Ammonia Assessment

Blackmoss Farm, Chipping

Client: Stanworth Agricultural Limited

Reference: 6499-1r1

Date: 31st October 2024

Report Issue

Report Title: Ammonia Assessment - Blackmoss Farm, Chipping

Report Reference: 6499-1

Field	Report Version			
	1	2	3	4
Authored by	Megan Hall			
Position	Air Quality Consultant			
Reviewed by	Catrin Rathbone			
Position	Graduate Air Quality Consultant			
Authorised by	Pearl Hutchinson			
Position	Associate Director			
Date of Issue	31st October 2024			
Comment	-			

Serendipity Labs, Building 7, Exchange Quay, Salford, M5 3EP

[redacted]

Table of Contents

1.0 INTRODUCTION 1
1.1 Background 1
1.2 Site Location and Context 1
2.0 METHODOLOGY 2
2.1 Introduction 2
2.2 Guidance 2
2.3 Assessment Stages 2
Stage 1: Screening 3
Stage 2: Appropriate Assessment 4
3.0 STAGE 1: SCREENING 6
3.1 Introduction 6
3.2 Step 1 6
3.3 Step 2 6
3.4 Step 3 7
3.5 Step 4a 9
3.6 Step 4b 11
3.7 Summary 15
4.0 CONCLUSION 17
5.0 ABBREVIATIONS 18

1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by Stanworth Agricultural Limited to undertake an Ammonia Assessment in support of an agricultural development on land at Blackmoss Farm, Chipping

1.1.2 The proposals have the potential to cause changes in pollution levels at sensitive ecological locations as a result of ammonia (NH_3) emissions associated with the development. An Ammonia Assessment was therefore undertaken in order to consider potential effects.

1.2 Site Location and Context

1.2.1 Blackmoss Farm is located off Gib Hey Lane, Chipping, at approximate National Grid Reference (NGR): 360152, 440399.

1.2.2 The project is Phase 2 of a multi-phase development at the farm. Phase 2 comprises the construction of a new calving shed which will have capacity for 70 cows and the extension of an existing calf shed with a maximum capacity of 138 calves under the age of 12-months. Additionally, it is proposed to construct a covered midden with a maximum capacity of 1,521 tonnes (t) of manure. Reference should be made to Figure 1 for a site layout plan.

1.2.3 The proposals have the potential to cause changes in pollution levels at sensitive ecological locations as a result of NH_3 emissions associated with the project. An Ammonia Assessment was therefore undertaken in order to consider potential effects. The methodology and findings are presented in the following report.

2.0 METHODOLOGY

2.1 Introduction

2.1.1 The proposals have the potential to cause changes in pollution levels at sensitive ecological locations as a result of NH_3 emissions associated with the development. An assessment was therefore undertaken in order to determine baseline conditions and assess potential effects. The associated methodology is outlined in the following Sections.

2.2 Guidance

2.2.1 The following guidance was utilised throughout the assessment:

- Air quality risk assessment interim guidance, NE, 2022;
- Intensive farming risk assessment for your environmental permit, Environment Agency (EA), 2018;
- Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, NE, 2018; and,
- Habitats regulations assessments: protecting a European site, Department for Environment, Food and Rural Affairs (DEFRA), NE, Welsh Government and Natural Resources Wales, 2021.

2.3 Assessment Stages

2.3.1 The assessment was undertaken in accordance with the stages outlined within the Habitat Regulations Assessment (HRA) guidance[1] produced by DEFRA. This is summarised as follows, though it should be noted that completion of all elements is not always necessary, depending on the findings of each stage:

- Stage 1 - Screening: Plans or projects with no likely significant effect on an ecological designation can be 'screened out' of the need for further assessment;

[1] Habitats regulations assessments: protecting a European site, DEFRA, NE, Welsh Government and Natural Resources Wales, 2021.

- Stage 2 - Appropriate Assessment: Detailed assessment to consider the likely significant effects of the proposal in more detail and identify ways to avoid or minimise any effects; and,
- Stage 3 - Derogation: To assess the likely significant effects of the proposal in more detail and identify ways to avoid or minimise any effects.

2.3.2 The methodology adopted for each stage is summarised in the following Sections.

2.3.3 It should be noted that although the HRA methodology only applies to European sites, the approach has also been adopted when considering effects on Sites of Special Scientific Interest (SSSIs) in lieu of alternative guidance.

Stage 1: Screening

2.3.4 Stage 1: Screening utilised the following steps, as derived from relevant guidance[2] [3] and information provided within consultation responses from NE on similar projects:

- Step 1: Does the proposal give rise to emissions which are likely to reach an international or national site? If there are no designations within the vicinity of the project, then a screening conclusion of no likely significant effect can be reached with regard to air quality;
- Step 2: Are the qualifying features of the designation sensitive to air pollution? If there are no sensitive qualifying features, then a screening conclusion of no likely significant effect on the site can be reached with regard to air quality;
- Step 3: Could the sensitive qualifying features of the site be exposed to emissions? If the qualifying features could not be exposed to emissions, then a screening conclusion of no likely significant effect on the site can be reached with regard to air quality;
- Step 4: Application of the following screening thresholds to determine potential risk of effects alone and in-combination with emissions from other plans and projects:
    - 4a) Alone: Risk of significant effect if a Predicted Concentration (PC) is 1% of the critical load or level or greater as a result of the proposal in isolation; and,

[2] Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, NE, 2018.

[3] Air quality risk assessment interim guidance, NE, 2022.

- 4b) In-combination: Risk of significant effect if a PC is 1% of the critical load or level or greater as a result of the proposal in-combination with other relevant plans or projects.

2.3.5 If the above criteria are not exceeded, then a screening conclusion of no likely significant effect on the site can be reached with regard to air quality.

2.3.6 If the above steps indicate a screening conclusion of no likely significant effects on the relevant designations can be reached with regard to air quality, then the assessment can be concluded. If potential effects cannot be screened out, then the assessment should proceed to Stage 2: Appropriate Assessment.

Stage 2: Appropriate Assessment

2.3.7 Having identified a risk of a significant effect from a plan or project either alone or in-combination, the purpose of Stage 2: Appropriate Assessment is to more precisely assess the likely effects and to inform a conclusion as to whether an adverse effect on site integrity can be ruled out. It should be noted that the assessment should be 'appropriate' in terms of its scope, content, length and complexity to the plan or project under assessment. This was reiterated by the Supreme Court[4], which clarified:

> '"Appropriate' is not a technical term. It indicates no more than that the assessment should be appropriate to the task in hand: that task being to satisfy the authority that the project will not adversely affect the integrity of the site concerned."

2.3.8 It should not be assumed that an Appropriate Assessment will necessarily involve detailed and complex monitoring or modelling work. Whilst this may be necessary in fully understanding what will happen to a site if the plan or project goes ahead, it is equally possible that a fairly concise and straightforward assessment might be entirely 'appropriate'.

[4] Champion v North Norfolk DC, UK Supreme Court, 2015.

2.3.9 A number of factors are identified in the NE guidance[5] for further consideration during an Appropriate Assessment. These are summarised as follows:

- Consider whether the sensitive qualifying features of the site would be exposed to emissions;
- Consider the European Site's Conservation Objectives;
- Consider background pollution;
- Consider the designated site in its national context;
- Consider the best available evidence on small incremental impacts from nitrogen deposition;
- Consider the spatial scale and duration of the predicted impact and the ecological functionality of the affected area;
- Consider site survey information;
- Consider national, regional and local initiatives or measures which can be relied upon to reduce background levels at the site;
- Consider measures to avoid or reduce the harmful effects of the plan or project on site integrity; and,
- Consider any likely in-combination effects with other live plans and projects from other sectors.

2.3.10 It should be noted that in accordance with the above definition of an Appropriate Assessment, not all factors may be relevant to a specific plan or project and only those which aid in forming a conclusion as to whether an adverse effect on site integrity can be ruled out need to be considered.

[5] Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, NE, 2018.

3.0 STAGE 1: SCREENING

3.1 Introduction

3.1.1 A Stage1: Screening Assessment of potential effects on sensitive ecological designations as result of emissions from the development was undertaken in accordance with the stages outlined in Section 2.3. The results are provided in the following Sections.

3.2 Step 1

3.2.1 Step 1 required identification of any ecological designations within the vicinity of the site that may be affected by emissions from the development. Review of the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service[6] indicated the following designations within 10km of the site:

- Bowland Fells SSSI;
- Bowland Fells Special Protection Area (SPA);
- Hodder River Section SSSI;
- Red Scar and Tun Brook Woods SSSI; and,
- Rough Hey Wood SSSI.

3.2.2 As shown above, five designations were identified that may be affected by emissions associated with the development. As such, the assessment proceeded to Step 2.

3.3 Step 2

3.3.1 In order to identify whether the designations are sensitive to air pollution, the critical loads and levels for the qualifying features were obtained from the Air Pollution Information System (APIS)[7] website.

3.3.2 Review of the relevant data indicated that NH_3 critical levels and nitrogen and acid deposition critical loads have not been defined for the qualifying features of the Hodder River Section SSSI and Rough Hey Wood SSSI. As such, these designations are not

6 MAGIC, www.magic.gov.uk

7 APIS, www.apis.ac.uk.

considered sensitive to changes in pollutant levels. A screening conclusion of no likely significant effect on these sites as a result of the project alone and in-combination can therefore be reached with regard to air quality impacts.

3.3.3 Critical levels and loads have been identified for qualifying features in the remaining three designations. As such, these are considered sensitive to air pollution and the assessment proceeded to Step 3.

3.4 Step 3

3.4.1 For the purpose of Stage 1: Screening, discrete receptors were placed at the boundary closest to the development. The relevant positions are shown in Table 1.

Table 1 Discrete Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	Bowland Fells SPA and Bowland Fells SSSI	354662.9	446628.3
E2	Bowland Fells SPA and Bowland Fells SSSI	355943.7	447121.9
E3	Bowland Fells SPA and Bowland Fells SSSI	357171.2	447388.8
E4	Bowland Fells SPA and Bowland Fells SSSI	359666.1	444466.9
E5	Bowland Fells SPA and Bowland Fells SSSI	361253.8	445587.6
E6	Bowland Fells SPA and Bowland Fells SSSI	362307.8	446281.4
E7	Bowland Fells SPA and Bowland Fells SSSI	363255.1	447028.5
E8	Red Scar and Tun Brook Woods SSSI	359059.6	434156.9
E9	Red Scar and Tun Brook Woods SSSI	358417.1	432166.2
E10	Red Scar and Tun Brook Woods SSSI	357822.4	431319.6

3.4.2 Reference should be made to Figure 2 for a map of the discrete receptor locations.

3.4.3 The relevant features and critical levels for NH_3 at the identified receptors are presented in Table 2.

Table 2 Features and Critical Levels for NH_3

Receptor		Feature	Annual Mean Critical Level for NH_3 ($\mu g/m^3$)
E1 - E7	Bowland Fells SPA and Bowland Fells SSSI	Erica tetralix - sphagnum papillosum raised and blanket mire	1
E8 - E10	Red Scar and Tun Brook Woods SSSI	Fraxinus excelsior - sorbus aucuparia - mercurialis perennis woodland	1

3.4.4 The relevant features and nitrogen deposition critical loads at the identified receptors are presented in Table 3.

Table 3 Features and Critical Loads for Nitrogen Deposition

Receptor		Feature	Relevant Nitrogen Critical Load Class	Critical Load (kgN/ha/yr)	
				Low	High
E1 - E7	Bowland Fells SPA and Bowland Fells SSSI	Erica tetralix - sphagnum papillosum raised and blanket mire	Raised and blanket bogs	5	10
E8 - E10	Red Scar and Tun Brook Woods SSSI	Fraxinus excelsior - sorbus aucuparia - mercurialis perennis woodland	Carpinus and Quercus mesic deciduous forest	15	20

3.4.5 The relevant features and acid deposition critical loads at the identified receptors are presented in Table 4.

Table 4 Features and Critical Loads for Acid Deposition

Receptor		Feature	Relevant Acid Critical Load Class	Critical Load (keq/ha/yr)		
				CLMinN	CLMaxS	CLMaxN
E1 - E7	Bowland Fells SPA and Bowland Fells SSSI	Erica tetralix - sphagnum papillosum raised and blanket mire	Bogs	0.321	0.334	0.655
E8 - E10	Red Scar and Tun Brook Woods SSSI	Fraxinus excelsior - sorbus aucuparia - mercurialis perennis woodland	Unmanaged broadleafed/ coniferous woodland	0.142	1.446	1.707

3.4.6 A review of the relevant data indicated the qualifying features within the identified designations could be exposed to emissions. As such, a screening conclusion of no likely significant effects on the sites could not be reached with regard to air quality and the assessment proceeded to Step 4.

3.5 Step 4a

3.5.1 Dispersion modelling was undertaken in order to quantify the predicted PC as a result of emissions from the development alone as a proportion of the relevant critical load or level with subsequent comparison against the screening threshold. Reference should be made to Appendix 2 for the dispersion modelling inputs.

3.5.2 Predicted annual mean NH_3 concentrations are summarised in Table 5.

Table 5 Predicted Annual Mean NH_3 Concentrations - Development Alone

Receptor		Predicted Annual Mean NH_3 PC (µg/m^3)	PC as Prop. of CL (%)
E1	Bowland Fells SPA and Bowland Fells SSSI	0.0004	0.04
E2	Bowland Fells SPA and Bowland Fells SSSI	0.0004	0.04
E3	Bowland Fells SPA and Bowland Fells SSSI	0.0004	0.04
E4	Bowland Fells SPA and Bowland Fells SSSI	0.0008	0.08
E5	Bowland Fells SPA and Bowland Fells SSSI	0.0004	0.04
E6	Bowland Fells SPA and Bowland Fells SSSI	0.0002	0.02
E7	Bowland Fells SPA and Bowland Fells SSSI	0.0002	0.02
E8	Red Scar and Tun Brook Woods SSSI	0.0004	0.04
E9	Red Scar and Tun Brook Woods SSSI	0.0002	0.02
E10	Red Scar and Tun Brook Woods SSSI	0.0002	0.02

3.5.3 As shown in Table 5, the predicted PC as a result of emissions from the development alone was below 1% of the relevant critical level at all relevant receptors. As such, a screening conclusion of no likely significant effect as a result of the development alone can be reached with regard to annual mean NH_3 concentrations.

3.5.4 Predicted annual nitrogen deposition rates are summarised in Table 6.

Table 6 Predicted Annual Nitrogen Deposition - Development Alone

Receptor		Predicted Annual Nitrogen Deposition PC (kgN/ha/yr)	PC as Prop. of CL (%)
E1	Bowland Fells SPA and Bowland Fells SSSI	0.0021	0.04
E2	Bowland Fells SPA and Bowland Fells SSSI	0.0021	0.04
E3	Bowland Fells SPA and Bowland Fells SSSI	0.0022	0.04
E4	Bowland Fells SPA and Bowland Fells SSSI	0.0040	0.08
E5	Bowland Fells SPA and Bowland Fells SSSI	0.0019	0.04
E6	Bowland Fells SPA and Bowland Fells SSSI	0.0012	0.02
E7	Bowland Fells SPA and Bowland Fells SSSI	0.0009	0.02
E8	Red Scar and Tun Brook Woods SSSI	0.0030	0.02
E9	Red Scar and Tun Brook Woods SSSI	0.0018	0.01
E10	Red Scar and Tun Brook Woods SSSI	0.0016	0.01

3.5.5 As shown in Table 6, the predicted PC as a result of emissions from the development alone was below 1% of the critical load at all receptors. As such, a screening conclusion of no likely significant effect as a result of the development alone can be reached with regard to nitrogen deposition.

3.5.6 Predicted annual acid deposition rates are summarised in Table 7.

Table 7 Predicted Annual Acid Deposition - Development Alone

Receptor		Predicted Annual Acid Deposition PC (keq/ha/yr)	PC as Prop. of CL (%)
E1	Bowland Fells SPA and Bowland Fells SSSI	0.0001	0.02
E2	Bowland Fells SPA and Bowland Fells SSSI	0.0002	0.02
E3	Bowland Fells SPA and Bowland Fells SSSI	0.0002	0.02

Receptor		Predicted Annual Acid Deposition PC (keq/ha/yr)	PC as Prop. of CL (%)
E4	Bowland Fells SPA and Bowland Fells SSSI	0.0003	0.04
E5	Bowland Fells SPA and Bowland Fells SSSI	0.0001	0.02
E6	Bowland Fells SPA and Bowland Fells SSSI	0.0001	0.01
E7	Bowland Fells SPA and Bowland Fells SSSI	0.0001	0.01
E8	Red Scar and Tun Brook Woods SSSI	0.0002	0.01
E9	Red Scar and Tun Brook Woods SSSI	0.0001	0.01
E10	Red Scar and Tun Brook Woods SSSI	0.0001	0.01

3.5.7 As shown in Table 7, the predicted PC as a result of emissions from the development alone was below 1% of the critical load at all relevant receptors. As such, a screening conclusion of no likely significant effect as a result of the development alone can be reached with regard to acid deposition.

3.6 Step 4b

3.6.1 Step 4b required consideration of potential effects in-combination with other plans or projects. A review of the following information sources was therefore undertaken in order to identify any schemes that may act in-combination, as required by NE guidance[8]:

- Planning Portals to locate applications awaiting permissions;
- Environmental Permits Register of Applications and Register of Issued Permits; and,
- Local Plans (including brownfield registers with permission in principle) and any allocations not yet permitted.

3.6.2 A review of planning applications submitted since 2021 was undertaken to identify the following projects within 10km of the site:

- Any agricultural proposals; and,

[8] Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, NE, 2018.

- Any industrial proposals with associated NH_3 emissions.

3.6.3 A review of the Environmental Permit register[9] was also undertaken in order to identify the following projects within 10km of the site which had received an Environmental Permit or Variation since 2021:

- Any intensive agricultural proposals; and,
- Any industrial proposals with associated NH_3 emissions.

3.6.4 Additionally, review of the site allocations in the relevant Local Plans were undertaken in order to identify any further proposals potentially coming forward within the relevant plan period.

3.6.5 A review period of 2021 onwards was selected to correlate with the latest background pollution data information available from APIS, as well as the expiration timescale for any planning consents that had not been implemented.

3.6.6 A review of the above information sources identified the following projects for consideration in the assessment:

- Preston City Council (PCC) reference: 06/2021/1509 - Agricultural livestock building;
- PCC reference: 06/2022/0441 - Agricultural livestock building (part retrospective);
- PCC reference: 06/2023/0743 - Siting of concrete ring tank for slurry store with canopy, following removal of existing metal ring tank slurry store;
- PCC reference: 06/2023/0246 - Covered slurry lagoon (partially submerged);
- PCC reference: 06/2024/0611 - Agricultural livestock building;
- Ribble Valley Borough Council (RVBC) reference: 3/2023/0021 - Earth banked, clay-lined slurry lagoon;
- RVBC reference: 3/2023/0632 - Earth banked slurry lagoon;
- RVBC reference: 3/2023/0465 - Dairy cattle building with underground slurry tanks, removal of redundant metal ring slurry store and erection of two concrete slurry tanks with canopies;
- Wyre Borough Council (WBC) reference: 21/00976/FUL - Agricultural livestock building;

[9] https://environment.data.gov.uk/public-register/view/index.

- WBC reference: 22/00316/FULMAJ - Cylindrical concrete slurry store;
- WBC reference: 23/00628/FUL - Agricultural slurry storage building; and,
- South Ribble Borough Council (SBRB) reference: 07/2023/00044/FUL - Earth bank slurry lagoon and associated works.

3.6.7 Reference should be made to Figure 3 for a map of the identified in-combination projects.

3.6.8 Dispersion modelling of the above sources was undertaken in order to derive in-combination PCs. Therse values were subsequently compared against the relevant screening threshold. Reference should be made to Appendix 2 for details of the model inputs.

3.6.9 It should be noted that project reference: 3/2023/0465, is associated with Phase 1 of this development at Blackmoss Farm. PCs have already been derived from the dispersion modelling assessment[10] undertaken for this Phase. As such, these results were added to the modelled in-combination PCs in order to calculate the total in-combination PCs.

3.6.10 Predicted annual mean NH_3 concentrations are summarised in Table 8.

Table 8 Predicted Annual Mean NH_3 Concentrations - Development In-Combination

Receptor		Predicted Annual Mean NH_3 In-Combo. PC (µg/m^3)	In-Combination PC as Prop. of CL (%)
E1	Bowland Fells SPA and Bowland Fells SSSI	0.0030	0.30
E2	Bowland Fells SPA and Bowland Fells SSSI	0.0026	0.26
E3	Bowland Fells SPA and Bowland Fells SSSI	0.0030	0.30
E4	Bowland Fells SPA and Bowland Fells SSSI	0.0060	0.60
E5	Bowland Fells SPA and Bowland Fells SSSI	0.0032	0.32
E6	Bowland Fells SPA and Bowland Fells SSSI	0.0019	0.19
E7	Bowland Fells SPA and Bowland Fells SSSI	0.0014	0.14

[10] 6499r1 - Ammonia Assessment - Blackmoss Farm, Chipping, Redmore Environmental Ltd, 2023.

Receptor		Predicted Annual Mean NH_3 In-Combo. PC (µg/m³)	In-Combination PC as Prop. of CL (%)
E8	Red Scar and Tun Brook Woods SSSI	0.0086	0.86
E9	Red Scar and Tun Brook Woods SSSI	0.0072	0.72
E10	Red Scar and Tun Brook Woods SSSI	0.0060	0.60

3.6.11 As shown in Table 8, the predicted in-combination PC was below 1% of the relevant critical level at all receptors. As such, a screening conclusion of no likely significant effect as a result of the development in-combination can be reached with regard to annual mean NH_3 concentrations.

3.6.12 Predicted annual nitrogen deposition rates are summarised in Table 9

Table 9 Predicted Annual Nitrogen Deposition - Development In-Combination

Receptor		Predicted Annual Nitrogen Deposition In-Combo. PC (µg/m³)	In-Combination PC as Prop. of CL (%)
E1	Bowland Fells SPA and Bowland Fells SSSI	0.016	0.32
E2	Bowland Fells SPA and Bowland Fells SSSI	0.014	0.27
E3	Bowland Fells SPA and Bowland Fells SSSI	0.016	0.32
E4	Bowland Fells SPA and Bowland Fells SSSI	0.031	0.62
E5	Bowland Fells SPA and Bowland Fells SSSI	0.017	0.33
E6	Bowland Fells SPA and Bowland Fells SSSI	0.010	0.20
E7	Bowland Fells SPA and Bowland Fells SSSI	0.008	0.15
E8	Red Scar and Tun Brook Woods SSSI	0.072	0.48
E9	Red Scar and Tun Brook Woods SSSI	0.051	0.34
E10	Red Scar and Tun Brook Woods SSSI	0.046	0.31

3.6.13 As shown in Table 9, the predicted in-combination PC was below 1% of the critical load at all receptors. As such, a screening conclusion of no likely significant effect as a result of the development in-combination can be reached with regard to nitrogen deposition.

3.6.14 Predicted annual acid deposition rates are summarised in Table 10.

Table 10 Predicted Annual Acid Deposition - Development In-Combination

Receptor		Predicted Annual Acid Deposition In-Combination PC (µg/m^3)	In-Combination PC as Prop. of CL (%)
E1	Bowland Fells SPA and Bowland Fells SSSI	0.0011	0.17
E2	Bowland Fells SPA and Bowland Fells SSSI	0.0010	0.15
E3	Bowland Fells SPA and Bowland Fells SSSI	0.0011	0.17
E4	Bowland Fells SPA and Bowland Fells SSSI	0.0022	0.34
E5	Bowland Fells SPA and Bowland Fells SSSI	0.0012	0.18
E6	Bowland Fells SPA and Bowland Fells SSSI	0.0007	0.11
E7	Bowland Fells SPA and Bowland Fells SSSI	0.0002	0.04
E8	Red Scar and Tun Brook Woods SSSI	0.0038	0.22
E9	Red Scar and Tun Brook Woods SSSI	0.0026	0.15
E10	Red Scar and Tun Brook Woods SSSI	0.0024	0.14

3.6.15 As shown in Table 10, the predicted in-combination PC was below 1% of the critical load at all receptors. As such, a screening conclusion of no likely significant effect as a result of the development in-combination can be reached with regard to acid deposition.

3.7 Summary

3.7.1 The results of Stage 1: Screening can be summarised as follows:

- Five ecological designations were identified that may be affected by emissions from the development;
- Of the identified designations, three have features that are considered sensitive to air pollution. As such, these sites were progressed through the assessment;
- Dispersion modelling was used to determine PCs as a result of the development alone and in-combination at discrete receptor positions within the designations; and,

- The results indicated that a screening conclusion of no likely significant effect as a result of the development alone and in-combination could be reached with regard to NH_3 concentrations and nitrogen and acid deposition on the ecological designations.

3.7.2 As shown above, a screening conclusion of no likely significant effect as a result of the development alone could be reached for all designations. As such, a Stage 2: Appropriate Assessment was not required.

4.0 CONCLUSION

4.1.1 Redmore Environmental Ltd was commissioned by Stanworth Agricultural Limited to undertake an Ammonia Assessment in support of an agricultural development on land at Blackmoss Farm, Chipping.

4.1.2 The proposals have the potential to cause changes in pollution levels at sensitive ecological locations as a result of NH_3 emissions associated with the development. An Ammonia Assessment was therefore undertaken in order to consider potential effects.

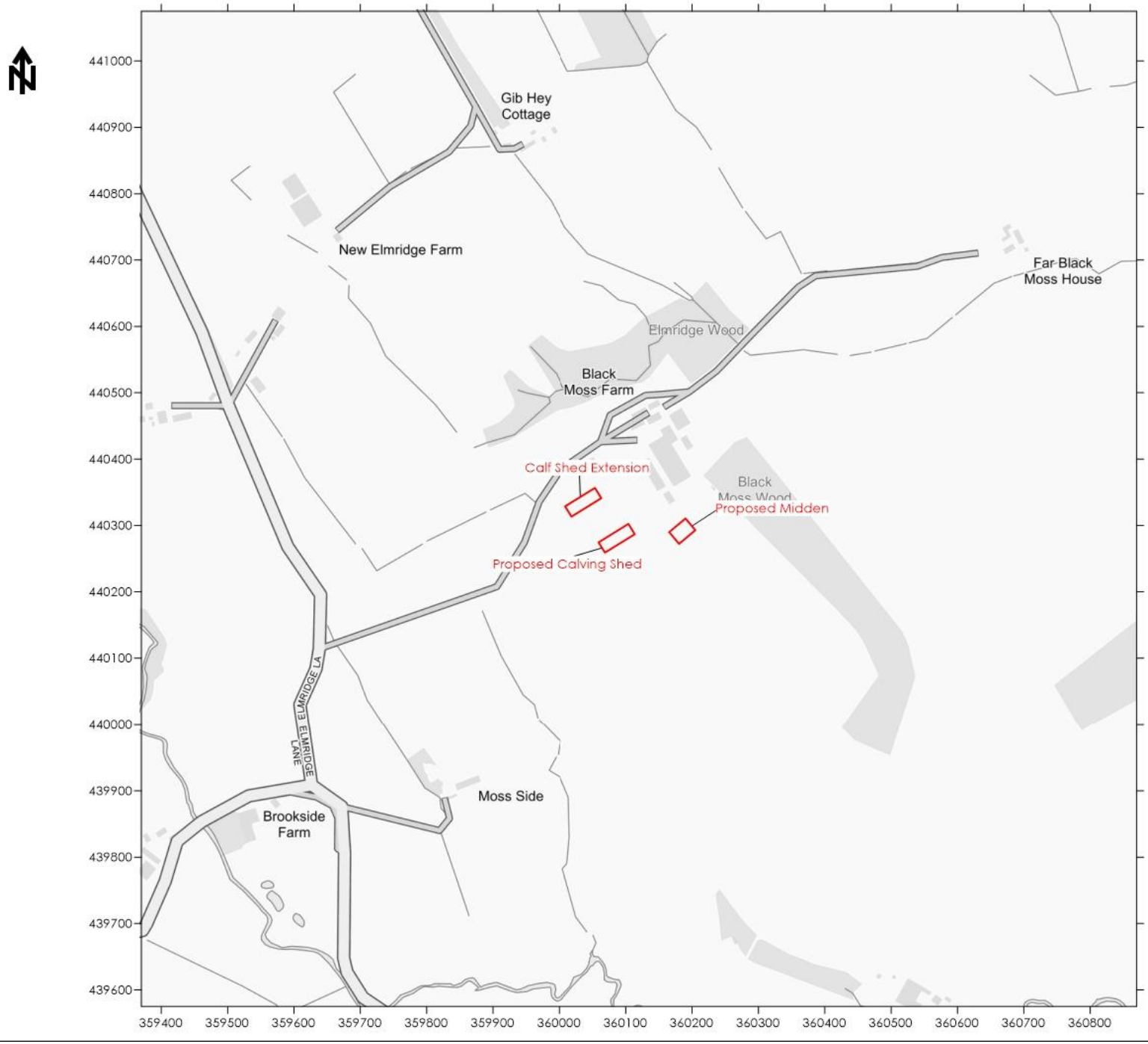
4.1.3 A staged assessment was undertaken with reference to relevant NE guidance. This considered emissions from the development alone and in-combination with other plans and projects.

4.1.4 The results of the assessment indicated a screening conclusion of no likely significant effect as a result of the development in relation to annual mean NH_3 concentrations and nitrogen and acid deposition both alone and in-combination could be reached for the identified ecological designations. As such, a Stage 2: Appropriate Assessment was not required.

5.0 ABBREVIATIONS

APIS	Air Pollution Information System
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FYM	Farmyard Manure
HRA	Habitat Regulations Assessment
LU	Livestock Unit
MAGIC	Multi-Agency Geographic Information for the Countryside
NE	Natural England
NGR	National Grid Reference
NH_3	Ammonia
PC	Predicted Concentration
PCC	Preston City Council
RVBC	Ribble Valley Borough Council
SPA	Special Protection Area
SRBC	South Ribble Borough Council
SSSI	Site of Special Scientific Interest
t	Tonne
WBC	Wyre Borough Council
z_0	Surface Roughness

Figures



Legend

Proposed Development

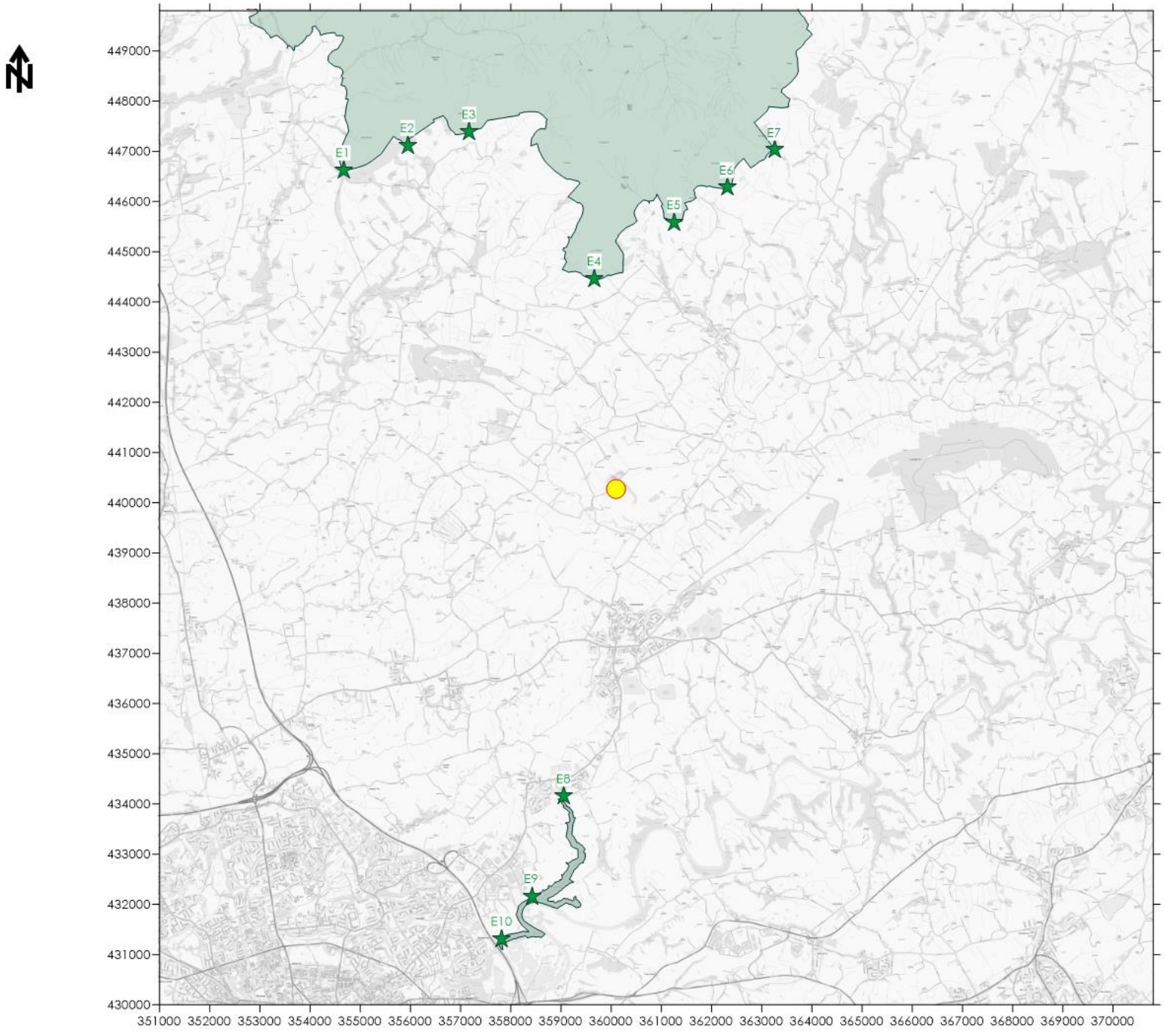
Title
Figure 1 - Site Layout Plan

Project
Ammonia Assessment
Blackmoss Farm, Chipping

Project Reference
6499-1

Client
Stanworth Agricultural Ltd

Redmore environmental
www.red-env.co.uk | 0161 7060075



Legend

Site Location

Discrete Receptor

Ecological Designation

Title
Figure 2 - Discrete Receptor Locations

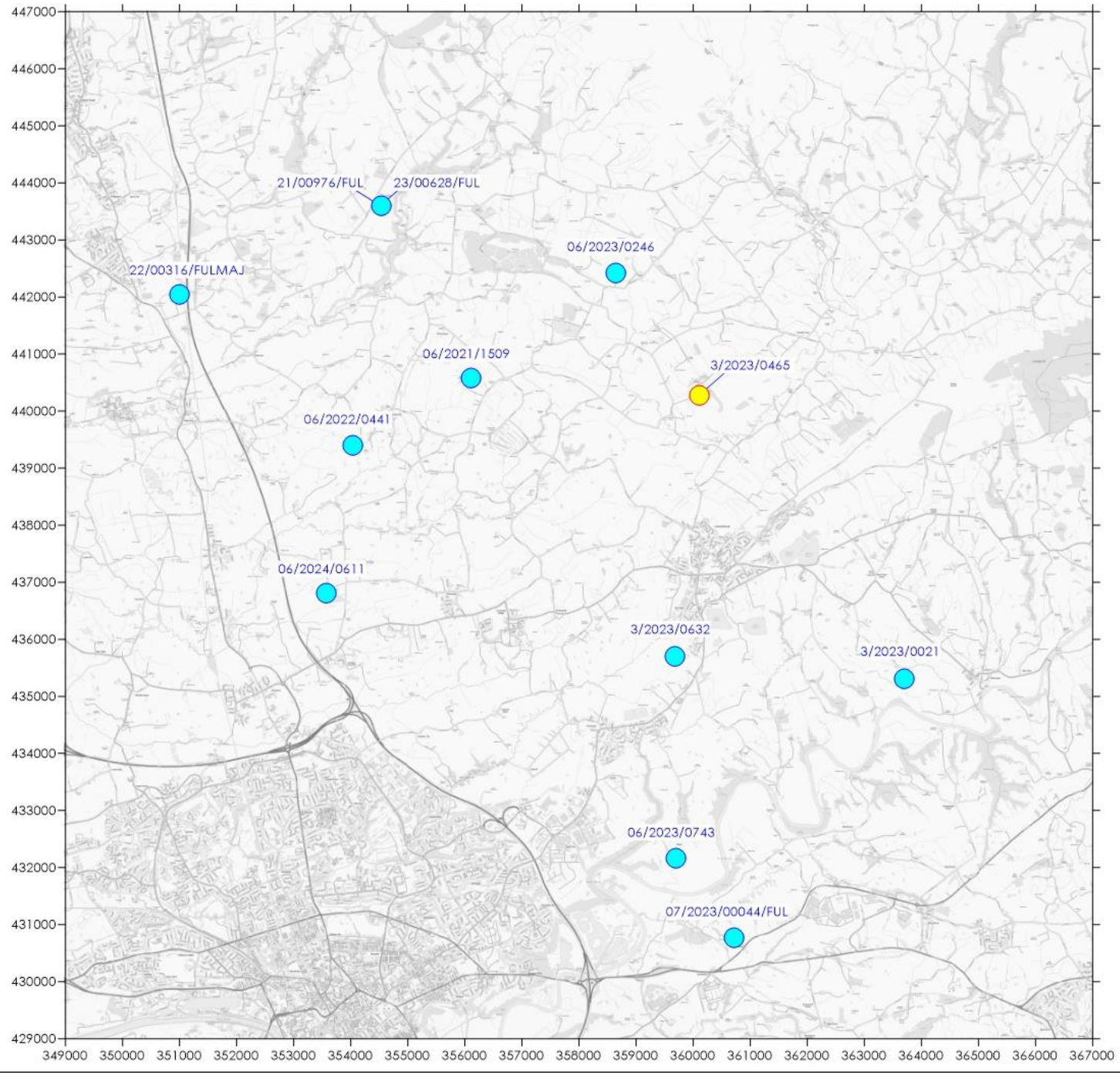
Project
Ammonia Assessment
Blackmoss Farm, Chipping

Project Reference
6499-1

Client
Stanworth Agricultural Ltd

Redmore environmental

www.red-env.co.uk | 0161 7060075



Legend

- Site Location
- In-Combination Source

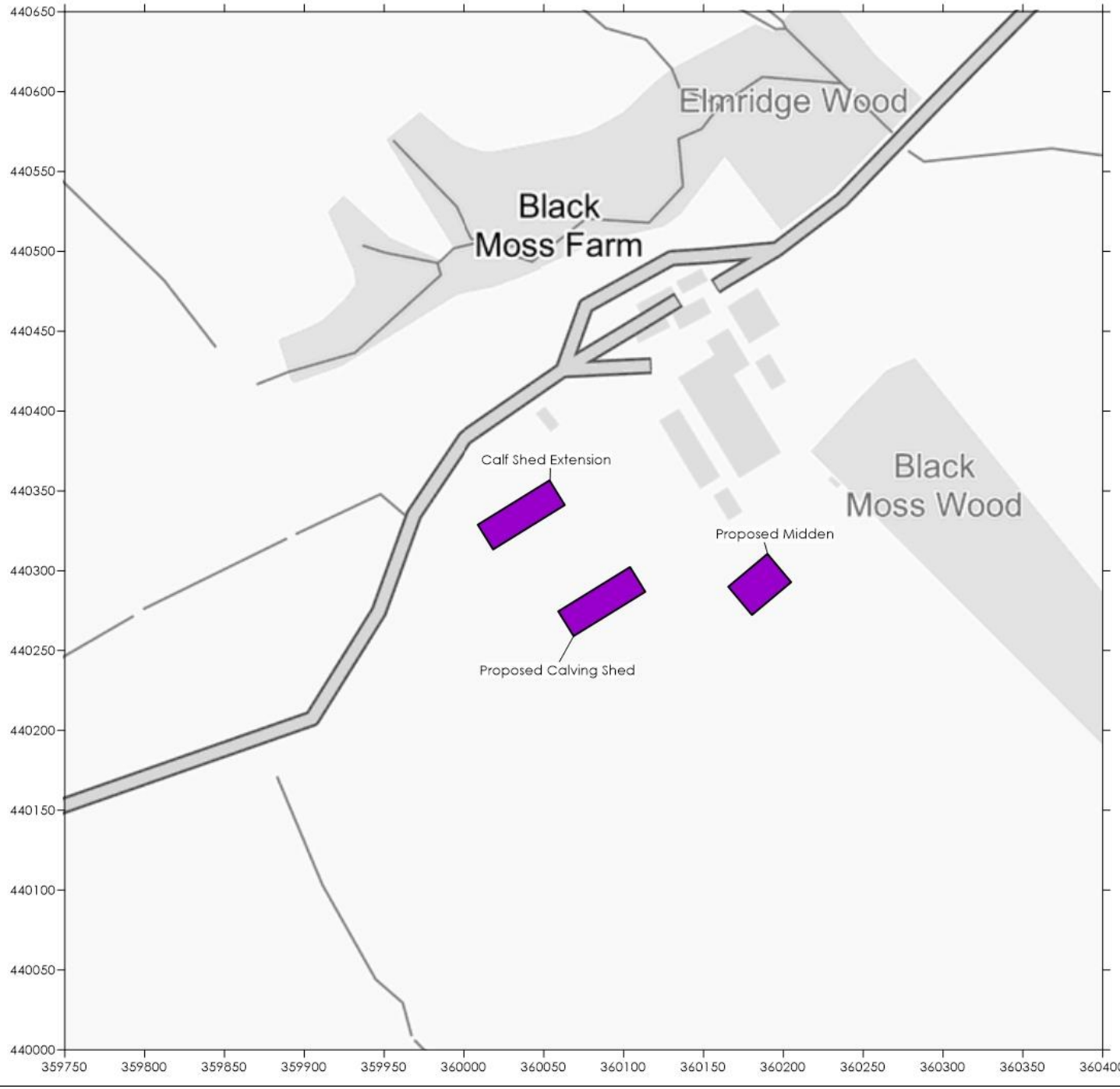
Title
Figure 3 - In-Combination Source Locations

Project
Ammonia Assessment
Blackmoss Farm, Chipping

Project Reference
6499-1

Client
Stanworth Agricultural Ltd

Redmore environmental
www.red-env.co.uk | 0161 7060075



Legend

Volume Source

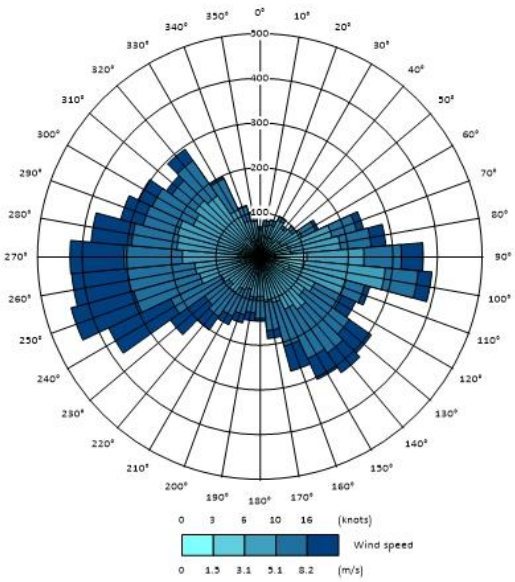
Title
Figure 4 - ADMS-6 Inputs

Project
Ammonia Assessment
Blackmoss Farm, Chipping

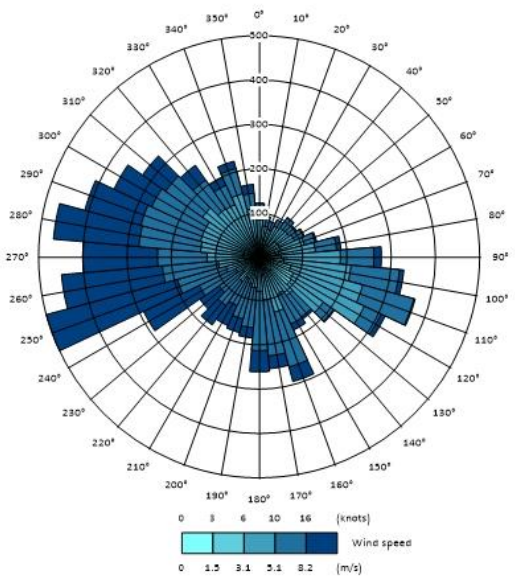
Project Reference
6499-1

Client
Stanworth Agricultural Ltd

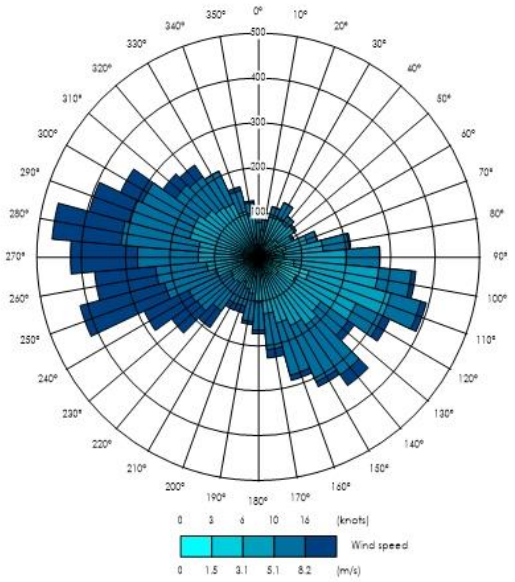
Redmore environmental
www.red-env.co.uk | 0161 7060075



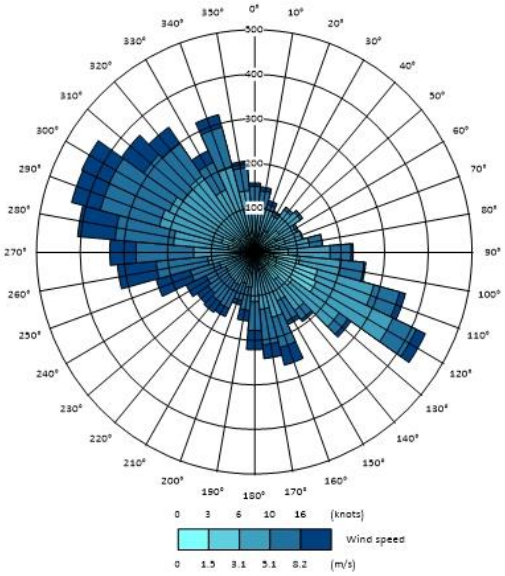
2018 Meteorological Data



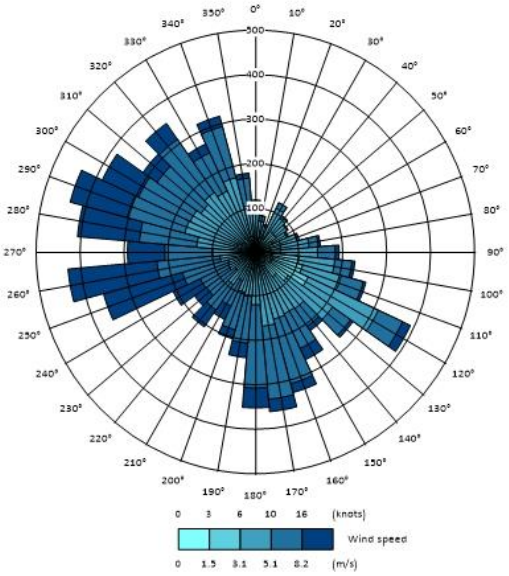
2019 Meteorological Data



2020 Meteorological Data



2021 Meteorological Data



2021 Meteorological Data

Legend

Title
Figure 5 - Wind Roses of 2018 to 2022 Blackpool Airport Meteorological Data

Project
Ammonia Assessment
Blackmoss Farm, Chipping

Project Reference
6499-1

Client
Stanworth Agricultural Ltd

Redmore environmental
www.red-env.co.uk | 0161 7060075

Appendix 1 - Critical Loads and Levels

Critical Levels

The NH_3 critical levels for Bowland Fells SPA are presented in Table A1.1.

Table A1.1 NH_3 Critical Level - Bowland Fells SPA

Habitat	Are Bryophytes Integral for this Habitat?	Are Lichens Integral for this Habitat?	Annual Mean NH_3 Critical Level (µg/m³)
Circus cyaneus	-	-	-(a)
Falco columbarius	-	-	-(a)
Larus fuscus (Western Europe / Mediterranean / Western Africa)	-	-	-(a)

Note: (a) Critical level not assigned for feature on APIS.

The NH_3 critical levels for Bowland Fells SSSI are presented in Table A1.2.

Table A1.2 NH_3 Critical Level - Bowland Fells SSSI

Habitat	Are Bryophytes Integral for this Habitat?	Are Lichens Integral for this Habitat?	Annual Mean NH_3 Critical Level (µg/m³)
Calluna vulgaris - deschampsia flexuosa heath	Yes	Yes	1
Calluna vulgaris - erica cinerea heath	Yes	Yes	1
Calluna vulgaris - eriophorum vaginatum blanket mire	Yes	Yes	1
Calluna vulgaris - vaccinium myrtillus - sphagnum capillifolium heath	Yes	No	1
Calluna vulgaris - vaccinium myrtillus heath	Yes	Yes	1
Carex echinata - sphagnum recurvum (fallax) /auriculatum (denticulatum) mire	Yes	No	1
Erica tetralix - sphagnum compactum wet heath	Yes	Yes	1
Erica tetralix - sphagnum papillosum raised and blanket mire	Yes	Yes	1
Eriophorum angustifolium bog pool community	Yes	No	1
Eriophorum vaginatum blanket and raised mire	Yes	Yes	1

Habitat	Are Bryophytes Integral for this Habitat?	Are Lichens Integral for this Habitat?	Annual Mean NH_3 Critical Level (µg/m³)
Philonotis fontana - saxifraga stellaris spring	Yes	No	1
Ranunculus omiophyllus - montia fontana rill	Yes	No	1
Scirpus cespitosus - erica tetralix wet heath	Yes	Yes	1
Sphagnum cuspidatum / recurvum (fallax) bog pool community	Yes	No	1
Vaccinium myrtillus - deschampsia flexuosa heath	Yes	No	1
Circus cyaneus	-	-	-(a)
Falco columbarius	-	-	-(a)
Quercus petraea - betula pubescens - dicranum majus woodland	Yes	Yes	1
Quercus spp.- betula spp.- deschampsia flexuosa woodland	Yes	Yes	1
Circus cyaneus	-	-	-(a)
Carex dioica - pinguicula vulgaris mire	Yes	No	1
Juncus effusus / acutiflorus - galium palustre rush pasture	No	No	3
Molinia caerulea - potentilla erecta mire	Yes	No	1
Circus cyaneus	-	-	-(a)
Vascular plant assemblage	-	-	-(a)
Larus fuscus	-	-	-(a)
Upland moorland and grassland with water bodies	-	-	-(a)

Note: (a) Critical level not assigned for feature on APIS.

The NH_3 critical levels for Red Scar and Tun Brook Wood SSSI are presented in Table A1.3.

Table A1.3 NH_3 Critical Level - Red Scar and Tun Brook Woods SSSI

Habitat	Are Bryophytes Integral for this Habitat?	Are Lichens Integral for this Habitat?	Annual Mean NH_3 Critical Level (µg/m³)
Fraxinus excelsior - sorbus aucuparia - mercurialis perennis woodland	Yes	Yes	1

Habitat	Are Bryophytes Integral for this Habitat?	Are Lichens Integral for this Habitat?	Annual Mean NH_3 Critical Level (µg/m^3)
Quercus robur - pteridium aquilinum - rubus fruticosus woodland	Yes	Yes	1
Alnus glutinosa - fraxinus excelsior - lysimachia nemorum woodland	Yes	Yes	1
Satyrium w-album	-	-	-(a)

Note: (a) Critical level not assigned for feature on APIS.

Nitrogen Critical Loads

The nitrogen critical loads for Bowland Fells SPA are presented in Table A1.4.

Table A1.4 Nitrogen Critical Loads - Bowland Fells SPA

Feature Name	Is the Feature Sensitive to Nitrogen?	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
Circus cyaneus	Yes	Northern wet heath: calluna dominated wet heath (upland)	5	15
Falco columbarius	Yes	Northern wet heath: calluna dominated wet heath (upland)	5	15
Larus fuscus (Western Europe / Mediterranean / Western Africa)	No	Species' broad habitat not sensitive to eutrophication	-(a)	-(a)

Note: (a) Critical load not assigned for feature on APIS.

The nitrogen critical loads for Bowland Fells SSSI are presented in Table A1.5.

Table A1.5 Nitrogen Critical Loads - Bowland Fells SSSI

Feature Name	Is the Feature Sensitive to Nitrogen?	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
Calluna vulgaris - deschampsia flexuosa heath	Yes	Dry heaths	5	15

Feature Name	Is the Feature Sensitive to Nitrogen?	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
Calluna vulgaris - erica cinerea heath	Yes	Dry heaths	5	15
Calluna vulgaris - eriophorum vaginatum blanket mire	Yes	Raised and blanket bogs	5	10
Calluna vulgaris - vaccinium myrtillus - sphagnum capillifolium heath	Yes	Dry heaths	5	15
Calluna vulgaris - vaccinium myrtillus heath	Yes	Dry heaths	5	15
Carex echinata - sphagnum recurvum (fallax) / auriculatum (denticulatum) mire	Yes	Valley mires, poor fens and transition mires	5	15
Erica tetralix - sphagnum compactum wet heath	Yes	Northern wet heath: Erica tetralix dominated wet heath (lowland)	5	15
Erica tetralix - sphagnum papillosum raised and blanket mire	Yes	Raised and blanket bogs	5	10
Eriophorum angustifolium bog pool community	Yes	Raised and blanket bogs	5	10
Eriophorum vaginatum blanket and raised mire	Yes	Raised and blanket bogs	5	10
Philonotis fontana - saxifraga stellaris spring	Yes	Valley mires, poor fens and transition mires	5	15
Ranunculus omiophyllus - montia fontana rill	Yes	Valley mires, poor fens and transition mires	5	15
Scirpus cespitosus - erica tetralix wet heath	Yes	Northern wet heath: Erica tetralix dominated wet heath (lowland)	5	15
Sphagnum cuspidatum / recurvum (fallax) bog pool community	Yes	Raised and blanket bogs	5	10
Vaccinium myrtillus - deschampsia flexuosa heath	Yes	Dry heaths	5	15
Circus cyaneus	Yes	Northern wet heath: calluna dominated wet heath (upland)	5	15

Feature Name	Is the Feature Sensitive to Nitrogen?	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
Falco columbarius	Yes	Northern wet heath: calluna dominated wet heath (upland)	5	15
Quercus petraea - betula pubescens - dicranum majus woodland	Yes	Acidophilous quercus forest	10	15
Quercus spp.- betula spp.- deschampsia flexuosa woodland	Yes	Acidophilous quercus forest	10	15
Circus cyaneus	Yes	Atlantic upper-mid & mid-low salt marshes	10	20
Carex dioica - pinguicula vulgaris mire	Yes	Rich fens	15	25
Juncus effusus / acutiflorus - galium palustre rush pasture	Yes	Moist or wet mesotrophic to eutrophic hay meadow	15	25
Molinia caerulea - potentilla erecta mire	Yes	Moist or wet mesotrophic to eutrophic hay meadow	15	25
Circus cyaneus	Yes	Rich fens	15	25
Vascular plant assemblage	Yes	No comparable habitat with established critical load estimate available	-(a)	-(a)
Larus fuscus	No	Species' broad habitat not sensitive to eutrophication	-(a)	-(a)
Upland moorland and grassland with water bodies	Not assessed for this feature	No critical load has been assigned to this feature	-(a)	-(a)

Note: (a) Critical load not assigned for feature on APIS.

The nitrogen critical loads for Red Scar and Tun Brook Woods SSSI are presented in Table A1.6.

Table A1.6 Nitrogen Critical Loads - Red Scar and Tun Brook Woods SSSI

Feature Name	Is the Feature Sensitive to Nitrogen?	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
Fraxinus excelsior - sorbus aucuparia - mercurialis perennis woodland	Yes	Carpinus and quercus mesic deciduous forest	15	20
Quercus robur - pteridium aquilinum - rubus fruticosus woodland	Yes	Carpinus and quercus mesic deciduous forest	15	20
Alnus glutinosa - fraxinus excelsior - lysimachia nemorum woodland	No	Designated feature / feature habitat not sensitive to eutrophication	-(a)	-(a)
Satyrium w-album	Not assessed for this feature	No critical load has been assigned to this feature	-(a)	-(a)

Note: (a) Critical level not assigned for feature on APIS.

Acid Critical Loads

The acid critical loads for Bowland Fells SPA are presented in A1.7.

Table A1.7 Acid Critical Loads - Bowland Fells SPA

Feature Name	Is the Feature Sensitive to Acidity?	Relevant Acid Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Circus cyaneus	Yes	Dwarf shrub heath	0.642	0.180	0.822
Falco columbarius	Yes	Dwarf shrub heath	0.642	0.180	0.822

The acid critical loads for Bowland Fells SSSI are presented in Table A1.8.

Table A1.8 Acid Critical Loads - Bowland Fells SSSI

Feature Name	Is the Feature Sensitive to Acidity?	Relevant Acid Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Calluna vulgaris - deschampsia flexuosa heath	Yes	Dwarf shrub heath	0.642	0.180	0.822

Feature Name	Is the Feature Sensitive to Acidity?	Relevant Acid Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Calluna vulgaris - erica cinerea heath	Yes	Dwarf shrub heath	0.642	0.180	0.822
Calluna vulgaris - eriophorum vaginatum blanket mire	Yes	Bogs	0.321	0.334	0.655
Calluna vulgaris - vaccinium myrtillus - sphagnum capillifolium heath	Yes	Dwarf shrub heath	0.642	0.180	0.822
Calluna vulgaris - vaccinium myrtillus heath	Yes	Dwarf shrub heath	0.642	0.180	0.822
Carex echinata - sphagnum recurvum (fallax) /auriculatum (denticulatum) mire	Yes	Bogs	0.321	0.334	0.655
Erica tetralix - sphagnum compactum wet heath	Yes	Dwarf shrub heath	0.642	0.180	0.822
Erica tetralix - sphagnum papillosum raised and blanket mire	Yes	Bogs	0.321	0.334	0.655
Eriophorum angustifolium bog pool community	Yes	Bogs	0.321	0.334	0.655
Eriophorum vaginatum blanket and raised mire	Yes	Bogs	0.321	0.334	0.655
Quercus petraea - betula pubescens - dicranum majus woodland	Yes	Unmanaged broadleafed / coniferous woodland	0.285	0.496	0.781
Quercus spp.- betula spp.- deschampsia flexuosa woodland	Yes	Unmanaged broadleafed / coniferous woodland	0.285	0.496	0.781
Scirpus cespitosus - erica tetralix wet heath	Yes	Dwarf shrub heath	0.642	0.180	0.822
Sphagnum cuspidatum / recurvum (fallax) bog pool community	Yes	Bogs	0.321	0.334	0.655
Vaccinium myrtillus - deschampsia flexuosa heath	Yes	Dwarf shrub heath	0.642	0.180	0.822
Vascular plant assemblage	Yes	No comparable acidity class	-(a)	-(a)	-(a)

Feature Name	Is the Feature Sensitive to Acidity?	Relevant Acid Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Circus cyaneus	Yes	Dwarf shrub heath	0.642	0.180	0.822
Falco columbarius	Yes	Dwarf shrub heath	0.642	0.180	0.822
Upland moorland and grassland with water bodies	Not assessed for this feature	No critical load has been assigned for this feature	-(a)	-(a)	-(a)

Note: (a) Critical load not assigned for feature on APIS.

The acid critical loads for Red Scar and Tun Brook Woods SSSI are presented in Table A1.9.

Table A1.9 Acid Critical Loads - Red Scar and Tun Brook Woods SSSI

Feature Name	Is the Feature Sensitive to Acidity?	Relevant Acid Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Fraxinus excelsior - sorbus aucuparia - mercurialis perennis woodland	Yes	Unmanaged broadleafed / coniferous woodland	0.142	1.446	1.707
Quercus robur - pteridium aquilinum - rubus fruticosus woodland	Yes	Unmanaged broadleafed / coniferous woodland	0.142	1.446	1.707
Satyrium w-album	Not assessed for this feature	No critical load has been assigned for this feature	-(a)	-(a)	-(a)

Note: (a) Critical load not assigned for feature on APIS.

Appendix 2 - Dispersion Model Input Data

Dispersion Model

Dispersion modelling was undertaken using ADMS-6.0 (v6.0.2.0). ADMS-6 is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from agricultural sources. Modelling predictions from this software package are accepted within the UK by the EA, Natural Resource Wales and DEFRA.

Baseline Pollution Levels

Baseline annual mean NH_3 concentrations and nitrogen and acid deposition rates were obtained from APIS[11]. The relevant values are summarised in Table A2.1.

Table A2.1 Baseline Pollution Levels

Receptor		Annual Mean NH_3 Conc. ($\mu g/m^3$)	Annual Nitrogen Dep. Rate (kgN/ha/yr)	Annual Acid Dep. Rate (keq/ha/yr)
E1	Bowland Fells SPA and Bowland Fells SSSI	1.76	21.67	1.56
E2	Bowland Fells SPA and Bowland Fells SSSI	1.45	21.19	1.52
E3	Bowland Fells SPA and Bowland Fells SSSI	1.25	21.42	1.53
E4	Bowland Fells SPA and Bowland Fells SSSI	1.79	23.24	1.67
E5	Bowland Fells SPA and Bowland Fells SSSI	1.57	23.08	1.66
E6	Bowland Fells SPA and Bowland Fells SSSI	1.38	23.37	1.67
E7	Bowland Fells SPA and Bowland Fells SSSI	1.34	23.13	1.65
E8	Red Scar and Tun Brook Woods SSSI	2.54	37.80	2.80
E9	Red Scar and Tun Brook Woods SSSI	2.23	35.84	2.66
E10	Red Scar and Tun Brook Woods SSSI	2.08	35.85	2.66

[11] APIS, www.apis.ac.uk.

Model Inputs - Development Alone

Calf Sheds

Releases from the proposed calf sheds were derived from relevant emission rates provided within the DEFRA document 'Inventory of Ammonia Emissions from UK Agriculture'[12], as well as information provided by the Applicant. The model inputs are summarised in Table A2.2.

Table A2.2 Development Alone Model Inputs - Calf Sheds

Parameter	Unit	Proposed Calving Shed	Calf Shed Extension
Source type	-	Volume	Volume
Source area	m^2	960.1	961.9
Source height	m	7.1	7.1
Source volume	m^3	6,816.7	6,829.3
Livestock type	-	Dairy cows[(a)]	Calves aged 0-3 months
Number of livestock	-	70	138
Housing system	-	Straw-bedded	Straw-bedded
NH_3-N emission rate	g/LU/day	23.1	9.2
NH_3 emission rate	g/LU/day	0.00033	0.00013
Gross NH_3 emission rate	g/day	0.023	0.018
Volume specific NH_3 emission rate	$g/m^3/s$	0.0000026	0.0000033

Note: (a) Calves are removed within an hour of birth. Due to short period these will be in the shed for they have not been included in this structure.

[12] Inventory of Ammonia Emissions from UK Agriculture, DEFRA, 2021.

Midden

Releases from the proposed Midden were derived from relevant emission rates provided within the DEFRA document 'Inventory of Ammonia Emissions from UK Agriculture'[13], as well as information provided by the Applicant. The relevant model inputs are summarised in Table A2.3.

Table A2.3 Development Alone Model Inputs - Midden

Parameter	Unit	Proposed Midden
Source type	-	Volume
Source area	m^2	737.1
Source height	m	7.8
Source volume	m^3	5,749.0
Manure stored	t	1,521
NH_3-N emission rate	g/t	265
NH_3 emission rate	g/t	322
Gross NH_3 emission rate	g	489,961
Volume specific NH_3 emission rate	$g/m^3/s$	0.0000027

It has been assumed that the midden operates at full capacity at all times and emission occur constantly, 24-hours per day, 365-days per year.

Reference should be made to Figure 4 for a map of the proposed emission source locations.

Model Inputs - In-Combination Sources

Releases from the identified in-combination projects were derived from information provided in support of the relevant planning applications and library emission rates from DEFRA.

Model inputs for livestock sheds are summarised in Table A2.4.

[13] Inventory of Ammonia Emissions from UK Agriculture, DEFRA, 2021.

Table A2.4 Development In-combination Model Inputs - Livestock Sheds

Parameter	Unit	06/2021/1509	06/2022/0441	06/2024/0611		21/00976/FUL
Source type	-	Volume	Volume	Volume		Volume
Source height	m	4.5	8.3	5.2		5.1
Source area	m^2	332.9	832.2	349.7		165.6
Source volume	m^3	1,497.8	6,907.4	1821.8		844.5
Livestock type	-	Ewes	Calves (<12-months)	Dairy cow	Calves (<12-months)	Calves(<12-months)
Number of livestock	-	80	100	34	50	50
Housing system	-	-	Straw	Straw	Straw	Straw
NH_3 emission rate	g/LU/s	0.000044	0.00013	0.00033	0.00013	0.00013
Volume specific NH_3 emission rate	$g/m^3/s$	0.000000029	0.0000019	0.0000085		0.0000077

Model inputs for slurry storage are summarised in Table A2.5 and Table A2.6.

Table A2.5 Development In-combination Model Inputs - Slurry Storage

Parameter	Unit	06/2023/0743	06/2023/0246	3/2023/0021	3/2023/0623
Storage type	-	Covered tank	Lagoon	Covered lagoon	Lagoon
Source area	m^2	441.8	895.9	1,444.5	2,500.7
NH_3 emission rate	$g/m^2/day$	4.2	4.2	4.2	4.2
Factored NH_3 emission rate	$g/m^2/day$	0.4[a]	-	1.7[a]	-
Storage period	Days	365	365	365	182
NH_3 emission rate	$g/m^2/s$	0.0000048	0.000048	0.000019	0.000024[b]

Note: (a) Factored based on information from DEFRA to reflect store covering arrangements.
(b) Factored based on storage period.

Table A2.6 Development In-combination Model Inputs - Slurry Storage

Parameter	Unit	22/00316/FULMAJ	23/00628/FUL	07/2023/00044/FUL
Storage type	-	Covered tank	Lagoon	Lagoon
Source area	m^2	1224.7	332.2	874.2
NH_3 emission rate	$g/m^2/day$	4.2	4.2	4.2
Factored NH_3 emission rate	$g/m^2/day$	1.7[(a)]	4.2	4.2
Storage period	Days	365	365	365
NH_3 emission rate	$g/m^2/s$	0.000019	0.000048	0.000048

Note: (a) Factored based on information from DEFRA to reflect store covering arrangements.

Terrain Data

Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC[14].

Meteorological Data

Meteorological data used in the assessment was taken from Blackpool Airport meteorological station over the period 1st January 2018 to 31st December 2022 (inclusive). Blackpool Airport meteorological station is located at NGR: 332308, 430915, which is approximately 29.9km south-west of the site.

All meteorological files used in the assessment were provided by Atmospheric Dispersion Modelling Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 for wind roses of utilised meteorological records.

[14] Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

Roughness Length

The surface roughness (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.2m was used to describe the modelling extents. This is considered appropriate for the morphology of the area and is suggested within ADMS-6 as being suitable for 'agricultural areas (min)'.

A z_0 of 0.1m was used to describe the meteorological site. This is considered appropriate for the morphology of the area and is suggested within ADMS-6 as being suitable for 'root crops'.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 1m was used to describe the modelling extents. This is considered appropriate for the nature of the area and is suggested within ADMS-6 as being suitable for rural areas.

A minimum Monin-Obukhov length of 30m was used to describe the meteorological site. This is considered appropriate for the nature of the area and is suggested within ADMS-6 as being suitable for 'mixed urban/industrial'.

Deposition

Nitrogen deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06'[15]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used for the determination of nitrogen deposition are presented within Table A2.7.

[15] Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.

Table A2.7 Conversion Factors to Determine Dry Deposition Flux for Nitrogen Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NH_3	0.02	0.03	260

The relevant deposition velocity for each ecological receptor was selected from Table A2.7 based on the vegetation type of the qualifying feature.

Predicted ground level NH_3 concentrations were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each of the identified ecological receptors. The conversion to units of equivalents, a measure of the potential acidifying effect of a species, was undertaken using the standard conversion factors shown in Table A2.8.

Table A2.8 Conversion Factors to Determine Dry Deposition Flux for Acid Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to keq/ha/yr of pollutant species)
	Grassland	Forest	
NH_3	0.02	0.03	18.5

The following formula was used to calculate predicted PCs as a proportion of the critical load function:

PC as %CL function = ((PC of N deposition)/CLmaxN) x 100

The above formula was obtained from APIS[16].

Scientific literature suggests that the dry deposition velocity of NH_3 is concentration dependent and is significantly reduced at high concentrations, i.e. from 0.02m/s to 0.03m/s at ambient

[16] http://www.apis.ac.uk/.

concentration down to approximately 0.003m/s at a long-term average over 80µg/m^3 [17] [18]. When the concentration dependence of the deposition velocity is considered, the reported cumulative depletion ratio (the ratio of NH_3 deposited to the total emitted) was about 10% at 500m to 1,000m downwind[19] [20].

In order to represent the above within the model, the variable concentration dependent deposition velocity function within ADMS-6 was engaged, as outlined within EA guidance[21]. This utilised predicted annual mean NH_3 concentrations to determine location specific deposition velocities throughout the assessment extents for inclusion within the final model.

17 Walker J, Spence P, Kimbrough S and Robarge W, 2008. Inferential model estimates of ammonia dry deposition in the vicinity of a swine production facility. Atmospheric Environment 42, 3407-3418.

18 Cape JN, Jones MR, Leith ID, Sheppard LJ, van Dijk N, Sutton MA, Fowler D, Estimate of annual NH3 dry deposition to a fumigated ombrotrophic bog using concentration-dependant deposition velocities. Atmospheric Environment 42 (2008) 6637-6646.

19 Walker J, Spence P, Kimbrough S and Robarge W, 2008. Inferential model estimates of ammonia dry deposition in the vicinity of a swine production facility. Atmospheric Environment 42, 3407-3418.

20 Cape JN, Jones MR, Leith ID, Sheppard LJ, van Dijk N, Sutton MA, Fowler D, Estimate of annual NH3 dry deposition to a fumigated ombrotrophic bog using concentration-dependant deposition velocities. Atmospheric Environment 42 (2008) 6637-6646.

21 Guidance on Modelling the Concentration and Deposition of Ammonia Emitted from Intensive Farming, EA, 2010.