



PROPOSED POULTRY UNITS, DOLIDRE FARM

AMMONIA EMISSIONS: IMPACT ASSESSMENT

March 2020

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1.0 INTRODUCTION

Isopleth Ltd has been commissioned by Ian Pick Associates Ltd, on behalf of Mr Edward Morgan and Mr James Morgan, to carry out a detailed assessment of ammonia impacts associated with a proposed extension to their poultry unit at Dolidre (Dol-Y-Dre) Farm, Llanddewi, Llandrindod Wells LD1 6SE. A site location plan is shown in Figure 3-1 of this report.

1.1 Background

The potential ammonia impacts on local ecological sites associated with the development of an extension to an existing poultry (broiler) farm at Dolidre Farm has been assessed.

The site lies within the administrative area of Powys County Council (planning) and Natural Resources Wales are responsible for regulating the site under an Environmental Permit.

The new facility would consist of 3 new broiler houses housing approximately 150,000 birds, in addition to the existing 3 houses which typically house 130,000 birds. The existing houses are ventilated by uncapped high speed ridge mounted fans, with exhaust via a single chimney per ridge fan. Whilst under the proposed scenario the new houses would include ammonia and odour control scrubbers which would also be fitted to one of the existing sheds.

1.2 Previous Applications / Assessments

The existing site benefits from planning permission for a total of 3 broiler houses, the most recent of which was approved on 17th March 2016 (Application P/2015/0457).

The current application (Reference: 19/0178/PRE) relates to the erection of 3 broiler chicken units. The site already holds an Environmental Permit for this scheme (Permit number EPR/MP3130TW), the application having been supported by detailed modelling submitted with the application, the findings described in the NRW Decision Document for the scheme:

'The applicant has carried out detailed modelling of the potential impact of dispersion and deposition of Ammonia (NH₃) from the site. The submitted report concludes that proposed poultry units may exceed the lower critical level (CLE) for NH₃ at several areas of Ancient Woodlands, SSSI and SACs.'

'The applicant has proposed that they will put air scrubbing units and use the biomass boilers for indirect heating to help reduce these emissions further. The air scrubbing units will be placed on four out of the six sheds and will reduce the ammonia from the sheds by up to 90%. The indirect heating will further reduce the ammonia by approximately 35% (a figure accepted by both NRW and the EA).'

'By using these two methods the amount of ammonia emitted will be reduced from the site. Although this variation is to double the number of birds, when taking into account the mitigation methods, the impact from the number of birds will be less than is currently permitted. Therefore the overall emissions from the site will be reduced from current practice.'

This March 2020 ammonia assessment represents an update to the detailed modelling submitted in support of the Permit Application and based on the latest scrubber designs, APIS background information and ecological searches.

1.3 Approach

An assessment of ammonia impacts against critical levels and critical loads (for nutrient nitrogen and acid deposition) has been completed:

- 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.

The type, source and significance of potential impacts have been identified and detailed modelling undertaken in line with NRW Guidance:

- NRW (December 2018) Assessing the impact of ammonia and nitrogen on designated sites from new and expanding intensive livestock units. Technical guidance for determining environmental permit applications or responding to planning application consultations. Reference number: **GN020**
- NRW (March 2017) Assessment of ammonia and nitrogen impacts from livestock units when applying for an Environmental Permit or Planning Permission. Reference number: **OGN 41**
- NRW Modelling the concentration and deposition of ammonia emitted from intensive farming Reference number: **GN036** (version 1.0, December 2019)

GN 020, GN036, OGN 41 and *Intensive farming risk assessment for your environmental permit* only requires that the ammonia and nutrient nitrogen critical load calculations are undertaken. There is no requirement for the calculation of acidification as the calculation of the ammonia and nutrient N forms the more stringent test.

1.4 Scope

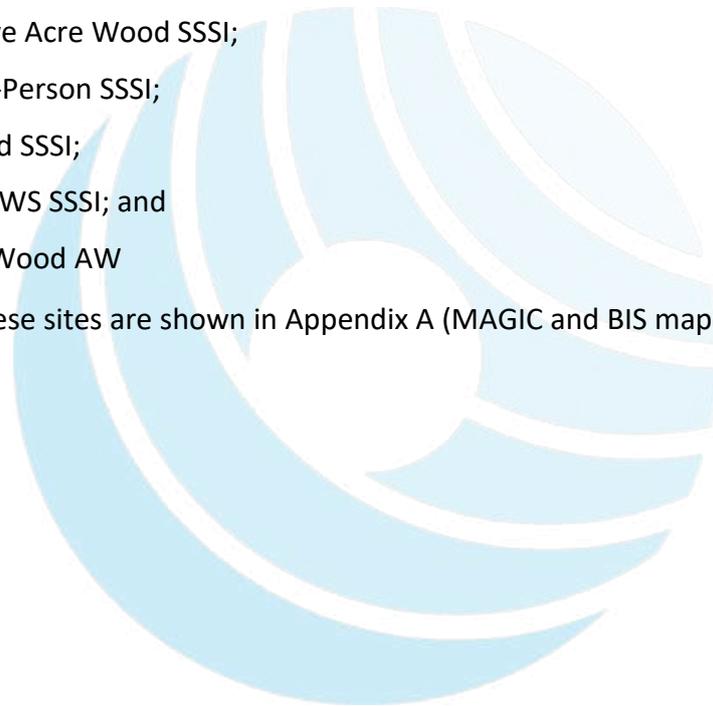
This report is aimed at comparing the predictions of the ammonia modelling with limit values described by Natural Resources Wales and Powys County Council. Interpretation of the results and the screening thresholds to be used by the Natural Resources Wales, for example in relation to screening distances and impact thresholds are relevant for both planning and Permitting. This assessment is therefore aimed at meeting the requirements of NRW and therefore also the requirements of Powys Council and represents an update to the detailed modelling submitted in support of the Permit Application.

1.5 Ecological Receptors

Ecological site searches 2km (local sites and AW) and 5km (SSSI and European sites) are included as Appendix A to this report. These confirmed that the following sites are of interest:

- River Wye SAC (River Ithon SSSI);
- Cwm Roches Meadow SSSI;
- Cae Llwyn SSSI;
- Cwmsaise SSSI;
- Far Hall Meadow SSSI;
- Ithon Valley Woodlands SSSI;
- Meeting House Quarry SSSI;
- Twenty-Five Acre Wood SSSI;
- Coed Bryn-Person SSSI;
- Maelienydd SSSI;
- Trehirion LWS SSSI; and
- Dol-y-dre Wood AW

The location of these sites are shown in Appendix A (MAGIC and BIS maps).



2.0 APPROACH

2.1 General Approach

NRW guidance GN 020 and OGN 41 has been followed for this assessment in relation to sites of European and National interest (i.e. 'Natura 2000' sites). Predicted ground level concentrations of ammonia, nutrient nitrogen and acid deposition are compared with relevant air quality standards and guidelines for the protection of sensitive habitats. For local sites and ancient woodland, Guidance *Intensive farming risk assessment for your environmental permit* (May 2018) is used.

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 3-1
Ammonia Critical Level

Concentration ($\mu\text{g}/\text{m}^3$)	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)

The decision document for Permit number EPR/MP3130TW states that a critical level for all higher plants of $3\mu\text{g}/\text{m}^3$ is appropriate for the Dol-y-dre woodland. The delegated planning report for application P/2015/0457 confirms that a critical level for all higher plants of $3\mu\text{g}/\text{m}^3$ is also appropriate for all of the identified SSSIs.

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) website¹. The contribution to critical loads for Nitrogen deposition are recorded as KgN/ha/yr. Deposition rates are converted to units of acid equivalents ($k_{\text{eq}}/\text{ha}/\text{year}$), which is a measure of how acidifying the chemical species can be, by dividing the dry deposition flux (kg/ha/year) by standard conversion factors.

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

¹ www.apis.ac.uk

Firstly, calculate dry deposition flux using the following equation:

$$\text{Dry deposition flux } (\mu\text{g}/\text{m}^2/\text{s}) = \text{ground level concentration } (\mu\text{g}/\text{m}^3) \times \text{deposition velocity } (\text{m}/\text{s})$$

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 $\mu\text{g}/\text{m}^3$, as stated in NRW *Modelling the concentration and deposition of ammonia emitted from intensive farming Reference number: GN036* (version 1.0, December 2019):

Table 1. Recommended ammonia dry deposition velocity at different long term average concentration to be used in an impact assessment.

NH3 conc (farm contribution + background – the PEC) ($\mu\text{g}/\text{m}^3$)	<10	10 – 20	20 – 30	30 – 80	>80
Deposition velocity (m/s)	0.02 or 0.03*	0.015	0.01	0.005	0.003

*0.02 m/s for short vegetation and 0.03 m/s for tall vegetation

An applied deposition velocity for ammonia of 0.005m/s for water bodies has been accepted by the NRW for other poultry schemes.

The units are then converted from $\mu\text{g}/\text{m}^2/\text{s}$ to units of kg/ha/year by multiplying the dry deposition flux by a standard conversion factor for ammonia of 259.7.

As nutrient nitrogen depositions forms a more stringent test than acid deposition

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

OGN 41 presents thresholds for livestock developments in relation to European sites (RAMSAR, SPA and SAC) and SSSIs:

- threshold of insignificance (% of the designated site Critical Level or Load): **1%**;
- upper threshold % of the designated site Critical Level or Load: **8%**.

In the case of Local sites such as Sites of Special Interest to Nature Conservation (SINC) and Ancient Woodlands, Natural Resources Wales apply a limit for PC of up to 100% of Critical Level or Critical Load, i.e. the upper and lower thresholds are the same (100%).

2.4.1 Threshold of Insignificance

Where process contributions, considered in isolation, are up to 1% of the designated site Critical Level or Load, then it should be determined that there is no significant environmental effect/no likely significant effect/damage to scientific interest.

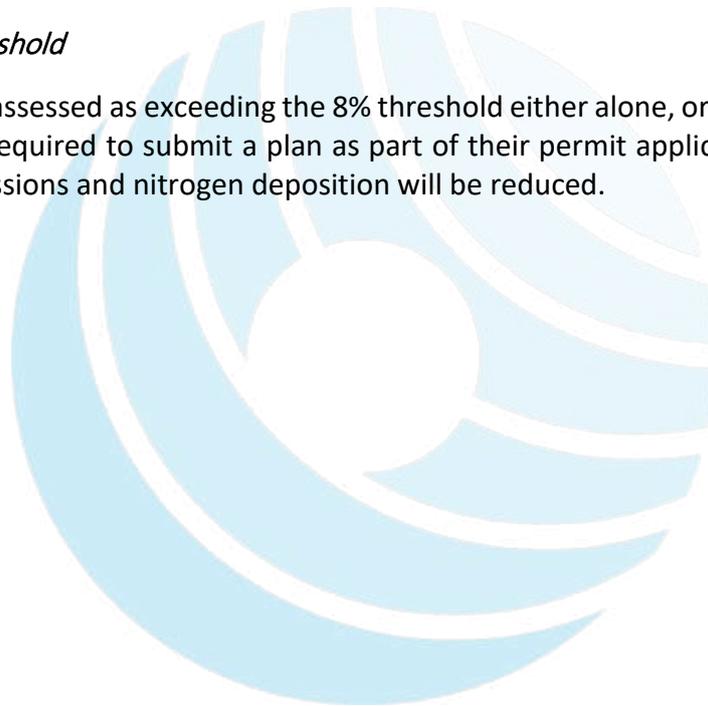
2.4.2 In-Combination Range

Where process contributions, considered in isolation, are between 1% and 8% of the designated site Critical Level or Load, an in-combination assessment is required. Should the in-combination process contributions be between 1% and 8% of the designated site Critical Level or Load then it should be determined that the application would cause no significant environmental effect/likely significant effect/damage to scientific interest.

Within the range between the lower and upper thresholds, whether or not the impact is deemed acceptable is at the discretion of Natural Resources Wales.

2.4.3 Upper Threshold

For units that are assessed as exceeding the 8% threshold either alone, or in combination, the applicant will be required to submit a plan as part of their permit application detailing how the ammonia emissions and nitrogen deposition will be reduced.



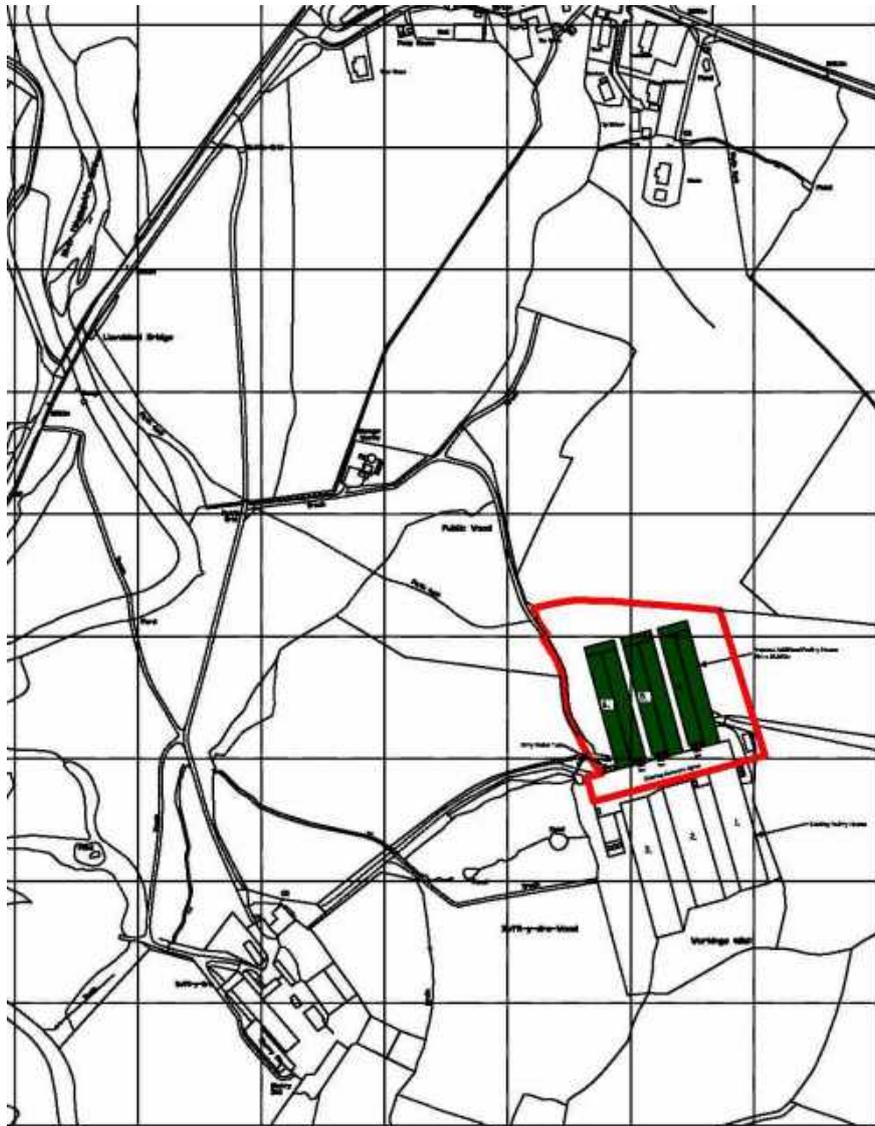
3.0 SITE SETTING AND OPERATIONS

3.1 Location

The applicant operates an existing broiler unit farming enterprise at Dolidre (Dol-Y-Dre) Farm. The site lies to the south of Llanddewi Ystradenni, Powys, approximately 8.3km North East of Llandrindod Wells. The surrounding area is hilly with some woodland. The predominant land use is grassland and grazing.

The site is located at approximate site grid reference OS GR 310940, 267920 as shown in Figure 3-1 below.

Figure 3-1: Site Location



- Drawing reproduced with permission from Ian Pick associates

3.2 Description of Development

The proposal seeks full planning consent for the erection of 3 additional poultry rearing units with associated infrastructure. A site layout plan is shown in Appendix B to this report.

The 3 existing sheds are currently fan ventilated with a fully littered floor equipped with non-leaking drinking systems. In each of the existing broiler houses ventilation is provided by side inlets and high velocity ridge extract fans. Gable end fans on each house are fitted to provide additional cooling during times of extreme hot weather.

Ventilation in the new houses and existing house 2 will be drawn through the gable end air scrubbing systems reducing ammonia release by 90% and a reduction in odour release of 40%.

Each of the sheds is operated in accordance with best practice and BAT standards in EPR 6.09.

- A computer automatically controls ventilation and heating so that heat is not wasted by being drawn out of the building.
- Litter is kept loose and friable. The quality is regularly inspected to ensure it does not become excessively wet or dry.
- Temperature in the sheds meets the health and welfare needs for the age and number of the birds. Hot water heaters are spaced regularly within the sheds to prevent cold spots and extremes of temperature. The fans are fitted with back draft shutters to prevent drafts and unnecessary heat loss.
- Birds are fed a minimum of three diets during their cycle, with gradually reducing levels of protein and phosphorous as bird age increases. Feed is delivered from a UKASTA accredited feed mill and blown into bulk feed bins situated adjacent to the houses, from the feed bins the feed is piped into the houses and distributed to the birds via a pan feeding system.
- Fallen stock will be recorded daily and securely stored in vermin proof containers awaiting regular collection by a licenced renderer.

Ammonia emissions will be reduced by reduced protein feed, maintaining good litter conditions with dry matter content above 60%.

3.3 Stocking

The Environmental Permit for the site allows for a maximum of 280,000 birds distributed across the 6 sheds. For purposes of this ammonia assessment, this distribution has been assumed as follows:

- Sheds 1 and 2 (existing): 40,000 birds per shed;
- Shed 3 (existing): 50,000 birds; and
- Sheds 4-6 (proposed): 50,000 birds per shed.

The proposed poultry unit will produce standard birds, based on a 38 day growing cycle, with an empty period at the end of each cycle for cleanout and preparation of the buildings for the incoming flock. The unit will operate with approximately 7.5 flocks per annum.

During the growing cycle temperature is controlled within the buildings. The buildings are pre-warmed to a temperature of 32°C on day 1 of the cycle typically reducing to approximately 18°C at clear-out of the crop.

3.4 Dispersion Modelling Inputs

Detailed dispersion modelling has been completed in line with *Guidance on modelling the concentration and deposition of ammonia emitted from intensive farming. Air Quality Modelling and Assessment Unit v3*. The BREEZE AERMOD model has been used.

3.4.1 Buildings

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 Dolidre Farm site details have been provided by the applicant and the specifications for the new buildings are consistent with those submitted for the planning application. A detailed dispersion model constructed on this basis.

**Table 3-1
Building Details**

Building	Width (m)	Length (m)	Basal Height (mAoD)	Angle (°)	No. of stacks
Shed 1	101.4	24.0	273	74.0	6
Shed 2 (exist)	101.4	24.0	270	75.0	6
Shed 2 (proposed)	101.4	24.0	267	75.0	3 (scrubber)
Shed 3	112.8	21.8	265	75.1	17
Shed 4	95.0	24.7	265	75.1	3 (scrubber)
Shed 5	95.0	24.7	265	75.1	3 (scrubber)
Shed 6	95.0	24.7	273	74.0	3 (scrubber)

The heights of the buildings have been taken as 3.79m for the existing buildings and 5.082m for the new buildings purposes of downwash with these figures calculated as 75% of the average of eaves to ridge taken from the existing and proposed elevations for the site.

3.4.2 Meteorology

In accordance with current guidance, 5 years of meteorological data has been used (2014 – 2018). The site at Shobdon is the closest representative site with a >90% complete data set.

3.4.3 Topography

Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away. The site is set on sloping ground between 265 and 273m 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.

3.4.4 Source Parameters

Modelling inputs for the proposed Dolidre Farm broiler buildings are shown in Appendix C. The emission parameters are as shown in Table 3-1 below and they are identical for all stacks detailed in Appendix C:

**Table 3-1
 Stack Details**

Building	Stack height (m)	Stack diameter (m)	Velocity (m/s)
Shed 1	5.3	1.0	10.0
Shed 2 (exist)	5.3	1.0	10.0
Shed 2 (proposed)	3.8	2.0	5.0
Shed 3	5.3	1.0	10.0
Shed 4	5.1	2.0	5.0
Shed 5	5.1	2.0	5.0
Shed 6	5.1	2.0	5.0

The temperature of all emissions has been taken as 22°C for all hours of the year.

3.4.5 Emission Rate

The process contribution is calculated as a result of the emissions from the proposed buildings. The emission rates for each building are shown below.

**Table 3-1
 Emission Rate**

Building	No. of Birds	Emission (kg/yr)	% abatement	Emission (g/s) per stack
Shed 1	40000	1360	0%	0.007188
Shed 2 (exist)	40000	1360	0%	0.007188
Shed 2 (proposed)	40000	1360	90%	0.001438
Shed 3	50000	1700	0%	0.003171
Shed 4	50000	1700	90%	0.001797
Shed 5	50000	1700	90%	0.001797
Shed 6	50000	1700	90%	0.001797

The emission rate used above is calculated from the standard emission factors for broilers of 0.034kg/bird/year.

3.5 Ecological Receptors

As discussed in section 1.5 above, the relevant sites are:

- River Wye SAC (River Ithon SSSI);
- Cwm Roches Meadow SSSI;
- Cae Llwyn SSSI;
- Cwmsaise SSSI;
- Far Hall Meadow SSSI;
- Ithon Valley Woodlands SSSI;
- Meeting House Quarry SSSI;
- Twenty-Five Acre Wood SSSI;
- Coed Bryn-Person SSSI;
- Maelienydd SSSI;
- Trehirion LWS (SINC); and
- Dol-y-dre Wood AW.

The MAGIC Ecological site search is included within Appendix A. The NRW citations for the SSSI are included as Appendix D.

3.5.1 River Wye SAC (River Ithon SSSI)

The JNCC describes the River Wye SAC as consisting of:

- Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins) (9.5%)
- Salt marshes, Salt pastures, Salt steppes (1.5%)
- Inland water bodies (Standing water, Running water) (52.5%)
- Bogs, Marshes, Water fringed vegetation, Fens (3.1%)
- Heath, Scrub, Maquis and Garrigue, Phygrana (1%)
- Dry grassland, Steppes (5.3%)
- Humid grassland, Mesophile grassland (2.4%)
- Improved grassland (10.4%)
- Broad-leaved deciduous woodland (12.3%)
- Inland rocks, Scree, Sands, Permanent Snow and ice (0.2%)

- Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites) (1.8%)

The Annex I habitat that is a primary reason for selection of this site is:

'3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation'

An Annex I habitat present as a qualifying feature, but not a primary reason for selection of this site is:

'7140 Transition mires and quaking bogs'

3.5.2 Cwm Roches Meadow SSSI

The NRW citation for this site provides the following description:

'This site comprises a single large hay meadow situated on gently sloping ground in the valley of the River Ithon at Penybont. It supports an unusual plant community that has strong affinities with those found in certain flood-meadows in central and southern England'

The site is therefore a hay meadow and the critical loads for each of these sites are based on that for high altitude hay meadows of 10 - 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.

3.5.3 Cae Llwyn SSSI

The NRW citation for this site provides the following description:

'This site comprises a single, gently sloping field with a southerly aspect. It is an excellent example of a traditionally managed herb-rich meadow supporting both "wet" and "dry" plant communities.'

The critical loads this site is based on that for high altitude hay meadows of 10 - 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.

3.5.4 Cwmsaise SSSI

The NRW citation for this site provides the following description:

'Cwmsaise is of special interest for its neutral and acidic grasslands which have been maintained as part of the extensive, traditionally farmed pastures and meadows'

The site is therefore typified by neutral grassland and the critical loads for each of these sites are based on that for high altitude hay meadows of 10 - 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.

3.5.5 Far Hall Meadow SSSI

The NRW citation for this site provides the following description:

'This site comprises a single traditionally managed hay meadow situated on level ground in the flood-plain of the River Aran near Dolau.'

The site is therefore typified by neutral grassland and the critical loads for each of these sites are based on that for high altitude hay meadows of 10 - 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.

3.5.6 Ithon Valley Woodlands SSSI

The NRW citation for this site provides the following description:

'The site is an important example of semi-natural mixed deciduous ancient woodland.'

'The woodland is varied in structure, with moderately grown maidens of sessile oak Quercus petraea being the dominant trees.'

The site is therefore typified by deciduous woodland and the critical loads for each of these sites are 10 - 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.

3.5.7 Meeting House Quarry SSSI

There is no NRW citation for this site, which appears to be an earth heritage / geological designation.

3.5.8 Twenty-Five Acre Wood SSSI

The NRW citation for this site provides the following description:

'A gently sloping south-facing oakwood developed on acidic, poorly draining clay overlying Ordovician strata. It has close affinities with the lowland hazel-sessile oak facies of the acid birch/oak woodland grouping. The wood is largely composed of mature maiden trees of oak with occasional alder and birch.'

The site is therefore typified by deciduous woodland and the critical loads for each of these sites are 10 - 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.

3.5.9 Coed Bryn-Person SSSI

The NRW citation for this site provides the following description:

'This mixed deciduous woodland with sessile oak dominant has developed on predominantly well-drained Silurian (Wenlock and Ludlow) shales. It is on a moderately steep slope with a western aspect. Some of the oak trees are derived from secondary growth, but there is a good representation of large mature trees. There is a closed canopy and locally a well-developed understorey of birch, hazel and rowan.'

The site is therefore typified by deciduous woodland and the critical loads for each of these sites are 10 - 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.

3.5.10 Maelienydd SSSI

The NRW citation for this site provides the following description:

'This area of unimproved hill land, lying at 300-350 metres above sea level, is of botanical and ornithological interest. The mixture of habitats of wet and freely drained acid grassland, small pools, gullies and gorse thickets enables this area to support a diverse range of breeding birds'

The site is therefore typified by acidic grassland and the critical loads for each of these sites are based on that for Moist and wet oligotrophic grasslands of 10 - 20 Kg N/ha/year. Within this range, the lower critical load is therefore 20 Kg N/ha/year with the upper threshold being 30 Kg N/ha/year.

3.5.11 Trehirion LWS (SINC)

This is a local site designated as a result of the presence of Great Crested Newts and consists of ponds and scrub.

3.5.12 Dol-y-dre Wood AW

The site is typified by deciduous woodland and the critical loads for each of these sites are 10 - 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.

3.5.13 Baseline Concentration / Deposition

The existing baseline values at each of the designated site types (i.e. roughness class) are as follows.

Table 3-2
Baseline Conditions

Site	NH ₃ concentration (µg/m ³)	Nutrient N (kg/ha/yr)
Grassland	1.180	15.4
Woodland	1.180	25.2

The existing concentration of ammonia all sites is below the upper critical level limit of 3 µg/m³, but above the limit for sites designated for epiphytes and bryophytes of 1 µg/m³.

3.5.14 Model Input

Modelling was carried out with discrete receptors representing the ecological sites of biological interest:

- River Wye SAC (River Ithon SSSI): 47 receptor points;
- Cwm Roches Meadow SSSI: 1 receptor point;
- Cae Llwyn SSSI: 1 receptor point;
- Cwmsaise SSSI: 1 receptor point;

- Far Hall Meadow SSSI: 1 receptor point;
- Ithon Valley Woodlands SSSI: 3 receptor points;
- Meeting House Quarry SSSI: 1 receptor point;
- Twenty-Five Acre Wood SSSI: 1 receptor point;
- Coed Bryn-Person SSSI: 1 receptor point;
- Maelienydd SSSI: 2 receptor points;
- Trehirion LWS (SINC): 1 receptor point; and
- Dol-y-dre Wood AW: 794 receptor points.



4.0 IMPACTS: PROCESS CONTRIBUTION (BASELINE)

Scenario 1 impacts relate to 3 existing sheds, stocking a maximum of 130,000 birds. The results of the ammonia modelling for these three sheds is presented below. None of the sheds are fitted with ammonia scrubbers.

4.1 Results: Critical Levels

The maximum dispersion modelling results for each site are shown in the tables below. Critical levels have been selected based on information from APIS, Powys Council and NRW as discussed in Section 2.2 of this report.

Table 4-1
Results: Critical Levels

Site	Type	Conc ($\mu\text{g}/\text{m}^3$)	Critical Level	% of C.L.
River Wye (River Ithon)	SAC / SSSI	0.248	1	24.8%
Cwm Roches Meadow	SSSI	0.014	3	0.5%
Cae Llwyn	SSSI	0.014	3	0.5%
Cwmsaise	SSSI	0.035	3	1.2%
Far Hall Meadow	SSSI	0.052	3	1.7%
Ithon Valley Woodlands	SSSI	0.056	1	5.6%
Meeting House Quarry	SSSI	0.006	3	0.2%
Twenty-Five Acre Wood	SSSI	0.031	3	1.0%
Coed Bryn-Person	SSSI	0.012	3	0.4%
Maelienydd	SSSI	0.009	3	0.3%
Trehirion	LWS	0.091	3	3.0%
Dol-y-dre Wood	AW	3.431	3	114.4%

Impacts at sites where the critical level applies are predicted to be above 1% of the critical level at the point of greatest impact (or 100% for AW and LWS) for 6 of the 13 sites identified. The impact is therefore insignificant at these sites, either alone or in combination with other schemes. Only impacts at the River Wye (River Ithon) are above the upper threshold percentage of 8%.

The existing impact at Dol-y-dre Wood as a result of emissions from the farm is above 100% for both the lower and upper critical levels for ammonia.

4.2 Results: N Nitrogen Critical Load

The maximum nutrient nitrogen critical load results at each ecological site are shown in table 4-2.

Table 4-2
Results: N Deposition

Site	kg/ha/yr	Upper C.L.	% of C.L.	Lower C.L.	% of C.L.
River Wye (River Ithon)	1.29	---	---	---	---
Cwm Roches Meadow	0.07	20.0	0.4%	10.0	0.7%
Cae Llwyn	0.07	20.0	0.4%	10.0	0.7%
Cwmsaise	0.18	20.0	0.9%	10.0	1.8%
Far Hall Meadow	0.27	20.0	1.3%	10.0	2.7%
Ithon Valley Woodlands	0.44	20.0	2.2%	10.0	4.4%
Meeting House Quarry	0.03	20.0	0.1%	10.0	0.3%
Twenty-Five Acre Wood	0.24	20.0	1.2%	10.0	2.4%
Coed Bryn-Person	0.10	20.0	0.5%	10.0	1.0%
Maelienydd	0.05	20.0	0.2%	10.0	0.5%
Trehirion	0.47	20.0	2.4%	10.0	4.7%
Dol-y-dre Wood	26.76	20.0	133.8%	10.0	267.6%

Impacts at sites where the nutrient nitrogen critical load applies are predicted to at or above 1% of the critical level at the point of greatest impact (or 100% for AW and LWS) for 6 of the 13 sites identified. No impacts are above the upper threshold percentage of 8%.

The existing impact at Dol-y-dre Wood as a result of emissions from the farm is above 100% for both the lower and upper critical loads for ammonia.

5.0 IMPACTS: PROCESS CONTRIBUTION (NEW SHEDS)

Scenario 2 impacts relate to:

- 3 existing sheds, stocking a maximum of 130,000 birds; and
- 3 new sheds, stocking a maximum of 150,000 birds.

One of the existing shed (shed 2) and all 3 of the new sheds are fitted with ammonia scrubbers.

The results of the ammonia modelling for these three sheds is presented below.

5.1 Results: Critical Levels

The maximum dispersion modelling results for each site are shown in the tables below.

Table 4-1
Results: Critical Levels

Site	Conc ($\mu\text{g}/\text{m}^3$)	Critical Level	% of C.L.
River Wye (River Ithon)	0.199	1	19.9%
Cwm Roches Meadow	0.011	3	0.4%
Cae Llwyn	0.012	3	0.4%
Cwmsaise	0.029	3	1.0%
Far Hall Meadow	0.042	3	1.4%
Ithon Valley Woodlands	0.045	1	4.5%
Meeting House Quarry	0.005	3	0.2%
Twenty-Five Acre Wood	0.026	3	0.9%
Coed Bryn-Person	0.010	3	0.3%
Maelienydd	0.007	3	0.2%
Treherion	0.073	3	2.4%
Dol-y-dre Wood	2.943	3	98.1%

Impacts at sites where the critical level applies are predicted to be above 1% of the critical level at the point of greatest impact for 4 of the 13 sites identified. The impact is therefore insignificant at these sites, either alone or in combination with other schemes, including Cwmsaise which falls below 1% of the critical level with the proposed scheme. Only impacts at the River Wye (River Ithon) are above the upper threshold percentage of 8%.

Whilst the existing impact at Dol-y-dre Wood as a result of emissions from the farm is above both the critical level for ammonia, with the proposed scheme the maximum impact falls below 100% of this limit.

5.2 Results: N Nitrogen Critical Load

The maximum nutrient nitrogen critical load results are shown in table 4-2 below.

Table 4-2
Results: N Deposition

Site	kg/ha/yr	Upper C.L.	% of C.L.	Lower C.L.	% of C.L.
River Wye (River Ithon)	1.03	---	---	---	---
Cwm Roches Meadow	0.06	20.0	0.3%	10.0	0.6%
Cae Llwyn	0.06	20.0	0.3%	10.0	0.6%
Cwmsaise	0.15	20.0	0.8%	10.0	1.5%
Far Hall Meadow	0.22	20.0	1.1%	10.0	2.2%
Ithon Valley Woodlands	0.35	20.0	1.8%	10.0	3.5%
Meeting House Quarry	0.02	20.0	0.1%	10.0	0.2%
Twenty-Five Acre Wood	0.20	20.0	1.0%	10.0	2.0%
Coed Bryn-Person	0.08	20.0	0.4%	10.0	0.8%
Maelienydd	0.04	20.0	0.2%	10.0	0.4%
Treherion	0.38	20.0	1.9%	10.0	3.8%
Dol-y-dre Wood	22.96	20.0	114.8%	10.0	229.6%

Impacts at sites where the nutrient nitrogen critical load applies are predicted to at or above 1% of the critical level at the point of greatest impact for 5 of the 13 sites identified. Coed Bryn-Person falls below 1% of the critical load with the proposed scheme. The impact is therefore insignificant at the other sites, either alone or in combination with other schemes. No impacts at SSSI are above the upper threshold percentage of 8%.

The existing impact at Dol-y-dre Wood as a result of emissions from the farm remains above 100% for both the lower and upper critical loads for ammonia.

6.0 ASSESSMENT COMPARISON

As can be seen in sections 4 and 5 above, the new proposals result in a general betterment when compared with the existing 3 house scheme without ammonia abatement. This comparison can be seen in the sections below.

6.1 Results Comparison: Critical Levels

The maximum dispersion modelling results for each site are shown in the tables below, with the Process Contribution results for the 2 scenarios (existing and proposed) compared.

Table 6-1
PC Results Comparison: Ammonia

Site	Scenario 1	Scenario 2	Difference	C.L.	% of C.L.
River Wye (River Ithon)	0.248	0.199	-0.049	1.0	-4.9%
Cwm Roches Meadow	0.014	0.011	-0.003	3.0	-0.1%
Cae Llwyn	0.014	0.012	-0.003	3.0	-0.1%
Cwmsaise	0.035	0.029	-0.006	3.0	-0.2%
Far Hall Meadow	0.052	0.042	-0.010	3.0	-0.3%
Ithon Valley Woodlands	0.056	0.045	-0.011	1.0	-1.1%
Meeting House Quarry	0.006	0.005	-0.001	3.0	0.0%
Twenty-Five Acre Wood	0.031	0.026	-0.006	3.0	-0.2%
Coed Bryn-Person	0.012	0.010	-0.002	3.0	-0.1%
Maelienydd	0.009	0.007	-0.002	3.0	-0.1%
Trehirion	0.091	0.073	-0.018	3.0	-0.6%
Dol-y-dre Wood	3.431	2.943	-0.488	3.0	-16.3%

Impacts at all locations are lower for the proposed layout (6 houses, 4 with scrubbers) than the existing site (3 houses, no scrubbers). The PC impacts at Dol-y-dre Wood fall below 100% of the critical level with the proposed scheme and are therefore insignificant.

The maximum dispersion modelling results for each site are shown in the tables below, with the Predicted Environmental Concentration results for the 2 scenarios (existing and proposed) compared. Impacts at all locations are lower for the proposed layout (6 houses, 4 with scrubbers) than the existing site (3 houses, no scrubbers).

Table 6-2
PEC Results Comparison: Ammonia

Site	Scenario 1	% of C.L.	Scenario 2	% of C.L.
River Wye (River Ithon)	1.428	142.8%	1.379	137.9%
Cwm Roches Meadow	1.194	39.8%	1.191	39.7%
Cae Llwyn	1.194	39.8%	1.192	39.7%
Cwmsaise	1.215	40.5%	1.209	40.3%
Far Hall Meadow	1.232	41.1%	1.222	40.7%

Site	Scenario 1	% of C.L.	Scenario 2	% of C.L.
Ithon Valley Woodlands	1.236	123.6%	1.225	122.5%
Meeting House Quarry	1.186	39.5%	1.185	39.5%
Twenty-Five Acre Wood	1.211	121.1%	1.206	120.6%
Coed Bryn-Person	1.192	119.2%	1.190	119.0%
Maelienydd	1.189	39.6%	1.187	39.6%
Trehirion	1.271	42.4%	1.253	41.8%
Dol-y-dre Wood	4.611	461.1%	4.123	412.3%

6.2 Results Comparison: N Nitrogen Critical Load

The maximum nutrient nitrogen critical load results for each site are shown in the tables below, with the Predicted Environmental Concentration results for the 2 scenarios (existing and proposed) compared.

Table 6-2
PEC Results Comparison: N Deposition

Site	Scenario 1	Scenario 2	Difference
River Wye (River Ithon)	16.69	16.43	-0.25
Cwm Roches Meadow	15.47	15.46	-0.01
Cae Llwyn	15.47	15.46	-0.01
Cwmsaise	15.58	15.55	-0.03
Far Hall Meadow	15.67	15.62	-0.05
Ithon Valley Woodlands	25.64	25.55	-0.08
Meeting House Quarry	15.43	15.42	-0.01
Twenty-Five Acre Wood	25.44	25.40	-0.04
Coed Bryn-Person	25.30	25.28	-0.02
Maelienydd	15.45	15.44	-0.01
Trehirion	15.87	15.78	-0.09
Dol-y-dre Wood	51.96	48.16	-3.81

Impacts at all locations are lower for the proposed layout (6 houses, 4 with scrubbers) than the existing site (3 houses, no scrubbers). This is consistent with the findings of NRW in the permitting decision document for this scheme.

6.3 In-Combination Effects

NRW and Powys Council guidance requires an assessment of in-combination effects where the Process Contribution is >1% from the scheme at a designated site of European or National interest. In this case, the impacts at all sites represent a betterment when compared with the existing layout and therefore the Process Contribution is <0% (and also therefore less than 1%). No further in-combination assessment is therefore required in this case as accepted by NRW when determining the application for the Environmental Permit.

7.0 CONCLUSIONS

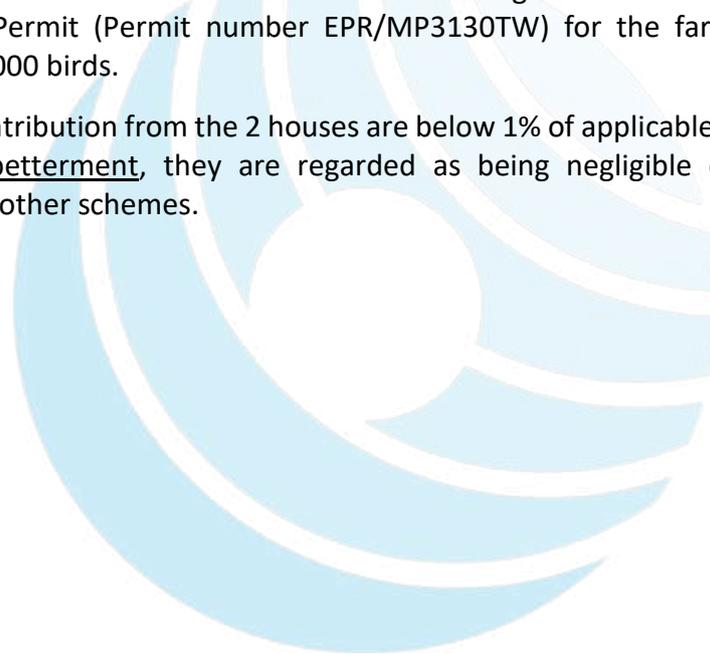
Isopleth Ltd has been commissioned by Ian Pick Associates Ltd, on behalf of Mr Edward Morgan and Mr James Morgan, to carry out a detailed assessment of ammonia impacts associated with a proposed extension to their poultry unit at Dolidre (Dol-Y-Dre) Farm, Llanddewi, Llandrindod Wells LD1 6SE.

The type, source and significance of potential impacts have been identified and detailed modelling undertaken in line with guidance issued by Natural Resources Wales.

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

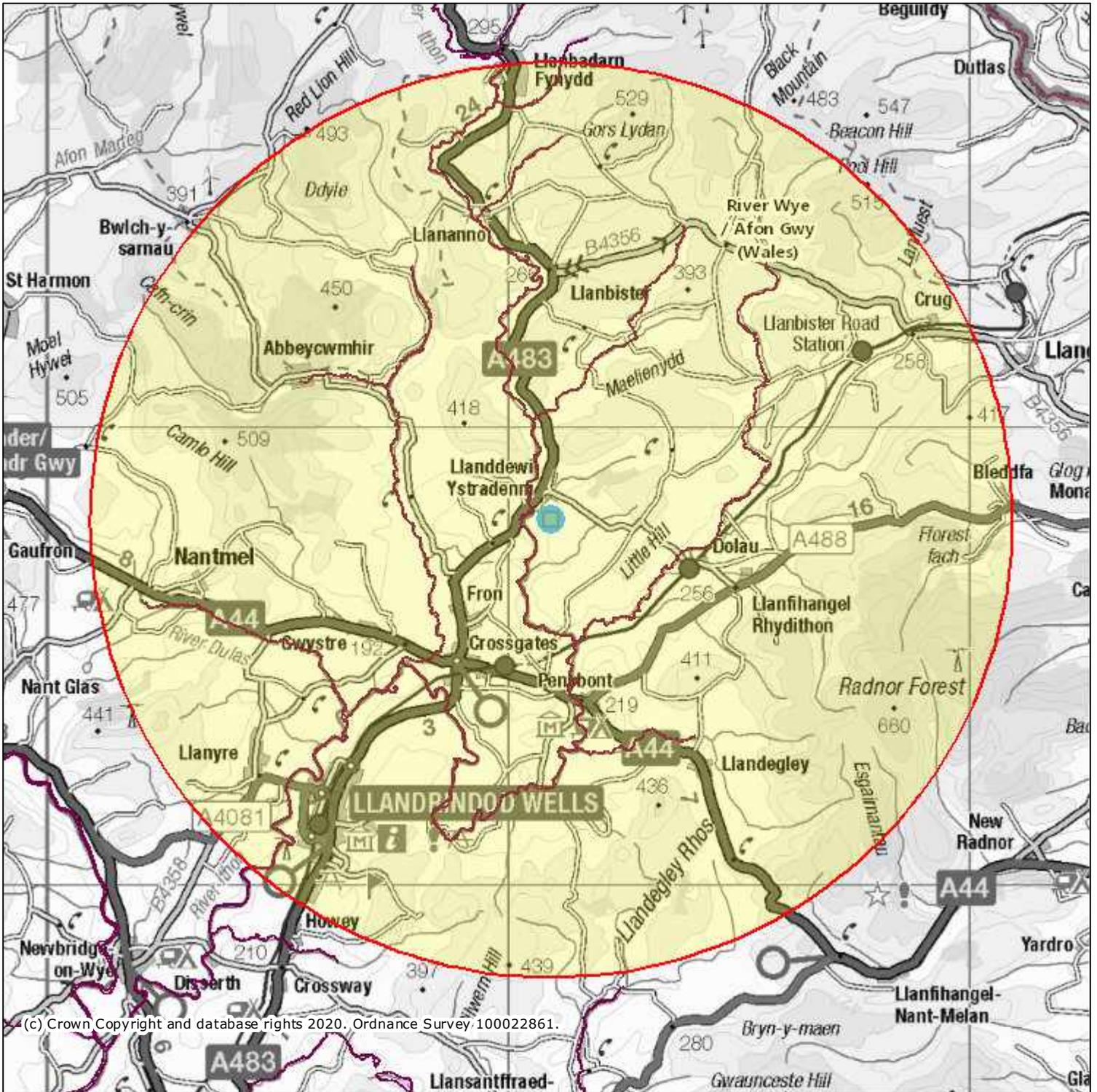
The assessment shows that impacts at all designated ecological sites are likely to be reduced with the development proposals in place, through end-of-pipe ammonia scrubbers on the new houses and one of the existing units. The results of this assessment are consistent with the findings of Natural Resources Wales when considering the same scheme prior to issuing an Environment Permit (Permit number EPR/MP3130TW) for the farm when housing a maximum of 280,000 birds.

As the process contribution from the 2 houses are below 1% of applicable limits all sites given that there is a betterment, they are regarded as being negligible either alone or in combination with other schemes.



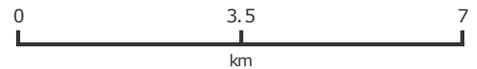
APPENDIX A





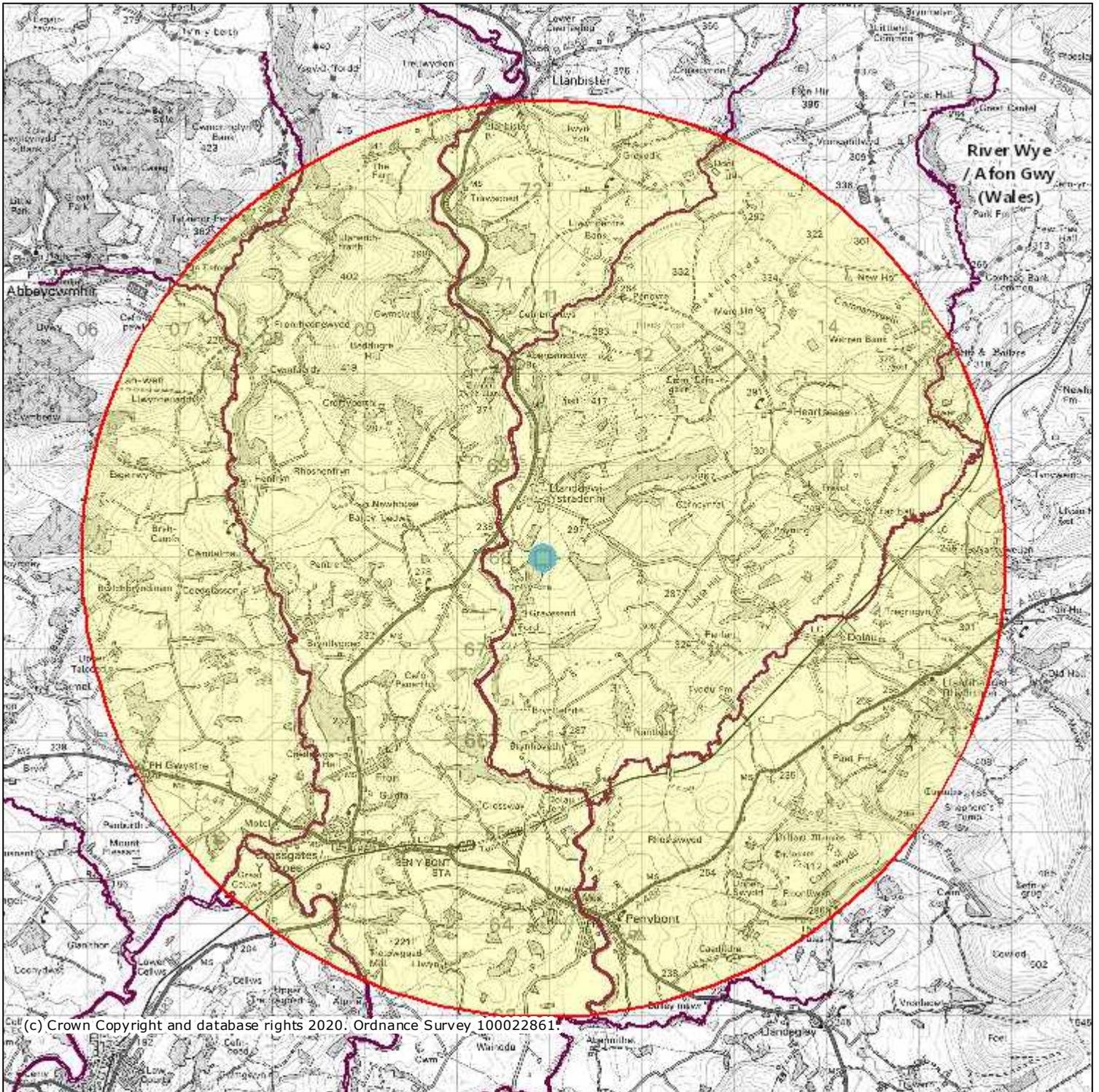
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- Ramsar Sites (Wales)
- Special Areas of Conservation (Wales)
- Special Protection Areas (Wales)



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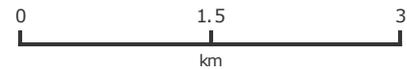
Map produced by MAGiC on 24 March, 2020.
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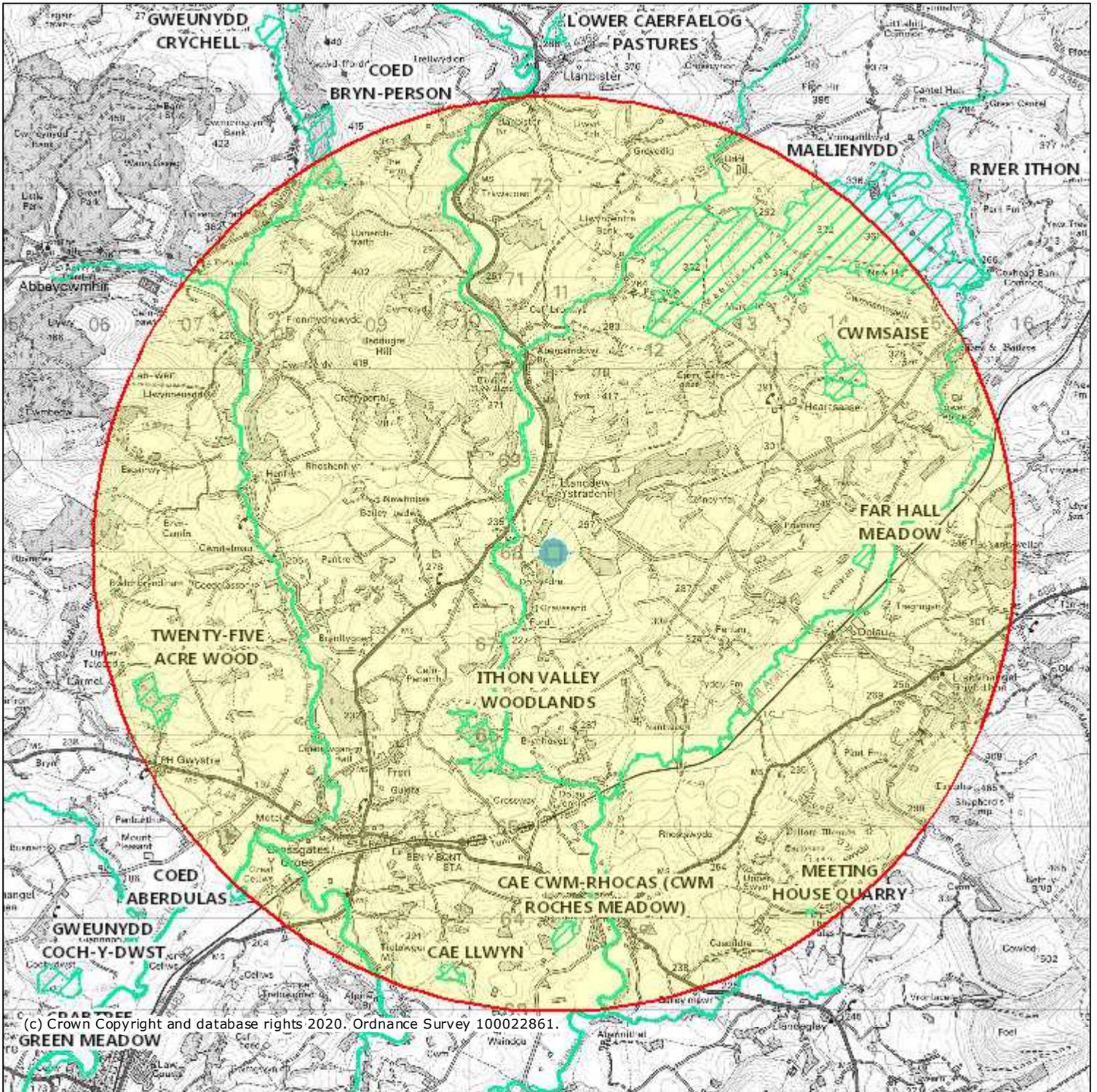
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-  Ramsar Sites (Wales)
-  Special Areas of Conservation (Wales)
-  Special Protection Areas (Wales)



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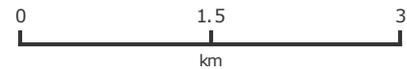
Map produced by MAGiC on 24 March, 2020.
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Legend

 Sites of Special Scientific Interest (Wales)



Projection = OSGB36

xmin = 295700

ymin = 260700

xmax = 326000

ymax = 275300

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3/25/2020

Site Check Report Report generated on Wed Mar 25 2020
You selected the location: Centroid Grid Ref: SO10926799
The following features have been found in your search area:

Sites of Special Scientific Interest (Wales) - points

Name CAE CWM-RHOCAS (CWM ROCHES MEADOW)
SSSI Code 32WG4
Eastings 311031
Northings 263804
First Notified 14/12/1990
Last Notified Null
Confirmation Date 12/07/1991
Cartesian Area (Ha) 4.766699

Name CAE LLWYN
SSSI Code 32WG7
Eastings 309803
Northings 263388
First Notified 14/12/1990
Last Notified Null
Confirmation Date 12/07/1991
Cartesian Area (Ha) 3.441597

Name CWMSAISE
SSSI Code 32WG6
Eastings 314072
Northings 269984
First Notified 05/08/1997
Last Notified Null
Confirmation Date 18/03/1998
Cartesian Area (Ha) 15.496646

Name FAR HALL MEADOW
SSSI Code 32WD3
Eastings 314282
Northings 267955
First Notified 14/12/1990
Last Notified Null
Confirmation Date 12/07/1991
Cartesian Area (Ha) 3.474307

Name ITHON VALLEY WOODLANDS
SSSI Code 32WRZ
Eastings 310170
Northings 265898
First Notified 01/01/1981
Last Notified 23/06/1983
Confirmation Date Null
Cartesian Area (Ha) 18.176973

Name MAELIENYDD
SSSI Code 32WSD
Eastings 313675
Northings 271311
First Notified 01/01/1980
Last Notified 07/09/1983
Confirmation Date Null
Cartesian Area (Ha) 342.524691

Name MEETING HOUSE QUARRY
SSSI Code 32WVG
Eastings 313700.766971
Northings 264077.634185
First Notified 10/08/2016
Last Notified Null
Confirmation Date 07/03/2017
Cartesian Area (Ha) 0.213135

Name TWENTY-FIVE ACRE WOOD
SSSI Code 32WSJ
Eastings 306599
Northings 266387
First Notified 01/01/1981
Last Notified 29/01/1982

3/25/2020

Confirmation Date Null
Cartesian Area (Ha) 12.350811

Sites of Special Scientific Interest (Wales)

Name CAE CWM-RHOCAS (CWM ROCHES MEADOW)
Eastings 311031
Northings 263804
First Notified 14/12/1990
Last Notified Null
Confirmation Date 12/07/1991
Cartesian Area (Ha) 4.766699

Name CAE LLWYN
Eastings 309803
Northings 263388
First Notified 14/12/1990
Last Notified Null
Confirmation Date 12/07/1991
Cartesian Area (Ha) 3.441597

Name COED BRYN-PERSON
Eastings 308406
Northings 272428
First Notified 01/01/1981
Last Notified 23/06/1983
Confirmation Date Null
Cartesian Area (Ha) 22.265265

Name CWMSAISE
Eastings 314072
Northings 269984
First Notified 05/08/1997
Last Notified Null
Confirmation Date 18/03/1998
Cartesian Area (Ha) 15.496646

Name FAR HALL MEADOW
Eastings 314282
Northings 267955
First Notified 14/12/1990
Last Notified Null
Confirmation Date 12/07/1991
Cartesian Area (Ha) 3.474307

Name ITHON VALLEY WOODLANDS
Eastings 310170
Northings 265898
First Notified 01/01/1981
Last Notified 23/06/1983
Confirmation Date Null
Cartesian Area (Ha) 18.176973

Name MAELIENYDD
Eastings 313675
Northings 271311
First Notified 01/01/1980
Last Notified 07/09/1983
Confirmation Date Null
Cartesian Area (Ha) 342.524691

Name MEETING HOUSE QUARRY
Eastings 313700.766971
Northings 264077.634185
First Notified 10/08/2016
Last Notified Null
Confirmation Date 07/03/2017
Cartesian Area (Ha) 0.213135

Name RIVER ITHON
Eastings 307538
Northings 268905
First Notified 30/05/2002
Last Notified Null
Confirmation Date 21/02/2003

3/25/2020

Cartesian Area (Ha)

173.766778

Name

TWENTY-FIVE ACRE WOOD

Eastings

306599

Northings

266387

First Notified

01/01/1981

Last Notified

29/01/1982

Confirmation Date

Null

Cartesian Area (Ha)

12.350811

APPENDIX B



This drawing is to be read in conjunction with the schedule of works



Ian Pick Associates Ltd
Specialist: Agricultural & Rural Planning Consultants

Station Farm Offices
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Nafferton
Ditfield
East Yorkshire
YO25 8NJ
Tel/Fax (01377) 253363
Mobile 07702814950

CLIENT

E. & J Morgan
Poultry Site
Doldre
Llandewi
Llandrindod Wells
Powys, LD1 6SE

JOB TITLE

Proposed Poultry Unit
Expansion

DWG. TITLE

Site Plan

SCALE
1=500

DRN
IP

DATE ALTERATION REV

---/---/--- ---

---/---/--- ---

---/---/--- ---

---/---/--- ---

---/---/--- ---

---/---/--- ---

DWG. NUMBER
IP/EJM/02

DATE
Mar 20

REV
-



This drawing is to be read in conjunction with the schedule of works



Ian Pick Associates Ltd
Specialist Agricultural & Rural Planning Consultants

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Tel/Fax (01377) 253363
Mobile 07702814950

CLIENT

E. & J Morgan
Poultry Site
Doldre
Llandewi
Llandrindod Wells
Powys, LD1 6SE

JOB TITLE

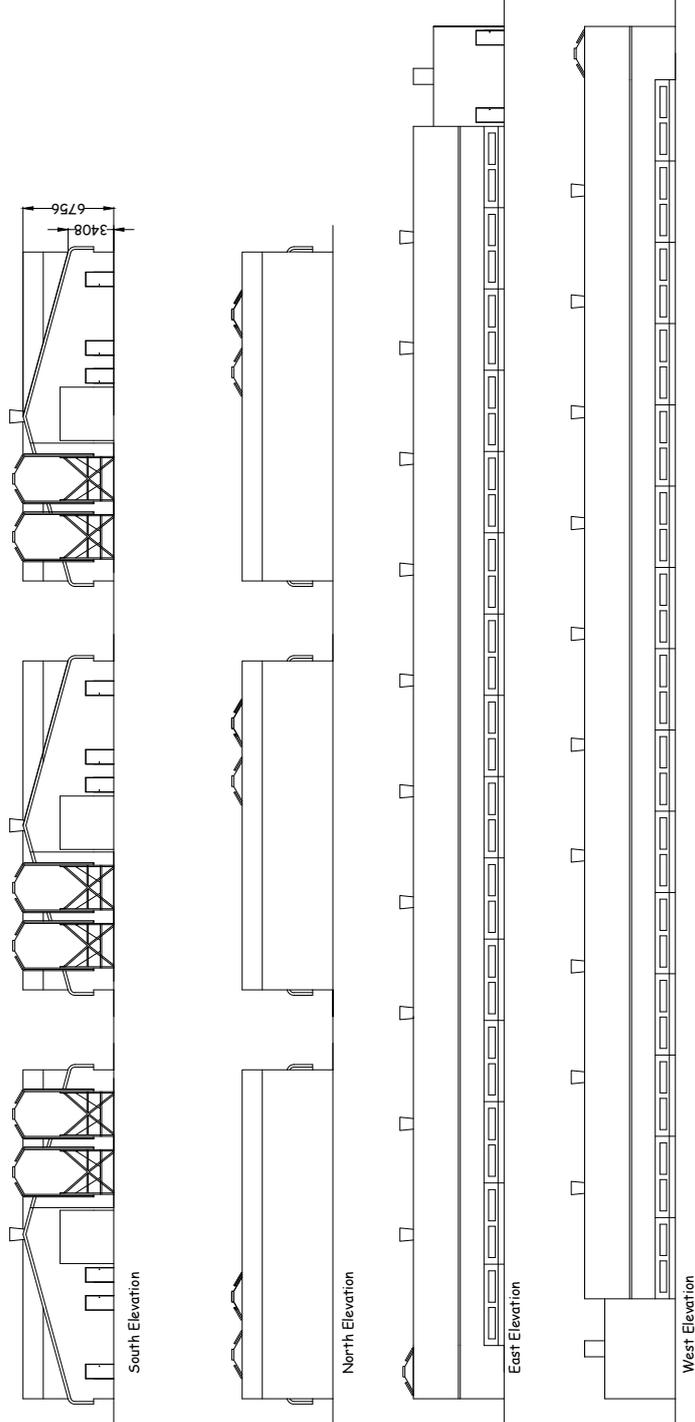
Proposed Poultry Unit
Expansion

DWG. TITLE
Elevations

SCALE	DRN
1=200	IP

DATE	ALTERATION	REV
---/---/---		

DWG. NUMBER	DATE	REV
IP/EJM/03	Mar 20	-



APPENDIX C

Table C-1
Source Locations: Existing

Stack ID	Reference	Location (OS Xm)	Location (OS Ym)	Basal Height (mAoD)
B1E1	Building 1 EXIST	310974.8	267980.8	273
B1E2	Building 1 EXIST	310991.7	267920.3	273
B1E3	Building 1 EXIST	310982.7	267950.7	273
B1E4	Building 1 EXIST	311002.1	267905.3	273
B1E5	Building 1 EXIST	310992.6	267937.3	273
B1E6	Building 1 EXIST	310983.5	267968	273
B2E1	Building 2 EXIST	310939.3	267968.2	270
B2E2	Building 2 EXIST	310956.2	267907.7	270
B2E3	Building 2 EXIST	310947.2	267938.1	270
B2E4	Building 2 EXIST	310966.6	267892.7	270
B2E5	Building 2 EXIST	310957.1	267924.7	270
B2E6	Building 2 EXIST	310948	267955.4	270
B3E1	Building 3 EXIST	310904	267961.4	267
B3E2	Building 3 EXIST	310905.7	267955.2	267
B3E3	Building 3 EXIST	310907.4	267948.9	267
B3E4	Building 3 EXIST	310909	267942.7	267
B3E5	Building 3 EXIST	310910.7	267936.4	267
B3E6	Building 3 EXIST	310912.4	267930.2	267
B3E7	Building 3 EXIST	310914.1	267923.9	267
B3E8	Building 3 EXIST	310915.7	267917.7	267
B3E9	Building 3 EXIST	310917.4	267911.4	267
B3E10	Building 3 EXIST	310919.1	267905.2	267
B3E11	Building 3 EXIST	310920.8	267898.9	267
B3E12	Building 3 EXIST	310922.4	267892.7	267
B3E13	Building 3 EXIST	310924.1	267886.4	267
B3E14	Building 3 EXIST	310925.8	267880.2	267
B3E15	Building 3 EXIST	310927.5	267873.9	267
B3E16	Building 3 EXIST	310929.1	267867.7	267
B3E17	Building 3 EXIST	310930.8	267861.4	267

Table C-2
Source Locations: Proposed

Stack ID	Reference	Location (OS Xm)	Location (OS Ym)	Basal Height (mAoD)
B1E1	Building 1 EXIST	310974.8	267980.8	273
B1E2	Building 1 EXIST	310991.7	267920.3	273
B1E3	Building 1 EXIST	310982.7	267950.7	273
B1E4	Building 1 EXIST	311002.1	267905.3	273
B1E5	Building 1 EXIST	310992.6	267937.3	273
B1E6	Building 1 EXIST	310983.5	267968.0	273
B2E1	Building 2 EXIST	310975.4	267881.6	270
B2E2	Building 2 EXIST	310967.3	267879.1	270
B2E3	Building 2 EXIST	310958.9	267876.7	270
B3E1	Building 3 EXIST	310904.0	267961.4	267
B3E2	Building 3 EXIST	310905.7	267955.2	267
B3E3	Building 3 EXIST	310907.4	267948.9	267
B3E4	Building 3 EXIST	310909.0	267942.7	267
B3E5	Building 3 EXIST	310910.7	267936.4	267
B3E6	Building 3 EXIST	310912.4	267930.2	267
B3E7	Building 3 EXIST	310914.1	267923.9	267
B3E8	Building 3 EXIST	310915.7	267917.7	267
B3E9	Building 3 EXIST	310917.4	267911.4	267
B3E10	Building 3 EXIST	310919.1	267905.2	267
B3E11	Building 3 EXIST	310920.8	267898.9	267
B3E12	Building 3 EXIST	310922.4	267892.7	267
B3E13	Building 3 EXIST	310924.1	267886.4	267
B3E14	Building 3 EXIST	310925.8	267880.2	267
B3E15	Building 3 EXIST	310927.5	267873.9	267
B3E16	Building 3 EXIST	310929.1	267867.7	267
B3E17	Building 3 EXIST	310930.8	267861.4	267
B4N1	Building 4 NEW	310943.2	268107.8	265
B4N2	Building 4 NEW	310935.3	268105.5	265
B4N3	Building 4 NEW	310926.5	268103.1	265
B5N1	Building 5 NEW	310913.8	268099.8	265
B5N2	Building 5 NEW	310905.4	268097.6	265
B5N3	Building 5 NEW	310896.9	268095.3	265
B6N1	Building 6 NEW	310884.2	268092.0	265
B6N2	Building 6 NEW	310876.1	268090.0	265
B6N3	Building 6 NEW	310867.0	268087.2	265

APPENDIX D



**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

MAELIENYDD

Date of Notification: 1980, 1983

National Grid Reference: SO 140715

O.S. Maps: 1:50,000 Sheet number: 148
1:25,000 Sheet number: SO 17

Site Area: 350 ha

Description:

This area of unimproved hill land, lying at 300-350 metres above sea level, is of botanical and ornithological interest.

The mixture of habitats of wet and freely drained acid grassland, small pools, gullies and gorse thickets enables this area to support a diverse range of breeding birds. Within Powys it is of particular significance for wader species, both as wintering and breeding habitat; species include lapwing, snipe, curlew and redshank.

Botanically, the area is most noted for the occurrence of populations of the scarce pillwort *Pilularia globulifera* in some of the pools.

Remarks:

Owned by the Crown Estate.
Registered as Common Land.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS CAE CWM-RHOCAS (CWM ROCHES MEADOW)

Date of Notification: 1990

National Grid Reference: SO110638

O.S. Maps: 1:50,000 Sheet number: 148
1:25,000 Sheet number: SO16

Site Area: 5ha

Description:

This site comprises a single large hay meadow situated on gently sloping ground in the valley of the River Ithon at Penybont. It supports an unusual plant community that has strong affinities with those found in certain flood-meadows in central and southern England.

The sward is characterised by an abundance of common bent *Agrostis Capillaris*, sweet vernal-grass *Anthoxanthum Odoratum*, red fescue *Festuca Rubra*, Yorkshire-fog *Holcus Lanatus* and clovers *Trifolium spp.*, with frequent meadowsweet *Filipendula Ulmaria*, ribwort plantain *Plantago Lanceolata*, meadow buttercup *Ranunculus Acris*, yellow-rattle *Rhinanthus Minor*, common sorrel *Rumex Acetosa* and great burnet *Sanguisorba Officinalis*. There is a wide range of associated plants, including meadow foxtail *Alopecurus Pratensis*, soft-brome *Bromus Hordeaceus subsp.Hordeaceus*, yellow oat-grass *Trisetum Flavescens*, common knapweed *Centaurea Nigra*, common mouse-ear *Cerastium Fontanum*, meadow vetchling *Lathyrus Pratensis*, autumn hawkbit *Leontodon Autumnalis*, rough hawkbit *Leontodon Hispidus*, oxeye daisy *Leucanthemum Vulgare*, common bird's-foot-trefoil *Lotus Corniculatus*, adder's-tongue *Ophioglossum Vulgatum*, creeping buttercup *Ranunculus Repens*, common dandelion *Taraxacum Officinale* and tufted vetch *Vicia Cracca*. Species indicative of meadows in more upland situations are also present. These include smooth lady's-mantle *Alchemilla Glabra*, intermediate lady's-mantle *Alchemilla Xanthochlora*, pignut *Conopodium Majus* and bitter-vetch *Lathyrus Montanus*.

On its western side the meadow grades into alder *Alnus Glutinosa* carr at the edges of a small lake. A stand of planted broadleaves here supports a small heronry. Further interest is added by the presence of ancient oak trees *Quercus spp.* within the meadow.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

CAE LLWYN

<u>Date of Notification:</u>	1990
<u>National Grid Reference:</u>	SO098634
<u>O.S. Maps:</u>	1:50,000 Sheet number: 147 1:25,000 Sheet number: SO06
<u>Site Area:</u>	3.4 ha

Description:

This site comprises a single, gently sloping field with a southerly aspect. It is an excellent example of a traditionally managed herb-rich meadow supporting both "wet" and "dry" plant communities.

The top part of the meadow supports a rather impoverished community dominated by perennial rye-grass *Lolium perenne* and crested dog's-tail *Cynosurus cristatus*, but this soon gives way to a more typical unimproved grassland community on the slopes below. Common bent *Agrostis capillaris*, crested dog's-tail and Yorkshire-fog *Holcus lanatus* are dominant here, along with frequent sweet vernal-grass *Anthoxanthum odoratum*, pignut *Conopodium majus*, common bird's-foot-trefoil *Lotus corniculatus*, ribwort plantain *Plantago canceolata* and clovers *Trifolium spp.* Other typical associates include common knapweed *Centaurea nigra*, meadow vetchling *Lathyrus pratensis*, rough hawkbit *Leontodon hispidus*, yellow-rattle *Rhinanthus minor*, common sorrel *Rumex acetosa*, great burnet *Sanguisorba officinalis* and tufted vetch *Vicia cracca*.

The lower part of the field supports a rich fen-meadow community dominated by mixtures of sweet vernal-grass, crested dog's-tail, red fescue *Festuca rubra*, Yorkshire-fog and purple moor-grass *Molinia caerulea*, with frequent carnation sedge *Carex panicea*, meadow thistle *Cirsium dissectum*, autumn hawkbit *Leontodon autumnalis*, ribwort plantain, tormentil *Potentilla erecta*, meadow buttercup *Ranunculus acris*, yellow-rattle, devil's-bit scabious *Succisa pratensis* and clovers. Other associated species include quaking-grass *Briza media*, bugle *Ajuga reptans*, common knapweed, heath-spotted orchid *Dactylorhiza maculata subsp. ericetorum*, sharp-flowered rush *Juncus acutiflorus*, bitter-vetch *Lathyrus montanus*, lousewort *Pedicularis sylvatica*, saw-wort *Serratula tinctoria*, betony *Stachys officinalis* and the locally uncommon dyer's greenweed *Genista tinctoria*. Wet hollows dominated by sharp-flowered rush support additional species such as sneezewort *Achillea ptarmica*, common spotted-orchid *Dactylorhiza fuchsii* and meadowsweet *Filipendula ulmaria*.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

TWENTY-FIVE ACRE WOOD

Date of Notification: 1981

National Grid Reference: SO 066664

O.S. Maps: 1:50,000 Sheet number: 147
1:25,000 Sheet number: SO 06

Site Area: 13 ha

Description:

A gently sloping south-facing oakwood developed on acidic, poorly draining clay overlying Ordovician strata. It has close affinities with the lowland hazel-sessile oak facies of the acid birch/oak woodland grouping. The wood is largely composed of mature maiden trees of oak with occasional alder and birch. Grazing in the southern portion is light and in the northern part is largely confined to winter and early spring. In winter cattle are fed in the northern part, but poaching of the soil is only localised.

There is a well developed diverse shrub and ground flora. Damper areas support species such as meadowsweet *Filipendula ulmaria*, common valerian *Valeriana officinalis* and sanicle *Sanicula europaea*, whilst yellow pimpernel *Lysimachia nemorum* is generally abundant. Dry areas tend to be less species-rich with only occasional bluebell *Endymion non-scriptus* in a predominant grass layer with wood stitchwort *Stellaria nemorum* and local occurrences of bracken *Pteridium aquilinum*.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

COED BRYN-PERSON

<u>Date of Notification:</u>	1981, 1983
<u>National Grid Reference:</u>	SO 084724
<u>O.S. Maps:</u>	1:50,000 Sheet number: 147 1:25,000 Sheet number: SO 07
<u>Site Area:</u>	21.5 ha

Description:

This mixed deciduous woodland with sessile oak dominant has developed on predominantly well-drained Silurian (Wenlock and Ludlow) shales. It is on a moderately steep slope with a western aspect. Some of the oak trees are derived from secondary growth, but there is a good representation of large mature trees. There is a closed canopy and locally a well-developed understorey of birch, hazel and rowan. The ground layer is not very diverse except at the foot of the slope, where there is impeded drainage. The site includes the Bachell Brook with associated riparian marsh habitat. Locally uncommon species such as yellow loosestrife *Lysimachia vulgaris* and wood club-rush *Scirpus sylvaticus* occur here. In association with the nearby Tyfaenor Park woodlands, this area is of considerable ornithological importance, with good populations of typical western oakwood bird species, including woodpeckers, flycatchers and warblers. Birds of prey also breed in the woodland.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

FAR HALL MEADOW

<u>Date of Notification:</u>	1990
<u>National Grid Reference:</u>	SO 143680
<u>O.S. Maps:</u>	1:50,000 Sheet number: 148 1:25,000 Sheet number: SO 16
<u>Site Area:</u>	3.8 ha

Description:

This site comprises a single traditionally managed hay meadow situated on level ground in the flood-plain of the River Aran near Dolau. It supports an uncommon vegetation type that is more normally associated with the river valleys of central and southern England.

The sward is characterised by an abundance of common bent *Agrostis capillaris*, sweet vernal-grass *Anthoxanthum odoratum*, soft-brome *Bromus hordeaceus* subsp. *hordeaceus*, crested dog's-tail *Cynosurus cristatus*, red fescue *Festuca rubra*, Yorkshire-fog *Holcus lanatus*, great burnet *Sanguisorba officinalis*, lesser trefoil *Trifolium dubium*, red clover *T. pratense* and white clover *T. repens*, with frequent perennial rye-grass *Lolium perenne*, ribwort plantain *Plantago lanceolata*, meadow buttercup *Ranunculus acris*, yellow-rattle *Rhinanthus minor* and common sorrel *Rumex acetosa*. Meadow foxtail *Alopecurus pratensis*, yellow oat-grass *Trisetum flavescens*, marsh-marigold *Caltha palustris*, autumn hawkbit *Leontodon autumnalis* and tufted vetch *Vicia cracca* are all locally prominent, along with a wide range of other associates, including cuckooflower *Cardamine pratensis*, common knapweed *Centaurea nigra*, common mouse-ear *Cerastium fontanum*, heath spotted-orchid *Dactylorhiza maculata* subsp. *ericetorum*, meadow fescue *Festuca pratensis*, rough hawkbit *Leontodon hispidus*, oxeye daisy *Leucanthemum vulgare*, common bird's-foot-trefoil *Lotus corniculatus* and common dandelion *Taraxacum officinale*.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

ITHON VALLEY WOODLANDS

Date of Notification: 1981, 1983, 1989

National Grid Reference: SO 102658

O.S. Maps: 1:50,000 Sheet number: 147 and 148
1:25,000 Sheet number: SO 06 and SO 16

Site Area: 19 ha

Description:

The site is an important example of semi-natural mixed deciduous ancient woodland. It is relatively species-rich for woodland development on acid/neutral soils and contains uncommon plant species. The area is largely a plateau of level or gently east-facing slopes above the flood plain of the River Ithon. However, steeper ground occurs in the vicinity of the river and of east-flowing streams whose dingles dissect the plateau. The woodland is mainly open to grazing stock from the adjacent improved grassland, but in recent years the central area has been fenced out from stock.

The woodland is varied in structure, with moderately grown maidens of sessile oak *Quercus petraea* being the dominant trees. However, the steeper slopes have a variable quantity of ash *Fraxinus excelsior*, and on poorly draining slopes the occasional alder *Alnus glutinosa*. The shrub layer is well developed, with abundant hazel *Corylus avellana* throughout, and other shrubs including holly *Ilex aquifolium* on the drier areas and guelder-rose *Sorbus aucuparia* on the lower slopes. Other tree and shrub species include rowan *Sorbus aucuparia*, birch *Betula pendula* and *B. pubescens*, goat willow *Salix caprea* and hawthorn *Crataegus monogyna*. The drier areas are intermediate in character between the oak-birch-wood sorrel (*Quercus-Betula-Oxalis acetosella*) vegetation type and the more base-rich ash-rowan-dog's mercury (*Fraxinus-Sorbus-Mercurialis perennis*) community. They are, however, probably closer to the former despite a generally well developed herb layer with wood avens *Geum urbanum*, enchanter's-nightshade *Circaea lutetiana* and sanicle *Sanicula europaea*. Honeysuckle *Lonicera periclymenum* is also well represented. In grazed areas, the ground layer is more grass-dominated, with abundant creeping soft-grass *Holcus mollis* and frequent male-fern *Dryopteris felix-mas*.

The damp slopes are botanically varied since they include both flushed slopes and receiving sites. There are few clear boundaries between vegetation types, other than in association with topography. The wetter stands may be described as an alder-ash-yellow

pimpernel (*Alnus-Fraxinus-Lysimachia nemorum*) woodland, but alder is not well represented and the stands merge into types with affinities to both the vegetation communities described above. Characteristic is the presence of more ash and some guelder-rose, and a herb-rich layer including bugle *Ajuga reptans*, opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium*, remote sedge *Carex remota* and lady-fern *Athyrium filix-femina*. Locally uncommon species occurring in the varied area include broad-leaved helleborine *Epipactis helleborine*, herb-Paris *Paris quadrifolia* and, near the river, water avens *Geum rivale*.

The site also includes two small areas of pasture close to the river. These provide shelter to a variety of insects, including common butterfly species such as meadow brown *Maniola jurtina*. The river bank provides nesting sites for sand martins.

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**CYNGOR CEFN GWLAD CYMRU
COUNTRYSIDE COUNCIL FOR WALES**

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

POWYS

CWMSAISE

<u>Date of Notification:</u>	1997
<u>National Grid Reference:</u>	SO 140698
<u>O.S. Maps:</u>	1:50,000 Sheet number: 148 1:10,000 Sheet number: SO 16 NW, SO 17 SW
<u>Site Area:</u>	15.5 ha

Description:

Cwmsaise is of special interest for its neutral and acidic grasslands which have been maintained as part of the extensive, traditionally farmed pastures and meadows. There are also small areas of marshy grassland, woodland and scrub, as well as an extensive network of species-rich hedges, banks and ditches, and two watercourses.

Cwmsaise is situated in rolling hills at an altitude of 260-340m, 2km north of the village of Dolau. It consists of 19 enclosures, divided by ditches, banks which support a woodland flora, and relic, species-rich hedge lines. The fields lie on gentle to moderate south-facing slopes which run down to a brook. Two small tributaries of the River Aran are included in the site. The bedrock is composed of Silurian shales, which are overlain by free-draining brown earths, and in places by more water-retentive cambic stagnogleys. Small-scale variations in soil drainage and pH give rise to intimate, small-scale mosaics of neutral and acidic grassland, which grade into one another.

The neutral grassland is composed principally of red fescue *Festuca rubra*, Yorkshire-fog *Holcus lanatus*, sweet vernal-grass *Anthoxanthum odoratum*, common bent *Agrostis capillaris* and crested dog's-tail *Cynosurus cristatus*. A variety of other plants are also present, including common bird's-foot trefoil *Lotus corniculatus*, common knapweed *Centaurea nigra*, great burnet *Sanguisorba officinalis*, common spotted-orchid *Dactylorhiza fuchsii*, broad-leaved helleborine *Epipactis helleborine* and cat's ear *Hypochaeris radicata*. In some areas, the mosses *Rhytidiadelphus squarrosus* and *Calliargon cuspidatum* are abundant. Where the brown earths are more base-poor, these swards also contain tormentil *Potentilla erecta*, carnation sedge *Carex caryophyllea* and devil's-bit scabious *Succisa pratensis*.

The major constituents of the acidic swards at Cwmsaise are common bent, Yorkshire-fog, sweet vernal-grass, red fescue and sheep's fescue *Festuca ovina*. Lousewort *Pedicularis sylvatica*, tormentil, heath bedstraw *Galium saxatile* and red clover *Trifolium pratense* are amongst the more common herbaceous plants. This latter species is indicative of less acidic conditions, and common bird's-foot trefoil and common knapweed, which are more commonly associated with neutral soils, are also present in some parts of the sward. A distinctive variant of the predominant type of acidic grassland occurs the southern edge of the site, where the soils are

even more base-rich. In addition to the species described above, these areas support mountain vetch *Lathyrus montanus*, quaking-grass *Briza media*, betony *Stachys officinalis* and devil's-bit scabious. Elsewhere, damper sedge and rush-rich areas are interspersed with patches of acidic grassland.

The northernmost enclosure, at an altitude of over 300 m above sea level, consists of upland acidic grassland containing some heather *Calluna vulgaris*. Ridge and furrow topography indicate past ploughing or drainage. Tormentil, heath bedstraw and heath milkwort *Polygala serpyllifolia* are also found in the sward. Patches of mire, dominated by purple moor-grass *Molinia caerulea*, form a mosaic with the grassland.

Damper areas of rush-pasture occur along the water courses, and as isolated pockets where drainage is impeded. These are dominated by sharp-flowered rush *Juncus acutiflorus*, and associated species include common marsh-bedstraw *Galium palustre*, marsh-marigold *Caltha palustris*, marsh valerian *Valeriana dioica*, meadowsweet *Filipendula ulmaria*, wild angelica *Angelica sylvestris* and lesser spearwort *Ranunculus flammula*.

Woodland occupies some steep valley sides, and bracken, scrub and gorse have colonised parts of some enclosures, providing additional habitats for invertebrates and birds. No animal surveys have been carried out, but brown hares have been recorded at Cwmsaise.

The enclosures north of the track, and the verges, support the largest known population of adder's-tongue fern *Ophioglossum vulgatum* in Radnor. A few plants of wood bitter-vetch *Vicia orobus* occur in the neutral grassland.

Remarks:

The site boundary along the access road takes in the hedges and verges and adder's-tongue fern occur on the roadside banks.

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