000	3 000	131,0	144,0	1 721	10,3
4	271	790	7	031	536	17,0	NORDEX	N131/3000	3000	131.0	!...Yes	NORDEX	N131/3000-3	0 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	Bostad (Munsolbacken)	273 053	7 030 347	15,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Jeppovägen 264)	271 454	7 029 590	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Bostad (Vägaminnet)	270 675	7 030 693	8,9	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Solbackavägen)	270 505	7 031 325	15,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Gunilackvägen 90)	270 712	7 033 804	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Monåvägen 19)	270 899	7 034 022	20,6	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Harjuxvägen 336)	273 981	7 034 287	24,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Harjuxvägen 425)	273 583	7 033 632	28,4	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Harjuxvägen 430)	273 621	7 033 482	23,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Project:

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Osmontie 34, PO Box 950

FI-00601 Helsinki

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Calculated:

15.4.2014 17:03/2.8.579



SHADOW - Main Result

Calculation: Sandbacka N131 x 4 x HH144_ALT 2

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values
		Shadow hours per year [h/year]
A	Bostad (Munsolbacken)	8:27
B	Bostad (Jeppovägen 264)	0:00
C	Bostad (Vägaminnet)	9:41
D	Bostad (Solbackavägen)	3:17
E	Bostad (Gunilackvägen 90)	0:00
F	Bostad (Monåvägen 19)	0:00
G	Bostad (Harjuxvägen 336)	0:00
H	Bostad (Harjuxvägen 425)	0:00
I	Bostad (Harjuxvägen 430)	0:00

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
1	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (471)	31:52	6:06
2	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (472)	34:03	6:58
3	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (473)	0:00	0:00
4	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (474)	32:57	8:25

Project:

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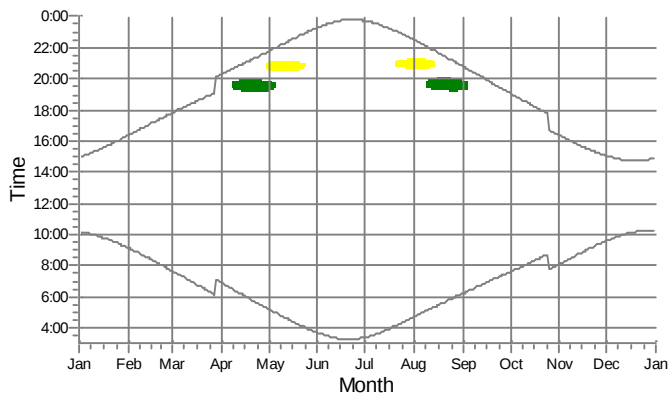
Calculated:

15.4.2014 17:03/2.8.579

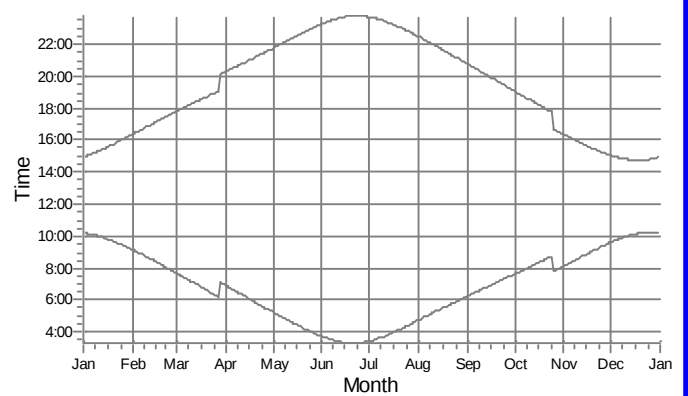
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 4 x HH144 _ALT 2

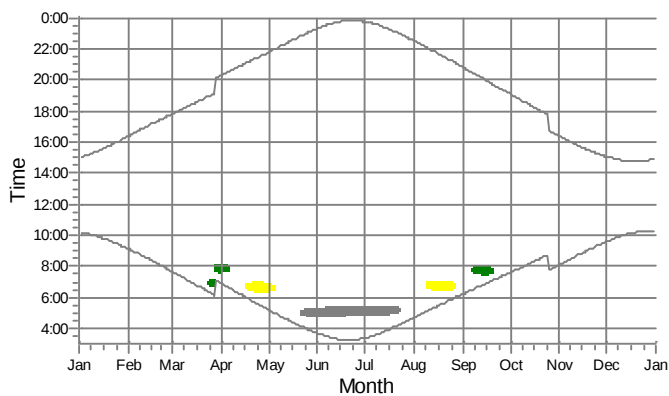
A: Bostad (Munsolbacken)



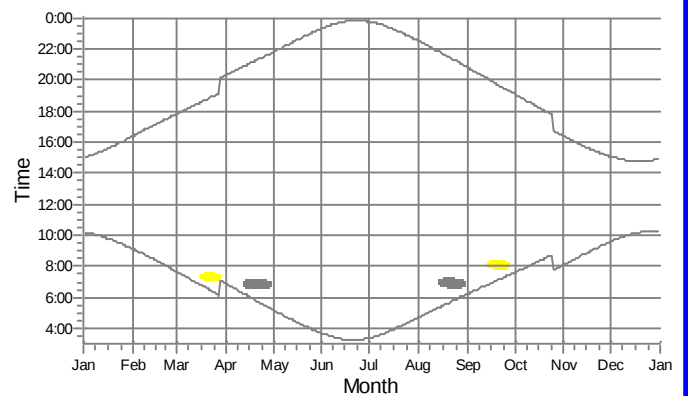
B: Bostad (Jeppovägen 264)



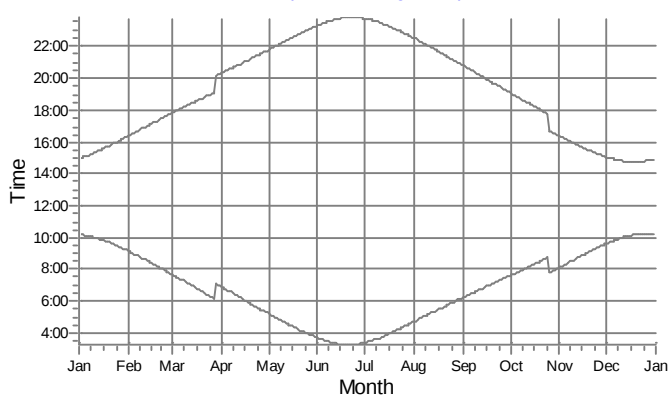
C: Bostad (Vägaminnet)



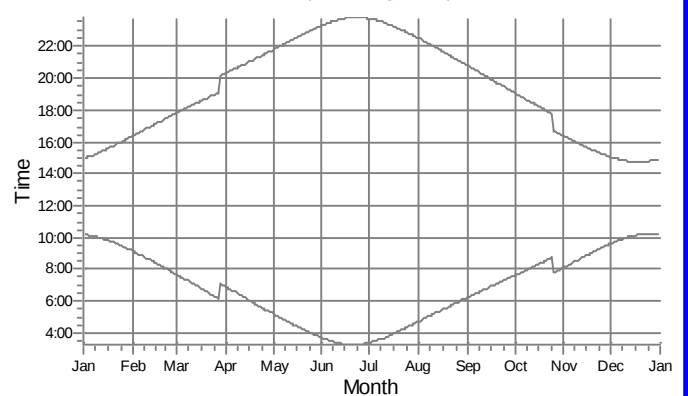
D: Bostad (Solbackavägen)



E: Bostad (Gunilackvägen 90)



F: Bostad (Monåvägen 19)



WTGs

- 1: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (471)
- 2: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (472)
- 4: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (474)

Project:

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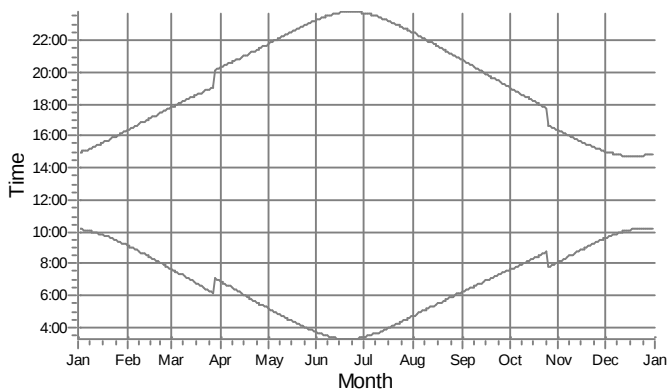
Calculated:

15.4.2014 17:03/2.8.579

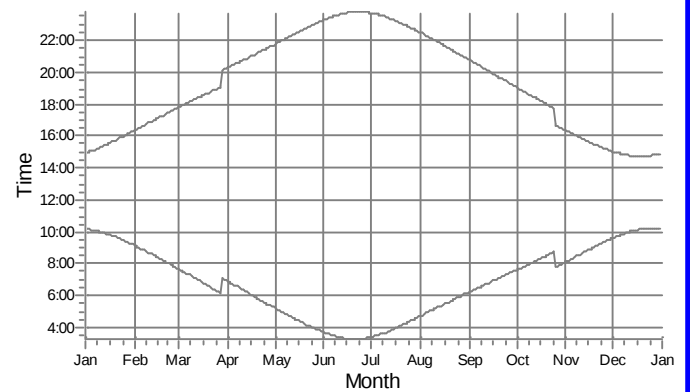
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 4 x HH144 _ALT 2

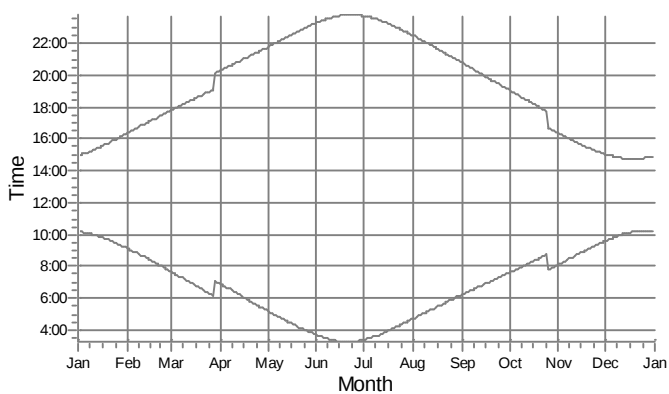
G: Bostad (Harjuxvägen 336)



H: Bostad (Harjuxvägen 425)



I: Bostad (Harjuxvägen 430)



WTGs

Project:

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Osmontie 34, PO Box 950

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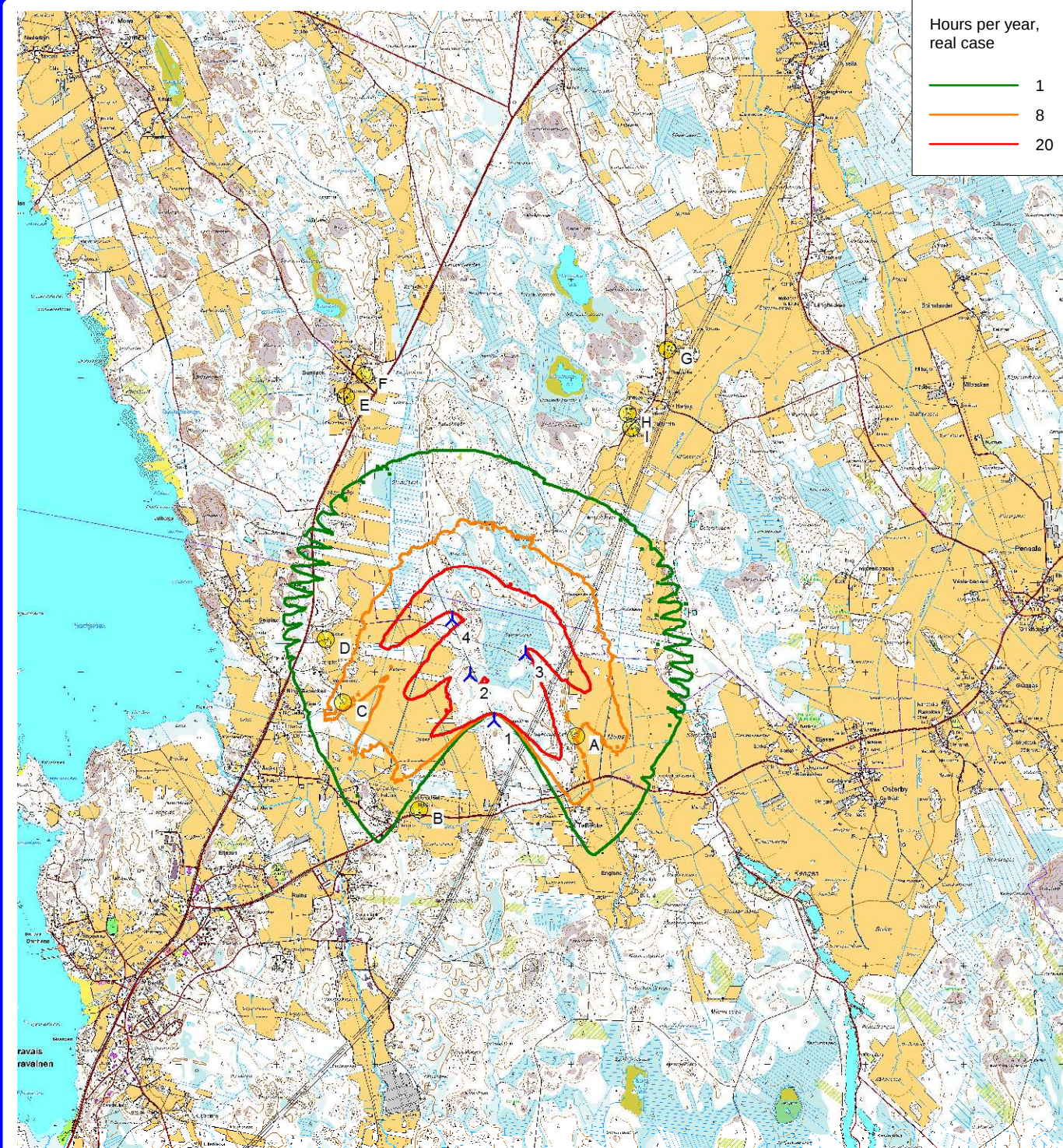
Hans Vadback / hans.vadback@fcg.fi

Calculated:

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SHADOW - Map

Calculation: Sandbacka N131 x 4 x HH144_ALT 2



0 1 2 3 4 km

Map: Peruskarttarasteri, Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 272 160 North: 7 031 440

▲ New WTG

● Shadow receptor

Flicker map level: Height Contours: Oravais_korkeusk.wpo (1)

27.6.2014

ALT 2. N131 x 4 x HH144 (4 vindkraftverk)

Skogens skyddande inverkan beaktad

Project:

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Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadback / hans.vadback@fcg.fi

Calculated:

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SHADOW - Main Result

Calculation: Sandbacka N131 x 4 x HH144_ALT 2 (Skog corine 20-20-15)

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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

Operational hours are calculated from WTGs in calculation and wind distribution:

Site data 12 sectors; Radius: 20 000 m (3)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
762	492	355	441	462	661	1 099	1 522	1 108	718	357	411	8 387

Idle start wind speed: Cut in wind speed from power curve

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: Oravais_korkeusk.wpo (1)

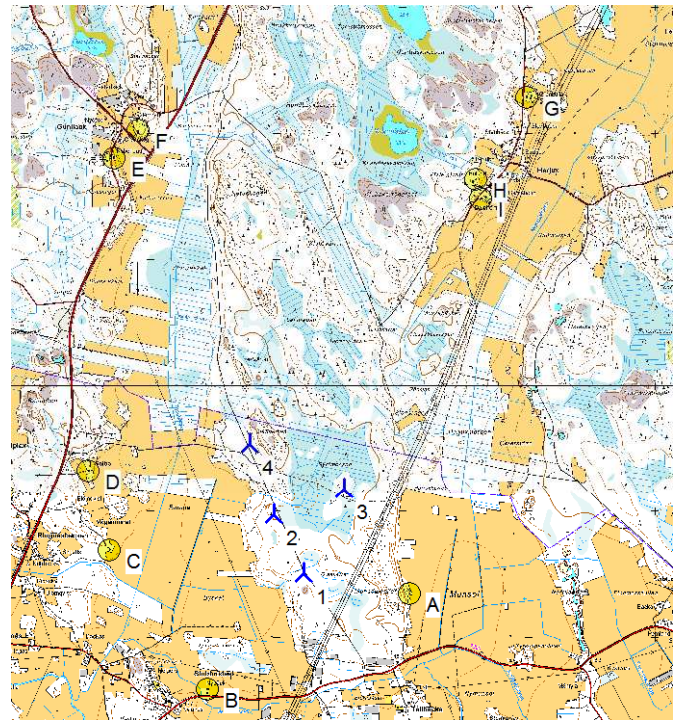
Area object(s) used in calculation:

Area object (Roughness, ZVI): REGIONS_Storbötet_2(1).w2r (14)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



New WTG

Scale 1:60 000

Shadow receptor

WTGs

ETRS 89 Zone: 35				WTG type				Shadow data			
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
1	272 217	7 030 506	17,5 NORDEX N131/3000 3000 131.0 !...Yes	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
2	271 975	7 030 974	20,0 NORDEX N131/3000 3000 131.0 !...Yes	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
3	272 536	7 031 182	18,9 NORDEX N131/3000 3000 131.0 !...Yes	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
4	271 790	7 031 536	17,0 NORDEX N131/3000 3000 131.0 !...Yes	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35											Direction mode	
No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window			
				[m]	[m]	[m]	[m]	[°]	[°]			
A	Bostad (Munsolbacken)	273 053	7 030 347	15,1	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
B	Bostad (Jeppovägen 264)	271 454	7 029 590	10,0	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
C	Bostad (Vägaminnet)	270 675	7 030 693	8,9	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
D	Bostad (Solbackavägen)	270 505	7 031 325	15,0	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
E	Bostad (Gunilackvägen 90)	270 712	7 033 804	17,7	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
F	Bostad (Monåvägen 19)	270 899	7 034 022	20,6	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
G	Bostad (Harjuxvägen 336)	273 981	7 034 287	24,0	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
H	Bostad (Harjuxvägen 425)	273 583	7 033 632	28,4	5,0	5,0	1,0	0,0	0,0		"Green house mode"	
I	Bostad (Harjuxvägen 430)	273 621	7 033 482	23,8	5,0	5,0	1,0	0,0	0,0		"Green house mode"	

Project:

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Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

15.4.2014 17:16/2.8.579



SHADOW - Main Result

Calculation: Sandbacka N131 x 4 x HH144_ALT 2 (Skog corine 20-20-15)

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values
		Shadow hours per year [h/year]
A	Bostad (Munsolbacken)	0:00
B	Bostad (Jeppovägen 264)	0:00
C	Bostad (Vägaminnet)	9:41
D	Bostad (Solbackavägen)	3:17
E	Bostad (Gunilackvägen 90)	0:00
F	Bostad (Monåvägen 19)	0:00
G	Bostad (Harjuxvägen 336)	0:00
H	Bostad (Harjuxvägen 425)	0:00
I	Bostad (Harjuxvägen 430)	0:00

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
1	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (471)	6:41	1:13
2	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (472)	17:55	3:24
3	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (473)	0:00	0:00
4	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (474)	32:57	8:25

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Svevind Sandbacken

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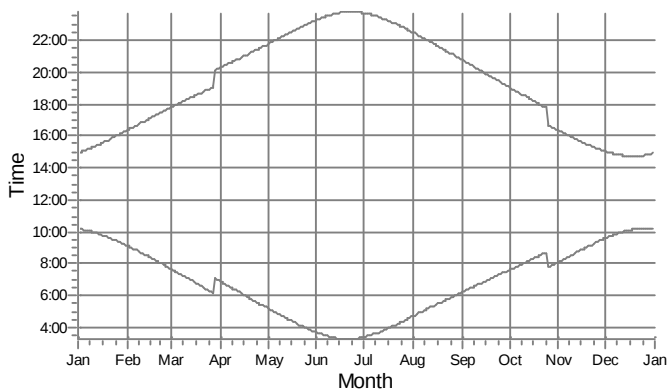
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15.4.2014 17:16/2.8.579

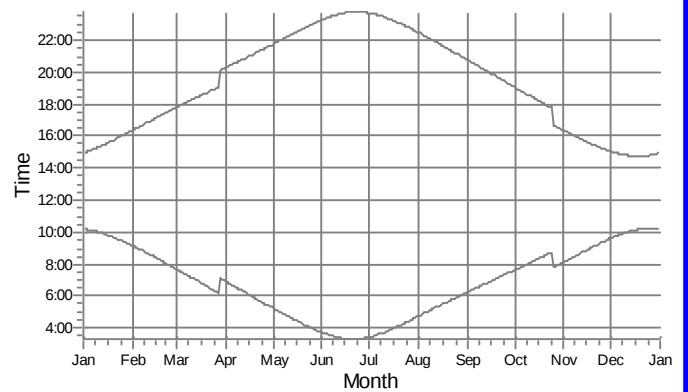
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 4 x HH144 _ALT 2 (Skog corine 20-20-15)

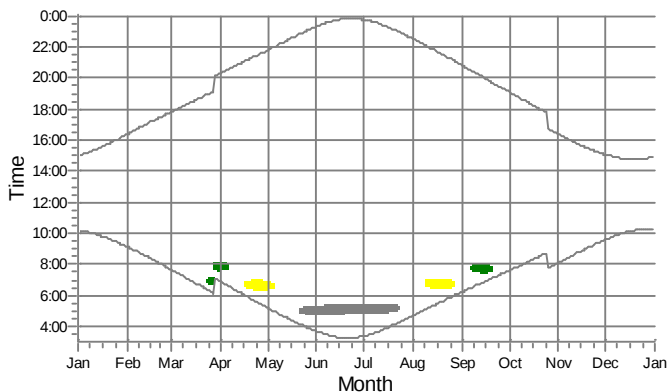
A: Bostad (Munsolbacken)



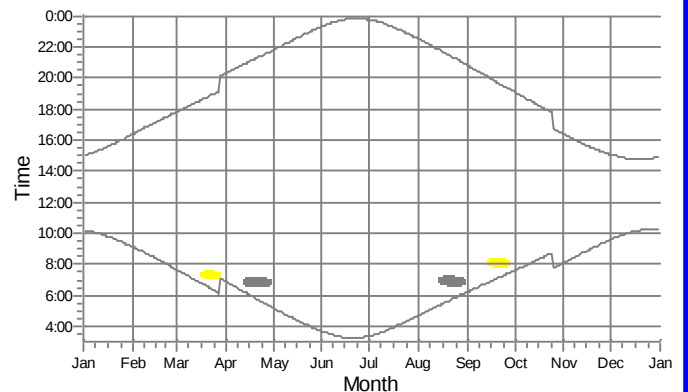
B: Bostad (Jeppovägen 264)



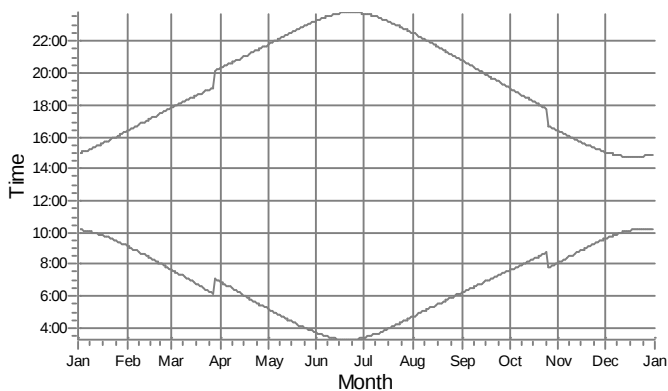
C: Bostad (Vägaminnet)



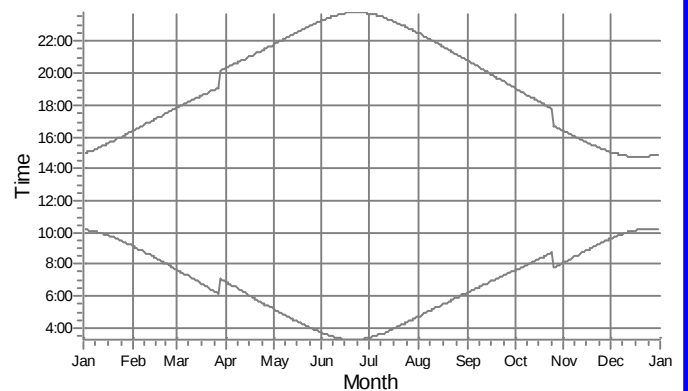
D: Bostad (Solbackavägen)



E: Bostad (Gunilackvägen 90)



F: Bostad (Monåvägen 19)



WTGs



1: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (471)

2: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (472)

4: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (474)

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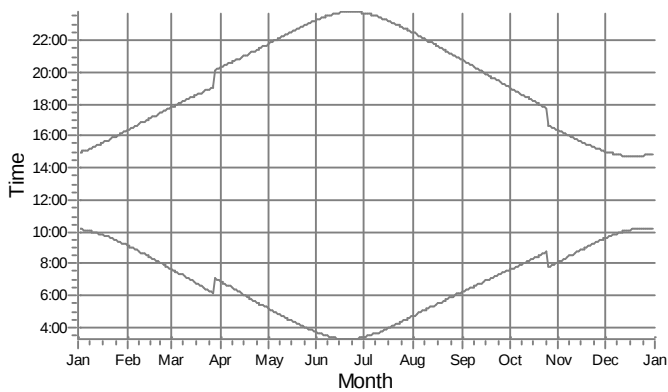
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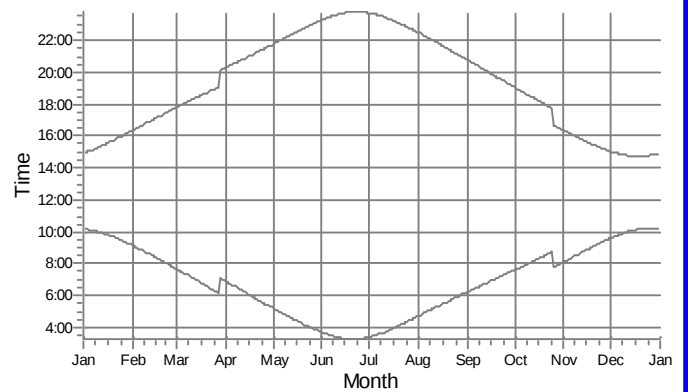
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 4 x HH144 _ALT 2 (Skog corine 20-20-15)

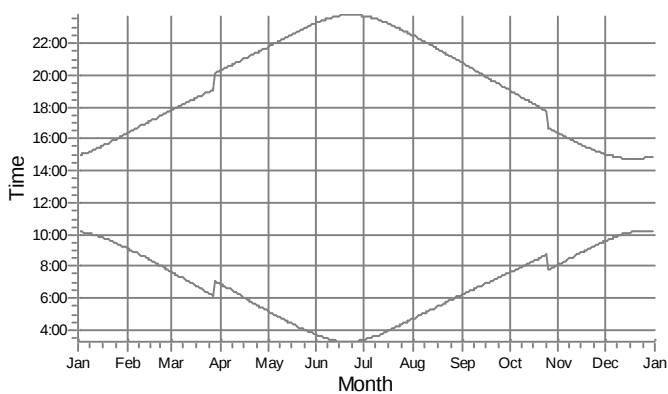
G: Bostad (Harjuxvägen 336)



H: Bostad (Harjuxvägen 425)



I: Bostad (Harjuxvägen 430)



WTGs

Project:

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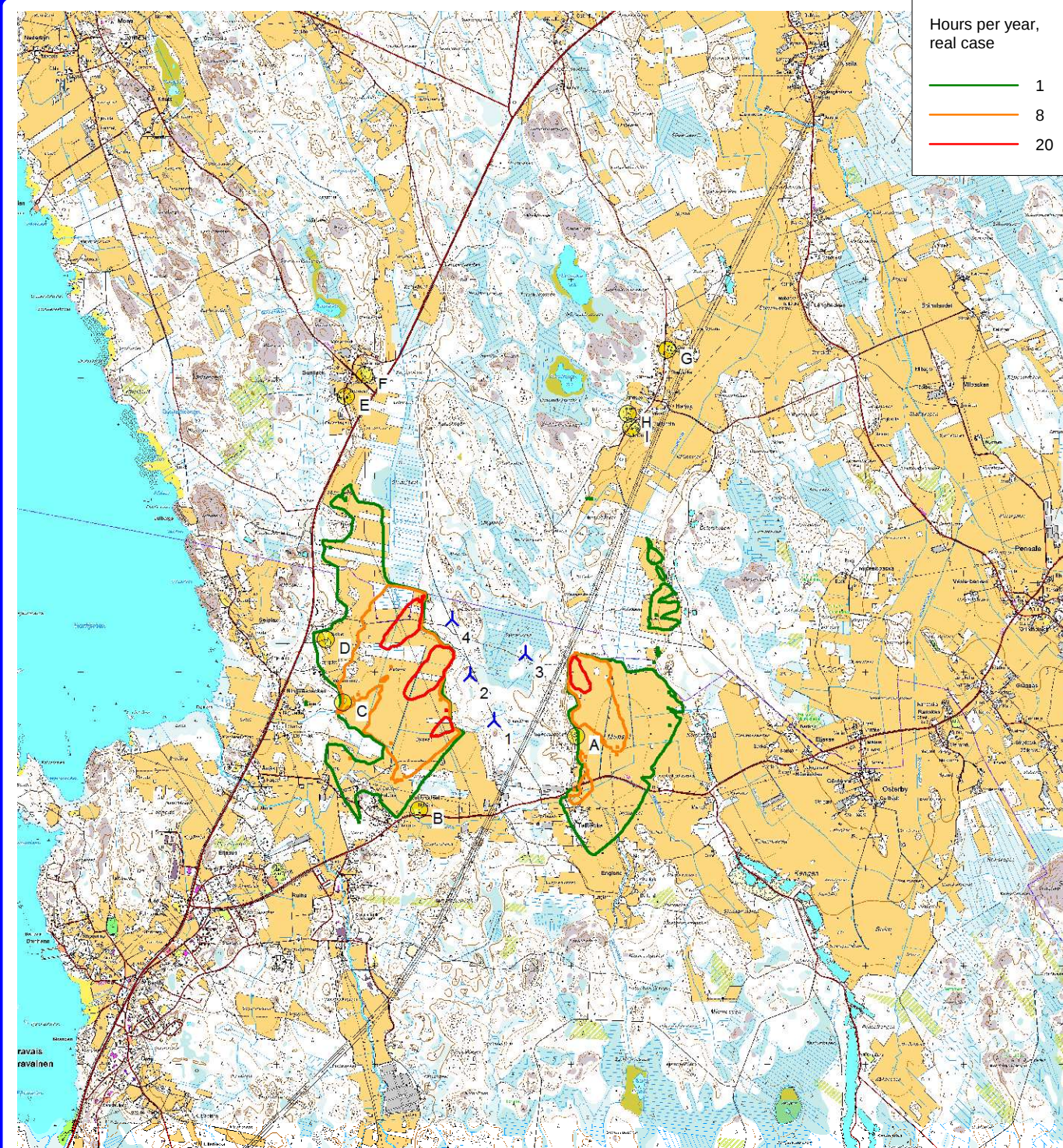
Hans Vadback / hans.vadback@fcg.fi

Calculated:

15.4.2014 17:16/2.8.579

SHADOW - Map

Calculation: Sandbacka N131 x 4 x HH144_ALT 2 (Skog corine 20-20-15)



0 1 2 3 4 km

Map: Peruskarttarasteri , Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 272 160 North: 7 031 440

New WTG

Shadow receptor

Flicker map level: Height Contours: Oravais_korkeusk.wpo (1)

27.6.2014

ALT 3. N131 x 19 x HH144 (19 vindkraftverk)

Skogens skyddande inverkan inte beaktad

Project:

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+358104095666

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Calculated:

15.4.2014 15:03/2.8.579



SHADOW - Main Result

Calculation: Sandbacka N131 x 19 x HH144_ALT 3

...continued from previous page

ETRS 89 Zone: 35

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
E	Bostad (Gunilackvägen 90)	270 712	7 033 804	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Monåvägen 19)	270 899	7 034 022	20,6	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Harjuxvägen 336)	273 981	7 034 287	24,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Harjuxvägen 425)	273 583	7 033 632	28,4	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Harjuxvägen 430)	273 621	7 033 482	23,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Name	Shadow hours per year [h/year]
A	Bostad (Munsolbacken)	8:26
B	Bostad (Jeppovägen 264)	0:00
C	Bostad (Vägaminnet)	9:39
D	Bostad (Solbackavägen)	10:20
E	Bostad (Gunilackvägen 90)	9:41
F	Bostad (Monåvägen 19)	16:39
G	Bostad (Harjuxvägen 336)	4:06
H	Bostad (Harjuxvägen 425)	14:09
I	Bostad (Harjuxvägen 430)	13:46

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (452)	31:52	6:05
2	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (453)	34:03	6:57
3	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (454)	0:00	0:00
4	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (455)	32:57	8:24
5	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (456)	25:15	7:10
6	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (457)	0:00	0:00
7	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (458)	0:00	0:00
8	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (459)	0:00	0:00
9	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (460)	21:48	3:37
10	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (461)	27:00	5:03
11	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (462)	24:28	4:44
12	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (463)	26:03	5:06
13	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (464)	25:29	4:27
14	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (465)	41:11	7:49
15	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (466)	33:14	7:39
16	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (467)	52:31	12:34
17	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (468)	7:32	1:37
18	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (469)	14:55	4:24
19	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (470)	0:00	0:00

Project:

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+358104095666

Hans Vadbäck / hans.vadbäck@fcg.fi

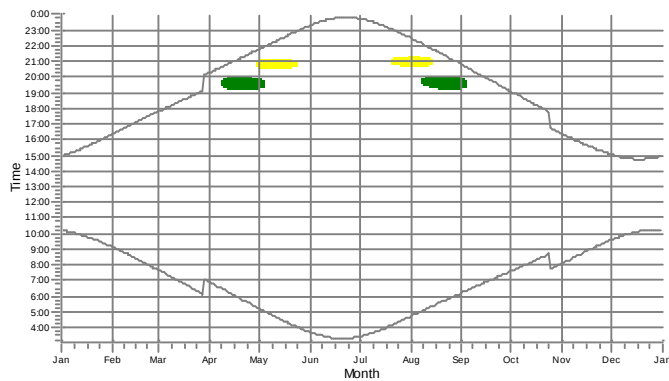
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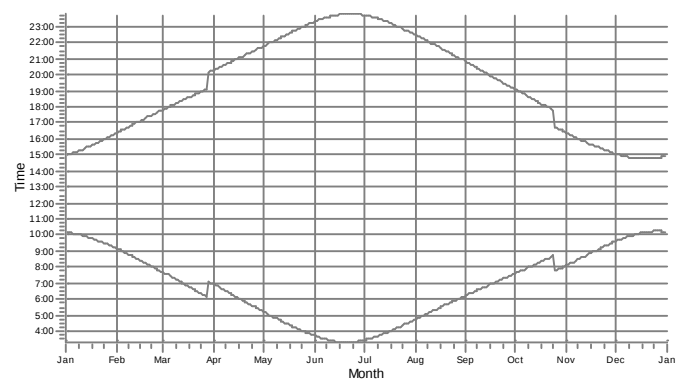
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 19 x HH144 _ALT 3

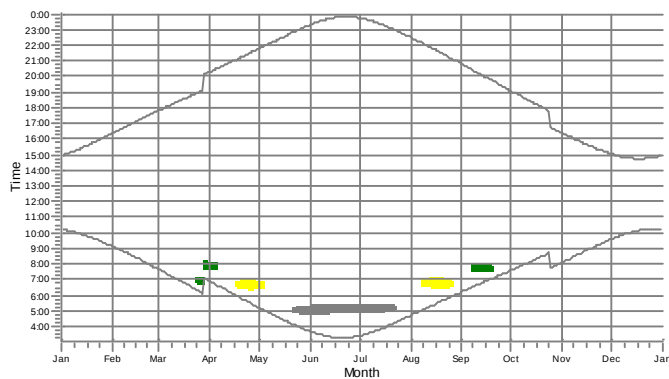
A: Bostad (Munsolbacken)



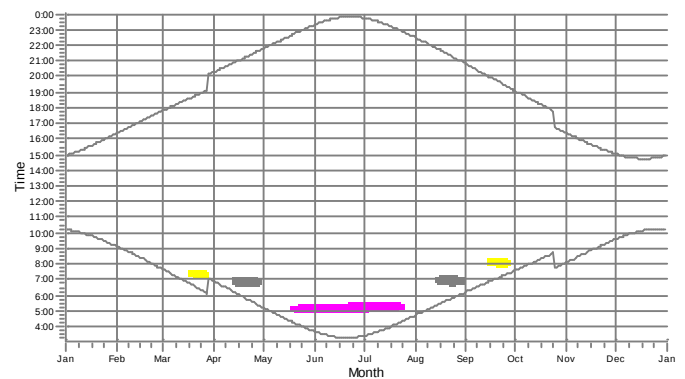
B: Bostad (Jeppovägen 264)



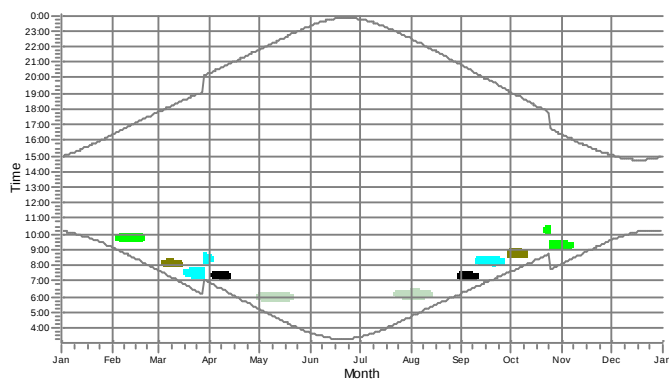
C: Bostad (Vägamminnet)



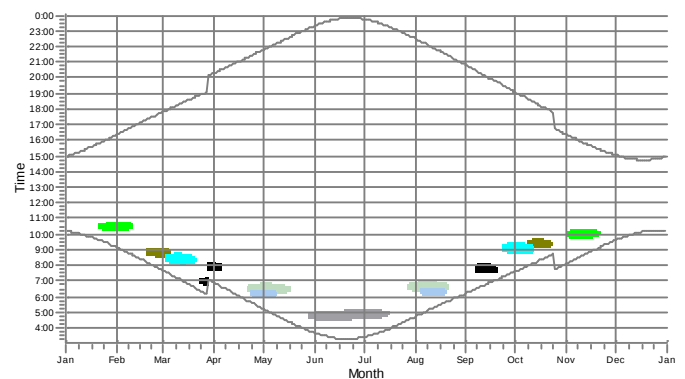
D: Bostad (Solbackavägen)



E: Bostad (Gunilackvägen 90)



F: Bostad (Monåvägen 19)



WTGs

- 1: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (452)
- 2: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (453)
- 4: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (455)
- 5: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (456)
- 9: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (460)
- 10: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (461)

- 13: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (464)
- 14: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (465)
- 15: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (466)
- 16: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (467)
- 18: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (469)

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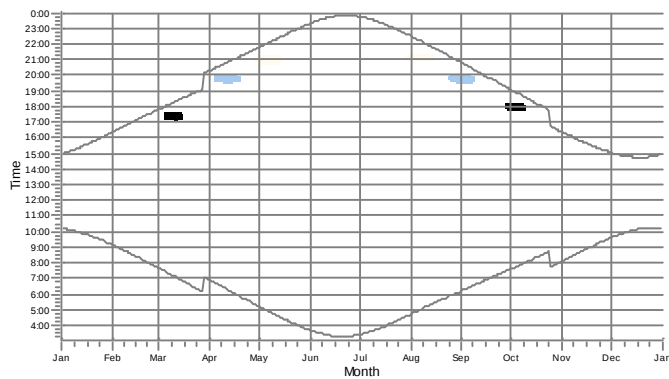
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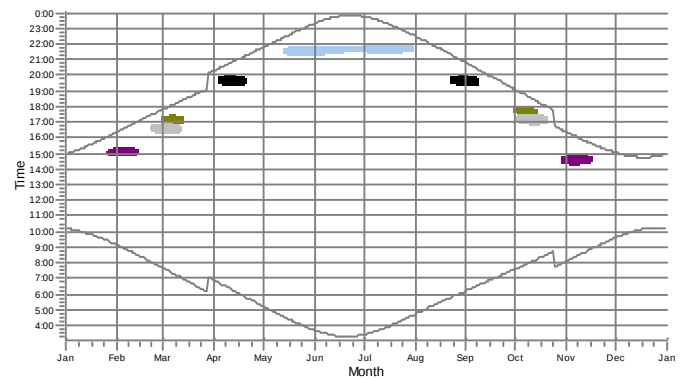
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 19 x HH144 _ALT 3

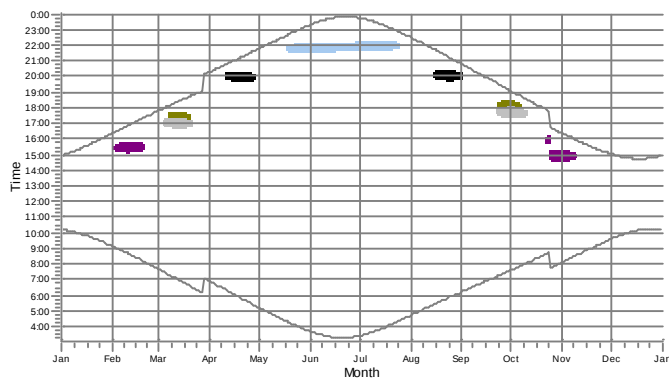
G: Bostad (Harjuxvägen 336)



H: Bostad (Harjuxvägen 425)



I: Bostad (Harjuxvägen 430)



WTGs

- 10: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (461)
- 11: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (462)
- 12: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (463)

- 14: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (465)
- 16: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (467)
- 17: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (468)

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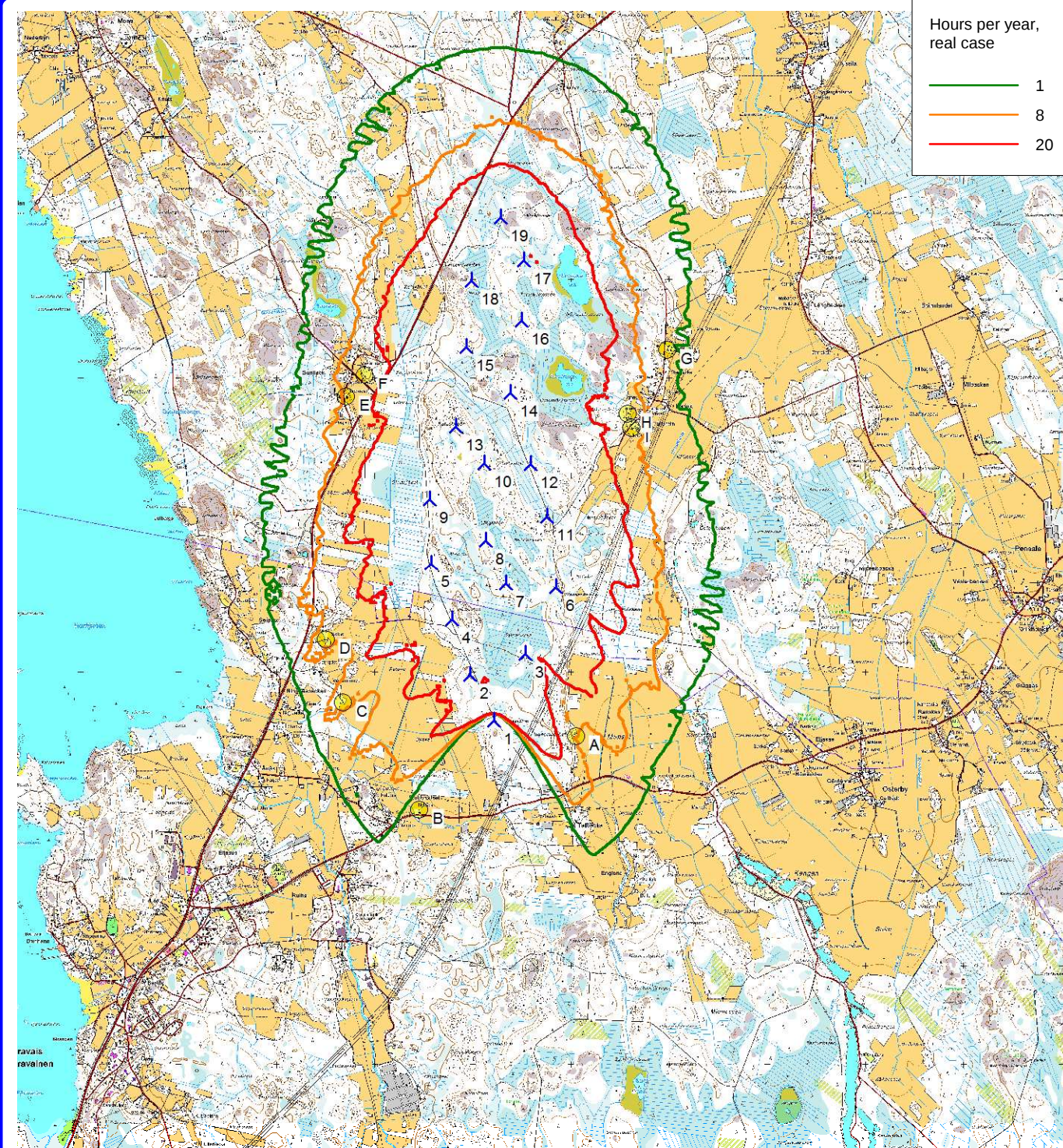
Hans Vadback / hans.vadback@fcg.fi

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SHADOW - Map

Calculation: Sandbacka N131 x 19 x HH144_ALT 3



0 1 2 3 4 km

Map: Peruskarttarasteri, Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 272 160 North: 7 031 440

New WTG

Shadow receptor

Flicker map level: Height Contours: Oravais_korkeusk.wpo (1)

27.6.2014

ALT 3. N131 x 19 x HH144 (19 vindkraftverk)

Skogens skyddande inverkan beaktad

15.4.2014 15:38/2.8.579

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

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**SHADOW - Main Result****Calculation:** Sandbacka N131 x 19 x HH144 ALT 3 (Skog corine 20-20-15)

...continued from previous page

ETRS 89 Zone: 35

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
C	Bostad (Vägaminnet)	270 675	7 030 693	8,9	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Solbackavägen)	270 505	7 031 325	15,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Gunilackvägen 90)	270 712	7 033 804	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Monåvägen 19)	270 899	7 034 022	20,6	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Harjuxvägen 336)	273 981	7 034 287	24,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Harjuxvägen 425)	273 583	7 033 632	28,4	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Harjuxvägen 430)	273 621	7 033 482	23,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Name	Shadow hours per year [h/year]
A	Bostad (Munsolbacken)	0:00
B	Bostad (Jeppovägen 264)	0:00
C	Bostad (Vägaminnet)	9:39
D	Bostad (Solbackavägen)	10:20
E	Bostad (Gunilackvägen 90)	9:41
F	Bostad (Monåvägen 19)	5:34
G	Bostad (Harjuxvägen 336)	4:06
H	Bostad (Harjuxvägen 425)	0:00
I	Bostad (Harjuxvägen 430)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (452)	6:41	1:13
2	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (453)	17:55	3:23
3	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (454)	0:00	0:00
4	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (455)	32:57	8:24
5	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (456)	25:15	7:10
6	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (457)	0:00	0:00
7	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (458)	0:00	0:00
8	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (459)	0:00	0:00
9	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (460)	21:48	3:37
10	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (461)	13:54	2:31
11	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (462)	0:00	0:00
12	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (463)	0:00	0:00
13	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (464)	25:29	4:27
14	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (465)	11:35	2:14
15	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (466)	14:12	3:26
16	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (467)	7:25	1:25
17	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (468)	7:32	1:37
18	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (469)	0:00	0:00
19	NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (470)	0:00	0:00

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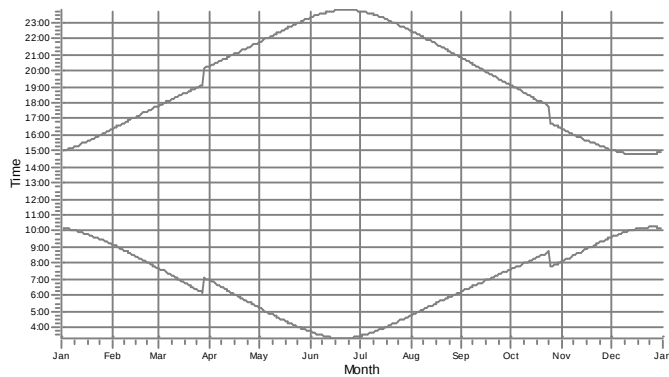
Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

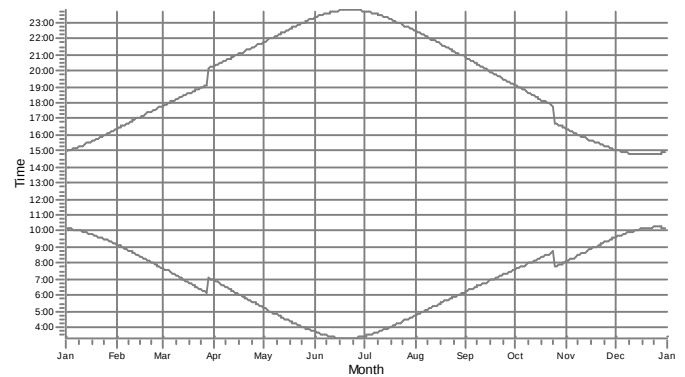
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SHADOW - Calendar, graphical**Calculation:** Sandbacka N131 x 19 x HH144 _ALT 3 (Skog corine 20-20-15)

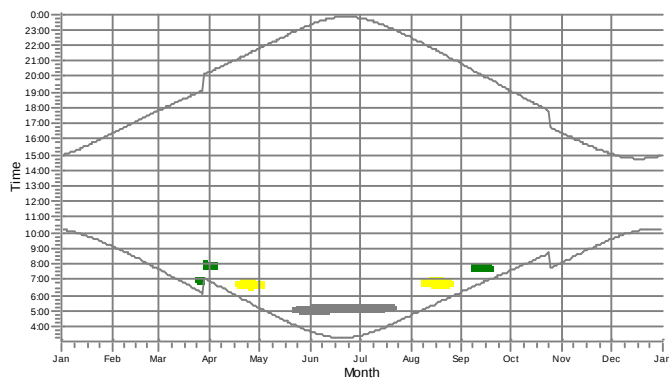
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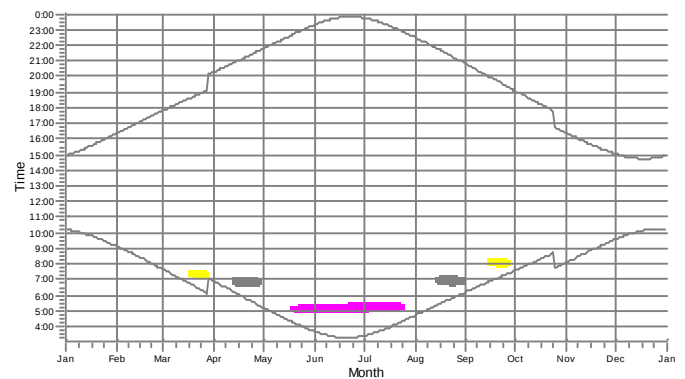
B: Bostad (Jeppovägen 264)



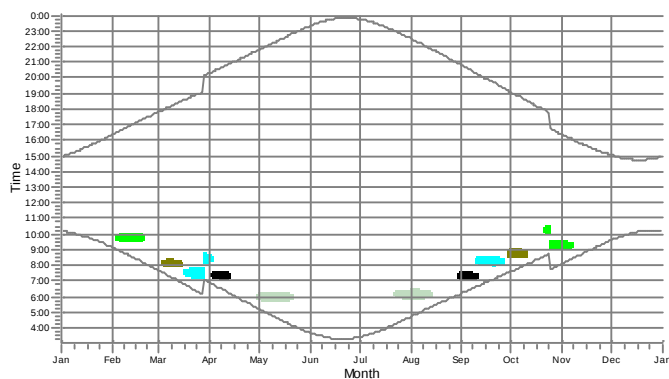
C: Bostad (Vägamminnet)



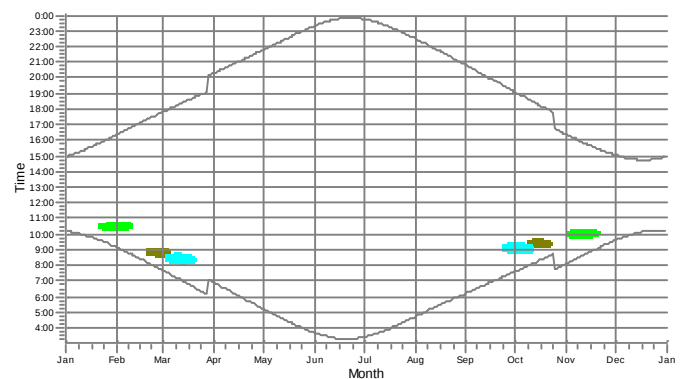
D: Bostad (Solbackavägen)



E: Bostad (Gunilackvägen 90)



F: Bostad (Monåvägen 19)



WTGs

- 1: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (452)
- 2: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (453)
- 4: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (455)
- 5: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (456)
- 9: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (460)

- 10: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (461)
- 13: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (464)
- 14: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (465)
- 15: NORDEX N131/3000 3000 131.0 !O! hub: 144,0 m (TOT: 209,5 m) (466)

Project:

Svevind Sandbacken

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FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadbäck / hans.vadback@fcg.fi

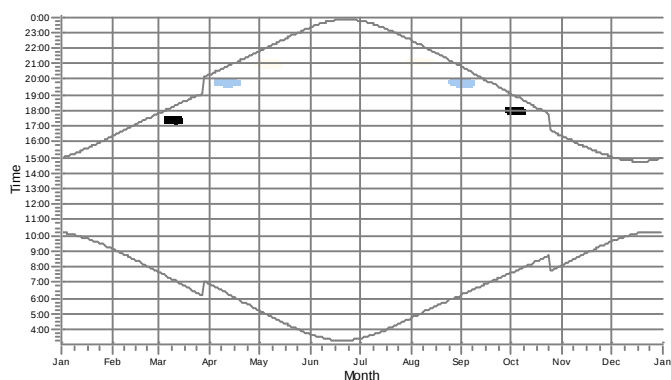
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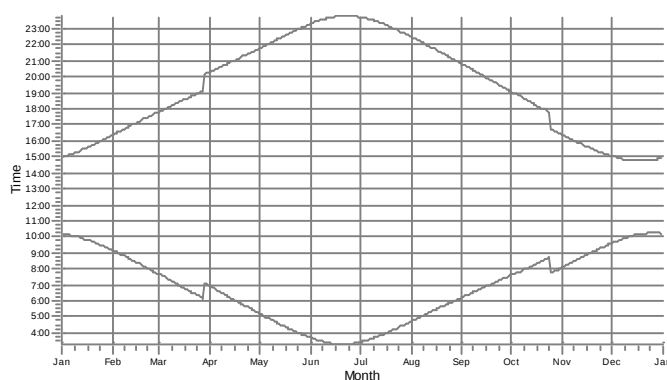
SHADOW - Calendar, graphical

Calculation: Sandbacka N131 x 19 x HH144 _ALT 3 (Skog corine 20-20-15)

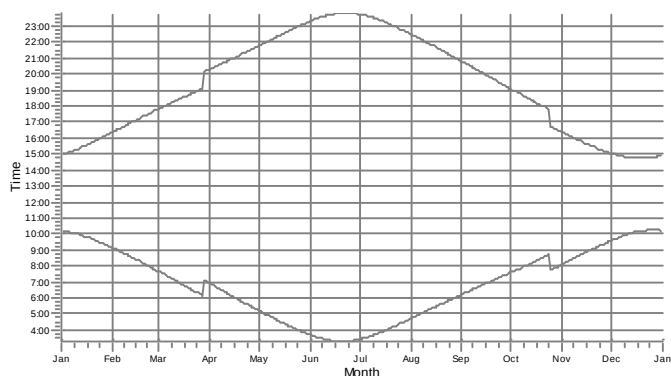
G: Bostad (Harjuxvägen 336)



H: Bostad (Harjuxvägen 425)



I: Bostad (Harjuxvägen 430)



WTGs

14: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (465)

16: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (467)

17: NORDEX N131/3000 3000 131.0 !OI! hub: 144,0 m (TOT: 209,5 m) (468)

Project:

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FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

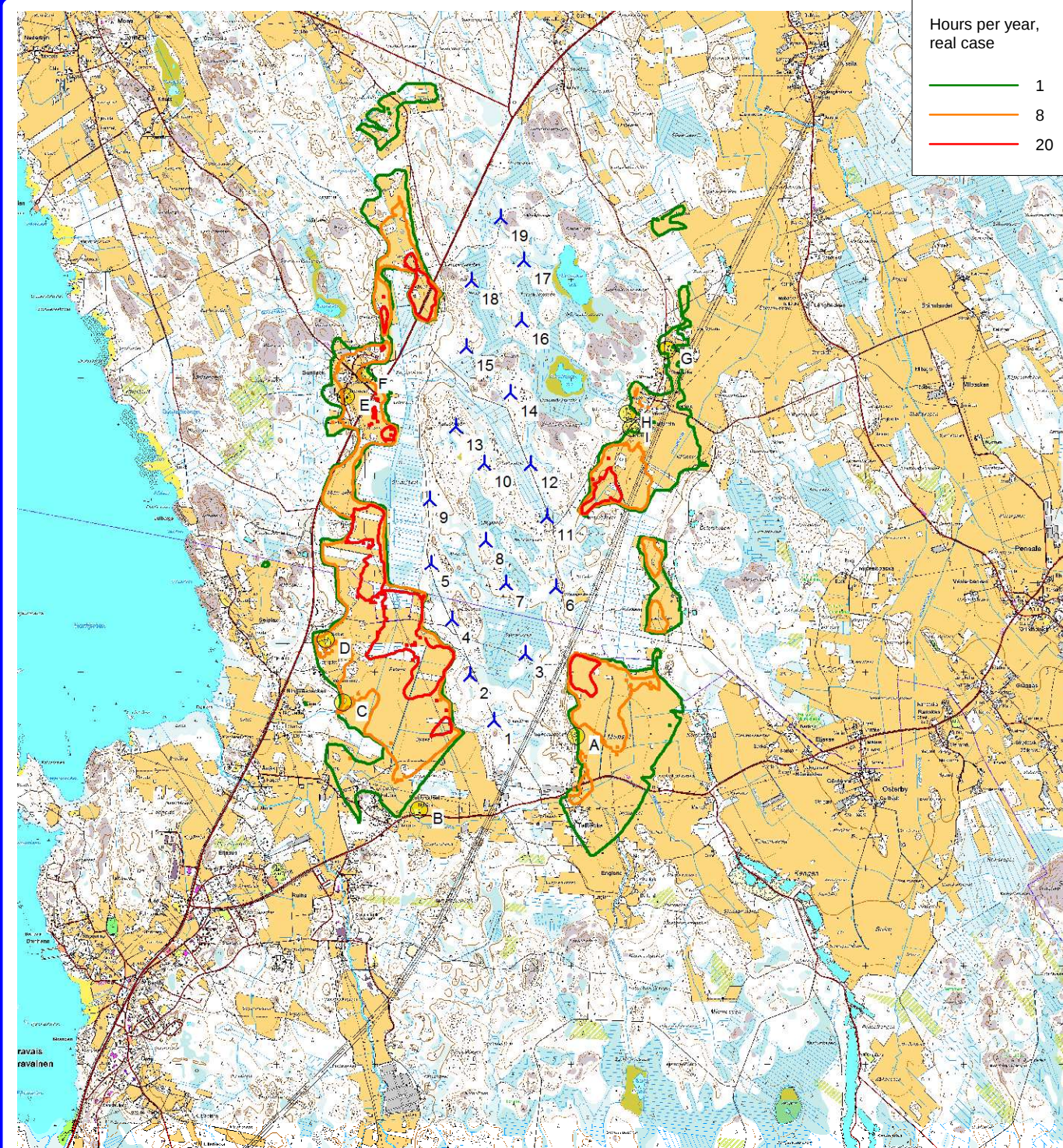
Hans Vadback / hans.vadback@fcg.fi

Calculated:

15.4.2014 15:38/2.8.579

SHADOW - Map

Calculation: Sandbacka N131 x 19 x HH144 ALT 3 (Skog corine 20-20-15)



0 1 2 3 4 km

Map: Peruskarttarasteri, Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 272 160 North: 7 031 440

New WTG

Shadow receptor

Flicker map level: Height Contours: Oravais_korkeusk.wpo (1)