Appendix D
Shadow Flicker Report

ReGenerate
Renewable Energy Consulting

Shadow Flicker Assessment

Project: Plum Creek (MN)

Date: October 7, 2024

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Contents

Revision History

Issue	Date	Revision Purpose
1	27-Sep-19	Original
2	02-Oct-19	Minor Revisions and Correction for Typos
3	28-Oct-19	Update to WTG Layouts
4	03-Aug-20	Update to WTG Layouts
5	04-Aug-20	Change in V162 Hub Height and SG 6.2-170 Nameplate
6	28-May-24	Update to WTG Layouts/WTG Configurations
7	17-Jun-24	Update to WTG Layout/Minor Report Revisions
8	25-Jul-24	Changes to Receptor Participation Status
9	30-Jul-24	Changes to Receptor Participation Status
10	07-Oct-24	Changes to Layout/Receptor Participation Status

1. Executive Summary

The Plum Creek Wind Farm in southwestern Minnesota has been studied for the impact of shadow flicker on surrounding residences. Modeling and topographic reviews were completed to determine potential results at receptor locations in and around the Project.

The Project was reviewed for one turbine layout with 78 locations and four potential turbine configurations:

- GE 6.1-158 at 117m hub-height;
- GE 3.8-154 at 98m hub-height;
- Vestas V150-4.5 at 120m hub-height; and
- Vestas V163-4.5 at 113 m hub-height.

ReGenerate used WindPRO to model shadow flicker for 461 receptors. This model is likely to overestimate the shadow flicker experienced due to conservative assumptions.

The maximum value of shadow flicker at receptor locations is presented in the table below.

Layout	Participating		Non-Participating	
	0 – 30 hr/yr	30+ hr/yr	0 – 30 hr/yr	30+ hr/yr
GE 6.1-158 h117	117	19	325	0
GE 3.8-154 h98	117	19	325	0
V150-4.5 h120	118	18	325	0
V163-4.5 h113	116	20	325	0

The maximum value of shadow flicker for any layout was found to be 26.7 hr/yr for non-participating receptors while the maximum value for all receptors was found to be 105.5 hr/yr and this assessment finds that the Plum Creek Wind Project does not cause or contribute to potential exceedance of the standard.

Appendix I shows the spatial mapping for shadow flicker results. Appendix II shows turbine coordinates provided for the Plum Creek Wind Farm. Appendix III shows the results at each receptor analyzed for this study.

2. Introduction

The Plum Creek Wind Farm (Project) is being developed by Plum Creek Wind Farm LLC (Plum Creek) in southwestern Minnesota. Merjent (on behalf of NGR) has retained ReGenerate Consulting (ReGenerate) to carry out an independent analysis of the shadow flicker effects caused by the proposed Project.

These turbines can cause shadow flicker throughout the Project area and this effect was studied at sensitive locations (receptors) to quantify the impact before the proposed Project is constructed.

The objective of this assessment is to predict the shadow flicker levels generated by the Project at all receptors within or near the Project area and in accordance with any applicable regulations as described in further detail later in the report. This report describes the Project site, shadow flicker methodology and results of the analysis.

3. Background

The cumulative effects of turbine generated shadow flicker throughout the Project area were studied to determine the impact on sensitive receptors. This effect occurs when wind turbine blades cast a moving shadow across the ground and nearby structures; this is perceived as a flickering effect due to the constant rotation of the blades. Flicker occurs when the following conditions are met: turbine is operating, sun is shining with insignificant cloud cover, turbine blades are positioned directly between the sun and receptor, and the receptor is close enough to distinguish the shadow created.

ReGenerate used the WindPRO software to model shadow flicker for this Project. [1] Calculation of potential shadow impact is carried out by simulating the position of the sun relative to the turbine rotor swept area with the resulting shadow calculated in steps of 1 minute throughout a complete year. If the shadow at any time casts a shadow reflection on the window defined for the receptor, this step will be registered as 1 minute of potential shadow impact. Information required in this calculation includes: position of wind turbines, turbine hub height and rotor diameter, position of receptor, terrain elevation, window information (height, size, azimuth and tilt), time zone and daylight savings time information and simulation model which holds information about the earth's orbit and rotation relative to the sun. A diagram of this simulation is presented in Figure 1 below.

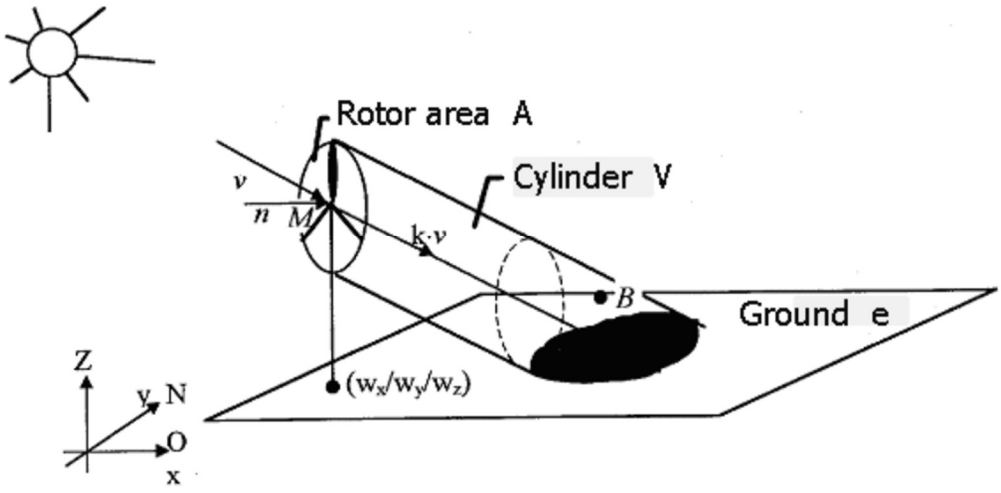

Figure 1: Diagram of Shadow Flicker Model Simulation [1]

This simulation will provide worst case results, to determine a more realistic scenario the wind direction and cloud cover may be incorporated. In the absence of wind direction data, the model will assume that the rotor swept area is always perpendicular to the sun. Wind direction data are generally gathered from on-site meteorological mast measurements or a nearby reference data set. Measured monthly sunshine data from local data sources may also be incorporated to account for cloud cover and visibility at times when the solar disk is not prominent enough to perceive shadow flicker.

Available scientific evidence suggests that shadow flicker impact from wind turbines is unlikely to affect human health. [2] It can however be considered a nuisance for homeowners near wind turbines, especially those that frequently experience shadow flicker.

4. Project Details

The Project is located near Tracy, Minnesota in agricultural land consisting mostly of rolling hills. There are scattered dwellings, farm buildings and trees throughout the Project area.

The Project was reviewed for one turbine layout with 78 locations and four potential configurations:

- GE 6.1-158 at 117m hub-height;
- GE 3.8-154 at 98m hub-height;
- Vestas V150-4.5 at 120m hub-height; and
- Vestas V163-4.5 at 113 m hub-height.

Plum Creek provided ReGenerate with the coordinates of turbines for the Project. This layout was dated 04-Oct-24. The layouts feature 78 turbine locations including alternate locations. The coordinates provided for turbines are shown in Appendix II.

Plum Creek provided ReGenerate with the coordinates of receptors for the Project. The impact of shadow flicker was calculated for 461 receptors, 136 of which are participating receptors and 325 are non-participating. Coordinates for receptors can be found in Appendix III.

No information on neighboring projects was provided. A cursory review by ReGenerate did not indicate any operating wind farms with the immediate Project area that would have an impact on the shadow flicker results. [3]

5. Project Regulations

There are no applicable state or local regulations establishing a shadow flicker limit. However, the Minnesota Public Utilities Commission requires a Shadow Flicker Mitigation Plan for receptors with more than 30 hours/year of expected shadow flicker impacts. [4]

6. Modeling Procedures

ReGenerate used the WindPRO software to model shadow flicker. [1] Modeling assumptions for the shadow flicker analysis include:

- Turbine is operating 100% of the time;
- Flicker is modeled out to ten times the rotor diameter from each respective turbine;
- Flicker is ignored if sun is less than 3° above horizon;
- Default observer eye level is 4 m;
- Receptors are perpendicular to all turbines, also known as greenhouse mode;
- Cloud cover was incorporated using annual climate normals from a representative met station;
- Turbine orientation is taken into account from on-site met data; and
- Obstacles (like trees or buildings) are not taken into account.

ReGenerate studied nearby meteorological reference stations available from usclimatedata.com (USCD) historical norms and from the Global Historical Climatology Network (GHCN) for this analysis; see Table 1, below. [4,5]

Station	Data Source	State	Average Sunshine [hr/day]	Distance from Project [km]
Minneapolis-St. Paul	USCD	MN	7.1	207
Des Moines	USCD	IA	7.4	321
Minneapolis-St. Paul	GHCN	MN	7.4	207
Sioux Falls	GHCN	SD	7.5	120
Sioux City	GHCN	IA	7.3	196
Des Moines	GHCN	IA	7.4	321

Table 1: Meteorological reference stations

Though the closest station, the Sioux Falls station exhibited numerous days of erroneous data and was therefore excluded from the analysis. Based on the proximity and more similar expected solar resource, the Sioux City meteorological station was chosen as most representative. Monthly average sunshine hours per month for the station are shown in Table 2 below:

Sioux City Average Sunshine [hr/month]											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
164	165	209	227	270	307	326	294	238	204	139	138

Table 2: Average sunshine hours per month

The wind direction frequency was considered to account for turbine orientation of the rotor area relative to the sun. This data was provided by Plum Creek from the on-site met mast from the Project at hub height. The wind frequency rose is shown below as Figure 2.

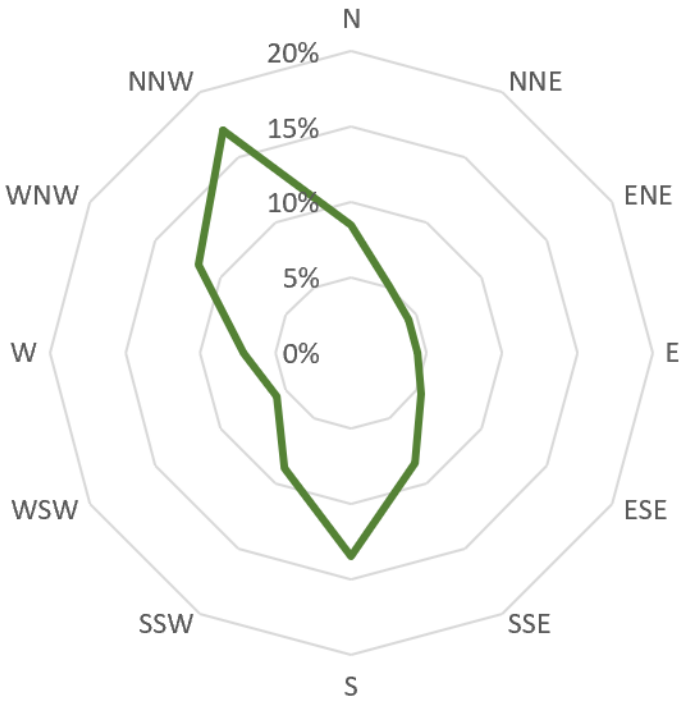

Figure 2: Wind Frequency Rose for Plum Creek Project

This model is still likely to produce estimates higher than those which will actually be experienced. Factors that will lower the impact, but were not modeled include:

- Availability of the turbines;
- Turbines not operating below cut-in and above cut-out;
- Alternate turbines not being constructed;
- Obstacles (like trees or buildings) not being considered; and
- Dust or aerosols in the air which reduce the impact of shadow flicker.

7. Modeling Results

The effect on receptors has been quantified using the methodology described above and the maximum value of shadow flicker was found to be 33.2 hr/yr for non-participating receptors while the maximum value for all receptors was found to be 105.5 hr/yr. A summary of the results can be seen below in Table 3 - Table 7; detailed results can be found in Appendix III.

Layout	Maximum Shadow Flicker [hr/yr]	
	Participating	Non-Participating
GE 6.1-158 h117	99.5	25.7
GE 3.8-154 h98	94.3	22.0
V150-4.5 h120	88.9	23.7
V163-4.5 h113	105.5	26.7

Table 3: Maximum Shadow flicker results by turbine configuration

GE 6.1-158 h117	Participating		Non-Participating		Total	
Shadow Flicker [hr/yr]	№ Receptors	% of Receptors	№ Receptors	% of Receptors	№ Receptors	% of Receptors
0	66	48.53%	276	84.92%	342	74.19%
0.1 to 20	35	25.74%	43	13.23%	78	16.92%
20.1 to 30	16	11.76%	6	1.85%	22	4.77%
30.1 to 40	4	2.94%	0	0.00%	4	0.87%
40.1 to 50	8	5.88%	0	0.00%	8	1.74%
50.1 to 60	3	2.21%	0	0.00%	3	0.65%
60.1 or more	4	2.94%	0	0.00%	4	0.87%

Table 4: Shadow flicker results summary for GE 6.1-158 h117

GE 3.8-154 h98	Participating		Non-Participating		Total	
Shadow Flicker [hr/yr]	№ Receptors	% of Receptors	№ Receptors	% of Receptors	№ Receptors	% of Receptors
0	69	50.74%	276	84.92%	345	74.84%
0.1 to 20	40	29.41%	46	14.15%	86	18.66%
20.1 to 30	8	5.88%	3	0.92%	11	2.39%
30.1 to 40	11	8.09%	0	0.00%	11	2.39%
40.1 to 50	3	2.21%	0	0.00%	3	0.65%
50.1 to 60	2	1.47%	0	0.00%	2	0.43%
60.1 or more	3	2.21%	0	0.00%	3	0.65%

Table 5: Shadow flicker results summary for GE 3.8-154 h98

V150-4.5 h120	Participating		Non-Participating		Total	
Shadow Flicker [hr/yr]	№ Receptors	% of Receptors	№ Receptors	% of Receptors	№ Receptors	% of Receptors
0	67	49.26%	279	85.85%	346	75.05%
0.1 to 20	38	27.94%	41	12.62%	79	17.14%
20.1 to 30	13	9.56%	5	1.54%	18	3.90%
30.1 to 40	7	5.15%	0	0.00%	7	1.52%
40.1 to 50	5	3.68%	0	0.00%	5	1.08%
50.1 to 60	2	1.47%	0	0.00%	2	0.43%
60.1 or more	4	2.94%	0	0.00%	4	0.87%

Table 6: Shadow flicker results summary for V150-4.5 h120

V163-4.5 h113	Participating		Non-Participating		Total	
Shadow Flicker [hr/yr]	№ Receptors	% of Receptors	№ Receptors	% of Receptors	№ Receptors	% of Receptors
0	65	47.79%	272	83.69%	337	73.10%
0.1 to 20	34	25.00%	46	14.15%	80	17.35%
20.1 to 30	17	12.50%	7	2.15%	24	5.21%
30.1 to 40	4	2.94%	0	0.00%	4	0.87%
40.1 to 50	9	6.62%	0	0.00%	9	1.95%
50.1 to 60	2	1.47%	0	0.00%	2	0.43%
60.1 or more	5	3.68%	0	0.00%	5	1.08%

Table 7: Shadow flicker results summary for V163-4.5 h113

8. Conclusions

There are no non-participating receptors above the standard of 30 hr/yr specified by Plum Creek with the maximum value of shadow flicker at these receptors found to be 26.7 hr/yr and this assessment finds that the Plum Creek Wind Project does not cause or contribute to potential exceedance of the standard.

The maximum value for all receptors was found to be 105.5 hr/yr with up to 20 participating receptors over 30 hr/yr although there is no specified regulation or design standard relating to participating receptors.

9. References

[1] EMD International A/S. (Apr 2019). WindPRO 3.3 User Manual – 6 Environment. Retrieved from https://www.emd-international.com/windpro/windpro-modules/environment-modules/shadow/.

[2] Knopper, Loren D et al. “Wind turbines and human health.” *Frontiers in public health* vol. 2 63. 19 Jun. 2014, doi:10.3389/fpubh.2014.00063.

[3] United States Geological Survey. “The U.S. Wind Turbine Database.” Retrieved from https://eerscmap.usgs.gov/uswtdb/.

[4] Davis, Monika. Email to Chris Nuckols and Ryan McDevitt. 07-Jun-2024.

[5] U.S. Climate Data. (2024). Climate Minneapolis – Minnesota. Retrieved from https://www.usclimatedata.com/climate/minneapolis/minnesota/united-states/usmn0503.

[6] National Centers for Environmental Information. (February 2024). Global Historical Climatology Network – Daily (GHCN Daily), Version 3. Retrieved from https://www.ncei.noaa.gov/access/search/data-search/daily-summaries?dataTypes=PSUN&dataTypes=TSUN.

Appendix I – Maps

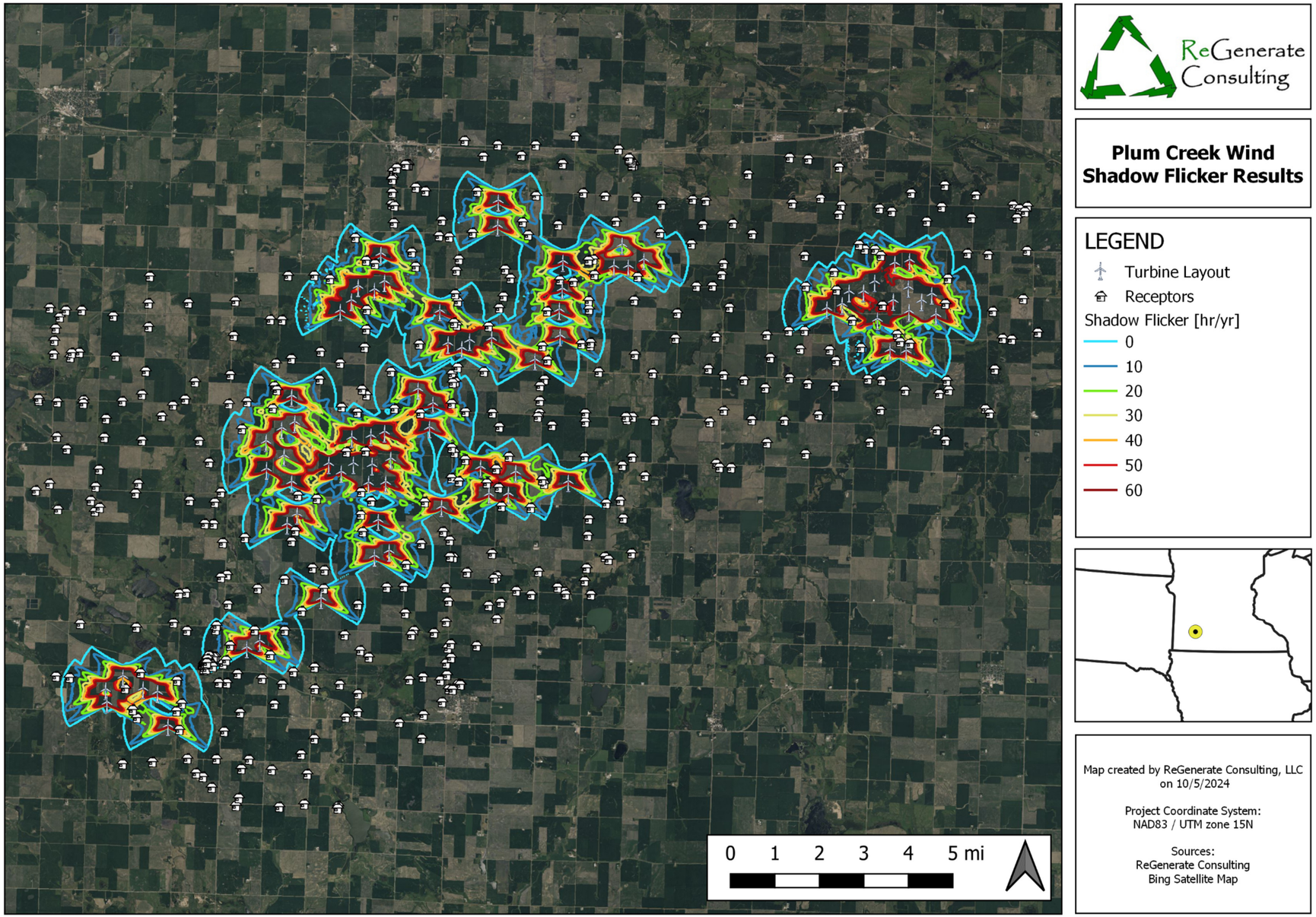

Figure 3: Shadow Flicker Map of Plum Creek Wind Project – GE 6.1-158 h117

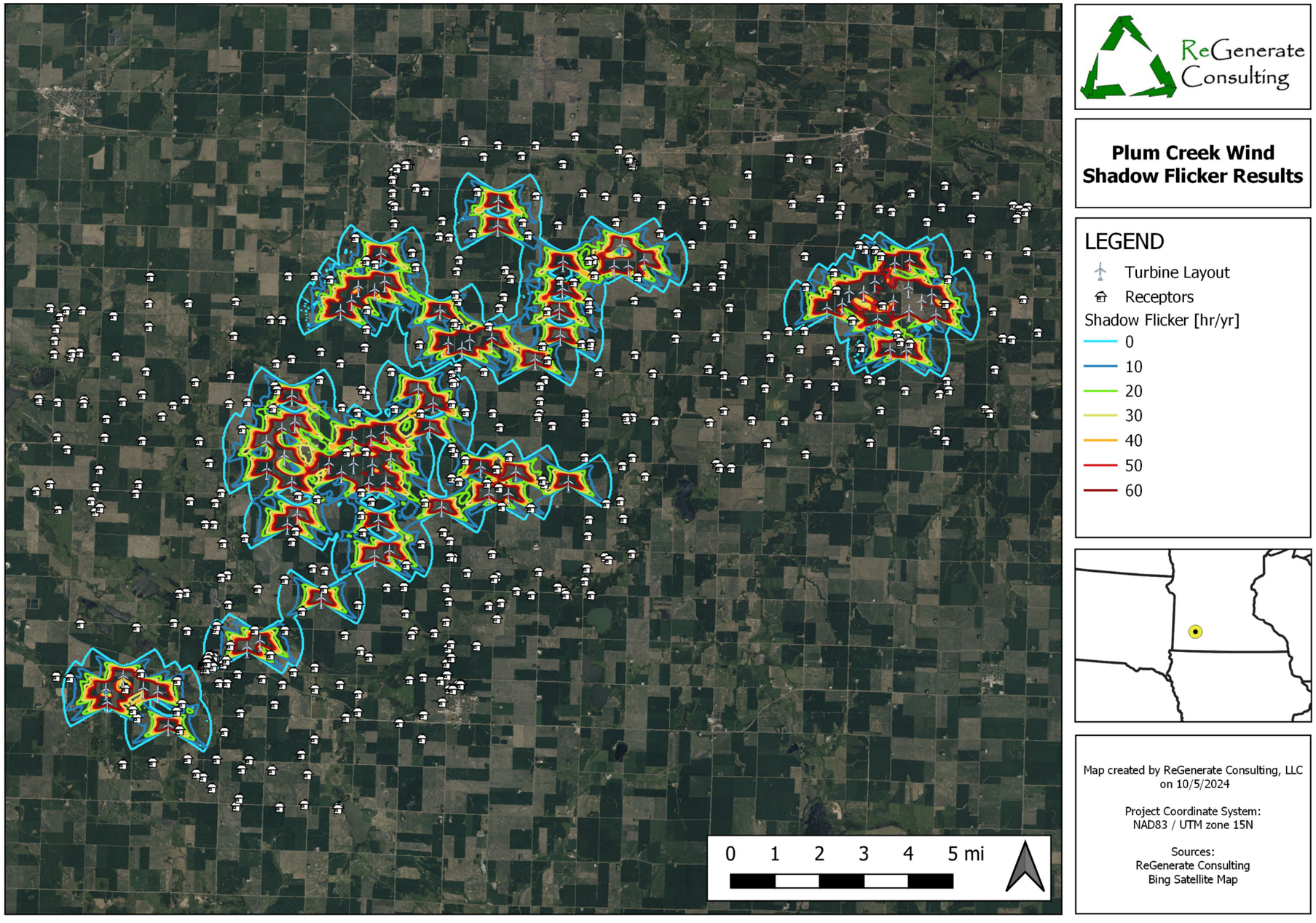

Figure 4: Shadow Flicker Map of Plum Creek Wind Project – GE 3.8-154 h98

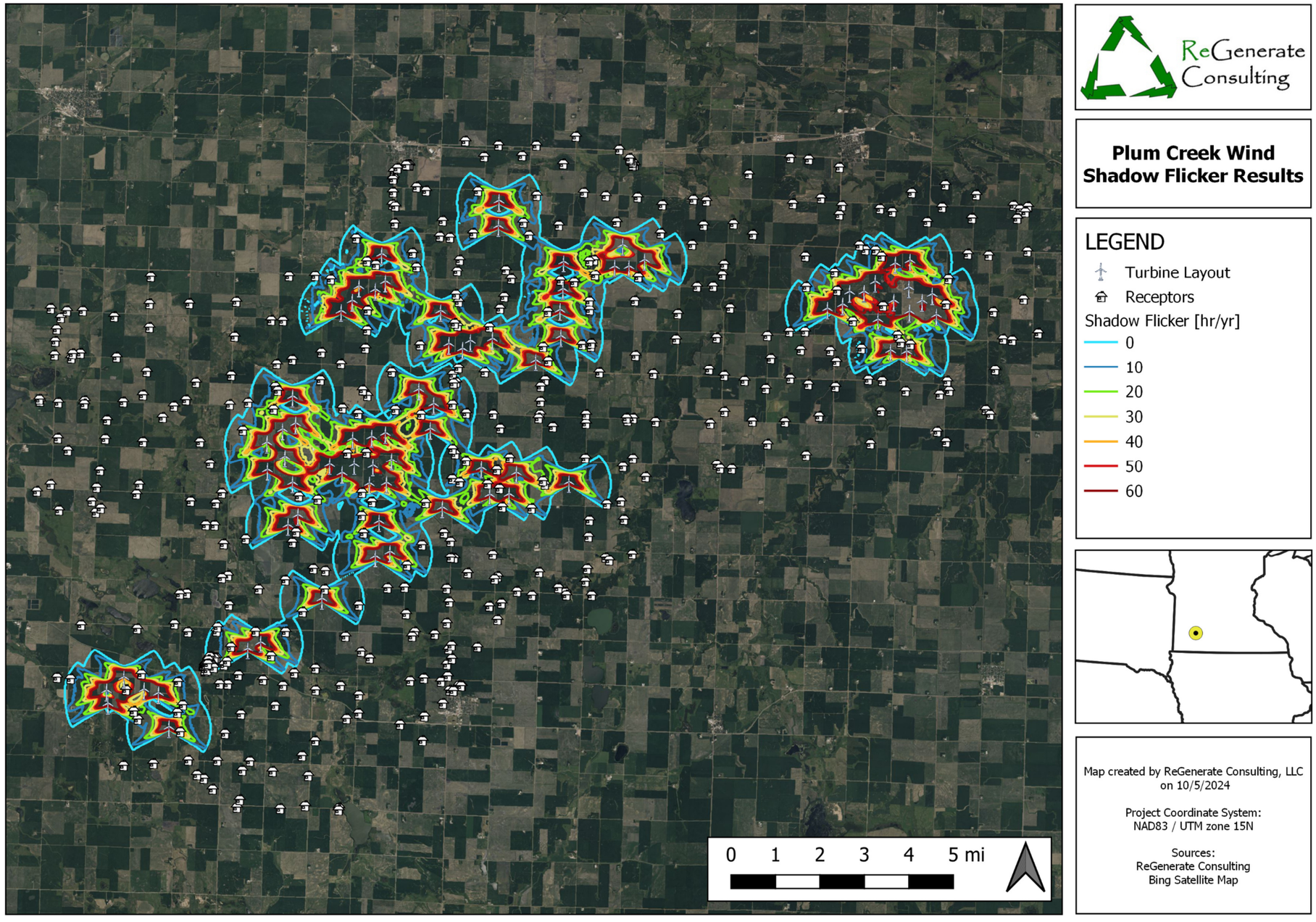

Figure 5: Shadow Flicker Map of Plum Creek Wind Project – V150-4.5 h120

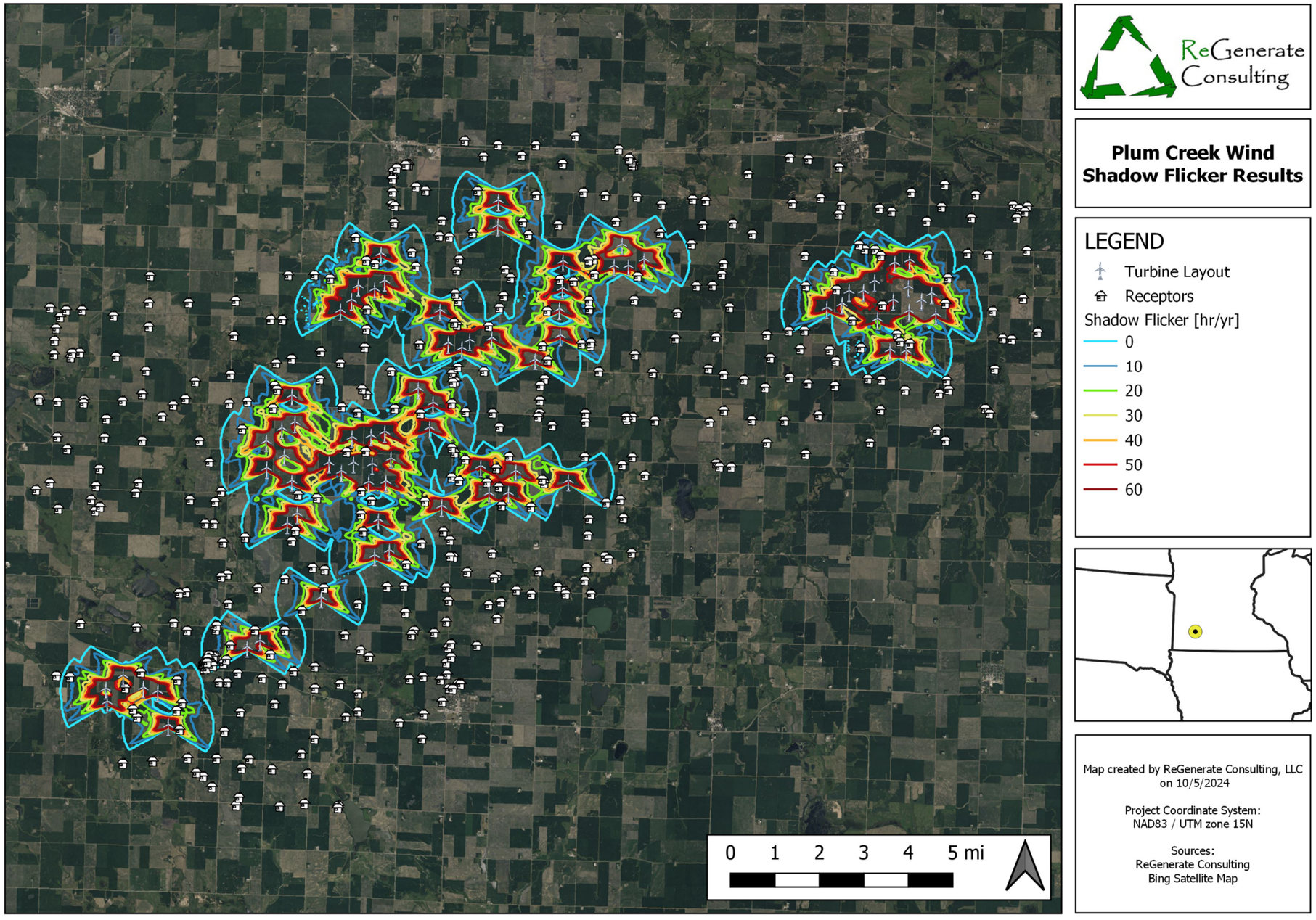

Figure 6: Shadow Flicker Map of Plum Creek Wind Project – V163-4.5 h113

Appendix II – Project Turbine Coordinates

(UTM WGS84 Zone 15)

Turbine	X [m]	Y [m]
T-1	294316	4878637
T-2	292108	4879481
T-3	293936	4879860
T-4	292057	4879950
T-5	293413	4879991
T-6	292685	4880429
T-7	297169	4881469
T-8	297636	4881702
T-9	299855	4883271
T-10	301789	4884797
T-11	302317	4884977
T-12	298628	4885947
T-13	301926	4886085
T-14	298987	4886307
T-15	304214	4886583
T-16	305931	4887046
T-17	306633	4887062
T-18	301574	4887452
T-19	302193	4887475
T-20	298789	4887485
T-21	301025	4888147
T-22	300586	4887838
T-23	306896	4887842
T-24	297882	4887952
T-25	305628	4888023
T-26	308800	4887499
T-27	301701	4888104
T-28	300135	4888149
T-29	302373	4888316
T-30	298514	4888425
T-31	297864	4888943
T-32	300968	4889088
T-33	301657	4889156
T-34	302154	4889284
T-35	303780	4889442
T-36	298429	4889417
T-37	298902	4889633
T-38	303903	4890335
T-39	298791	4890603

Turbine	X [m]	Y [m]
T-40	303367	4890855
T-41	307597	4891913
T-42	320448	4892276
T-43	321030	4892236
T-44	304946	4892337
T-46	305232	4892622
T-47	306028	4892694
T-48	308508	4892786
T-49	319991	4893384
T-50	322108	4893550
T-51	304154	4893694
T-52	321132	4893674
T-53	300550	4893694
T-54	308476	4893730
T-55	318161	4893780
T-56	318710	4893928
T-57	321587	4894058
T-58	300953	4894065
T-59	320562	4894067
T-60	321955	4894297
T-61	318963	4894380
T-62	319485	4894387
T-63	301788	4894460
T-64	308583	4894483
T-65	321108	4894540
T-66	301197	4894576
T-67	319890	4894747
T-68	302151	4894755
T-69	310456	4895312
T-70	310974	4895314
T-71	320618	4895421
T-72	308607	4895479
T-73	321150	4895525
T-74	311541	4895548
T-75	302016	4895758
T-76	310746	4896087
T-77	306248	4896771
T-78	306268	4897675
T-45	304451	4892516

Appendix III – Individual Receptor Results

(UTM WGS84 Zone 15)

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_001	302440	4898831	Non-Participating	0	0	0	0
R_002	302434	4898600	Non-Participating	0	0	0	0
R_003	302410	4898539	Non-Participating	0	0	0	0
R_004	302410	4898068	Non-Participating	0	0	0	0
R_005	303263	4898256	Non-Participating	0	0	0	0
R_006	302569	4898952	Non-Participating	0	0	0	0
R_007	302991	4899048	Non-Participating	0	0	0	0
R_008	302935	4899048	Non-Participating	0	0	0	0
R_009	302993	4899080	Non-Participating	0	0	0	0
R_010	302938	4899080	Non-Participating	0	0	0	0
R_011	302889	4899071	Non-Participating	0	0	0	0
R_012	303607	4898119	Non-Participating	0	0	0	0
R_013	305486	4898110	Non-Participating	12.6	11.0	11.6	13.1
R_014	305709	4899371	Participating	0	0	0	0
R_015	305029	4899934	Non-Participating	0	0	0	0
R_016	306229	4899784	Non-Participating	0	0	0	0
R_017	307085	4899404	Participating	0	0	0	0
R_018	307602	4899778	Non-Participating	0	0	0	0
R_019	308573	4899106	Non-Participating	0	0	0	0
R_020	309321	4898056	Non-Participating	0	0	0	0
R_021	310114	4897936	Non-Participating	0	0	0	0
R_022	310503	4896999	Non-Participating	0	0	0	0
R_023	311268	4897890	Participating	0	0	0	0
R_024	312160	4897614	Participating	0	0	0	0
R_025	312103	4896593	Participating	3.1	2.4	2.9	3.1
R_026	313241	4896184	Non-Participating	0	0	0	0
R_027	313653	4896880	Non-Participating	0	0	0	0
R_028	313286	4897805	Non-Participating	0	0	0	0
R_029	313755	4897756	Non-Participating	0	0	0	0
R_030	315290	4898733	Non-Participating	0	0	0	0
R_031	316889	4897657	Non-Participating	0	0	0	0
R_032	316794	4899329	Non-Participating	0	0	0	0
R_033	317467	4899274	Non-Participating	0	0	0	0
R_034	318580	4898982	Non-Participating	0	0	0	0
R_035	317909	4897852	Non-Participating	0	0	0	0
R_036	320044	4897476	Participating	0	0	0	0
R_037	320488	4897361	Participating	0	0	0	0
R_038	321192	4898051	Participating	0	0	0	0
R_039	321755	4897005	Participating	0	0	0	0
R_040	322294	4897529	Non-Participating	0	0	0	0
R_041	323375	4897131	Non-Participating	0	0	0	0
R_042	323532	4897971	Non-Participating	0	0	0	0
R_043	322408	4898331	Non-Participating	0	0	0	0
R_044	324880	4897592	Non-Participating	0	0	0	0
R_045	325401	4897546	Non-Participating	0	0	0	0
R_046	325107	4897456	Non-Participating	0	0	0	0
R_047	325309	4897354	Non-Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_048	325381	4895945	Non-Participating	0	0	0	0
R_049	323979	4895800	Non-Participating	0	0	0	0
R_050	323227	4895846	Non-Participating	0	0	0	0
R_051	319512	4895997	Non-Participating	6.0	5.0	5.7	6.2
R_052	319882	4895985	Non-Participating	23.3	20.4	21.8	23.9
R_053	318665	4897583	Non-Participating	0	0	0	0
R_054	318571	4897256	Non-Participating	0	0	0	0
R_055	318392	4895181	Participating	10.5	6.8	7.2	10.8
R_056	317339	4895765	Non-Participating	0	0	0	0
R_057	314740	4896929	Non-Participating	0	0	0	0
R_058	315441	4896547	Non-Participating	0	0	0	0
R_059	314397	4895470	Non-Participating	0	0	0	0
R_060	311291	4895001	Participating	22.4	16.6	20.4	22.9
R_061	309727	4895074	Participating	45.3	38.6	42.9	46.2
R_062	309691	4895631	Participating	36.7	31.3	34.4	37.5
R_063	309516	4895594	Participating	28.2	22.3	26.4	28.7
R_064	308968	4894821	Participating	40.2	33.7	34.3	41.7
R_065	308479	4894880	Participating	28.4	14.6	26.7	28.1
R_066	308415	4896879	Non-Participating	0	0	0	0
R_067	307332	4896515	Non-Participating	7.8	6.3	7.3	8.0
R_068	307616	4897952	Non-Participating	3.3	2.6	3.1	3.3
R_069	307129	4896978	Non-Participating	8.6	7.5	8.0	8.9
R_070	305314	4896593	Non-Participating	10.3	8.4	9.6	10.5
R_071	304105	4896480	Non-Participating	0	0	0	0
R_072	304473	4896440	Participating	0	0	0	0
R_073	304206	4897040	Participating	0	0	0	0
R_074	302391	4897623	Non-Participating	0	0	0	0
R_075	302489	4897566	Participating	0	0	0	0
R_076	302467	4896951	Participating	0	0	0	0
R_077	301787	4895466	Participating	0	0	0	0
R_078	301465	4895588	Participating	40.8	38.8	37.9	42.4
R_079	301488	4893806	Participating	45.6	44.9	41.1	48.1
R_080	301469	4893094	Participating	4.0	4.1	3.5	4.5
R_081	301409	4892442	Non-Participating	0	0	0	0
R_082	300524	4891872	Participating	0	0	0	0
R_083	299816	4892289	Non-Participating	0	0	0	0
R_084	300155	4894922	Non-Participating	12.2	8.2	11.3	12.3
R_085	299782	4891280	Non-Participating	8.7	7.3	8.3	8.8
R_086	300578	4890267	Non-Participating	0	0	0	0
R_087	301479	4890717	Participating	0	0	0	0
R_088	301316	4890916	Non-Participating	0	0	0	0
R_089	302494	4890211	Participating	7.1	5.6	6.8	7.3
R_090	301148	4890065	Participating	10.5	8.8	10.0	10.7
R_091	303429	4890039	Participating	7.5	8.1	6.3	10.4
R_092	304563	4890401	Participating	25.4	21.6	23.3	26.2
R_093	304577	4891475	Non-Participating	4.1	3.3	3.8	4.2
R_094	304698	4891201	Non-Participating	3.3	2.7	3.1	3.4
R_095	304602	4891163	Participating	4.0	3.3	3.8	4.1
R_096	304777	4891721	Participating	0	0	0	0
R_097	302364	4891566	Non-Participating	8.6	7.2	7.9	8.8
R_098	303389	4892554	Non-Participating	8.5	5.3	6.1	8.6

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_099	304750	4893244	Participating	12.9	6.6	12.0	12.9
R_100	304645	4893333	Participating	8.2	4.0	4.5	8.1
R_101	304787	4894112	Non-Participating	19.2	18.2	16.2	20.6
R_102	304688	4894375	Participating	0.5	0	0.2	0.3
R_103	304824	4895632	Non-Participating	0	0	0	0
R_104	304736	4895223	Non-Participating	0	0	0	0
R_105	303116	4895888	Non-Participating	6.0	5.0	5.5	6.1
R_106	303259	4895373	Non-Participating	11.6	9.6	10.9	11.9
R_107	305729	4891565	Non-Participating	0	0	0	0
R_108	305898	4893203	Participating	13.8	11.6	13.0	16.8
R_109	306437	4894291	Non-Participating	0	0	0	0
R_110	306286	4893869	Non-Participating	0	0	0	0
R_111	306691	4894942	Non-Participating	0	0	0	0
R_112	306493	4895268	Participating	0	0	0	0
R_113	308018	4893754	Participating	42.6	38.7	38.4	45.3
R_114	307842	4892489	Participating	21.8	21.2	20.1	22.7
R_115	308030	4891978	Participating	38.8	36.8	34.8	41.5
R_116	307920	4891279	Participating	0	0	0	0
R_117	307763	4891048	Participating	0	0	0	0
R_118	307749	4890507	Participating	0	0	0	0
R_119	307740	4890046	Participating	0	0	0	0
R_120	307680	4889909	Non-Participating	0	0	0	0
R_121	308195	4889597	Non-Participating	0	0	0	0
R_122	309261	4892567	Non-Participating	21.8	17.9	20.1	22.5
R_123	309578	4892507	Participating	8.5	7.0	8.0	8.8
R_124	309591	4892613	Participating	7.4	6.1	6.9	7.6
R_125	309534	4893820	Non-Participating	6.6	5.9	6.0	7.1
R_126	309523	4894130	Participating	21.2	16.9	19.6	21.6
R_127	309883	4891551	Non-Participating	0	0	0	0
R_128	311188	4892176	Non-Participating	0	0	0	0
R_129	311835	4891505	Non-Participating	0	0	0	0
R_130	312659	4892764	Participating	0	0	0	0
R_131	311165	4894146	Participating	0	0	0	0
R_132	312724	4893680	Participating	0	0	0	0
R_133	313418	4894654	Non-Participating	0	0	0	0
R_134	314000	4894665	Non-Participating	0	0	0	0
R_135	314335	4895070	Non-Participating	0	0	0	0
R_136	317374	4894651	Participating	5.5	2.8	1.5	8.0
R_137	318490	4894518	Participating	43.6	40.2	40.2	45.7
R_138	319300	4896162	Non-Participating	3.8	3.0	0	3.8
R_139	319057	4893415	Participating	31.0	23.1	28.9	31.8
R_140	320098	4895767	Participating	35.0	33.5	31.2	37.6
R_141	322522	4894937	Non-Participating	15.4	7.9	14.3	15.3
R_142	322432	4894021	Participating	58.6	50.2	51.9	61.6
R_143	325012	4897124	Non-Participating	0	0	0	0
R_144	314615	4893885	Participating	0	0	0	0
R_145	314125	4892813	Participating	0	0	0	0
R_146	315963	4892890	Non-Participating	0	0	0	0
R_147	316091	4892068	Non-Participating	0	0	0	0
R_148	316760	4893037	Non-Participating	0	0	0	4.1
R_149	317329	4893046	Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_150	317173	4892383	Non-Participating	0	0	0	0
R_151	318240	4892349	Non-Participating	0	0	0	0
R_152	318463	4891955	Non-Participating	0	0	0	0
R_153	318428	4891036	Participating	0	0	0	0
R_154	317450	4891118	Non-Participating	0	0	0	0
R_155	317839	4889972	Non-Participating	0	0	0	0
R_156	316601	4889775	Non-Participating	0	0	0	0
R_157	315906	4890969	Non-Participating	0	0	0	0
R_158	316792	4891336	Non-Participating	0	0	0	0
R_159	315139	4891258	Non-Participating	0	0	0	0
R_160	314401	4891442	Non-Participating	0	0	0	0
R_161	313855	4891664	Non-Participating	0	0	0	0
R_162	315970	4888971	Non-Participating	0	0	0	0
R_163	315422	4889795	Non-Participating	0	0	0	0
R_164	314406	4890141	Non-Participating	0	0	0	0
R_165	314138	4888222	Non-Participating	0	0	0	0
R_166	314253	4888085	Non-Participating	0	0	0	0
R_167	314675	4888072	Non-Participating	0	0	0	0
R_168	313897	4889718	Non-Participating	0	0	0	0
R_169	311913	4889779	Non-Participating	0	0	0	0
R_170	311105	4889903	Participating	0	0	0	0
R_171	310907	4889813	Non-Participating	0	0	0	0
R_172	310867	4889907	Non-Participating	0	0	0	0
R_173	311094	4888449	Participating	0	0	0	0
R_174	310737	4888155	Participating	0	0	0	0
R_175	311557	4887777	Non-Participating	0	0	0	0
R_176	310774	4886232	Non-Participating	0	0	0	0
R_177	310659	4886894	Non-Participating	0	0	0	0
R_178	310154	4886791	Non-Participating	11.0	9.2	0	11.2
R_179	311074	4884972	Participating	0	0	0	0
R_180	310109	4884845	Non-Participating	0	0	0	0
R_181	310239	4884745	Participating	0	0	0	0
R_182	309440	4884436	Non-Participating	0	0	0	0
R_183	309489	4885610	Non-Participating	0	0	0	0
R_184	309523	4886206	Participating	0	0	0	0
R_185	309603	4883480	Non-Participating	0	0	0	0
R_186	309375	4883975	Non-Participating	0	0	0	0
R_187	308656	4883585	Non-Participating	0	0	0	0
R_188	308396	4883744	Non-Participating	0	0	0	0
R_189	308687	4883487	Non-Participating	0	0	0	0
R_190	307699	4884311	Non-Participating	0	0	0	0
R_191	307441	4883475	Non-Participating	0	0	0	0
R_192	306902	4883620	Non-Participating	0	0	0	0
R_193	306336	4883196	Non-Participating	0	0	0	0
R_194	305898	4883087	Non-Participating	0	0	0	0
R_195	306192	4882604	Non-Participating	0	0	0	0
R_196	305466	4881612	Non-Participating	0	0	0	0
R_197	309373	4888459	Non-Participating	0	0	0	0
R_198	309397	4889720	Non-Participating	0	0	0	0
R_199	309397	4890037	Participating	0	0	0	0
R_200	307908	4887500	Non-Participating	24.9	20.4	23.5	25.7

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_201	307839	4887630	Participating	23.1	19.1	21.5	23.7
R_202	307426	4886633	Non-Participating	23.0	18.6	18.5	23.5
R_203	306366	4886685	Participating	0	0	0	0
R_204	306265	4887354	Participating	99.5	94.3	88.9	105.5
R_205	305837	4887518	Participating	21.9	17.6	19.8	21.8
R_206	306171	4888030	Participating	43.2	38.7	39.3	45.6
R_207	305053	4888360	Participating	23.3	21.3	20.9	24.4
R_208	304662	4888619	Participating	8.1	6.7	7.5	8.3
R_209	304563	4888793	Participating	8.0	6.9	7.4	8.3
R_210	304555	4887703	Participating	12.1	9.5	8.3	12.4
R_211	304822	4887585	Non-Participating	13.0	11.9	11.8	13.6
R_212	303588	4886835	Participating	25.7	21.7	18.0	26.5
R_213	301649	4886866	Participating	0	0	0	0
R_214	301288	4887203	Participating	13.9	10.8	12.9	14.1
R_215	301276	4886371	Participating	18.3	16.2	16.7	19.0
R_216	301342	4885743	Participating	16.5	15.9	14.0	17.9
R_217	299523	4884438	Participating	0	0	0	0
R_218	299957	4884360	Non-Participating	0	0	0	0
R_219	299682	4886958	Participating	19.7	16.8	18.5	20.2
R_220	300754	4888643	Participating	50.5	36.2	41.8	51.1
R_221	301445	4888665	Participating	26.6	17.5	24.9	26.8
R_222	304492	4885437	Non-Participating	0	0	0	0
R_223	304253	4885748	Non-Participating	0	0	0	0
R_224	304623	4884826	Non-Participating	0	0	0	0
R_225	304499	4884845	Participating	0	0	0	0
R_226	305112	4884283	Non-Participating	0	0	0	0
R_227	304353	4883725	Non-Participating	0	0	0	0
R_228	304444	4883240	Non-Participating	0	0	0	0
R_229	304356	4882484	Non-Participating	0	0	0	0
R_230	302829	4883767	Non-Participating	0	0	0	0
R_231	302882	4882812	Non-Participating	0	0	0	0
R_232	303201	4882162	Non-Participating	0	0	0	0
R_233	303103	4882008	Non-Participating	0	0	0	0
R_234	303920	4882082	Non-Participating	0	0	0	0
R_235	304422	4881532	Non-Participating	0	0	0	0
R_236	304528	4881679	Non-Participating	0	0	0	0
R_237	301564	4881199	Non-Participating	0	0	0	0
R_238	301254	4881443	Participating	0	0	0	0
R_239	299607	4880051	Non-Participating	0	0	0	0
R_240	299598	4880835	Participating	0	0	0	0
R_241	300686	4882004	Participating	0	0	0	0
R_242	301168	4883123	Non-Participating	4.1	3.2	3.9	4.2
R_243	302208	4883746	Non-Participating	0	0	0	0
R_244	302916	4884561	Participating	7.1	9.3	6.6	9.8
R_245	303460	4885312	Participating	4.6	3.8	4.3	4.7
R_246	306021	4884959	Non-Participating	0	0	0	0
R_247	306197	4884156	Participating	0	0	0	0
R_248	306090	4884064	Participating	0	0	0	0
R_249	306631	4888472	Participating	6.3	5.3	5.8	6.5
R_250	306288	4889543	Non-Participating	0	0	0	0
R_251	306037	4890049	Non-Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_252	305062	4890086	Participating	9.7	7.7	9.1	9.9
R_253	298424	4893434	Participating	0	0	0	0
R_254	298512	4884026	Participating	3.4	0	0	3.4
R_255	299933	4883698	Participating	8.6	0	7.6	7.8
R_256	299134	4882883	Participating	8.7	8.9	7.6	9.4
R_257	297541	4883702	Non-Participating	0	0	0	0
R_258	296436	4884193	Non-Participating	0	0	0	0
R_259	296213	4884106	Non-Participating	0	0	0	0
R_260	297075	4885531	Participating	0	0	0	2.8
R_261	296279	4885349	Participating	0	0	0	0
R_262	295949	4886025	Non-Participating	0	0	0	0
R_263	295991	4886821	Non-Participating	0	0	0	0
R_264	296212	4887189	Non-Participating	0	0	0	0
R_265	296971	4889470	Non-Participating	11.9	9.7	11.2	12.2
R_266	296499	4890396	Non-Participating	0	0	0	0
R_267	297162	4890469	Participating	0	0	0	0
R_268	296552	4891448	Participating	0	0	0	0
R_269	296672	4892865	Non-Participating	0	0	0	0
R_270	298000	4893446	Participating	0	0	0	0
R_271	298199	4891867	Non-Participating	0	0	0	0
R_272	298148	4891041	Participating	19.8	18.2	18.0	20.9
R_273	298237	4890899	Participating	24.7	22.6	22.2	26.1
R_274	298761	4892031	Non-Participating	0	0	0	0
R_275	298085	4890223	Participating	23.2	22.1	20.9	24.7
R_276	296466	4883131	Non-Participating	0	0	0	0
R_277	296541	4881622	Non-Participating	25.7	22.0	23.7	26.7
R_278	296290	4880956	Non-Participating	2.9	2.8	2.1	3.2
R_279	296398	4881086	Non-Participating	12.9	12.1	12.2	13.2
R_280	295886	4881211	Non-Participating	4.3	3.3	4.1	4.4
R_281	296003	4881212	Non-Participating	5.8	4.6	5.5	5.9
R_282	296810	4880595	Non-Participating	0	0	0	0
R_283	296427	4880265	Participating	0	0	0	0
R_284	296130	4880273	Participating	0	0	0	0
R_285	297701	4880422	Participating	0	0	0	0
R_286	297993	4881280	Participating	15.6	13.2	14.4	16.1
R_287	297432	4882178	Participating	12.3	1.4	11.3	11.9
R_288	298520	4882167	Non-Participating	8.6	7.5	7.8	8.8
R_289	298829	4880667	Non-Participating	0	0	0	0
R_290	298426	4880214	Non-Participating	0	0	0	0
R_291	298767	4885402	Participating	0	0	0	0
R_292	298902	4885776	Participating	23.2	38.6	12.6	32.2
R_293	299001	4887076	Participating	0	0	0	0
R_294	299590	4895047	Non-Participating	0	0	0	0
R_295	298643	4895038	Non-Participating	0	0	0	0
R_296	295420	4889048	Non-Participating	0	0	0	0
R_297	295783	4888265	Non-Participating	0	0	0	0
R_298	295629	4886034	Non-Participating	0	0	0	0
R_299	296019	4882191	Participating	5.3	4.3	5.0	5.4
R_300	296054	4882340	Non-Participating	8.5	6.9	8.1	8.6
R_301	300511	4880208	Non-Participating	0	0	0	0
R_302	301172	4879873	Non-Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_303	301158	4879218	Non-Participating	0	0	0	0
R_304	302662	4878821	Non-Participating	0	0	0	0
R_305	303544	4879111	Non-Participating	0	0	0	0
R_306	303028	4880384	Non-Participating	0	0	0	0
R_307	303524	4880479	Non-Participating	0	0	0	0
R_308	304152	4880363	Non-Participating	0	0	0	0
R_309	304392	4880555	Non-Participating	0	0	0	0
R_310	304365	4880978	Non-Participating	0	0	0	0
R_311	304540	4881184	Non-Participating	0	0	0	0
R_312	304801	4880223	Non-Participating	0	0	0	0
R_313	304893	4880211	Non-Participating	0	0	0	0
R_314	304875	4880203	Non-Participating	0	0	0	0
R_315	304458	4880046	Non-Participating	0	0	0	0
R_316	304595	4880027	Non-Participating	0	0	0	0
R_317	304215	4879572	Non-Participating	0	0	0	0
R_318	303476	4878235	Non-Participating	0	0	0	0
R_319	320154	4893962	Participating	90.4	89.7	80.8	96.5
R_320	320681	4892907	Participating	9.5	2.9	0	10.5
R_321	320794	4892643	Participating	70.9	56.9	66.8	72.3
R_322	321147	4892580	Participating	55.1	42.1	51.4	56.3
R_323	319375	4892433	Non-Participating	6.7	5.6	6.2	6.9
R_324	319627	4891295	Non-Participating	0	0	0	0
R_325	320122	4891247	Participating	0	0	0	0
R_326	320971	4890880	Non-Participating	0	0	0	0
R_327	320080	4890163	Non-Participating	0	0	0	0
R_328	319697	4888987	Non-Participating	0	0	0	0
R_329	317368	4888570	Non-Participating	0	0	0	0
R_330	301074	4896416	Participating	9.7	8.5	9.0	10.1
R_331	296734	4894119	Non-Participating	0	0	0	0
R_332	295033	4894051	Non-Participating	0	0	0	0
R_333	293638	4895016	Non-Participating	0	0	0	0
R_334	293591	4894038	Non-Participating	0	0	0	0
R_335	292315	4893575	Non-Participating	0	0	0	0
R_336	291174	4893786	Non-Participating	0	0	0	0
R_337	290378	4893537	Non-Participating	0	0	0	0
R_338	290231	4893127	Non-Participating	0	0	0	0
R_339	290602	4893783	Non-Participating	0	0	0	0
R_340	290017	4893869	Non-Participating	0	0	0	0
R_341	290179	4892686	Non-Participating	0	0	0	0
R_342	290153	4892196	Non-Participating	0	0	0	0
R_343	290761	4892086	Non-Participating	0	0	0	0
R_344	291091	4892258	Non-Participating	0	0	0	0
R_345	290810	4892239	Non-Participating	0	0	0	0
R_346	292400	4892119	Non-Participating	0	0	0	0
R_347	293591	4893187	Non-Participating	0	0	0	0
R_348	295273	4891191	Non-Participating	0	0	0	0
R_349	293490	4891579	Non-Participating	0	0	0	0
R_350	294914	4890560	Non-Participating	0	0	0	0
R_351	294475	4890336	Non-Participating	0	0	0	0
R_352	293355	4890737	Non-Participating	0	0	0	0
R_353	292641	4890487	Non-Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_354	291246	4890532	Non-Participating	0	0	0	0
R_355	291230	4890414	Non-Participating	0	0	0	0
R_356	290290	4890466	Non-Participating	0	0	0	0
R_357	289627	4890515	Non-Participating	0	0	0	0
R_358	289608	4890582	Non-Participating	0	0	0	0
R_359	290271	4889187	Non-Participating	0	0	0	0
R_360	290011	4887500	Non-Participating	0	0	0	0
R_361	289512	4887252	Non-Participating	0	0	0	0
R_362	290315	4886569	Non-Participating	0	0	0	0
R_363	291648	4886488	Non-Participating	0	0	0	0
R_364	291825	4886638	Participating	0	0	0	0
R_365	291503	4886894	Non-Participating	0	0	0	0
R_366	291675	4887391	Non-Participating	0	0	0	0
R_367	291799	4888012	Non-Participating	0	0	0	0
R_368	291990	4889164	Non-Participating	0	0	0	0
R_369	290632	4888748	Non-Participating	0	0	0	0
R_370	292052	4889840	Non-Participating	0	0	0	0
R_371	293353	4889057	Non-Participating	0	0	0	0
R_372	294068	4889931	Non-Participating	0	0	0	0
R_373	293219	4887500	Non-Participating	0	0	0	0
R_374	293120	4887152	Participating	0	0	0	0
R_375	295080	4886893	Non-Participating	0	0	0	0
R_376	294943	4883554	Non-Participating	0	0	0	0
R_377	294689	4883523	Non-Participating	0	0	0	0
R_378	294494	4882448	Non-Participating	0	0	0	0
R_379	294981	4882162	Non-Participating	0	0	0	0
R_380	295596	4880736	Non-Participating	0	0	0	0
R_381	293146	4882280	Non-Participating	0	0	0	0
R_382	291118	4882412	Non-Participating	0	0	0	0
R_383	290244	4880506	Non-Participating	0	0	0	0
R_384	290735	4880458	Non-Participating	4.1	3.3	3.8	4.1
R_385	293170	4879002	Non-Participating	18.0	13.0	16.8	18.3
R_386	293020	4879293	Non-Participating	15.5	12.9	14.0	16.3
R_387	292743	4880064	Participating	44.7	36.7	41.6	45.7
R_388	293301	4880632	Participating	22.8	18.9	20.4	23.7
R_389	294624	4880352	Non-Participating	22.3	19.9	20.5	22.9
R_390	294798	4879518	Participating	25.6	18.8	24.1	26.1
R_391	294604	4879244	Participating	4.5	4.1	4.1	4.7
R_392	294704	4878550	Participating	82.1	82.4	75.6	86.8
R_393	294996	4877510	Participating	0	0	0	0
R_394	296046	4877497	Non-Participating	0	0	0	0
R_395	296328	4878491	Participating	0	0	0	0
R_396	296903	4879190	Participating	0	0	0	0
R_397	293731	4877392	Non-Participating	0	0	0	0
R_398	292652	4877320	Non-Participating	0	0	0	0
R_399	295559	4876854	Participating	0	0	0	0
R_400	295312	4876988	Non-Participating	0	0	0	0
R_401	295879	4876470	Non-Participating	0	0	0	0
R_402	296755	4875816	Non-Participating	0	0	0	0
R_403	296860	4876092	Non-Participating	0	0	0	0
R_404	298324	4875771	Non-Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_405	299227	4875871	Participating	0	0	0	0
R_406	300456	4875798	Non-Participating	0	0	0	0
R_407	300441	4875720	Non-Participating	0	0	0	0
R_408	298142	4879496	Non-Participating	0	0	0	0
R_409	300728	4879025	Participating	0	0	0	0
R_410	299591	4878225	Non-Participating	0	0	0	0
R_411	299116	4877671	Non-Participating	0	0	0	0
R_412	299340	4876952	Participating	0	0	0	0
R_413	298047	4877108	Non-Participating	0	0	0	0
R_414	297228	4877478	Non-Participating	0	0	0	0
R_415	296951	4877144	Participating	0	0	0	0
R_416	295720	4881173	Non-Participating	3.1	2.3	3.0	3.2
R_417	295777	4881187	Non-Participating	3.5	2.6	3.3	3.5
R_418	295845	4881210	Non-Participating	3.9	3.0	3.7	4.0
R_419	295844	4881182	Non-Participating	3.9	3.0	3.8	4.0
R_420	295840	4881163	Non-Participating	4.0	3.0	3.8	4.0
R_421	295946	4881204	Non-Participating	5.1	3.9	4.8	5.1
R_422	295778	4881256	Non-Participating	3.5	2.6	3.3	3.5
R_423	295722	4881136	Non-Participating	3.2	2.4	3.0	3.2
R_424	295600	4880808	Non-Participating	0	0	0	0
R_425	295598	4880827	Non-Participating	0	0	0	0
R_426	295600	4880855	Non-Participating	0	0	0	0
R_427	295601	4880885	Non-Participating	0	0	0	0
R_428	295647	4880889	Non-Participating	0	0	0	3.4
R_429	295651	4880930	Non-Participating	0	0	0	3.2
R_430	295647	4880773	Non-Participating	0	0	0	0
R_431	295590	4880771	Non-Participating	0	0	0	0
R_432	295685	4880774	Non-Participating	0	0	0	0
R_433	295880	4880943	Non-Participating	7.8	5.3	7.2	7.8
R_434	295918	4880862	Non-Participating	8.1	7.0	7.8	8.1
R_435	295608	4880969	Non-Participating	0	0	0	0
R_436	295607	4880944	Non-Participating	0	0	0	0
R_437	295649	4880980	Non-Participating	0	0	0	3.0
R_438	295707	4880992	Non-Participating	3.4	2.4	0	3.4
R_439	311154	4899063	Non-Participating	0	0	0	0
R_440	311084	4899038	Non-Participating	0	0	0	0
R_441	311085	4899067	Non-Participating	0	0	0	0
R_442	311094	4899148	Non-Participating	0	0	0	0
R_443	311086	4899178	Non-Participating	0	0	0	0
R_444	311028	4899235	Non-Participating	0	0	0	0
R_445	310969	4899266	Non-Participating	0	0	0	0
R_446	310982	4899306	Non-Participating	0	0	0	0
R_447	310603	4899627	Non-Participating	0	0	0	0
R_448	309031	4900100	Non-Participating	0	0	0	0
R_449	322551	4890896	Non-Participating	0	0	0	0
R_450	322478	4891236	Non-Participating	0	0	0	0
R_451	322205	4890762	Non-Participating	0	0	0	0
R_452	324146	4893748	Non-Participating	0	0	0	0
R_453	325243	4894199	Non-Participating	0	0	0	0
R_454	324499	4892766	Non-Participating	0	0	0	0
R_455	324832	4892729	Non-Participating	0	0	0	0

Receptor ID	X [m]	Y [m]	Status	GE 6.1-158 h117	GE 3.8-154 h98	V150-4.5 h120	V163-4.5 h113
R_456	325775	4892983	Non-Participating	0	0	0	0
R_457	324215	4891646	Non-Participating	0	0	0	0
R_458	322116	4889430	Non-Participating	0	0	0	0
R_459	323874	4890208	Non-Participating	0	0	0	0
R_460	324031	4890035	Non-Participating	0	0	0	0
R_461	322437	4889055	Non-Participating	0	0	0	0