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**Re: Response to EPA RFI received on 17<sup>th</sup> June 2021 – Reg. No. PO467-03**

Date: 27<sup>th</sup> July 2021 Rev 1, 10<sup>th</sup> August 2021 Rev 2.

Dear Martin,

Please find included a response to RFI request Points 3a and 3b with particular focus upon the changes in odour and ammonia emission rates and dispersion model outputs for these particular changes.

The odour and ammonia dispersion model has being update to take account of the requested changes in odour and ammonia emission rates from Production pigs to Fattening/Finishing pigs.

The odour emission rate that has being accounted for within the odour model was 22.50  $O_u_e$ /pig place/s.

The ammonia emission rate that has being accounted for within the ammonia model was 131.3  $\mu g$ /pig place/s.

These emission factors were taken from the documents:

1. Sniffer ER26 Final Report, March 2014.
2. "Odour Impacts and Odour Emission Control Measures for Intensive Agriculture" Final Report Environmental Research R&D Report Series No. 14 published by the Irish Environmental Protection Agency 2006,

As the dispersion model remains the same with respect to model and source characteristics, layout etc. the results of the model are presented only for simplicity. Greater detail on the specific model and set up can be found in the original document :-

- Document Ref: 20211002(2) - Odour impact assessment of a proposed expansion of existing Woodville Pig Farm Ltd located in Woodville, Ballymackey, Nenagh, Co. Tipperary

The overall changes to the emission rates are highlighted within the Table 1 and 2 in yellow for ease of consideration.

If you have any queries in relation to this correspondence, please do not hesitate to contact me on the details above.

Yours sincerely,



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Brian Sheridan Ph.D Eng.

For and on behalf of Odour Monitoring Ireland

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## **EPA RFI QUERY**

3. With respect to the odour and ammonia modelling assessments submitted:
  - a. The odour emission factor used for production pigs (10 ou<sub>E</sub>/s) is not acceptable and has not been justified. The EPA's guidance document, *Odour Impacts and Odour Emission Control: Measures for Intensive Agriculture* (2001), recommends an emission factor for production pigs (fatteners) of 22.5 ou<sub>E</sub>/s.
  - b. The ammonia emission factor used for production pigs reflects only the grower stage and not the finisher stage. Given the increase in sow, weaner, and grower numbers, there will be a corresponding increase in the quantity of finishers, either at the Woodville breeding unit or the Ballyknockane finishing unit. If the increased number of finishers is to be disproportionately concentrated at the Ballyknockane finishing unit, then the associated increase in ammonia and odour emissions from that site must also be assessed.

## **Answer to Query**

Please find within this technical letter an updated odour and ammonia emission tables labelled Table 1 (Odour) and Table 2 (Ammonia). The update emission tables take into account the EPA requested emission factors for Fattening pigs.

The odour emission rate that has being accounted for within the odour model was 22.50 Ou<sub>e</sub>/pig place/s. The ammonia emission rate that has being accounted for within the ammonia model was 131.3 µg/pig place/s.

This has resulted in an increase in the overall odour and ammonia emission rate for the Woodville Farm. The odour and ammonia emission rate will increase up to a value of 123,850 Ou<sub>E</sub>/s and 0.6303 g/s for odour and ammonia, respectively.

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**Table 1 (Odour).** Predicted mass emission value results for odour for proposed pig production facility operations.

Pig housing type	Woodville Farm House numbers	Fan Capacity (m3/hr)	Max Stack height (m)	Max Building height (m)	Ventilation type	No. of Fans	Fan location	Fan diameter (m)	Pig numbers in house	Type of pig unit	Flooring type	Fan flowrate (m3/s)	Odour emission rate per pig place (OuE/pig/s)	Total odour emission rate (OuE/s)	Total ventilation rate per house (m3/hr)	Ventilation rate (m3/s)	Ventilation capacity per pig place (m3/pig/hr)	Odour emission rate per vent (OuE/s)	Temp (K)	Max efflux velocity (m/s)	Notes
Farrowing House	1	13400	6.85	6.4	Mechanical	10	Centre of house	0.6	220	Sows and piglets	Slatted	3.72	19	4,180	134,000	37.22	609.09	418	293.15	13.16	Vertical
Existing Farrowing House	2	4338	4.95	4.5	Mechanical	11	Centre of house	0.4	80	To be farrowing	Slatted	1.21	20	1,600	47,718	13.26	596.48	145	293.15	9.59	Vertical
Ex. Sow House	2A	11634	4.95	4.5	Mechanical	4	Centre of house	0.6	150	Loose sows	Slatted	3.23	19	2,850	46,536	12.93	310.24	713	293.15	11.43	Vertical
Gilt House	3	12700	4.85	4.4	Mechanical	2	Centre of house	0.6	81	Gilts	Slatted	3.53	20	1,620	25,400	7.06	313.58	810	293.15	12.48	Vertical
Gilt House	4	10575	4.85	4.4	Mechanical	6	Centre of house	0.6	210	M Gilts/Prod. pigs	Slatted	2.94	20	4,200	63,450	17.63	302.14	700	293.15	10.39	Vertical
Gilt House	5	10575	4.75	4.3	Mechanical	3	Centre of house	0.6	300	M Gilts	Slatted	2.94	20	6,000	31,725	8.81	105.75	2000	293.15	10.39	Vertical
Gilt House	6	5751	4.85	4.4	Mechanical	4	Centre of house	0.45	109	Gilts	Slatted	1.6	20	2,180	23,004	6.39	211.05	545	293.15	10.04	Vertical
First stage weaner	7	10575	4.15	3.7	Mechanical	4	Centre of house	0.6	900	Weaners	Slatted	2.94	6	5,400	42,300	11.75	47.00	1350	293.15	10.39	Capped emission point.
Loose Sow House	8	12700	6.85	6.4	Mechanical	8	Centre of house	0.6	850	Loose sows	Slatted	3.53	19	16,150	101,600	28.22	119.53	2019	293.15	12.48	Vertical
First Stage Weaner House	9	6400	4.25	3.8	Mechanical	2	Centre of house	0.45	900	Weaners	Slatted	1.78	6	5,400	12,800	3.56	14.22	2700	293.15	11.18	Vertical
Loose Sow House	10	12700	4.95	4.5	Mechanical	4	Centre of house	0.6	250	Loose Sows	Slatted	3.53	19	4,750	50,800	14.11	203.20	1188	293.15	12.48	Vertical
First Stage Weaner House	13	6482	4.15	3.7	Mechanical	2	Centre of house	0.4	400	Weaners	Slatted	1.8	6	2,400	12,964	3.60	32.41	1200	293.15	14.33	Vertical
First Stage Weaner House	14	13400	4.15	3.7	Mechanical	2	Centre of house	0.6	900	Weaners	Slatted	3.72	6	5,400	26,800	7.44	29.78	2700	293.15	13.16	Vertical
New Farrowing House	1A	13400	6.95	6.5	Mechanical	5	Centre of house	0.6	100	Sows and piglets	Slatted	3.72	19	1,900	67,000	18.61	670.00	380	293.15	13.16	Vertical
New Weaner House	2B	13400	3.95	3.5	Mechanical	5	Centre of house	0.6	950	Weaners	Slatted	3.72	6	5,700	67,000	18.61	70.53	1140	293.15	13.16	Vertical
New Second Stage	15	13400	5.05	4.6	Mechanical	20	Centre of house	0.6	5270	Weaners /Prod pigs	Slatted	3.72	6	31,620	268,000	74.44	50.85	1581	293.15	13.16	Vertical
Production Pigs	16	10000	4.75	4.3	Mechanical	12	Centre of house	0.6	1000	Fatteners	Slatted	2.78	22.5	22,500	120,000	33.33	120.00	1,875	293.15	9.82	Vertical
<b>Total Odour emission rate (OuE/s)</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	<b>123,850</b>	-	-	-	-	-	-	-

**Table 2 (Ammonia).** Predicted mass emission value results for Ammonia for proposed pig production facility operations.

Pig housing type	Woodville Farm House numbers	Fan Capacity (m3/hr)	Max Stack height (m)	Max Building height (m)	Ventilation type	No. of Fans	Fan location	Fan diameter (m)	Pig numbers in house	Type of pig unit	Flooring type	Fan flowrate (m3/s)	NH3 emission rate per pig place (µg/pig/s)	Total NH3 emission rate (g/s)	Total ventilation rate per house (m3/hr)	Ventilation rate (m3/s)	Ventilation capacity per pig place (m3/pig/hr)	NH3 emission rate per vent (g/s)	Temp (K)	Max efflux velocity (m/s)	Notes
Farrowing House	1	13400	6.85	6.4	Mechanical	10	Centre of house	0.6	220	Sows and piglets	Slatted	3.72	185.2	0.041	134,000	37.22	609.09	0.004	293.15	13.16	Vertical
Existing Farrowing House	2	4338	4.95	4.5	Mechanical	11	Centre of house	0.4	80	To be farrowing	Slatted	1.21	185.2	0.015	47,718	13.26	596.48	0.001	293.15	9.59	Vertical
Ex. Sow House	2A	11634	4.95	4.5	Mechanical	4	Centre of house	0.6	150	Loose sows	Slatted	3.23	185.2	0.028	46,536	12.93	310.24	0.007	293.15	11.43	Vertical
Gilt House	3	12700	4.85	4.4	Mechanical	2	Centre of house	0.6	81	Gilts	Slatted	3.53	185.2	0.015	25,400	7.06	313.58	0.008	293.15	12.48	Vertical
Gilt House	4	10575	4.85	4.4	Mechanical	6	Centre of house	0.6	210	M Gilts/Prod. Pigs	Slatted	2.94	185.2	0.039	63,450	17.63	302.14	0.006	293.15	10.39	Vertical
Gilt House	5	10575	4.75	4.3	Mechanical	3	Centre of house	0.6	300	M Gilts	Slatted	2.94	185.2	0.056	31,725	8.81	105.75	0.019	293.15	10.39	Vertical
Gilt House	6	5751	4.85	4.4	Mechanical	4	Centre of house	0.45	109	Gilts	Slatted	1.6	185.2	0.020	23,004	6.39	211.05	0.005	293.15	10.04	Vertical
First stage weaner	7	10575	4.15	3.7	Mechanical	4	Centre of house	0.6	900	Weaners	Slatted	2.94	9.2	0.008	42,300	11.75	47.00	0.002	293.15	10.39	Capped emission point.
Loose Sow House	8	12700	6.85	6.4	Mechanical	8	Centre of house	0.6	850	Loose sows	Slatted	3.53	185.2	0.157	101,600	28.22	119.53	0.020	293.15	12.48	Vertical
First Stage Weaner House	9	6400	4.25	3.8	Mechanical	2	Centre of house	0.45	900	Weaners	Slatted	1.78	9.2	0.008	12,800	3.56	14.22	0.004	293.15	11.18	Vertical
Loose Sow House	10	12700	4.95	4.5	Mechanical	4	Centre of house	0.6	250	Loose Sows	Slatted	3.53	95.4	0.024	50,800	14.11	203.20	0.006	293.15	12.48	Vertical
First Stage Weaner House	13	6482	4.15	3.7	Mechanical	2	Centre of house	0.4	400	Weaners	Slatted	1.8	9.2	0.004	12,964	3.60	32.41	0.002	293.15	14.33	Vertical
First Stage Weaner House	14	13400	4.15	3.7	Mechanical	2	Centre of house	0.6	900	Weaners	Slatted	3.72	9.2	0.008	26,800	7.44	29.78	0.004	293.15	13.16	Vertical
New Farrowing House	1A	13400	6.95	6.5	Mechanical	5	Centre of house	0.6	100	Sows and piglets	Slatted	3.72	185.2	0.019	67,000	18.61	670.00	0.004	293.15	13.16	Vertical
New Weaner House	2B	13400	3.95	3.5	Mechanical	5	Centre of house	0.6	950	Weaners	Slatted	3.72	9.2	0.009	67,000	18.61	70.53	0.002	293.15	13.16	Vertical
New Second Stage	15	13400	5.05	4.6	Mechanical	20	Centre of house	0.6	5270	Weaners /Prod pigs	Slatted	3.72	9.2	0.048	268,000	74.44	50.85	0.002	293.15	13.16	Vertical
Production Pigs	16	10,000	4.75	4.3	Mechanical	12	Centre of house	0.6	1000	Fatteners	Slatted	2.78	131.30	0.1313	120,000	33.33	120.00	0.01094	293.15	9.82	Vertical
<b>Total NH3 emission rate (g/s)</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	<b>0.6303</b>	-	-	-	-	-	-	-

## **Dispersion model output data and assessment of Odour and Ammonia impact.**

The results of the dispersion modelling assessment are contained in Tables 3 and 4. As can be observed, there is no significant change in the model output and conclusions, with all sensitive receptors in the vicinity of the facility in compliance with the guideline and target limit values for Odour and Ammonia.

*Figures 1 to 3* presents the model output plots for the proposed Woodville scenarios for Odour and Ammonia impact.

### **Proposed Odour Impact**

The plotted odour concentrations of  $\leq 3.0 \text{ Ou}_E/\text{m}^3$  for the 98<sup>th</sup> percentile for the proposed pig production facility for worst case meteorological year 2017 is illustrated in *Figure 1*. As can be observed in *Figure 1*, the odour plume spread is approximately 700 m from the facility buildings in a north westerly and north easterly direction. The maximum predicted ground level concentration of odour at the worst case sensitive receptor in the vicinity of the facility was less than or equal to  $2.08 \text{ Ou}_E/\text{m}^3$  for the 98<sup>th</sup> percentile of hourly averages for the worst case meteorological year (*see Table 3*). This is less than the guideline odour limit value of  $3.0 \text{ Ou}_E/\text{m}^3$  for the 98<sup>th</sup> percentile of hourly averages for the worst case meteorological year Shannon 2017 (*see Table 3 and Figure 1*).

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**Table 3.** Predicted 98<sup>th</sup> percentile ground level concentrations of odour at receptor locations in the vicinity of the facility for the worst case meteorological year 2017 (see Figure 7.1 of Document 20211002(2) for locations).

Receptor identity	X coordinate (m)	Y coordinate (m)	Predicted 98 <sup>th</sup> %ile Ground level Odour conc. for Proposed Pig Production Facility (O <sub>uE</sub> /m <sup>3</sup> ) Year 2017
R1	597975	681984	0.28
R2	597968	682026	0.26
R3	597986	682054	0.25
R4	597984	682082	0.27
R5	597945	682136	0.25
R6	-	-	Omitted due to building type
R7	597949	682176	0.24
R8	596058	682055	<b>2.08</b>
R9	597917	682218	0.25
R10	596796	681795	1.96
R11	598020	682283	0.23
R12	597758	682145	0.31
R13	597835	682228	0.28
R14	597972	682309	0.25
R15	596855	681777	1.51
R16	598289	682337	0.18
R17	598337	682335	0.18
R18	597659	682142	0.37
R19	598378	682331	0.17
R20	597857	682332	0.29
R21	597725	681399	0.19
R22	598375	682399	0.17
R23	598410	682405	0.16
R24	598535	682350	0.14
R25	598567	682355	0.14
R26	597708	682422	0.33
R27	598599	682383	0.14
R28	598841	681673	0.14
R29	598634	682368	0.13
R30	598864	681816	0.12
R31	598599	682438	0.14
R32	597371	682019	0.46
R33	595679	682193	1.24
R34	598631	682443	0.13
R35	598279	682616	0.20
R36	598941	681850	0.12
R37	597315	682040	0.52
R38	597176	681664	0.53
R39	596589	681215	0.21
R40	596234	681230	1.27
R41	597565	681155	0.18
R42	597795	681010	0.17
R43	596641	681193	0.18
R44	596091	681219	0.47
R45	599022	682104	0.10
R46	598139	680884	0.13
R47	595472	682174	0.62
R48	597928	680863	0.15
<b>Max predicted value (O<sub>uE</sub>/m<sup>3</sup>)</b>	-	-	<b>2.08</b>
<b>Limit value (O<sub>uE</sub>/m<sup>3</sup>)</b>	-	-	<b>3.0</b>

### **Proposed Ammonia Impact**

The plotted Ammonia concentrations of  $\leq 100 \mu\text{g}/\text{m}^3$  for the 100<sup>th</sup> percentile for the proposed pig production facility for worst case meteorological year 2017 is illustrated in *Figure 2*. As can be observed in *Figure 2*, the Ammonia plume spread is approximately 300 m from the facility buildings in a north westerly to north easterly direction. The maximum predicted ground level concentration of Ammonia at the worst case sensitive receptor in the vicinity of the facility was less than or equal to  $91 \mu\text{g}/\text{m}^3$  for the 100<sup>th</sup> percentile of hourly averages for the worst case meteorological year (see *Table 4*). This is less than the guideline Ammonia limit value for the protection of human health (see *Table 4* and *Figure 2*).

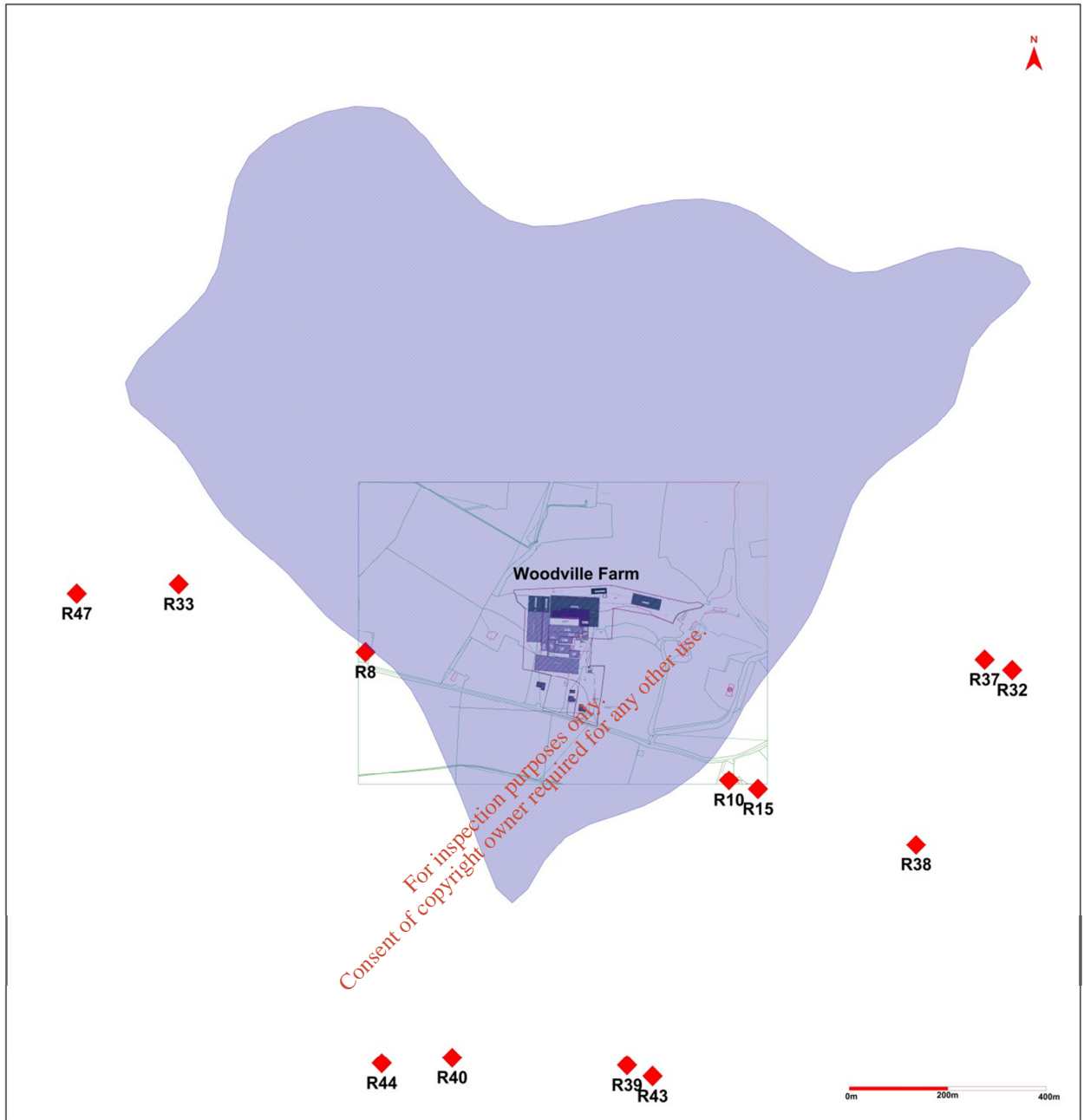
The Annual average ground level concentration for the proposed pig production facility is present in the *Figure 3* and *Table 4*. As can be observed in *Figure 3*, the Ammonia plume spread is approximately 100 to 150 m from the facility buildings in a north westerly and north easterly direction. The maximum predicted ground level concentration of Ammonia at the worst case sensitive receptor in the vicinity of the facility was less than or equal to  $2.0 \mu\text{g}/\text{m}^3$  for the Annual averages for the worst case meteorological year 2017 (see *Table 4*). The maximum predicted ground level concentration at the identified Natura sites is less than  $0.05 \mu\text{g}/\text{m}^3$ . This is less than the guideline Ammonia limit value for the protection of ecosystems at these locations (see *Table 4* and *Figure 3*).

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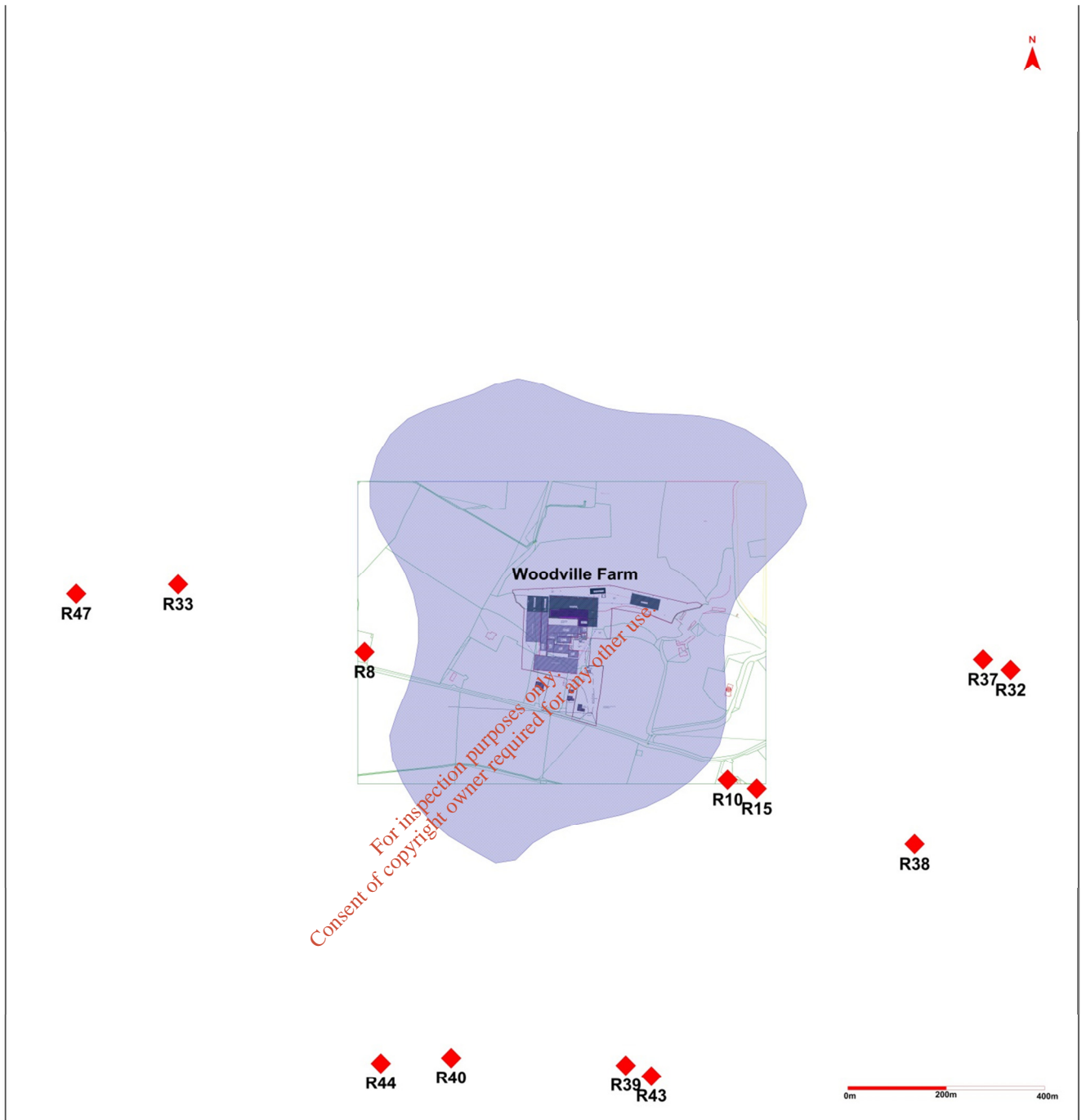


**Table 4..** Predicted 1 hr max and Annual average ground level concentrations of Ammonia at receptor locations in the vicinity of the facility and at Natura sites for the worst case meteorological year 2017 (see Figure 7.1 of Document 20211002(2) for locations).

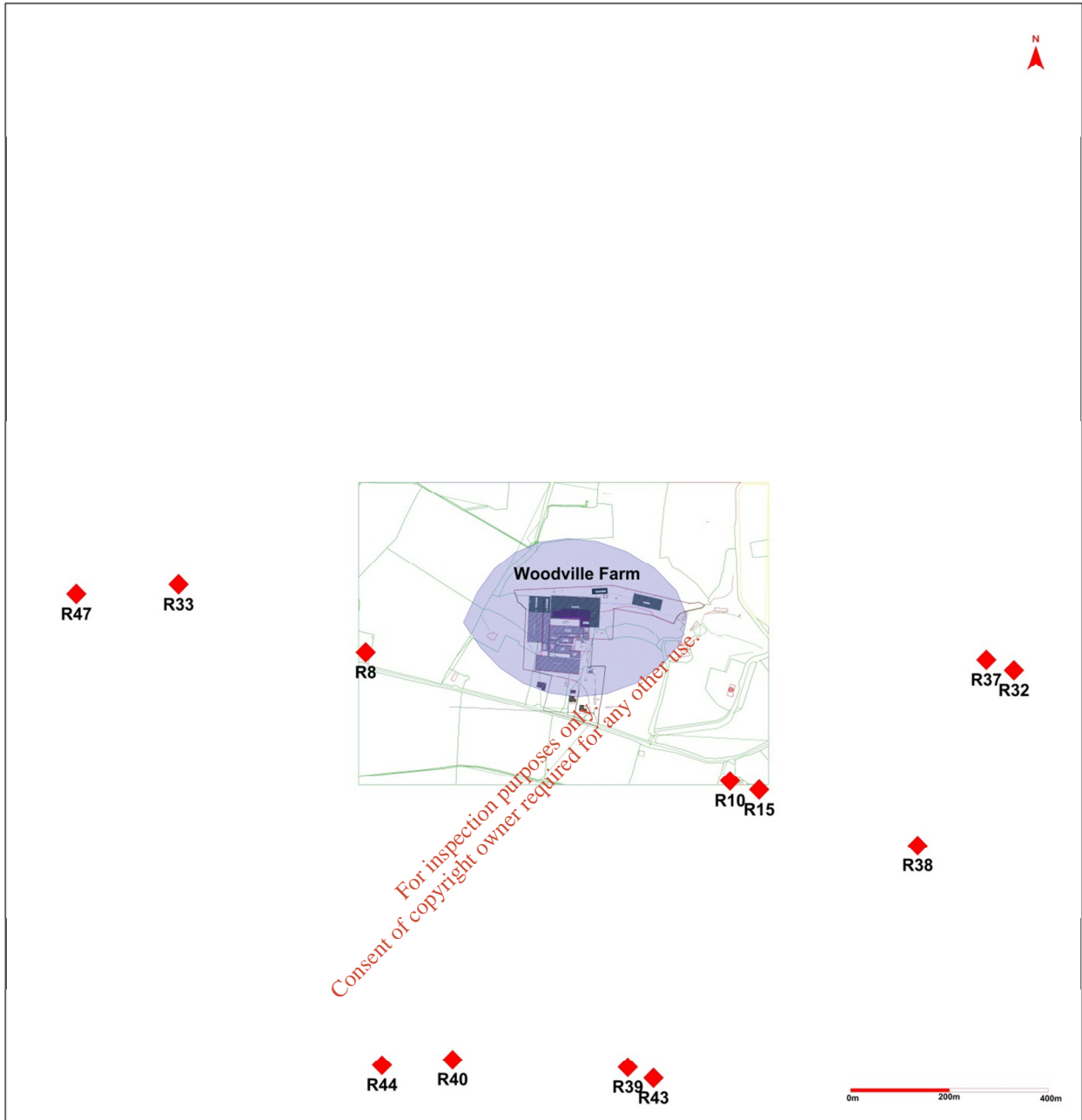
Receptor identity	X coordinate (m)	Y coordinate (m)	Predicted 1hr max Ground level NH3 conc. for Proposed Pig Production Facility ( $\mu\text{g}/\text{m}^3$ ) Year 2017	Predicted Annual average max Ground level NH3 conc. for Proposed Pig Production Facility ( $\mu\text{g}/\text{m}^3$ ) Year 2017
R1	597975	681984	32	0.2
R2	597968	682026	33	0.2
R3	597986	682054	32	0.2
R4	597984	682082	30	0.2
R5	597945	682136	32	0.2
R6	-	-	Omitted due to building type	Omitted due to building type
R7	597949	682176	29	0.2
R8	596058	682055	82	1.1
R9	597917	682218	29	0.2
R10	596796	681795	91	1.1
R11	598020	682283	30	0.2
R12	597758	682145	34	0.2
R13	597835	682228	32	0.2
R14	597972	682309	32	0.2
R15	596855	681777	77	0.9
R16	598289	682337	27	0.1
R17	598337	682335	26	0.1
R18	597659	682142	36	0.3
R19	598378	682331	25	0.1
R20	597857	682332	36	0.2
R21	597725	681399	31	0.2
R22	598375	682399	25	0.1
R23	598410	682405	24	0.1
R24	598535	682350	24	0.1
R25	598567	682355	24	0.1
R26	597708	682422	41	0.3
R27	598599	682383	23	0.1
R28	598841	681673	22	0.1
R29	598634	682368	23	0.1
R30	598864	681816	22	0.1
R31	598599	682438	22	0.1
R32	597371	682019	46	0.4
R33	595679	682193	40	0.5
R34	598631	682443	22	0.1
R35	598279	682616	28	0.2
R36	598941	681850	21	0.1
R37	597315	682040	50	0.4
R38	597176	681664	45	0.4
R39	596589	681215	36	0.1
R40	596234	681230	48	0.6
R41	597565	681155	36	0.2
R42	597795	681010	36	0.2
R43	596641	681193	40	0.1
R44	596091	681219	36	0.3
R45	599022	682104	21	0.1
R46	598139	680884	30	0.1
R47	595472	682174	50	0.3
R48	597928	680863	32	0.1
Scohaboy (Sopwell) Bog SAC	596522.9	691710.9	--	0.049
Kilduff, Devilsbit Mountain SAC	605867.1	675525.9	--	0.009
Slievefelim to Silvermines Mountains SPA	590287.3	670289.1	--	0.010
Sharavogue Bog SAC	603971.3	693249.8	--	0.027
Lough Derg, North-east Shore SAC	584072.8	689620.8	--	0.050
<b>Max predicted value at receptor (<math>\mu\text{g}/\text{m}^3</math>)</b>	-	-	<b>91</b>	--
<b>Max predicted value at Natura (<math>\mu\text{g}/\text{m}^3</math>)</b>			--	<b>0.050</b>
<b>Limit value (<math>\mu\text{g}/\text{m}^3</math>)</b>	-	-	<b>3,600</b>	<b>3.0 (Natura only)</b>



**Figure 1.** Predicted odour plume spread of the proposed pig production facility for at the 98<sup>th</sup> percentile of hourly averages for an odour concentrations of  $\leq 3.0 \text{ Ou}_E/\text{m}^3$  Shannon met station yr 2017 (■).



**Figure 2.** Predicted Ammonia plume spread of the proposed pig production facility for the 100<sup>th</sup> percentile of 1 hour averages for an Ammonia concentrations of  $\leq 100 \mu\text{g}/\text{m}^3$  Shannon met station yr 2017 (■).



**Figure 3.** Predicted Ammonia plume spread of the proposed pig production facility for the Annual averages Ammonia concentrations of  $\leq 8.0 \mu\text{g}/\text{m}^3$  Shannon met station yr 2017 ( █ ).

## Conclusions

The following conclusions were drawn from the updated dispersion modelling assessment: The main conclusions include:

- With regards to the proposed pig production facility operations, the odour plume spread is approximately 700 m from the facility buildings in a north westerly and north easterly direction (see *Figure 1*). The maximum predicted ground level concentration of odour at the worst case sensitive receptor in the vicinity of the facility was less than or equal to  $2.08 \text{ Ou}_E/\text{m}^3$  for the 98<sup>th</sup> percentile of hourly averages for the worst case meteorological year Shannon 2017 (see *Table 3*). This is less than the guideline odour limit value of less than or equal to  $3.0 \text{ Ou}_E/\text{m}^3$  for the 98<sup>th</sup> percentile of hourly averages (see *Table 3 and Figure 1*).
- With regards to the proposed pig production facility operations, the Ammonia plume spread for the 100<sup>th</sup> percentile 1 hour maximum ground level concentration is approximately 300 m from the facility buildings in a north easterly to north westerly direction. The maximum predicted ground level concentration of Ammonia at the worst case sensitive receptor in the vicinity of the facility was less than or equal to  $91 \mu\text{g}/\text{m}^3$  for the 100<sup>th</sup> percentile of hourly averages for the worst case meteorological year Shannon 2017 (see *Table 4*). This is less than the guideline Ammonia limit value for the protection of human health (see *Table 4 and Figure 2*).
- With regards to the proposed pig production facility operations, the Ammonia plume spread for the Annual average ground level concentration is approximately 100 to 150 m from the facility buildings in a north westerly and north easterly direction. The maximum predicted ground level concentration of Ammonia at the worst case sensitive receptor in the vicinity of the facility was less than or equal to  $2.0 \mu\text{g}/\text{m}^3$  for the Annual averages for the worst case meteorological year Shannon 2017 (see *Table 4*). The maximum predicted ground level concentration at the identified Natura sites is less than  $0.050 \mu\text{g}/\text{m}^3$ . This is less than the guideline Ammonia limit value for the protection of ecosystems at these locations (see *Table 4 and Figure 3*).
- With regards to the proposed facility operations, the facility operations will be in compliance with the guideline Odour and Ammonia impact presented within this document.

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