HOLLINS LANE, WOODSEAVES

AMMONIA EMISSIONS: IMPACT ASSESSMENT

January 2023

Report Ref: 01.0101.006 v1

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CONTENTS

1.0 INTRODUCTION

Isopleth Ltd has been commissioned by Berrys, on behalf of International Energy Crops Ltd ('IEC'), to carry out a further detailed assessment of ammonia impacts associated with the proposed expansion to an existing poultry operation at the at Hollins Lane Poultry Unit, Hollins Lane, Woodseaves, Market Drayton TF9 2AP.

1.1 Background

The potential ammonia impacts on local ecological sites associated with the expansion of the poultry (broiler) farm at Hollins Lane has been assessed further to a request from Shropshire Council. The new houses would house the same number of broilers (approx. 232000 in total for the 4 house extension) over the same cycle length as the existing unit. The 4 new houses would therefore be partially ventilated through ammonia scrubbing units with any remaining flows emitted from the houses via uncapped high speed ridge mounted fans, with exhaust via a single chimney per ridge fan. Ammonia scrubbing units would also be fitted to two of the existing houses.

1.2 Planning Background

Permission was granted for poultry houses on 15th September 2015:

> *15/00924/EIA Erection of two poultry sheds and feed bins, ancillary works including access track and associated landscaping works*

The planning application allowed for the erection of four poultry houses on land to the east of Hollins Lane, Woodseaves, Market Drayton. The shed measures 116 metres x 24 metres, with an eaves height of 3 metres and a ridge height of 5.6 metres. Fans extend above the ridge to a height of 6.4 metres. The houses are aligned in two parallel rows, with each pair connected by a central cover access, giving the impression of two parallel long houses. Although the houses could house a maximum of 65,000 birds and remain within the minimum floor space requirements for broiler birds, the existing site operates with a maximum of 232,000 birds across the 4 houses (58,000 per house).

Application ref 19/05127/EIA was validated on 28th November 2019:

> *Construction of two poultry sheds, feed bins and associated ancillary works*

This application seeks to double the size of the unit by constructing an identical pair of buildings (4 houses) to the east of the existing houses approved under application ref 15/00924/EIA.

The application has been supported with information relating to emissions such as ammonia:

> *Isopleth Ltd (July 2018) Hollins Lane, Woodseaves. Ammonia Emissions: Impact Assessment. Report Ref: 01.0101.001*

This report demonstrated that the ammonia impacts of the development on ecological sites was acceptable. However, Shropshire Council requirements have changed since the

application was validated, particularly with regard to emissions such as ammonia. Following correspondence from Suzanne Wykes, Specialist Practitioner (Ecology) Shropshire Council Ecology Team on 31st January 2022 and 9th February 2022 it was decided by the applicant that the only solution in this case is to incorporate a system of ammonia scrubbing on all of the proposed new houses and retrofitting of ammonia scrubbing on two existing sheds in order to ensure that ammonia impacts are no higher for the proposed scheme than that approved under application ref: 15/00924/EIA.

1.3 Requirement

A new assessment of ammonia impacts against critical levels and critical loads for nutrient nitrogen has therefore been completed to reflect the updates to the scheme design:

- Critical levels are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.
- Critical loads are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.

Predicted ground level concentrations of ammonia and nutrient nitrogen are compared with relevant air quality standards and guidelines for the protection of sensitive habitats.

This January 2023 report supercedes the July 2018 report detailed above, although it follows the same general approach and structure consistent with the requirements of Shropshire Council.

2.0 APPROACH

2.1 General Approach

Shropshire guidance has been followed for this assessment:

> *Shropshire Council Interim Guidance Note GN2 (Version 1, April 2018). Assessing the impact of ammonia and nitrogen on designated sites and Natural Assets from new and expanding livestock units (LSUs).*

Predicted ground level concentrations of ammonia and nutrient nitrogen deposition are compared with relevant air quality standards and guidelines for the protection of sensitive habitats.

The assessment has also been prepared to ensure that it meets the requirements of Natural Resources Wales In relation to screening distances. Although the site is located in England, Shropshire Council has indicated that it may be seeking to adopt the NRW (rather than Environment Agency) Guidance. As such, it is consistent with the requirements of the Shropshire Council Ecology Team as detailed in the correspondence of 31st January 2022 and 9th February 2022.

2.2 Critical Levels

Critical levels for the protection of vegetation and ecosystems are specified within relevant European air quality directives and corresponding UK air quality regulations.

Table 2-1
Ammonia Critical Level

Concentration (µg/m^3)	Habitat and Averaging Period
1	Annual mean. Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity
3	For all higher plants (all other ecosystems)

It is important to note that, as the lower critical level applies only where lichens and bryophytes they form a key part of the ecosystem integrity, it should not be applied at all sites, or even sites where lichens or bryophytes are present but are not a key part of the ecosystem integrity as detailed in the citation for that site.

2.3 Critical Loads

Critical loads are set for the deposition of various substances to sensitive ecosystems. Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with each designated site as

derived from the UK Air Pollution Information System (APIS) website[1]. The contribution to critical loads for Nitrogen deposition are recorded as KgN/ha/yr.

Deposition rates were calculated using dispersion modelling results processed by following empirical methods recommended by the Environment Agency in AQTAG and summarised below.

Firstly, calculate dry deposition flux using the following equation:

> *Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)*

The applied deposition velocity for ammonia is 0.020 for grassland and 0.030 for woodland. This may be adapted based on the overall concentration of ammonia as a process contribution however this value is appropriate for concentrations below 10 µg/m^3. An applied deposition velocity for ammonia of 0.005m/s for water bodies has been accepted by the Natural England and the EA for other poultry schemes.

The units are then converted from µg/m^2/s to units of kg/ha/year by multiplying the dry deposition flux by a standard conversion factor for ammonia of 259.7.

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow and is not considered significant over short distances compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered.

2.4 Significance: Interpretation of Results

In relation to the assessment of a site where there is an existing source and there is the potential for a reduction in overall impact at a designated site, it is important to note that the Shropshire Council Guidance GN2 (and the most recent NRW position) is that where there is a reduction in impact at receptors, no further assessment of in-combination effects is required.

2.4.1 Natural England Threshold of Insignificance

Where process contributions and potential in-combination sites, are up to 1% of the Critical Level or Load at a Natura site (European or SSSI), then it should be determined that there is no significant environmental effect/no likely significant effect/damage to scientific interest.

2.4.2 Shropshire Council

Shropshire Council requires that the PC and background (including any other schemes, where relevant) are added and compared with a 1% criteria:

- Where the PC and Sum of PCs are below 1% further assessment is not required (although BAT may be required). A decision can be made on the application.

[1] www.apis.ac.uk

- Where the PC and Sum of PCs are above 1% and when added to the background levels create the PEC which results in an exceedance of the critical level / load, or where the background level already exceeds the critical level / load, control measures will have to be considered to avoid or reduce the emissions.

Shropshire Guidance GN2 (Step 3b: Avoidance of additional PC) requires the assessor to ask the following question:

> *'Does modelling of the PC, including BAT (Best Available Techniques) or other avoidance/mitigation measures show either no additional nitrogen Deposition or, a reduction in background nitrogen Deposition?'*

The reason given is that:

> *'new sites would have to be N neutral. Extensions to existing sites would need to add no extra N deposition or, ideally, a reduction in the N background level, achieved by use of Best Available Techniques (BAT) or other mitigation measures.'*

If this is the case (i.e. that process contribution impacts are at worst neutral) then the application can be determined providing avoidance and mitigation measures can be conditioned.

2.4.3 EA Screening Thresholds

In addition to screening distances, the EA[2] also presents thresholds for livestock developments in relation to European sites (RAMSAR, SPA and SAC) and SSSIs:

Table 2-2
Ammonia screening thresholds

Nature conservation site designation)	Lower threshold %	Upper threshold %
Special protection areas (SPAs), special areas of conservation (SACs), Ramsar sites	4	20
Sites of special scientific interest (SSSIs)	20	50
National nature reserves (NNRs), local nature reserves (LNRs), local wildlife sites (LWS), ancient woodland (AW)	100	100

These screening levels may be interpreted as follows:

- If the simple screening predicts that emissions from a farm will be less than the lower threshold of the relevant critical level or load there is no need to do detailed modelling.
- If the simple screening predicts that ammonia emissions from a farm will be more than the upper threshold of the relevant critical level or load there is a requirement to do detailed modelling.

[2] https://www.gov.uk/guidance/intensive-farming-risk-assessment-for-your-environmental-permit

Where impacts are in the range between lower and upper thresholds, there may be a requirement to consider in-combination sources.

3.0 SITE SETTING AND OPERATIONS

3.1 Site Setting

The new houses will be located to the east of the existing houses at the Hollins Lane Poultry Unit. The approximate site grid reference is OS GR 369160, 331600.

The applicant, Mr Keith Wilson on behalf of HLW Farms, owns the land on which the facility is sited as part of the landholding of Old Springs Farm. Historically this 1555 acre farm grew general arable crops in addition to rearing beef cattle. Since 2004 the farm has been growing *miscanthus* (elephant grass) which is used for burning in biomass boilers and is also used for the bedding of broiler chickens. The existing poultry houses were fully operational before 2018.

The closest residences to the facility are Tyreley Farm to the north and Woodseaves Farm off the A529. The location of the site can be seen in Appendix A.

3.2 Development Proposals

The existing farm was constructed and fully operational before 2018. The farm houses up to 232,000 birds in 4 houses (2 buildings). Air drawn from the buildings is exhausted through 36 No. ridge stacks for each of the 2 buildings. The houses are heated indirectly, resulting in drier litter and therefore ammonia emissions lower than EA benchmark emission rates for broiler farms.

The application documents propose that the farm will house:

- up to 232,000 birds in 4 existing houses (2 buildings); and
- up to 232,000 birds in 4 new houses (2 buildings).

The proposed scheme therefore allows for up to 464,000 birds in total. All houses will be heated indirectly, with the new houses also fitted with heat exchangers in order to optimise energy efficiency.

For two of the existing houses, air will continue to be drawn from the buildings is exhausted through ridge stacks. For two of the existing houses and all 4 of the new houses, up to 120,000m3 / hr air per shed will be drawn from the buildings and passed through an ammonia scrubber.

For purposes of this assessment the scrubber design is based on JF McKenna sourced INNO+ systems with a maximum flow capacity of 120,000m3 / hr air per unit. In the event that the total flow exceeds 120,000m3 / hr in any shed the additional air would exhaust through the ridge stacks as for the existing scheme.

3.3 Ecological Receptors

The following ecological sites of interest are located within 10km of the proposed development site. These sites are shown in Appendix B.

Sites of European interest include Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar Sites. Sites of Special Scientific Interest (SSSIs) are of national importance. 'Natural Assets' include as Local Nature Reserves (LNRs), Local Wildlife Sites (LWS) Priority Habitats and Ancient Woodland (AW).

Table 3-1
Ecological Sites

Designation	Site
SSSI	Hodnet Heath
SSSI	Burnt Wood
Ancient Woodland	The Dingle
Ancient Woodland	Colehurst Wood
Ancient Woodland	Chipnall Wood
Ancient Woodland	Lloyd Drumble
Ancient Woodland	Ellerton Wood
LWS	Sydnall
LWS	Tyrley Spoil Banks

There are no sites with a European designation within 10km of the farm. There is also one SSSI, the Tyrley Canal Cutting which is not sensitive to ammonia or nutrient nitrogen as it is a geological designation.

None of Shropshire Council, Shropshire Wildlife Trust or APIS have site specific information relating to the sensitivity of the ancient woodlands above to ammonia or nutrient nitrogen. However the Environment Agency has confirmed that the Tyrley Spoil Banks LWS is not sensitive.

4.0 ASSESSMENT

The model inputs are described below as they relate to the sources, pathway and receptors associated with the existing and proposed developments.

4.1 Assessment Scenarios

A total of 2 No. Scenarios have been completed which relate to the 2 different site layouts reflected in the planning applications for the site (i.e. existing and proposed).

4.1.1 Scenario 1: Existing

The existing farm was constructed and fully operational before 2018. The farm houses up to 232,000 birds in 4 houses (2 buildings). Air drawn from the buildings is exhausted through 36 No. ridge stacks for each of the 2 buildings.

4.1.2 Scenario 2: Proposed

This scenario relates to the farm now proposed. The application documents propose that the farm will house:

- up to 232,000 birds in 4 existing houses (2 buildings); and
- up to 232,000 birds in 4 new houses (2 buildings).

The proposed scheme therefore allows for up to 464,000 birds in total. For three of the existing houses, air will continue to be drawn from the buildings is exhausted through ridge stacks. For two of the existing houses and all 4 of the new houses, up to 120,000m3 / hr air per shed will be drawn from the buildings and passed through an ammonia scrubber.

For purposes of this assessment the scrubber design is based on JF McKenna sourced INNO+ systems with a maximum flow capacity of 120,000m3 / hr air per unit. In the event that the total flow exceeds 120,000m3 / hr in any shed the additional air would exhaust through the ridge stacks as for the existing scheme.

4.2 Model inputs: Layout

The stack coordinates are shown in Appendix C. The temperature of the flows from the units has been assumed at 23ºC.

The velocity of releases from the ridge fans has been taken as 3m/s and the velocity of releases from the scrubber fans has been taken as 4.15 m/s which has been calculated as the velocity from 5 No. fans with a total flow of 120,000m3 / hr.

The stack height has been taken as 5.815m for the ridge fans and 5m for the scrubber fans.

The site is located at approximately 117m AOD. Information relating to the topography of the area surrounding the site has been used to assess the impact of terrain features on the dispersion of emissions from the site. Topographical data has been obtained in digital (.ntf) format and incorporated into the assessment.

The movement of air over and around buildings and other structures generates areas of flow re-circulation that can lead to increased ground level concentrations of pollutants close to the source. Where the stack height is less than 2.5 times the height of any nearby building (within 5 stack heights), downwash effects and entrainment can be significant. The site details have been provided by the applicant and a detailed dispersion model constructed on this basis, with the height taken as 4.815m for the buildings (average of eaves to ridge) and 4.9 for the scrubber boxes.

4.3 Model inputs: Emissions

4.3.1 Assumptions

As described above, for purposes of this assessment the scrubber design is based on JF McKenna sourced INNO+ systems.

The scrubbing units have a maximum flow capacity of 120,000m^3 / hr air per unit. In the event that the total flow exceeds 120,000m^3 / hr in any shed the additional air would exhaust through the ridge stacks as for the existing scheme.

These have been sized from records of flow data across multiple growth cycles within the existing houses at Hollins Lane, with the period covering the whole of 2021. The flow details for 2021 were as follows:

- Total volume of air released: 2,794,052,695 m^3/yr across the 4 houses;
- Average volume of air released: 79,739 m^3/hr per shed;
- 75th Percentile volume of air released: 118,201 m^3/hr per shed; and
- 25th Percentile volume of air released: 38,007 m^3/hr per shed.

The data shows that when broilers are in each of the houses, the minimum ventilation rate was in the range 4000m^3 / hr - 78000m^3 / hr dependent on the number and size of birds in the shed (i.e. 'mass' of birds in kgs). The maximum flow capacity of the ridge fans is 520,000m^3 / hr per shed with the maximum peak flow recorded in 2021 being 67% of this total. As such this flow should never be reached even should the most extreme outdoor temperatures coincide with the largest mass of birds in the cycle, particularly with the total ventilation capacity increasing from 520,000 m^3/hr to 640,000 m^3/hr on the sheds fitted with scrubbers.

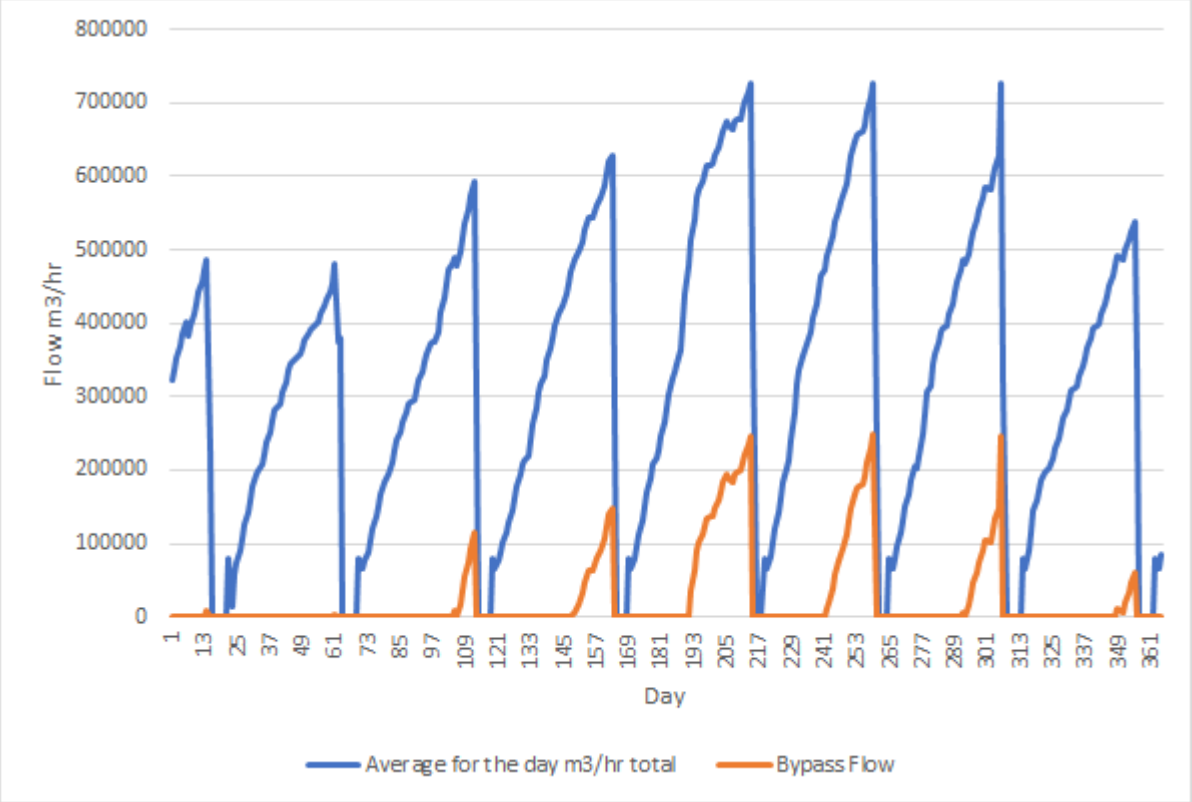
The result of the above is that:

- 7.70% of the hours in the year the flow was above 120k m^3/hr per shed; and
- 92.30% of the hours in the year the flow was below 120k m^3/hr per shed.

If the sheds had been fitted with scrubbing units with a maximum flow capacity of 120,000m^3 / hr air per unit then 92.3% of the air would have been scrubbed (at 90%) with the remaining 7.7% bypassing the scrubbers and being exhausted via the ridge vents. In terms of ammonia mitigation this would have resulted in 9.2% of the original ammonia in scrubbed air added to the 7.7% of ammonia bypassing the scrubbers, therefore a total of 81.3% of the ammonia generated would have been removed.

A graphical representation of the above calculation is shown below. Assuming a total treatment capacity of 120,000m^3 / hr in any shed the 2021 monitored flow (blue line) and the flow above 120,000m^3 / hr (orange line) is as shown in Figure 4-1, below. As would be expected, the highest peaks are in the warmest months.

Figure 4-1
Shed Flow (m^3/hr)



4.3.2 Inputs

The site emissions are as follows for scenario 1:

Table 4-1
Emissions: Scenario 1

Source	number of birds	emission rate kg/bird/year	total emission (kg/yr)	
			No mitigation	With mitigation
Building 1	58000	0.0221	1281.80	----
Building 2	58000	0.0221	1281.80	----
Building 3	58000	0.0221	1281.80	----
Building 4	58000	0.0221	1281.80	----
		TOTAL	**5127.20**	

The site emissions are as follows for scenario 2:

Table 4-2
Emissions: Scenario 2

Source	number of birds	emission rate kg/bird/year	total emission (kg/yr)	
			No mitigation	With mitigation
Building 1	58000	0.0221	1281.8	---
Building 2	58000	0.0221	1281.8	---
Building 3	58000	0.0221	---	235.00
Building 4	58000	0.0221	---	235.00
Building 5	58000	0.0221	---	235.00
Building 6	58000	0.0221	---	235.00
Building 7	58000	0.0221	---	235.00
Building 8	58000	0.0221	---	235.00
		TOTAL	**3973.6**	

As shown above, the total site ammonia mass emissions for Scenario 2 are less than those for Scenario 1 as a result of the ammonia scrubbing on existing Buildings 3 and 4 as well as the new buildings. The proposed facility therefore represents a betterment in terms of total mass emission of ammonia.

4.4 Meteorological Data

In accordance with current guidance, 5 years of meteorological data has been used (2016 – 2020). The site at Shawbury is the closest representative site with a >90% complete data set.

4.5 Model Receptors

Modelling has been completed in line with the requirements of *Guidance on modelling the concentration and deposition of ammonia emitted from intensive farming. Air Quality Modelling and Assessment Unit, 22 November 2010, v3*. The BREEZE AERMOD model has been used. Modelling was carried out with discrete receptors representing the ecological sites of biological interest.

Modelling was carried out with discrete receptors representing the ecological sites of biological interest. For larger sites (or linear sites perpendicular to the proposed development), multiple discrete receptor locations have been used. For example, impacts at the Tyrley Spoil Banks LWS have been quantified through modelling at 566 discrete receptor locations covering that site.

The ecological receptor locations are also shown on Appendix B and in Table 4-3, below.

Table 4-3
Receptor Locations

Receptor	Site	OS Coordinate Xm	OS Coordinate Ym	Height (m AoD)
ECO1	Hodnet Heath	362204.0	326371.0	70.9
ECO2	Burnt Wood 1	373214.0	335023.0	167.1
ECO3	Burnt Wood 2	373859.0	333483.0	163.9
ECO4	The Dingle AW 1	367745.0	331140.0	107.0
ECO5	The Dingle AW 2	367665.2	331056.0	107.3
ECO6	The Dingle AW 3	367760.7	331014.6	107.8
ECO7	The Dingle AW 4	367729.6	330966.0	108.7
ECO8	Colehurst Wood	366975.0	331140.0	98.1
ECO9	Chipnall Wood	371399.0	331560.0	137.8
ECO10	Lloyd Drumble	371945.0	333170.0	97.1
ECO11	Ellerton Wood	371651.0	327332.0	83.7
ECO12	Sydnall LWS 1	368024.4	330936.1	109.0
ECO13	Sydnall LWS 2	368072.6	330889.2	109.2
ECO14	Sydnall LWS 3	367987.7	330866.4	109.7
TSB1	Tyrley Spoil Banks 1	566 receptors		

There are no APIS critical load values or Natural England citations for local sites (e.g. LWS) or ancient woodland. However, a detailed ecological survey report has been produced in support of the previous planning application for the existing 4 houses:

> *Turnstone Ecology Ltd (September 2017) Land at Hollins Lane, Market Drayton Ecological Assessment*

This report confirmed that a 3µg/m^3 critical level is appropriate for the Tyrley Spoil Banks LWS. The Canal & River Trust subsequently confirmed that they actively manage the woodland. No site specific data was provided on the Sydnall LWS or The Dingle AW.

Nutrient nitrogen results are based on the lower critical load for woodlands, as follows for nutrient nitrogen:

- Broadleaved deciduous woodland: 10 - 20 Kg N/ha/year;
- Fagus woodland: 10 - 20 Kg N/ha/year;
- Acidophilous Quercus-dominated woodland: 10 - 15 Kg N/ha/year;
- Meso- and eutrophic Quercus woodland: 15 - 20 Kg N/ha/year.

Within this range, the lower critical load is therefore 10 Kg N/ha/year with the upper threshold being 20 Kg N/ha/year. This must be confirmed by Shropshire Council and Natural England, if required.

The critical levels and loads for each ecological receptor site are therefore as follows. Where the critical level is unknown, results have been presented against the lower and upper critical levels.

Table 4-4
Impact Limits

Receptor	Site	Critical Level µg/m³	Lower Critical Load kgN/ha/yr
ECO1	Hodnet Heath	1	10
ECO2	Burnt Wood 1	1	10
ECO3	Burnt Wood 2	1	10
ECO4	The Dingle AW 1	1 or 3	10
ECO5	The Dingle AW 2	1 or 3	10
ECO6	The Dingle AW 3	1 or 3	10
ECO7	The Dingle AW 4	1 or 3	10
ECO8	Colehurst Wood	1 or 3	10
ECO9	Chipnall Wood	1 or 3	10
ECO10	Lloyd Drumble	1 or 3	10
ECO11	Ellerton Wood	1 or 3	10
ECO12	Sydnall LWS 1	1 or 3	10
ECO13	Sydnall LWS 2	1 or 3	10
ECO14	Sydnall LWS 3	1 or 3	10
TSB1	Tyrley Spoil Banks (566 receptors)	3	10

5.0 RESULTS

The results of the modelling assessment are shown below. The predictions for Process Contribution are shown and the requirement for assessment against existing backgrounds and consideration of potential in-combination effects is discussed in section 5.5.

5.1 Scenario 1: Existing

5.1.1 Critical Level

The dispersion modelling process contribution results for Scenario 1 are shown in the table below. These process contributions will now form part of the APIS background as the site was operation prior to 2018. The % has been shown relative to both the upper and lower critical level for completeness.

Table 5-1
PC Results: Critical Level

Site	Conc (µg/m^3)	Lower Critical Level	% of C.L.	Upper Critical Level	% of C.L.
ECO1	0.010	1	1.0%	---	---
ECO2	0.011	1	1.1%	---	---
ECO3	0.014	1	1.4%	---	---
ECO4	0.106	1	10.6%	3	3.5%
ECO5	0.096	1	9.6%	3	3.2%
ECO6	0.095	1	9.5%	3	3.2%
ECO7	0.091	1	9.1%	3	3.0%
ECO8	0.073	1	7.3%	3	2.4%
ECO9	0.068	1	6.8%	3	2.3%
ECO10	0.069	1	6.9%	3	2.3%
ECO11	0.026	1	2.6%	3	0.9%
ECO12	0.097	1	9.7%	3	3.2%
ECO13	0.093	1	9.3%	3	3.1%
ECO14	0.090	1	9.0%	3	3.0%
TSB	1.424	---	---	3	47.5%

The scheme approved under App Ref. 15/00924/EIA resulted in impacts at greater than 1% of the critical level at multiple ancient woodland sites and the SSSI. The average impacts at the Tyrley Spoil Banks is 47.8% of the upper critical level for this site for the existing farm.

5.1.2 Nutrient Nitrogen Critical Load

The nutrient nitrogen critical load results are shown in table 5-2 below.

Table 5-2
PC Results: N Deposition

Site	N Dep kg/ha/yr	Lower Critical Load kg/ha/yr	% of Lower Critical Load
ECO1	0.053	10	0.5%
ECO2	0.086	10	0.9%
ECO3	0.106	10	1.1%
ECO4	0.830	10	8.3%
ECO5	0.746	10	7.5%
ECO6	0.742	10	7.4%
ECO7	0.711	10	7.1%
ECO8	0.572	10	5.7%
ECO9	0.530	10	5.3%
ECO10	0.542	10	5.4%
ECO11	0.199	10	2.0%
ECO12	0.753	10	7.5%
ECO13	0.727	10	7.3%
ECO14	0.703	10	7.0%
TSB	11.109	10	111.1%

The scheme approved under App Ref. 15/00924/EIA resulted in impacts at greater than 1% of the critical load at multiple ancient woodland sites and the Burnt Wood SSSI. The average impacts at the Tyrley Spoil Banks is 111% of the lower critical load for this site for the existing farm.

5.2 Scenario 2: Proposed

5.2.1 Critical Level

The dispersion modelling process contribution results for Scenario 2 are shown in the table below.

Table 5-3
PC Results: Critical Level

Site	Conc (µg/m^3)	Lower Critical Level	% of C.L.	Upper Critical Level	% of C.L.
ECO1	0.007	1	0.7%	---	---
ECO2	0.008	1	0.8%	---	---
ECO3	0.011	1	1.1%	---	---
ECO4	0.071	1	7.1%	3	2.4%
ECO5	0.064	1	6.4%	3	2.1%

Site	Conc (µg/m³)	Lower Critical Level	% of C.L.	Upper Critical Level	% of C.L.
ECO6	0.063	1	6.3%	3	2.1%
ECO7	0.061	1	6.1%	3	2.0%
ECO8	0.049	1	4.9%	3	1.6%
ECO9	0.049	1	4.9%	3	1.6%
ECO10	0.048	1	4.8%	3	1.6%
ECO11	0.018	1	1.8%	3	0.6%
ECO12	0.064	1	6.4%	3	2.1%
ECO13	0.062	1	6.2%	3	2.1%
ECO14	0.060	1	6.0%	3	2.0%
TSB	0.986	1	98.6%	---	---

The proposed scheme is also predicted to result in impacts at greater than 1% of the critical level at multiple ancient woodland sites and the Burnt Wood SSSI. However, impacts are lower than for the existing scheme and the proposals therefore represent a betterment.

5.2.2 Nutrient Nitrogen Critical Load

The nutrient nitrogen critical load results are shown in table 5-4 below.

Table 5-4
PC Results: N Deposition

Site	N Dep kg/ha/yr	Lower Critical Load	% of Lower Critical Load
ECO1	0.036	10	0.4%
ECO2	0.066	10	0.7%
ECO3	0.083	10	0.8%
ECO4	0.552	10	5.5%
ECO5	0.496	10	5.0%
ECO6	0.494	10	4.9%
ECO7	0.473	10	4.7%
ECO8	0.383	10	3.8%
ECO9	0.381	10	3.8%
ECO10	0.371	10	3.7%
ECO11	0.137	10	1.4%
ECO12	0.499	10	5.0%
ECO13	0.481	10	4.8%
ECO14	0.465	10	4.7%
TSB	7.691	10	76.9%

The proposed scheme is also predicted to result in impacts at greater than 1% of the critical load at multiple ancient woodland sites. However, impacts are lower than for the existing scheme and the proposals therefore represent a betterment. There are no impacts >1% at SSSI locations.

5.3 Results Comparison: All Scenarios

5.3.1 Critical Level

The ammonia impacts are compared for both scenarios in the table below for the 1µg/m^3 critical level.

Table 5-5
PC Results: Lower Critical Level

Site	Scenario 1 (Existing)	Scenario 2 (Proposed)	Difference
ECO1	1.0%	0.7%	-0.3%
ECO2	1.1%	0.8%	-0.3%
ECO3	1.4%	1.1%	-0.3%
ECO4	10.6%	7.1%	-3.6%
ECO5	9.6%	6.4%	-3.2%
ECO6	9.5%	6.3%	-3.2%
ECO7	9.1%	6.1%	-3.1%
ECO8	7.3%	4.9%	-2.4%
ECO9	6.8%	4.9%	-1.9%
ECO10	6.9%	4.8%	-2.2%
ECO11	2.6%	1.8%	-0.8%
ECO12	9.7%	6.4%	-3.3%
ECO13	9.3%	6.2%	-3.2%
ECO14	9.0%	6.0%	-3.0%

Scenario 2 represents a betterment when compared with on Scenario 1 (the existing scheme). The ammonia impacts are compared for all scenarios in the table below for the 3µg/m^3 critical level.

Table 5-6
PC Results: Upper Critical Level

Site	Scenario 1 (Existing)	Scenario 2 (Proposed)	Difference
ECO4	3.5%	2.4%	-1.2%
ECO5	3.2%	2.1%	-1.1%
ECO6	3.2%	2.1%	-1.1%
ECO7	3.0%	2.0%	-1.0%
ECO8	2.4%	1.6%	-0.8%
ECO9	2.3%	1.6%	-0.6%
ECO10	2.3%	1.6%	-0.7%
ECO11	0.9%	0.6%	-0.3%
ECO12	3.2%	2.1%	-1.1%
ECO13	3.1%	2.1%	-1.1%

Site	Scenario 1 (Existing)	Scenario 2 (Proposed)	Difference
ECO14	3.0%	2.0%	-1.0%
TSB	47.5%	32.9%	-14.6%

5.3.2 Nutrient Nitrogen Critical Load

The nutrient nitrogen deposition is compared for all scenarios in the table below against the lower N critical load.

Table 5-7
PC Results: N Critical Loads

Site	Scenario 1 (Existing)	Scenario 2 (Proposed)	Difference
ECO1	0.5%	0.4%	-0.2%
ECO2	0.9%	0.7%	-0.2%
ECO3	1.1%	0.8%	-0.2%
ECO4	8.3%	5.5%	-2.8%
ECO5	7.5%	5.0%	-2.5%
ECO6	7.4%	4.9%	-2.5%
ECO7	7.1%	4.7%	-2.4%
ECO8	5.7%	3.8%	-1.9%
ECO9	5.3%	3.8%	-1.5%
ECO10	5.4%	3.7%	-1.7%
ECO11	2.0%	1.4%	-0.6%
ECO12	7.5%	5.0%	-2.5%
ECO13	7.3%	4.8%	-2.5%
ECO14	7.0%	4.7%	-2.4%
TSB	111.1%	76.9%	-34.2%

Scenario 2 represents a betterment when compared with on Scenario 1 (the existing scheme). There are no impacts >1% at SSSI locations for the proposed scheme.

5.4 Mitigation

The proposed scheme represents a betterment in relation to the farm that it will replace. No further mitigation is required beyond the installation of the scrubbing units, as described.

5.5 Backgrounds and In-Combination

Ms Suzanne Wykes (Specialist Practitioner, Ecology Team, Shropshire Council) provided further comments relating to Application ref 19/05127/EIA on 31st January 2022 and 9th February 2022. It should be noted that these comments related to the previous sites design without ammonia scrubbing. A scheme of tree planting had instead been proposed at the suggestion of the Council however I understand that Shropshire Council is of the view that this is no longer considered an acceptable mitigation measure.

Ms Wykes requested that an in-combination assessment is completed which took account of the following schemes:

- Wytheford House Farm, Wytheford, Shawbury;
- Painsbrook Farm, Painsbrook Lane, Hadnall SY4 4BA; and
- Ollerton Park Farm, Ollerton, Market Drayton, Shropshire TF9 2DP.

Permission for Wytheford House Farm has since been granted and represents a betterment on the existing scheme at that site.

The results for the proposed development at Hollins Lane show that this will also be a betterment when compared with the existing scheme and no detailed assessment of in-combination effects is therefore required where ammonia scrubbing is used as described above.

6.0 CONCLUSIONS

Isopleth Ltd has been commissioned by Berrys, on behalf of International Energy Crops Ltd ('IEC'), to carry out a further detailed assessment of ammonia impacts associated with the proposed expansion to an existing poultry operation at the at Hollins Lane Poultry Unit, Hollins Lane, Woodseaves, Market Drayton TF9 2AP.

The potential ammonia impacts on local ecological sites associated with the expansion of the poultry (broiler) farm at Hollins Lane has been assessed further to a request from Shropshire Council. The new houses would house the same number of broilers (approx. 232000 in total for the 4 house extension) over the same cycle length. The 4 new houses would therefore be partially ventilated through ammonia scrubbing units with any remaining flows emitted from the houses via uncapped high speed ridge mounted fans, with exhaust via a single chimney per ridge fan. Ammonia scrubbing units would also be fitted to two of the existing houses.

The type, source and significance of potential impacts have been identified and detailed modelling undertaken in line with relevant guidance from Shropshire Council and the Environment Agency.

Predicted ground level concentrations of ammonia and nutrient nitrogen deposition are compared with relevant air quality standards and guidelines for the protection of sensitive habitats.

The assessment shows that:

- There are two ammonia / nutrient nitrogen sensitive SSSI within 10km however there are no European designations;
- Ammonia and nutrient nitrogen PC impacts for the existing site at Burnt Wood SSSI and several ancient woodlands are above 1% and have been since these houses were constructed prior to 2018;
- The process contribution is lower for the proposed scheme with ammonia scrubbers than that approved in 2015 and subsequently constructed. The proposed layout therefore represents a betterment to the existing scheme.

No appropriate assessment for SACs, SPAs, Ramsar Sites is required by the competent authority as none existing within the screening area. No in combination assessment is required as the scheme represents a betterment to the existing layout.

Notice:

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APPENDIX A

Tyrely spoil banks receptors

EC1
EC2
EC3
EC4
EC5
EC6
EC7
EC8
EC9
EC10
EC11
EC12
EC13
EC14

NOTES

LEGEND

SITE LOCATION

ECOLOGICAL RECEPTOR LOCATION

N
W
E
S

IEC

SITE
Hollins Lane, Woodseaves

PROJECT
Air Quality Assessment

DRAWING TITLE
Site Setting and Ecological Receptor Location

DRAWING NUMBER	REVISION
AQ1	0
SCALE	DATE
1:50000 @ A3	19.01.2023

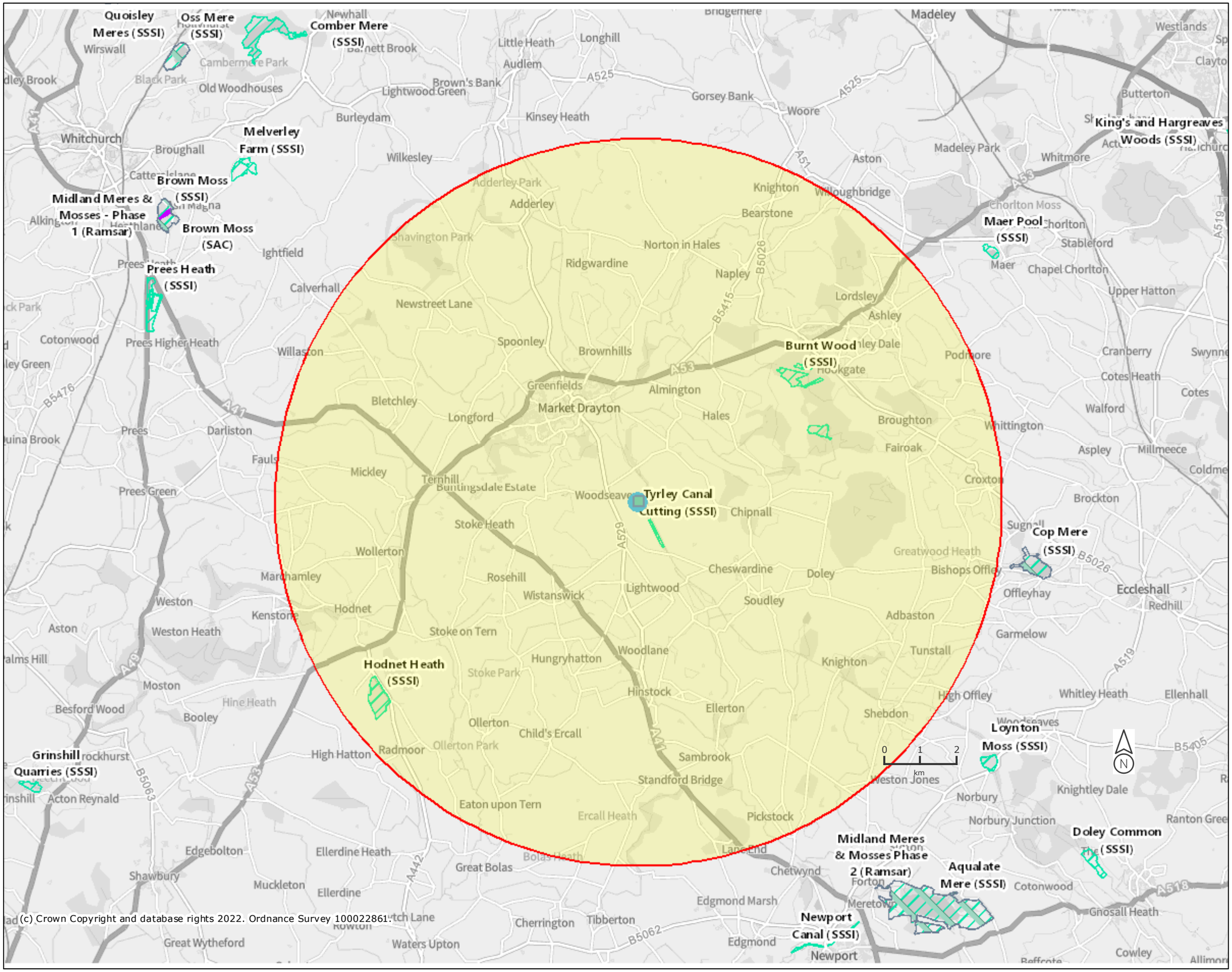
ISOPLETH

APPENDIX B

[Courtesy of MAGIC Maps]

MAGIC

Magic Map



Legend

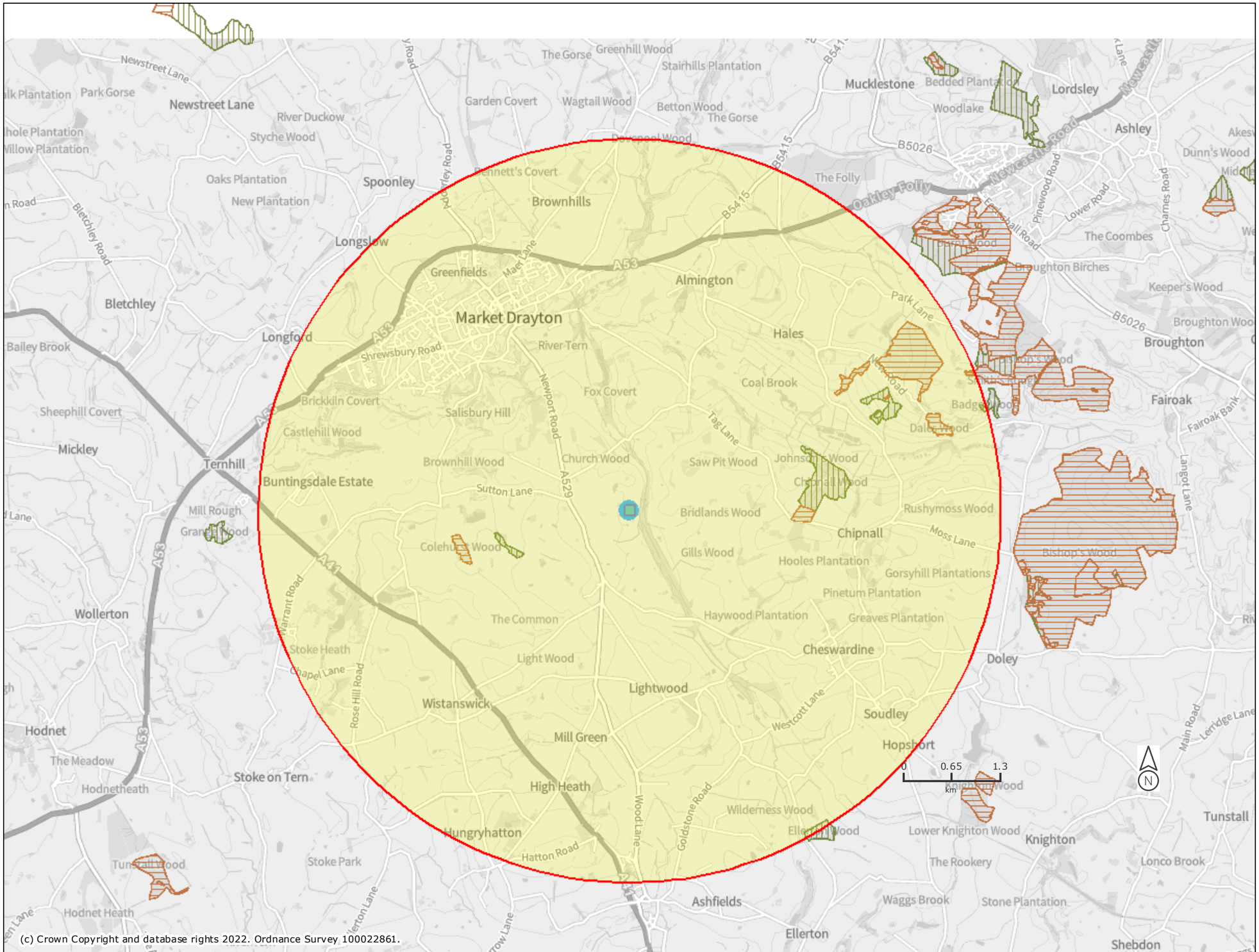
- Ramsar Sites (England)
- Proposed Ramsar Sites (England)
- Sites of Special Scientific Interest (England)
- Special Areas of Conservation (England)
- Possible Special Areas of Conservation (England)
- Special Protection Areas (England)
- Potential Special Protection Areas (England)

Projection = OSGB36
xmin = 341900
ymin = 318900
xmax = 395200
ymax = 345100

0 2 4 km

Map produced by MAGIC on 30 May, 2022.

Magic Map



Legend

Ancient Woodland (England)

- Ancient and Semi-Natural Woodland
- Ancient Replanted Woodland

Projection = OSGB36
xmin = 355900
ymin = 325600
xmax = 382500
ymax = 337900

0 1 2
km

Map produced by MAGIC on 30 May, 2022.

APPENDIX C

Table C-1
Scenario 1: Model (stacks)

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
S1	Stack 1	369058.4	331519.1	117	0.002258	5.815	0.8	3.0
S2	Stack 2	369062.5	331530.6	117	0.002258	5.815	0.8	3.0
S3	Stack 3	369066.7	331542.0	117	0.002258	5.815	0.8	3.0
S4	Stack 4	369070.8	331553.5	117	0.002258	5.815	0.8	3.0
S5	Stack 5	369075.0	331564.9	117	0.002258	5.815	0.8	3.0
S6	Stack 6	369079.1	331576.4	117	0.002258	5.815	0.8	3.0
S7	Stack 7	369083.2	331587.8	117	0.002258	5.815	0.8	3.0
S8	Stack 8	369087.4	331599.3	117	0.002258	5.815	0.8	3.0
S9	Stack 9	369091.5	331610.7	117	0.002258	5.815	0.8	3.0
S10	Stack 10	369095.6	331622.2	117	0.002258	5.815	0.8	3.0
S11	Stack 11	369099.7	331633.7	117	0.002258	5.815	0.8	3.0
S12	Stack 12	369103.9	331645.1	117	0.002258	5.815	0.8	3.0
S13	Stack 13	369108.0	331656.6	117	0.002258	5.815	0.8	3.0
S14	Stack 14	369112.2	331668.0	117	0.002258	5.815	0.8	3.0
S15	Stack 15	369116.3	331679.5	117	0.002258	5.815	0.8	3.0
S16	Stack 16	369120.4	331690.9	117	0.002258	5.815	0.8	3.0
S17	Stack 17	369124.6	331702.4	117	0.002258	5.815	0.8	3.0
S18	Stack 18	369128.7	331713.8	117	0.002258	5.815	0.8	3.0
S19	Stack 19	369059.0	331512.3	117	0.002258	5.815	0.8	3.0
S20	Stack 20	369063.1	331523.8	117	0.002258	5.815	0.8	3.0
S21	Stack 21	369067.3	331535.2	117	0.002258	5.815	0.8	3.0
S22	Stack 22	369071.4	331546.7	117	0.002258	5.815	0.8	3.0
S23	Stack 23	369075.6	331558.1	117	0.002258	5.815	0.8	3.0
S24	Stack 24	369079.7	331569.6	117	0.002258	5.815	0.8	3.0
S25	Stack 25	369083.8	331581.0	117	0.002258	5.815	0.8	3.0
S26	Stack 26	369088.0	331592.5	117	0.002258	5.815	0.8	3.0
S27	Stack 27	369092.1	331603.9	117	0.002258	5.815	0.8	3.0
S28	Stack 28	369096.5	331615.5	117	0.002258	5.815	0.8	3.0
S29	Stack 29	369100.6	331627.0	117	0.002258	5.815	0.8	3.0
S30	Stack 30	369104.8	331638.4	117	0.002258	5.815	0.8	3.0
S31	Stack 31	369108.9	331649.9	117	0.002258	5.815	0.8	3.0
S32	Stack 32	369113.1	331661.3	117	0.002258	5.815	0.8	3.0
S33	Stack 33	369117.2	331672.8	117	0.002258	5.815	0.8	3.0
S34	Stack 34	369121.3	331684.2	117	0.002258	5.815	0.8	3.0
S35	Stack 35	369125.5	331695.7	117	0.002258	5.815	0.8	3.0

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
S36	Stack 36	369129.6	331707.1	117	0.002258	5.815	0.8	3.0
S37	Stack 37	369089.0	331508.0	117	0.002258	5.815	0.8	3.0
S38	Stack 38	369093.1	331519.5	117	0.002258	5.815	0.8	3.0
S39	Stack 39	369097.3	331530.9	117	0.002258	5.815	0.8	3.0
S40	Stack 40	369101.4	331542.4	117	0.002258	5.815	0.8	3.0
S41	Stack 41	369105.6	331553.8	117	0.002258	5.815	0.8	3.0
S42	Stack 42	369109.7	331565.3	117	0.002258	5.815	0.8	3.0
S43	Stack 43	369113.8	331576.7	117	0.002258	5.815	0.8	3.0
S44	Stack 44	369118.0	331588.2	117	0.002258	5.815	0.8	3.0
S45	Stack 45	369122.1	331599.6	117	0.002258	5.815	0.8	3.0
S46	Stack 46	369089.6	331501.1	117	0.002258	5.815	0.8	3.0
S47	Stack 47	369093.7	331512.6	117	0.002258	5.815	0.8	3.0
S48	Stack 48	369097.9	331524.0	117	0.002258	5.815	0.8	3.0
S49	Stack 49	369102.0	331535.5	117	0.002258	5.815	0.8	3.0
S50	Stack 50	369106.2	331546.9	117	0.002258	5.815	0.8	3.0
S51	Stack 51	369110.3	331558.4	117	0.002258	5.815	0.8	3.0
S52	Stack 52	369114.4	331569.8	117	0.002258	5.815	0.8	3.0
S53	Stack 53	369118.6	331581.3	117	0.002258	5.815	0.8	3.0
S54	Stack 54	369122.7	331592.7	117	0.002258	5.815	0.8	3.0
S55	Stack 55	369126.8	331610.6	117	0.002258	5.815	0.8	3.0
S56	Stack 56	369130.9	331622.1	117	0.002258	5.815	0.8	3.0
S57	Stack 57	369135.1	331633.5	117	0.002258	5.815	0.8	3.0
S58	Stack 58	369139.2	331645.0	117	0.002258	5.815	0.8	3.0
S59	Stack 59	369143.4	331656.4	117	0.002258	5.815	0.8	3.0
S60	Stack 60	369147.5	331667.9	117	0.002258	5.815	0.8	3.0
S61	Stack 61	369151.6	331679.3	117	0.002258	5.815	0.8	3.0
S62	Stack 62	369155.8	331690.8	117	0.002258	5.815	0.8	3.0
S63	Stack 63	369159.9	331702.2	117	0.002258	5.815	0.8	3.0
S64	Stack 64	369127.5	331604.5	117	0.002258	5.815	0.8	3.0
S65	Stack 65	369131.6	331616.0	117	0.002258	5.815	0.8	3.0
S66	Stack 66	369135.8	331627.4	117	0.002258	5.815	0.8	3.0
S67	Stack 67	369139.9	331638.9	117	0.002258	5.815	0.8	3.0
S68	Stack 68	369144.1	331650.3	117	0.002258	5.815	0.8	3.0
S69	Stack 69	369148.2	331661.8	117	0.002258	5.815	0.8	3.0
S70	Stack 70	369152.3	331673.2	117	0.002258	5.815	0.8	3.0
S71	Stack 71	369156.5	331684.7	117	0.002258	5.815	0.8	3.0
S72	Stack 72	369160.6	331696.1	117	0.002258	5.815	0.8	3.0

Table C-2
Scenario 2: Model (stacks)

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
S1	Stack 1	369058.4	331519.1	117	0.002258	5.815	0.8	3.0
S2	Stack 2	369062.5	331530.6	117	0.002258	5.815	0.8	3.0
S3	Stack 3	369066.7	331542.0	117	0.002258	5.815	0.8	3.0
S4	Stack 4	369070.8	331553.5	117	0.002258	5.815	0.8	3.0
S5	Stack 5	369075.0	331564.9	117	0.002258	5.815	0.8	3.0
S6	Stack 6	369079.1	331576.4	117	0.002258	5.815	0.8	3.0
S7	Stack 7	369083.2	331587.8	117	0.002258	5.815	0.8	3.0
S8	Stack 8	369087.4	331599.3	117	0.002258	5.815	0.8	3.0
S9	Stack 9	369091.5	331610.7	117	0.002258	5.815	0.8	3.0
S10	Stack 10	369095.6	331622.2	117	0.002258	5.815	0.8	3.0
S11	Stack 11	369099.7	331633.7	117	0.002258	5.815	0.8	3.0
S12	Stack 12	369103.9	331645.1	117	0.002258	5.815	0.8	3.0
S13	Stack 13	369108.0	331656.6	117	0.002258	5.815	0.8	3.0
S14	Stack 14	369112.2	331668.0	117	0.002258	5.815	0.8	3.0
S15	Stack 15	369116.3	331679.5	117	0.002258	5.815	0.8	3.0
S16	Stack 16	369120.4	331690.9	117	0.002258	5.815	0.8	3.0
S17	Stack 17	369124.6	331702.4	117	0.002258	5.815	0.8	3.0
S18	Stack 18	369128.7	331713.8	117	0.002258	5.815	0.8	3.0
S19	Stack 19	369059.0	331512.3	117	0.002258	5.815	0.8	3.0
S20	Stack 20	369063.1	331523.8	117	0.002258	5.815	0.8	3.0
S21	Stack 21	369067.3	331535.2	117	0.002258	5.815	0.8	3.0
S22	Stack 22	369071.4	331546.7	117	0.002258	5.815	0.8	3.0
S23	Stack 23	369075.6	331558.1	117	0.002258	5.815	0.8	3.0
S24	Stack 24	369079.7	331569.6	117	0.002258	5.815	0.8	3.0
S25	Stack 25	369083.8	331581.0	117	0.002258	5.815	0.8	3.0
S26	Stack 26	369088.0	331592.5	117	0.002258	5.815	0.8	3.0
S27	Stack 27	369092.1	331603.9	117	0.002258	5.815	0.8	3.0
S28	Stack 28	369096.5	331615.5	117	0.002258	5.815	0.8	3.0
S29	Stack 29	369100.6	331627.0	117	0.002258	5.815	0.8	3.0
S30	Stack 30	369104.8	331638.4	117	0.002258	5.815	0.8	3.0
S31	Stack 31	369108.9	331649.9	117	0.002258	5.815	0.8	3.0
S32	Stack 32	369113.1	331661.3	117	0.002258	5.815	0.8	3.0
S33	Stack 33	369117.2	331672.8	117	0.002258	5.815	0.8	3.0
S34	Stack 34	369121.3	331684.2	117	0.002258	5.815	0.8	3.0
S35	Stack 35	369125.5	331695.7	117	0.002258	5.815	0.8	3.0
S36	Stack 36	369129.6	331707.1	117	0.002258	5.815	0.8	3.0
S37	Stack 37	369089.0	331508.0	117	0.000174	5.815	0.8	3.0

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
S38	Stack 38	369093.1	331519.5	117	0.000174	5.815	0.8	3.0
S39	Stack 39	369097.3	331530.9	117	0.000174	5.815	0.8	3.0
S40	Stack 40	369101.4	331542.4	117	0.000174	5.815	0.8	3.0
S41	Stack 41	369105.6	331553.8	117	0.000174	5.815	0.8	3.0
S42	Stack 42	369109.7	331565.3	117	0.000174	5.815	0.8	3.0
S43	Stack 43	369113.8	331576.7	117	0.000174	5.815	0.8	3.0
S44	Stack 44	369118.0	331588.2	117	0.000174	5.815	0.8	3.0
S45	Stack 45	369122.1	331599.6	117	0.000174	5.815	0.8	3.0
S46	Stack 46	369089.6	331501.1	117	0.000174	5.815	0.8	3.0
S47	Stack 47	369093.7	331512.6	117	0.000174	5.815	0.8	3.0
S48	Stack 48	369097.9	331524.0	117	0.000174	5.815	0.8	3.0
S49	Stack 49	369102.0	331535.5	117	0.000174	5.815	0.8	3.0
S50	Stack 50	369106.2	331546.9	117	0.000174	5.815	0.8	3.0
S51	Stack 51	369110.3	331558.4	117	0.000174	5.815	0.8	3.0
S52	Stack 52	369114.4	331569.8	117	0.000174	5.815	0.8	3.0
S53	Stack 53	369118.6	331581.3	117	0.000174	5.815	0.8	3.0
S54	Stack 54	369122.7	331592.7	117	0.000174	5.815	0.8	3.0
S55	Stack 55	369126.8	331610.6	117	0.000174	5.815	0.8	3.0
S56	Stack 56	369130.9	331622.1	117	0.000174	5.815	0.8	3.0
S57	Stack 57	369135.1	331633.5	117	0.000174	5.815	0.8	3.0
S58	Stack 58	369139.2	331645.0	117	0.000174	5.815	0.8	3.0
S59	Stack 59	369143.4	331656.4	117	0.000174	5.815	0.8	3.0
S60	Stack 60	369147.5	331667.9	117	0.000174	5.815	0.8	3.0
S61	Stack 61	369151.6	331679.3	117	0.000174	5.815	0.8	3.0
S62	Stack 62	369155.8	331690.8	117	0.000174	5.815	0.8	3.0
S63	Stack 63	369159.9	331702.2	117	0.000174	5.815	0.8	3.0
S64	Stack 64	369127.5	331604.5	117	0.000174	5.815	0.8	3.0
S65	Stack 65	369131.6	331616.0	117	0.000174	5.815	0.8	3.0
S66	Stack 66	369135.8	331627.4	117	0.000174	5.815	0.8	3.0
S67	Stack 67	369139.9	331638.9	117	0.000174	5.815	0.8	3.0
S68	Stack 68	369144.1	331650.3	117	0.000174	5.815	0.8	3.0
S69	Stack 69	369148.2	331661.8	117	0.000174	5.815	0.8	3.0
S70	Stack 70	369152.3	331673.2	117	0.000174	5.815	0.8	3.0
S71	Stack 71	369156.5	331684.7	117	0.000174	5.815	0.8	3.0
S72	Stack 72	369160.6	331696.1	117	0.000174	5.815	0.8	3.0
S73	Stack 73	369124.8	331494.9	117	0.000174	5.815	0.8	3.0
S74	Stack 74	369128.9	331506.4	117	0.000174	5.815	0.8	3.0
S75	Stack 75	369133.1	331517.8	117	0.000174	5.815	0.8	3.0
S76	Stack 76	369137.2	331529.3	117	0.000174	5.815	0.8	3.0
S77	Stack 77	369141.4	331540.7	117	0.000174	5.815	0.8	3.0

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
S78	Stack 78	369145.5	331552.2	117	0.000174	5.815	0.8	3.0
S79	Stack 79	369149.6	331563.6	117	0.000174	5.815	0.8	3.0
S80	Stack 80	369153.8	331575.1	117	0.000174	5.815	0.8	3.0
S81	Stack 81	369157.9	331586.5	117	0.000174	5.815	0.8	3.0
S82	Stack 82	369162.0	331598.0	117	0.000174	5.815	0.8	3.0
S83	Stack 83	369166.1	331609.5	117	0.000174	5.815	0.8	3.0
S84	Stack 84	369170.3	331620.9	117	0.000174	5.815	0.8	3.0
S85	Stack 85	369174.4	331632.4	117	0.000174	5.815	0.8	3.0
S86	Stack 86	369178.6	331643.8	117	0.000174	5.815	0.8	3.0
S87	Stack 87	369182.7	331655.3	117	0.000174	5.815	0.8	3.0
S88	Stack 88	369186.8	331666.7	117	0.000174	5.815	0.8	3.0
S89	Stack 89	369191.0	331678.2	117	0.000174	5.815	0.8	3.0
S90	Stack 90	369195.1	331689.6	117	0.000174	5.815	0.8	3.0
S91	Stack 91	369125.4	331488.1	117	0.000174	5.815	0.8	3.0
S92	Stack 92	369129.5	331499.6	117	0.000174	5.815	0.8	3.0
S93	Stack 93	369133.7	331511.0	117	0.000174	5.815	0.8	3.0
S94	Stack 94	369137.8	331522.5	117	0.000174	5.815	0.8	3.0
S95	Stack 95	369142.0	331533.9	117	0.000174	5.815	0.8	3.0
S96	Stack 96	369146.1	331545.4	117	0.000174	5.815	0.8	3.0
S97	Stack 97	369150.2	331556.8	117	0.000174	5.815	0.8	3.0
S98	Stack 98	369154.4	331568.3	117	0.000174	5.815	0.8	3.0
S99	Stack 99	369158.5	331579.7	117	0.000174	5.815	0.8	3.0
S100	Stack 100	369162.9	331591.3	117	0.000174	5.815	0.8	3.0
S101	Stack 101	369167.0	331602.8	117	0.000174	5.815	0.8	3.0
S102	Stack 102	369171.2	331614.2	117	0.000174	5.815	0.8	3.0
S103	Stack 103	369175.3	331625.7	117	0.000174	5.815	0.8	3.0
S104	Stack 104	369179.5	331637.1	117	0.000174	5.815	0.8	3.0
S105	Stack 105	369183.6	331648.6	117	0.000174	5.815	0.8	3.0
S106	Stack 106	369187.7	331660.0	117	0.000174	5.815	0.8	3.0
S107	Stack 107	369191.9	331671.5	117	0.000174	5.815	0.8	3.0
S108	Stack 108	369196.0	331682.9	117	0.000174	5.815	0.8	3.0
S109	Stack 109	369159.6	331482.3	117	0.000174	5.815	0.8	3.0
S110	Stack 110	369163.7	331493.8	117	0.000174	5.815	0.8	3.0
S111	Stack 111	369167.9	331505.2	117	0.000174	5.815	0.8	3.0
S112	Stack 112	369172.0	331516.7	117	0.000174	5.815	0.8	3.0
S113	Stack 113	369176.2	331528.1	117	0.000174	5.815	0.8	3.0
S114	Stack 114	369180.3	331539.6	117	0.000174	5.815	0.8	3.0
S115	Stack 115	369184.4	331551.0	117	0.000174	5.815	0.8	3.0
S116	Stack 116	369188.6	331562.5	117	0.000174	5.815	0.8	3.0
S117	Stack 117	369192.7	331573.9	117	0.000174	5.815	0.8	3.0

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
S118	Stack 118	369160.2	331475.4	117	0.000174	5.815	0.8	3.0
S119	Stack 119	369164.3	331486.9	117	0.000174	5.815	0.8	3.0
S120	Stack 120	369168.5	331498.3	117	0.000174	5.815	0.8	3.0
S121	Stack 121	369172.6	331509.8	117	0.000174	5.815	0.8	3.0
S122	Stack 122	369176.8	331521.2	117	0.000174	5.815	0.8	3.0
S123	Stack 123	369180.9	331532.7	117	0.000174	5.815	0.8	3.0
S124	Stack 124	369185.0	331544.1	117	0.000174	5.815	0.8	3.0
S125	Stack 125	369189.2	331555.6	117	0.000174	5.815	0.8	3.0
S126	Stack 126	369193.3	331567.0	117	0.000174	5.815	0.8	3.0
S127	Stack 127	369197.4	331584.9	117	0.000174	5.815	0.8	3.0
S128	Stack 128	369201.5	331596.4	117	0.000174	5.815	0.8	3.0
S129	Stack 129	369205.7	331607.8	117	0.000174	5.815	0.8	3.0
S130	Stack 130	369209.8	331619.3	117	0.000174	5.815	0.8	3.0
S131	Stack 131	369214.0	331630.7	117	0.000174	5.815	0.8	3.0
S132	Stack 132	369218.1	331642.2	117	0.000174	5.815	0.8	3.0
S133	Stack 133	369222.2	331653.6	117	0.000174	5.815	0.8	3.0
S134	Stack 134	369226.4	331665.1	117	0.000174	5.815	0.8	3.0
S135	Stack 135	369230.5	331676.5	117	0.000174	5.815	0.8	3.0
S136	Stack 136	369198.1	331578.8	117	0.000174	5.815	0.8	3.0
S137	Stack 137	369202.2	331590.3	117	0.000174	5.815	0.8	3.0
S138	Stack 138	369206.4	331601.7	117	0.000174	5.815	0.8	3.0
S139	Stack 139	369210.5	331613.2	117	0.000174	5.815	0.8	3.0
S140	Stack 140	369214.7	331624.6	117	0.000174	5.815	0.8	3.0
S141	Stack 141	369218.8	331636.1	117	0.000174	5.815	0.8	3.0
S142	Stack 142	369222.9	331647.5	117	0.000174	5.815	0.8	3.0
S143	Stack 143	369227.1	331659.0	117	0.000174	5.815	0.8	3.0
S144	Stack 144	369231.2	331670.4	117	0.000174	5.815	0.8	3.0
SB1S1	SB1S1	369164.4	331647.8	117	0.00075	5.2	1.6	4.2
SB1S2	SB1S2	369163.8	331645.9	117	0.00075	5.2	1.8	4.2
SB1S3	SB1S3	369163.1	331643.9	117	0.00075	5.2	1.8	4.2
SB1S4	SB1S4	369162.4	331642.0	117	0.00075	5.2	1.8	4.2
SB1S5	SB1S5	369161.6	331639.8	117	0.00075	5.2	1.8	4.2
SB2S1	SB2S1	369199.7	331634.5	117	0.00075	5.2	1.8	4.2
SB2S2	SB2S2	369199.1	331632.6	117	0.00075	5.2	1.8	4.2
SB2S3	SB2S3	369198.4	331630.6	117	0.00075	5.2	1.8	4.2
SB2S4	SB2S4	369197.7	331628.7	117	0.00075	5.2	1.8	4.2
SB2S5	SB2S5	369197.0	331626.8	117	0.00075	5.2	1.8	4.2
SB3S1	SB3S1	369160.3	331525.9	117	0.00075	5.2	1.8	4.2
SB3S2	SB3S2	369159.7	331524.0	117	0.00075	5.2	1.8	4.2
SB3S3	SB3S3	369159.0	331522.0	117	0.00075	5.2	1.8	4.2

Ref	Source	Xm	Ym	Zm	emission rate (mg/s)	Height (m)	Diameter (m)	Velocity (m/s)
SB3S4	SB3S4	369158.3	331520.1	117	0.00075	5.2	1.8	4.2
SB3S5	SB3S5	369157.6	331518.1	117	0.00075	5.2	1.8	4.2
SB4S1	SB4S1	369200.6	331649.5	117	0.00075	5.2	1.8	4.2
SB4S2	SB4S2	369200.0	331647.6	117	0.00075	5.2	1.8	4.2
SB4S3	SB4S3	369199.3	331645.6	117	0.00075	5.2	1.8	4.2
SB4S4	SB4S4	369198.6	331643.7	117	0.00075	5.2	1.8	4.2
SB4S5	SB4S5	369201.4	331651.5	117	0.00075	5.2	1.8	4.2
SB5S1	SB5S1	369161.0	331540.7	117	0.00075	5.2	1.8	4.2
SB5S2	SB5S2	369160.4	331538.8	117	0.00075	5.2	1.8	4.2
SB5S3	SB5S3	369159.7	331536.8	117	0.00075	5.2	1.8	4.2
SB5S4	SB5S4	369159.0	331534.9	117	0.00075	5.2	1.8	4.2
SB5S5	SB5S5	369161.5	331542.4	117	0.00075	5.2	1.8	4.2
SB6S1	SB6S1	369130.3	331554.0	117	0.00075	5.2	1.8	4.2
SB6S2	SB6S2	369129.5	331552.1	117	0.00075	5.2	1.8	4.2
SB6S3	SB6S3	369128.7	331549.7	117	0.00075	5.2	1.8	4.2
SB6S4	SB6S4	369128.0	331547.8	117	0.00075	5.2	1.8	4.2
SB6S5	SB6S5	369127.3	331546.0	117	0.00075	5.2	1.8	4.2

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