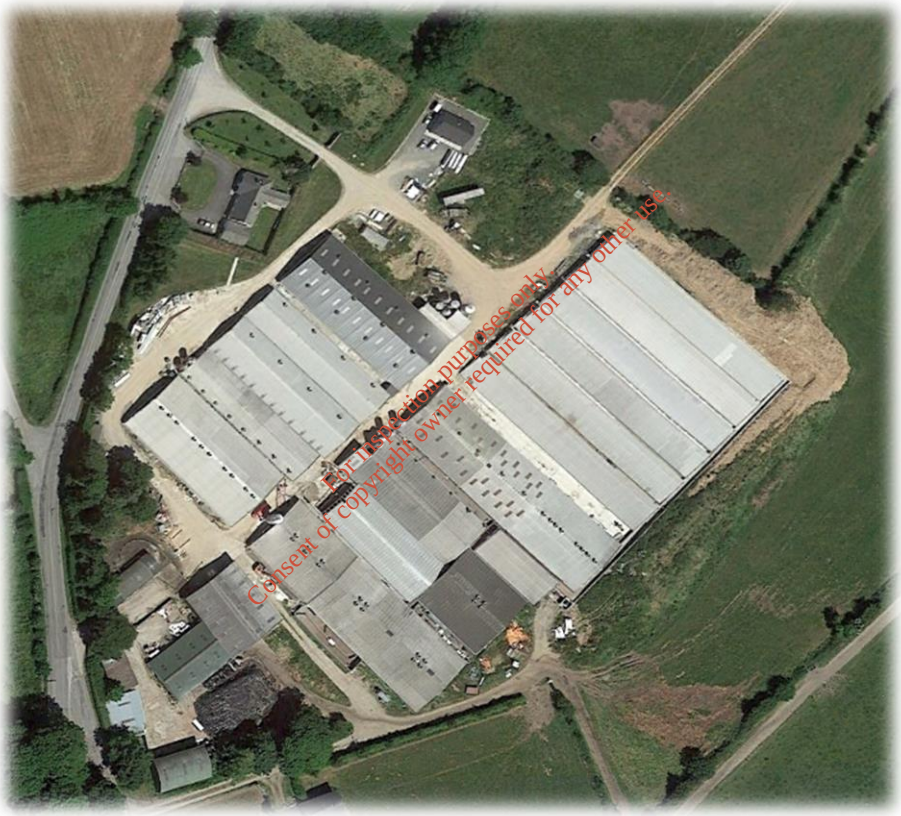
VOLUME 3

EIAR APPENDICES

For;

For 'BALLYFASKIN PIG FARM'

BALLYFAUSKEEN, BALLYLANDERS, CO LIMERICK



In relation to the application for; "increased capacity of the piggery from 600 sows to 1000 sows and their progeny in addition to new electrical substation will be constructed. The development requires EPA Industrial Emissions License (formerly Integrated Pollution Prevention and Control License)".

Prepared by

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October 2020

Signed by;

Dated ; 12/10/2020

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Appendix 1 – Noise Impact Assessment Report & Supplementary Report

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ENVIRONMENTAL NOISE IMPACT ASSESSMENT REPORT

BALLYFASKIN ENTERPRISES LTD
BALLYFASKIN, BALLYLANDERS,
CO. LIMERICK

2020

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DATE:	03rd March 2020	**REVIEWED:**	Mike Fraher, BSc.

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1.0 INTRODUCTION & SCOPE OF REPORT

Ballyfaskin Enterprises Ltd, whom operate a pig rearing facility at Ballyfaskin, Ballylanders, Co. Limerick, are seeking permission (Planning Ref:191135) from Limerick Co Co to increase the capacity of the piggery from 600 sows to 1000 sows and their progeny and the construction of a new electrical substation.

The farm was originally designed for the finishing of pigs at 130kgs, with an allowance of 1.1 M^2 of floor space per pig in accordance with Bord Bia specifications. The market has now shifted to a demand for pigs finished to a weight of between 100 to 110 kgs. Bord Bia specifications require an allowance of 0.65 M^2 per pig at these weights. Therefore, the capacity for the increase in pig numbers is already in place at the site and no additional development would be required.

The only construction which would occur would be a new electrical substation, which would be constructed to ESB / best practice standards.

Ballyfaskin Enterprises Ltd received the following request for further information:

Noise
A noise assessment should be carried out in accordance with BS 4142:2014 Methods for rating and assessing industrial and commercial sound to establish the potential impact on the nearest noise sensitive properties from the electric substation, as well as the potential impact due to increased noise levels from the development related to increase numbers of animals in the existing buildings, traffic movement and associated machinery…The baseline noise assessment should be carried out not taking into account the existing development.

A map of the site, site boundary, surrounding noise sensitive receptors and monitoring locations is provided in Appendix A.

This Noise Impact Assessment included:

1. Description of noise and the noise meter to be used.
2. Details and maps of the locations for noise monitoring stations.
3. Detailing the noise measurements obtained.
4. Calibration certificates for all noise monitoring equipment.
5. Determine the baseline noise levels at the closest sensitive receptors.
6. Predict the impact of the current operations and proposed new operations and construction on the closest noise sensitive receptors.
7. Discussion & Recommendations.

The survey was undertaken in accordance with the methodology specified in the '*BS4142:2014 – Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas'* as published by The British Standards Institution in 2014.

The report also presents and interprets the results of the survey with reference to the 2016 EPA '*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'.*

2.0 LEGISLATION AND GUIDANCE

Planning and Development Act (2000), as amended

Local authorities are responsible for the planning and environmental regulation of any proposed developments. The current planning and environmental regulatory framework requires these developments to comply with the Planning and Development Act (2000) and related regulations.

The local authorities and An Bord Pleanala attach conditions relating to environmental management of these developments to planning permissions granted. Local authorities consider the land use and planning issues associated with the proposed developments in their County Development Plans.

The EPA Act (Noise) Regulations 1994 (S.I. No. 179 of 1994)

The relevant part of the Environmental Protection Agency Act 1992 dealing with noise is Part VI, Sections 106 to 108. These Sections deal with the control of noise, the power of local authorities to prevent or limit noise and the issue of noise as a nuisance.

The 1994 Regulations came into effect in July 1994 and outline the procedures for dealing with noise nuisance. The Regulations allow affected individuals, local authorities or the EPA to take action against an activity causing a noise nuisance.

These Regulations replaced the procedures for noise complaints contained in the Local Government (Planning & Development) Act 1963. Companies must show that reasonable care was taken to prevent or limit the noise from their activities.

If the courts decide that a company is responsible for causing a noise nuisance, they can order the company to take measures to reduce, prevent or limit it.

Ballyfaskin Enterprises Ltd EPA IE Licence (Ref: P0915-01)

The farm to which this application applies operates under a licence issued by the EPA. Ballyfaskin Enterprises Ltd received an IPPC licence on the 10th June 2013. This licence was amended on the 16th December 2013.

Condition 4.1 and Schedule B.4 of the sites licence establish noise limits to which the site must comply, as follows:

Condition 4.1 Noise
Noise from the installation shall not give rise to sound pressure levels $L_{Aeq,\ T}$) measured at the noise sensitive locations of the installation which exceed the limit value(s).

Schedule B.4 Noise Emission Limits

Daytime dB $L_{Ar,T}$ (30 minutes)	Daytime dB $L_{Ar,T}$ (30 minutes)	Daytime dB $L_{Aeq,T}$ (15-30 minutes)
55	50	45

Note 1: There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise- sensitive location.

EPA (NG4) 'Guidance Note on Noise' (2016)

The document relates primarily to noise surveys and assessments for EPA licensed facilities but in the absence of any other directly applicable guidance documents, it also is pertinent for the purposes of noise surveys and assessments accompanying planning applications.

It deals in general terms with the approach to be taken in the measurement and control of noise, and provides advice in relation to the settling of noise ELV's and compliance monitoring. In line with World Health Organisation (WHO) guidance, it recommends that the following noise levels not be exceeded at the facades of the nearest noise-sensitive receptors:

Table 2.1: EPA (NG4) Recommended Noise Limits

Period	Times	Standard dB(A)	Low Background Noise Area dB(A)
Day	(07:00 to 19:00hrs)	55dB $L_{Ar,T}$	45dB $L_{Ar,T}$
Evening	(19:00 to 23:00hrs)	50dB $L_{Ar,T}$	40dB $L_{Ar,T}$
Night	(23:00 to 07:00hrs)	45dB $L_{Aeq,T}$	35dB $L_{Ar,T}$

Other EPA general EIA guidelines such as Guidelines on the Information to be Contained in Environmental Impact Statements [2002] and Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) [2003] have been considered in the preparation of this Noise and Vibration Chapter.

World Health Organisation Document 'Guidelines for Community Noise'

The World Health Organisation (WHO) published the document '*Guidelines for Community Noise'* in 1999/2000. This states that general outdoor noise levels of below 50dB LAeq during the day are desirable to prevent 'moderate' community annoyance. The guidance also recommends the LAeq should not exceed 30dB indoors if negative effects on sleep are to be avoided.

The World Health Organisation (WHO) published an extension document *'Environmental Noise Directive 2002/49/EC – Night Noise Guidelines for Europe'* in 2002. This states that outdoor noise levels should not exceed 40dB LAeq during the night to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly.

The World Health Organisation proposed *Guidelines for Community Noise* details that, if the daytime and evening LAeq for general steady, continuous noise in an outdoor living area exceeds 55 dB, then there is likely to be serious annoyance. If this value drops to 50 dB, then the annoyance factor becomes moderate. The guidelines also considered noise levels at which sleep disturbance would not take place. The guidelines suggest that an internal LAeq, 8hr not greater than 30 dB for continuous noise is needed to prevent negative effects on sleep. This is equivalent to a façade level of 45 dB LAeq, assuming open windows, or a free-field level of approximately 42 dB LAeq.

BS 4142:2014

The British Standard EN BS 4142 '*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*' provides a method for predicting the likelihood of impact from noisy activities such as industrial activities, quarries and landfills etc.

British Standard 4142:2014 Methods for rating and assessing industrial and commercial sound describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) sound from industrial and manufacturing processes;
b) sound from fixed installations which comprise mechanical and electrical plant and equipment;
c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

This standard is applicable to the determination of the following levels at outdoor locations:

a) rating levels for sources of sound of an industrial and/or commercial nature; and
b) ambient, background and residual sound levels, for the purposes of:
    1) investigating complaints;
    2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and
    3) assessing sound at proposed new dwellings or premises used for residential purposes.

BS4142 defines the following terms for describing existing and future noise levels:

Ambient Sound Level, La = $L_{Aeq,T}$
Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far, at the assessment location over a given time interval, T.

Specific Sound Level, Ls = $L_{Aeq,Tr}$
Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, Tr.

Residual Sound Level, Lr = $L_{Aeq,T}$
Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.

Background Noise Level, $L_{A90,T}$
A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

Rating Level, $L_{Ar,Tr}$
Specific sound level plus any adjustment for the characteristic features of the sound.

The standard states that, when possible, the background sound level should be measured at the assessment location. It should be ensured that the measurement time interval is of sufficient duration to obtain a representative value of the background sound level.

BS4142 notes that where it is not possible to determine the specific sound level directly by measurement, it may be appropriate to determine the specific sound level by a combination of measurement and calculation.

Certain acoustic features can increase the significance of impact over the basic comparison between the specific sound level and the background sound level.

Subjectively and where appropriate, such as for instances where a new, proposed sound cannot be measured, the specific sound level should be corrected if a tonal or impulsive characteristic is expected to be present.

A correction factor, typically of up to +6dB for tonal elements and up to +9dB for impulsive elements, may be applied arithmetically to the predicted noise from the proposed activity based upon the character of the noise, audibility and its likelihood to cause nuisance. This is termed the 'rating level'.

If the rating level exceeds the background L_{90} by 10 dBA or more, this is likely to be an indication of a significant adverse impact. A positive difference of around 5 dBA could be an indication of a significant adverse impact, depending on the context. The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact.

Table 2.2: BS 4142:2014 Tonal and Impulse Noise Penalties	
Tonality	**Impulsivity**
Just perceptible, apply a penalty of 2dB	Just perceptible, apply a penalty of 3dB
Clearly perceptible, apply a penalty of 4dB	Clearly perceptible, apply a penalty of 6dB
Highly perceptible, apply a penalty of 6dB	Highly perceptible, apply a penalty of 9dB

For other sound characteristics which are not tonal or impulsive but readily distinguishable, a penalty of 3dB can be applied.

Where a specific sound is intermittent and readily distinctive, a penalty of 3dB can be applied. If the subjective method is not sufficient for assessing the audibility or prominence of tones or impulsive sounds, identification can be made using the one-third octave method.

When making an assessment on the impact of a specific sound, an initial estimation is made by subtracting the measured background sound level from the rating level. Typically, the greater the difference, the greater the magnitude of impact:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact.
- A difference of around +5dB is likely to be an indication of an adverse impact.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

3.0 MEASUREMENT PARAMETERS

The parameters used to assess noise are as follows:

L_{eq}, T: The L_{AF} noise values recorded continuously at every instant during a given sampling period (T) are integrated by the noise metre to give a single value that represents the continuous equivalent sound level over the given period during this survey.

L_{10} and L_{90}: are both statistical noise levels. L_{10} indicates that for 10% of the monitoring period the sound levels were greater than the quoted value. L_{90} indicates that for 90% of the monitoring period, the sound levels were greater than the quoted value. L_{10} is used to express event noise. L_{90} is used to express background noise, usually filtering out load, and intermittent interferences such as traffic noise.

Continuous: noise produced without interruption.

Intermittent: noise that is punctuated with interruptions e.g. equipment operating in cycles or events such as single passing vehicle or aircraft.

Impulsive: a noise of short duration (typically less than one second), the sound pressure of which is significantly higher than the background; brief and abrupt.

Tonal: noise that contains a clearly audible tone i.e. a distinguishable, discrete or continuous note (whine, hiss, hum or screech etc.).

In order for a tone or impulsive element to warrant a penalty, it should be clearly noticeable and audible. Situations in which a penalty applies include the following:

- The noise contains a distinguishable, discrete continuous note (whine, hiss, screech, hum etc.).
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps).
- The noise is irregular enough to attract attention.
- The tonal components are clearly audible and the level in a 1/3rd octave band is greater than or equal to the following level in the two adjacent bands;
    - 15dB in low-frequency bands (25Hz to 125Hz);
    - 8dB in middle-frequency bands (160Hz to 400Hz), and;
    - 5dB in high-frequency bands (500Hz to 10,000Hz)

Noise measurements are usually 'A' weighted (to equate to human ear hearing) and the time-weighting 'Fast' is normally applied.

A-Weighted Decibels dB(A)

Noise, in its simplest form can be described as unwanted sound. Sound is the result of a propagating disturbance through a physical medium i.e. sound wave. Through air, it is perceived by the ear as a pressure wave superimposed upon the ambient air pressure about the ear of the listener. When the medium is a fixed body, it is called vibration.

'A' Weighting is standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. At low and high frequencies, the human ear is not very sensitive, but between 500 Hz and 6 kHz the ear is much more sensitive. In the A-weighted system, the decibel values of sounds at low frequencies are reduced compared with un-weighted decibels, in which no correction is made for audio frequency.

Sound level (Lp dB) and sound power (L_W dB) are physical quantities which measure derivatives of the energy associated with a sound that can be measured by recording instruments.

Loudness is a psycho-physical subjective measure of the perceived response by the human auditory system to a sound. The loudness level of a sound is determined by adjusting a sound pressure level of a comparison pure tone of specified frequency until it is judged by normal hearing observers to be equal in loudness. Loudness level is expressed in phons.

In the mid-frequency range at sound pressures greater than approximately 2 x 10^{-3} Pa (40 dB re 20 µPa SPL), the following table summarises the average subjective perception of noise level changes.

Table 3.1: WHO International: Fundamentals of Acoustics

Change in Sound Level (dB)	Change in Power		Change in Apparent Loudness
	Decrease	Increase	
3	1/2	2	Just Perceptible
5	1/3	3	Clearly Noticeable
10	1/10	10	Half or Twice as Loud
20	1/100	100	Much Quieter or Louder

As can be seen in the above table, an increase of 3 dB is double the sound power level, however, the change in loudness is just perceptible.

The term Leq is used to express the average noise level. It is measured in dB(A) and measured over a defined period of time. Specifically, it is the constant level equivalent to the same acoustic energy as a given event. The Leq is written as LAeq when it is measured with the A frequency weighting.

4.0 EQUIPMENT USED

The equipment used for the noise monitoring was a Cirrus CR:171B Sound Level Meter, and CR:515 Acoustic Calibrator. Both the CR:171B meter and CR:515 calibrator were calibrated externally on 18th July 2019.

A calibration check of 94 dB(A) at 1kHz was carried out on the instrument before and after measurement. The calibrator is a Class 1 grade, which conforms to IEC 60942:2003.

The difference between the initial calibration value, any subsequent calibration check, and a final calibration check on completion of measurements did not exceed 0.5 dB, and the instrument calibration was found to be satisfactory.

Measurement periods were appropriate to establish a typical noise level reading at each location in order to establish a dB(A) $L_{Aeq}(T)$ reading.

5.0 METEOROLOGICAL CONDITIONS

Weather conditions during the survey were dry and calm with wind speeds of less than 5 m/s (the preferred limit for taking measurements).

The Sound Level Meter was also fitted with a windshield to minimise interference from meteorological conditions.

6.0 METHODOLOGY

6.1 BASELINE NOISE ASSESSMENT METHODOLOGY

The facility is located in an area rural in character with residences in the area predominantly linearly aligned along the existing road network.

Several submissions have been made with respect to the proposed development stating noise as a concern. All of the submission noise sensitive receptor locations are arrayed to the north of the proposed development at distances of 195m to 1.3km from the existing farm boundary.

As the primary determinant of noise impact at this development would be distance from the noise source, this study has taken the approach of assessing potential noise impacts at the closest northern noise sensitive receptor location. Potential noise impacts at residences further from the farm would be less than that at the closest noise sensitive receptor. The closest third-party noise sensitive receptor to the farm is as follows:

- NSR1 – Residence *c.*195m north of the existing farm boundary.

Baseline noise monitoring was carried out in general accordance with the British Standard EN BS 4142 '*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*'.

Monitoring was carried out at an Ambient Noise (AM) monitoring location, where noise from the site was dominant and clearly audible, and at a Background Noise (BG) monitoring location, where the site was not audible and had no impact on the noise levels.

From the Ambient Noise Levels, it is possible to calculate a Specific Noise Level and a Rated Noise Level. This Rated Noise Level is then compared against the measured Background Noise Levels in order to determine the impact as a result of the facility.

Table 6.1: Noise Monitoring Locations

Ref. No.	Grid Ref	Location Type	Location
AN1	R 79096 23486	Ambient Noise Monitoring	North-Eastern Boundary
BG1	R 79167 24318	Background Noise Monitoring	Gateway *c.*880m North of the Site Boundary

Grid Ref Source: http://irish.gridreferencefinder.com

All measurements were taken at:

- 1.2 – 1.5 metres height above local ground level
- 1.0 – 5.0 metres away from reflective surfaces

These monitoring points are mapped in Appendix A.

Additional monitoring of existing noise sources was carried out where applicable.

6.2 NOISE PREDICTION METHODOLOGY

BS EN ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

The noise prediction methodology used in this report is based upon the international standard ISO 9613-2 "*Attenuation of Sound during Propagation Outdoors*". This standard outlines a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.

The central formula for this calculation is as follows:

$$A = A_{div} + A_{gr} + A_{bar} + A_{misc}$$

Where:

A is the attenuation due to site conditions
A_{div} is the attenuation due to the geometrical divergence (distance from source)
A_{gr} is the attenuation due to the ground effect
A_{bar} is the attenuation due to a barrier
A_{misc} is the attenuation due to miscellaneous other effects as appropriate

This attenuation factor is then subtracted from the predicted operational noise at the proposed activity. The resultant figure is the predicted noise from the proposed activity at a given noise sensitive location.

This figure may then be added logarithmically to the existing background noise at the noise sensitive location to attain the predicted noise level if the proposed activity were to begin.

Relevant Formulae

In order to carry out this predictive analysis, the following attenuation characteristics have been taken into account:

Divergence – A_{div}

The geometrical divergence accounts for the spherical spreading in the free field from the point sound source, causing attenuation due to the inverse square law. Divergence is calculated as follows:

$$A_{div} = 20.\log_{10} (d/d_0) + Q$$

Where:
d is the distance from the source to the receiver (m)
d_0 is the reference distance (1 m)
Q is a constant relating the sound power level to the sound pressure level at a reference distance d_0 which is 1 meter from a point source.

When a directivity factor is included, this attenuation figure converts the source Sound Power Level (L_W) to Sound Pressure Level (Lp). The calculation is frequency independent, therefore if the source noise is presented as A-weighted, the resulting receptor noise is also A-weighted.

BS EN ISO 12354‑4:2017 Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 4: Transmission of indoor sound to the outside

ISO 12354-4:2017 specifies a calculation model to estimate the sound power level radiated by the envelope of a building due to airborne sound inside that building.

The method defines the sound power level (L_W) of a calculated substitute point source for noise break out from the building elements and openings in a building.

Annex F of BS12354-4 provides a method for estimating the A-weighted Sound Power Level (L_{WA}) of a substitute point source at the façade of a building where the single figure internal A-weighted Sound Pressure Level (L_{pA}) and single figure Sound Reduction Indices (Rw / Dn,e,w) of building elements are known.

The following formulas from Annex F of BS12354-4 are used to determine the Sound Power Level (L_{WA}):

$$L_{WA} = L_{pA,in} - 6 - X'_{As} + 10 \lg \frac{S}{S_o} \quad \text{(F.1)}$$

where

$L_{pA,in}$	is the A-weighted sound pressure level at 1 m to 2 m from the inside of segment j, in decibels;
X'_{As}	is the quantity characterizing the A-weighted sound level difference over segment j for source spectrum *s*, in decibels;
S	is the area of segment j, in square metres;
S_o	is the reference area, in square metres; S_o = 1 m².

$$X'_{As} = -10 \lg \left(\sum_{i=1}^{m} \frac{S_i}{S} 10^{-\left(R_{w,i} + C_{s,i}\right)/10} + \sum_{i=1}^{m} \frac{A_o}{S} 10^{-\left(D_{n,e,w,1} + C_{s,i}\right)/10} \right) \quad \text{(F.2)}$$

where

$R_{w,i}$	is the weighted sound reduction index of element i, in decibels;
$D_{n,e,w,i}$	is the weighted element normalized level difference of a small element i, in decibels;
$C_{s,i}$	is the spectrum adaptation term for spectrum s of element i, in decibels;
S_i	is the area of element i, in square metres;
A_o	is the reference absorption area, in square metres; A_o = 10 m²;
m	is the number of large elements of the segment;
n	is the number of small elements of the segment;

The sound pressure level at a reception point outside the building is determined from the contributions of each substitute point source according to:

$$L_p = L_W + D_c - A_{tot} \quad \text{(1)}$$

where

L_p	is the sound pressure level at a reception point outside the building due to the sound radiation of a substitute point source, in decibels;
L_W	is the sound power level of the substitute point source, in decibels;
D_c	is the directivity correction for the substitute point sources in the direction of the reception point, in decibels;
A_{tot}	is the total attenuation that occurs during sound propagation from the substitute point source to the reception point, in decibels.

Note: In this assessment, the directivity correction (Dc / Q) has been incorporated into the Atot figure, in compliance with BS 9613-2.

6.3 NOISE SOURCE SPECIFICATIONS

6.3.1 Electrical Substation

The only construction and new equipment which would occur as a result of the proposed development would be the installation of an ESB Sub-station at the site.

The model of the transformer has not been chosen as yet, however, it would be chosen from the list provided in Appendix D. The specified sound power level (LwA) ratings for this equipment range from 51 dB to 83 dB.

The maximum LwA 83 dB (LpA 72 dB) rated transformer has been chosen for this assessment.

The transformer would be enclosed within the proposed sub-station building, as defined within the drawings submitted with the planning application. The construction of the walls of the building would be a concrete block cavity wall, with a 450mm inner leaf, 200mm cavity and 230mm outer leaf, plastered outer leaf.

No sound reduction index (Rw) could be found for this construction, and a reduction index for a similar construction of Rw 55 dB (100mm-75mm-100mm cavity wall, 13mm plaster both sides) has been used. As this construction would be of a lower mass than the proposed construction, it is anticipated that predicted noise impact levels will be over-estimated.

6.3.2 Pig Vocalisations

The request for further information has instructed to assess potential noise impacts as a result of the *increase to numbers of animals in the existing buildings, traffic movement and associated machinery*.

It is proposed to increase the capacity of the piggery from 600 sows to 1000 sows and their progeny at the farm.

In order to define noise levels from pigs at the site, source noise measurements were taken at external locations to sheds and escaping pig noise was recorded. Noise was recorded in the vicinity of doors and openings to the sheds in order to capture the maximum noise escaping.

In general, low level pig communications were not audible at external locations. Only high distress vocalisations were audible outside of the buildings. These occurred from individual pigs and were intermittent.

From a review of relevant literature, noise issues typically occur at pig farms during feeding and loading for transport. Where pigs are fed at set times in the day, and particularly where feed delivery is by farm operators, significant noise can occur from pigs in anticipation of feed. Noise can also occur as pigs are moved to a confined loading area to the trailer.

At the Ballyfaskin farm, pigs are fed using a best practice *ad libitum* mechanised feed delivery system. Feed is delivered continuously as required based on low level sensors within feed troughs. Therefore, no anticipatory noise from pigs is expected at the farm.

On the evening before loading and transport is to occur, farm operators move pigs into the loading area, in order to allow the pigs to settle prior to loading. This minimises the effort for operators during loading, as the pigs are not as agitated and, consequently, reduce noise generated as a result of loading. The loading bay is also located at the southern area of the farm, and noise propagating to the north would be shielded by the existing farm buildings.

It is noted that the intensity of noise from loading of pigs would not be expected to change as a result of the proposed development. However, the frequency of loading pigs would increase as the number of pigs onsite would increase.

As a result of the above, it is considered that the general noise levels of pigs at the farm would not significantly increase as a result of the proposed development due to the existing noise insulation properties of the farm buildings and the existing farming practices. General background noise levels at the farm would continue to be dominated by the operation of fans.

However, it is considered that the frequency of high pig vocalisations would increase as pig numbers at the site increase. The increased frequency may cause the proposed changes at the site to result in additional noise impact.

In order to define the maximum noise from pigs at the farm, maximum noise events of high pig vocalisations were selected from onsite monitoring. At 1 metre from building facades / openings, the average sound pressure level (Lp) of pig squeal events was found to be 82.4 dB LAFmax, and ranged from 87.4 dB LAFmax to 79.9 dB LAFmax.

The sound power level Lw of 95.4 dB LAFmax has been used in this assessment to represent maximum pig noise.

6.3.3 Site Traffic

The request for further information has instructed to assess potential noise impacts as a result of the *increase to numbers of animals in the existing buildings, traffic movement and associated machinery*.

Traffic noise associated with the site would include staff arriving and leaving the farm, slurry tractors during the open landspreading period and transport lorries removing pigs from the site.

The maximum expected noise impact which would occur as a result of traffic noise at the site would be due to animal haulage lorries. By necessity, for animal welfare reasons, pigs are loaded early in the morning so that loading and transport can occur in the cooler part of the day. Therefore, lorries would be leaving the site during the early morning, as is stated within submissions to the planning application.

Lorries enter the site from the southern entrance, at the dairy farm gate, and back-up to the loading bay on the southern boundary of the pig houses. When loaded, haulage lorries drive to the western side of the farm and then north along the yard to the exit gate in the north-western corner. Lorries then exit the site and turn left (south) on the R662, towards Mitchelstown and access to the motorway.

The ambient noise level of the area would be lower at this time of the morning, and therefore, the potential impact of noise from lorries would be increased.

Similarly as would occur with noise from pigs, as discussed above, it is not anticipated that noise from transport lorries would increase individually. Rather, the potential impact of the proposed development would be due to the expected increase in frequency.

In order to represent the maximum noise potential level of lorries traveling onsite and exiting the site, source noise levels have been taken from BS 5228-1 (2009) *Code of Practice for Noise and Vibration Control on Construction and Open Sites*. This guidance provides standard noise levels for typical industrial vehicles conducting tasks, idling and maximum pass-by noise level.

This report will use a sound pressure level (LpA) of 80 dB @10m drive-by maximum sound level for a 39t full road lorry conducting haulage (C6.21) (LpA 100 dB @1m or LwA 111 @1m).

7.0 MEASUREMENT RESULTS

The results summary tables below show the noise measurement results at all monitoring locations.

Associated particulars such as a description of the noise, the equipment operational/audible at each location and any interferences/background noise recorded are also provided in Appendix B.

For this assessment, the daytime monitoring was carried out between 11:17am and 18:06pm on Wednesday 5th February 2020, while night-time monitoring was carried out between 21:58pm on Wednesday 5th February and 01:25am Thursday 6th February 2020.

7.1 AMBIENT NOISE LEVELS - RESULTS

Definition:
Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far, at the assessment location over a given time interval, T.

Ambient Noise (Leq) measurements were taken at the site boundary location where the facility was still clearly audible and the dominant noise source.

Monitoring locations are mapped in Appendix A.

BS4142:2014 guidance recommends a 60-minutes monitoring period during the day from 07:00 - 23:00 and a shorter monitoring period of 15-minutes at night from 23:00 - 07:00. For this assessment the following reference time intervals were used to measure the ambient noise levels:

- 60-minutes duration during the daytime hours
- 30-minutes duration during the night-time hours

Table 7.1: Measured Ambient Noise Levels					
Ref	**Location**	**Time**	**L_{Aeq}**	**L_{A10}**	**L_{A90}**
Daytime					
AN1	North-Eastern Boundary, *c.*135m E-SE of site entrance	12:37	**53**	53	44
Night-time					
AN1	North-Eastern Boundary, *c.*135m E-SE of site entrance	00:20	**40**	43	36

7.2 BACKGROUND NOISE LEVELS - RESULTS

Definition:
A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

In order to determine the Background (L_{90}) noise levels at the closest noise sensitive receptors, monitoring was carried out at locations that represent the noise level that would be experienced at the NSR's in the absence of facility related noise.

Monitoring locations are mapped in Appendix A.

BS4142:2014 guidance recommends a 60-minutes monitoring period during the day from 07:00 - 23:00 and a shorter monitoring period of 15-minutes at night from 23:00 - 07:00. For this assessment the following reference time intervals were used to measure the ambient noise levels:

- 60-minutes duration during the daytime hours.
- 30-minutes duration during the night-time hours.

Table 7.2: Measured Background Noise Levels					
Ref	**Location**	**Time**	**L_{Aeq}**	**L_{A10}**	**L_{A90}**
Daytime					
BG1	Gateway *c.*880m North of the Site Boundary	11:17	62	55	**35**
Night-time					
BG1	Gateway *c.*880m North of the Site Boundary	21:58	58	42	**28**

7.3 PREDICTIVE NOISE ASSESSMENT - RESULTS

In order to determine the potential impact of noise from the proposed changes at the farm, the resultant noise levels at noise sensitive receptors have been calculated.

7.3.1 Prediction of Electric Sub-station Noise

It is assumed that the rear gable of the electric sub-station would face towards the north.

	Width (m)	Height (m)	Number (#)	S (m^2)
Gable Wall	4.000	2.715	1	10.860
			S (wall)	**10.860**
			S (total)	**10.860**

The following table determines the A-weighted sound level difference for the segment:

Attenuation Calculation	Concrete
Rw / Dn,e,w	55
Cs	0
Si	10.860
S	10.860
A_0	-
(Si/S)*(10^-((Rw+Cs)/10))	3.16E-06
(A_0/S)*(10^-((Dn,e,w+Cs)/10))	-
X'As	**55.00**

The following table determines the A-weighted Sound Power Level (L_{WA}) of a substitute point source on the façade segment as per formula 1 above:

Table 7.3: Electric Substation Source Noise	
Substitute Point Source	**Values**
LpA, in (dB)	72
Diffusivity Term (Cd)	-6
X'As	55.00
S	10.86
S_0	1
LwA (dB)	**21.36**

7.3.2 Prediction of Noise Levels at Receptor Façade

The equivalent external sound power level for substation noise has been calculated in section 7.3.2. The external sound power level for pig vocalisations were monitored at locations around the pig sheds and have been discussed in section 6.3.2. As stated in section 6.3.3, maximum pass-by traffic noise from a haulage lorry has been sourced from BS5228.

The following table determines the equivalent sound pressure level (LpA) at the nearest receptor, based upon the formula for divergence between the source and receptor.

Lp = Lw-20Log(d/d0)-Q factor

Table 7.4: Predicted Sound Pressure Levels (LpA) at NSR1

Sound Pressure Level at Receptor	Sub-Station	Pig Noise	Traffic
L_{WA} (dB)	21	95	111
distance (m)	281	395	124
Q factor (dB)*	8	8	11
20Log(d) (dB)	49	52	42
Atotal (Adiv + Q)	57	60	53
L_{pA} (dB) at NSR1	<0	35	58

* Directivity factor (whole sphere = 11 dB, half sphere = 8 dB, quarter sphere = 5 dB)

The methodology outlined in BS4142 requires that predicted noise levels be compared to existing L_{90} figures at noise sensitive locations in order to determine the likely noise impact. The BS4142 assessment has been carried out in the following section.

A noise character penalty of +5 has been applied to noise levels in order to account for potential subjective annoyance factors for noise sources.

The following table determines the likelihood of noise impacts at the noise sensitive receptor following the BS4142 methodology:

Table 7.5: BS4142 Noise Assessment NSR1

Source	Background Noise (L_{90})	Predicted Noise			Difference from Background
		Predicted Noise	Predicted Penalty	Rating Level	
Daytime					
Sub-Station	35	0	-	0	-35
Pig Noise	35	35	+5	40	5
Haulage	35	58	+5	63	28
Night-time					
Sub-Station	28	0	-	0	-28
Pig Noise	28	35	+5	40	12
Haulage	28	58	+5	63	35

8.0 DISCUSSION

8.1 GENERAL DISCUSSION

Baseline noise monitoring was carried out in general accordance with the British Standard EN BS 4142 '*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*'.

Noise levels at the ambient noise monitoring location (AN1) (site noise dominant) were determined to be LAeq 53 dB during the daytime and LAeq 40 dB during night-time monitoring.

Noise at the farm boundary was found to be characterised by continuous low fan noise. Intermittent noise from construction/installation in the new mill shed, site car traffic, pig vocalisations and feed mixing equipment also added to on-site noise levels.

Noise levels at the background noise monitoring location (BG1) (site noise absent) was determined to be L_{A90} 35 dB during the daytime and L_{A90} 28 dB during night-time monitoring.

Noise at the background monitoring location was found to be characterised by distant low traffic noise and noise from wind in trees. Intermittent noise from traffic passing on the R662 and birds singing also added to background noise levels.

Existing farm noise levels recorded at AN1, when divergence to NSR1 is subtracted (c.239metres), would be in excess of 10 dB below the recorded background noise level for the area. Therefore, no potential noise impact would be anticipated due to the recorded existing farm noise level at noise sensitive receptors, as per the BS4142 methodology.

The noise limits defined in the sites EPA IE licence apply at noise sensitive receptor locations. However, the recorded activity noise at the boundary (AN1) was found to be in compliance with the $L_{Ar,T}$ 55 dBA day-time and $L_{Ar,T}$ 45 dBA night-time noise limits.

8.2 BS4142:2014 IMPACT ASSESSMENT

A BS4142 has been completed on the potential noise impacts which may occur as a result of the proposed permission (Planning Ref:191135) from Limerick Co Co to increase the capacity of the piggery from 600 sows to 1000 sows and their progeny and the construction of a new electrical substation.

BS4142 infers that for a given excess of the rating level over the background level, the impacts and potential likelihood of complaints are as follows:

Excess	Likelihood of Complaints	Interpretation of Impact
≥ 10dB	Likely	An indication of a significant adverse impact.
> 5dB	Possible	An indication of an adverse impact.
≤ 5 dB	Unlikely	An indication that it is unlikely that the specific sound source will have an adverse impact or a significant adverse impact.
< 0dB	Very Unlikely	An indication that the specific sound source will have a low impact.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

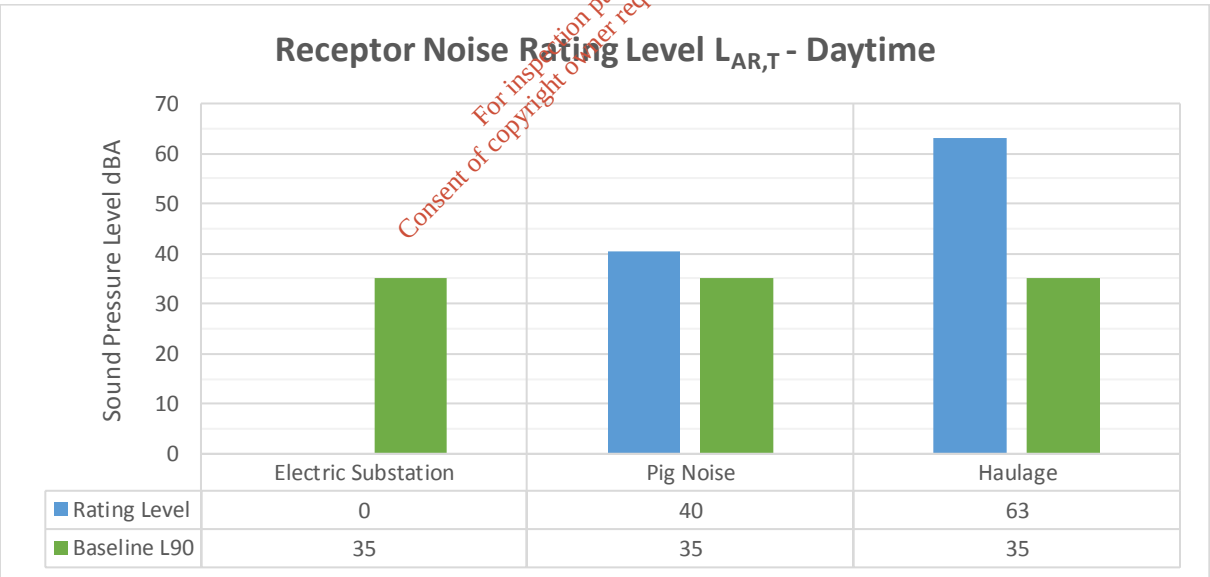


***Figure 8.1**: Daytime Background L_{90} vs Predicted Noise Levels at NSR1*

It should be noted that predicted noise levels only consider divergence, as this would be the primary parameter influencing noise between the source and receptor. Other parameters which would contribute the reduction of sound such as ground absorption, absorption by vegetation or existing barriers or buildings have not been considered. Therefore, this may be considered a worst case scenario for noise from the farm.

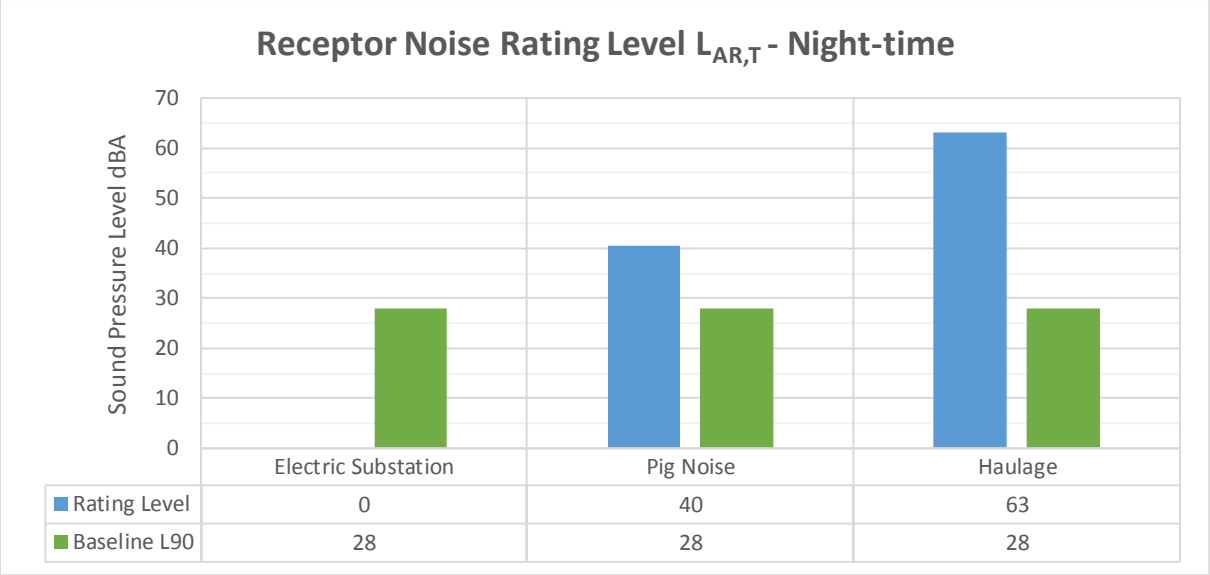


***Figure 8.2**: Night-time Background L_{90} vs Predicted Noise Levels at NSR1*

The predicted noise level for the Electric Substation was found to be less than 0 dB at NSR1. The predicted noise level at the substitute point source at the sub-station building façade was calculated to be Lw 21 dBA (Lp 13 dBA) which is below the recorded day-time and night-time background noise levels for the area. Therefore, there is not anticipated to be any potential for noise impacts as a result of the proposed sub-station at noise sensitive locations.

Maximum pig noise events (L_{AFmax}) have been predicted to generate noise levels at 5dB above existing day-time background noise levels and 12dB above existing night-time background noise levels at NSR1. Therefore, potential noise impacts / complaints would be considered "possible" to "likely", in accordance with the BS4142 methodology.

Maximum pass-by haulage lorry events (L_{AFmax}) have been predicted to generate noise levels at 28dB above existing day-time background noise levels and 35dB above existing night-time background noise levels at NSR1. Therefore, potential noise impacts / complaints would be considered "likely", in accordance with the BS4142 methodology.

8.3 PROPOSED NOISE MITIGATION MEASURES

In order to ensure that peak noise levels at the factory fall into the "very unlikely" or "unlikely" BS4142 categories, it would be necessary for noise mitigation to be applied to noise from the northernmost pig houses, and haulage lorries exiting the site.

A standard noise mitigation option is to install a barrier or earth berm around a noise source, or along the boundary facing a noise sensitive receptor. Depending upon the relative heights of the source, receptor and top of the barrier, theoretical noise reductions of up to 15 dB are possible. Actual noise reduction in the field is typically found to be circa 10 dB.

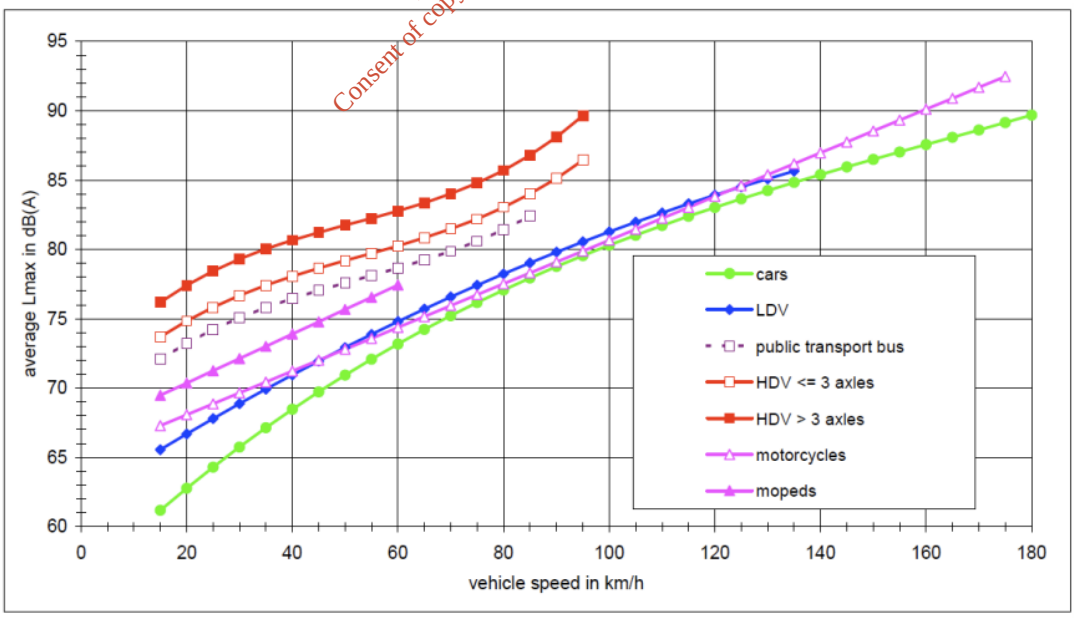
It is recommended that an earth berm be constructed along the northern boundary of the site. The earth berm should be a minimum of;

- 1.5m tall above the ground level of the entrance / exit roadway,
- 1.5m tall above the ground level of the pig house floor level.

Figure 8.3 below shows the recommended arrangement of the proposed earth berms in order to mitigate against noise from the pig houses and traffic exiting the farmyard.

***Figure 8.3**: Potential arrangement of proposed noise barrier*

It is also recommended that a site speed limit be set to 20 km/h within the farm. As can be seen from the following graph, the modelled maximum pass-by noise level of Lp_{AFmax} 100 dB used in this report would be a worst case scenario. Noise levels reported in the above graph range from Lp_{AFmax} 76 to 90 dB for Heavy Duty Vehicles > 3 axles.



(Source: Ellebjerg 2008a:12, Figure 2.1)

***Figure 8.4**: Average maximum noise emissions for different vehicle types in free flowing traffic.*

The limitation of onsite speeds to 20 km/h, and the installation of an earth berm along the exit road would minimise the potential for noise impacts to noise sensitive locations.

Hauliers should be informed of noise considerations when driving within the site and avoid any unnecessary revving, particularly at night. Signage should be placed at entrances and exits to the farm instructing hauliers to consider neighbours when exiting the site.

Following mitigation, potential maximum traffic noise levels (L_{AFmax}) are predicted to be at 15 dB (actual level L_{AFmax} 50 dB) above existing day-time background noise levels and 22 dB (actual level L_{AFmax} 50 dB) above existing night-time background noise levels at NSR1.

It is noted that traffic noise from cars passing the background noise monitoring location BG1 achieved L_{AFmax} noise levels of 86 dB during daytime monitoring and 88 dB during night-time monitoring. As such, predicted onsite traffic L_{AFmax} noise levels, following mitigation, would be significantly lower than existing traffic noise on the R662 road, which would be unaffected by the development.

9.0 CONCLUSIONS

The conclusions of this BS4142 assessment are as follows;

- Farm noise levels at the ambient noise monitoring location (AN1) (site noise dominant) were determined to be LAeq 53 dB during the daytime and LAeq 40 dB during night-time monitoring.

- Noise levels at the background noise monitoring location (BG1) (site noise absent) was determined to be L_{A90} 35 dB during the daytime and L_{A90} 28 dB during night-time monitoring.

- Existing farm noise levels recorded at AN1 would be in excess of 10 dB below the recorded background noise level for the area. As per the BS4142 methodology, this would be "*an indication that the specific sound source will have a low impact*".

- The recorded activity noise at the boundary (AN1) was found to be in compliance with the EPA IE licence $L_{Ar,T}$ 55 dBA day-time and $L_{Ar,T}$ 45 dBA night-time noise limits.

- The predicted noise level for the Electric Substation was found to be less than 0 dB at NSR1, more than 10 dB below day-time and night-time background noise levels. As per the BS4142 methodology, this would be "*an indication that the specific sound source will have a low impact*".

- L_{AFmax} noise from pig vocalisations and haulage lorries have been predicted to generate noise levels of 5 to 28 dB above day-time background noise levels and 12 to 35 dB above night-time background noise levels. As per the BS4142 methodology, this would be "*an indication an adverse, to significant adverse impact*".

- It has been recommended that the applicant provide for noise mitigation measures, to include
    - An earth berm along the northern boundary of the farm,
    - Onsite traffic speed limit of 20 km /h,

- Following implementation of the proposed noise mitigation measures, it is considered that the farm would have a low noise impact at NSR1 and complaints would be very unlikely, as defined in BS4142.

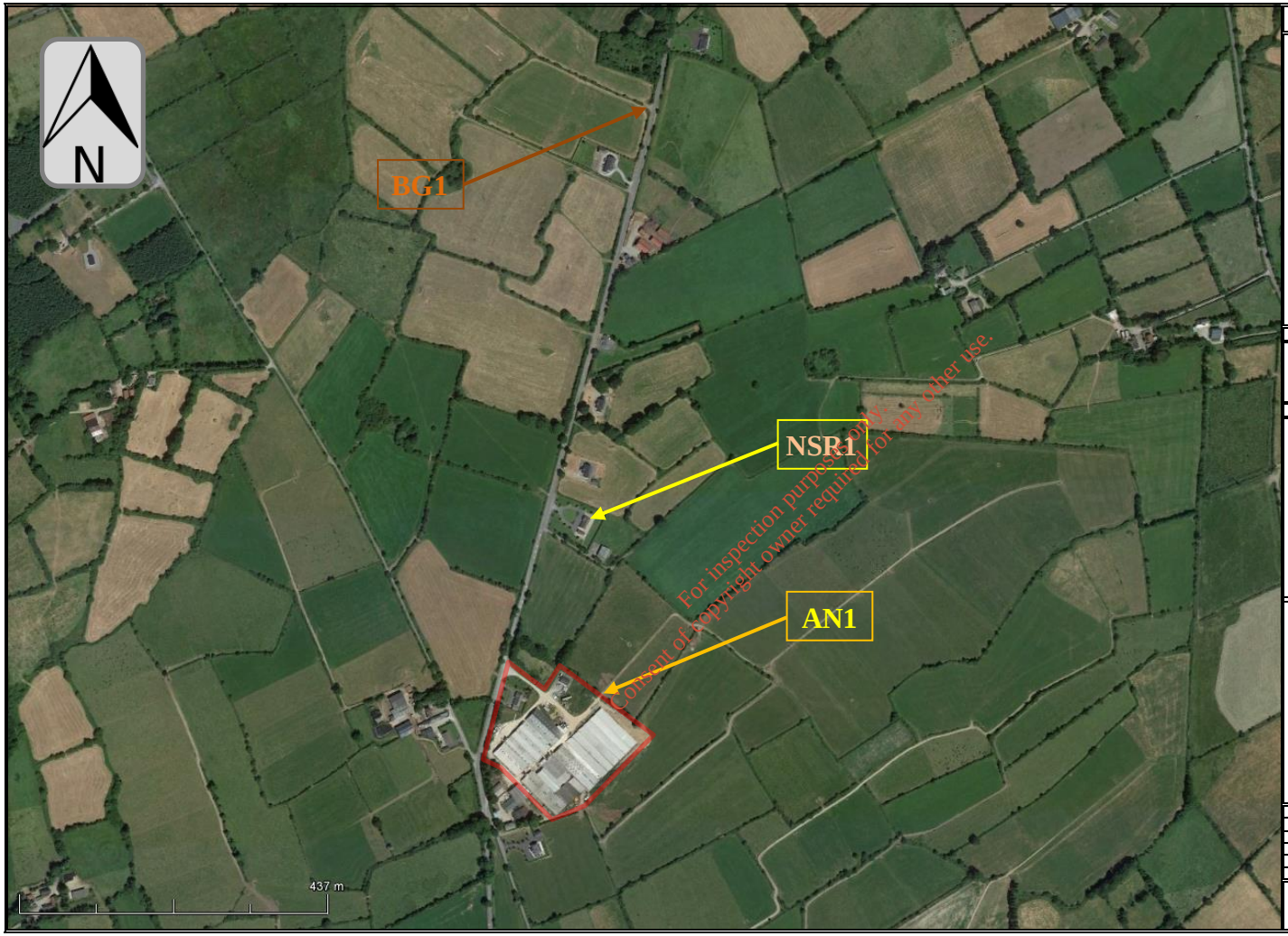
10.0 REFERENCES

- BS EN ISO 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound*.
- ISO 9613-2:1996 *Attenuation of Sound during Propagation Outdoors*.
- BS EN ISO 12354‑4:2017 Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 4: Transmission of indoor sound to the outside
- Grant S. Anderson and Ulrich J. Kurze, "*Outdoor Sound Propagation*," Chpt. 5 in Noise and Vibration Control Engineering – Principals and Applications, edited by L.L. Beranek and I.L. Vér, (John Wiley & Sons, NY, NY 1992).
- BS EN ISO 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites*.
- EPA (2016) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).*
- World Health Organization (1999) *Guidelines for Community Noise*, Birgitta Berglund, Thomas Lindvall, Dietrich H Schwela.
- BREF Document for Intensive Rearing of Poultry or Pigs (2017) Reference Document for the Intensive Rearing of Poultry or Pigs.
- Joint Research Centre "*Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry and Pigs*" Draft 2, European IPPC Bureau, August 2013.
- P. Mitchell (December 2009), "*Speed and Road Traffic Noise*" UK Noise Association.
- Ellebjerg, L. (2008) "*Noise Reduction in Urban Areas from Traffic and Driver Management*"

APPENDIX A

- SITE MAPS WITH MONITORING POINTS -

APPENDIX A: NOISE MONITORING LOCATIONS



Notes

– Boundary of Premises

Project Title:

Location Map 1

Client Name:

BALLYFASKIN ENTERPRISES LTD, BALLYFASKIN, BALLYLANDERS, CO. LIMERICK

PANTHER ENVIRONMENTAL SOLUTIONS LTD
UNITS 3 & 4
INNOVATION CENTRE
GREEN ROAD
CARLOW
R93 W248
TELE: 059 91 34222
MOBILE: 087 851 9284
EMAIL:info@pantherwms.com
WEB: www.pantherwms.com

Drawing Status:	Scale:	NTS	A4
Report	Datum:	Google Pro	
Drawing Number:	Drawn:	NR	
	Checked:	MF	
Revision:	Approved:	-	
R0	Date:	20/02/2020	

APPENDIX B

- NOISE MONITORING FIELD SHEETS -

Daytime

NOISE ASSESSMENT TABLE					
Reference	AN1	**Result**	**$L_{eq(30)}$**	53	NP
Location	North-Eastern Boundary		**L_{10}**	53	
Times	12:37 pm 05-02-2020		**L_{90}**	44	
Equipment Audible		**Description of Noise**			
Milling Shed. Feed Silos Fan Noise Pigs. Internal traffic.		Intermittent Construction Noise (installing equipment) Short period of silos discharging to mixer. V. lowly audible continuous fan noise. Intermittent pig vocalizations. Intermittent cars on farm hardcore.			
Interferences/ Background Noise	Traffic on R662, common. Bird Song. Tree in intermittent breeze.				
Meteorological Data	Dry, calm and cloudy, wind speeds <5m/s				
Assessment	• This daytime ambient noise monitoring location is situated on the north-eastern boundary of the site. • The monitoring point is approximately 18-meters north of the closest shed containing animals. • Road traffic and bird noise added to the background noise levels at this location. • The Leq and L_{10} were slightly elevated as a result of internal and external traffic and noise from equipment installation within the milling shed. • The L_{90}, which may be used to give an indication of the actual background noise in the area, was determined to be 44 dB(A). • The Leq at this location was determined to be 53 dB(A), which is below the 55 dB(A) limit as per the site EPA licence. • Site related noise at this monitoring location is therefore in compliance with the sites IE licence conditions.				

NOISE ASSESSMENT TABLE					
Reference	BG1	**Result**	**$L_{eq(30)}$**	62	NP
Location	Gateway *c.*880m North of the Site Boundary		**L_{10}**	55	
Times	11:17 am 05-02-2020		**L_{90}**	35	
Equipment Audible		**Description of Noise**			
N/A		N/A			
Interferences/ Background Noise	Traffic on the Adjacent R662 road. Distant traffic noise in other local roads. Bird Song.				
Meteorological Data	Dry, calm and cloudy, wind speeds <5m/s				
Assessment	• This daytime background noise monitoring location is situated *c.*880m north of the site boundary, at a distance when the site is not audible. • Traffic noise added to the background noise levels at this location. • The Leq and L_{10} were slightly elevated as a result of traffic noise from the adjacent local road. • The L_{90}, which may be used to give an indication of the actual background noise in the area, was determined to be 35 dB(A).				

Night-time

NOISE ASSESSMENT TABLE					
Reference	AN1	**Result**	**$L_{eq(30)}$**	40	NP
Location	North-Eastern Boundary		**L_{10}**	43	
Times	00:20 am 06-02-2020		**L_{90}**	36	
Equipment Audible		**Description of Noise**			
Fan Noise Pigs		V. lowly audible continuous fan noise. Intermittent pig vocalizations.			
Interferences/ Background Noise	Traffic on R662, intermittent. Tree in intermittent breeze.				
Meteorological Data	Dry, calm and cloudy, wind speeds <5m/s				
Assessment	• This night-time ambient noise monitoring location is situated on the north-eastern boundary of the site. • The monitoring point is approximately 18-meters north of the closest shed containing animals. • The Leq and L_{10} were slightly elevated as a result of intermittent road traffic and intermittent pig vocalisations, which added to the background noise levels at this location. • The L_{90}, which may be used to give an indication of the actual background noise in the area, was determined to be 36 dB(A). • The Leq at this location was determined to be 40 dB(A), which is below the 45 dB(A) limit as per the site EPA licence. • Site related noise at this monitoring location is therefore in compliance with the sites IE licence conditions.				

<table>
<tr><th colspan="6">NOISE ASSESSMENT TABLE</th></tr>
<tr><td>Reference</td><td>BG1</td><td rowspan="3">Result</td><td>$L_{eq(30)}$</td><td>58</td><td rowspan="3">NP</td></tr>
<tr><td>Location</td><td>Gateway c.880m North of the Site Boundary</td><td>L_{10}</td><td>42</td></tr>
<tr><td>Times</td><td>21:58 pm
05-02-2020</td><td>L_{90}</td><td>28</td></tr>
<tr><td colspan="3">Equipment Audible</td><td colspan="3">Description of Noise</td></tr>
<tr><td colspan="3">N/A</td><td colspan="3">N/A</td></tr>
<tr><td>Interferences/ Background Noise</td><td colspan="5">Traffic on the Adjacent R662 road.
Distant traffic noise in other local roads.</td></tr>
<tr><td>Meteorological Data</td><td colspan="5">Dry, calm and cloudy, wind speeds <5m/s</td></tr>
<tr><td>Assessment</td><td colspan="5">• This night-time background noise monitoring location is situated c.880m north of the site boundary, at a distance when the site is not audible.
• Traffic noise added to the background noise levels at this location.
• The Leq and L_{10} were slightly elevated as a result of traffic noise from the adjacent local road.
• The L_{90}, which may be used to give an indication of the actual background noise in the area, was determined to be 28 dB(A).</td></tr>
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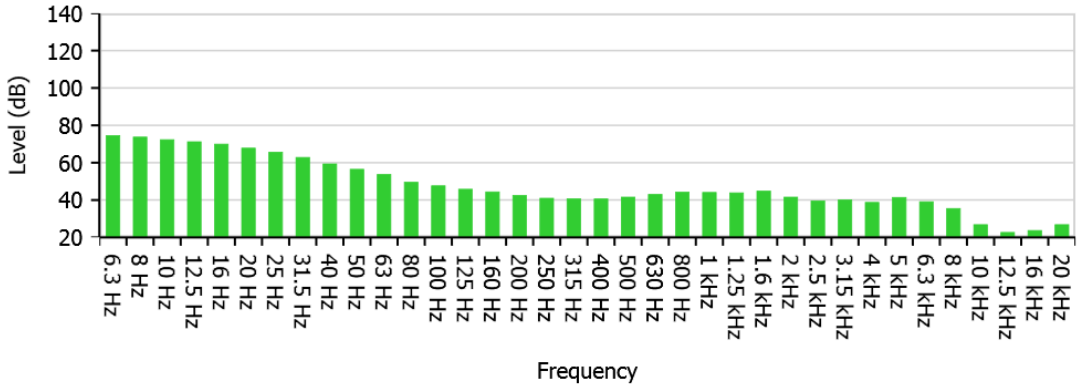
APPENDIX C

- AMBIENT NOISE THIRD OCTAVE SHEETS -

Daytime

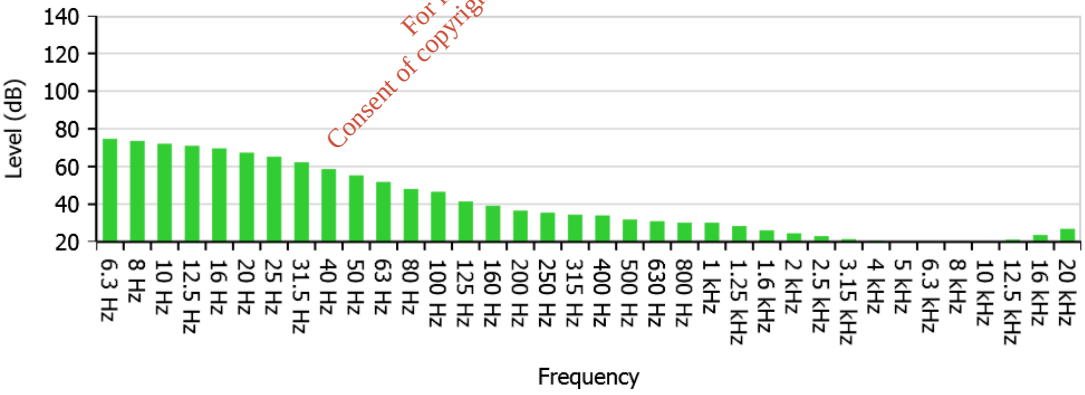
AN1 – 05/02/2020 (12:37 - 13:37)



Frequency (Hz)	6.3	8	10	12.5	16	20	25	31.5	40
Level (dB)	74.5	73.7	72.3	71.2	69.9	67.8	65.6	62.8	59.3
-	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**
-	56.4	53.7	49.6	47.6	45.7	44.3	42.4	41.0	40.6
-	**400**	**500**	**630**	**800**	**1 000**	**1 250**	**1 600**	**2 000**	**2 500**
-	40.5	41.5	43.0	44.2	44.1	43.8	44.8	41.5	39.5
-	**3 150**	**4 000**	**5 000**	**6 300**	**8 000**	**10 000**	**12 500**	**16 000**	**20 000**
-	40.0	38.7	41.3	39.1	35.4	26.8	22.6	23.7	26.8

Night-time

AN1 — 06/02/2020 (00:20 - 00:50)



Frequency (Hz)	6.3	8	10	12.5	16	20	25	31.5	40
Level (dB)	74.4	73.4	71.8	70.8	69.4	67.1	65.0	62.1	58.4
-	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**
-	55.1	51.6	47.9	46.3	41.2	39.0	36.3	35.2	34.3
-	**400**	**500**	**630**	**800**	**1 000**	**1 250**	**1 600**	**2 000**	**2 500**
-	33.8	31.6	30.8	30.0	30.0	28.1	26.0	24.3	22.8
-	**3 150**	**4 000**	**5 000**	**6 300**	**8 000**	**10 000**	**12 500**	**16 000**	**20 000**
-	21.3	20.4	19.1	18.6	18.6	19.3	20.9	23.4	26.7

APPENDIX D

- EQUIPMENT NOISE SPECIFICATIONS -

Electrical Sub-Station

Green efficiency

MF Trasformatori

CAST RESIN

TR-PA

from 100 to 3150 kVA - 17,5 – 24 kV
losses Ao - Ak according to
IEC EN 50541-1

GENERAL INFORMATION

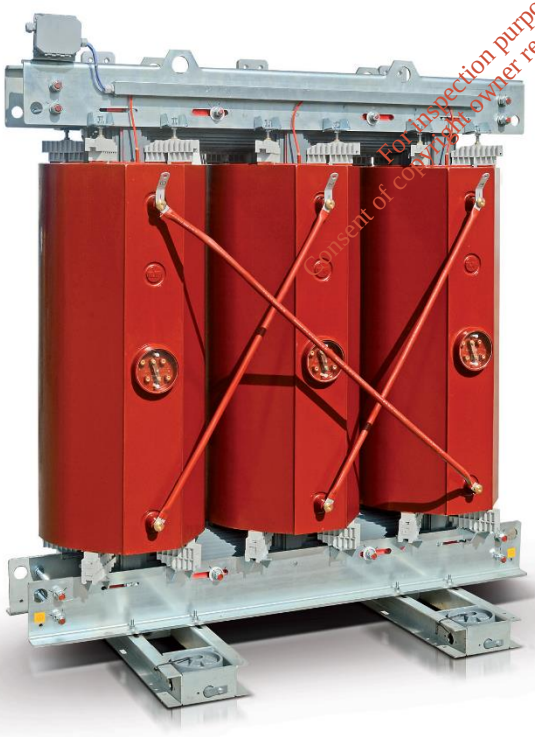
At present, the improvement of the energy efficiency cannot be considered a slogan anymore, but a need of our time. TR-PA series high efficiency transformers are created for this purpose guaranteeing:

- savings in operating costs of the plant, due to low values of losses.
- consumption reduction o f energy resources.
- reduction of CO_2 emissions.

ANNUAL SAVINGS (MAXIMUM) COMPARED TO TRANSFORMERS WITH LOSSES, ACCORDING TO HD 538.1 / HD 538.2

RATED OUTPUT kVA	100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
LOW CONSUMPTION (MWh)	3,8	5,3	6,7	12,7	9,2	18,4	24,1	26,3	34,2	29,8	51,7	71,8
LOW EMISSIONS CO_2 (T)	2,8	3,9	5,0	9,5	6,9	13,8	18,1	19,7	25,6	22,3	38,8	53,9
ENERGY SAVINGS TOE *	0,7	1,0	1,2	2,4	1,7	3,4	4,5	4,9	6,4	5,6	9,7	13,4

* TONNE OF OIL EQUIVALENT



PARTICULARITY

Reference norms :

- CEI EN 60067-1,2,3,4,5 -11
- CEI EN 50541-1

The phases of design and building, in addition to their compliance with IEC EN norms, take into account the following regulations:

- ISO 9001 : 2008 regarding the quality standards and procedures .
- ISO 14001 : 2004 regarding the environmental issues .

Easy and fast to install are suitable for use in:

- MV/LV prefabricated substation and substation with reduced dimensions.
- fire and pollution hazard areas.
- buildings with public access.

Moreover, their disposal is simple and with low environmental impact.

DESCRIPTION

The three-phase cast resin transformers have the following features:

- MV windings encapsulated in cast resin.
- LV windings impregnated with resin.

Magnetic core made using magnetic grain-oriented steel sheets with low loss, and the joints are Step-Lap inserted sheet.

- Level of partial discharges < 10 pC.
- Thermal class F – Temperature rise 100 K.
- Ambient temperature ≤ 40°C, altitude ≤ 1000 m.
- Self-extinguishing with low emission of gas, classification F1.
- Resistant to thermal shock, classification C2.
- Resistant to condensation and humidity, classification E2.

COMPLETION ACCESSORIES ALWAYS PROVIDED

- LV terminal connector plates
- MV voltage variation by off circuit tappings links
- Rating plate
- Lifting lugs
- 2 earthing points
- 4 bi-directional flat rollers

FROM 100 TO 3150 KVA 17,5 24 KV
LOSSES Ao - Ak ACCORDING TO
IEC EN 50541 1

Green efficiency

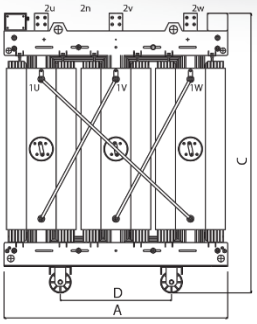
CAST RESIN

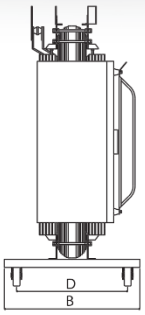
TR-PA

RATED OUTPUT kVA		100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
NO-LOAD LOSSES	W	280	350	520	750	1.100	1.300	1.550	1.800	2.200	2.600	3.100	3.800
LOAD LOSSES AT 75 °C	W	1.575	2.275	2.975	3.950	6.200	7.000	7.875	9.625	11.375	14.000	16.625	19.250
LOAD LOSSES AT 120 °C	W	1.800	2.600	3.400	4.500	7.100	8.000	9.000	11.000	13.000	16.000	19.000	22.000
NO-LOAD CURRENT	%	1	0,9	0,8	0,8	0,8	0,6	0,6	0,6	0,6	0,6	0,4	0,4
IMPEDANCE VOLTAGE	%	6	6	6	6	6	6	6	6	6	6	6	6
INRUSH CURRENT IE/IN		11,5	10,5	10,00	9,5	9,5	9	9	8,5	8,5	8	8	7,5
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	98,15	98,36	98,60	98,83	98,84	98,96	99,06	99,09	99,15	99,17	99,21	99,27
COSΦ 1 75% LOAD	%	98,45	98,65	98,83	99,01	99,03	99,13	99,20	99,23	99,28	99,30	99,34	99,38
COSΦ 0,9 100% LOAD	%	97,90	98,14	98,41	98,67	98,68	98,82	98,93	98,96	99,04	99,06	99,10	99,17
COSΦ 0,9 75% LOAD	%	98,25	98,47	98,68	98,88	98,90	99,01	99,10	99,13	99,19	99,21	99,25	99,30
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	1,74	1,59	1,36	1,16	1,16	1,05	0,96	0,95	0,89	0,88	0,84	0,79
COSΦ 0,9 100% LOAD	%	4,04	3,93	3,75	3,59	3,59	3,5	3,43	3,41	3,36	3,36	3,33	3,28
NOISE													
SOUND POWER LEVEL (LwA)	dB(A)	51	54	57	60	62	64	65	67	68	70	71	74

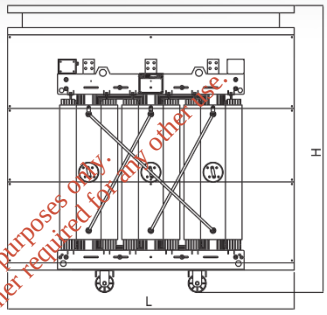
SIZES AND WEIGHTS (INDICATIVE)

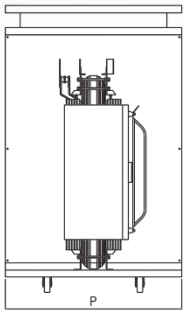
Without enclosure IP 00





With IP 31 Protective enclosure





INSULATION VOLTAGE 17,5 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.000	1.100	1.250	1.450	1.450	1.650	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	800	1.000	1.000	1.000	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.150	1.250	1.350	1.500	1.700	1.800	1.900	2.050	2.150	2.250	2.350	2.550
WHEEL INTERAXIS (D)	mm	520	520	520	670	670	820	820	820	1.000	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	600	750	1.000	1.400	1.750	2.150	2.550	2.900	3.400	3.900	4.750	6.100

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1.700	1.950	2.200	2.500	2.800
DEPTH (P)	mm	1.000	1.200	1.300	1.500	1.500
HEIGHT (H)	mm	1.850	2.000	2.400	2.650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

INSULATION VOLTAGE 24 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.100	1.150	1.250	1.450	1.650	1.650	1.650	1.900	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	1.000	1.000	1.000	1.200	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.200	1.350	1.400	1.550	1.750	1.850	1.950	2.050	2.150	2.250	2.400	2.550
WHEEL INTERAXIS (D)	mm	520	520	670	670	820	820	820	1.000	1.000	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	700	850	1.150	1.600	1.900	2.350	2.750	3.100	3.700	4.400	5.250	6.250

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1700	1950	2200	2500	2.800
DEPTH (P)	mm	1000	1200	1300	1500	1.500
HEIGHT (H)	mm	1850	2000	2400	2650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

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Green efficiency

MF Trasformatori

from 100 to 3150 kVA - 17,5 – 24 kV
losses Bo - Bk according to
IEC EN 50541-1

CAST RESIN

TR-PB

GENERAL INFORMATION

At present, the improvement of the energy efficiency cannot be considered a slogan anymore, but a need of our time.
TR-PB series high efficiency transformers are created for this purpose guaranteeing:

- savings in operating costs of the plant, due to low values of losses.
- consumption reduction of energy resources.
- reduction of CO_2 emissions.

ANNUAL SAVINGS (MAXIMUM) COMPARED TO TRANSFORMERS WITH LOSSES, ACCORDING TO HD 538.1 / HD 538.2

RATED OUTPUT KVA	100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
LOW CONSUMPTION (MWh)	1,4	1,5	2,0	2,3	3,5	4,4	4,4	6,1	6,1	8,8	12,3	14,9
LOW EMISSIONS CO_2 (T)	0,7	1,1	1,5	1,7	2,6	3,3	3,3	4,6	4,6	6,6	9,2	11,2
ENERGY SAVINGS TOE *	0,2	0,3	0,4	0,5	0,7	0,8	0,8	1,2	1,2	1,6	2,3	2,8

* TONNE OF OIL EQUIVALENT

PARTICULARITY

Reference norms :

- CEI EN 60067-1,2,3,4,5 -11
- CEI EN 50541-1

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- ISO 9001 : 2008 regarding the quality standards and procedures .
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Easy and fast to install are suitable for use in:

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- fire and pollution hazard areas.
- buildings with public access.

Moreover, their disposal is simple and with low environmental impact.

DESCRIPTION

The three-phase cast resin transformers have the following features:

- MV windings encapsulated in cast resin.
- LV windings impregnated with resin.

Magnetic core made using magnetic grain-oriented steel sheets with low loss, and the joints are Step-Lap inserted sheet.

- Level of partial discharges < 10 pC.
- Thermal class F – Temperature rise 100 K.
- Ambient temperature ≤ 40°C, altitude ≤ 1000 m.
- Self-extinguishing with low emission of gas, classification F1.
- Resistant to thermal shock, classification C2.
- Resistant to condensation and humidity, classification E2.

ACCESSORIES ALWAYS PROVIDED

- LV terminal connector plates
- MV voltage variation by off circuit tappings links
- Rating plate
- Lifting lugs
- 2 earthing points
- 4 bi-directional flat rollers

FROM 100 TO 3150 KVA 17,5 24 KV
LOSSES Bo - Bk ACCORDING TO
IEC EN 505411

Green efficiency

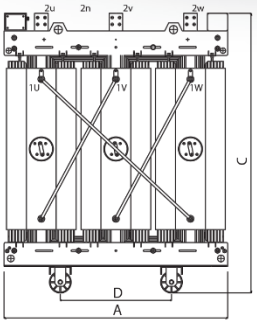
CAST RESIN

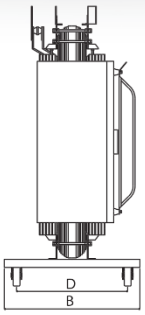
TR-PB

RATED OUTPUT kVA		100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
NO-LOAD LOSSES	W	340	480	650	940	1250	1.500	1.800	2.100	2.400	3.000	3.600	4.300
LOAD LOSSES AT 75 °C	W	1.800	2.550	3.325	4.800	6.650	8.225	9.625	11.375	14.000	15.750	20.125	24.500
LOAD LOSSES AT 120 °C	W	2.050	2.900	3.800	5.500	7.600	9.400	11.000	13.000	16.000	18.000	23.000	28.000
NO-LOAD CURRENT	%		1,2	1,4	1	0,8	0,8	0,8	0,8	0,6	0.8	0,6	0,6
IMPEDANCE VOLTAGE	%	6	6	6,00	6	6	6	6	6	6	6	6	6
INRUSH CURRENT IE/IN		12,3	12,9	12,00	11,8	11	9,6	9,4	9,2	9	8,8	8,8	8,4
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	97,87	98,11	98,41	98,57	98,75	98,79	98,86	98,92	98,98	99,06	99,05	99,09
COSΦ 1 75% LOAD	%	98,20	98,41	98,66	98,79	98,95	98,98	99,04	99,10	99,15	99,21	99,21	99,24
COSΦ 0,9 100% LOAD	%	97,58	97,86	98,20	98,37	98,58	98,62	98,70	98,78	98,84	98,93	98,92	98,96
COSΦ 0,9 75% LOAD	%	97,97	98,21	98,49	98,63	98,81	98,85	98,91	98,98	99,03	99,11	99,10	99,14
VOLTAGE DROP AT 75° C													
COSΦ 1 100% LOAD	%	1,96	1,76	1,50	1,37	1,23	1,2	1,14	1,09	1,05	0,96	0,98	0,95
COSΦ 0,9 100% LOAD	%	4,21	4,06	3,86	3,76	3,64	3,62	3,57	3,53	3,5	3,43	3,44	3,42
NOISE													
SOUND POWER LEVEL (LwA)	dB(A)	51	54	57	60	62	64	65	67	68	70	71	74

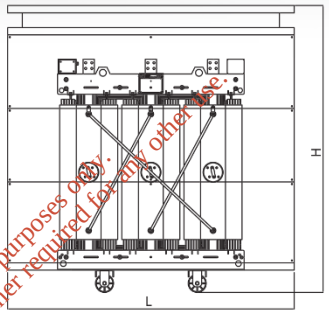
SIZES AND WEIGHTS (INDICATIVE)

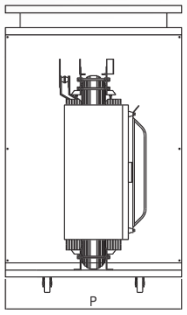
Without enclosure IP 00





With IP 31 Protective enclosure





INSULATION VOLTAGE 17,5 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.000	1.100	1.200	1.250	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	650	800	800	1.000	1.000	1.000	1.200	1.200	1.200
HEIGHT (C)	mm	1.100	1.200	1.350	1.500	1.700	1.800	1.850	2.050	2.150	2.250	2.350	2.400
WHEEL INTERAXIS (D)	mm	520	520	520	520	670	670	820	820	820	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	550	700	900	1.200	1.600	1.900	2.300	2.600	3.150	3.800	4.450	5.40

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1.700	1.950	2.200	2.500	2.800
DEPTH (P)	mm	1.000	1.200	1.300	1.500	1.500
HEIGHT (H)	mm	1.850	2.000	2.400	2.650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

INSULATION VOLTAGE 24 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.100	1.150	1.250	1.450	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	800	800	1.000	1.000	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.150	1.300	1.400	1.550	1.750	1.900	1.950	2.050	2.150	2.400	2.400	2.450
WHEEL INTERAXIS (D)	mm	520	520	670	670	820	820	820	820	1.000	1.000	1.000	1.000
WHEEL WIDTH	mm	40	40	40	40	50	50	50	50	50	50	50	50
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	600	750	900	1.350	1.750	2.000	2.450	2.700	3.400	3.900	4.750	6.050

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1700	1950	2200	2500	2.800
DEPTH (P)	mm	1000	1200	1300	1500	1.500
HEIGHT (H)	mm	1850	2000	2400	2650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

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MF Trasformatori

CAST RESIN

from 100 to 3150 kVA - 17,5 – 24 kV
losses Co - Bk according to
IEC EN 50541-1

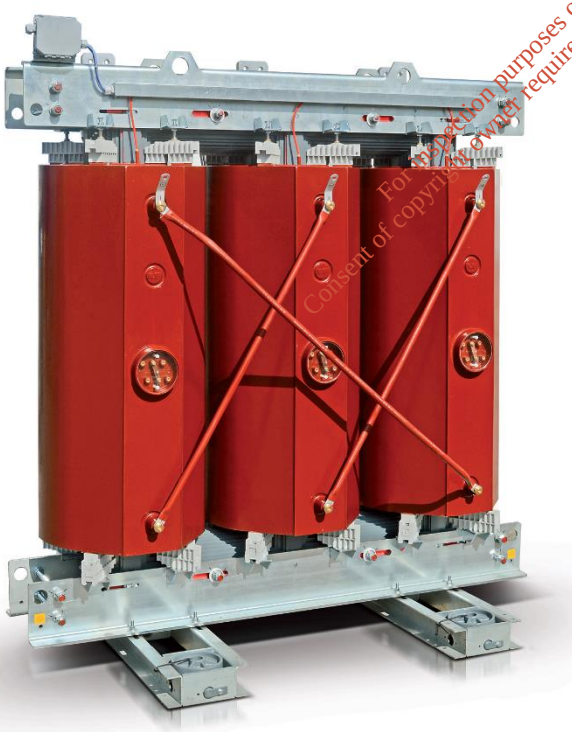
TR-PC

GENERAL INFORMATION

The new IEC EN 50541-1 has been prepared with the mission to improve the efficiency of the transformers.
This results in transformers with better efficiency which guarantee to our customers:

- savings in operating costs of the plant, due to low values of losses.
- consumption reduction of energy resources.

RATED OUTPUT kVA	100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
EFFICIENCY AT 75°C												
COSφ 1 100% LOAD	97,79	98,04	98,35	98,52	98,70	98,74	98,82	98,88	98,94	99,02	99,00	99,04
COSφ 1 50% LOAD	98,21	98,42	98,65	98,81	98,86	99,00	99,07	99,11	99,18	99,21	99,20	99,24



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The three-phase cast resin transformers have the following features:

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- LV windings impregnated with resin.

Magnetic core made using magnetic grain-oriented steel sheets with low loss, and the joints are Step-Lap inserted sheet.

- Level of partial discharges < 10 pC.
- Thermal class F – Temperature rise 100 K.
- Ambient temperature ≤ 40°C, altitude ≤ 1000 m.
- Self-extinguishing with low emission of gas, classification F1.
- Resistant to thermal shock, classification C2.
- Resistant to condensation and humidity, classification E2.

ACCESSORIES ALWAYS PROVIDED

- LV terminal connector plates
- MV voltage variation by off circuit tappings links
- Rating plate
- Lifting lugs
- 2 earthing points
- 4 bi-directional flat rollers

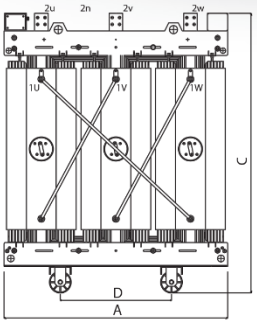
FROM 100 TO 3150 KVA 17,5 24 KV
LOSSES Co - Bk ACCORDING TO
IEC EN 505411

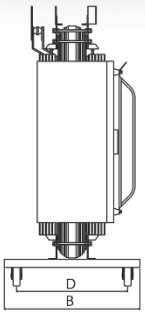
CAST RESIN
TR-PC

RATED OUTPUT kVA		100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
NO-LOAD LOSSES	W	460	650	880	1.200	1.650	2.000	2.300	2.800	3.100	4.000	5.000	6.000
LOAD LOSSES AT 75 °C	W	1.800	2.550	3.325	4.800	6.650	8.225	9.625	11.375	14.000	15.750	20.125	24.500
LOAD LOSSES AT 120 °C	W	2.050	2.900	3.800	5.500	7.600	9.400	11.000	13.000	16.000	18.000	23.000	28.000
NO-LOAD CURRENT	%	1,4	1,4	1,2	1	0,8	0,8	0,8	0,8	0,7	0,7	0,6	0,6
IMPEDANCE VOLTAGE	%	6	6	6	6	6	6	6	6	6	6	6	6
INRUSH CURRENT IE/IN		10,5	10,5	10,50	10	10	9,5	9,5	9	9	8,5	8,5	8,5
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	97,79	98,04	98,35	98,52	98,70	98,74	98,82	98,88	98,94	99,02	99,00	99,04
COSΦ 1 75% LOAD	%	98,07	98,29	98,55	98,72	98,87	98,91	98,98	99,03	99,09	99,15	99,14	99,17
COSΦ 0,9 100% LOAD	%	97,55	97,83	98,17	98,36	98,56	98,60	98,69	98,76	98,83	98,91	98,90	98,94
COSΦ 0,9 75% LOAD	%	97,87	98,11	98,40	98,58	98,75	98,79	98,87	98,92	98,99	99,06	99,04	99,08
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	1,96	1,76	1,50	1,37	1,23	1,2	1,14	1,09	1,05	0,96	0,98	0,95
COSΦ 0,9 100% LOAD	%	4,21	4,06	3,86	3,76	3,64	3,62	3,57	3,53	3,5	3,43	3,44	3,42
NOISE													
SOUND POWER LEVEL (LwA)	dB(A)	59	62	65	68	70	72	73	75	76	78	81	83

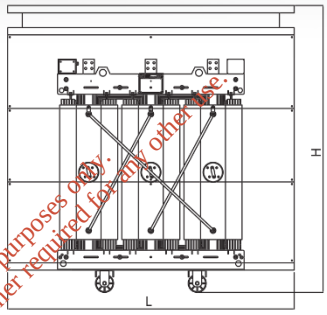
SIZES AND WEIGHTS (INDICATIVE)

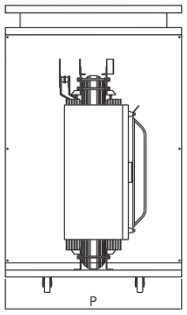
Without enclosure IP 00





With IP 31 Protective enclosure





INSULATION VOLTAGE 17,5 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.000	1.100	1.200	1.250	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	650	800	800	1.000	1.000	1.000	1.200	1.200	1.200
HEIGHT (C)	mm	1.100	1.200	1.350	1.500	1.700	1.800	1.850	2.050	2.150	2.250	2.350	2.400
WHEEL INTERAXIS (D)	mm	520	520	520	520	670	670	820	820	820	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	500	700	900	1.200	1.600	1.900	2.300	2.600	3.150	3.800	4.450	5.350

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1.700	1.950	2.200	2.500	2.800
DEPTH (P)	mm	1.000	1.200	1.300	1.500	1.500
HEIGHT (H)	mm	1.850	2.000	2.400	2.650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

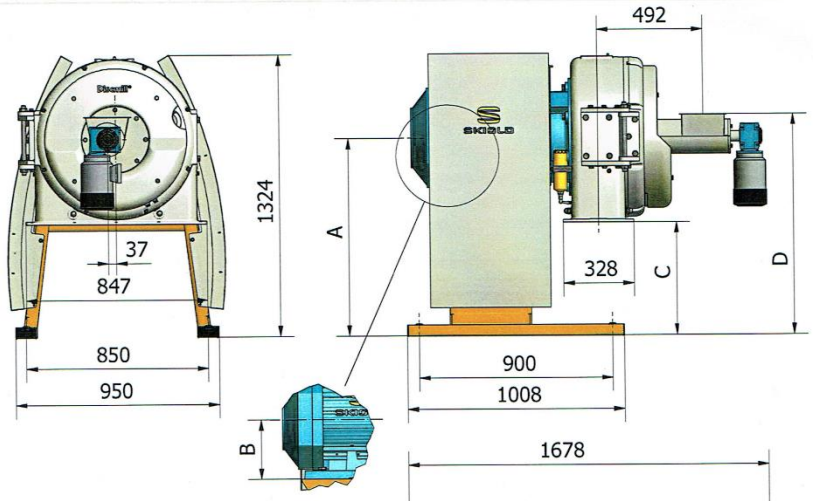
INSULATION VOLTAGE 24 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.100	1.150	1.250	1.250	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	800	800	1.000	1.000	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.150	1.300	1.400	1.550	1.750	1.900	1.950	2.050	2.150	2.400	2.400	2.450
WHEEL INTERAXIS (D)	mm	520	520	670	670	820	820	820	820	1.000	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	600	750	900	1.300	1.700	2.000	2.400	2.700	3.300	3.900	4.650	5.850

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1700	1950	2.200	2500	2.800
DEPTH (P)	mm	1000	1200	1.300	1500	1.500
HEIGHT (H)	mm	1850	2000	2.400	2650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

MF Trasformatori
LOC. S. ANNA 22/24 - 25011 CALCINATO - BRESCIA - ITALY
TEL. +39 030 9636020-028-596 FAX +39 030 9980218
www.mftrasformatori.it - info@mftrasformatori.it

Milling Machine

SKIOLD DISC MILL SK10T



MEASURE SKETCH	55 kW	75 kW	90 kW
A	899 mm	929 mm	929 mm
B	250 mm	280 mm	280 mm
C	500 mm	530 mm	530 mm
D	1005 mm	1035 mm	1035 mm

TECHNICAL SPECIFICATIONS	
Main motor (kW):	55 / 75 / 90
Motor rotation speed (rpm):	3000
Disc diameter, external (mm):	550
Distance regulation:	Automatic
Approx. noise level (dB):	80
Weight (kg):	1100-1400
Feeding auger:	0,75
Auger rotation speed (rpm):	2800

CAPACITY			
Cereal	55 kW	75 kW	90 kW
Barley	3000-10000	4000-13000	7000-16000
Wheat	3000-12000	4000-15000	7000-18000
Maize	3000-12000	4000-15000	7000-18000
Oats	2500-9000	3000-12000	6000-14000
Peas	2500-9000	3000-12000	6000-14000

In storage dry and well cleaned crops, max. kg/h.
The capacity depends on the grinding fineness

SKIOLD SK10T DISC MILLS may be used for grinding of ordinary cleaned small-grained seed crops in storage dry condition and with a maximum diameter of 10 mm. Wheat, barley etc. can furthermore be ground from air tight silo with up to 25 % moisture content. However, please note that the capacity is reduced by approx. 5 % for each percentage of moisture content higher than 15 % - for example 18 % moisture content reduces the capacity by (18-15) x 5 = 15 %.

The disc mill is also suitable for granulation of clean pelleted feed products, and wood pellets, with a pellet diameter of up to Ø16 mm.

Data sheet. 130 986 003 118. 03. 07-09-2017.

APPENDIX E

- NOISE EQUIPMENT CALIBRATION CERTS -

Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Equipment Details

Instrument Manufacturer	Cirrus Research Plc
Instrument Type	CR:171B
Description	Sound Level Meter
Serial Number	G071199

Calibration Procedure

The instrument detailed above has been calibrated to the publish test and calibration data as detailed in the instrument hand book, using the techniques recommended in the latest revisions of the International Standards IEC 61672-1:2013, IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:2003, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

Calibration Traceability

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

Microphone Type	GRAS 40AP	Serial Number	173198	Calibration Ref.	0170
Calibrator Type	B&K 4231	Serial Number	2564324	Calibration Ref.	A1914
Calibrator Type	B&K 4231	Serial Number	2564325	Calibration Ref.	A1915
Calibrator Type	B&K 4231	Serial Number	2594796	Calibration Ref.	A1916

Calibrated by

Calibration Date 8 July 2019
Calibration Certificate Number 22682

Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH
Telephone: +44 (0) 1723 891655 Fax: +44 (0) 1723 891742
Email: sales@cirrusresearch.co.uk

Certificate of Calibration

Certificate Number: **130782**
Date of Issue: **18 July 2019**

Instrument

Manufacturer: **Cirrus Research plc** Serial Number: **54060**
Model Number: **CR:515**

Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer s data.

Date of Calibration: **18 July 2019**

Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	93.99	1000.0	0.26
2	93.98	1000.0	0.25
3	93.98	1000.0	0.25
Average	**93.98**	**1000.0**	**0.25**
Uncertainty	± 0.11	± 0.14	± 0.10

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

Cirrus Research plc, Acoustic House, Bridlington Road
Hunmanby, North Yorkshire, YO14 0PH, United Kingdom
Telephone: 0845 230 2434 **Int**: +44 1723 891655
Email: sales@cirrusresearch.co.uk
Web: www.cirrusresearch.co.uk
UK Registration No. 987160

bsi. ISO 9001:2015 Quality Management FM 531001 ISO 14001 Environmental Management EMS 552104

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **18/07/19** CERTIFICATE NUMBER **130781**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 203537A

Calibration procedure

Date of calibration: 16 July 2019

Open circuit: 52.7 mV/Pa

Sensitivity at 1 kHz: -25.6 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 101.10 kPa

Temperature: 21.0 °C

Humidity: 58.0 %

Panther Environmental Solutions Ltd
Units 3 & 4, Innovation Centre
Institute of Technology
Green Road, Carlow
Ireland
R93 W248

Telephone: 059-9134222
Email: info@pantherwms.com
Website: www.pantherwms.com

ENVIRONMENTAL NOISE IMPACT ASSESSMENT REPORT

(SUPPLEMENTARY)

BALLYFASKIN ENTERPRISES LTD
BALLYFASKIN, BALLYLANDERS,
CO. LIMERICK

2020

REPORT NO:	ENA_20_9886	**AUTHOR:**	Martin O'Looney, BSc.
DATE:	28th September 2020	**REVIEWED:**	Mike Fraher, BSc.

TABLE OF CONTENTS

LIST OF TABLES & FIGURES

1.0 INTRODUCTION & SCOPE OF REPORT

This report provides a supplementary assessment to a Noise Impact Assessment completed by PES on 3rd March 2020 (Report Ref: ENA_20_9668). This report should be read in conjunction with that original report, and includes;

- an impact assessment of noise from the proposed transformer on additional noise sensitive receptors and,
- A Noise Management Plan for the farm.

Ballyfaskin Enterprises Ltd, whom operate a pig rearing facility at Ballyfaskin, Ballylanders, Co. Limerick, are seeking permission (Planning Ref:191135) from Limerick Co Co to increase the capacity of the piggery from 600 sows to 1000 sows and their progeny and the construction of a new electrical substation.

The only construction which would occur would be a new electrical substation, which would be constructed to ESB / best practice standards.

The original March 2020 noise report should be consulted for the background legislation, guidance, measurement parameters and terminology, baseline noise survey methods and figures used in this supplementary report.

The original report and this supplementary report assess noise in accordance with the methodology specified in the 'BS4142 (2014) – *Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas'* as published by The British Standards Institution in 2014 and EPA (2016) – '*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'.*

2.0 METHODOLOGY

2.1 NOISE PREDICTION METHODOLOGY

BS EN ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

The noise prediction methodology used in this report is based upon the international standard ISO 9613-2 "*Attenuation of Sound during Propagation Outdoors*". This standard outlines a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.

The central formula for this calculation is as follows:

$$\mathbf{A = A_{div} + A_{gr} + A_{bar} + A_{misc}}$$

Where:
A is the attenuation due to site conditions
A_{div} is the attenuation due to the geometrical divergence (distance from source)
A_{gr} is the attenuation due to the ground effect
A_{bar} is the attenuation due to a barrier
A_{misc} is the attenuation due to miscellaneous other effects as appropriate

This attenuation factor is then subtracted from the predicted operational noise at the proposed activity. The resultant figure is the predicted noise from the proposed activity at a given noise sensitive location.

This figure may then be added logarithmically to the existing background noise at the noise sensitive location to attain the predicted noise level if the proposed activity were to begin.

Relevant Formulae

In order to carry out this predictive analysis, the following attenuation characteristics have been taken into account:

Divergence – A_{div}
The geometrical divergence accounts for the spherical spreading in the free field from the point sound source, causing attenuation due to the inverse square law. Divergence is calculated as follows:

$$\mathbf{A_{div} = 20.log_{10} (d/d_o) + Q}$$

Where:
d is the distance from the source to the receiver (m)
d_o is the reference distance (1 m)
Q is a constant relating the sound power level to the sound pressure level at a reference distance d_0 which is 1 meter from a point source.

When a directivity factor is included, this attenuation figure converts the source Sound Power Level (L_W) to Sound Pressure Level (Lp). The calculation is frequency independent, therefore if the source noise is presented as A-weighted, the resulting receptor noise is also A-weighted.

BS EN ISO 12354-4:2017 Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 4: Transmission of indoor sound to the outside

ISO 12354-4:2017 specifies a calculation model to estimate the sound power level radiated by the envelope of a building due to airborne sound inside that building.

The method defines the sound power level (L_W) of a calculated substitute point source for noise break out from the building elements and openings in a building.

Annex F of BS12354-4 provides a method for estimating the A-weighted Sound Power Level (L_{WA}) of a substitute point source at the façade of a building where the single figure internal A-weighted Sound Pressure Level (L_{pA}) and single figure Sound Reduction Indices (Rw / Dn,e,w) of building elements are known.

The following formulas from Annex F of BS12354-4 are used to determine the Sound Power Level (L_{WA}):

$$L_{WA} = L_{pA,in} - 6 - X'_{As} + 10 \lg \frac{S}{S_o} \quad \text{(F.1)}$$

where

$L_{pA,in}$	is the A-weighted sound pressure level at 1 m to 2 m from the inside of segment j, in decibels;
X'_{As}	is the quantity characterizing the A-weighted sound level difference over segment j for source spectrum *s*, in decibels;
S	is the area of segment j, in square metres;
S_o	is the reference area, in square metres; S_o = 1 m².

$$X'_{As} = -10 \lg \left(\sum_{i=1}^{m} \frac{S_i}{S} 10^{-\left(R_{w,i} + C_{s,i}\right)/10} + \sum_{i=1}^{m} \frac{A_o}{S} 10^{-\left(D_{n,e,w,1} + C_{s,i}\right)/10} \right) \quad \text{(F.2)}$$

where

$R_{w,i}$	is the weighted sound reduction index of element i, in decibels;
$D_{n,e,w,i}$	is the weighted element normalized level difference of a small element i, in decibels;
$C_{s,i}$	is the spectrum adaptation term for spectrum s of element i, in decibels;
S_i	is the area of element i, in square metres;
A_o	is the reference absorption area, in square metres; A_o = 10 m²;
m	is the number of large elements of the segment;
n	is the number of small elements of the segment.

The sound pressure level at a reception point outside the building is determined from the contributions of each substitute point source according to:

$$L_p = L_W + D_c - A_{tot} \quad (1)$$

where

L_p	is the sound pressure level at a reception point outside the building due to the sound radiation of a substitute point source, in decibels;
L_W	is the sound power level of the substitute point source, in decibels;
D_c	is the directivity correction for the substitute point sources in the direction of the reception point, in decibels;
A_{tot}	is the total attenuation that occurs during sound propagation from the substitute point source to the reception point, in decibels.

Note: In this assessment, the directivity correction (Dc / Q) has been incorporated into the Atot figure, in compliance with BS 9613-2.

2.2 NOISE SOURCE SPECIFICATION

2.2.1 Electrical Substation

The only construction and new equipment which would occur as a result of the proposed development would be the installation of an ESB Sub-station at the site.

The model of the transformer has not been chosen as yet, however, it would be chosen from the list provided in **Appendix B** of this report. The specified sound power level (LwA) ratings for this equipment range from 51 dB to 83 dB.

The maximum LwA 83 dB (LpA 72 dB) rated transformer has been chosen for this assessment.

The transformer would be enclosed within the proposed sub-station building, as defined within the drawings submitted with the planning application. The construction of the walls of the building would be a concrete block cavity wall, with a 450mm inner leaf, 200mm cavity and 230mm outer leaf, plastered outer leaf.

No sound reduction index (Rw) could be found for this construction, and a reduction index for a similar construction of Rw 55 dB (100mm-75mm-100mm cavity wall, 13mm plaster both sides) has been used. As this construction would be of a lower mass than the proposed construction, it is anticipated that predicted noise impact levels will be over-estimated.

2.3 LOCATION OF NOISE IMPACT ASSESSMENT

The facility is located in an area rural in character with residences in the area predominantly linearly aligned along the existing road network.

We have been requested to provide additional noise impact assessment with regard to transformer noise at residences in close proximity to the western boundary of the farm, as follows:

Table 2.1: Noise Sensitive Receptors

Ref. No.	Grid Ref	Location Type	Location
NSR2	178883, 123407	Noise Sensitive Receptor	Residence *c.*80m west of the proposed transformer.
NSR3	178853, 123445	Noise Sensitive Receptor	Residence *c.*115m north of the proposed transformer.

These noise sensitive receptor locations will be used to predict the resultant noise levels at the residences from the proposed transformer, in the context of existing background noise levels in the area.

Baseline noise monitoring was carried out in general accordance with the British Standard EN BS 4142 '*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*'.

Detailed results of the baseline noise assessment may be found in the original March 2020 noise impact assessment report. The daytime monitoring was carried out between 11:17am and 18:06pm on Wednesday 5th February 2020, while night-time monitoring was carried out between 21:58pm on Wednesday 5th February and 01:25am Thursday 6th February 2020.

Background noise levels were determined at the following location:

Table 2.2: Noise Monitoring Locations

Ref. No.	Grid Ref	Location Type	Location
BG1	179167,124318	Background Noise Monitoring	Gateway on R662 road *c.*880m North of the Site Boundary

Grid Ref Source: http://irish.gridreferencefinder.com

All measurements were taken at:

- 1.2 – 1.5 metres height above local ground level
- 1.0 – 5.0 metres away from reflective surfaces

These locations are mapped in **Appendix A**.

3.0 RESULTS

3.1 BACKGROUND NOISE LEVELS - RESULTS

Definition:
A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

In order to determine the Background (L_{90}) noise levels at the closest noise sensitive receptors, monitoring was carried out at locations that represent the noise level that would be experienced at the NSR's in the absence of facility related noise.

BS4142:2014 guidance recommends a 60-minutes monitoring period during the day from 07:00 - 23:00 and a shorter monitoring period of 15-minutes at night from 23:00 - 07:00. For this assessment the following reference time intervals were used to measure the ambient noise levels:

- 60-minutes duration during the daytime hours.
- 30-minutes duration during the night-time hours.

Table 3.1: Measured Background Noise Levels

Ref	Location	Time	L_{Aeq}	L_{A10}	L_{A90}
Daytime					
BG1	Gateway *c.*880m North of the Site Boundary	11:17	62	55	**35**
Night-time					
BG1	Gateway *c.*880m North of the Site Boundary	21:58	58	42	**28**

3.2 PREDICTIVE NOISE ASSESSMENT - RESULTS

In order to determine the potential impact of noise from the proposed changes at the farm, the resultant noise levels at noise sensitive receptors have been calculated.

3.2.1 Prediction of Electric Sub-station Noise

It is assumed that the rear gable of the electric sub-station would face towards the north.

	Width (m)	Height (m)	Number (#)	S (m^2)
Gable Wall	4.000	2.715	1	10.860
			S (wall)	**10.860**
			S (total)	**10.860**

The following table determines the A-weighted sound level difference for the segment:

Attenuation Calculation	Concrete
Rw / Dn,e,w	55
Cs	0
Si	10.860
S	10.860
A_0	-
(Si/S)*(10^-((Rw+Cs)/10))	3.16E-06
(A_0/S)*(10^-((Dn,e,w+Cs)/10))	
X'As	**55.00**

The following table determines the A-weighted Sound Power Level (L_{WA}) of a substitute point source on the façade segment as per formula 1 above:

Table 3.2: Electric Substation Source Noise	
Substitute Point Source	**Values**
LpA, in (dB)	72
Diffusivity Term (Cd)	-6
X'As	55.00
S	10.86
S_0	1
L_{WA} (dB)	**21.36**

3.2.2 Prediction of Noise Levels at Receptor Façade

The equivalent external sound power level for substation noise has been calculated in **section 3.2.1**.

The following table determines the equivalent sound pressure level (LpA) of sub-station noise at the nearest receptor, based upon the formula for divergence between the source and receptor.

Lp = Lw-20Log(d/d0)-Q factor

Table 3.3: Predicted Sound Pressure Levels (LpA) at Receptors		
Sound Pressure Level at Receptor	**NSR2**	**NSR3**
L_{WA} (dB)	**21**	**21**
distance (m)	**80**	**115**
Q factor (dB)*	**8**	**8**
20Log(d) (dB)	**38**	**41**
Atotal (Adiv + Q)	**46**	**49**
L_{pA} (dB) at NSR1	**<0**	**<0**

* Directivity factor (whole sphere = 11 dB, half sphere = 8 dB, quarter sphere = 5 dB)

The methodology outlined in BS4142 requires that predicted noise levels be compared to existing L_{90} figures at noise sensitive locations in order to determine the likely noise impact. The BS4142 assessment has been carried out in the following section.

A noise character penalty of +5 has been applied to noise levels in order to account for potential subjective annoyance factors for noise sources.

The following tables determine the likelihood of noise impacts at the noise sensitive receptor following the BS4142 methodology:

Table 3.4: BS4142 Noise Assessment NSR2

Source	Background Noise (L_{90})	Predicted Noise			Difference from Background
		Predicted Noise	Predicted Penalty	Rating Level	
Daytime					
Sub-Station	35	0	-	0	-35
Night-time					
Sub-Station	28	0	-	0	-28

Table 3.5: BS4142 Noise Assessment NSR3

Source	Background Noise (L_{90})	Predicted Noise			Difference from Background
		Predicted Noise	Predicted Penalty	Rating Level	
Daytime					
Sub-Station	35	0	-	0	-35
Night-time					
Sub-Station	28	0	-	0	-28

4.0 DISCUSSION

4.1 GENERAL DISCUSSION

Baseline noise monitoring was carried out in general accordance with the British Standard EN BS 4142 '*Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas*'.

Noise levels at the background noise monitoring location (BG1) (site noise absent) was determined to be L_{A90} 35 dB during the daytime and L_{A90} 28 dB during night-time monitoring.

Noise at the background monitoring location was found to be characterised by distant low traffic noise and noise from wind in trees. Intermittent noise from traffic passing on the R662 and birds singing also added to background noise levels.

The noise limits defined in the sites EPA IE licence (Ref: P0915-01) apply at noise sensitive receptor locations.

Condition 4.1 and Schedule B.4 of the sites licence establish noise limits to which the site must comply, as follows:

Condition 4.1 Noise
Noise from the installation shall not give rise to sound pressure levels ($L_{Aeq, T}$) measured at the noise sensitive locations of the installation which exceed the limit value(s).

Schedule B.4 Noise Emission Limits

Daytime dB $L_{Ar,T}$ (30 minutes)	**Daytime dB $L_{Ar,T}$ (30 minutes)**	**Daytime dB $L_{Aeq,T}$ (15-30 minutes)**
55	50	45

Note 1: There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise- sensitive location.

4.2 BS4142:2014 IMPACT ASSESSMENT

A BS4142 has been completed on the potential noise impacts which may occur as a result of the proposed permission (Planning Ref:191135) from Limerick Co Co to increase the capacity of the piggery from 600 sows to 1000 sows and their progeny and the construction of a new electrical substation.

BS4142 infers that for a given excess of the rating level over the background level, the impacts and potential likelihood of complaints are as follows:

Excess	Likelihood of Complaints	Interpretation of Impact
≥ 10dB	Likely	An indication of a significant adverse impact.
> 5dB	Possible	An indication of an adverse impact.
≤ 5 dB	Unlikely	An indication that it is unlikely that the specific sound source will have an adverse impact or a significant adverse impact.
< 0dB	Very Unlikely	An indication that the specific sound source will have a low impact.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

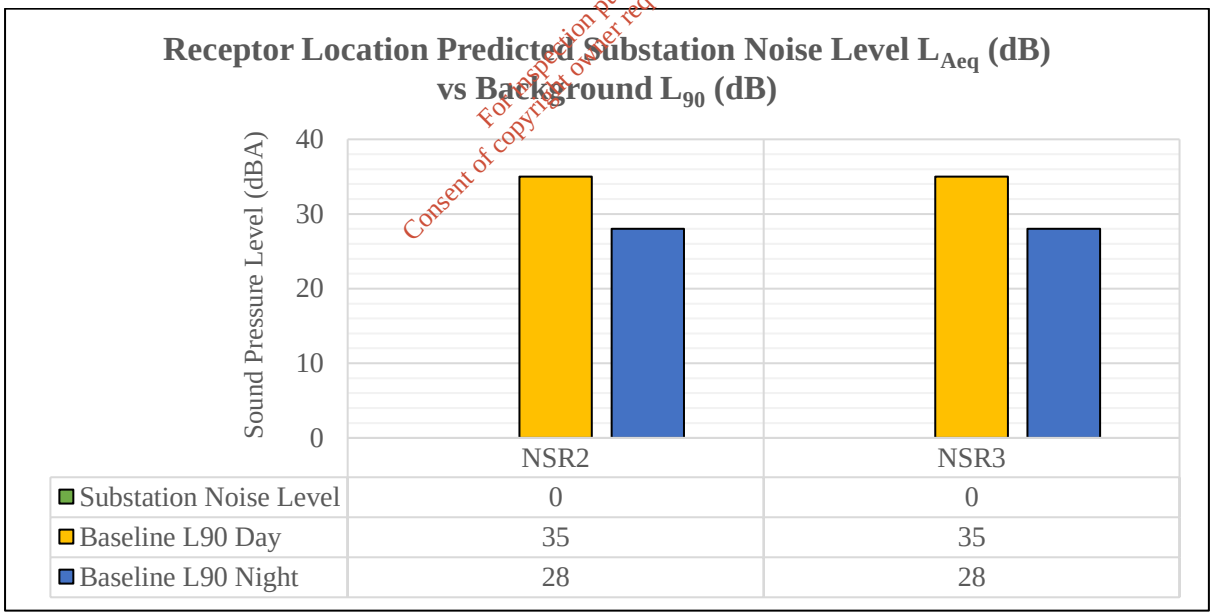


Figure 4.1: Background Noise L_{90} vs Predicted Noise Levels at Receptors

It should be noted that predicted noise levels only consider divergence, as this would be the primary parameter influencing noise between the source and receptor. Other parameters which would contribute the reduction of sound such as ground absorption, absorption by vegetation or existing barriers or buildings have not been considered. Therefore, this may be considered a worst case scenario for noise from the proposed sub-station.

The predicted noise level at receptor locations for the Electric Substation was found to be less than 0 dB at NSR2 and NSR3.

The predicted noise level at the substitute point source at the sub-station building façade, before the noise travels offsite, was calculated to be Lw 21 dBA (Lp 13 dBA) which is below the recorded day-time and night-time background noise levels for the area.

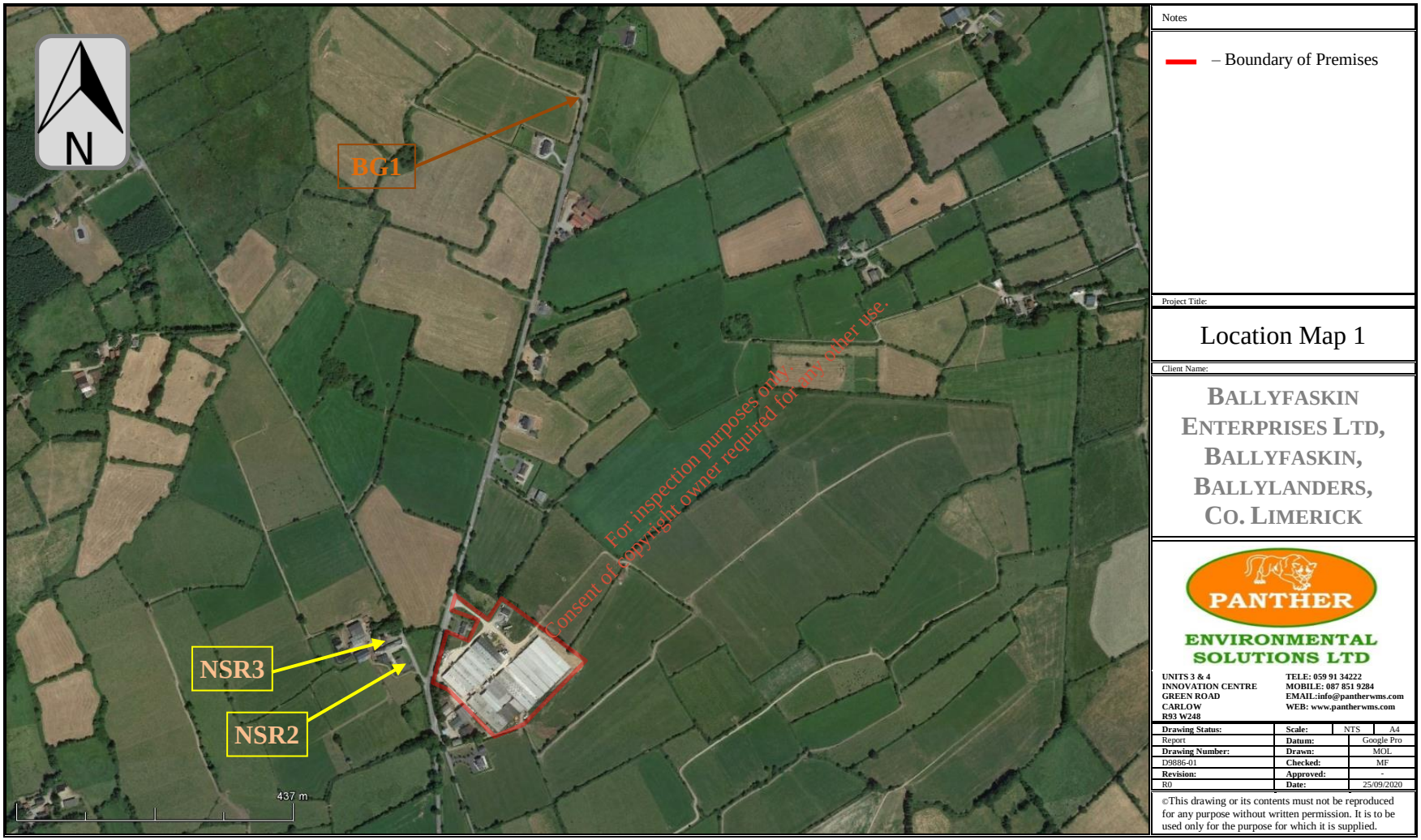
As a result of the substation house construction materials, the noise level outside the substation building is predicted to be greater than 10 dB below the background daytime and night-time L_{90}. Therefore, the substation noise would be anticipated to be inaudible within the farm boundary. It should be noted that the construction material noise reduction indices used in this assessment are anticipated to be less than the expected noise reduction figures of the proposed substation building (see **section 2.2.1**).

Therefore, there is not anticipated to be any potential for noise impacts as a result of the proposed sub-station at noise sensitive locations.

APPENDIX A

- SITE MAPS WITH MONITORING POINTS -

APPENDIX A: NOISE ASSESSMENT LOCATIONS



Notes

– Boundary of Premises

Project Title:

Location Map 1

Client Name:

BALLYFASKIN ENTERPRISES LTD, BALLYFASKIN, BALLYLANDERS, CO. LIMERICK

PANTHER ENVIRONMENTAL SOLUTIONS LTD

UNITS 3 & 4
INNOVATION CENTRE
GREEN ROAD
CARLOW
R93 W248

TELE: 059 91 34222
MOBILE: 087 851 9284
EMAIL:info@pantherwms.com
WEB: www.pantherwms.com

Drawing Status:	**Scale:**	NTS	A4
Report	**Datum:**	Google Pro	
Drawing Number:	**Drawn:**	MOL	
D9886-01	**Checked:**	MF	
Revision:	**Approved:**	-	
R0	**Date:**	25/09/2020	

APPENDIX B

- SUBSTATION NOISE SPECIFICATIONS -

Electrical Sub-Station

Green efficiency

MF Trasformatori

CAST RESIN

TR-PA

from 100 to 3150 kVA - 17,5 – 24 kV
losses Ao - Ak according to
IEC EN 50541-1

GENERAL INFORMATION

At present, the improvement of the energy efficiency cannot be considered a slogan anymore, but a need of our time. TR-PA series high efficiency transformers are created for this purpose guaranteeing:

- savings in operating costs of the plant, due to low values of losses.
- consumption reduction o f energy resources.
- reduction of CO_2 emissions.

ANNUAL SAVINGS (MAXIMUM) COMPARED TO TRANSFORMERS WITH LOSSES, ACCORDING TO HD 538.1 / HD 538.2

RATED OUTPUT kVA	100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
LOW CONSUMPTION (MWh)	3,8	5,3	6,7	12,7	9,2	18,4	24,1	26,3	34,2	29,8	51,7	71,8
LOW EMISSIONS CO_2 (T)	2,8	3,9	5,0	9,5	6,9	13,8	18,1	19,7	25,6	22,3	38,8	53,9
ENERGY SAVINGS TOE *	0,7	1,0	1,2	2,4	1,7	3,4	4,5	4,9	6,4	5,6	9,7	13,4

* TONNE OF OIL EQUIVALENT

PARTICULARITY

Reference norms :

- CEI EN 60067-1,2,3,4,5 -11
- CEI EN 50541-1

The phases of design and building, in addition to their compliance with IEC EN norms, take into account the following regulations:

- ISO 9001 : 2008 regarding the quality standards and procedures .
- ISO 14001 : 2004 regarding the environmental issues .

Easy and fast to install are suitable for use in:

- MV/LV prefabricated substation and substation with reduced dimensions.
- fire and pollution hazard areas.
- buildings with public access.

Moreover, their disposal is simple and with low environmental impact.

DESCRIPTION

The three-phase cast resin transformers have the following features:

- MV windings encapsulated in cast resin.
- LV windings impregnated with resin.

Magnetic core made using magnetic grain-oriented steel sheets with low loss, and the joints are Step-Lap inserted sheet.

- Level of partial discharges < 10 pC.
- Thermal class F – Temperature rise 100 K.
- Ambient temperature ≤ 40°C, altitude ≤ 1000 m.
- Self-extinguishing with low emission of gas, classification F1.
- Resistant to thermal shock, classification C2.
- Resistant to condensation and humidity, classification E2.

COMPLETION ACCESSORIES ALWAYS PROVIDED

- LV terminal connector plates
- MV voltage variation by off circuit tappings links
- Rating plate
- Lifting lugs
- 2 earthing points
- 4 bi-directional flat rollers

FROM 100 TO 3150 KVA 17,5 24 KV
LOSSES Ao - Ak ACCORDING TO
IEC EN 50541 1

Green efficiency

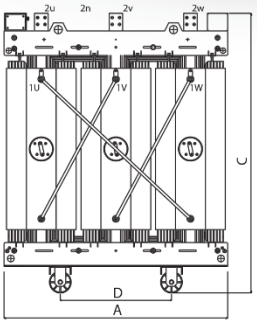
CAST RESIN

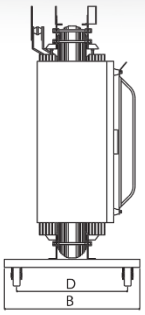
TR-PA

RATED OUTPUT kVA		100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
NO-LOAD LOSSES	W	280	350	520	750	1.100	1.300	1.550	1.800	2.200	2.600	3.100	3.800
LOAD LOSSES AT 75 °C	W	1.575	2.275	2.975	3.950	6.200	7.000	7.875	9.625	11.375	14.000	16.625	19.250
LOAD LOSSES AT 120 °C	W	1.800	2.600	3.400	4.500	7.100	8.000	9.000	11.000	13.000	16.000	19.000	22.000
NO-LOAD CURRENT	%	1	0,9	0,8	0,8	0,8	0,6	0,6	0,6	0,6	0,6	0,4	0,4
IMPEDANCE VOLTAGE	%	6	6	6	6	6	6	6	6	6	6	6	6
INRUSH CURRENT IE/IN		11,5	10,5	10,00	9,5	9,5	9	9	8,5	8,5	8	8	7,5
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	98,15	98,36	98,60	98,83	98,84	98,96	99,06	99,09	99,15	99,17	99,21	99,27
COSΦ 1 75% LOAD	%	98,45	98,65	98,83	99,01	99,03	99,13	99,20	99,23	99,28	99,30	99,34	99,38
COSΦ 0,9 100% LOAD	%	97,90	98,14	98,41	98,67	98,68	98,82	98,93	98,96	99,04	99,06	99,10	99,17
COSΦ 0,9 75% LOAD	%	98,25	98,47	98,68	98,88	98,90	99,01	99,10	99,13	99,19	99,21	99,25	99,30
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	1,74	1,59	1,36	1,16	1,16	1,05	0,96	0,95	0,89	0,88	0,84	0,79
COSΦ 0,9 100% LOAD	%	4,04	3,93	3,75	3,59	3,59	3,5	3,43	3,41	3,36	3,36	3,33	3,28
NOISE													
SOUND POWER LEVEL (LwA)	dB(A)	51	54	57	60	62	64	65	67	68	70	71	74

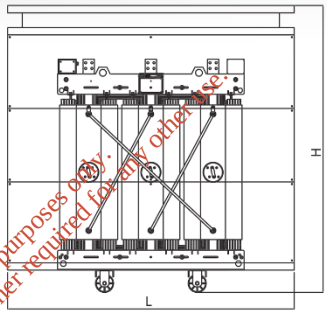
SIZES AND WEIGHTS (INDICATIVE)

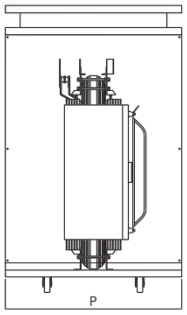
Without enclosure IP 00





With IP 31 Protective enclosure





INSULATION VOLTAGE 17,5 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.000	1.100	1.250	1.450	1.450	1.650	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	800	1.000	1.000	1.000	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.150	1.250	1.350	1.500	1.700	1.800	1.900	2.050	2.150	2.250	2.350	2.550
WHEEL INTERAXIS (D)	mm	520	520	520	670	670	820	820	820	1.000	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	600	750	1.000	1.400	1.750	2.150	2.550	2.900	3.400	3.900	4.750	6.100

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1.700	1.950	2.200	2.500	2.800
DEPTH (P)	mm	1.000	1.200	1.300	1.500	1.500
HEIGHT (H)	mm	1.850	2.000	2.400	2.650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

INSULATION VOLTAGE 24 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.100	1.150	1.250	1.450	1.650	1.650	1.650	1.900	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	1.000	1.000	1.000	1.200	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.200	1.350	1.400	1.550	1.750	1.850	1.950	2.050	2.150	2.250	2.400	2.550
WHEEL INTERAXIS (D)	mm	520	520	670	670	820	820	820	1.000	1.000	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	700	850	1.150	1.600	1.900	2.350	2.750	3.100	3.700	4.400	5.250	6.250

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1700	1950	2200	2500	2.800
DEPTH (P)	mm	1000	1200	1300	1500	1.500
HEIGHT (H)	mm	1850	2000	2400	2650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

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WE SUPPORT

MF Trasformatori

Green efficiency

CAST RESIN

TR-PB

from 100 to 3150 kVA - 17,5 – 24 kV
losses Bo - Bk according to IEC EN 50541-1

GENERAL INFORMATION

At present, the improvement of the energy efficiency cannot be considered a slogan anymore, but a need of our time.
TR-PB series high efficiency transformers are created for this purpose guaranteeing:

- savings in operating costs of the plant, due to low values of losses.
- consumption reduction of energy resources.
- reduction of CO_2 emissions.

ANNUAL SAVINGS (MAXIMUM) COMPARED TO TRANSFORMERS WITH LOSSES, ACCORDING TO HD 538.1 / HD 538.2

RATED OUTPUT KVA	100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
LOW CONSUMPTION (MWh)	1,4	1,5	2,0	2,3	3,5	4,4	4,4	6,1	6,1	8,8	12,3	14,9
LOW EMISSIONS CO_2 (T)	0,7	1,1	1,5	1,7	2,6	3,3	3,3	4,6	4,6	6,6	9,2	11,2
ENERGY SAVINGS TOE *	0,2	0,3	0,4	0,5	0,7	0,8	0,8	1,2	1,2	1,6	2,3	2,8

*TONNE OF OIL EQUIVALENT

PARTICULARITY

Reference norms :
- CEI EN 60067-1,2,3,4,5 -11
- CEI EN 50541-1

The phases of design and building, in addition to their compliance with IEC EN norms, take into account the following regulations:
- ISO 9001 : 2008 regarding the quality standards and procedures .
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Easy and fast to install are suitable for use in:
- MV/LV prefabricated substation and substation with reduced dimensions.
- fire and pollution hazard areas.
- buildings with public access.

Moreover, their disposal is simple and with low environmental impact.

DESCRIPTION

The three-phase cast resin transformers have the following features:
- MV windings encapsulated in cast resin.
- LV windings impregnated with resin.

Magnetic core made using magnetic grain-oriented steel sheets with low loss, and the joints are Step-Lap inserted sheet.
- Level of partial discharges < 10 pC.
- Thermal class F – Temperature rise 100 K.
- Ambient temperature ≤ 40°C, altitude ≤ 1000 m.
- Self-extinguishing with low emission of gas, classification F1.
- Resistant to thermal shock, classification C2.
- Resistant to condensation and humidity, classification E2.

ACCESSORIES ALWAYS PROVIDED

- LV terminal connector plates
- MV voltage variation by off circuit tappings links
- Rating plate
- Lifting lugs
- 2 earthing points
- 4 bi-directional flat rollers

FROM 100 TO 3150 KVA 17,5 24 KV
LOSSES Bo - Bk ACCORDING TO
IEC EN 505411

Green efficiency

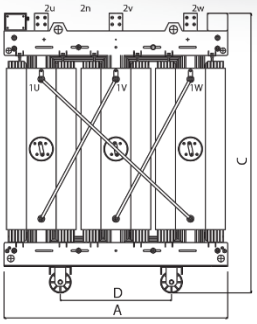
CAST RESIN

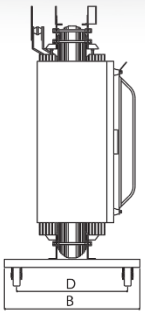
TR-PB

RATED OUTPUT kVA		100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
NO-LOAD LOSSES	W	340	480	650	940	1250	1.500	1.800	2.100	2.400	3.000	3.600	4.300
LOAD LOSSES AT 75 °C	W	1.800	2.550	3.325	4.800	6.650	8.225	9.625	11.375	14.000	15.750	20.125	24.500
LOAD LOSSES AT 120 °C	W	2.050	2.900	3.800	5.500	7.600	9.400	11.000	13.000	16.000	18.000	23.000	28.000
NO-LOAD CURRENT	%		1,2	1,4	1	0,8	0,8	0,8	0,8	0,6	0.8	0,6	0,6
IMPEDANCE VOLTAGE	%	6	6	6,00	6	6	6	6	6	6	6	6	6
INRUSH CURRENT IE/IN		12,3	12,9	12,00	11,8	11	9,6	9,4	9,2	9	8,8	8,8	8,4
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	97,87	98,11	98,41	98,57	98,75	98,79	98,86	98,92	98,98	99,06	99,05	99,09
COSΦ 1 75% LOAD	%	98,20	98,41	98,66	98,79	98,95	98,98	99,04	99,10	99,15	99,21	99,21	99,24
COSΦ 0,9 100% LOAD	%	97,58	97,86	98,20	98,37	98,58	98,62	98,70	98,78	98,84	98,93	98,92	98,96
COSΦ 0,9 75% LOAD	%	97,97	98,21	98,49	98,63	98,81	98,85	98,91	98,98	99,03	99,11	99,10	99,14
VOLTAGE DROP AT 75° C													
COSΦ 1 100% LOAD	%	1,96	1,76	1,50	1,37	1,23	1,2	1,14	1,09	1,05	0,96	0,98	0,95
COSΦ 0,9 100% LOAD	%	4,21	4,06	3,86	3,76	3,64	3,62	3,57	3,53	3,5	3,43	3,44	3,42
NOISE													
SOUND POWER LEVEL (LwA)	dB(A)	51	54	57	60	62	64	65	67	68	70	71	74

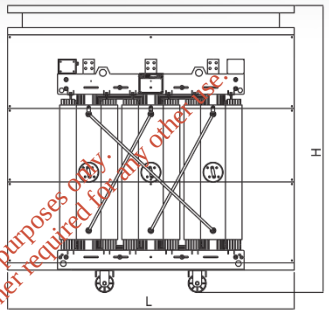
SIZES AND WEIGHTS (INDICATIVE)

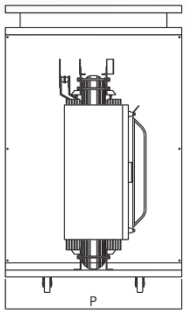
Without enclosure IP 00





With IP 31 Protective enclosure





INSULATION VOLTAGE 17,5 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.000	1.100	1.350	1.250	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	650	800	800	1.000	1.000	1.000	1.200	1.200	1.200
HEIGHT (C)	mm	1.100	1.200	1.350	1.500	1.700	1.800	1.850	2.050	2.150	2.250	2.350	2.400
WHEEL INTERAXIS (D)	mm	520	520	520	520	670	670	820	820	820	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	550	700	900	1.200	1.600	1.900	2.300	2.600	3.150	3.800	4.450	5.40

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1.700	1.950	2.200	2.500	2.800
DEPTH (P)	mm	1.000	1.200	1.300	1.500	1.500
HEIGHT (H)	mm	1.850	2.000	2.400	2.650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

INSULATION VOLTAGE 24 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.100	1.150	1.250	1.450	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	800	800	1.000	1.000	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.150	1.300	1.400	1.550	1.750	1.900	1.950	2.050	2.150	2.400	2.400	2.450
WHEEL INTERAXIS (D)	mm	520	520	670	670	820	820	820	820	1.000	1.000	1.000	1.000
WHEEL WIDTH	mm	40	40	40	40	50	50	50	50	50	50	50	50
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	600	750	900	1.350	1.750	2.000	2.450	2.700	3.400	3.900	4.750	6.050

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1700	1950	2200	2500	2.800
DEPTH (P)	mm	1000	1200	1300	1500	1.500
HEIGHT (H)	mm	1850	2000	2400	2650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

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MF Trasformatori

CAST RESIN

from 100 to 3150 kVA - 17,5 – 24 kV
losses Co - Bk according to
IEC EN 50541-1

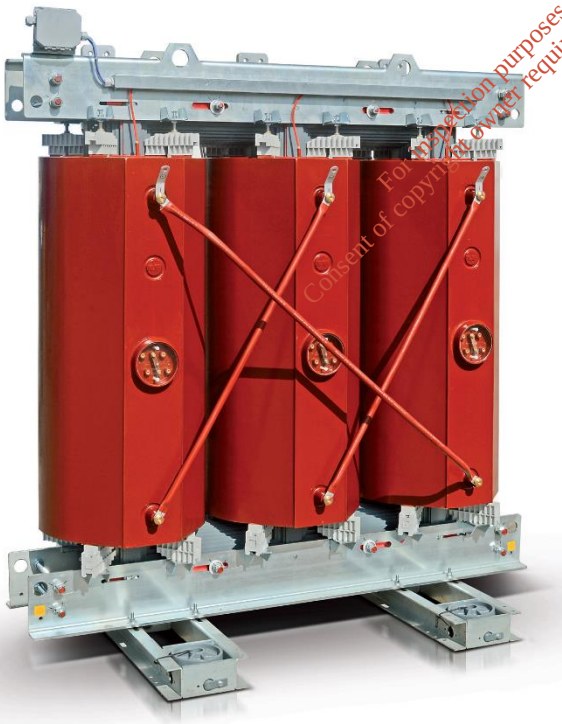
TR-PC

GENERAL INFORMATION

The new IEC EN 50541-1 has been prepared with the mission to improve the efficiency of the transformers.
This results in transformers with better efficiency which guarantee to our customers:

- savings in operating costs of the plant, due to low values of losses.
- consumption reduction of energy resources.

RATED OUTPUT kVA	100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
EFFICIENCY AT 75°C												
COSφ 1 100% LOAD	97,79	98,04	98,35	98,52	98,70	98,74	98,82	98,88	98,94	99,02	99,00	99,04
COSφ 1 50% LOAD	98,21	98,42	98,65	98,81	98,86	99,00	99,07	99,11	99,18	99,21	99,20	99,24



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The three-phase cast resin transformers have the following features:
- MV windings encapsulated in cast resin.
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Magnetic core made using magnetic grain-oriented steel sheets with low loss, and the joints are Step-Lap inserted sheet.
- Level of partial discharges < 10 pC.
- Thermal class F – Temperature rise 100 K.
- Ambient temperature ≤ 40°C, altitude ≤ 1000 m.
- Self-extinguishing with low emission of gas, classification F1.
- Resistant to thermal shock, classification C2.
- Resistant to condensation and humidity, classification E2.

ACCESSORIES ALWAYS PROVIDED

- LV terminal connector plates
- MV voltage variation by off circuit tappings links
- Rating plate
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- 4 bi-directional flat rollers

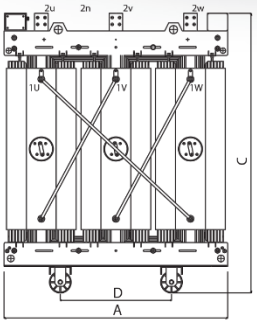
FROM 100 TO 3150 KVA 17,5 24 KV
LOSSES Co - Bk ACCORDING TO
IEC EN 505411

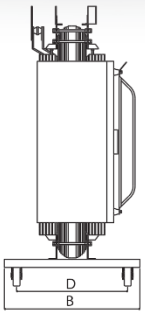
CAST RESIN
TR-PC

RATED OUTPUT kVA		100	160	250	400	630	800	1.000	1.250	1.600	2.000	2.500	3.150
NO-LOAD LOSSES	W	460	650	880	1.200	1.650	2.000	2.300	2.800	3.100	4.000	5.000	6.000
LOAD LOSSES AT 75 °C	W	1.800	2.550	3.325	4.800	6.650	8.225	9.625	11.375	14.000	15.750	20.125	24.500
LOAD LOSSES AT 120 °C	W	2.050	2.900	3.800	5.500	7.600	9.400	11.000	13.000	16.000	18.000	23.000	28.000
NO-LOAD CURRENT	%	1,4	1,4	1,2	1	0,8	0,8	0,8	0,8	0,7	0,7	0,6	0,6
IMPEDANCE VOLTAGE	%	6	6	6	6	6	6	6	6	6	6	6	6
INRUSH CURRENT IE/IN		10,5	10,5	10,50	10	10	9,5	9,5	9	9	8,5	8,5	8,5
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	97,79	98,04	98,35	98,52	98,70	98,74	98,82	98,88	98,94	99,02	99,00	99,04
COSΦ 1 75% LOAD	%	98,07	98,29	98,55	98,72	98,87	98,91	98,98	99,03	99,09	99,15	99,14	99,17
COSΦ 0,9 100% LOAD	%	97,55	97,83	98,17	98,36	98,56	98,60	98,69	98,76	98,83	98,91	98,90	98,94
COSΦ 0,9 75% LOAD	%	97,87	98,11	98,40	98,58	98,75	98,79	98,87	98,92	98,99	99,06	99,04	99,08
EFFICIENCY AT 75°C													
COSΦ 1 100% LOAD	%	1,96	1,76	1,50	1,37	1,23	1,2	1,14	1,09	1,05	0,96	0,98	0,95
COSΦ 0,9 100% LOAD	%	4,21	4,06	3,86	3,76	3,64	3,62	3,57	3,53	3,5	3,43	3,44	3,42
NOISE													
SOUND POWER LEVEL (LwA)	dB(A)	59	62	65	68	70	72	73	75	76	78	81	83

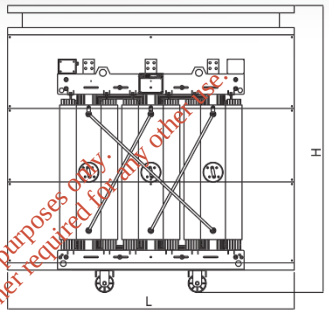
SIZES AND WEIGHTS (INDICATIVE)

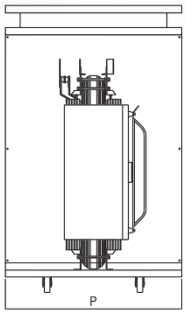
Without enclosure IP 00





With IP 31 Protective enclosure





INSULATION VOLTAGE 17,5 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.000	1.100	1.150	1.250	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	650	800	800	1.000	1.000	1.000	1.200	1.200	1.200
HEIGHT (C)	mm	1.100	1.200	1.350	1.500	1.700	1.800	1.850	2.050	2.150	2.250	2.350	2.400
WHEEL INTERAXIS (D)	mm	520	520	520	520	670	670	820	820	820	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	500	700	900	1.200	1.600	1.900	2.300	2.600	3.150	3.800	4.450	5.350

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1.700	1.950	2.200	2.500	2.800
DEPTH (P)	mm	1.000	1.200	1.300	1.500	1.500
HEIGHT (H)	mm	1.850	2.000	2.400	2.650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

INSULATION VOLTAGE 24 kV		100	160	250	400	630	800	1000	1250	1600	2000	2500	3150
LENGTH (A)	mm	1.100	1.150	1.250	1.250	1.450	1.450	1.650	1.650	1.900	1.900	1.900	2.200
DEPTH (B)	mm	650	650	650	800	800	800	1.000	1.000	1.200	1.200	1.200	1.200
HEIGHT (C)	mm	1.150	1.300	1.400	1.550	1.750	1.900	1.950	2.050	2.150	2.400	2.400	2.450
WHEEL INTERAXIS (D)	mm	520	520	670	670	820	820	820	820	1.000	1.000	1.000	1.000
WHEEL DIAMETER	mm	100	100	100	100	160	160	160	160	160	160	160	160
WEIGHT	kg	600	750	900	1.300	1.700	2.000	2.400	2.700	3.300	3.900	4.650	5.850

PROTECTIVE ENCLOSURE IP31		TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
LENGTH (L)	mm	1700	1950	2.200	2500	2.800
DEPTH (P)	mm	1000	1200	1.300	1500	1.500
HEIGHT (H)	mm	1850	2000	2.400	2650	2.900
ENCLOSURE WEIGHT	kg	220	260	320	360	400

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APPENDIX C

- NOISE MANAGEMENT PLAN -

NOISE MANAGEMENT PLANNING

The Noise Management Plan (NMP) is a core document that is intended to detail operational and control measures appropriate to management and control of noise at the site. The format of the NMP should provide sufficient detail to allow operators and maintenance staff to clearly understand the operational procedures for both normal and abnormal conditions.

A Noise Management Plan should be prepared for all processes. The NMP should also include sufficient feedback data to allow site management (and local authority inspectors) to audit site operations. An example of some of the issues to be considered is summarised as follows. More detailed guidance is provided with this document.

- A summary of the site, noise sources and the location of receptors.
- Details of the site management responsibilities and procedures for reporting faults, identifying maintenance needs and complaints procedure.
- Noise critical plant operation and management procedures (e.g. correct use of plant, process, materials, and checks on plant performance, maintenance and inspection).
- Operative training.
- Housekeeping.
- Maintenance and inspection of plant (both routine and emergency response).
- Record keeping – format, responsibility for completion and location of records.
- Emergency breakdown and incident response planning including responsibilities and mechanisms for liaison with the local authority.
- Public relations.

The Noise Management Plan is a living document and should be reviewed annually.

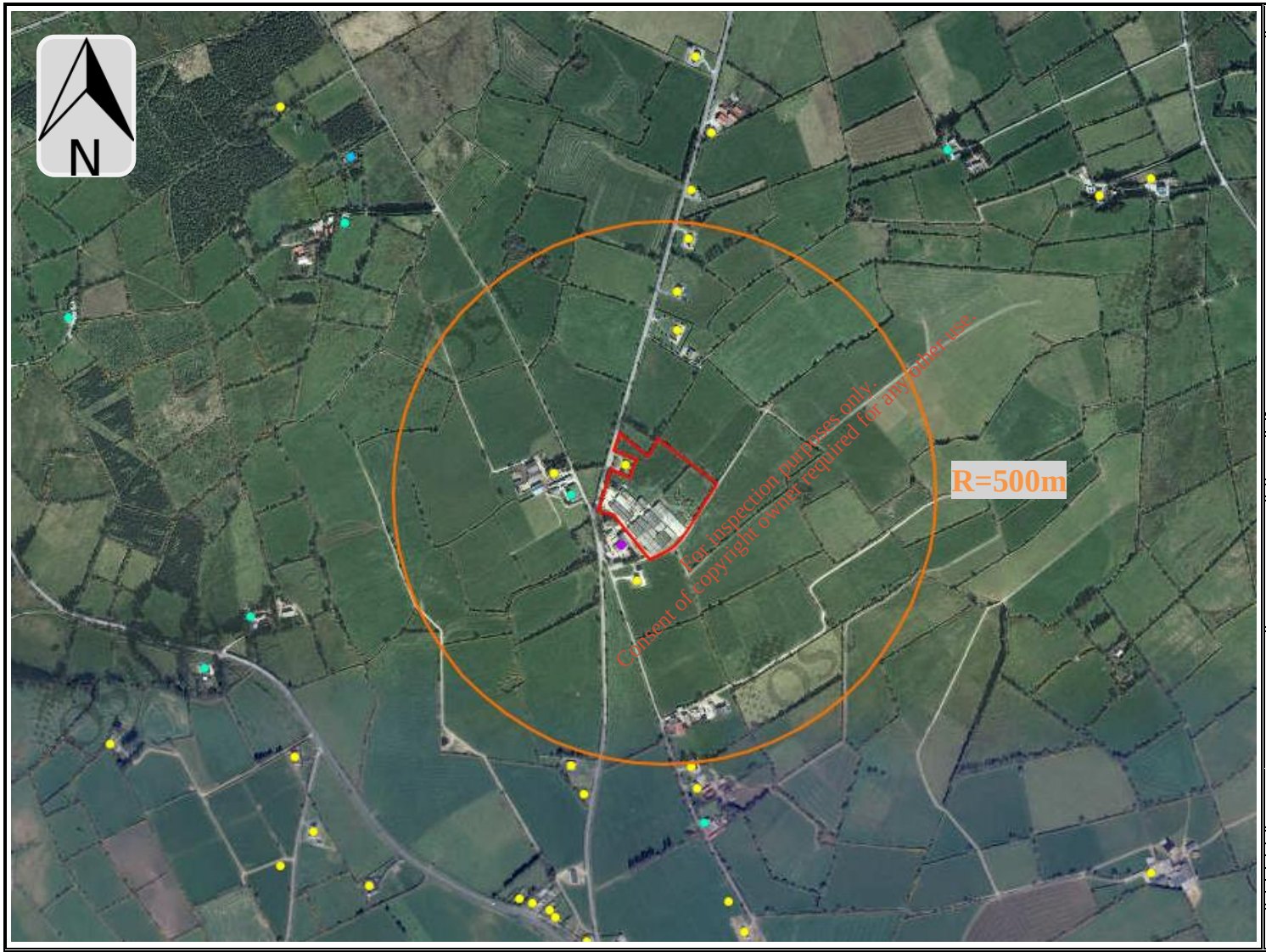
It should form the basis of a documented Environmental and Noise Management system for the operating site. The Noise Management System documentation should define the roles of the Operator and the Caretaker and sets out templates in relation to the operating of the farm and reporting procedures to be employed. Requirements for the NMP should be implemented throughout the site with a branched management system implemented in order to share responsibility around the site. The farm manager should ensure all works are performed in accordance with the NMP.

	Noise Source	Specific Source	Action Plan	Monitoring Required	Review and Comments - Monthly
1.a			All relevant staff to be trained on Noise Management measures.	Immediate	
1.b			Review and update NMP initially on annual basis, or following any relevant changes at the site. Key Performance Indicators (KPI's): - Number of Complaints, - Number of abnormal noise events (site checks), - Results/recommendations of any noise surveys	Annual / as necessary	
1.c			Carry out weekly noise patrol checks and keep log of all findings, including weather conditions and wind direction. Note any equipment, vehicles or staff/visitor actions leading to excessive/unusual increased noise. At times where a complaint has been received or issues identified during environmental checks, monitoring or during maintenance, daily noise monitoring should be carried out at times relevant to the complaint or identified issue until the investigation is complete.	Weekly / Daily as necessary	
1.d			Keep a log of environmental noise complaints, including description of the noise, details of investigation, any follow-up actions and outcomes.	On-going	
1.e			Keep a log of noise monitoring carried out, including reason for survey, main findings and remedial actions taken.	On-going	
1.f			Inform neighbours of any abnormal planned operations/projects which may lead to significantly increased noise. Provide detail of timing and likely duration to minimise noise impact. Provide contact details to neighbours of relevant members of staff for the receipt of environmental complaints.	As applicable	

	Noise Source	Specific Source	Action Plan	Monitoring Required	Review and Comments - Monthly
2.	Construction	Excavators/large plant	Carry out construction activities associated with elevated noise levels during normal working hours where practicable. (07:00am to 19:00pm Monday to Friday)	On-going	
3.	Construction	Off-schedule works	Any works outside of these times should be notified to any potentially effected local residents in good time and prior to specified works commencing.	Prior to off-schedule works	
4.	Construction	Proposed Earth Berm	Construct an earth berm along the northern boundary of the site as defined within the Noise Impact Assessment Report (Ref: ENA-20-9668).	As part of proposed works.	
5.	Pig Shed	Feeding	Ensure all feeding systems are passive ad libitum type, to prevent feeding time animal noise. Ensure feed supply rates are maintained to ensure continuous feed availability and prevent anticipation for feed delivery.	On-going.	
6.	Pig Shed	Destocking	Continue to move pigs to the loading bay on the evening before transport. This will reduce animal noise as the pigs are acclimatised to the bay and reduce the time for destocking to occur.	On-going	
7.	Employees	Employees/visitors	Inform all employees and visitors of noise awareness.	Monitoring on-going, awareness is continuous	
8.	Yard	Tractors (slurry removal)	The removal of shed slurry should be conducted within normal working hours (08:00am to 18:00pm Monday to Friday).	Monitor during operations	

	Noise Source	Specific Source	Action Plan	Monitoring Required	Review and Comments - Monthly
9.	Equipment	Equipment	Consult with manufacturer regarding associated noise emissions prior to purchase of any new equipment.	As equipment is being purchased	
10.	Equipment	Equipment	Use existing farm buildings to shield closest Sensitive Receptors from any potentially noisy new equipment (e.g. boiler, pump, motors etc.) where possible.	As equipment is installed	
11.	Vehicles	Vehicles entering and leaving site	Maintain site roads in good condition.	As per preventative maintenance schedule	
12.	Vehicles	Vehicles entering and leaving site	Ensure that a site speed limit of onsite traffic speed limit of 20 km /h is maintained. Ensure excessive revving of engines does not occur, particularly during evening or night-time periods.		
13.	Vehicles	Site Vehicles	Ensure site owned/operated forklifts and vehicles are well maintained (especially exhaust systems and silencers).	Monitor on-going, awareness is continuous	
14.	Equipment	Equipment	Maintain equipment and ventilation to ensure high efficiency.	As per preventative maintenance schedule	
15.	Equipment	New Equipment	Consult with manufacturer regarding noise levels before buying any new equipment.	As equipment is being purchased	

	Noise Source	Specific Source	Action Plan	Monitoring Required	Review and Comments - Monthly
16.	Employees	Manual handling / Forklift operation	Reduce impulsive noise in external areas by lowering of materials to ground level where practical. Reduce drop heights of bulk materials by design.	Monitor on-going, awareness is continuous	
17.	Site wide	Alarm Testing	Testing of emergency generators or alarms should be carried out during the daytime of the normal working week between 09.00 and 17.00 Monday to Friday.	On-going	
18.	Site wide	All areas	Consider potential noise as an aspect in any future infrastructure works. Assess opportunities for reduction of existing noise sources where practical within project scope.	Project Planning	



Notes

Site Boundary
0.5km Radius
From farm centre

– Residential

– Residential and Commercial

– Commercial

Project Title:

RECEPTORS WITHIN 0.5KM

Client Name:

BALLYFASKIN ENTERPRISES LTD,
BALLYFASKIN, BALLYLANDERS,
CO. LIMERICK

PANTHER ENVIRONMENTAL SOLUTIONS LTD

UNITS 3 & 4
INNOVATION CENTRE
GREEN ROAD
CARLOW
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TELE: 059 91 34222
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Drawing Status:	Scale:	NTS	A4
Report	Datum:		Myplan.ie
Drawing Number:	Drawn:		MOL
D9886-02	Checked:		MF
Revision:	Approved:		-
R0	Date:		28/09/2020

Appendix 2 – European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017

STATUTORY INSTRUMENTS.

S.I. No. 605 of 2017

EUROPEAN UNION (GOOD AGRICULTURAL PRACTICE FOR PROTECTION OF WATERS) REGULATIONS 2017

S.I. No. 605 of 2017

EUROPEAN UNION (GOOD AGRICULTURAL PRACTICE FOR PROTECTION OF WATERS) REGULATIONS 2017

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S.I. No. 605 of 2017

EUROPEAN UNION (GOOD AGRICULTURAL PRACTICE FOR PROTECTION OF WATERS) REGULATIONS 2017

I, EOGHAN MURPHY, Minister for Housing, Planning and Local Government, in exercise of the powers conferred on me by section 3 of the European Communities Act 1972 (No. 27 of 1972) and for the purpose of giving further effect to Directive 91/676/EEC of 12 December 1991[1], Directive 2000/60/EC of 23 October 2000[2], Directive 2003/35/EC of 26 May 2003[3], Directive 2006/11/EC of 15 February 2006[4], Directive 2006/118/EC of 12 December 2006[5] and Directive 2008/98/EC of 19 November 2008[6] hereby make the following regulations:

PART 1

PRELIMINARY

Citation, commencement and application

1. (*a*) These Regulations may be cited as the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017.

(*b*) These Regulations shall apply to all holdings in the State.

(*c*) These Regulations shall apply to all movements of livestock manure in the State.

(*d*) These Regulations shall come into effect on 1 January 2018.

Purpose of Regulations

2. The purpose of these Regulations is to give effect to Ireland's Nitrates Action Programme for the protection of waters against pollution caused by agricultural sources. The set of measures in these regulations provides a basic level of protection against possible adverse impacts to waters arising from the agricultural expansion targets set under Food Harvest 2020.

Revocations

3. The European Union (Good Agricultural Practice for Protection of Waters) Regulations 2014 and the European Union (Good Agricultural Practice for Protection of Waters) (Amendment) (No. 2) Regulations 2014 are hereby revoked.

[1]O.J. No. L 375/1, 31 December 1991.
[2]O.J. No. L 327/1, 22 December 2000.
[3]O.J. No. L 156/17, 25 June 2003.
[4]O.J. No. L 64/52, 4 March 2006.
[5]O.J. No. L 372/19, 27 December 2006.
[6]O.J. No. L 312/3, 22 November 2008.

Notice of the making of this Statutory Instrument was published in "Iris Oifigiúil" of 2nd January, 2018.

Interpretation

4. (1) In these Regulations, save where the context otherwise requires—

"Act of 1992" means the Environmental Protection Agency Act, 1992 (No. 7 of 1992);

"Agency" means the Environmental Protection Agency established under section 19 of the Act of 1992;

"agriculture" includes the breeding, keeping and sale of livestock (including cattle, horses, pigs, poultry, sheep and any creature kept for the production of food, wool, skins or fur), the making and storage of silage, the cultivation of land, and the growing of crops (including forestry and horticultural crops);

"application to land", in relation to fertiliser, means the addition of fertiliser to land whether by spreading on the surface of the land, injection into the land, placing below the surface of the land or mixing with the surface layers of the land but does not include the direct deposition of manure to land by animals;

"aquifer" means a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater;

"biochemical oxygen demand" for the purposes of sub-article (2) (*b*) (i) means a 5 day biochemical oxygen demand test done in accordance with method ISO 5815-1:2003, International Organisation for Standardization, or any update of that method;

"chemical fertiliser" means any fertiliser that is manufactured by an industrial process;

"dry matter" for the purposes of sub-article (2)(*b*)(ii) means a test for total solids done in accordance with method 2540B, Standard Methods for the Examination of Water and Wastewater, American Public Health Association, 21st Edition, 2005, or any update of that method;

"eligible area" in relation to a holding and the grassland stocking rate, means the eligible area of the holding or the grassland as appropriate excluding areas under farm roads, paths, buildings, farmyards, woods, dense scrub, rivers, streams, ponds, lakes, sandpits, quarries, expanses of bare rock, areas of bogland not grazed, areas fenced off and not used for production, inaccessible areas and areas of forestry (including Christmas trees), or required to be totally destocked under a Commonage Framework Plan;

"farmyard manure" means a mixture of bedding material and animal excreta in solid form arising from the housing of cattle, sheep and other livestock excluding poultry;

"fertiliser" means any substance containing nitrogen or phosphorus or a nitrogen compound or phosphorus compound utilised on land to enhance growth of

vegetation and may include livestock manure, the residues from fish farms and sewage sludge;

"groundwater" means all water that is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil;

"holding" means an agricultural production unit and, in relation to an occupier, means all the agricultural production units managed by that occupier;

"livestock" means all animals kept for use or profit (including cattle, horses, pigs, poultry, sheep and any creature kept for the production of food, wool, skins or fur);

"livestock manure" means waste products excreted by livestock or a mixture of litter and waste products excreted by livestock, even in processed form;

"local authority" means a city council or county council within the meaning of the Local Government Act, 2001 (No. 37 of 2001);

"the Minister" means the Minister for Housing, Planning and Local Government;

"the Nitrates Directive" means Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources;

"occupier", in relation to a holding, includes the owner, a lessee, any person entitled to occupy the holding or any other person having for the time being control of the holding;

"organic fertiliser" means any fertiliser other than that manufactured by an industrial process and includes livestock manure, dungstead manure, farmyard manure, slurry, soiled water, silage effluent, spent mushroom compost, non-farm organic substances such as sewage sludge, industrial by-products and sludges and residues from fish farms;

"ploughing" includes ploughing and primary cultivation, excluding light cultivation carried out to encourage natural regeneration;

"relevant local authority" means the local authority in whose administrative area a farm holding or part of a farm holding is situated;

"river basin district" means a river basin district established by the European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003) or any amendment thereof in relation to the establishment of river basin districts;

"slurry" includes—

(*a*) excreta produced by livestock while in a building or yard, and

(*b*) a mixture of such excreta with rainwater, washings or other extraneous material or any combination of these, of a consistency that allows it

to be pumped or discharged by gravity at any stage in the handling process but does not include soiled water;

"soil test" means a soil sample taken in accordance with the soil sampling procedure set out in Schedule 1 and analysed in accordance with that Schedule, at a laboratory that meets the requirements of the Minister for Agriculture, Food and the Marine for this purpose;

"soiled water" has the meaning assigned by sub-article (2);

"steep slope" means ground which has an average incline of 20% or more in the case of grassland or 15% or more in the case of other land;

"tidal waters" includes the sea and any estuary up to high water mark medium tide and any enclosed dock adjoining tidal waters;

"waters" includes—

(*a*) any (or any part of any) river, stream, lake, canal, reservoir, aquifer, pond, watercourse, or other inland waters, whether natural or artificial,

(*b*) any tidal waters, and

(*c*) where the context permits, any beach, river bank and salt marsh or other area which is contiguous to anything mentioned in paragraph (*a*) or (*b*), and the channel or bed of anything mentioned in paragraph (*a*) which is for the time being dry, but does not include a sewer;

"waterlogged ground" means ground that is saturated with water such that any further addition will lead, or is likely to lead, to surface run-off;

and cognate words shall be construed accordingly.

(2) (*a*) In these Regulations "soiled water" includes, subject to this sub-article, water from concreted areas, hard standing areas, holding areas for livestock and other farmyard areas where such water is contaminated by contact with any of the following substances—

(i) livestock faeces or urine or silage effluent,

(ii) chemical fertilisers,

(iii) washings such as vegetable washings, milking parlour washings or washings from mushroom houses,

(iv) water used in washing farm equipment.

(*b*) In these Regulations, "soiled water" does not include any liquid where such liquid has either—

(i) a biochemical oxygen demand exceeding 2,500 mg per litre, or

(ii) a dry matter content exceeding 1% (10 g/L).

(*c*) For the purposes of these Regulations, soiled water which is stored together with slurry is deemed to be slurry.

(3) In these Regulations a reference to:—

(*a*) an Article, Part or Schedule which is not otherwise identified is a reference to an Article, Part or Schedule of these Regulations,

(*b*) a sub-article or paragraph which is not otherwise identified is a reference to a sub-article or paragraph of the provision in which the reference occurs, and

(*c*) a period between a specified day in a month and a specified day in another month means the period commencing on the first-mentioned day in any year and ending on the second-mentioned day which first occurs after the first-mentioned day.

(4) In these Regulations a footnote to a table in Schedule 2 shall be deemed to form part of the table.

PART 2

FARMYARD MANAGEMENT

Minimisation of soiled water

5. (1) An occupier of a holding shall take all such reasonable steps as are necessary for the purposes of minimising the amount of soiled water produced on the holding.

(2) Without prejudice to the generality of sub-article (1), an occupier of a holding shall ensure, as far as is practicable, that—

(*a*) clean water from roofs and unsoiled paved areas and that flowing from higher ground on to the farmyard is diverted away from soiled yard areas and prevented from entering storage facilities for livestock manure and other organic fertilisers, soiled water, and effluents from dungsteads, farmyard manure pits, silage pits or silage clamps and

(*b*) rainwater gutters and downpipes where required for the purposes of paragraph (*a*) are maintained in good working condition.

Collection and holding of certain substances

6. (1) Livestock manure and other organic fertilisers, soiled water and effluents from dungsteads, farmyard manure pits, silage pits or silage clamps arising or produced in a building or yard on a holding shall, prior to its application to land or other treatment, be collected and held in a manner that prevents the run-off or seepage, directly or indirectly, into groundwaters or surface waters of such substances.

(2) The occupier of a holding shall not cause or permit the entry to waters of any of the substances specified in sub-article (1).

Provision and management of storage facilities

7. (1) Storage facilities for livestock manure and other organic fertilisers, soiled water and effluents from dungsteads, farmyard manure pits, silage pits or silage clamps shall be maintained free of structural defect and be maintained and managed in such manner as is necessary to prevent run-off or seepage, directly or indirectly, into groundwater or surface water, of such substances.

(2) Storage facilities being provided on a holding on or after 31 March 2009 shall—

(*a*) be designed, sited, constructed, maintained and managed so as to prevent run-off or seepage, directly or indirectly, into groundwater or surface water of a substance specified in sub-article (1), and

(*b*) comply with such construction specifications for those facilities as may be approved from time to time by the Minister for Agriculture, Food and the Marine.

(3) Storage facilities other than those referred to in sub-article (2) shall be of such construction and design and shall be maintained and managed in such a manner so as to comply with the requirements of sub-article (1) and article 6(2).

(4) In this article "storage facilities" includes out-wintering pads, earthen-lined stores, integrated constructed wetlands and any other system used for the holding or treatment of livestock manure or other organic fertilisers.

General obligations as to capacity of storage facilities

8. (1) The capacity of storage facilities for livestock manure and other organic fertilisers, soiled water and effluents from dungsteads, farmyard manure pits, silage pits or silage clamps on a holding shall be adequate to provide for the storage of all such substances as are likely to require storage on the holding for such period as may be necessary as to ensure compliance with these Regulations and the avoidance of water pollution.

(2) For the purposes of sub-article (1) an occupier shall have due regard to the storage capacity likely to be required during periods of adverse weather conditions when, due to extended periods of wet weather, frozen ground or otherwise, the application to land of livestock manure or soiled water is precluded.

(3) For the purposes of Articles 8 to 14, the capacity of storage facilities on a holding shall be disregarded insofar as the occupier does not have exclusive use of those facilities.

(4) For the purposes of Articles 10 to 14 the capacity of facilities required in accordance with these Regulations for the storage of manure from livestock of the type specified in Tables 1, 2 or 3 of Schedule 2 shall be determined by reference to the criteria set out in the relevant table and the rainfall criteria set

out in Table 4 of that schedule and shall include capacity for the storage for such period as may be necessary for compliance with these Regulations of rainwater, soiled water or other extraneous water which enters or is likely to enter the facilities.

(5) The occupier of a holding shall only be eligible to avail of a derogation from the limits on the amount of livestock manure to be applied as specified in Article 20 if the capacity of storage facilities for livestock manure, effluent and soiled water on the holding is in accordance with Articles 8 and 9.

Capacity of storage facilities for effluents and soiled water

9. Without prejudice to the generality of Article 8, the capacity of facilities for the storage on a holding of—

(*a*) effluent produced by ensiled forage and other crops shall equal or exceed the capacity specified in Table 5 of Schedule 2,

(*b*) soiled water shall equal or exceed the capacity required to store all soiled water likely to arise on the holding during a period of 10 days, and

(*c*) soiled water being provided on a holding on or after 1 January 2015 shall equal or exceed the capacity required to store all soiled water likely to arise on the holding during a period of 15 days.

Capacity of storage facilities for pig manure

10. (1) Without prejudice to the generality of Article 8, the capacity of facilities for the storage on a holding of livestock manure produced by pigs shall, subject to sub-article (2) and Article 14, equal or exceed the capacity required to store all such livestock manure produced on the holding during a period of 26 weeks.

(2) The period specified in Schedule 3 shall, in substitution for that prescribed by sub-article (1), apply in relation to livestock manure produced by pigs on a holding where all the following conditions are met—

(*a*) the number of pigs on the holding does not at any time exceed one hundred pigs, and

(*b*) the holding comprises a sufficient area of land for the application in accordance with these Regulations of all livestock manure produced on the holding.

Capacity of storage facilities for poultry manure

11. (1) Without prejudice to the generality of Article 8, the capacity of facilities for the storage on a holding of livestock manure produced by poultry shall, subject to sub-article (2) and Article 14, equal or exceed the capacity required to store all such livestock manure produced on the holding during a period of 26 weeks.

(2) The period specified in Schedule 3 shall, in substitution for that prescribed by sub-article (1), apply in relation to livestock manure produced by poultry on a holding where all the following conditions are met—

(*a*) tillage or grassland farming is carried out on the holding,

(*b*) the number of poultry places on the holding does not exceed 2,000 places, and

(*c*) the holding comprises a sufficient area of land for the application in accordance with these Regulations of all livestock manure produced on the holding.

Capacity of storage facilities for manure from deer, goats and sheep

12. Without prejudice to the generality of Article 8, the capacity of facilities for the storage on a holding of livestock manure produced by deer, goats and sheep shall, subject to Article 14, equal or exceed the capacity required to store all such livestock manure produced on the holding during a period of six weeks.

Capacity of storage facilities for manure from cattle

13. Without prejudice to the generality of Article 8, the capacity of facilities for the storage on a holding of livestock manure produced by cattle shall, subject to Article 14, equal or exceed the capacity required to store all such livestock manure produced on the holding during the period specified in Schedule 3.

Reduced storage capacity in certain circumstances

14. (1) The capacity of facilities for the storage of livestock manure on a holding may, to such extent as is justified in the particular circumstances of the holding, be less than the capacity specified in Article 10, 11, 12 or 13, as appropriate, in the case of a holding where—

(*a*) the occupier of the holding has a contract providing exclusive access to adequate alternative storage capacity located outside the holding,

(*b*) the occupier has a contract for access to a treatment facility for livestock manure, or

(*c*) the occupier has a contract for the transfer of the manure to a person registered under and in accordance with the European Communities (Transmissible Spongiform Encephalopathies and Animal By-products) Regulations 2008 S.I. 252 of 2008 to undertake the transport of manure.

(2) Subject to sub-article (3), the capacity of facilities for the storage of livestock manure may be less than the capacity specified in Article 12 or 13, as appropriate, in relation to—

(*a*) deer, goats or sheep which are out-wintered at a grassland stocking rate which does not exceed 130 kg nitrogen at any time during the period specified in Schedule 4 in relation to the application of organic fertiliser other than farmyard manure, or

(*b*) livestock (other than dairy cows, deer, goats or sheep) which are out-wintered at a grassland stocking rate which does not exceed 85 kg nitrogen at any time during the period specified in Schedule 4 in relation to the application of organic fertiliser other than farmyard manure.

(3) Sub-article (2) shall apply only in relation to a holding where all the following conditions are met—

(*a*) all the lands used for out-wintering of the livestock are comprised in the holding,

(*b*) the out-wintered livestock have free access at all times to the required lands,

(*c*) the amount of manure produced on the holding does not exceed an amount containing 140kg of nitrogen per hectare per annum,

(*d*) severe damage to the surface of the land by poaching does not occur, and

(*e*) the reduction in storage capacity is proportionate to the extent of out-wintered livestock on the holding.

(4) In this article, a grassland stocking rate of 130 kg or 85 kg of nitrogen, as the case may be, means the stocking of grassland on a holding at any time by such numbers and types of livestock as would in the course of a year excrete waste products containing 130 kg or 85 kg of nitrogen, as the case may be, per hectare of the grassland when calculated in accordance with the nutrient excretion rates for livestock specified in Table 6 of Schedule 2.

PART 3

NUTRIENT MANAGEMENT

Interpretation, commencement etc

15. (1) In this Part, "crop requirement", in relation to the application of fertilisers to promote the growth of a crop, means the amounts and types of fertilisers which are reasonable to apply to soil for the purposes of promoting the growth of the crop having regard to the foreseeable nutrient supply available to the crop from the fertilisers, the soil and from other sources.

(2) The amount of nitrogen or phosphorus specified in Table 7 or 8 of Schedule 2, as the case may be, in relation to a type of livestock manure or other substance specified in the relevant table shall for the purposes of this Part be deemed to be the amount of nitrogen or phosphorus, as the case may be, contained in that type of manure or substance except as may be otherwise specified in a certificate issued in accordance with Article 32.

(3) The amount of nitrogen or phosphorus available to a crop from a fertiliser of a type which is specified in Table 9 of Schedule 2 in the year of application of

that fertiliser shall, for the purposes of this Part, be deemed to be the percentage specified in that table of the amount of nitrogen or phosphorus, as the case may be, in the fertiliser.

(4) The amount of nitrogen or phosphorus available to a crop from an organic fertiliser of a type which is not specified in Table 9 of Schedule 2 shall be deemed to be the amount specified in the table in relation to cattle manure or, where supported by the necessary analysis, the amount of nitrogen estimated on the basis of the C:N ratio of the compost in accordance with Table 9A unless a different amount has been determined in relation to that fertiliser by, or with the agreement of, the relevant local authority or the Agency, as the case may be.

(5) A reference in this Part to the "nitrogen index" or the "phosphorus index" in relation to soil is a reference to the index number assigned to the soil in accordance with Table 10 or 11 of Schedule 2, as the case may be, to indicate the level of nitrogen or phosphorus available from the soil.

Duty of occupier in relation to nutrient management

16. (1) An occupier of a holding shall take all such reasonable steps as are necessary for the purposes of preventing or minimising the application to land of fertilisers in excess of crop requirement on the holding.

(2) For the purposes of the determination of the grassland stocking rate in tables 12, 13A and 13B the previous calendar year's stocking rate data shall be used.

(3) (*a*) For the purposes of this article, the phosphorus index for soil shall be deemed to be phosphorus index 3 unless a soil test indicates that a different phosphorus index is appropriate in relation to that soil.

(*b*) The soil test to be taken into account for the purposes of paragraph (*a*) in relation to soil shall, subject to paragraph (*c*), be the soil test most recently taken in relation to that soil.

(*c*) Where a period of four years or more has elapsed after the taking of a soil test, the results of that test shall be disregarded for the purposes of paragraph (*a*) except in a case where that soil test indicates the soil to be at phosphorus index 4.

(*d*) An occupier of a holding located in an area where soils have an organic matter content of 20% and above, as defined on the Teagasc-EPA Indicative Soils map, shall ensure that the soil test undertaken includes organic matter determination. The phosphorus fertilisation rate for soils with more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils. Soil organic matter determination shall not be required where it is certified by a Farm Advisory System Advisor that soils on a holding/field in such areas are mineral soils.

(4) Without prejudice to the generality of sub-article (1) and subject to sub-article (5), the amount of available nitrogen or available phosphorus applied to

promote the growth of a crop specified in Table 12, 13A, 14, 15, 16, 17, 18, 19, 20 or 21 of Schedule 2 shall not exceed the amount specified in the table in relation to that crop having regard to the relevant nitrogen index or phosphorus index, as the case may be, for the soil on which the crops are to be grown. In the case of crops not identified in the tables listed above, fertilisers shall be applied in accordance with the national agriculture and food development authority's guidance as approved by the Minister for Agriculture, Food and the Marine.

(5) Increased phosphorus build-up on grassland on farms with grassland stocking rates of 130kg nitrogen per hectare and above shall only be permitted in accordance with the rates contained in Table 13B provided that the following conditions are met:

(*a*) Soil analysis is carried out for soil phosphorus and soil organic matter contents; soil organic matter testing shall not be required where it is certified by a Farm Advisory System Advisor that all soils on a holding are mineral soils.

(*b*) An occupier availing of the phosphorus build-up programme shall engage the services of a Department of Agriculture, Food and the Marine approved Farm Advisory System Advisor.

(*c*) A detailed farm nutrient plan for the holding shall be submitted in a format specified by the Minister for Agriculture, Food and the Marine.

(*d*) The occupier shall participate in an appropriate training programme specified by the Minister for Agriculture, Food and the Marine for the purpose of meeting the requirements of these regulations.

(6) In the case of a holding on which grazing livestock are held, the amount of available phosphorus supplied to the holding by concentrated feedstuff shall be the amount fed to such livestock in excess of 300kg per 85kg livestock manure nitrogen in the previous calendar year and the phosphorus content of such concentrated feedstuff shall, in the absence of a known phosphorus content or phosphorus content provided by the supplier, be deemed to be 0.5 kg phosphorus in respect of each 100 kg of such concentrated feedstuff.

(7) The nitrogen and phosphorus maximum limits in Tables 12, 13A and 13B are in addition to the nitrogen and phosphorus contained in grazing livestock manure produced on the holding.

PART 4

PREVENTION OF WATER POLLUTION FROM FERTILISERS AND CERTAIN ACTIVITIES

Distances from a water body and other issues

17. (1) Chemical fertiliser shall not be applied to land within 2m of any surface waters.

(2) Organic fertiliser or soiled water shall not be applied to land within—

(*a*) 200m of the abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 100m^3 or more of water per day or serving 500 or more persons,

(*b*) 100m of the abstraction point (other than an abstraction point specified in paragraph (*a*)) of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 10m^3 or more of water per day or serving 50 or more persons,

(*c*) 25m of any borehole, spring or well used for the abstraction of water for human consumption other than a borehole, spring or well specified in paragraph (*a*) or (*b*),

(*d*) 20m of a lake shoreline or a turlough likely to flood,

(*e*) 15m of exposed cavernous or karstified limestone features (such as swallow-holes and collapse features),

(*f*) subject to sub-article (13), 5m of any surface waters (other than a lake or surface waters specified at paragraph (*a*) or (*b*)), or

(*g*) the distance specified in sub-article 2(*f*) shall be increased to 10m for a period of two weeks preceding and two weeks following the periods specified in Schedule 4.

(3) Notwithstanding the requirements of sub-articles (2)(*a*), (2)(*b*) and (2)(*c*), the following distances shall apply—

(*a*) 30m from the abstraction point in the case of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 10m^3 or more of water per day or serving 50 or more persons,

(*b*) 15m from the abstraction point in the case of any borehole, spring or well used for the abstraction of water for human consumption other than a borehole, spring or well specified in paragraph (*a*).

(4) Sub-article (3) shall only apply in situations where a local authority or Irish Water (as the case may be) has completed a technical assessment of conditions in the vicinity of the abstraction point, including taking into account variation in soil and subsoil conditions, the landspreading pressures in the area, the type of abstraction, available water quality evidence and the likely risk to the water supply source and the local authority, in consultation with Irish Water, where relevant, has determined that the distance does not give rise to a risk to the water supply and a potential danger to human health.

(5) A local authority may, following consultation with Irish Water, where relevant, decide to apply the landspreading restriction to the upstream catchment area and to the close proximity downstream of the abstraction point in the case of any surface waters.

(6) A local authority may, in the case of any particular abstraction point and following consultation with the Agency and, where relevant, Irish Water, specify a greater distance to that specified in sub-articles (2) or (3) where, following prior investigations by Irish Water or the local authority (as the case may be), the local authority is satisfied that such distance is appropriate for the protection of waters being abstracted at that point. The distance so specified shall be determined by the local authority using an evidence-based approach which takes into account the natural vulnerability of the waters to contamination from land spreading, the potential risk to human health arising from the landspreading activity as well as the water quality evidence, including information on water quality trends.

(7) Notwithstanding the provisions of sub-articles (2), (3) and (6), a local authority shall, following prior investigations by Irish Water or the local authority (as the case may be) and following consultation with the Agency and, where relevant, Irish Water, specify an alternative distance, including a landspreading exclusion area where necessary, in the case of a water abstraction for human consumption in a scheme supplying $10m^3$ or more of water per day, or serving 50 or more persons, within a timeframe to be agreed with the Agency and, where relevant, Irish Water, where—

(*a*) on the basis of the results of monitoring carried out for the purposes of Article 7 of the European Communities (Drinking Water) Regulations (S.I. No. 122 of 2014), the quality of water intended for human consumption does not meet the parametric values specified in Part I of the Schedule of those Regulations or the quality of water constitutes a potential danger to human health, and it appears to the local authority following consultation with the Agency and, where relevant, Irish Water, that this is due to the landspreading of organic fertilisers or soiled water in the vicinity of the abstraction point, or

(*b*) investigations undertaken by Irish Water as part of the management of a water supply scheme indicate that the landspreading activity presents a significant risk to the drinking water supply or a potential danger to human health having regard to catchment factors in the vicinity of the abstraction point including but not limited to slope, vulnerability, and hydrogeology, the scale and intensity of land spreading pressures, the type of water supply source and water quality evidence, including information on water quality trends.

(8) A distance specified by a local authority in accordance with sub-articles (3), (5), (6) and (7) may be described as a distance or distances from an abstraction point, a hydrogeological boundary or topographical feature or as an area delineated on a map or in such other way as appears appropriate to the authority.

(9) In relation to sub-articles (6) and (7), "prior investigations" means, in relation to an abstraction point, an assessment of the susceptibility of waters to contamination in the vicinity of the abstraction point having regard to—

(*a*) the direction of flow of surface water or groundwater, as the case may be,

(*b*) the slope of the land and its runoff potential,

(*c*) the natural geological and hydrogeological attributes of the area including the nature and depth of any overlying soil and subsoil and its effectiveness in preventing or reducing the entry of harmful substances to water, and

(*d*) where relevant, the technical specifications set out in the document "Groundwater Protection Schemes" published in 1999 (ISBN 1-899702-22-9) or any subsequent published amendment of that document.

(10) Where a local authority specifies a distance in accordance with either of sub-articles (3), (5), (6) or (7) the authority shall, as soon as may be—

(*a*) notify the affected landowners, Irish Water, the Agency and the Department of Agriculture, Food and the Marine of the distance so specified,

(*b*) send to the Agency a summary of the report of any investigations undertaken and the reasons for specifying the alternative distance,

(*c*) make an entry in the register maintained in accordance with Article 30(6), and

(*d*) publish and maintain on the local authority website an updated schedule of setback distances specified for each drinking water supply.

(11) The Agency may issue advice and/or direction to Irish Water or a local authority in relation to any requirements including requirements for technical assessments and prior investigations arising under sub-articles (2), (3), (4), (5), (6), (7), (8) or (9) and Irish Water or a local authority (as the case may be) shall comply with any such advice or direction given.

(12) Notwithstanding sub-article (2)(*f*), organic fertiliser or soiled water shall not be applied to land within 10m of any surface waters where the land has an average incline greater than 10% towards the water.

(13) Where farmyard manure is held in a field prior to landspreading it shall be held in a compact heap and shall not be placed within-

(*a*) 250m of the abstraction point of any surface waters or borehole, spring or well used for the abstraction of water for human consumption in a

water scheme supplying $10m^3$ or more of water per day or serving 50 or more persons,

(*b*) 50m of any other borehole, spring or well used for the abstraction of water for human consumption other than a borehole, spring or well specified at paragraph (*a*),

(*c*) 20m of a lake shoreline or a turlough likely to flood,

(*d*) 50m of exposed cavernous or karstified limestone features (such as swallow-holes and collapse features),

(*e*) 20m of any surface waters (other than a lake or surface waters specified at paragraph (*a*)).

(14) Farmyard manure shall not be held in a field at any time during the periods specified in Schedule 4 as applicable to that substance.

(15) Silage bales shall not be stored outside of farmyards within 20m of surface waters or a drinking water abstraction point in the absence of adequate facilities for the collection and storage of any effluent arising.

(16) No cultivation shall take place within 2m of a watercourse identified on the modern 1:5,000 scale OSi mapping or better, except in the case of grassland establishment or the sowing of grass crops.

(17) Supplementary feeding points shall not be located within 20m of waters and shall not be located on bare rock.

(18) In the case of holdings with grassland stocking rates of 170kgs nitrogen per hectare from livestock manure or above, bovine livestock shall not be permitted to drink directly from waters from 1 January 2021 onwards. Where bovine livestock have direct access to water from the holding, a fence shall be placed at least 1.5m from the top of the riverbank or water's edge (as the case may be) by 1 January 2021. It will be permissible to move livestock across a watercourse to an isolated land parcel where necessary, provided that both sides of the watercourse are fenced.

(19) In the case of holdings identified in sub-Article 18, supplementary drinking points may not be located within 20m of surface waters from 1 January 2021.

(20) There shall be no direct runoff of soiled water from farm roadways to waters from 1 January 2021. The occupier of a holding shall comply with any specification for farm roadways specified by the Minister for Agriculture, Food and the Marine pursuant to this requirement.

(21) There shall be no direct runoff of soiled waters to waters resulting from the poaching of land on the holding.

Requirements as to manner of application of fertilisers, soiled water etc

18. (1) Livestock manure, other organic fertilisers, effluents, soiled water and chemical fertilisers shall be applied to land in as accurate and uniform a manner as is practically possible.

(2) Organic and chemical fertilisers or soiled water shall not be applied to land in any of the following circumstances—

(*a*) the land is waterlogged;

(*b*) the land is flooded or likely to flood;

(*c*) the land is snow-covered or frozen;

(*d*) heavy rain is forecast within 48 hours, or

(*e*) the ground slopes steeply and there is a risk of water pollution having regard to factors such as surface runoff pathways, the presence of land drains, the absence of hedgerows to mitigate surface flow, soil condition and ground cover.

(3) A person shall, for the purposes of sub-article (2)(*d*), have regard to weather forecasts issued by Met Éireann.

(4) Organic fertilisers or soiled water shall not be applied to land—

(*a*) by use of an umbilical system with an upward-facing splashplate,

(*b*) by use of a tanker with an upward-facing splashplate,

(*c*) by use of a sludge irrigator mounted on a tanker, or

(*d*) from a road or passageway adjacent to the land irrespective of whether or not the road or passageway is within or outside the curtilage of the holding.

(5) Subject to sub-article (6), soiled water shall not be applied to land—

(*a*) in quantities which exceed in any period of 42 days a total quantity of 50,000 litres per hectare, or

(*b*) by irrigation at a rate exceeding 5 mm per hour.

(6) In an area which is identified on maps compiled by the Geological Survey of Ireland as "Extreme Vulnerability Areas on Karst Limestone Aquifers", soiled water shall not be applied to land—

(*a*) in quantities which exceed in any period of 42 days a total quantity of 25,000 litres per hectare, or

(*b*) by irrigation at a rate exceeding 3 mm per hour unless the land has a consistent minimum thickness of 1m of soil and subsoil combined.

(7) For the purposes of sub-article (6), it shall be assumed until the contrary is shown that areas so identified as "Extreme Vulnerability Areas on Karst Limestone Aquifers" do not have a consistent minimum thickness of 1m of soil and subsoil combined.

Periods when application of fertilisers is prohibited

19. (1) Subject to this article, the application of fertiliser to land is prohibited during the periods specified in Schedule 4.

(2) Sub-article (1) shall not apply in relation to the application to land of—

(*a*) soiled water, or

(*b*) chemical fertilisers to meet the crop requirements of Autumn-planted cabbage or of crops grown under permanent cover, or

(*c*) fertilisers whose application rate or usage rate is less than 1kg per hectare of available nitrogen or phosphorus.

Limits on the amount of livestock manure to be applied

20. (1) The amount of livestock manure applied in any year to land on a holding, together with that deposited to land by livestock, shall not exceed an amount containing 170 kg of nitrogen per hectare. Where imported livestock manure is to be applied to the land on the holding, calculations shall be based on the previous calendar year's stocking rate.

(2) For the purposes of sub-article (1), the amount of nitrogen produced by livestock and the nitrogen content of livestock manure shall be calculated in accordance with Tables 6, 7 and 8 of Schedule 2 except in the case of pig manure or poultry manure where a different amount is specified in a certificate issued in accordance with Article 32 in relation to that manure.

(3) For the purposes of sub-article (1), the area of a holding shall be deemed to be the eligible area of the holding.

Ploughing and the use of non-selective herbicides

21. (1) Where arable land is ploughed between 1 July and 30 November the necessary measures shall be taken to provide for emergence, within 6 weeks of ploughing, of green cover from a sown crop. A rough surface shall be maintained prior to a crop being sown in the case of lands ploughed between 1 December and 15 January.

(2) Where grassland is ploughed between 1 July and 15 October the necessary measures shall be taken to provide for emergence by 1 November of green cover from a sown crop.

(3) Grassland shall not be ploughed between 16 October and 30 November.

(4) (*a*) When a non-selective herbicide is applied to arable land or to grassland in the period between 1 July and 30 November the necessary measures shall be taken to provide for the emergence, within 6 weeks

of the application, of green cover from a sown crop or from natural regeneration.

(*b*) When a non-selective herbicide is applied to land after 15 October, the requirement in sub-article 4 (*a*) shall be reduced to 75% of the relevant cereal area where a contract is in place for seed crops or crops producing grain destined for human consumption which prohibits the application of a non- selective herbicide preharvest.

(5) Where green cover is provided for in compliance with this Article, the cover shall not be removed by ploughing or by the use of a non-selective herbicide before 1 December unless a crop is sown within two weeks of its removal.

(6) In the case of land which is ploughed in the course of a ploughing competition under the auspices of the National Ploughing Association, a temporary exemption applies in the form of an extension to the time period specified in sub-article (1) or (2) for establishment of green cover after the land is ploughed.

PART 5

GENERAL

General duty of occupier

22. (1) An occupier of a holding shall ensure compliance with the provisions of these Regulations in relation to that holding.

(2) An occupier of a holding shall comply with any advice or guidelines which may be issued from time to time for the purposes of these Regulations by the Minister, the Minister for Agriculture, Food and the Marine or the Agency.

Keeping of records by occupier

23. (1) Records shall be maintained for each holding which shall indicate—

(*a*) total area of the holding,

(*b*) eligible area of the holding,

(*c*) cropping regimes and their individual areas,

(*d*) livestock numbers and type,

(*e*) an estimation of the annual fertiliser requirement for the holding and a copy of any Nutrient Management Plan prepared in relation to the holding,

(*f*) quantities and types of chemical fertilisers moved on to or off the holding, including opening stock, records of purchase and closing stock,

(*g*) livestock manure and other organic fertilisers moved on to or off the holding including quantities, type, dates and details of exporters and

importers, as the case may be, in a format specified by the Minister for Agriculture, Food and the Marine,

(*h*) the results of any soil tests carried out in relation to the holding,

(*i*) the nature and capacity of facilities on the holding for the storage of livestock manure and other organic fertilisers, soiled water and effluents from dungsteads, farmyard manure pits, silage pits or silage clamps, including an assessment of compliance with Articles 9 to 14,

(*j*) the quantities and types of concentrated feedstuff fed to grazing livestock on the holding, and

(*k*) the location of any abstraction point of water used for human consumption from any surface waters, borehole, spring or well.

(2) Where fertiliser is used on a holding and a certificate of the type mentioned in Article 15 or 20 was issued in relation to that fertiliser in accordance with Article 32, a copy of the certificate shall be retained and be available for inspection on the holding for a period of not less than five years from the expiry of validity of the certificate.

(3) Records shall be prepared for each calendar year by 31 March of the following year and shall be retained for a period of not less than five years.

(4) Notwithstanding sub-paragraphs (1), (2) and (3), an occupier shall, where requested by the Minister, the Minister for Agriculture, Food and the Marine, a local authority or the Agency, provide such information as is requested relating to the movement of organic fertilisers on or off the holding.

False or misleading information

24. A person shall not compile information which is false or misleading to a material extent or furnish any such information in any notice or other document for the purposes of these Regulations.

Authorised person

25. (1) In this Article, "authorised person" means—

(*a*) a person who is an authorised person for the purposes of section 28 of the Local Government (Water Pollution) Act, 1977 (No. 1 of 1977), or

(*b*) a person appointed under sub-article (11) to be an authorised person for the purposes of these Regulations.

(2) An authorised person may for any purpose connected with these Regulations—

(*a*) enter and inspect any premises for the purposes of performing a function under these Regulations or of obtaining any information which he or she may require for such purposes,

(*b*) at all reasonable times, or at any time if he or she has reasonable grounds for believing that there is or may be a risk to the environment, or that an offence under these Regulations is being or is about to be committed, arising from the carrying on of an activity at a premises, enter any premises and bring onto those premises such other persons (including a member of the Garda Síochána) or equipment as he or she may consider necessary, or

(*c*) at any time if he or she has reasonable grounds for suspecting there may be a risk to the environment, or that an offence under these Regulations is being or is about to be committed, involving the use of any vehicle halt and board the vehicle and require the driver of the vehicle to take it to a place designated by the authorised person, and such a vehicle may be detained at that place by the authorised person for such period as he or she may consider necessary.

(3) An authorised person shall not enter into a private dwelling under this article unless one of the following conditions applies—

(*a*) the entry is effected with the consent of the occupier or

(*b*) the entry is authorised by a warrant issued under sub-article (7).

(4) Whenever an authorised person enters any premises or boards any vehicle, under this article, he or she may—

(*a*) take photographs and carry out inspections, record information on data loggers, make tape, electrical, video or other recordings,

(*b*) carry out tests and make copies of documents (including records kept in electronic form) found therein and take samples,

(*c*) monitor any effluent, including trade effluent or other matter, which is contained in or discharged from a premises,

(*d*) carry out surveys, take levels, make excavations and carry out examinations of depth and nature of subsoil,

(*e*) require that the premises or vehicle or any part of the premises or anything in the premises or vehicle shall be left undisturbed for a specified period,

(*f*) require information from an occupier of the premises of any occupant of the vehicle or any person employed on the premises or any other person on the premises,

(*g*) require the production of, or inspect, records (including records held in electronic form) or documents, or take copies of or extracts from any records or documents, and

(*h*) remove and retain documents and records (including documents held in electronic form) for such period as may be reasonable for further examination,

which the authorised person, having regard to all the circumstances, considers necessary for the purposes of exercising any function under these Regulations.

(5) (*a*) An authorised person who, having entered any premises or boarded any vehicle pursuant to these Regulations, considers that a risk to the environment arises from the carrying on of an activity at the premises or involving the use of the vehicle, may direct the owner or occupier of the premises or the driver of the vehicle to take such measures as are considered by that authorised person to be necessary to remove that risk.

(*b*) If the owner, occupier or driver referred to in paragraph (*a*) fails to comply with a direction of an authorised person under this subsection, the authorised person may do all things as are necessary to ensure that the measures required under the direction are carried out and the costs incurred by him or her in doing any such thing shall be recoverable from the owner or occupier by him or her, or the person by whom he or she was appointed.

(6) A person shall not—

(*a*) refuse to allow an authorised person to enter any premises or board any vehicle or to bring any person or equipment with him or her in the exercise of his or her powers,

(*b*) obstruct or impede an authorised person in the exercise of any of his or her powers,

(*c*) give to an authorised person information which is to his or her knowledge false or misleading in a material respect, or

(*d*) fail or refuse to comply with any direction or requirement of an authorised person.

(7) (*a*) Where an authorised person in the exercise of his or her powers under this Article is prevented from entering any premises, or if the authorised person has reason to believe that evidence related to a suspected offence under these Regulations may be present in any premises and that the evidence may be removed therefrom or destroyed, or if the authorised person has reason to believe that there is a significant immediate risk to the environment, the authorised person or the person by whom he or she was appointed may apply to the District Court for a warrant under this Article authorising the entry by the authorised person onto or into the premises.

(*b*) If, on application being made to the District Court under this Article, the District Court is satisfied, on the sworn information of the authorised person that he or she has been prevented from entering a premises, the Court may issue a warrant authorising that person, accompanied, if the Court deems it appropriate by another authorised person or a member of the Garda Síochána, as may be specified in the warrant, at any time or times within one month from the date of the issue of the warrant, on production if so requested of the warrant, to enter, if need be by force, the premises concerned and exercise the powers referred to in sub-article (4) or (5).

(8) An authorised person may, in the exercise of any power conferred on him or her by these Regulations involving the bringing of any vehicle to any place, or where he or she anticipates any obstruction in the exercise of any other power conferred on him or her by these Regulations, request a member of the Garda Síochána to assist him or her in the exercise of such a power and any member of the Garda Síochána to whom he or she makes such a request shall comply with this request.

(9) Any certificate or other evidence given, or to be given, in respect of any test, examination or analysis of any sample shall, in relation to that sample, be evidence, without further proof, of the result of the test, examination or analysis unless the contrary is shown.

(10) When exercising any power conferred on him or her by these Regulations an authorised person shall, if requested by any person affected, produce a certificate or other evidence of his or her appointment as an authorised person.

(11) A person may be appointed as an authorised person for the purposes of these Regulations by the Minister, the Minister for Agriculture, Food and the Marine or the Agency.

(12) In this article "premises" includes land whether or not there are any structures on the land.

Offences and related matters

26. (1) A person who contravenes a provision of Parts 2 to 5 and Schedule 5 of these Regulations, excluding Article 17(5), (6), (7), (10) and (11), is guilty of an offence and shall be liable—

(*a*) on summary conviction to a Class A fine or to imprisonment for a term not exceeding 3 months or both or,

(*b*) on conviction on indictment to a fine not exceeding €500,000 or to imprisonment for a term not exceeding one year or to both such fine and such imprisonment.

(2) Where an offence under these Regulations has been committed by a body corporate and it is proved to have been so committed with the consent or connivance of or to be attributable to any neglect on the part of any person who, when the offence was committed, was a director, manager, secretary or other

officer of the body corporate, or a person purporting to act in any such capacity, that person, as well as the body corporate, is guilty of an offence and liable to be proceeded against and punished as if guilty of the first-mentioned offence.

(3) Where the affairs of a body corporate or unincorporated body are managed by its members, sub-article (2) shall apply to the acts and defaults of a member in connection with the functions of management as if such a member were a director or manager of the body.

(4) A prosecution for a summary offence under these Regulations may be taken by a local authority or the Agency.

(5) A prosecution for a summary offence may be taken by a local authority whether or not the offence is committed in the functional area of the authority.

(6) Where a court imposes a fine or affirms or varies a fine imposed by another court for an offence under these Regulations, prosecuted by the Agency or a local authority, it shall, on the application of the Agency or local authority concerned (made before the time of such imposition, affirmation or variation), provide by order for the payment of the amount of the fine to the Agency or local authority, as the case may be, and such payment may be enforced by the Agency or local authority, as the case may be, as if it were due to it on foot of a decree or order made by the court in civil proceedings.

(7) Where a person is convicted of an offence under these Regulations the court shall, unless it is satisfied that there are special and substantial reasons for not so doing, order that person to pay to the Agency or local authority concerned the costs and expenses, measured by the court, reasonably incurred by the Agency or local authority in relation to the investigation, detection and prosecution of the offence, including costs incurred in the taking of samples, the carrying out of tests, examinations and analyses and in respect of the remuneration and other expenses of employees, consultants and advisers.

(8) (*a*) Where a local authority has reason to believe that an offence has been or is being committed in relation to a holding the authority may by notice require the person who appears to the authority to be the occupier to provide such information as is specified in the notice in relation to the alleged offence and it shall be the duty of that person to provide such information within the time frame specified in the notice insofar as is known to him or her.

(*b*) A notice issued in accordance with paragraph (*a*) shall set out the provisions of Articles 22(1) and 24 and of sub-article (1).

(9) Where a local authority considers that an offence under these Regulations has been or is being committed in relation to a holding the authority shall take such enforcement measures as are warranted by the circumstances and as are necessary to ensure satisfactory compliance with these Regulations and which, save in the case of a trivial or insignificant offence or specific mitigating circumstances, shall include prosecution for the alleged offence.

(10) (*a*) Where on application by motion by the Agency or a local authority to the District Court, Circuit Court or the High Court, the court hearing the application is satisfied that a person has failed or is failing to comply with a provision of Parts 2 to 5 of these Regulations, the court may by order—

(i) direct the person to comply with the provisions,

(ii) make such other provision, including provision in relation to the payment of costs, as the court considers appropriate, and

(iii) make such interim or interlocutory order as it considers appropriate.

(*b*) An application for an order under this Article may be made whether or not there has been a prosecution for an offence under these Regulations in relation to the relevant failure of compliance and shall not prejudice the initiation of a prosecution for an offence under these Regulations in relation to the failure of compliance.

(11) The powers, duties and functions assigned to a local authority or the Agency by this Article are additional to, and not in substitution for, the powers, duties and functions assigned by the Local Government (Water Pollution) Acts 1977 and 1990 or any other statute.

(12) A local authority shall maintain a register of inspections undertaken of farm holdings and information received for the purposes of Article 26(8) and shall keep updated a record of all enforcement measures undertaken in accordance with the requirements of Article 26(9).

PART 6

FUNCTIONS OF PUBLIC AUTHORITIES

Minister for Agriculture, Food and the Marine

27. (1) The Minister for Agriculture, Food and the Marine shall carry out, or cause to be carried out, such monitoring and evaluation programmes in relation to farm practices as may be necessary to determine the effectiveness of measures being taken in accordance with these Regulations.

(2) The Minister for Agriculture, Food and the Marine shall, in relation to each year, make the overall results of monitoring and evaluations carried out in accordance with sub-article (1) available to the Agency, to the Minister and, on request, to a local authority.

(3) The Minister for Agriculture, Food and the Marine shall prepare and keep updated a register of all holdings and shall, on request, make a copy of the register available to the Minister, the Agency or a local authority.

(4) The Minister for Agriculture, Food and the Marine shall make available to the Minister, a local authority and/or the Agency a report of an inspection or

inspections carried out for the purposes of these Regulations and/or upon written request other information in relation to any holding or holdings as the case may be where such transfer of data is necessary for the purposes of ensuring compliance with these Regulations.

(5) The Minister for Agriculture, Food and the Marine shall make available to the Minister, a local authority and its agents upon written request information in relation to any holding or holdings as the case may be where such transfer of data is necessary for the purposes of promoting compliance with these Regulations.

Making and review of action programme by the Minister

28. (1) The Minister shall, following consultation with the Minister for Agriculture, Food and the Marine and other interested parties in accordance with this Article, prepare and publish not later than 31 December 2021 and every four years thereafter, a programme of measures (hereafter in this Article referred to as "an action programme") for the protection of waters against pollution from agriculture.

(2) An action programme required by sub-article (1) shall include all such measures as are necessary for the purposes of Article 5 of the Nitrates Directive and shall contain a review of the action programme most recently made for those purposes and of such additional measures and reinforced actions as may have been taken.

(3) The Minister shall ensure that all interested parties are given early and effective opportunities to participate in the preparation, review and revision of an action programme required by this Article and for this purpose shall—

(*a*) inform interested parties by public notices or other appropriate means including electronic media, in relation to any proposals for the preparation, review or revision of an action programme,

(*b*) make available to interested parties information in relation to the proposals referred to in paragraph (*a*) including information about the right to participate in decision-making in relation to those proposals,

(*c*) provide an opportunity for comment by interested parties before any decision is made on the establishment, review or revision of an action programme,

(*d*) in making any such decision, take due account of the comments made by interested parties and the results of the public participation, and

(*e*) having examined any comments made by interested parties, make reasonable efforts to inform those parties of the decisions taken and the reasons and considerations on which those decisions are based, including information on the public participation process.

(4) The Minister shall ensure that such reasonable time is allowed as is sufficient to enable interested parties to participate effectively.

(5) Where the Minister publishes any information in accordance with this Article, the Minister shall—

(*a*) do so in such manner as the Minister considers appropriate for the purpose of bringing that information to the attention of the public, and

(*b*) make copies of that information accessible to interested parties free of charge through a website or otherwise.

(6) The Minister shall specify by way of public notice on a website or otherwise the detailed arrangements made to enable public participation in the preparation, review or revision of an action programme, including—

(*a*) the address to which comments in relation to those proposals may be submitted, and

(*b*) the date by which such comments should be received.

(7) In this Article "interested parties" includes persons who—

(*a*) are carrying on any business which relies upon the water environment or which is affected, or likely to be affected, by the action programme, or

(*b*) are carrying on any activities which have or are likely to have an impact on water status, or

(*c*) have an interest in the protection of the water environment whether as users of the water environment or otherwise.

Agency

29. (1) The Agency shall prepare at four-yearly intervals a report in accordance with Article 10 of the Nitrates Directive and shall submit such report to the Minister.

(2) The Agency shall undertake a review of progress made in implementing these Regulations and shall submit a report to the Minister by 30 June 2021 and every four years thereafter with the results of that review and with recommendations as to such additional measures, if any, as appear to be necessary to prevent and reduce water pollution from agricultural sources.

(3) In preparing the reports required under sub-articles (1) and (2) the Agency shall consult with the Department of Agriculture, Food and the Marine and the co-ordinating local authority in each river basin district, and such other persons as it considers appropriate.

(4) The Department of Agriculture, Food and the Marine, the relevant local authorities and Irish Water shall provide the Agency with such information appropriate to their functions as may be requested by the Agency for the purposes of these Regulations.

(5) Each monitoring programme prepared by the Agency for the purposes of Article 10 of European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003) shall include provision for such monitoring as is necessary for the purposes of these Regulations.

(6) The Agency shall, from time to time as it considers appropriate, make recommendations and give directions to a local authority in relation to the monitoring and inspections to be carried out, or other measures to be taken, by the authority for the purposes of these Regulations and may revise such recommendations and directions at such times thereafter as the Agency considers appropriate.

(7) The powers, duties and functions assigned to the Agency by these Regulations are additional to, and not in substitution for, the powers, duties and functions assigned to the Agency by section 63 of the Environmental Protection Agency Act, 1992 (No. 7 of 1992) or any other statute.

Local authorities

30. (1) A local authority shall carry out, or cause to be carried out, such monitoring of surface waters and groundwaters at selected measuring points within its functional area as makes it possible to establish the extent of pollution in the waters from agricultural sources and to determine trends in the occurrence and extent of such pollution.

(2) A local authority shall carry out or cause to be carried out such inspections of farm holdings as is necessary for the purposes of these Regulations and shall aim to co-ordinate its inspection activities with inspections carried out by other public authorities.

(3) For the purposes of sub-article (2) a local authority shall aim to develop co-ordination arrangements with other public authorities with a view to promoting consistency of approach in inspection procedures and administrative efficiencies between public authorities and to avoid any unnecessary duplication of administrative procedures and shall have regard to any inspection protocol which may be developed by the Minister, following consultation with the Minister for Agriculture, Food and the Marine.

(4) A local authority shall, in the exercise of its functions for the purposes of these Regulations—

(*a*) consult to such extent as it considers appropriate with the Minister, the Minister for Agriculture, Food and the Marine, the Agency, Irish Water and such other persons as it considers appropriate, and

(*b*) have regard to any recommendations made, and comply with any direction given, to the authority by the Agency in accordance with Article 29.

(5) A local authority shall follow the protocol as established by the Minister for furnishing a report of an inspection or inspections to the Department of

Agriculture, Food and the Marine and such other persons as it considers appropriate for the purposes of these Regulations where non-compliance has been detected.

(6) A local authority shall maintain a register of all prior investigations carried out by the local authority itself or carried out by Irish Water within its jurisdiction, and distances specified, for the purposes of Article 17.

Compliance with Data Protection Acts

31. The provision of information by a local authority, the Agency or the Minister for Agriculture, Food and the Marine in accordance with Article 27, 29 or 30 of these Regulations shall not be a breach of the Data Protection Acts, 1988 and 2003.

Certificate in relation to nutrient content of fertiliser

32. (1) A certificate of the type specified in Article 15 or 20 may be issued by a competent authority where the authority is satisfied that the nutrient content of the fertiliser in question has been assessed on the basis of appropriate methodologies based on net farm balance and is as specified in the certificate.

(2) A certificate issued under this Article shall be valid for such period, not exceeding twelve months, as shall be specified in the certificate.

(3) In this Article "competent authority" means—

(*a*) the Agency in relation to fertiliser arising in an activity in relation to which there is in force a licence under Part IV of the Act of 1992, and

(*b*) the Minister for Agriculture, Food and the Marine in relation to any other fertiliser.

(4) Notice of the methodologies used for the purposes of sub-article (1) shall be notified to the European Commission by the competent authority.

Exemption for exceptional circumstances for research

33. (1) A temporary exemption from a requirement of these Regulations may be granted to a person by the Agency or the Minister for Agriculture, Food and the Marine in the case of exceptional circumstances relating to research.

(2) A temporary exemption for the purposes of sub-article (1) shall be granted by way of certificate issued to a person by the Agency or the Minister for Agriculture, Food and the Marine and shall be subject to such conditions, if any, as are specified in the certificate.

(3) A certificate issued for the purposes of this Article shall specify the nature, extent and duration of the exemption to which the certificate relates and a copy of the certificate shall be sent as soon as may be to the relevant local authority.

Transitional provisions

34. Notwithstanding Articles 16 and 26 and sub-article (2), the application to land of phosphorus in excess of the quantities prescribed by Article 16 shall not be an offence for the purposes of Article 16 in a case where—

(*a*) the excess arises from the application of pig manure, and

(*b*) the excess amount does not exceed the amounts specified in Schedule 2, Table 22 of these Regulations from the prescribed dates.

SCHEDULE 1

SOIL TEST

A soil test refers to the results of an analysis of a soil sample carried out by a soil-testing laboratory that meets the requirements of the Minister for Agriculture, Food and the Marine for this purpose.

The analysis for phosphorus and, where appropriate, organic matter content and soil pH, and the taking of soil samples shall be carried out in accordance with the procedures below.

Analysis for Phosphorus

The Morgan's extractable P test as detailed below shall be used to determine the Soil P Index.

Preparation of soil sample

The soil shall be dried at 40°C for at least 24 hours (longer if necessary to ensure complete drying) in a forced draught oven with moisture extraction facilities. It shall then be sieved through a 2 mm mesh screen to remove stones and plant debris. After thorough mixing, it shall be sub-divided to obtain a representative sample. Where large samples are received at the laboratory, the entire sample shall be dried and sieved prior to sub-sampling for analysis.

Morgan's extracting solution

Constituents:— 1,400 ml of 40% NaOH in approximately 15 litres of water. Add 1,440 ml of glacial acetic acid. Make up to 20 litres with water and adjust pH to 4.8. The pH of the solution must be checked regularly and adjusted as necessary before use. A volume ratio of one part sieved soil to five parts of solution must be used, e.g. 6 ml of the prepared soil sample is extracted with a 30 ml volume of Morgan's extracting solution. The sample shall be shaken for 30 minutes to get a suitable mix and permit intended reaction, after which it is filtered through a No. 2 Whatman filter paper into vials for analysis. The filtered extract shall be analysed using standard laboratory techniques.

Results shall be reported in mg per litre.

Analysis of organic matter

Organic matter content shall be determined by loss on ignition.

Place a quantity of the prepared soil sample in an oven for 16 hours at 105°C. Remove and cool in a desiccator. Put approximately 4g of this soil into a pre-weighed crucible and determine the weight of the soil (initial weight). Place in a muffle furnace at 500°C for 16 hours for ashing. Remove the crucible, cool in a desiccator and determine the weight of the ash (final weight).

The organic matter of the soil is the difference in weight between the initial and final weights expressed as a percentage of the initial weight.

Analysis of soil pH

Soil pH shall be determined by measuring pH in a soil:water suspension of 1:2 ratio. Place 10 ml of dried sieved soil and 20 mls of deionised water into a suitable container. Mix thoroughly and allow to stand for at least 10 minutes. Stir for 30 seconds, and allow to settle immediately before recording the pH on a meter calibrated using buffer solutions of pH 4.0 and 7.0

Soil Sampling Procedure

The soil sample shall be taken in accordance with the procedure as specified below:

(*a*) The sampling area shall not exceed 4 hectares. Exceptionally, where soil types and cropping of lands were similar during the previous five years, a sample area of up to 5 hectares shall be deemed acceptable.

(*b*) Separate samples shall be taken from areas that are different in soil type, previous cropping history, slope, drainage or persistent poor yields.

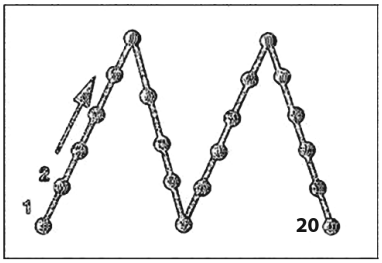
(*c*) Any unusual spots such as old fences, ditches, drinking troughs, dung or urine patches or where fertiliser or lime has been heaped or spilled shall be avoided.

(*d*) A field shall not be sampled for phosphorus until 3 months after the last application of any fertiliser containing this nutrient (chemical or organic).

(*e*) The sampling pattern shown in the figure below shall be followed. A soil core shall be taken to the full 100 mm depth. 20 cores shall be taken from the sampling area and placed in the soil container to make up the sample. Ensure the container is full of soil.

(*f*) The field and sample numbers shall be written/attached onto the soil container.

Figure 1: Sampling pattern



SCHEDULE 2

CRITERIA AS TO STORAGE CAPACITY AND NUTRIENT MANAGEMENT

Table 1 Slurry storage capacity required for sows and pigs

Unit type	m^3/week[1]				
Water:meal ratio changing for finishers only	2.0:1	2.5:1	3.0:1	3.5:1	4.0:1
Breeding unit (per sow place)	-	-	-	-	0.174
Integrated unit (per sow place)	0.312	0.355	0.398	0.441	0.483
Finishing unit (per pig)	0.024	0.031	0.039	0.046	0.053

[1]An additional 200mm freeboard must be provided in all covered tanks and 300mm freeboard in all uncovered tanks. Allowance must also be made for net rainfall during the specified storage period for uncovered tanks.

Table 2 Slurry storage capacity required for cattle, sheep and poultry

Livestock type	m^3/week[1]
Dairy cow	0.33
Suckler cow	0.29
Cattle > 2 years	0.26
Cattle (18-24 months old)	0.26
Cattle (12-18 months old)	0.15
Cattle (6-12 months old)	0.15
Cattle (0-6 months old)	0.08
Lowland ewe	0.03
Mountain ewe	0.02
Lamb-finishing	0.01
Poultry — layers per 1000 birds (30% DM)	0.81

[1]An additional 200mm freeboard must be provided in all covered tanks and 300mm freeboard in all uncovered tanks. Allowance must also be made for net rainfall during the specified storage period for uncovered tanks.

Table 3 Storage capacity required for dungstead manure

Livestock type	Solid fraction (m^3/week)	Seepage fraction (m^3 /week)[1]
Dairy cow	0.28	0.04
Suckler cow	0.25	0.03
Cattle > 2 years	0.23	0.02
Cattle (18-24 months old)	0.23	0.02
Cattle (12-18 months old)	0.13	0.01
Cattle (6-12 months old)	0.13	0.01
Cattle (0-6 months old)	0.07	0.01

[1]Allowance must also be made for net rainfall during the specified storage period for uncovered tanks.

Table 4 Average net rainfall during the specified storage period

County	Millimetres per week
Carlow	24
Cavan	27
Clare	32
Cork	37
Donegal	38
Dublin	17
Galway	34
Kerry	45
Kildare	18
Kilkenny	23
Laois	22
Leitrim	33
Limerick	26
Longford	23
Louth	20
Mayo	40
Meath	19
Monaghan	23
Offaly	20
Roscommon	26
Sligo	32
Tipperary	27
Waterford	31
Westmeath	21
Wexford	25
Wicklow	33

Article 9

Table 5 Storage capacity required for effluent produced by ensiled forage

Crop	Minimum storage requirement	(m^3/100 tonnes)
	Short Term Storage[1]	Full Storage
Grass	7	21
Arable silage	7	21
Maize	4	10
Sugar beet tops	15	50

[1]Only permitted where a vacuum tanker or an irrigation system is available on the holding.

Article 14 and 20

Table 6 Annual nutrient excretion rates for livestock

Livestock type	Total Nitrogen	Total Phosphorus
	kg/year	kg/year
Dairy cow	85	13
Suckler cow	65	10
Cattle (0-1 year old)	24	3
Cattle (1-2 years old)	57	8
Cattle > 2 years	65	10
Mountain ewe & lambs	7	1
Lowland ewe & lambs	13	2
Mountain hogget	4	0.6
Lowland hogget	6	1
Goat	9	1
Horse (>3 years old)	50	9
Horse (2-3 years old)	44	8
Horse (1-2 years old)	36	6
Horse foal (< 1 year old)	25	3
Donkey/small pony	30	5
Deer (red) 6 months — 2 years	13	2
Deer (red) > 2 years	25	4
Deer (fallow) 6 months — 2 years	7	1
Deer (fallow) > 2 years	13	2
Deer (sika) 6 months — 2 years	6	1
Deer (sika) > 2 years	10	2
Breeding unit (per sow place)	35	8
Integrated unit (per sow place)	87	17
Finishing unit (per pig place)	9.2	1.7
Laying hen per bird place	0.56	0.12
Broiler per bird place	0.24	0.09
Turkey per bird place	1	0.4

Article 15 and 20

Table 7 Amount of nutrient contained in 1m^3 of slurry

Livestock type	Total Nitrogen (kg)	Total Phosphorus (kg)
Cattle	5.0	0.8
Pig	4.2	0.8
Sheep	10.2	1.5
Poultry — layers 30% DM	13.7	2.9

For the purposes of calculation, assume that 1 m^3 = 1,000 litres = 1 tonne.

Table 8 Amount of nutrients contained in 1 tonne of organic fertilisers other than slurry

Livestock type		Total Nitrogen (kg)	Total Phosphorus (kg)
Poultry manure	broilers/deep litter	11.0	6.0
	layers 55% dry matter	23.0	5.5
	turkeys	28.0	13.8
Dungstead manure (cattle)		3.5	0.9
Farmyard manure		4.5	1.2
Spent mushroom compost		8	1.5
Sewage sludge		Total nitrogen and total phosphorus content per tonne shall be declared by the supplier in accordance with the Waste Management (Use of Sewage Sludge in Agriculture) Regulations,1998 to 2001 and any subsequent amendments thereto.	
Dairy processing residues and other products not listed above		Total nitrogen and total phosphorus content per tonne based on certified analysis shall be provided by the supplier.	

Article 15

Table 9 Nutrient availability in fertilisers

Fertiliser	Availability (%)		
	Nitrogen	Phosphorus	
		Soil Index 1& 2	Soil Index 3 & 4
Chemical	100	100	100
Pig and poultry manure	50	50	100
Farmyard manure	30	50	100
Spent mushroom compost	20	50	100
Cattle and other livestock manure (including that produced on the holding)	40	50	100

Table 9A Nutrient availability in compost

Compost C:N ratio[1]	N availability (%)
<10	25
12.5	17.5
15.0	10
17.5	5.5
>20	0.0

[1]The determination of the C:N ratio shall be based on a methodology agreed with the Agency or the Minister for Agriculture, Food and the Marine

Table 10 Determining nitrogen index for tillage crops

Tillage crops that follow permanent pasture			
Nitrogen Index			
Index 1	Index 2	Index 3	Index 4
The 5th tillage crop following permanent pasture. For subsequent tillage crops use the continuous tillage table.	The 3rd or 4th tillage crop following permanent pasture. If original permanent pasture was cut only, use index 1.	The 1st or 2nd tillage crop following permanent pasture (see also Index 4). If original permanent pasture was cut only, use index 2.	The 1st or 2nd tillage crop following very good permanent pasture which was grazed only.
Continuous tillage: — crops that follow short leys (1-4 years) or tillage crops			
Previous crop			
Index 1	Index 2	Index 3	Index 4
Cereals Maize	Sugar beet Fodder beet Potatoes Mangels Kale Oil seed rape, Peas, Beans		
	Leys (1-4 years) grazed or cut and grazed		
	Swedes removed	Swedes grazed in situ	
Vegetables receiving less than 200 kg/ha nitrogen	Vegetables receiving more than 200 kg/ha nitrogen		

Table 11 Phosphorus index system

Soil phosphorus index	Soil phosphorus ranges (mg/l)	
	Grassland	Other crops
1	0.0-3.0	0.0-3.0
2	3.1-5.0	3.1-6.0
3	5.1-8.0	6.1-10.0
4	> 8.0	>10.0

Table 12 Annual maximum fertilisation rates of nitrogen on grassland

Grassland stocking rate[1]	Available Nitrogen[2]
(kg/ha/year)	(kg/ha)
⩽170	206
Grassland stocking rate greater than 170 kg/ha/year[3, 4]	
171-210	282
211-250	250
>250	250[5]

[1]Total annual nitrogen (kg) excreted by grazing livestock averaged over the eligible grassland area (ha) (grazing and silage area). Stocking rate refers to grassland area only.
[2]The maximum nitrogen fertilisation of grassland shall not exceed that specified for stocking rates less than or equal to 170 kg/ha/year unless a minimum of 5% of the eligible area of the holding is used to grow crops other than grass or a derogation applies in respect of the holding.
[3]This table does not imply any departure from Article 20(1) which prohibits the application to land on a holding of livestock manure in amounts which exceed 170kg nitrogen per hectare per year, including that deposited by the animals themselves (or 250kg in the case of a holding to which a derogation has been granted, in accordance with the Nitrates Directive).
[4]From 1 January 2021 these fertilisation rates are only applicable where the fertiliser type specified by the Minister for Agriculture, Food and the Marine is used.
[5]The application of nitrogen from livestock manure (including that deposited by the animals themselves) to the eligible grassland area shall not exceed 250 kg nitrogen per hectare per year.

Table 13A Annual maximum fertilisation rates of phosphorus on grassland

Grassland stocking rate[1] (kg/ha/year)	Phosphorus Index			
	1	2	3	4
	Available Phosphorus (kg/ha) [2,3,6]			
<85	27	17	7	0
86-130	30	20	10	0
131-170	33	23	13	0
Grassland stocking rate greater than 170 kg/ha/year[4,5]				
171-210	36	26	16	0
211-250	39	29	19	0
>250	39	29	19	0

[1]Total annual nitrogen (kg) excreted by grazing livestock averaged over the eligible grassland area (grazing and silage area). Stocking rate refers to grassland area only.
[2]The fertilisation rates for soils which have more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils.
[3]Manure produced by grazing livestock on a holding may be applied to Index 4 soils on that holding in a situation where there is a surplus of such manure remaining after the phosphorus fertilisation needs of all crops on soils at phosphorus indices 1, 2 or 3 on the holding have been met by the use only of such manure produced on the holding.
[4]The maximum phosphorus fertilisation of grassland shall not exceed that specified for stocking rates less than or equal to 170 kg/ha/year unless a minimum of 5% of the eligible area of the holding is used to grow crops other than grass or a derogation applies in respect of the holding.
[5]This table does not imply any departure from Article 20(1) which prohibits the application to land on a holding of livestock manure in amounts which exceed 170kg Nitrogen per hectare per year, including that deposited by the animals themselves (or 250kg in the case of a holding to which a derogation has been granted in accordance with the Nitrates Directive).
[6]An additional 15 kg of phosphorus per hectare may be applied on soils at phosphorus indices 1, 2, or 3 for each hectare of pasture establishment undertaken.

Table 13B Annual maximum fertilisation rates of phosphorus on grassland adopting increased P build-up application rates

Grassland stocking rate[1] (kg/ha/year)	Phosphorus Index			
	1	2	3	4
	Available Phosphorus (kg/ha) [2,3,6]			
131-170	63	43	13	0
Grassland stocking rate greater than 170 kg/ha/year[4,5]				
171-210	66	46	16	0
211-250	69	49	19	0
>250	69	49	19	0

[1]Total annual nitrogen (kg) excreted by grazing livestock averaged over the eligible grassland area (grazing and silage area). Stocking rate refers to grassland area only.
[2]The fertilisation rates for soils which have more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils.
[3]Manure produced by grazing livestock on a holding may be applied to Index 4 soils on that holding in a situation where there is a surplus of such manure remaining after the phosphorus fertilisation needs of all crops on soils at phosphorus indices 1, 2 or 3 on the holding have been met by the use only of such manure produced on the holding.
[4]The maximum phosphorus fertilisation of grassland shall not exceed that specified for stocking rates less than or equal to 170 kg/ha/year unless a minimum of 5% of the eligible area of the holding is used to grow crops other than grass or a derogation applies in respect of the holding.
[5]This table does not imply any departure from Article 20(1) which prohibits the application to land on a holding of livestock manure in amounts which exceed 170kg Nitrogen per hectare per year, including that deposited by the animals themselves (or 250kg in the case of a holding to which a derogation has been granted in accordance with the Nitrates Directive).
[6]An additional 15 kg of phosphorus per hectare may be applied on soils at phosphorus indices 1, 2, or 3 for each hectare of pasture establishment undertaken.

Table 14 Annual maximum fertilisation rates of available nitrogen on grassland (cut only, no grazing livestock on holding)

	Available nitrogen (kg/ha)
1st cut	125
Subsequent cuts	100
Hay	80

Table 15 Annual maximum fertilisation rates of phosphorus on grassland cut only

Phosphorus Index				
	1	2	3	4
Available Phosphorus (kg/ha)[1,2,3]				
First cut	40	30	20	0
Subsequent cuts	10	10	10	0

[1]The fertilisation rates for soils which have more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils.
[2]The fertilisation rates apply to grassland where there is no grazing livestock on the holding.
[3]The fertilisation rates in this table apply to those areas of farms where hay or silage is produced for sale off the holding on farms stocked <85kg grassland stocking rate.

Table 16 Maximum fertilisation rates of nitrogen on tillage crops

Crop	Nitrogen Index			
	1	2	3	4
	Available Nitrogen (kg/ha)			
Winter Wheat [1,2]	210	180	120	80
Spring Wheat [1,2]	160	130	95	60
Winter Barley [1]	180	155	120	80
Spring Barley [1,3]	135	100	75	40
Winter Oats[1]	145	120	85	45
Spring Oats[1]	110	90	60	30
Sugar Beet	195	155	120	80
Fodder Beet	195	155	120	80
Potatoes: Main Crop, >120 days[4]	250	190	170	140
Potatoes: Maincrop/seed, 90-120 days[4]	270	230	210	180
Potatoes: Early, 60-90 days[4]	210	170	150	120
Potatoes: Salad, <60 days[4]	140	120	100	60
Maize	180	140	110	75
Field Peas/Beans	0	0	0	0
Oil Seed Rape	225	180	160	140
Linseed	75	50	35	20
Swedes/Turnips	90	70	40	20
Kale	150	130	100	70
Forage Rape	130	120	110	90

[1]Where proof of higher yields is available, an additional 20kg N/ha may be applied for each additional tonne above the following yields:
Winter Wheat — 9.0 tonnes/ha Spring Wheat — 7.5 tonnes/ha
Winter Barley — 8.5 tonnes/ha Spring Barley — 6.5 tonnes/ha
Winter Oats — 7.5 tonnes/ha Spring Oats — 6.5 tonnes/ha
The higher yields shall be based on the best yield achieved in any of the three previous harvests, at 20% moisture content.
[2]Where milling wheat is grown under a contract to a purchaser of milling wheat, an extra 30 kg N/ha may be applied.
[3]Where malting barley is grown under a contract to a purchaser of malting barley, an extra 20 kg N/ha may be applied where it is shown on the basis of agronomic advice that additional nitrogen is needed to address a proven low protein content in the grain.
[4]Length of growing season

Table 17 Maximum fertilisation rates of phosphorus on tillage crops

Crop	Phosphorus Index			
	1	2	3	4
	Available Phosphorus (kg/ha)[1]			
Winter Wheat [2,3,5]	45	35	25	0
Spring Wheat [2,3]	45	35	25	0
Winter Barley [2,3,5]	45	35	25	0
Spring Barley [2,3]	45	35	25	0

Crop	Phosphorus Index			
	1	2	3	4
	Available Phosphorus (kg/ha)[1]			
Winter Oats [2,3,5]	45	35	25	0
Spring Oats [2,3]	45	35	25	0
Sugar Beet	70	55	40	20
Fodder Beet	70	55	40	20
Potatoes: Main Crop	125	100	75	50
Potatoes: Early	125	115	100	50
Potatoes: Seed/Salad	125	115	100	85
Maize	70	50	40	20[4]
Field Peas	40	25	20	0
Field Beans	50	40	20	0
Oil Seed Rape	55	45	35	0
Linseed	35	30	20	0
Swedes/Turnips	70	60	40	40
Kale	60	50	30	0
Forage Rape	40	30	20	0

[1]The fertilisation rates for soils which have more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils.
[2]Where proof of higher yields is available, an additional 3.8kg P/ha may be applied on soils at phosphorus 1, 2, or 3 for each additional tonne above a yield of 6.5 tonnes/ha. The higher yields shall be based on the best yield achieved in any of the three previous harvests, at 20% moisture content.
[3]Where pH is greater than or equal to 7, 20kg P/ha may be applied on soils at phosphorus index 4.
[4]Must be incorporated prior to or during sowing.
[5]For winter cereals on soils of P index 1 and 2, 20 kg of the maximum P fertilisation rate may be applied up to 31st October, which must be incorporated prior to or during sowing.

Table 18 Maximum fertilisation rates of nitrogen on vegetable crops

Crop	Nitrogen Index				Maximum additional supplementation (Top dressing)
	1	2	3	4	
	Available Nitrogen (kg/ha)				
Asparagus (Establishment)	140	115	95	70	
Asparagus (After harvest)	0	0	0	0	70
Broad Beans	0	0	0	0	
French Beans	90	85	75	70	
Beetroot	140	125	105	90	
Brussels Sprouts	120	115	105	100	180
Spring Cabbage	50	35	15	0	250
Other Cabbage	150	135	115	100	100
Broccoli	120	115	100	90	120
Cauliflower (Winter and Spring)	75	50	25	0	150
Cauliflower (Summer and Autumn)	120	85	65	40	120

Crop	Nitrogen Index				Maximum additional supplementation (Top dressing)
	1	2	3	4	
	Available Nitrogen (kg/ha)				
Carrots	90	70	40	0	
Celery	120	85	65	50	180
Courgettes	140	125	105	90	
Leeks	150	130	100	80	150
Lettuce	100	90	80	70	50
Onions	70	60	50	40	70
Scallions	90	80	70	60	60
Parsley	100	80	60	40	150
Parsnip	100	85	70	50	70
Peas (Market)	0	0	0	0	
Rhubarb	100	90	80	70	200
Spinach	140	125	105	90	100
Swede (Horticultural)	70	45	25	20	30
Swede (Transplanted crops)	90	60	30	0	

Table 19 Maximum fertilisation rates of phosphorus on vegetable crops

Crop	Nitrogen Index			
	1	2	3	4
	Available Phosphorus (kg/ha)[1]			
Asparagus (Establishment)	65	45	35	20
Asparagus (After harvest)	27	22	15	10
Broad Beans	65	45	35	20
French Beans	65	45	35	20
Beetroot	65	45	35	20
Brussels Sprouts	65	45	35	20
Spring Cabbage	65	45	35	20
Other Cabbage	65	45	35	20
Broccoli	65	45	35	20
Cauliflower (Winter and Spring)	65	45	35	20
Cauliflower (Summer and Autumn)	65	45	35	20
Carrots	65	45	35	20
Celery	88	65	55	28
Courgettes	65	45	35	20
Leeks	65	45	35	20
Lettuce	80	60	40	20

Crop	Nitrogen Index			
	1	2	3	4
	Available Phosphorus (kg/ha)[1]			
Onions	65	45	35	20
Scallions	65	45	35	20
Parsley	65	45	35	20
Parsnip	65	45	35	20
Peas (Market)	65	45	35	20
Rhubarb	65	45	35	20
Spinach	65	45	35	20
Swede (Horticultural)	70	60	45	35
Swede (Transplanted crops)	70	60	45	35

[1]The fertilisation rates for soils which have more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils.

Table 20 Annual maximum fertilisation rates of nitrogen on fruit/soft fruit crops

	Available Nitrogen (kg/ha)
Apples (Dessert)	125
Apples (Culinary)	125
Pears	50
Cherries	70
Plums	70
Blackcurrants	80
Gooseberries	40
Raspberries	60
Strawberries	50
Redcurrants	60
Loganberries	50
Blackberries	50

Table 21 Annual maximum fertilisation rates of phosphorus on fruit/soft fruit crops

Phosphorus Index				
	1	2	3	4
Available Phosphorus (kg/ha)[1]				
Apples (Dessert)	25	16	12	8
Apples(Culinary)	20	12	10	8
Pears	16	8	4	0
Cherries	16	8	4	0
Plums	16	8	4	0
Blackcurrants	20	16	12	8

Phosphorus Index				
	1	2	3	4
Available Phosphorus (kg/ha)[1]				
Gooseberries	20	16	12	8
Raspberries	20	16	12	8
Strawberries	16	8	4	0
Redcurrants	20	16	12	8
Loganberries	20	16	12	8
Blackberries	20	16	12	8

[1]The fertilisation rates for soils which have more than 20% organic matter shall not exceed the amounts permitted for Index 3 soils.

Table 22 Phosphorus excess limits Article 34

Date	Total available phosphorus (kg/ha)
1 January 2017	3
1 January 2018	3
1 January 2019	2
1 January 2020	1
I January 2021	0

SCHEDULE 3

Articles 10, 11, 13 and 16

STORAGE PERIODS FOR LIVESTOCK MANURE

1. The storage period specified for the purposes of Articles 10(2), 11(2), 13 and 16(5)(*b*) is—

(*a*) 16 weeks in relation to holdings in counties Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, Wexford and Wicklow;

(*b*) 18 weeks in relation to holdings in counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath;

(*c*) 20 weeks in relation to holdings in counties Donegal and Leitrim, and

(*d*) 22 weeks in relation to holdings in counties Cavan and Monaghan.

2. Where 20% or more of a holding lies within one or more counties of higher storage requirement as specified in paragraph 1, the holding shall be deemed for the purposes of this Schedule to lie wholly within the county in relation to which the longest storage period is specified.

SCHEDULE 4

Articles 14, 17 and 19

PERIODS WHEN APPLICATION OF FERTILISERS TO LAND IS PROHIBITED

1. In counties Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, Wexford and Wicklow, the period during which the application of fertilisers to land is prohibited in the period from—

(*a*) 15 September to 12 January in the case of the application of chemical fertiliser

(*b*) 15 October to 12 January in the case of the application of organic fertiliser (other than farmyard manure)

(*c*) 1 November to 12 January in the case of the application of farmyard manure.

2. In counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath, the period during which the application of fertilisers to land is prohibited is the period from—

(*a*) 15 September to 15 January in the case of the application of chemical fertiliser

(*b*) 15 October to 15 January in the case of the application of organic fertiliser (other than farmyard manure)

(*c*) 1 November to 15 January in the case of the application of farmyard manure.

3. In counties Cavan, Donegal, Leitrim and Monaghan, the period during which the application of fertilisers to land is prohibited is the period from—

(*a*) 15 September to 31 January in the case of the application of chemical fertiliser

(*b*) 15 October to 31 January in the case of the application of organic fertiliser (other than farmyard manure)

(*c*) 1 November to 31 January in the case of the application of farmyard manure.

L.S.

GIVEN under the Official Seal of the Minister for Housing, Planning and Local Government,
20 December 2017.

EOGHAN MURPHY,
Minister for Housing, Planning and Local Government.

EXPLANATORY NOTE

(This note is not part of the Instrument and does not purport to be a legal interpretation)

These Regulations revoke the European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2014.

These Regulations, which give effect to Ireland's 4th Nitrates Action Programme, provide statutory support for good agricultural practice to protect waters against pollution from agricultural sources and include measures such as

- periods when land application of fertilisers is prohibited
- limits on the land application of fertilisers
- storage requirements for livestock manure, and
- monitoring of the effectiveness of the measures in terms of agricultural practice and impact on water quality.

The Regulations give further effect to several EU Directives including Directives in relation to protection of waters against pollution from agricultural sources ("the Nitrates Directive"), dangerous substances in water, waste management, protection of groundwater, public participation in policy development and water policy (the Water Framework Directive).

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Appendix 3 – DAFM Draft Code of Good Practice for Reducing Emissions from Agriculture

An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

Code of Good Agricultural Practice for reducing Ammonia Emissions from Agriculture

Table of Contents

1. About the Code of Good Agricultural Practice for reducing Ammonia emissions from Agriculture

Ammonia is one of the gaseous phases of nitrogen and is an air pollutant, which has an adverse effect on human health and the environment. Agricultural activities account for over 99% of the national ammonia emissions. This code of good agricultural practice for reducing ammonia emissions (which will be referred to in the document as "the Code") is a guidance document, that outlines the best practice measures for removing or lowering ammonia emissions associated with agricultural activities. The objective of the Code is to help farmers identify appropriate measures for their individual farm enterprise that will reduce ammonia emissions. Many farms are already delivering a good standard of environmental protection, maintaining land in good agricultural and environmental condition[1] however; there are always practices that can be enhanced. The measures contained within the Code are not exhaustive and are not intended to be taken in isolation. There are co-benefits to be obtained from reducing emissions to air, including reducing loss of nutrients to water bodies and reducing biodiversity loss. The measures in the Code complement good agricultural practices for the protection of waterbodies[2].

It is important to seek professional guidance from an agricultural adviser or consultant when considering implementing a best practice measure outlined in the Code. Some relevant links for further technical information and guidance is provided at the end of each section. It is also vitally important to be mindful and take the necessary health and safety precautions when working on the farm to avoid unnecessary risk to you, others, livestock and the environment.

The following agricultural management activities contribute to ammonia emissions:

- Fertiliser application;
- Manure application;
- Animal feeding strategies;
- Animal housing and manure storage.

Ammonia is a significant precursor for secondary fine particles in the air. These are known to have an adverse effect on human and animal health and the environment. Therefore, reducing agricultural ammonia emissions will improve the air quality and benefit our health. As well as potentially damaging the environment, the release of ammonia is a cost to the farmer through the loss of a valuable plant nutrient. It is important that nutrients are applied using what can be referred to as the 4R principles: using the right nutrient source, at the right rate, at the right time and in the right place.

Nitrogen is a key farm input (through fertilisers and feedstuffs) and the priority should be to take steps to (i) introduce no more nitrogen into the production systems than is necessary and

[1] https://www.agriculture.gov.ie/farmerschemespayments/crosscompliance/goodagriculturalandenvironmentalconditionagaec/

[2] https://www.agriculture.gov.ie/media/migration/ruralenvironment/environment/nitrates/2019/NitratesExplanatoryHandbook070619.pdf

efficient, and (ii) retain it within the production system rather than releasing it to the atmosphere. Utilising nitrogen efficiently will result in higher nutrient use efficiency on farm allowing farmers to be less dependent on purchased or imported fertilisers, and less exposed to price variations or supply issues. In addition, by managing nutrients more efficiently farmers can assist and adapt to challenges of climate change, sequester more carbon in soils, and reduce greenhouse gases (GHG) emissions. This is a win-win both for the farmer and the environment.

There are reduction targets for ammonia that Ireland must adhere to as a Member State (MS) to the European Union (EU). Under the National Emissions Ceiling Directive (NECD) Ireland must reduce ammonia emissions by 1% below 2005 levels by 2020 and 5% below 2005 levels by 2030. In order to avoid potential fines and negative reputational damage on Irelands green image for breaching ammonia ceilings, ammonia emissions must be significantly reduced. It is imperative that existing efficient livestock production and manure management practices are encouraged along with adopting additional practices to reduce ammonia losses.

A summary of key good agricultural practice measures to reduce ammonia emissions are shown in the following chart. A star rating indicates the level of ammonia emission reduction associated with adopting the measure (1 star (0-40% reduction) to 5 stars (≥80-100% reduction)). These good agricultural practice measures will be discussed in more detail in the main body of the Code.

Farming Activity	Good Agricultural Practice to reduce Ammonia Emissions	Percentage Ammonia Emission Reduction
Application of Fertilisers (organic and inorganic) ***(Section 3.1, p.13-16)***	• Preparation and effective use of a Nutrient Management Plan • Limiting ammonia emissions from nitrogen fertilisers ○ reducing the use of urea ○ Replace with protected nitrogen products[3] ○ Soil incorporation[4]	★★★★ ★★★ ★★★★ ★★
Manure Application ***(Section 3.2, p.17-19)***	• Timing of manure application[5] • Incorporation of manures into the soil[6] • Using low emission manure spreading techniques (LESS)	★ ★★★★★ Injection [7]: ★★★★★ Trailing shoe [8]: ★★★ Trailing hose[9]: ★

0-40% ↓
≥50% ↓
≥60% ↓
≥70% ↓
≥80-100%↓

[3] Forrestal, P.J., Harty, M., Carolan, R., Lanigan, G.J., Watson, C.J., Laughlin, R.J., McNeill, G., Chambers, B.J. and Richards, K.G., 2016. Ammonia emissions from urea, stabilized urea and calcium ammonium nitrate: insights into loss abatement in temperate grassland. Soil use and Management, 32, pp.92-100.
[4] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120 . https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf
[5] https://www.teagasc.ie/media/website/publications/2009/Ammonia-emissions-5508.pdf
[6] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf
[7] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[8] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[9] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.

Agricultural Practices to reduce Ammonia Emissions (continued)

Farming Activity	Good Agricultural Practice to reduce Ammonia Emissions	Percentage Ammonia Emission Reduction
Animal Feeding Strategies ***(Section 3.3, p. 20-25)***	• Extended grazing [10] • Maintaining the quality of crude protein when making silage • Use of low-crude protein animal feed and utilising the PDI system (protein digestible in the small intestine) and managing nitrogen application at grazing	☆ ☆ ☆
Animal housing ***(Section 3.4, p. 26-28)***	• Farm cleanliness[11] • Improved housing management for all livestock e.g. regular and reduced yard scraping intervals	☆☆ >20-90% depending on animal type and livestock management[12]
Manure storage ***(Section 3.5, p. 29-32)***	• Farm yard manure storage; cover solid manure heaps[13] • Covered external stores [14,15] • Slurry/ manure amendments	☆ ☆☆ ☆☆

[10] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf

[11] Cited by Rachel Carolan in 'Making Ammonia Visible' An Annex to 'delivering our future, valuing our soils: a sustainable agricultural land management strategy for Northern Ireland. Produced by the Expert Working Group on Sustainable Agricultural Land Management in N. Ireland. Dec. 2017.

[12] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf

[13] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf

[14] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf

[15] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

Agricultural Practices to reduce Ammonia Emissions (continued)

Farming Activity	Good Agricultural Practice to reduce Ammonia Emissions	Percentage Ammonia Emission Reduction
Other beneficial measures to reduce ammonia emissions ***(Section 3.6, p.33)***	• Planting trees as shelterbelts to capture ammonia	★★
	• Incorporating fertiliser into the soil to minimise loss to air[16]	★★
	• Analysis of slurry and organic manure to determine its nutrient content	★★
	• Inclusion of legumes and reduction of N fertiliser in grasslands	★★
	• Protein analysis of grass to determine optimal nutrient requirements	★★
	• Milk urea anaylsis and feedback to nitrogen management	★★
	• Participation in Knowledge Transfer Groups and training courses to enhance agricultural knowledge and improve environmental awareness	★★★★★

HEALTH & SAFETY SAVES LIVES:

Please do not take unnecessary risks while working on the farm. Please adhere to all health and safety practices.

[16] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf.

2. WHY IS THIS CODE NEEDED?

2.1. Nitrogen Loss – Why does it matter?

Nitrogen exists in several different forms, solid, gas and liquid. Ammonia is one of the gaseous phases of nitrogen and is an air pollutant. Agricultural activities account for over 99% of the national ammonia emissions. Nitrogen is one of the key farm inputs entering farms in the form of fertilisers and feedstuffs. Grasslands for example, receive the bulk of the 40 million tonnes (Mt) of animal manures produced during housing annually in Ireland, along with approximately 300,000 to 400,000 tonnes of nitrogen in fertilisers[17]. A proportion of nitrogen from these inputs is volatilised or lost into the air. It is estimated that approximately 15 per cent of the nitrogen in animal manures and two per cent from chemical fertilisers is lost to the atmosphere as ammonia[18].

Ammonia has been found to have a negative impact on the environment and human health. Excess ammonia adversely affects ecosystems, impacting on sensitive plant, animal and invertebrates (e.g., butterflies, insects and birds), thereby changing species biodiversity. Once an ecosystem has been changed it takes a long time, potentially decades to recover and can be costly to restore. It can also have short and long-term negative impacts on human health. In combination with other air pollutants (NO_x and SO_x) it can lead to the formation of secondary particulate matter ($PM_{2.5}$) which can have long-term effects on the cardiovascular system and respiratory system when inhaled.

As well as the potential for environmental and human health damage, there is an economic loss to the farmer as a result of the loss of valuable plant nutrients. Utilising nitrogen efficiently will result in higher nitrogen use efficiency on farm and reduce the need for imported nitrogen. Also efficient nutrient recycling means farmers are less dependent on imported and purchased fertilisers, and less exposed to price variations or supply issues[19].

The main sources of ammonia on farm (2017 figures) are shown in Figure 1.

[17] EPA (2018). Ireland's Transboundary Gas Emissions 1990-2016. March 2018.
[18] EPA (2018). Ireland's Transboundary Gas Emissions 1990-2016. March 2018.
[19] EIP-Agri Focus Group Nutrient recycling. Final Report. November 2017; https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/eip-agri_fg_nutrients_recycling_final_report_2017_en.pdf

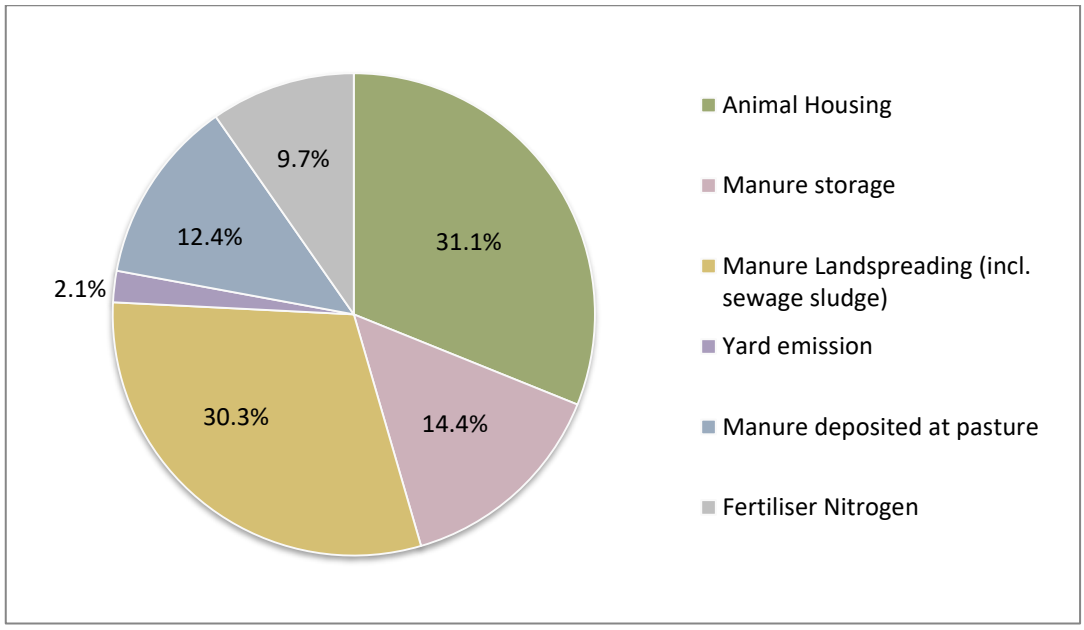


Figure 1: The main sources of ammonia emisions from agiculture (2017 EPA figures)

2.2. Objectives of the Code

The objective of the Code is to provide best guidance on farm practices that will reduce and limit ammonia emissions from agricultural and land management practices. The best practice measures outlined in this document will provide guidance on enhancing existing farm practices, as well as giving details about other easily adopted practices. These practices are centred on the agricultural management activities which are the key sources of ammonia emissions;

- Fertiliser application;
- Manure application;
- Animal feeding strategies;
- Animal housing and
- Manure storage.

Incorporation of some or all of these practices or enhancement of suitable manure and fertiliser strategies already on farms will reduce ammonia emissions and contribute to an overall reduction in ammonia losses. Also, manure measures are required when downstream pollution control measures are adopted to limit increased losses. The priority should be to take steps to:

(i) Introduce no more nitrogen into production systems than is necessary and efficient;
(ii) Retain nitrogen within the production system rather than releasing it to the environment. Utilising nitrogen efficiently will result in higher nutrient use efficiency on farm and the need for less additional bought in/ purchased nutrients. Also, efficient nutrient recycling can allow farmers to be less dependent on imported and purchased fertilisers, and less exposed to price variations or supply issues.

2.3. Legislation

The Clean Air Strategy for Ireland led by the Department of Communications, Climate Action and Environment (DCCAE) provides an opportunity to address air pollution in Ireland. Ammonia emissions are legislated for under the National Emissions Ceilings Directive (NECD). The establishment of this Code is a requirement under the NECD. In Ireland, there is a mandatory ammonia emission target since 2010 of 116 kilotonnes (kt), ammonia emissions must be reduced to 1% below 2005 levels by 2020 (112kt) and 5% below 2005 levels from 2030 onwards (107kt). Agriculture is responsible for many of these emissions and in recent year's ammonia emissions from agriculture have been increasing. The adoption and implementation of the good practice measures outlined in this Code will reduce ammonia emissions. However, it is also important to realise that our grass-based system of farming for cattle and sheep are recognised as having a low level of ammonia emissions. Grazing systems have been shown to provide a 50% reduction in ammonia emissions in comparison to confined systems of production[20].

2.4. What is already being done to address the problem of nitrogen losses in Ireland?

There are synergies between Ireland's air quality legislation and water quality legislation. Ireland, unlike other Member States (MS) has adopted a whole territory approach to nitrates implementation. All farmers are obliged to abide by nutrient management planning which has many synergies with reducing ammonia due to the efficient use of animal manure. The Nitrates Action Programme (NAP) gives effect to the Nitrates Directive; in late 2017 Ireland agreed with the European Commission on its fourth NAP for the period 2018-2021. The NAP agreed includes a balanced programme of measures supporting the objectives of achieving good water quality while at the same time encouraging sustainable and efficient agricultural practices.

In line with the agreement on the latest NAP, Ireland has availed of a derogation from the 170kg livestock manure nitrogen limit as provided for in the Nitrates Directive. This derogation enables farmers to exceed the 170 kg nitrogen limit up to a maximum of 250 kg N/ha subject to compliance with specific environmental conditions. The measures in Ireland's derogation take account of the growing numbers of derogation farmers who are farming at intensive stocking rates, and also environmental objectives for water, climate change and ammonia which Ireland must achieve. For example, a new condition for derogation farms has been included, i.e. from 2018, at least 50% of slurry must be applied by 15th June and after that it must be applied by using low emission slurry spreading (LESS) equipment. The practices within this Code are additional practices that can be adopted in conjunction with actions required under the Nitrates Directive.

The Department of Agriculture, Food and the Marine (DAFM) oversee and administer the Targeted Agricultural Modernisation Schemes (TAMS). This scheme supports capital investment in several target areas which will promote, among other things, sustainability, for example, the purchase of low emissions slurry spreading equipment. Grants are also provided towards farm nutrient storage. There is also a Nutrient Management Planning Online (NMP-Online) tool which is being used by trained advisers to produce fertiliser plans for farmers. Other tools and agri-

[20] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf

environmental programmes include the PastureBase Ireland, the Carbon Navigator Tool, the Agricultural Catchments Programme and the Smart Farming programme which help to reduce carbon emissions per unit of output produced and help protect our rivers.

Knowledge transfer through advisory services and training programmes continue to play an important role in information sharing and helping to reduce nutrient losses. The Department of Agriculture, Food and the Marine has trained in excess of 800 advisors to meet Farm Advisory System requirements. Furthermore, thirty Sustainability Advisors have been appointed within Teagasc and the Dairy Processors, under the Agricultural Sustainability Support and Advisory Programme (ASSAP)[21,22]. This programme offers a free support and advisory service and participation is voluntary. The programme is designed to work closely with the farming community across 190 priority areas of action. The advisers will work together with the Local Authorities Waters Programme (LAWPRO)[23] and proactively advise and work with farmers to identify pressures, protect and improve water quality, climate change and biodiversity strategies. The advisors will assess the farmers' farmyard, nutrient management plane and nutrient management practices and his/ her farmland management. The farmer and the advisor will then focus on whether improvements or actions may or may not be needed on the farm. The advice is designed to 'break the pathway' of pollution and prevent nutrients entering water.

Image Credit: National Rural Network (2018)

[21] https://www.teagasc.ie/environment/water-quality/farming-for-water-quality-assap/
[22] https://www.teagasc.ie/media/website/publications/2019/WEB-Improving-Farm-Sustainability---A5---12pp.pdf
[23] http://watersandcommunities.ie/

3. A SET OF GOOD PRACTICE MEASURES TO CONTROL AND REDUCE AMMONIA EMISSIONS FROM AGRICULTURAL ACTIVITIES

The main sources of ammonia emissions from agriculture arise from the production and application of livestock manures and synthetic fertilisers. The good practice measures give guidance on reducing emissions from these key areas:

- Limiting ammonia emissions from the use of mineral fertilisers;
- Manure application and low-emission manure spreading techniques;
- Animal feeding strategies;
- Animal housing systems;
- Manure storage systems;

Ammonia is generally the largest nitrogen loss pathway on farms. There are nutrient use efficiency benefits and potential reductions in the cost of fertiliser on farms to be gained from reducing ammonia emissions. There are also environmental co-benefits and trade-offs which must be considered to air, soil, water and biodiversity associated with adopting any of these measures;

Air: Decreased ammonia emissions leading to less particulate matter, odour and ozone formation which lowers risks to human health (e.g., aggravated asthma and respiratory problems).

Soil: Improved soil condition due to improved fertiliser management to enhance and maintain plant growth.

Water: Reduced leaching and run-off of nutrients, decreasing eutrophication and improving surface and groundwater quality, thereby also lowering risks to human health and biodiversity.

Biodiversity: Positive effects on biodiversity from reduced nitrogen deposition in natural ecosystems.

3.1. Limiting ammonia emissions from the use of organic and inorganic fertilisers

Ammonia emission from fertiliser applications is dependent on fertiliser type, weather and soil conditions. Organic manures, such as slurry, farmyard manure, sludge and composts are natural sources of nitrogen, which enhance soil fertility and facilitate plant growth; they may be supplemented with inorganic fertilisers if necessary. All applications of nitrogen fertilisers must be applied in accordance with the nutrient planning requirements of the Nitrates Action Programme (NAP). The aim of which is to ensure nutrients are applied under favourable soil, weather and plant growth conditions maximising their absorption in the plant thereby reducing ammonia emissions. Further information about the Nitrates Action Programme and the Directive can be found in the Appendix.

The preparation and use of a Nutrient Management Plan (NMP)

The preparation of a nutrient management plan for a farm as outlined under Ireland's whole territory approach to nitrates allows for the efficient and balanced use of fertilisers. It allows for the maximising of the return from on-farm and off-farm organic fertiliser resources, biological fertilisers and if required chemical fertilisers to balance plant needs. A key aspect of nutrient planning is determining the amount of N, P, K and other nutrients. This can vary according to the soil type, weather condition, application rate, application techniques, characteristics of the organic and mineral fertilisers used[24]. A summary of the NMP for farmers ensures targeted use of chemical and organic fertilisers based on accurate soil samples, waste storage capacities, stocking rates, feed usage inputs, organic fertiliser imports and exports. Following a well prepared NMP will have economic benefits as well as protecting the environment, by reducing nutrient loss to water and emissions to air.

Taking reliable representative soil samples is vitally important[25] and getting them analysed by an accredited laboratory (e.g., an Irish National Accreditation Board accredited laboratory). Organic manures can also be analysed to determine their nutrient value.

The nutrient requirements for a farm can be calculated and interpreted with the help of an approved agricultural advisor/ consultant, who can also prepare the NMP. The amount of fertiliser applied is determined by a soil fertility report and the crop requirement, helping to maintain and enhance soil fertility and reduce losses to the environment. A large proportion of soils in Ireland are sub-optimal in terms of pH, P and K; therefore, optimising soil fertility will allow nitrogen fertiliser rates to be reduced[26], increasing nutrient use efficiency. The application of lime (which is a natural and cost-effective soil conditioner) based on soil sample results will increase the efficacy of applied nitrogen. Also, maintaining soil at Index 3 for phosphorus (P) and potassium (K) will further increase the efficacy of fertilizer nitrogen.

[24] EIP-AGRI Focus Group –Nutrient recycling. Mini-paper – On Farm Tools for accurate fertilisation. https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/2_mp_on_farm_tools_final.pdf
[25] https://www.teagasc.ie/crops/soil--soil-fertility/soil-analysis/soil-sampling/
[26] https://www.teagasc.ie/crops/soil--soil-fertility/soil-analysis/soil-results/

It is important that the fertiliser spreading equipment is properly calibrated. This will ensure an accurate and even spread of inorganic compounds and avoid overlapping while spreading. There is also the additional benefit of a cost saving due to the reduced purchase and application of additional fertiliser.

Other practices that can be considered in Nutrient Management Planning include:

- *Use of a slurry hydrometer* - The nutrient content of cattle slurry is known to be highly variable. A slurry hydrometer is a useful decision support tool for nutrient management. The slurry hydrometer estimates the slurry dry matter content[27]. It can permit an on-the-spot estimate of nutrient concentrations in slurry. It will help to adjust slurry application rates on the move and to achieve better utilisation of available nutrients.
- *Role of Biological N fixation* - The potential to grow alternative crops or grow mixed swards that supply nutrients, e.g. clover which acts as a nitrogen supply. Clover maintains high quality pasture with a low nitrogen fertiliser input and a well-established clover sward can fix nitrogen but requires careful management.
- *Role of precision technology* - the use of precision technology including variable rate technology and GPS precision techniques help with the accurate and even spread of fertilisers. Other examples of precision technology that can enhance the accuracy of nutrient management planning include:

– On site measurement of organic fertiliser composition to improve manure and nutrient management, e.g. slurry hydrometer, Near Infrared Spectroscopy (NIRS) technology[28].
– A soil scan for site-specific fertilisation. Differences in hydraulic conditions, acidity and soil fertility can occur within a field. A soil scan can give information on the soil conditions within the field in order to adapt the fertilisation rates. The fertiliser use and other inputs can be adjusted based on this information.
– Uniform application of fertilisers by using a GPS-systems or variable rate technology for spreading organic and inorganic fertilisers.
– Correct application of fertilisers based on results of NIRS. The farmer can also choose how much nitrogen (or another nutrient) he/she wants to apply per hectare. The dosage system regulates the dosage on the spreader automatically.

Limiting ammonia emissions from nitrogen fertilisers

Fertilisers should be applied to the soil during favourable conditions and at times of optimum plant growth. This maximises the adsorption of ammonium ions into the clay component of the soil, the organic matter and in plant uptake[29], thereby ammonia emissions.

Calcium Ammonium Nitrate (C.A.N. 26-27% N) is the most widely used straight nitrogen source presently used in Ireland. It should be applied in cool but moist conditions and avoid application when rainfall is expected to minimise nitrogen loss to air and water.

[27] https://www.teagasc.ie/media/website/publications/2010/6094.pdf
[28] EIP-AGRI Focus Group –Nutrient recycling. Mini-paper – On Farm Tools for accurate fertilisation. https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/2_mp_on_farm_tools_final.pdf
[29] Department of Environment, Food & Rural Affairs (2018). Code of Good Agricultural Practice (COGAP) for reducing Ammonia Emissions.

Urea (46% N): Irish research has shown that maximum ammonia loss rates in Irish grassland are generally reached within 24-48 hours after application[30]. Ammonia losses from urea fertiliser can be reduced by rapid incorporation of the fertiliser into the soil, i.e. <4 hours after application. If possible, it should be applied when the soil is moist (not wet), or when rainfall is expected, and the weather is cold. Do not spread urea soon after the application of lime as this can lead to increased losses of nitrogen.

Using protected nitrogen products: Ammonia loss from urea is reduced when urea is protected by a urease inhibitor, i.e. protected urea. A *urease inhibitor* is an active ingredient which is coated or incorporated into the fertiliser granule to protect against ammonia loss, forming protected or stabilised urea. In Teagasc trials, the active ingredient known as nBTPT (N-(*n*-butyl) thiosphosphoric triamide) has been found to reduce ammonia losses from urea to levels comparable to CAN, and allowed urea perform equally as well as CAN in terms of grass growth, and also reduce greenhouse gases (GHG) compared with CAN[31].

Care should also be taken when spreading fertilisers. Urea is a less dense fertiliser compared to CAN 27%. It has a density of 0.75kg/l compared to CAN 1.0kg/l which can affect the spread at application and the evenness of application across the spread width. Urea and the urea plus urease inhibitor have limitations due to spread width and compatibility issues which do need careful management.

Image Credit: Teagasc (2019)

[30] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[31] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.

Where to get more information

- You can get information about the Nitrates Action Programme and the Nitrates Directive from:
  - The Department of Agriculture, Food and the Marine: https://www.agriculture.gov.ie/farmerschemespayments/crosscompliance/nitrates/
  - Department of Communications, Climate Action & Environment: https://www.dccae.gov.ie/en-ie/environment/Pages/default.aspx

- You can get guidance and technical advice from:
  - Teagasc (Agriculture and Food Development Authority): https://www.teagasc.ie/crops/soil--soil-fertility https://www.teagasc.ie/environment/water-quality/farming-for-water-quality-assap/
  - The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie/plant-nutrients/nitrogen/
  - The Agricultural Consultants Association: http://aca.ie/
  - Nutrient Management Planning (NMP) Online: https://www.teagasc.ie/environment/soil/nmp/

- Protecting your health and safety while working on the farm is crucial. Health and Safety saves lives, and farmers are urged not to take unnecessary risks and to follow the necessary precautions to ensure their own safety and others. More information about safe farming practices can be gotten from:
  - The Health and Safety Authority: https://www.hsa.ie/eng/
  - Teagasc: https://www.teagasc.ie/rural-economy/farm-management/farm-health--safety/

- Relevant training and courses are provided by:
  - Teagasc (Agriculture and Food Development Authority) (Teagasc ConnectED): https://www.teagasc.ie/about/our-organisation/connected/
  - The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie

3.2. Manure application

Animal slurries account for approximately 80% of organic fertilisers in Ireland[32], and ammonia emissions occur from the land application of slurry and manures. The exposure of slurry or manure to warm, windy and sunny conditions at the time of application promotes ammonia loss, therefore the timing of application and slurry management are important factors to consider. Also, reducing nitrogen losses at application means that more nutrients are available for crop uptake and losses to the environment are minimised. It is also essential to check that machinery used for spreading the manure is in good working order and set at the proper application rate.

Timing of application of manures

Manure needs to be applied at a time when crop demand is high in spring. Where soil conditions allow, aim to have 70% applied by the end of April[33]. Early slurry applications result in better nitrogen uptake, less ammonia emissions, and reduced fertiliser nitrogen requirement.

The application of fertiliser should be done under the right temperature and moisture conditions. The optimum temperature of the soil should be between 6 and 8 degrees to reduce ammonia loss. Application in dull, cool, overcast or misty conditions will result in lower ammonia losses compared to application in warm, dry, sunny weather.

It is also important to ensure that enough slurry storage capacity is available on the farm to ensure that slurry can be spread at the correct times.

Incorporation of manures into the soil (slurry, farmyard manure, sludges, compost)

Where organic fertilisers are applied to tillage land prior to or during the cultivation process, soil incorporation will reduce ammonia emissions. This is because the length of time that the manure is exposed to the air is reduced. Immediate incorporation (or at least within 3-6 hours of application) is recommended[34] . When manure is incorporated immediately after spreading, the risk of nutrient run-off is also reduced. The most effective reduction in emissions is achieved by incorporation within a couple of minutes of spreading, achieving a 70-90% reduction; a 45-65% reduction is achieved if incorporation is within 4 hours, and 30% reduction with incorporation after 24 hours[35, 36].

The appropriate application method may depend on the soil type/crop type and time of year. Incorporation of slurry using disc or tine cultivation is as effective as ploughing in reducing emissions and maximising nitrogen usage.

[32] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[33] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[34] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[35] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2015). United Nations Economic Commission for Europe Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. ECE/EB.AIR/129.
http://www.unece.org/fileadmin/DAM/env/documents/2015/AIR/EB/ECE_EB.AIR_129_ENG.pdf
[36] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions.
http://www.unece.org/index.php?id=41358

Use low emission slurry spreading (LESS) techniques to reduce ammonia emissions

The use of LESS equipment such as a dribble-bar, trailing shoe/hose or injection can reduce ammonia emissions compared to a splashplate by decreasing the surface area of manure in contact with the air.

Low emission slurry spreading techniques such as trailing shoe, place the slurry in bands or lines on the soil or crop, rather than the entire surface as with a conventional splashplate method. Slurry applied with a low emission method has been shown to reduce ammonia losses compared to splashplate application. Low emission slurry spreading techniques combined with adequate application timing help to decrease ammonia emissions and consequently increase the nitrogen fertiliser replacement economic value (NFRV) (Table 1)[37]. For example, a ≥25% reduction in ammonia losses for a trailing shoe technique compared to splashsplate[38], have been shown to occur.

Table 1: Grass contamination, ammonia reduction and NFRV of cattle slurry according to application timing and method[39, 40, 41].

	Low Emission Spreading Equipment				
	Splashplate	Trailing hose	Trailing shoe	Shallow Injector	Deep Injector
Grass contamination	Moderate	Low	Low	Moderate	High
Relative ammonia reduction	0%	30-35%	30-60%	70-80%	90%
NFRV (Spring)	30%	*	40%	*	*
NFRV (Summer)	15%	*	25%	*	*

Application close to the soil also reduces odour emissions and reduces grass contamination (as shown in Table 1). Using LESS technology also has an agronomic benefit, with a consistent application of slurry and an added advantage of reduced slurry run-off.

[37] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[38] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[39] Teagasc (2016). Major & Micro Nutrient Advice for Productive Agricultural Crops.
[40] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358
[41] Department for Environment, Food & Rural Affairs (2018). Code of Good Agricultural Practice (COGAP) for reducing Ammonia Emissions.

Where to get more information

- You can get information about low emission spreading technologies and grants available from:
  - The Department of Agriculture, Food and the Marine: https://www.agriculture.gov.ie/farmerschemespayments/tams/lowemissionslurryspreadingequipmentscheme/

- You can get guidance and technical advice from:
  - Teagasc (Agriculture and Food Development Authority): https://www.teagasc.ie/environment/climate-change/
  - The Agricultural Consultants Association: http://aca.ie/
  - Nutrient Management Planning (NMP) Online: https://www.teagasc.ie/environment/soil/nmp/

- Protecting your health and safety while working on the farm is crucial. Health and Safety saves lives, and farmers are urged not to take unnecessary risks and to follow the necessary precautions to ensure their own safety and others. More information about safe farming practices can be gotten from:
  - The Health and Safety Authority: https://www.hsa.ie/eng/
  - Teagasc: https://www.teagasc.ie/rural-economy/farm-management/farm-health--safety/

- Relevant training and courses are provided by:
  - Teagasc (Agriculture and Food Development Authority) (Teagasc ConnectED): https://www.teagasc.ie/about/our-organisation/connected/
  - The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie

Image Credit: DAFM (2019)

3.3. Animal feeding strategies

Animal feeding strategies help to decrease ammonia emissions from both the manure at housing and storage as well as following the application of the manure to land[42,43]. There is a lot of research currently being conducted regarding feeding strategies and their role in reducing emissions.

Animals absorb nitrogen from protein within the diet which is used to support animal function and growth, and to produce meat and milk. Any excess nitrogen (55% to 95%) is excreted primarily in the urine and the dung[44] which leads to ammonia emissions. The ratio of nitrogen excreted in the urine and dung depends on the animal species, the protein content of the animal feed and the production level of the animal[45] (e.g. young, growing cattle).

There are a number of livestock feeding strategies that can reduce ammonia emissions from livestock production systems. These strategies include:

- Extended grazing;
- Maintaining the quality of crude protein when making silage;
- Use of low-crude protein animal feeds;
- Managing nitrogen applications for grazing to maintain grass crude protein (CP) at acceptable levels.

Improved grassland management and feed budgeting are also important to ensure efficient feed usage on farms.

Extended grazing

Grass is an important source of low-cost and high-quality feed for ruminants. Increasing the grazing season reduces the volume of manure present to emit ammonia and other greenhouse gases during storage. It also reduces the direct and indirect emissions associated with land spreading[46]. It is important to follow good agricultural practices to avoid damaging the soil structure and poaching, which can result in run-off and loss of nutrients to waterbodies.

As grass is the cheapest form of feed for Irish farmers, extended grazing would reduce the dependence on concentrate feeds. Also, Irish grasslands can grow up to 10-15t of dry matter per hectare, significantly reducing the dependence on concentrate feeds, many of which are imported and reducing ammonia loss by a factor of about 10.

It is important to consider the protein content of grass if supplementing with concentrates. Grass has been shown to contain a high protein content and the grass protein content may be

[42] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21

[43] Oenema, O., Velthof, G. Kilmont, Z. and Winiwarter, W. 2012. Emissions from agriculture and their control potentials. TSAP Report #3, Version 2.1. International Institute for Applied Systems Analysis (IIASA).

[44] Oenema, O. and Tamminga, S. 2005. Nitrogen in global animal production and management options for improving nitrogen use efficiency. Sci. China Ser. C.-Life Sci. (2005) 48(Suppl 2): 871.

[45] Oenema, O. and Tamminga, S. 2005. Nitrogen in global animal production and management options for improving nitrogen use efficiency. Sci. China Ser. C.-Life Sci. (2005) 48(Suppl 2): 871.

[46] Schulte, R. and Donnellan T. (2012). A Marginal Abatement Cost Curve for Irish Agriculture. Teagasc.

in excess of the animal's requirements. Young, growing cattle and lactating cows need most protein. Young stock need 13-15% crude protein (CP) in the diet, lactating cows 14-17%, depending on yield and finishing cattle need 11-12% CP[47]. For this reason, crude protein analysis of grass fed to livestock can be beneficial in determining the optimal nutrient requirements.

In addition, grass measuring is an important aid to efficient grass management, for example, using tools such as plate meters and management programmes (e.g., PastureBase or AgriNet). Some of the benefits of grass measurement include[48]:

- Identifying grass surpluses or deficits
- More control over grass quality
- Improved use of fertilisers and meal feeding (less wastage)

A feed budget can help to determine the feed requirement on an annual basis, so the farmer is only growing the required amount of grass necessary, therefore enhancing nitrogen use efficiency.

Delaying fertiliser application after cutting allows the grass to recover and reduces ammonia emissions. Research has shown that a two-week delay in nitrogen fertilisation reduced total ammonia emissions from cut and fertilised grassland by 15%[49].

Image Credit: Teagasc (2019)

[47] https://www.teagasc.ie/media/website/animals/dairy/Whats_in_Grass_Todays_Farm_May2014.pdf
[48] https://www.teagasc.ie/media/website/publications/2011/LiquidMilkProceedings2011.pdf
[49] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21

Maintaining the quality of crude protein when making silage

Silage quality is fundamental to good animal performance, reducing winter feed costs and increasing profitability during the housing period. Grass silage is the basis of most winter-feeding systems and satisfactory animal performance is dependent on the intake of good quality silage[50]. The level of meal fed on farm is determined by silage quality. The composition of silage is determined by the composition of the grass samples, sward type, harvest date, harvest number, wilting period, weather conditions, additive treatment and ensiling method. Silage made under poor conditions could result in silage with a low dry matter, low digestibility (energy value), low crude protein, high ammonia levels and high acidity. This results in low feed intake and poor animal performance.

Crude protein levels are a direct reflection of the quality of grass at the time of harvest. Typical values range from 9-15%[51]. Young leafy grass produces high protein silage, while older stemmy grass produces low protein silage[52]. Protein levels in grass can also be much higher earlier in the silage season than in mid-season. Ensiling the grass as fast as possible after cutting can help to maintain a high quality of crude protein. Ammonia is released from the breakdown of protein in the grass during preservation, reducing feed quality and palatability. High nitrate levels in grass at ensiling contribute to elevated ammonia.

Farmers should aim to have a silage protein content of 12-14%. When the protein content of grass silage drops below this level (12-14%), cattle will require an additional source of protein in their diets. A crude protein of <10% may impede rumen microbial growth[53].

Maintaining the quality of crude protein when making silage, potentially limits the amount of crude protein needed in concentrates, which would be an economic benefit to a farm business.

A silage test can be used to determine the protein and energy content of silage, which will determine the amount of supplementary feed needed. This is particularly important for feed and fodder planning.

[50] https://www.teagasc.ie/publications/2017/silage-analysis---why-its-important-and-what-it-all-means.php
[51] https://www.teagasc.ie/media/website/publications/2016/Teagasc-Quality-Grass-Silage-Guide.pdf
[52] https://www.teagasc.ie/publications/2017/silage-analysis---why-its-important-and-what-it-all-means.php
[53] https://www.teagasc.ie/media/website/publications/2016/Teagasc-Quality-Grass-Silage-Guide.pdf

Image Credit: Teagasc (2019)

Use of low-crude protein animal feed

Using low-crude protein animal feed reduces nitrogen excretion in urine and it avoids the unnecessary and inefficient use of dietary crude protein. The feeding of low-crude protein animal feed has been shown to be one of the most cost-effective and strategic ways to reduce ammonia emissions.

The protein in any feed can be divided into the quantity (Crude Protein %) and quality of the protein (degradability). The crude protein of grass varies typically from 16-28%, depending on the sward type, growth stage, fertiliser regime and time of the year; it will typically be at the highest in spring/ early summer when nitrogen fertiliser is being applied at reasonably high levels to maximise grass growth. Occasionally, protein levels in grass dip as low as 11-12%, This can happen during a period of stress on the grass plant e.g., a drought [54]. The protein content in herbage can be managed through various techniques such as balanced nitrogen fertilisation and grazing/ harvesting the grass at a later growing stage.

The PDI system is a protein nutrition system utilised in Ireland and is based on a French system. A central principle of the PDI system which is used for ruminant dietary formulation is the balancing of energy and protein in the rumen; formulating diets using this system results in improved efficiency of utilisation of feed nitrogen and reduced nitrogen losses. Using effective monitoring tools, such as milk urea testing, enables good management of nitrogen fertilisation at grazing while also ensuring there is not excess nitrogen in the diet.

The net costs of livestock feeding strategies depend on how the diet is manipulated and the changes in the animal's performance.

[54] https://www.teagasc.ie/media/website/animals/dairy/Whats_in_Grass_Todays_Farm_May2014.pdf

Important points to note regarding choosing low protein animal feeds:

- Consider getting advice from a qualified ruminant nutritionist to formulate rations for livestock, taking into account the breed type, gender, stage of production and quality of feed available on farm.
- Consider analysing home-grown forage for crude protein content so that this can be considered in Total Mixed Rations (TMR), e.g., protein content of grass.
- Establish the protein requirements of your animals and adjust the diet as necessary.
- Care must be taken to ensure that crude protein is not reduced below a level where animal wellbeing and performance will be affected.

Dairy Cows & Cattle: It is important to consider the protein content of grass if supplementing with concentrates, as the grass may contain a high protein content. In this case, a crude protein analysis of grass being fed to livestock may be beneficial. It has been suggested that reducing the crude protein in dairy cow diets by 3-4% will significantly reduce the nitrogen excretion in urine by 45%[55]. Conducting a milk urea test will show where there is excess protein in the diet, excess protein in the diet is broken down into urea and excreted in the urine (see *Section 3.6* for more information about the milk urea test).

Pigs: More accurate matching of the diet to specific requirements of the different growth and production stages is necessary when feeding pigs. In pig diets, diet formulation with regards to amino acids is important. There is scope to manipulate the diet to reduce ammonia and odour emissions. It may be possible to reduce ammonia by up to 30% along with odour. Every 1% decrease in crude protein reduces ammonia by 10%[56,57]. Efficiency of nitrogen utilisation varies from 56% for weanling to 66% for finisher to 70% for a breeding sow. Almost half of nitrogen excretion can be attributed to poor amino acid balance in the diet. It is important to formulate the feed to match the specific nutritional requirements.

Poultry: The potential for reducing N excretion through feeding is more limited for poultry than pigs, because the conversion efficiency currently achieved is already great and the variability within a flock of birds is also high. A crude protein reduction of 1% to 2% (10-20 g/kg of feed) can be achieved depending on whether it is a broiler, layer or turkey and its age[58]. There is evidence that significant ammonia reductions of up to 35% are possible through changing poultry diets[59].

[55] 'The importance of research and innovation in the Dairy Sector' Dr. Keith Agnew, AFBI Stakeholder Day, 1st June 2017.
[56] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf
[57] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2015). United Nations Economic Commission for Europe Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. ECE/EB.AIR/129. http://www.unece.org/fileadmin/DAM/env/documents/2015/AIR/EB/ECE_EB.AIR_129_ENG.pdf
[58] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf
[59] Making Ammonia Visible. An Annex to "Delivering Our Future, Valuing Our Soils: A Sustainable Agricultural Land Management Strategy for Northern Ireland". Produced by the Expert Working Group on Sustainable Agricultural Land Management in N. Ireland. December 2017.

Where to get more information

- You can get information about animal health and welfare from:
  - The Department of Agriculture, Food and the Marine: https://www.agriculture.gov.ie

- You can get guidance and technical advice from:
- Teagasc (Agriculture and Food Development Authority): https://www.teagasc.ie/search/?q=animal+feeding+strageties
- Agricultural Consultants Association: http://aca.ie/
- Irish Grassland Association: https://www.irishgrassland.com/
- PastureBase Ireland: https://www.teagasc.ie/crops/grassland/pasturebase-ireland/

- Protecting your health and safety while working on the farm is crucial. Health and Safety saves lives, and farmers are urged not to take unnecessary risks and to follow the necessary precautions to ensure their own safety and others. More information about safe farming practices can be gotten from:
- The Health and Safety Authority: https://www.hsa.ie/eng/
- Teagasc: https://www.teagasc.ie/rural-economy/farm-management/farm-health--safety/

- Relevant training and courses are provided by:
- Teagasc (Agriculture and Food Development Authority) (Teagasc ConnectED): https://www.teagasc.ie/about/our-organisation/connected/
- The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie

3.4. Animal housing

Different animals require different housing systems and environmental conditions for their health and welfare. This section will look at management of animal housing to reduce ammonia emissions for cattle, dairy, pig and poultry housing systems. All these practices will further improve animal welfare and hygiene and have additional environmental benefits for air, soil, water and biodiversity.

For animal housing, reducing ammonia emissions is based on one or more of the following principles[60,61,62,63];

- Decreasing the surface area fouled by manure;
- Adsorption of urine (e.g. by straw);
- Rapid removal of urine;
- Rapid separation of faeces and urine;
- Decreasing the movement of air over the manure;
- Reducing the temperature of the manure and of the surface area;
- Removing (scrubbing) ammonia from exhaust air through scrubbers;

Farm Cleanliness

The areas of dirty yards in a farmyard should be minimised, by brushing, scraping and washing livestock and handling areas. Maintaining clean farmyards and housing areas reduces ammonia emissions and the amount of soiled water produced in a farmyard.

Regular cleaning of hard standing and collecting areas and regular manure/excreta removal can reduce ammonia emissions by up to 49%[64].

Cattle Housing

The tendency to increase the time that cattle are housed increases the amount of manure that must be managed compared to that deposited on fields. Not surprisingly, this increases ammonia emissions from animal houses, manure storage and manure spreading hot spots.

The following steps can help to reduce ammonia emissions from cattle housing;

- Regular cleaning of sheds and yards, for example, with automatic scrappers and regular washing down of collection yards. Keeping passageways and yards used by livestock as

[60] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21.
[61] Oenema, O. (2016). Principles of overall nitrogen management, background document. Prepared for the DG En/TFRN workshop, Brussels, October 11-12, 2016. Wageningen University.
[62] Economic Commission for Europe, Executive Body for the Convention on Long-range Transboundary Air Pollution (2014). Guidance document on preventing and abating ammonia emissions from agricultural sources. ECE/ EB.AIR/ 120. https://www.unece.org/fileadmin/DAM/env/documents/2012/EB/ECE_EB.AIR_120_ENG.pdf
[63] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358
[64] Cited by Rachel Carolan in 'Making Ammonia Visible' An Annex to 'delivering our future, valuing our soils: a sustainable agricultural land management strategy for Northern Ireland. Produced by the Expert Working Group on Sustainable Agricultural Land Management in N. Ireland. Dec. 2017.

clean as possible.

- Adsorption of urine, for example, straw can be used to soak up urine and keep floors dry, preventing the pooling of urine[65].
- Housing design to facilitate separation of faeces and urine; this can reduce both emissions during housing and emissions at spreading time. Design floors to drain effectively so urine and slurry do not pool.
- Decreasing the movement of air over the manure; a moderate reduction in emissions can be achieved in houses with automatically controlled natural ventilation due to decreased temperature and reduced air velocities above the manure.

Dairy Housing

The following practices can help to reduce ammonia emissions from dairy housing;

- Regular cleaning or washing down of dairy collection yards;
- Keeping passageways and yards used by livestock as clean as possible can help to lower ammonia emissions;
- Scraping of buildings at least twice a day[66], for example using automatic scrapers.

Pig Housing

These techniques can be considered for reducing ammonia emissions from pig housing, particularly when refurbishing or constructing new buildings. Ensuring that any changes are compatible with the existing housing system and allow for adequate ventilation:

- Reducing the area where manure is gathered;
- Partly slatted floors emit less ammonia, allowing the manure to fall more rapidly into the pit below the pen.
- Increase the frequency of slurry (manure) removal;
- Keep bedding clean and dry because wet material emits more ammonia;
- Reducing the ventilation rate taking into account the minimum levels required for animal welfare and health reasons;
- Reducing air flow over the surface of the manure;
- Air cleaning systems (such as wet acid scrubber; two-stage or three stage air cleaning system; bioscrubber (or biotrickling filter). These devices are fitted to the outlets of mechanically ventilated pig houses and some systems can reduce ammonia emissions in exhaust air by up to 90%[67].

[65] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

[66] Department for Environment, Food & Rural Affairs (2018). Code of Good Agricultural Practice (COGAP) for reducing Ammonia Emissions.

[67] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

Poultry Housing

Poultry manure and litter should be kept as dry as possible because wet material emits more ammonia. Other practices than can reduce ammonia emissions from poultry housing include:

- Reducing the surface area where manure is gathered;
- Removing the manure frequently to an external slurry store (e.g. removal of manure on a belt removal system);
- Drying the manure;
- Air cleaning system, e.g. using acid scrubbers or bio-trickling filters. A multistage scrubber is recommended because of the co-benefits of reducing ammonia and other particulate emissions, including phosphorus, which is an important plant nutrient.

Where to get more information

You can get information about animal health and welfare from:

- The Department of Agriculture, Food and the Marine:

  https://www.agriculture.gov.ie/animalhealthwelfare/animalwelfare/

  https://www.agriculture.gov.ie/farmerschemespayments/tams/

You can get guidance and technical advice from:

- Teagasc (Agriculture and Food Development Authority):

  https://www.teagasc.ie/rural-economy/farm-management/farm-buildings/animal-housing/

  https://www.teagasc.ie/animals/beef/animal-health/animal-welfare-and-health/

- Agricultural Consultants Association: http://aca.ie/

Protecting your health and safety while working on the farm is crucial. Health and Safety saves lives, and farmers are urged not to take unnecessary risks and to follow the necessary precautions to ensure their own safety and others. More information about safe farming practices can be gotten from:

- The Health and Safety Authority: https://www.hsa.ie/eng/
- Teagasc: https://www.teagasc.ie/rural-economy/farm-management/farm-health--safety/

Relevant training and courses are provided by:

- Teagasc (Agriculture and Food Development Authority) (Teagasc ConnectED): https://www.teagasc.ie/about/our-organisation/connected/
- The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie

3.5. Manure storage

Ammonia emissions from manure storage systems can be reduced by the appropriate design and management of the manure/ slurry storage systems. One or more of the following factors may be considered[68,69];

- Decreasing the surface area where emissions arise from, e.g., covering the storage area;
- Decreasing the time over which emissions can take place, i.e., frequent removal or slurry/ manure;
- Decreasing the amount of ammonia emitted from the manure/ slurry, e.g., lowering the pH.

Maintaining storage facilities in good condition is important to ensure the containment of slurry and prevent pollution to the environment.

HEALTH & SAFETY SAVES LIVES: SLURRY

Gas Poisoning from slurry gases and drowning in slurry or water, caused 20 (10%) of farm deaths between 2006 and 2015[70]

Please do not take unnecessary risks while working on the farm.
Please adhere to all health and safety practices.

For solid manures: It is important to minimise the movement of air over the manure to reduce ammonia emissions. For example, In the case of poultry manure and litter it is important to keep these dry. When poultry manure/ litter is wet it releases ammonia into the air.

For slurry or other liquid manure types: Cattle slurries for example, normally build up a natural crust of floating organic material. The crust should cover the whole area of the slurry store/ tank, to be efficient in reducing ammonia emissions. Crusts will only form if the slurry dry matter (DM) is high enough (>7%) and agitation should be avoided until spreading, as this will break the crust[71]. For outside stores, the store/ tank should be filled from below the surface of the crust to prevent it from breaking up. Natural crusts do not protect the manure from rainfall, so an impermeable cover or certain types of semi-permeable covers would be more effective. The addition of adding chopped straw or Light Expanded Clay Aggregate (LECA) pellets to non-crusting slurry may aid the formation of a crust. These fibres rise to the surface and act as a barrier, reducing the interaction between the movement of air and the nitrogen in the slurry.

If slurry does not form a natural crust, putting a cover over the store will reduce the ammonia lost to the air. It will also help retain valuable nutrients within the slurry. Covering the slurry

[68] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21

[69] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

[70] https://www.hsa.ie/eng/Publications_and_Forms/Publications/Agriculture_and_Forestry/Farm_Safety_Code_of_Practice_Risk_Assessment_Document.pdf

[71] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

store reduces the dilution of the slurry by rainfall, decreasing the volume of slurry to be spread and potentially allowing savings to be made on slurry spreading costs. Also, if LESS techniques are used for slurry application emissions are reduced even further. **It is important to seek professional advice if adding a cover to an existing tank.**

Farm yard manure storage

Cover solid manure heaps – Limits the amount of ammonia that can escape to the atmosphere.

Covered external slurry storage

Covering an external store can reduce the amount of ammonia released into the atmosphere. It also reduces the dilution of the slurry by rainfall, decreasing the volume of slurry to be spread and potentially allowing savings to be made on slurry spreading costs.

Examples of covers include:

- plastic, canvas, geotextile material applied over earthen bank lagoons or
- other external stores such as above-ground circular stores or air tight lids over circular above-ground slurry stores.

To decide on the type of cover, the percentage of dry matter in the manure needs to be considered as well as the expected amount of precipitation[72]. It is important to seek professional advice if adding a cover to an existing tank.

- *Retrofitting to existing stores*: Air tight lids are an effective measure to reduce emissions from slurry stores.
- *Tight lid, roof or tent structures*: can be built on concrete or steel tanks or silos. They can reduce ammonia emissions by 80%. It is important to check that the store is structurally sound to support the weight of the lid or roof[73].
- *Floating sheeting*: can be applied to concrete or steel slurry tanks but is best suited to small earth-banked lagoons. The sheeting may be made of plastic, canvas or other suitable materials. They can reduce ammonia emissions in storage by 60%[74], and some types will prevent water entering the store.
- *Floating LECA (light expanded clay aggregate) balls or hexa-covers:* are suitable for non-crusting pig manures or digestate. They can reduce ammonia emissions in storage by 60%[75], and some types will prevent water entering the store.

[72] Sarteel, M. and Tostivint, C. (2013). Closing the mineral cycles at farm level. Good practices to reduce nutrient loss in the Brittany Region (France). Part of the project 'Resource Efficiency in Practice – Closing Mineral Cycles Funded by the EC., No. 070372/2013/665122/ETU/B.1

[73] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

[74] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

[75] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

– *Slurry or digestate storage bags*: These can be installed within existing storage tanks or lagoons as an alternative to installing covers. They may not be suitable in all locations and require secondary containment, e.g. a bund to prevent leakages, spillages and ensure no pollution. Ammonia emissions can be reduced in storage by up to 100%[76].

Covering external stores means that there is the potential for higher nitrogen recovery, but this is dependent on appropriate land application methods i.e., the use of LESS technologies and incorporation of the manure.

Due to the higher nutrient content of the manure, manure nutrient levels need to be calculated to match crop requirements, otherwise application of the same quantity of manure would result in higher nutrient levels and potential environmental and economic losses.

Slurry/ manure amendments:

Amendment of poultry litter with Aluminium sulphate (Alum) & drying poultry manure

The addition of Alum has been found to reduce ammonia emissions from poultry houses, both by reducing its production in the litter and by reducing ventilation needs[77]. A reduction in pH may also persist in the litter during land spreading, further reducing ammonia loss. The pH reduction may also reduce pathogen numbers. This is suitable for all poultry houses producing dry litter (broilers/breeders/ turkeys).

Regular addition of Alum can decrease ammonia emissions by up to 70%[78]. This results in lower ammonia levels in the poultry houses and Alum also reduces particulate matter ($PM_{2,5}$)[79]. Alum additions to poultry litter also precipitates phosphorus into a form which is not water soluble. This greatly reduces phosphorus runoff from fields fertilized with poultry litter, as well as phosphorus leaching.

Ammonia emissions from battery deep-pit or channel systems can be lowered by reducing moisture content or the manure by ventilating the manure pit.

It is important to note that research is on-going into the effects of slurry/ manure amendments, such as Alum on soil chemistry and soil properties.

It is very important to seek the professional advice of an agricultural adviser/ consultant prior to choosing a slurry amendment product. This ensures that you pick the most appropriate product and that the product is safe and approved for use.

[76] UNECE (2015) Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. http://www.unece.org/index.php?id=41358

[77] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21

[78] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21

[79] Draft guidance document for preventing and abating ammonia emissions from agricultural sources, submitted by the Co-chairs of the Task Force on Reactive Nitrogen. WGSR-49. Informal document no. 21

Addition of amendments to cattle/ pig slurry

The addition of amendments to slurry to lower the pH can reduce ammonia emissions during storage.

A reduction in nitrogen losses during the storage period will result in more nitrogen in the slurry during application. There may be an impact of increased emissions after land spreading and this still needs to be investigated. There is a need to be careful during application and ensure that it is applied in the optimum conditions and using LESS technology to minimise losses.

It is important to note that research is on-going into the effect of slurry/ manure amendments on soil chemistry and soil properties.

It is very important to seek the professional advice of an agricultural adviser/ consultant prior to choosing a slurry amendment product. This ensures that you pick the most appropriate product and that the product is safe and approved for use.

Where to get more information

- You can get information about manure storage from:
  - The Department of Agriculture, Food and the Marine: https://www.agriculture.gov.ie

- You can get guidance and technical advice from:
  - Teagasc (Agriculture and Food Development Authority): https://www.teagasc.ie/rural-economy/farm-management/farm-buildings/silage--slurry/
  - The Agricultural Consultants Association: http://aca.ie/

- Protecting your health and safety while working on the farm is crucial. Health and Safety saves lives, and farmers are urged not to take unnecessary risks and to follow the necessary precautions to ensure their own safety and others. More information about safe farming practices can be gotten from:
  - The Health and Safety Authority: https://www.hsa.ie/eng/
  - Teagasc: https://www.teagasc.ie/rural-economy/farm-management/farm-health--safety/

- Relevant training and courses are provided by:
  - Teagasc (Agriculture and Food Development Authority) (Teagasc ConnectED): https://www.teagasc.ie/about/our-organisation/connected/
  - The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie

3.6. Additional measures to prevent and abate ammonia emissions

- **Capturing ammonia by planting trees** can be an effective mitigation measure in capturing ammonia deposition near livestock units. Trees with rapid growth and high leaf area index are ideal for shelterbelts established to recapture nitrogen.

- **Incorporating fertiliser into the soil** to minimise loss to the air.

- **Analysis of slurry and organic manure to determine its nutrient content:** The nutrient content of cattle slurry is known to be highly variable. A slurry hydrometer is a useful decision support tool for nutrient management and permits an on-the-spot estimate of nutrient concentrations in slurry. Samples of organic manure can also be sent to an accredited laboratory to determine its nutrient content.

- **Inclusion of legumes and reduction of N fertiliser in grasslands**

- **Protein analysis of grass on the farm:** grass has been shown to have high protein content and this should be taken with into account when feeding concentrates to livestock, optimising the diet and minimising excess crude protein in the diet.

- **Conduct milk urea analysis:** excess nitrogen is taken up in the diet and can be detected using milk urea analysis. Milk urea analysis could be used to optimise the level of protein in the diet; it reflects the level of protein in the diet. Milk urea levels are usually higher during the indoor period, this is due to the greater amount of crude protein (20-25 %) in good quality pasture. Milk urea is a by-product formed from the breakdown of dietary protein. Excess protein in the diet, which is not used by the cow, is broken down into urea and passed in the urine. Research in the Netherlands has found that ammonia emissions rise exponentially with increasing milk urea (MU) concentrations[80]. A MU levels <20 mg may be indicative of insufficient protein in the cows' diet and levels >35 mg could be considered excessive and may impact on reproduction. Outside the range of 20-35 mg it is advisable to have the diet checked for protein content. Balancing the diet for protein and energy intake is essential to ensure that cows produce milk with good constituents.

- Participation in **Knowledge Transfer Groups** and **training courses** for continued professional development, knowledge exchange and to enhance environmental awareness.

[80] Van Duinkerken, G. and Sebek, L.B.J. (2007) Milk urea as an indicator for ammonia emission reduction from diary barns by feeding measures. In: *Ammonia Emissions in Agriculture*. Wageningen Academic Publishers, Netherlands.

4. APPENDIX

4.1. Legislative information

Agricultural activities account for over 99% of the national ammonia (NH_3) emissions. Under the National Emissions Ceiling Directive (NECD), Ireland has had a mandatory ceiling for ammonia since 2010 of 116kt, ammonia emissions must be reduced by 1% below 2005 levels by 2020 (112kt) and 5% below 2005 levels from 2030 (107kt) onwards.

Ireland is a Party to the Convention on Long Range Transboundary Air Pollution (CLRTAP) under which certain transboundary air pollutants including ammonia are controlled. As a member of the EU, implementation of the Gothenburg protocol (a daughter protocol of the CLRTAP) is achieved through limits set out in the National Emissions Ceilings Directive 2001/81/EC (NECD). The National Emissions Ceiling Directive controls a range of emissions to the air which include sulphur dioxide, nitrous oxides, fine particulate matter, volatile organic carbon (VOC) and ammonia. Member states must implement measures to ensure that reduction targets for these air pollutants are met. The establishment of a National Advisory Code for the Control and Reduction of Ammonia Emissions is a requirement under the NECD. The Clean Air Strategy for Ireland lead by the Department of Communications, Climate Action and Environment (DCCAE) provides an opportunity to address air pollution in Ireland.

In order to avoid potential fines and negative reputational damage on Irelands green image for breaching ammonia ceilings, ammonia emissions must be significantly reduced.

Measures within the Common Agricultural Policy (CAP) such as cross compliance measures and green direct payments also support these environmental objectives. The Rural Development Programme (RDP) (2014-2020) measures (part of CAP) provide investment funding for environmental protection measures, e.g. the Green Low-Carbon, Agri-Environment Scheme (GLAS). The scheme is green as it preserves traditional hay meadows and low-input pastures; low-carbon as it retains the carbon stocks in soil through margins, habitat preservation and practices such as minimum tillage; and, agri-environment as it promotes agricultural actions, which introduce or continue to apply agricultural production methods compatible with the protection of the environment, water quality, the landscape and its features, endangered species of flora and fauna and climate change mitigation.

Additional pieces of legalisation that indirectly and directly address nitrogen losses to the environment include the Water Framework Directive (Directive 2000/60/EC) and the Nitrates Directive (Directive (91/676/EEC). These water protection measures ensure the protection of healthy rivers, lakes and estuaries while also preserving biodiversity. The objective of this legislation is to restore and protect water quality, by implementing measures that achieve ongoing improvements in the environmental status of water bodies from source to sea. There is a correlation between the level of nitrate in rivers and high nitrogen application to the soil[81]. There is scope to improve resource efficiency and reduce the loss of nutrients and environmental impacts, without impacting on productivity/ yields.

[81] Commission Staff Working Document. Agriculture and Sustainable Water Management in the EU. Brussels, 28.4.2017, SWD(2017) 153 final.

4.2. Relevant links for further information

Financial Support/ Guidance

Under Structural improvements (TAMS)[82], the following schemes are provided for in the 2014-2020 Rural Development Programme (RDP) of Ireland –The European Agricultural Fund for Rural Development: Europe investing in rural areas:

- Pig and Poultry Scheme;
- Young Farmer Capital Investment Scheme;
- Diary Equipment Scheme;
- Low Emission Slurry Spreading Equipment Scheme;
- Animal Welfare, Safety and Nutrient Storage Scheme;
- Organic Capital Investment Scheme.

More information can be found on
https://www.agriculture.gov.ie/farmerschemespayments/tams/

Technical Support/ Guidance

- The Department of Agriculture, Food and the Marine: https://www.agriculture.gov.ie
- Teagasc (Agriculture and Food Development Authority): https://www.teagasc.ie/
- Department of Communications, Climate Action & Environment: https://www.dccae.gov.ie
- The Health and Safety Authority: https://www.hsa.ie/eng/
- Agricultural Consultants Association: http://aca.ie/
- Best Available Techniques (BAT) for pig and poultry production: http://eippcb.jrc.ec.europa.eu/reference/BREF/IRPP/JRC107189_IRPP_Bref_2017_published.pdf
- The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie/plant-nutrients/nitrogen/
- DG Environment – Nitrates Directive:

  http://ec.europa.eu/environment/water/water-nitrates/index_en.html
- EU Climate Action: https://ec.europa.eu/clima/index_en
- Irish Grassland Association: https://www.irishgrassland.com/
- Smart Farming: https://smartfarming.ie/
- PastureBase Ireland: https://www.teagasc.ie/crops/grassland/pasturebase-ireland/
- NMP Online: https://www.teagasc.ie/environment/soil/nmp/

Continued Professional Development

- Teagasc (Agriculture and Food Development Authority) (Teagasc ConnectED): https://www.teagasc.ie/about/our-organisation/connected/
- The Fertilizer association of Ireland: https://www.fertilizer-assoc.ie

[82] Department of Agriculture, Food and the Marine (2015). Schemes and Services 2014-2020. https://www.agriculture.gov.ie/media/migration/publications/2015/SchemesServices050216.pdf

Appendix 4 – Odour Management Plan

ODOUR MANAGEMENT PLAN

1. INTRODUCTION

This document has been written with reference to Odour Emissions Guidance Note (Air Guidance Note AG9) September 2019 published by the EPA. Management is committed to implement this odour management plan. The purpose of the plan is to monitor and minimise odour emissions.

The key components to this plan are;

1. Odour audit;
2. Odour impact assessments; (in accordance with AG5)
3. Assessment of Abatement Technologies;
4. Methods employed to eliminate odours
5. Methods employed to minimise odours
6. Odour Investigation procedure

2. ODOUR AUDIT

2.1 Facility Details

Figure 1.1: Site Location

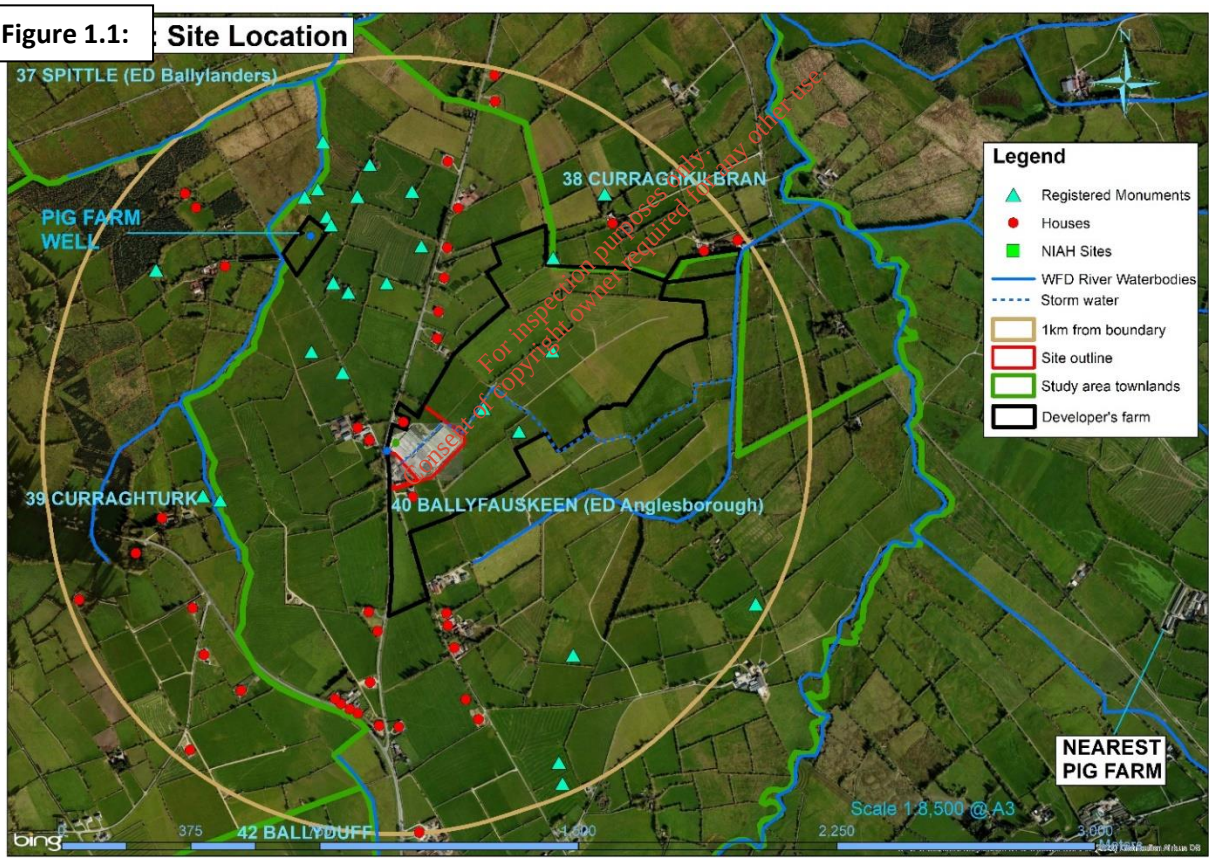


Figure 1.2 shows the location of the pig unit in 'Ballyfaskin' and the location of surrounding houses. There are 40 dwellings within 1 kilometre of the pig farm boundary. The nearest 5 houses include two dwellings adjoining the pig farm owned by the developers family. The next nearest sensitive receptors are located at 60m (W), 110m (SW) and 250m (N) respectively from the nearest pig buildings.

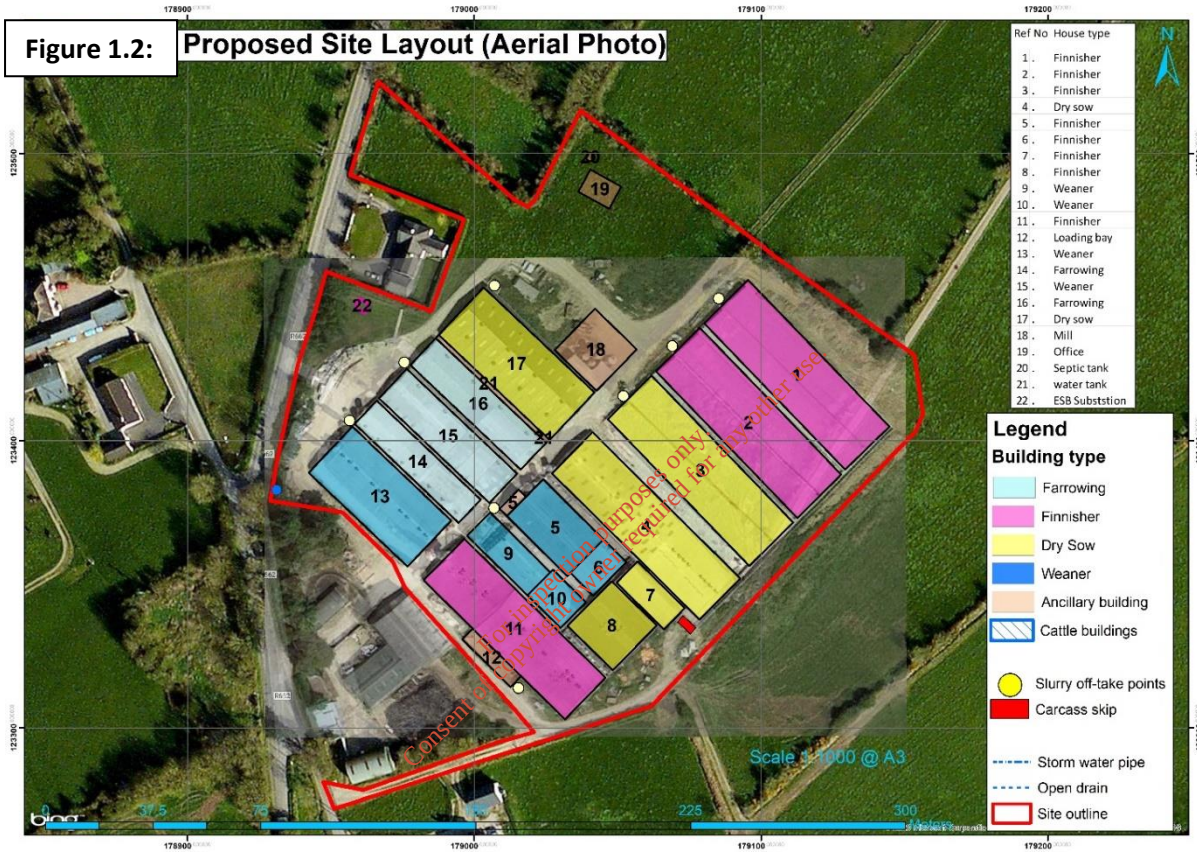
The surrounding area is primarily rural and agricultural. Rural dwellings are high sensitivity – the remaining land use is low – medium sensitivity. The topography is flat.

2.2 Management

'Ballyfaskin' Pig Farm is managed by the owner/developer. The pig farm manager will be responsible for implementing the Odour Management Plan. He will designate a key contact person for locals who have complaints and his phone number is available to them. This person will be trained to carry out regular odour assessments as per AG5 – Odour Impact Assessment Guidance for EPA Licensed Sites (http://www.epa.ie/pubs/advice/air/emissions/ag5-odourassessment.html).

2.3 Sources of Odour

Figure 1.2: **Proposed Site Layout (Aerial Photo)**



- At the site odour is released from the livestock directly, particularly where there are large numbers e.g. in the fattening houses and from the pig slurry stored in slatted tanks as a result of anaerobic metabolism of microorganisms. Faeces and urine deposited on surfaces of slats and floors are a source of odour. In combination with ammonia and substances such as dust, hydrogen sulphide (H2S), sulphur and volatile fatty acids emitted from the slurry surface contribute to the characteristic odour. These gases are ventilated through the exhaust vents of the houses and tanks. The concentration of these gases may be negligible in a measurable sense but combined they create odour. Odour gas emissions tends to increase when slurry is being pumped / agitated;
- At land-spreading locations the odour results from the decay of pig manure on the ground and from the production of aerosols during spreading. Odour nuisance from land-spreading is generally related to weather conditions, rates of application and proximity to sensitive receptors. Effects are generally dissipated within a few hours and are temporary;
- Carcass storage on site is a potential source – particularly during the summer; and
- Slurry spreading equipment (tractors and tankers) visiting the site is a potential source.

Quantitatively, the slurry stored in slurry tanks and pig excrement on slatted and solid surfaces are likely to be the most significant source of odour. The pigs themselves would be the second most important source.

2.4 Pathways

- The exhaust fans on the roof apexes of the pig houses will ventilate the odour forming gases from the pig houses. The finisher houses have climate controlled natural ventilation system. Ventilation is a relatively constant source;
- Uncovered pig walk ways and the faecal material deposited on them are potential source of odour. Theses surfaces are generally periodic pathways, for example a few times per week when pigs are transported on to or off the pig farm;
- Slurry movement via gravity flow and pumping and from tank to tank will result in spikes of odour. Slurry extraction i.e. pumping to slurry tankers results in additional odours. These spikes, while not a constant source, will occur regularly at certain times of the year;
- Open doors and uncovered carcass skips can potentially be a pathway for odour. These sources are infrequent and the carcass skip is on site is a sealed container; and
- Soiled surfaces at slurry extraction points are a potential pathways for odour.

Where a high degree of cleanliness is maintained on the site and where slurry is stored in separate covered tanks the primary pathway for odour is the exhaust air from the pig houses and the vents on the covered slurry tank. The ventilation of exhaust air is a constant process and the main pathway through which gases emitted from the slurry surface, gases emitted from the solid and slat surfaces and odour from the pigs themselves is transferred to the atmosphere outside the pig houses.

2.5 Inventory of odour forming materials

There will be 1,000 sows, 166 gilts, 50 boars, 5,357 weaners and 3,957 finnishers on site.

The slurry tanks have the capacity to store approximately 18,00m^3 of slurry on site. The slurry tanks are located under the pig houses.

Carcass material will stored in a sealed skip located east of pig house 7 (furthest from nearest dwelling) – labelled as S1 in Figure 1.3.

2.6 Process and Activities

Finisher pigs are ready for slaughter at 110 kgs live weight after 12 weeks. The proposed feeding system is a sealed wet feed system, which takes feed from sealed containers (Silos) and distributes it to the feeders in the rooms, on an ad-lib basis, as per pig's natural requirements, thereby significantly reducing the dust levels in the internal, and external environment. This mitigates dust emissions and, because dust particles will carry some of the odorous compounds, it will also mitigate odour

In a standard pig farm pigs are fed a mainly barley / soya based ration with varying protein content ranging from 16 – 18% for finishing pigs. The proposed pig farm will reduce protein levels to the 14-16% range by supplementing with essential amino acids.

Ad-lib water is available to pigs.

2.7 Equipment

Slurry is stored in slatted slurry tanks under each of the pig houses.

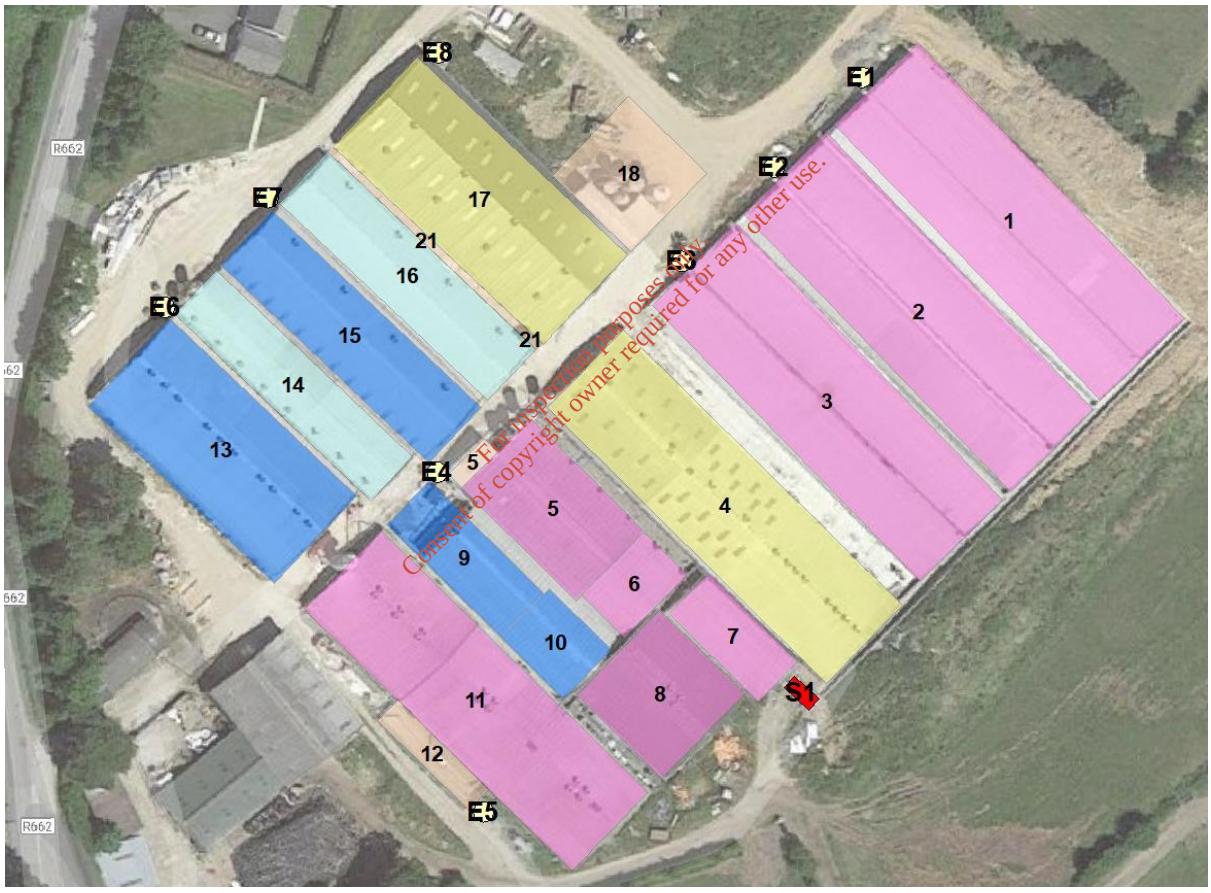
2.8 Release points

The ventilation chimneys and vent shutters on the pig houses are the main release points.

There are 8 slurry extraction points in the site. These 8 extraction points are located at;

- 3 (EI, E2 & E3) extraction points are located on the north western side of finisher houses 1, 2 and 3.
- There is one extraction point between buildings 5 and 9 (E4), at the north west end of these buildings.
- There is one extraction point at the south east side of building 12 (E5).
- There is one extraction point between buildings 13 and 14 (E6), at the north west end of these buildings.
- There is one extraction point between buildings 15 and 16 (E7), at the north west end of these buildings.
- There is one extraction point at the north western edge of building 17 (E8).

Figure 1.3 Extraction points and carcass storage area



2.9 Staff training and awareness

There is a high degree of awareness of odour avoidance at the existing 'Ballyfaskin' Pig Farm and this will also be the case at the proposed development. A key contact employee will be trained to carry out odour assessments on a continuous basis. Staff will be made aware of the source – pathway – receptor concept and realise that any odours released from the site have to potential to impact on sensitive receptors (dwellings) and staff will also be made aware of the conditions that exacerbate release of odours; for example wind direction and movements of pigs and slurry.

3.0 ODOUR IMPACT ASSESSMENT

3.1 Assessment of potential Odour Abatement Technology

The pig farm has considered potential Abatement Technologies available and those mentioned in BAT 13 of Commission Implementing Decision (EU) 2017/302 of 15/02/2017. These include;

Housing design abatement

1 Fully and partially slatted houses are the main house types on the pig farm. Emissions tend to be high from a fully slatted system which allows emissions from the stored slurry surface to be ventilated directly. This is the most economical system in terms of management, labour and water usage. In practise partially slatted houses seldom have significantly lower emissions than slatted houses unless solid surfaces are frequently cleaned or slurry removed frequently by a mechanical system. Solid floors can in many situations increase ammonia emissions and will result in an increased floor space requirement per animal and therefore additional setup and operational capital costs. The houses and tanks are in situ and the option to change the house design is not optional.

2 Various slurry flushing systems (e.g. scrapping, flushing using separated urine, flushing using water, flushing using gravity) are reported in the BAT 2017 document to reduce odour emissions. These systems work best where the flushed slurry is stored separately in a covered slurry store. These systems require additional operating energy and costs and structural changes such as an under-floor scrapping system installed beneath the tanks. The proposed system does not allow for the introduction of these systems because the slury tanks are in situ and the option to change the house design is not feasible.

3 Slurry cooling systems can be integrated into the tank wall at construction. It involves installing coolant piping system linked to a heat exchanger. Expected reduction of GHGs, reductions in ammonia of 40%+ and reduction in odour of 20 - 25% is reported in BAT. This system would require structural works under the slats and would require continued maintenance and would be difficult to replace at end of life. Also consideration has to be given to animal comfort and performance which may be compromised at certain times of year due to the cooling. This system would be too expensive to retrofit and would disrupt the existing production system.

4 Stack height of the ventilation chimneys relative to the roof heights of the existing pig houses and the surrounding topography have a significant effect on the dispersion of odour. High chimneys improve dispersion and avoid the ‘wake’ affect from adjoining buildings thus reducing potential odour effects. The Odournet UK report indicates 175 – 200m reduction in the threshold contours due to increasing the height from 4m to 15m. In practical terms this would involve the centralising of the vent ducting to one emission point and having a reduced number (possibly one or two) chimneys. The stack height and ventilation is fixed in the proposed development because existing houses are in situ and altering of this would cause large disturbance and incur a lot of additional costs

Diet management abatement

5 There is a linear relationship between dietary protein and ammonia emissions. Reducing dietary protein by 2% could reduce ammonia emissions by 20% and various odour reductions have been reported in the order of 20 - 25%. This mitigation will be employed by the proposed development.

6 Additives such as Bactocell can be used to increase efficiency of protein usage in the pig and therefore can be used to reduce/replace protein content in growing pig diets.

Reducing of dietary protein is an effective way of reducing emissions and will be implemented by the pig farm thereby complying with BAT.

Slurry management abatement

7 Solid-liquid separation gives variable results in relation to odour control.

8 Anaerobic digestion of the slurry significantly reduces odour of the end product i.e. the digestate. Additional GHG and water quality benefits would accrue from AD on a pig farm because the plant could use brown bin waste (or similar) as a feedstock thus providing a valuable alternative waste stream. Reported benefits are up to 40% reduction in NH_3 emissions, 80% CH_4 and odour reductions, improved availability of N in the residue manure and a potential 3kg CO_2 equivalent reduction in GHGs for every m^3 of biogas produced. Typical yields of biogas from pig manure are approx. 15 - 20m^3 per ton of manure.

9 Slurry amendments are being currently trialled by Teagasc to reduce NH_3 emissions. It is hoped that these will become more widely available and will provide an additional mitigation tool to reduce emissions. Using dairy wastes, sugar beet molasses, acetic acid, alum, sulphuric acid and ferric chloride have been shown to reduce NH_3 Emissions by 55%, 63%, 70%, 82%, 85%, and 95% respectively – and although odour emission data is not presently available from Teagasc it can be assumed that odour reduction would also be significant.

10 Slurry masking agents are also used with varying degrees of success.

Solid liquid separation does not provide an effective result for odour reduction would create another slurry handling operation with the potential to create extra odour. Anaerobic digestion is not supported by the Irish State to the extent that this technology is supported in other states. Teagasc publications state that in October 2017 there were 43 AD plants in Northern Ireland and a further 103 plants either being constructed or already approved – NI agricultural area = 25% of ROI. The majority of these are farm fed. In the Republic of Ireland there are approximately 30 AD plants either operational or in the planning stages. The majority of these are not farm fed. There are 7900 AD plants in Germany which has four times the Irish agricultural land area. The tariff for AD energy is 11 – 15c / kWh in the Republic of Ireland versus 22 – 28 c / kWh in Northern Ireland. Anaerobic Digestion can be readily adopted at this site because the space is available. However, the initial capital costs and operation costs are high and it is not currently economically viable. Also, there are potential risks of additional odours from the site and potential risks to pig health status due to transportation and storage of stock feed for the digestor.

Air treatment abatement

11 Wet scrubbing plus Bio filtration is a very effective air treatment. It requires centralising the ventilation system to one exhaust point and treating in a single treatment unit. These are often woodchip or peat based with reported odour reductions of 70-80%. This is an end- of-pipe system and therefore no benefit is experienced within the house for the workers or pigs. Water and energy usage and soiled water production can increase by at least 0.4m^3 / pig place – the acidified soiled water produced creates problems for land-spread disposal;

12 Various wet scrubbers and acid scrubbers (without Bio filters) are used in a centralised ventilation system when the vented air is passed through a staged filtering system removing dust, ammonia and odour. This is an end- of-pipe system and therefore no benefit is experienced within the house for the workers or pigs. Reductions of 70-80% in ammonia are reported and 30-45% for odours;

13 Water fogging is where water is sprayed through high pressure nozzles producing a fine mist which moistens dust particles which fall out of the atmosphere. Because dust particles are vectors for odours compounds there is a reduction in odours – 12 – 23% according to BAT. The system can be end of pipe or within the house;

14 Misting of capturing and reactive agents is reported to reduce ammonia emissions by 79%. In fattening houses laboratory tests showed reductions of odorous compounds in the pig houses

of 50-90%. Where the system is installed within the house additional working environment and pig health improvements are associated with this method. Water usage and soiled water production can increase by approx. 0.2m3 / pig place. Water and energy usage will increase;

Other technologies such as Activated carbon, thermal oxidation and UV / Ozone / Cold plasma are not referred to in the 2017 BAT and are more relevant for industrial application. These systems also require a centralised ventilation system, are capital intensive and not widely used in agriculture.

Of the above potential abatement technologies the following are selected as being appropriate for the 'Ballyfaskin' site;

1. Reduction in protein in growing pig diets.

3.2 Odour Control and minimisation measures

Following assessment of potential mitigation measures the following measures will be adopted to minimise and control odour emissions;

1. Low protein diets will be used.
2. Truck deliveries of odorous materials should be sealed or enclosed. Leaking or dirty slurry tankers will not be allowed on site.
3. The storage of odorous material such as carcass waste will be in sealed skips and will be removed frequently from the site.
4. The slurry extraction sites will be cleaned down daily. Slurry pumping equipment will be cleaned after use. Extraction points will drain back to the slurry tanks.
5. All odorous materials will be stored in sealed skips or in slurry tanks.
6. All spills, overflows and leaks should be cleaned up promptly with all operators aware and trained for this procedure.
7. A closed-door policy is enforced to prevent odorous releases through open doors.
8. A high level of cleanliness is maintained with outdoor surfaces washed down regularly with any remaining stagnant water removed.
9. Carcass skips will be cleaned regularly with an increased frequency in summer months.
10. The temperature is maintained as low as possible using adequate ventilation to reduce evaporation of odorous material. This reduces airflow over the surface of slurry and pigs thus reducing the rate of evaporation.
11. Agitation of slurry will increase the odour emission rate significantly. These activities will be avoided during weekends and evening times to minimise potential for nuisance.
12. Slurry amendments that reduce the potential release of certain odorous compounds will be considered as they become available.
13. Odour neutralisers / masking agents will be used if required.
14. The ventilation system in the pig houses will be maintained and serviced regularly to ventilate air efficiently.

3.3 Continuous odour assessment

Odour assessments will be conducted on a regular basis on the pig farm and reported to the relevant authority (i.e. EPA). Staff will be trained to adhere to the protocols set out in Air Guidance Document AG5, recording the prevailing weather conditions, the odour intensity and persistence at sensitive receptors. The results will reported to the pig farm manager.

4.0 MONITORING AND RECORD KEEPING

4.1 Odour assessments

The frequency of odour assessment will depend on the interaction of the local community and the pig farm. Where odour issues may arise the frequency will be agreed with EPA.

4.2 Record Keeping

An essential part of the odour management plan is the reporting and engaging with public. Complaints made to the pig farm will be recorded by the key contact for complaints – his/her number will be available to local residents. Complaints will be reported directed to the pig farm manager. An 'Odour Complaint Form' (see attached) will be completed for complaints received by the pig farm. The pig manager will liaise with the complainants.

5.0 REVIEW PROCESS / AUDIT TIME TABLE

Reviews of the Odour Management Plan and performance of the odour abatement and mitigation measures will take place every year and more frequently if there are complaints. Odour assessments will be carried out in response to odour complaints.

5.1 Response to odour complaints

The response procedure when complaints are received is as follows;

1. The key contact person is notified immediately if he was not the first contact in relation to the complaint;
2. The odour complaint record (attached below) must be completed, signed and dated. Each complaint should be given a reference number, for example, 2020_OC_1, 2020_OC_2, , 2020_OC_3, etc.;
3. The complainant must be asked to give details of;
    a. the time odour was detected;
    b. how long it lasted;
    c. how often it occurs;
    d. the nature of the nuisance – what sort of odour was it? (see nuisance odour wheel)
    e. weather conditions should be noted
4. The EPA inspector should be notified;
5. An odour assessment should be carried out as soon as possible after the complaint in compliance the EPA Guidance AG5;
6. The odour complaint should be logged in the complaints log;
7. The complainant should be contacted to explain what measures will be taken to avoid repeat of odour incident;
8. Following a complaint daily odour assessments should be carried out, to include the vicinity of the complainant source. The EPA AG5 records (see below) should be retained on site.
9. The key contact should explain to the complainant that the situation is being monitored and engage as much as possible with complainants;
10. Following repeat complaints the records should be reviewed to see if there is a pattern / time when odour issues arise;
11. Review production process to eliminate odour issues where possible.
12. Review odour management plan following corrective action.

ODOUR COMPLAINT REPORT FORM

Name & Address:	Phone Number:
Time / Date of Complaint:	Time / Date of Odour:

Location of Odour:										
Weather Conditions:	Dry	Rained Recently	Drizzle	Raining	Foggy					
Temperature:	Cold	Cool	Warm	Hot						
Wind Strength:	Calm	Light Air	Light Breeze	Gentle Breeze	Moderate Breeze	Fresh Breeze	Strong Breeze	Near Gale	Gale	Strong Gale
Type of Odour (see below):										
Odour Intensity (see below):										
Persistence Scale (see below):										
Duration of Odour (time):										
Nature of Exposure:	No Odour	Intermittent	Persistent							
Any Comments / Additional Information:										

Type Of Odour

Odour Complaints/Non-Conformance / Odour-Monitoring-Report Log - Template

Date	Type (Complaint / Non–Conformance / Assessment)	Complaint type / Area / Process / Report Type	Description of Odour	Corrective Action Taken	Outcome

ODOUR INVESTIGATION FIELD RECORD SHEET

General	Your Reference	Site Location	Assessment by	Date

Pre–Assessment Preparation				
Observer is free from medical conditions (cold, sore throat, sinus trouble)?	Observer abstinence (30 min) from smoking, flavoured drinks, scented toiletries and deodorisers?	Reason for odour assessment – Complaint verification; routine; other (specify).	Map – Has a map showing assessment locations been attached?	Weather Conditions Note 3 (record wind info on page 2)

Notes (the ranking systems in these notes must be used when completing the field observations table overleaf)

Note 1: Observation point Sensitivity (assuming detectable, if not then 0)

0 Remote (no housing, commercial/industrial premises or public area within 500m of observation point)
1 Low sensitivity (no housing, commercial/industrial premises or public area within 100m of observation point)
2 Moderate sensitivity (housing, commercial/industrial premises or public area within 100m of observation point)
3 High sensitivity (housing, commercial/industrial premises/public area within area of observation point)
4 Extra sensitive (complaints arising from residents, businesses and users of public areas within area of observation point)

Note 2: Wind Strength

0	Calm	Smoke rises vertically
1	Light air	Direction of wind shown by smoke drift, but not wind vanes
2	Light Breeze	Wind felt on face; leaves rustle, ordinary vane moved by wind
3	Gentle Breeze	Leaves and small twigs in constant motion
4	Moderate Breeze	Raises dust and loose paper; small branches are moved
5	Fresh Breeze	Small trees in leaf begin to sway
6	Strong Breeze	Large branches in motion; umbrellas used with difficulty against the wind
7	Near Gale	Whole trees in motion; inconvenience felt when walking against wind
8	Gale	Twigs break off trees; progress generally impeded
9	Strong Gale	Slight structural damage occurs (chimney pots and slates removed)

Note 3: Weather Conditions

Precipitation – dry, rained recently, drizzle, raining, foggy
Temperature – cold, cool, warm, hot

Note 4: Odour Persistence

0 No Odour
1 Intermittent (detected intermittently during the period of assessment)
2 Persistent (detected throughout the period of assessment)

Note 5: Odour Intensity

0 No detectable odour
1 Faint Odour (barely detectable, need to stand still and inhale facing the wind)
2 Moderate Odour (easily detectable while walking and breathing normally, possibly offensive)
3 Strong Odour (bearable but offensive – might make clothes / hair smell?)
4 Very Strong Odour (unbearable, difficult to remain in area affected by odour)

Odour Source Investigation (Post Odour Survey)				
Start Tim	Do any of the odours experienced on-site match in character those recorded during the off-site survey?	List areas inspected:	What relevant activities were occurring on-site during the off-site odour assessment	
Finish Time	Potential on-site odour sources identified:			

	Observer Location		Wind (nd = if not detectable)			Time		Odour Rating		Odour Description Comments
Parameter	Name of household / commercial site (describe so that location can be easily identified again by a third party)	Sensitivity (1-5) Note 1	Direction from which wind blows	Orientation (Observer Vs facility)	Strength Note 2	Start Time (24hr clock)	Period of observation	Odour Persistence (0-2) Note 4	Odour Intensity (0-4) Note 5	Description of any odours, other source(s) of odours etc. (Also note variable weather conditions etc)
Thresholds that could indicate nuisance	…	≥3	…	Down-Wind Approx DW or not detectable etc	…	…	…	1 or 2	≥2	**Guide-** A location where the score meets or exceeds all the threshold values may be deemed subject to nuisance/significant impairment, particularly if the observations are supported by public complaints on impact, frequency and duration of odours.
Field Observations										

Appendix 5 – Water Analysis Results for well in existing pig farm.

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: PATR-507030320
Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 03/03/2020
Date Reported 05/03/2020
Order Number V99.99

Sample Type Water
Client ID Well water 1 02.03.20 @ AM
Date Tested 03/03/2020
ALS ID 3907968

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Coliforms	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Sample Type Water
Client ID Well water 2 02.03.20 @ AM
Date Tested 03/03/2020
ALS ID 3907969

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Coliforms	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Report Authorised by: Mairead Gilmore

Mairead Gilmore
Deputy Microbiology Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: PATR-291140918
Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 14/09/2018
Date Reported 16/09/2018
Order Number N/A

Sample Type Water
Client ID well sample 13/9/18 @ 2pm
Date Tested 14/09/2018
ALS ID 3229419

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Coliforms	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)
Escherichia coli	0	MPN/100ml	SP 196 Based on ISO 9308-2 (2012)

Report Authorised by: Ann-Marie Fitzgerald
Ann-Marie Fitzgerald
Microbiology Manager

7.2

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: ROSF-191040718
Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 04/07/2018
Date Reported 06/07/2018
Order Number shane

Sample Type Water
Client ID 03/07/2018 @ 12 noon ZM003 Patrick Ryan
Date Tested 04/07/2018
ALS ID 3144601

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Escherichia coli	0	CFU/100ml	SP 140 MODW Part 4,B 2009
Coliform bacteria	0	CFU/100ml	SP 140 MODW Part 4,B 2009

Report Authorised by:

Denver Burke
Deputy Microbiology Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: ROSF-486021117

Document No: EF0011

SUPPLEMENTARY CERTIFICATE OF ANALYSIS

Date Received	02/11/2017
Date Reported	06/11/2017
Order Number	KARENFLYNN

Sample Type	Water
Client ID	01.11.2017 Patrick Ryan ZM003
Date Tested	02/11/2017
ALS ID	2874901

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Escherichia coli	0	CFU/100ml	SP 140 MODW Part 4,B 2009
Coliform bacteria	0	CFU/100ml	SP 140 MODW Part 4,B 2009

Report Authorised by: Olwen Maher

Olwen Maher
Deputy Microbiology Manager

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: ROSF-026190416
Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 19/04/2016
Date Reported 21/04/2016
Order Number SHANE

Sample Type Water
Client ID 18.04.2016 ZM003 Patrick Ryan
Date Tested 19/04/2016
ALS ID 2302105

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Escherichia coli	0	CFU/100ml	SP 140 MODW Part 4,B 2009
Coliform bacteria	0	CFU/100ml	SP 140 MODW Part 4,B 2009

Report Authorised by: Olwen Maher

Olwen Maher
Deputy Microbiology Manager

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ISO 17025 INAB ACCREDITED TESTING
DETAILED IN SCOPE REG NO.166T

Report No: ROSF-204051114
Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 05/11/2014
Date Reported 07/11/2014
Order Number N/A

Sample Type Water
Client ID 04/11/2014 ZM003 Patrick Ryan
Date Tested 05/11/2014
ALS 1835068

Test	Result	Unit	Method
Enterococci	0	CFU/100ml	SP 071 Based on ISO 7899-2 (2000)
Escherichia coli	0	CFU/100ml	SP 140 MODW Part 4,B 2009
Coliform bacteria	0	CFU/100ml	SP 140 MODW Part 4,B 2009

Report Authorised by: Ann-Marie Fitzgerald

Ann-Marie Fitzgerald
Microbiology Manager

Appendix 6 – Ordnance Survey License for Discovery Mapping.

Gmail **Con Curtin <curtinagri@gmail.com>**

OSi Store order confirmation for #50145301

1 message

OSi Store Sales <mapsales@osi.ie> 1 October 2020 at 12:02
To: Curtin Agri Consultants Ltd <curtinagri@gmail.com>

Ordnance Survey Ireland

Thank you for your purchase!

Hi Curtin Agri Consultants Ltd,

If you have questions about your order, you can email us at customer.services@osi.ie or call us at +353-1-802-5300. Our hours are Mon-Fri 9am to 4.45pm.

Thanks for ordering from Ordnance Survey Ireland. We'll get started on your order right away.

Here's what will happen next

Your order is currently being processed. We aim to ensure that you receive your order as quickly as possible. You will receive another email from us after all items in your order have successfully completed processing.

For Digital items: If your purchase contains digital downloads (i.e. A3-A4 PDF products) a secure download link to your item(s) will appear in the My Downloadable Products area under the My Account section. We will notify you by email when all item downloads links (i.e. ZIP FILE) become available. Please ensure you download and save all order item(s) promptly as all download links will expire after 7 days!

For Postal items: Any items to be delivered by post (i.e. paper publications, A2-A0 PDF products) will be prepared for delivery as soon as possible. You do not have to do anything else. We will notify you by email when all items have been sent.

Your Order #50145301

Placed on 1 October 2020 12:02:10 IST

Billing Info

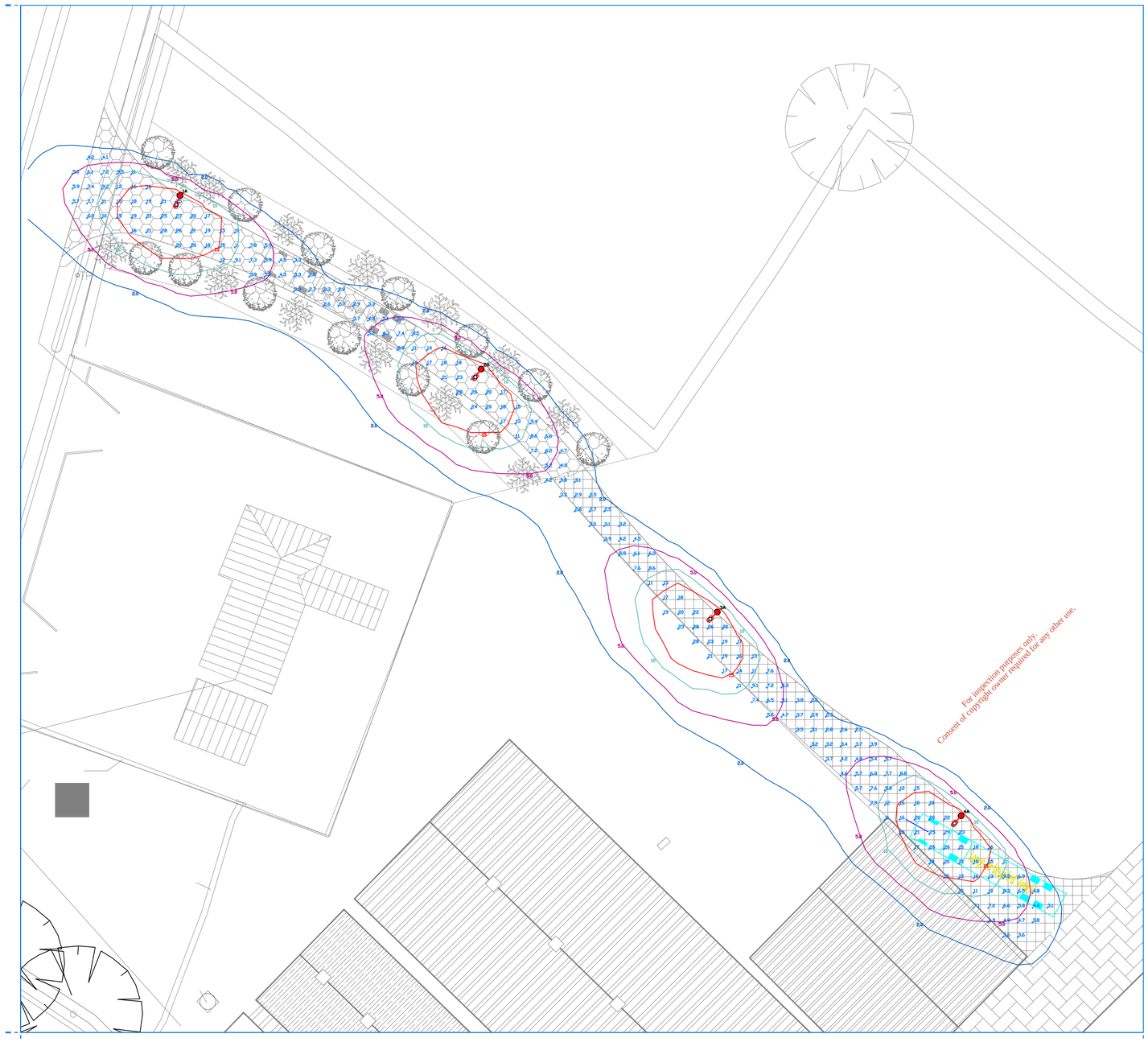
Cornelius Curtin
Curtin Agricultural Consultant
12 The Paddocks
Kells Road
Kilkenny, Ireland, R95VX4K
Ireland
T: 0872588798

Payment Method

Electronic Funds Transfer

Items	Qty	Price
Discovery Raster Tiles IG SKU: 215102	1567	€391.75
	Subtotal	€391.75
	Tax	€82.27
	Grand Total	**€474.02**

Appendix 7 – Lighting Specification / Lighting Spill Drawing.



Grid 1 - Road
Results - Horizontal Illuminance (lux)

Eav= 11,24
Emin= 2,21
Emax= 29,00
Emin/Emax= 0,08
Emin/Eav= 0,20

Luminaire Data
Luminaire A 3291 Sella 1 - STWB

Key

- Luminaire A Column
- Beam Aiming Target
- Photometric Centre

All Dimensions in metres

NOTES:
The lighting design complies with BS5489:2013 / BS EN 13201:2003
Lightning Columns shall be designed and installed in accordance with BS EN 40
LED output shall be minimum of 150lumens/ watt
LED LAMP Colour Temperature to be 4000K
Public Micro pillar locations are subject to change with future planning applications and ESB approval.
Micro pillars shall be connected to the ESB Local Network on the Castletroy link road.

General notes:

This drawing to be read in conjunction with all relevant architectural drawings and specifications.

This drawing to be read in conjunction with all relevant structural drawings and specifications.

This drawing to be read in conjunction with all relevant mechanical and electrical drawings and specifications.

All dimensions in millimeters. do not scale from this drawing. only use figured dimensions only.

Contractor must verify all dimensions on site prior to installation of services and production of working drawings.

Rev	Description	Date
P1	Issued for Planning	01/04/20

MOLONEYFOX CONSULTING ENGINEERS
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Client: BALLYFUSKEEN PIG FARM
LIMERICK

Architect: MEHS
KILLEEDY,LIMERICK

Project: BALLYFUSKEEN PIG FARM
LIMERICK

Drawing: ELECTRICAL INSTALLATION
LIGHTING SERVICES
FLOOR LEVEL

Proj Ref |	19.0000	Drg Ref |	E100	Scale |	1:100 A1
Drawn |	GJA	Checked |	JM	Approved |	MF

Drawing Status:

Preliminary	☐	For Approval	☐	Tender Issue	☐
For Information	☑	For Comment	☐	Contract Issue	☐

Appendix 9 – Design Drawings (Site Layout and Sample Electrical Substation Specification)

NOTES

1. THIS DRAWING AND ANY DESIGN HEREON IS THE COPYRIGHT OF THE CONSULTANT AND MUST NOT BE REPRODUCED WITHOUT HIS/HER WRITTEN CONSENT. ALL DRAWINGS REMAIN THE PROPERTY OF THE CONSULTANT.
2. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE.
3. CONSULTANT TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.
4. ALL WORKS TO DEPT. OF AGRIC. GRANT SPEC. SEE LEAFLETS - S101 & S123 MARCH 2006.
5. THESE DRAWINGS ARE TO BE USED AS PLANNING DRAWINGS ONLY AND MAY NOT CONTAIN ALL OF THE INFORMATION AND SPECIFICATIONS NECESSARY FOR CONSTRUCTION.

10cm - SCALE WITH CAUTION AS DISTORTION CAN OCCUR

GRAPHIC SCALE
(IN METERS)
10 0 5 10 20 30 40 50
1 : 500

N

NOTE:
- THIS LAYOUT SHOWS THE LAYOUT OF ALL EXISTING BUILDINGS CURRENTLY ON THE SITE.
- THERE ARE NO NEW BUILDINGS ASSOCIATED WITH THIS APPLICATION.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

LOCATION OF PROPOSED ESB SUBSTATION. ESB SUBSTATION WILL BE DESIGNED AN CONSTRUCTED IN ACCORDANCE WITH ESB SPECIFICATIONS AND REGULATIONS.

EXISTING SITE BOUNDARY

EXISTING OFFICE AND STAFF WELFARE BUILDING

EXISTING PERMEABLE PAVING TO STAFF / VISITOR PARKING AREA.
10No. PARKING BAYS PROVIDED ie. 6 STAFF AND 4 VISITOR

EXISTING SITE BOUNDARY

TO BALLYLANDERS

TO MITCHELSTOWN

TO ANGLESBOROUGH

EXISTING BUILDING / SITE PLAN

SCALE 1:500

REV.	AMENDMENT	BY	DATE

Job: BALLYFASKIN ENTERPRISES PIG UNIT
AT BALLYFAUSKEEN, BALLYLANDERS, Co. LIMERICK

Stage: PLANNING

Title: EXISTING BUILDING / SITE PLAN

Scale @A1: as shown | Drawn: SL | Date: JUNE 2020 | Drawing No: C-002 | Rev: P0

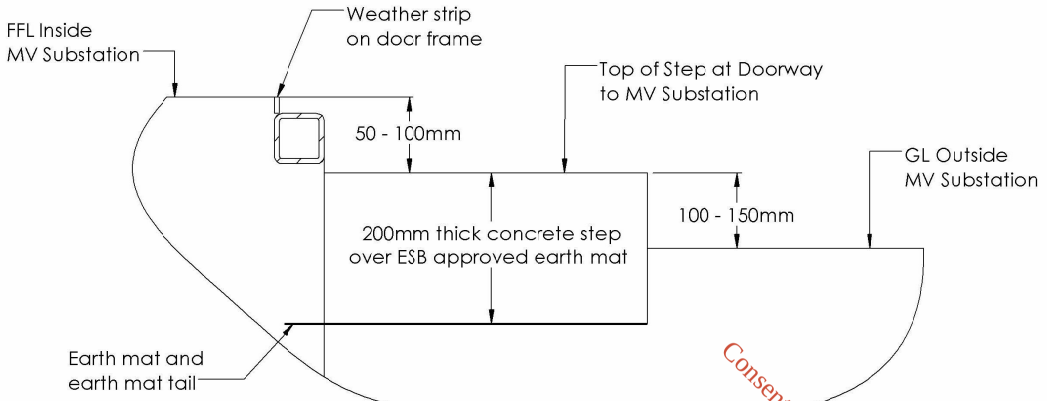
Séamus Lynch
t/a Corroville Designs.
Planning & Design Consultant
mob.087-9486000
e-mail: seamus.lynch@gmail.com
Belville
Kilmeedy
Co. Limerick

DRAWING NUMBER	REVISION
A3D.205071-16A	C

IF IN DOUBT ASK

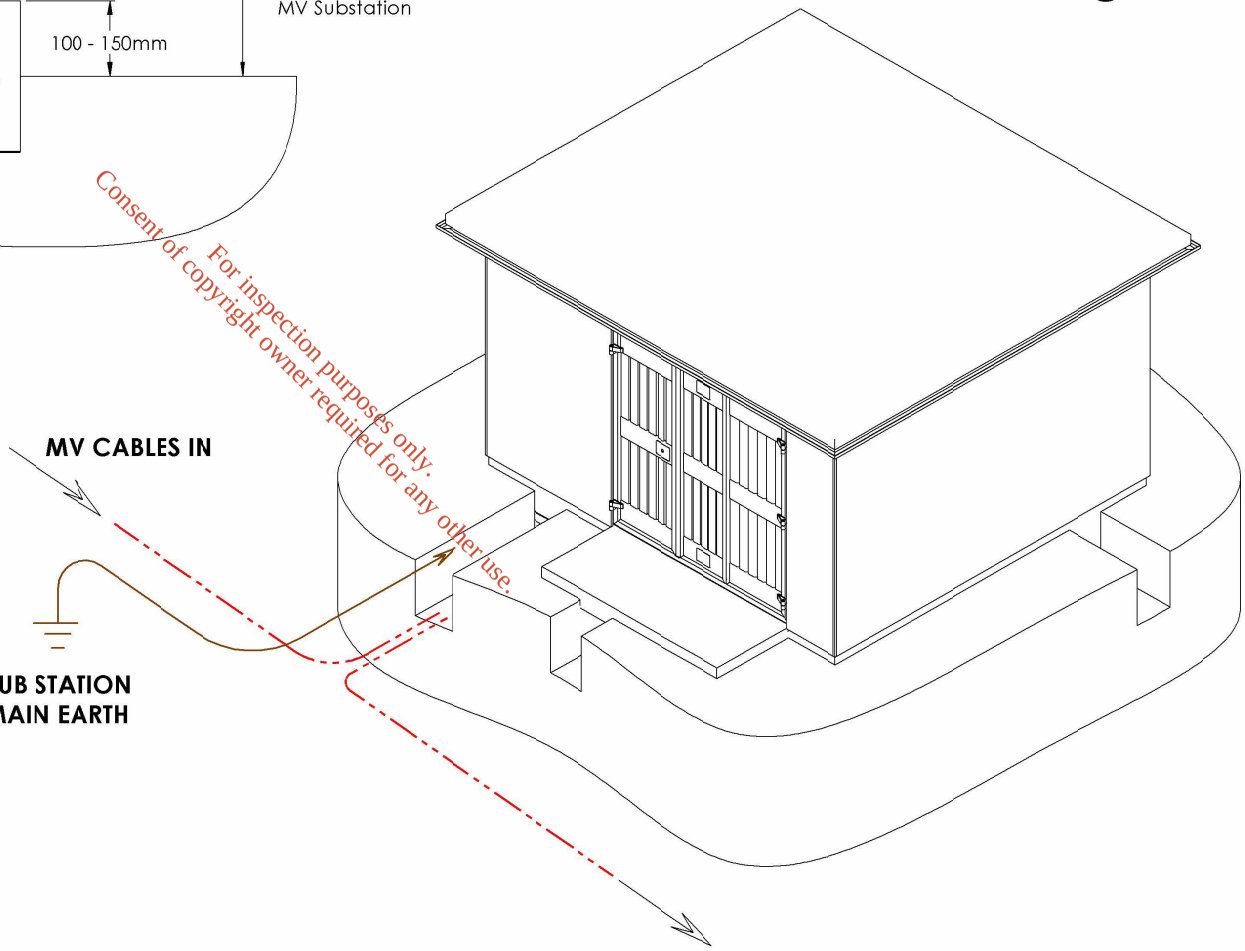
"Filehub Ref DOC-150916-CHU"

REVISION HISTORY				
ECO No.	REV.	DESCRIPTION.	DATE.	APPROVED.
10-18	E1	REVISED AND RE-ISSUED PER CM OCT 18	OCT 18	CM, ESB
05-19	C	RE-RELEASE IN LINE WITH NEW DOC-280518-DFK	MAY 19	CM - ESB



Illustrated Above, Requirements for FFL Inside, Outside Step Level & Outside Ground Levels.

ESB MV Sub-Station Building



Detail Drawings & Specification for the ESB Substation Building.

Sheet Index:

SIZE	DRAWING NUMBER		
A3	A3D.205071-16A		
SCALE 1:50	REV LETTER C	SHEET 3 OF 17	

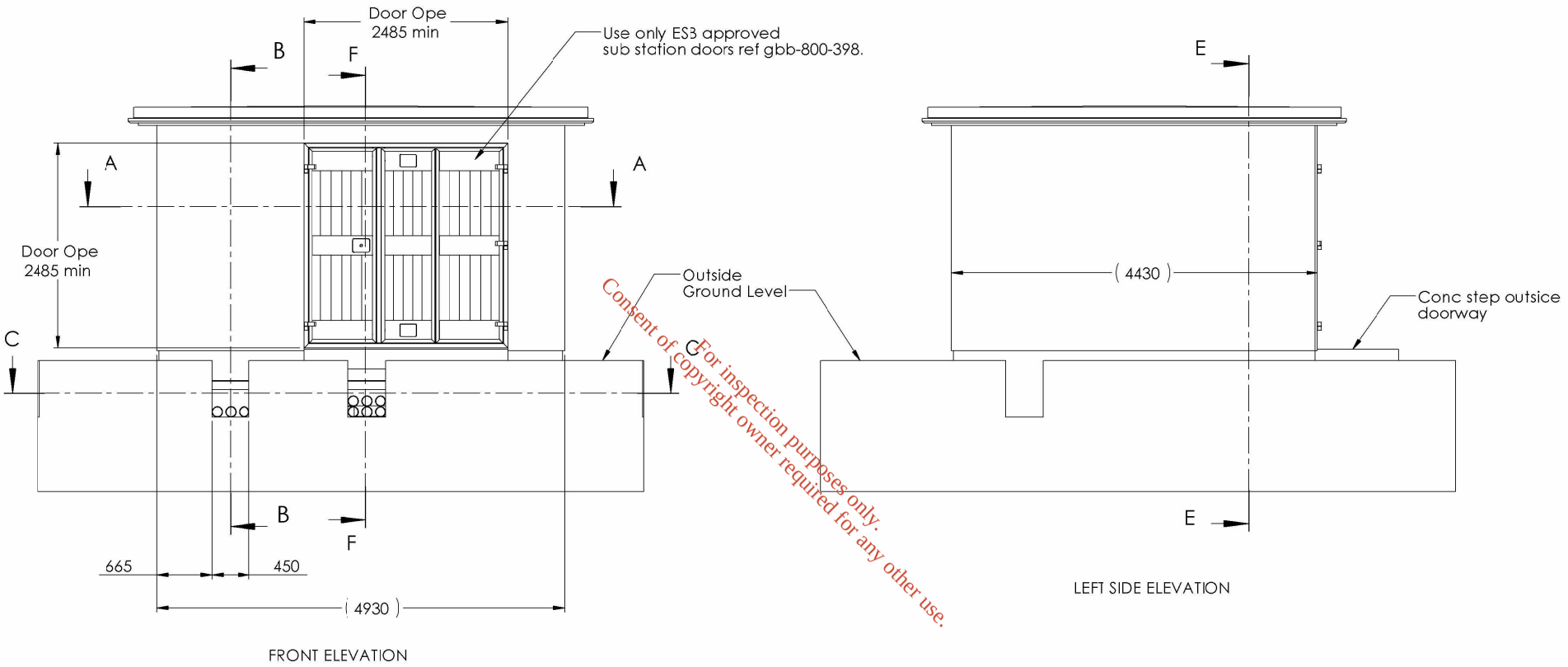
DRAWING NUMBER	REVISION
A3D.205071-16A	C

"Filehub Ref DOC-150916-CHU"

IF IN DOUBT ASK

REVISION HISTORY

ECO No.	REV.	DESCRIPTION.	DATE.	APPROVED.
10-18	E1	REVISED AND RE-ISSUED PER CM OCT 18	OCT 18	CM, ESB
05-19	C	RE-RELEASE IN LINE WITH NEW DOC-280518-DFK	MAY 19	CM - ESB



Before work commences be sure to read and fully inderstand the requirements as detailed in DOC-280518-DFK

ESB MV Sub-Station Building

SIZE	DRAWING NUMBER
A3	A3D.205071-16A

SCALE 1:75 | REV LETTER C | SHEET 4 OF 17